A HANDBOOK OF KERALA TIMBERS

Nazma
P.M.Ganapathy
K.M.Bhat
N.Sasidharan
R.Gnanaharan

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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 provided. These species include those of restricted occurrence 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—whether 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 possible 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 recognized 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 beginning in that direction.
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<tr>
<td><em>T. crenulata</em> Heyne ex Roth</td>
<td>... 205</td>
<td></td>
</tr>
<tr>
<td><em>Terminalia paniculata</em> Roth</td>
<td>... 207</td>
<td></td>
</tr>
<tr>
<td><em>Tetrameles nudiflora</em> R Br. ex Benn.</td>
<td>... 209</td>
<td></td>
</tr>
<tr>
<td><em>Thespesia populnea</em> (Linn.) Soland. ex Correa</td>
<td>... 210</td>
<td></td>
</tr>
<tr>
<td><em>Toona ciliata</em> Roemer</td>
<td>... 212</td>
<td></td>
</tr>
<tr>
<td><em>Trewia polycarpa</em> Benth. ex Hook. f.</td>
<td>... 214</td>
<td></td>
</tr>
<tr>
<td><em>Vateria indica</em> Linn.</td>
<td>... 215</td>
<td></td>
</tr>
<tr>
<td><em>V. macrocarpa</em> Gupta</td>
<td>... 217</td>
<td></td>
</tr>
<tr>
<td><em>V. malabarica</em> see <em>V.indica</em></td>
<td>... 215</td>
<td></td>
</tr>
<tr>
<td><em>Vatica chinensis</em> Linn.</td>
<td>... 218</td>
<td></td>
</tr>
<tr>
<td><em>V. roxburghiana</em> see <em>V. chinensis</em></td>
<td>... 218</td>
<td></td>
</tr>
<tr>
<td><em>Vitex altissima</em> Linn. f.</td>
<td>... 219</td>
<td></td>
</tr>
<tr>
<td><em>V. leucoxylon</em> Linn. f.</td>
<td>... 220</td>
<td></td>
</tr>
<tr>
<td><em>Walsura piscida</em> see <em>W. trifolia</em></td>
<td>... 221</td>
<td></td>
</tr>
<tr>
<td><em>W. trifolia</em> (A. Juss.) Harms</td>
<td>... 221</td>
<td></td>
</tr>
<tr>
<td><em>Wrightia tinctoria</em> (Roxb.) R. Br.</td>
<td>... 222</td>
<td></td>
</tr>
<tr>
<td><em>Xyilia xylocarpa</em> (Roxb.) Taub.</td>
<td>... 223</td>
<td></td>
</tr>
<tr>
<td><em>Zanthoxylum rhetsa</em> (Roxb ) DC,</td>
<td>... 225</td>
<td></td>
</tr>
</tbody>
</table>
**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/m³ at 12% m.c. |
| Grain | Straight to interlocked; texture coarse |

### Properties Table

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>1,149.9</td>
<td>122,800</td>
<td>152</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,538.5</td>
<td>145,000</td>
<td>130</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>2.3%</td>
</tr>
<tr>
<td>Tangential</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

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 multiples 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

Impact Compression

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
<td>Max. crushing stress kg/cm(^2)</td>
</tr>
<tr>
<td>Green</td>
<td>775.6</td>
<td>97,700</td>
<td>130</td>
</tr>
<tr>
<td>Air-dry</td>
<td>894.2</td>
<td>112,800</td>
<td>104</td>
</tr>
</tbody>
</table>

Processing

Drying

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

Shrinkage

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

Conflicting 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**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>806.8</td>
<td>126,000</td>
<td>81</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,119.8</td>
<td>154,500</td>
<td>97</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Sapwood yellowish-grey, heartwood pinkish-brown to dark brown</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy, 800 kg/m³ at 12% m. c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Interlocked; texture medium to coarse</td>
</tr>
</tbody>
</table>

### Processing

<table>
<thead>
<tr>
<th>Processing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying</td>
<td>Somewhat difficult to season, as it develops cracks</td>
</tr>
<tr>
<td>Working properties</td>
<td>Easy to work, can be finished to a smooth surface and takes good polish</td>
</tr>
</tbody>
</table>

### Natural durability and preservation
Reported to be durable

### Uses
Building construction; furniture; turnery; excellent firewood.

---

### AEGLE MARMELOS (Linn.) Correa

**Rutaceae**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>bael</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>koovalam</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>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</td>
</tr>
</tbody>
</table>
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/m³ at 12% m.c.

Grain
Straight to curly; texture fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>674.7</td>
<td>88,100</td>
<td>89</td>
</tr>
<tr>
<td>Air-dry</td>
<td>742.2</td>
<td>100,200</td>
<td>53</td>
</tr>
</tbody>
</table>

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 turnery articles; tool handles; posts.
7. **AGLAIA ELAEAGNOIDEA (A. Juss.) Benth.**  

*(A. roxburghiana Miq)*  

**Meliaceae**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade name</td>
<td>aglaia</td>
</tr>
<tr>
<td>Local name</td>
<td>punnyava</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to large, 15-22 m in height and up to 65 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark brownish-grey, smooth to somewhat rough, peels off in scales</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest</td>
</tr>
<tr>
<td>Wood</td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td>Gross structure</td>
<td>Distinct</td>
</tr>
<tr>
<td>Growth rings</td>
<td>Small to very small, moderately few to moderately numerous, solitary or in radial multiples of 2 or 3; often filled with yellowish deposits</td>
</tr>
<tr>
<td>Vessels</td>
<td>Paratracheal - vasicentric to confluent wavy bands</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Fine to very fine, closely spaced</td>
</tr>
<tr>
<td>Properties</td>
<td>Sapwood light greyish-yellow to light brown, heartwood pinkish-brown to reddish-brown</td>
</tr>
<tr>
<td>Colour</td>
<td>When freshly cut, heartwood has a pleasant odour</td>
</tr>
<tr>
<td>Odour</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Hardness</td>
<td>Heavy to very heavy, 730-940 kg/m³ air-dry</td>
</tr>
<tr>
<td>Weight</td>
<td>interlocked to curly; texture fine</td>
</tr>
<tr>
<td>Grain</td>
<td>Air-seasoning recommended</td>
</tr>
<tr>
<td>Processing</td>
<td>Difficult to saw, machining not satisfactory</td>
</tr>
<tr>
<td>Drying</td>
<td>Moderately durable</td>
</tr>
<tr>
<td>Working properties</td>
<td>Construction-work; tent accessories; agricultural implements.</td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td></td>
</tr>
<tr>
<td>Uses</td>
<td></td>
</tr>
</tbody>
</table>
8. AILANTHUS TRIPHYSA (Dennst.) Alston

(A. malabarica DC.)
Simaroubaceae

Trade name
Local names
Tree
Distribution
Wood

Gross structure

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/m³, air-dry
Grain
Straight; texture coarse

Processing

Drying
Easy to season; to avoid stains green conversion and rapid seasoning recommended

Working properties

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, heartwood 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**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>477.5</td>
<td>63,800</td>
<td>51</td>
</tr>
</tbody>
</table>
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, irregularly 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kglc㎡</td>
<td>Modulus of Elasticity kglc㎡</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>672.1</td>
<td>111,700</td>
<td>76</td>
</tr>
<tr>
<td>Air-dry</td>
<td>887.2</td>
<td>122,700</td>
<td>69</td>
</tr>
</tbody>
</table>

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 parquet; 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  kunivaga, 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, heartwood dark brown with dark streaks fairly lustrous
Hardness  Moderately hard to hard
Weight  Moderately heavy to very heavy, 595-1010 kg/m³ at 12% m.c.
Grain  Straight to wavy or slightly interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>936.8</td>
<td>135,400</td>
<td>109</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,437.9</td>
<td>145,200</td>
<td>99</td>
</tr>
</tbody>
</table>
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 satisfactory, 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
kardinthagara, 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/m³ at 120%m.c.

Grain  
Straight to somewhat wavy or interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending Modulus of Rupture kg/cm²</th>
<th>Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallel to grain Max. crushing stress kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>669.7</td>
<td>90,200</td>
<td>107</td>
<td>341.1</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,023.9</td>
<td>10,900</td>
<td>150</td>
<td>570.1</td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>361</td>
<td>63,100</td>
<td>41</td>
</tr>
<tr>
<td>Air-dry</td>
<td>466</td>
<td>70,400</td>
<td>30</td>
</tr>
</tbody>
</table>

**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 preservation**
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 - vasicectric to aliform

Rays
Fine, pinkish, closely spaced

Properties

Colour
Pale grey to brownish-grey, sapwood and heartwood usually indistinct

Hardness
Soft

Weight
Light, 425 kg/m³ 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; blockboards; packing cases; charcoal.

15. ANOEISSUS LATIFOLIA (DC.) Wall. ex Guill. & Perr.
Combretaceae

Trade name
axlewood

Local names
mazhukanjiram, vet la-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, Southern 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 2,3 or 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**

Slightly interlocked; texture fine

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>896.6</td>
<td>122,100</td>
<td>145</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,101.1</td>
<td>134,400</td>
<td>130</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Shrinkage</th>
<th>Green to oven-dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>4.2%</td>
</tr>
<tr>
<td>Tangent</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

**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
Grain
Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/m²</td>
<td>cm</td>
</tr>
<tr>
<td>10% m.c.</td>
<td>884.1</td>
<td>95,200</td>
<td>—</td>
</tr>
</tbody>
</table>

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
Local name
Tree
Distribution

pitraj
chemmaram
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
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

Atpotracheal – 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 medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>Max. crushing stress kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>733.7</td>
<td>103,562</td>
<td>94</td>
</tr>
<tr>
<td>Air-dry</td>
<td>965.8</td>
<td>113,475</td>
<td>89</td>
</tr>
</tbody>
</table>

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. lakooccha non Roxb.)

Moraceae

Trade name: lakoocch
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, heartwood 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:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>Max. crushing stress kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>499</td>
<td>61,400</td>
<td>160</td>
</tr>
<tr>
<td>Air-dry</td>
<td>808</td>
<td>76,400</td>
<td>122</td>
</tr>
</tbody>
</table>
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, heart-wood 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**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
<td>Max. crushing stress kg/cm(^2)</td>
</tr>
<tr>
<td>Green</td>
<td>633</td>
<td>82,300</td>
<td>73</td>
</tr>
<tr>
<td>Air-dry</td>
<td>806</td>
<td>100,700</td>
<td>64</td>
</tr>
</tbody>
</table>

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 multiples of 2 or 3; often filled with tyloses or white chalky deposits

**Parenchyma**
Paratracheal – vasicentric to aliform

**Rays**
Modestly 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**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm$^2$</th>
<th>Bending Modulus of Elasticity kg/cm$^2$</th>
<th>Impact Bending cm</th>
<th>Compression Max. crushing stress kg/cm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>752</td>
<td>104,500</td>
<td>76</td>
<td>414</td>
</tr>
<tr>
<td>Air-dry</td>
<td>969</td>
<td>122,400</td>
<td>58</td>
<td>616</td>
</tr>
</tbody>
</table>
Processing

Drying

Air-and klin-seasoning offer no difficulty

Shrinkage

Green to oven-dry

Radial 3.4%

Tangential 5.3%

Working 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/m³ at 12% m.c.

**Grain**
- Fairly straight to slightly twisted; texture fine

### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture (kg/cm²)</th>
<th>Bending Modulus of Elasticity (kg/cm²)</th>
<th>Impact Bending (cm)</th>
<th>Compression parallel to grain (kg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>833.9</td>
<td>103,100</td>
<td>58</td>
<td>451.9</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,158.8</td>
<td>136,700</td>
<td></td>
<td>612.7</td>
</tr>
</tbody>
</table>

### 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*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>neem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>aryaveppu, veppu</td>
</tr>
<tr>
<td>Tree</td>
<td>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.</td>
</tr>
<tr>
<td>Distribution</td>
<td>Naturally found in deciduous forests of Peninsular India. In Kerala, planted mostly in homesteads</td>
</tr>
</tbody>
</table>

### Wood

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Medium, few to moderately few, solitary or in radial multiples of 2 or 3, often in clusters; filled with brownish gum</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Apotracheal — irregularly placed tangential and continuous bands delimiting growth rings; paratracheal — vasicentric, also in tangential lines connecting vessels</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to moderately broad, somewhat widely spaced</td>
</tr>
<tr>
<td>Gum canals</td>
<td>Often present in tangential bands</td>
</tr>
</tbody>
</table>

### Properties

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood yellowish-grey to yellowish-brown, heartwood reddish brown, lustrous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Freshly cut wood has characteristic odour</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy, 835 kg/m³ at 12%</td>
</tr>
<tr>
<td>Grain</td>
<td>Interlocked; texture coarse</td>
</tr>
</tbody>
</table>
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>728.7</td>
<td>85,200</td>
<td>124</td>
</tr>
<tr>
<td>Air-dry</td>
<td>913.9</td>
<td>98,600</td>
<td>104</td>
</tr>
</tbody>
</table>

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

24. **BERRYA CORDIFOLIA (Willd.) Burret**

(B. *ammonilla* Roxb.)

*Tiliaceae*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium to large, 18-25 m in height with a clear bole of 9-11 m and about 80 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark brownish-grey with longitudinal fissures</td>
</tr>
</tbody>
</table>
Distribution

Native of Sri Lanka, occasionally grown as avenue trees

Wood

**Gross structure**

- **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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>945.2</td>
<td>133,700</td>
<td>150</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,193.8</td>
<td>147,200</td>
<td>145</td>
</tr>
</tbody>
</table>

**Strength**

- **Impact Compression Bending**
- **Static Bending**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Modulus of Rupture kg/cm$^2$</th>
<th>Modulus of Elasticity kg/cm$^2$</th>
<th>cm</th>
<th>kg/cm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>945.2</td>
<td>133,700</td>
<td>150</td>
<td>449.1</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,193.8</td>
<td>147,200</td>
<td>145</td>
<td>563.7</td>
</tr>
</tbody>
</table>

**Processing**

**Drying**

Seasons fairly well

Shrinkage

- **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, thrrippu
Tree              Medium to 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**
- Indistinct

Growth rings

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
- Paratracheal — scanty

Parenchyma

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/m³ at 12% m.c.

Grain
Straight to irregularly interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th></th>
<th>Impact Bending</th>
<th></th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of</td>
<td>Modulus of</td>
<td>Max. crushing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rupture</td>
<td>Elasticity</td>
<td>stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
<td></td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>490</td>
<td>88,400</td>
<td>58</td>
<td></td>
<td>237</td>
</tr>
<tr>
<td>Air-dry</td>
<td>882</td>
<td>113,100</td>
<td>76</td>
<td></td>
<td>533</td>
</tr>
</tbody>
</table>

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**

Predominantly 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/m³ at 12% m.c.

**Grain**

Straight; texture coarse

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>582</td>
<td>51,043</td>
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<tr>
<td>Air-dry</td>
<td>428</td>
<td>59,500</td>
</tr>
<tr>
<td>Condition</td>
<td>Compression Parallel to grain</td>
<td>Compression perpendicular to grain</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>144</td>
<td>181</td>
</tr>
<tr>
<td>Air–dry</td>
<td>188</td>
<td>242</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>39</td>
<td>49</td>
</tr>
<tr>
<td>Air–dry</td>
<td>40</td>
<td>55</td>
</tr>
</tbody>
</table>

**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.)

Euphorbiaceae

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/m³ at 12%

Grain  
Shallowly or deeply interlocked; texture medium to coarse
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>580</td>
<td>94,200</td>
<td>86</td>
</tr>
<tr>
<td>Air-dry</td>
<td>759</td>
<td>108,300</td>
<td>89</td>
</tr>
</tbody>
</table>

### 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
Vessels
Parenchyma
Rays
Gum canals
Properties
Colour
Hardness
Weight
Grain
Processing
Drying
Working properties
Natural durability and preservation
Uses

Indistinct
Large, very few to moderately few, solitary or in radial multiples of 2 or 3; frequently filled with tyloses
Paratracheal — scanty, vasicentric; brownish
Brownish; broad, widely spaced; fine, closely spaced among the broad ones
Horizontal, occasionally seen in broad rays
Greyish-white to greyish-brown, sapwood and heartwood not distinct
Soft to moderately hard
Light to moderately heavy, 605 kg/m$^3$ at 12% m.c.
Straight to somewhat interlocked; texture coarse
Quick conversion and open stacking under cover recommended
Easy to saw, machining satisfactory
Non-durable
Packing cases; temporary construction; light furniture; toys.

29. **BUCHANANIA LANZAN** Spreng.

*(B. *latifolia* Roxb.)*

**Anacardiaceae**

Local name
Tree

moongapezhu
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/m³ at 12% m.c.

Grain
Straight to somewhat interlocked; texture even and coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>321.9</td>
<td>57,500</td>
<td>41</td>
</tr>
<tr>
<td>Air-dry</td>
<td>522.0</td>
<td>80,300</td>
<td>—</td>
</tr>
</tbody>
</table>

Processing

Drying
Quick conversion and open stacking under cover recommended

Shrinkage
Green to oven-dry
Radial
4.1 %
Tangential
7.3%
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 fine 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/m³ at 12%

**Grain**

Straight to somewhat interlocked; texture coarse
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of</td>
<td>Modulus of</td>
<td>Max. crushing</td>
</tr>
<tr>
<td></td>
<td>Rupture</td>
<td>Elasticity</td>
<td>stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>257.8</td>
<td>31,400</td>
<td>53</td>
</tr>
<tr>
<td>Air-dry</td>
<td>364.3</td>
<td>43,000</td>
<td>23</td>
</tr>
</tbody>
</table>

### 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 cm 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>672.2</td>
<td>97,700</td>
<td>74</td>
</tr>
<tr>
<td>Air-dry</td>
<td>921.0</td>
<td>120,200</td>
<td>51</td>
</tr>
</tbody>
</table>

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/m³ at 12% m.c.
Grain: Interlocked; texture coarse
Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallel to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-dry</td>
<td>765.6</td>
<td>70,300</td>
<td></td>
<td>519.6</td>
</tr>
</tbody>
</table>
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
<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending Modulus kg/cm²</th>
<th>Compression Max. crushing stress kg/cm²</th>
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</thead>
<tbody>
<tr>
<td>Green</td>
<td>666.6</td>
<td>118,600</td>
<td>79</td>
<td>324.7</td>
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<tr>
<td>Air-dry</td>
<td>949.3</td>
<td>137,000</td>
<td>89</td>
<td>548.2</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>919.1</td>
<td>126,000</td>
<td>112</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,199.4</td>
<td>141,400</td>
<td>97</td>
</tr>
</tbody>
</table>

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

### 35. CAREYA ARBOREA Roxb.
Barringtoniaceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>kumbi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>pezhu</td>
</tr>
<tr>
<td>Tree</td>
<td>Small to medium, 8-15 m in height and about 30 cm in diameter. Bark dark grey, with shallow cracks, exfoliating in narrow flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern moist mixed deciduous, Moist teak bearing and Laterite thorn forests</td>
</tr>
</tbody>
</table>

#### Wood

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large to medium, moderately numerous, mostly solitary or in radial multiples of 2-4; mostly filled with tyloses</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Predominantly apotracheal — continuous tangential bands forming reticulum with rays</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine, closely spaced</td>
</tr>
<tr>
<td>Properties</td>
<td>Sapwood pale reddish-white, heartwood light to dark brownish-red</td>
</tr>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
</tbody>
</table>
Weight
Very heavy, 955 kg/m³ at 12% m.c.

Grain
Straight; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Msx. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>657</td>
<td>83,700</td>
<td>62</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,048</td>
<td>4,900</td>
<td>76</td>
</tr>
</tbody>
</table>

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; para-tracheal-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/m³ at 12% m.c.

Grain
Straight to slightly interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>960.7</td>
<td>118,000</td>
<td>119</td>
<td>491.7</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,306.5</td>
<td>161,300</td>
<td>117</td>
<td>673.7</td>
</tr>
</tbody>
</table>

Processing

Drying
Refractory to seasonings; as it develops 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 yellowish-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/m³ at 12% m. c.
Slightly interlocked; texture coarse
<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture stress kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>709.4</td>
<td>105,000</td>
<td>91</td>
</tr>
<tr>
<td>Air-dry</td>
<td>866.3</td>
<td>116,500</td>
<td>79</td>
</tr>
</tbody>
</table>

**Processing**

**Drying**
- Season well
- Shrinkage:
  - 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 extensively

**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/m³ at 12% m. c.

Grain
Straight; texture medium to fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression Parallel to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>732</td>
<td>114,400</td>
<td>124</td>
<td>327</td>
</tr>
</tbody>
</table>

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)

Bombacaceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>kapok</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>panji-ilavu, panya</td>
</tr>
</tbody>
</table>
| 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; usually filled with tyloses |
| Parenchyma | Predominantly apotracheal — fairly distinct, 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/m³, air-dry |
| Grain | Straight; texture coarse |
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture (kg/cm²)</th>
<th>Bending Modulus of Elasticity (kg/cm²)</th>
<th>Impact Bending (cm)</th>
<th>Compression parallel to grain (Max. crushing stress, kg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>136.0</td>
<td>23,000</td>
<td>18</td>
<td>61</td>
</tr>
</tbody>
</table>

### Processing

**Drying**

Quick conversion and air- or kiln-seasoning gives satisfactory results.

**Working properties**

Easy to work.

**Natural durability and preservation**

Non-durable.

**Uses**

Catamarans; 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 lustre, 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>865.5</td>
<td>115,400</td>
<td>99</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,272.3</td>
<td>151,900</td>
<td>86</td>
</tr>
</tbody>
</table>

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/m³ at 12% m.c.

Grain

Straight to interlocked; texture fine
### Strength

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

### 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; dobbey barrels and bobbins in textile mills.

---

### 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**

<p>| <strong>Trade name</strong> | coconut palm |
| <strong>Local name</strong> | thengu |
| <strong>Tree</strong> | A tall palm reaches to a height of about 20 m and is approximately 25 cm in diameter |
| <strong>Distribution</strong> | Cultivated extensively |
| <strong>Wood</strong> |
| <strong>Gross structure</strong> | 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 |
| <strong>Properties</strong> |
| <strong>Colour</strong> | Red towards periphery and reddish-brown towards centre |
| <strong>Hardness</strong> | Outer portion very hard and inner soft |
| <strong>Grain</strong> | Interlocked; texture medium to fine |
| <strong>Weight (Peripheral)</strong> | Very heavy, 946 kg/m$^3$ (green); 761 kg/m$^3$ (Kiln-dry) |
| <strong>Strength</strong> |
| <strong>Impact Bending</strong> |
| <strong>Condition</strong> | <strong>Static Modulus of Rupture</strong> kg/cma | <strong>Bending Modulus of Elasticity</strong> | <strong>Impact Bending</strong> |
| Green | 460 | 73,400 | 41 |
| Air-dry | 666 | 93,800 | 65 |</p>
<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit $\text{kg/cm}^2$</td>
<td>Max. crushing stress $\text{kg/cm}^2$</td>
</tr>
<tr>
<td>Green</td>
<td>249</td>
<td>380</td>
</tr>
<tr>
<td>Kiln-dry</td>
<td>293</td>
<td>502</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shearing stress $\text{kg/cm}^2$</td>
<td>Tensile stress $\text{kg/cm}^2$</td>
</tr>
<tr>
<td>Green</td>
<td>66.9</td>
<td>19.7</td>
</tr>
<tr>
<td>Kiln-dry</td>
<td>80.9</td>
<td>16.4</td>
</tr>
</tbody>
</table>

**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 get 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 smooth 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**

<table>
<thead>
<tr>
<th>Local name</th>
<th>Viri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium, about 12 m in height and up to 40 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark grey or brown, rough with shallow, longitudinal furrows</td>
</tr>
</tbody>
</table>

**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/m³ at 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

<table>
<thead>
<tr>
<th>Colour</th>
<th>Gray to brown with pinkish tinge. Sapwood and heartwood not distinct, lustrous when freshly cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Light to moderately heavy, 510 - 625 kg/m³ at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture medium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallel to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>736.8</td>
<td>124,300</td>
<td>74</td>
<td>361.2</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,061.8</td>
<td>145,800</td>
<td>89</td>
<td>571.1</td>
</tr>
</tbody>
</table>

Processing

<table>
<thead>
<tr>
<th>Drying</th>
<th>Kiln-seasoning gives good results. Green conversion and open stacking also satisfactory</th>
</tr>
</thead>
</table>
| 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 durable 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*

<table>
<thead>
<tr>
<th>Local name</th>
<th><em>vella-veetti</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium, 15–20 m in height and about 50 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark grey, smooth, flakes off in round scales</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern moist mixed deciduous forest</td>
</tr>
<tr>
<td>Wood</td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td>Gross structure</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Growth rings</td>
<td>Large, medium and small, few, solitary or in radial multiples of 2, 3 or 4</td>
</tr>
<tr>
<td>Vessels</td>
<td>Apotracheal — diffuse, diffuse-in-aggregate</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Fine to very fine, closely spaced</td>
</tr>
</tbody>
</table>
| Rays               | \_
| Properties         | \_
| Colour             | Yellowish or greyish-white to brown, sapwood and heartwood not distinct |
| Hardness           | Moderately hard |
| Weight             | Moderately heavy to heavy, 620–770 kg/m³, 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
</tr>
<tr>
<td>Green</td>
<td>845</td>
<td>92,700</td>
</tr>
<tr>
<td>Air-dry</td>
<td>943</td>
<td>101,700</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm(^2)</td>
<td>Max. crushing stress kg/cm(^2)</td>
</tr>
<tr>
<td>Green</td>
<td>242</td>
<td>418</td>
</tr>
<tr>
<td>Air-dry</td>
<td>292</td>
<td>486</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm(^2)</td>
<td>Tangential kg/cm(^2)</td>
</tr>
<tr>
<td>Green</td>
<td>104</td>
<td>108</td>
</tr>
<tr>
<td>Air-dry</td>
<td>99</td>
<td>156</td>
</tr>
</tbody>
</table>

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 durable, 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 I 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
Included phloem

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, m³, 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 2 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 lines; 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/m³ at 12% m.c.

Grain
Straight to shallowly interlocked; texture medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallel to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>727.7</td>
<td>73,500</td>
<td>132</td>
<td>325.9</td>
</tr>
<tr>
<td>Air-dry</td>
<td>832.7</td>
<td>99,500</td>
<td>107</td>
<td>452.1</td>
</tr>
</tbody>
</table>

Processing

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

Shrinkage
- 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
### 50. DILLENIA INDICA Linn.

**Dilleniaceae**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>dillenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>syalita</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to large, 15-25 m in height with a clear bole of 6 m and about 60 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark reddish-brown, smooth, peels off in small flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest in North Kerala</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Fairly distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large to medium, moderately few to moderately numerous, mostly solitary, occasionally in tangential or oblique pairs; sometimes filled with tyloses and white deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Apotracheal -- diffuse, usually indistinct, sometimes appear as white dots</td>
</tr>
<tr>
<td>Rays</td>
<td>Broad to moderately broad, widely spaced; fine to very fine, closely spaced among the broad rays</td>
</tr>
</tbody>
</table>
Properties

Colour
Sapwood yellowish-brown, heartwood light brown

Hardness
Moderately hard

Weight
Moderately heavy, 640 kg/m³ at 12% m.c.

Grain
Twisted to interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>602.6</td>
<td>36,100</td>
<td>71</td>
</tr>
<tr>
<td>Air-dry</td>
<td>947.9</td>
<td>11,950</td>
<td>79</td>
</tr>
</tbody>
</table>

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/m³ at 12% m.c.

**Grain**
Interlocked; texture coarse

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>591.5</td>
<td>75,700</td>
<td>56</td>
</tr>
<tr>
<td>Air-dry</td>
<td>803.3</td>
<td>95,500</td>
<td>74</td>
</tr>
</tbody>
</table>
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
A波特racheal — 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/m³ 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 to moderately numerous, mostly solitary; often filled with tyloses

Parenchyma
Apotracheai — diffuse to very short tangential lines; paratracheal — vasicentric, fairly conspicuous around resin ducts

Rays
Moderately broad to fine, widely spaced; silicious 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
Moderately heavy, 705 kg/m³ at 12% m.c.

Grain
Straight to interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>678</td>
<td>127,100</td>
<td>74</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,051</td>
<td>156,200</td>
<td>89</td>
</tr>
</tbody>
</table>

Processing

Drying
Air-seasoning easy. Kiln-seasoning difficult

Shrinkage
Green to oven-dry
Radial: 4.5%
Tangential: 9.6%

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

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 vein 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 to heavy, 705-900 kg/m³ at 12% m.c. |
| **Grain** | Fairly straight to somewhat interlocked or irregular; texture coarse |
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress cm kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>789</td>
<td>162,900</td>
<td>71</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,245</td>
<td>201,400</td>
<td>112</td>
</tr>
</tbody>
</table>

### 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 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 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/m³ air-dry

Grain

Straight to broadly interlocked; texture moderately fine

Processing

Drying

Air-andkiln-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**

<table>
<thead>
<tr>
<th>Local name</th>
<th>karakil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Large, reaches to a height of 30 m and up to 100 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark pale grey, smooth</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest, mostly confined to South Kerala</td>
</tr>
</tbody>
</table>

**Wood**

**Gross structure**

- Diffuse-porous

<table>
<thead>
<tr>
<th>Growth rings</th>
<th>Distinct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>Small to very small, moderately few, solitary or in radial multiples of 2-4; frequently filled with yellowish-brown deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Abundant; paratracheal — wavy bands and also aliform to aliform-confluent</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to very fine, closely spaced</td>
</tr>
</tbody>
</table>

**Properties**

**Colour**

<table>
<thead>
<tr>
<th></th>
<th>Sapwood greyish-yellow, heartwood pink or reddish-grey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy to heavy, 730 kg/m³ at 12%</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight to broadly interlocked; texture medium to fine</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>white cedar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>vella-agi, aki l</td>
</tr>
<tr>
<td>Tree</td>
<td>Very large, up to 35 m in height and 60-90 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark grey with white warts</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen and Southern hill-top tropical evergreen forests</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td><strong>Gross structure</strong></td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td><strong>Growth rings</strong></td>
<td>Distinct</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>Small, moderately numerous, solitary or in radial multiples of 2 or 3; usually filled with yellowish-brown deposits</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Paratracheal — vasicentric, forming a thin sheath around vessels and in bands delimiting growth rings</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Fine, numerous and closely spaced</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>Sapwood whitish or greyish-yellow, heartwood yellow to golden yellow or yellowish-brown</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>Moderately hard</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Moderately heavy, 720 kg/m³ at 12% m.c.</td>
</tr>
<tr>
<td><strong>Grain</strong></td>
<td>Straight to somewhat interlocked; texture fine</td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress cm</td>
</tr>
<tr>
<td>Green</td>
<td>661.2</td>
<td>109,200</td>
<td>104</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,816</td>
<td>141,300</td>
<td>107</td>
</tr>
</tbody>
</table>
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 paneling; aircraft plywood; furniture and cabinets; tool handles; artificial limbs and rehabilitation aids; textile mill accessories; cooperage; 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/m³, 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
Interilocked; texture fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>Max. crushing stress cm</td>
<td>kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>483.7</td>
<td>87,400</td>
<td>58</td>
<td>253.0</td>
</tr>
<tr>
<td>Air-dry</td>
<td>656.9</td>
<td>98,600</td>
<td>50</td>
<td>381.1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Trade name</th>
<th>amla</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>nelli</td>
</tr>
</tbody>
</table>

**Tree**

Small to medium, 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**

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

Erythroxylaceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>bastard sandal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>vella-devadhamar</td>
</tr>
<tr>
<td>Tree</td>
<td>Small, up to 8 m in height and about 15 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark dark brown, rough</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern dry mixed deciduous and Laterite thorn forests</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>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</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Apotracheal — diffuse, usually indistinct</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to very fine, closely spaced</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood creamy white or pale brown and heartwood reddish-brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Heartwood with pleasant odour</td>
</tr>
<tr>
<td>Hardness</td>
<td>Very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy to very heavy, 1000 kg/m³, air-dry</td>
</tr>
<tr>
<td>Grain</td>
<td>Interlocked; texture fine to very fine</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Trade names</th>
<th>rose gum, flooded gum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>eucalyptus, eucali</td>
</tr>
<tr>
<td>Tree</td>
<td>Large, about 30 m in height and 40-50 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark whitish or ash coloured, smooth</td>
</tr>
<tr>
<td>Distribution</td>
<td>Native of Australia, extensively raised in plantations</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Indistinct or scarcely distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large to medium moderately few; mostly solitary, sometimes in oblique alignment; tyloses sparse to abundant kino-like deposits sparse of absent</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Sparse to abundant apotracheal — diffuse; crystals sometimes present kino like deposits moderately abundant to absent</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine closely spaced; kino-like deposits abundant</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood pinkish, heartwood pinkish brown to reddish-brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Moderately hard to hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy to heavy, 740 kg/m³ air-dry</td>
</tr>
</tbody>
</table>

**Processing**

<table>
<thead>
<tr>
<th>Drying</th>
<th>Seasoning difficult; liable to warp and crack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working properties</td>
<td>Easy to saw and work</td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td>Non-durable</td>
</tr>
<tr>
<td>Uses</td>
<td>Mainly for pulping; suitable for packing cases and boxes; crates, beams, columns, poles and posts.</td>
</tr>
</tbody>
</table>
64. **EUCALYPTUS TERETICORNIS** Sm.

*Myrtaceae*

<table>
<thead>
<tr>
<th>Trade names</th>
<th>mysore gum, eucalyptus hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>eucalyptus, eucali</td>
</tr>
<tr>
<td>Tree</td>
<td>Large, about 25 m in height and 40 cm in diameter</td>
</tr>
<tr>
<td>Distribution</td>
<td>Native of Australia, extensively raised in plantations</td>
</tr>
</tbody>
</table>

**Wood**

**Gross structure**

<table>
<thead>
<tr>
<th>Growth rings</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>Indistinct</td>
</tr>
<tr>
<td></td>
<td>Medium, moderately numerous, mostly solitary; rarely in radial or oblique chains; tyloses abundant; kino-like deposits sparse to moderately abundant</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Moderately abundant to abundant; apotracheal — diffuse; kino-like deposits sparse to abundant</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine, closely spaced; kino-like deposits abundant</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood light or pale red, heartwood reddish-brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy to very heavy, 980 kg/m³, air-dry</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture medium</td>
</tr>
<tr>
<td>Strength</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>impact Bending cm</th>
<th>Compression parallel to grain Max. crushing stress kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>510</td>
<td>60,000</td>
<td>107</td>
<td>291</td>
</tr>
<tr>
<td>Air-dry</td>
<td>866</td>
<td>100,800</td>
<td>74</td>
<td>513</td>
</tr>
</tbody>
</table>
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
Yeillowish-white, sapwood and heartwood not distinct, lustrous

Hardness
Soft

Weight
Light, 450 kg/m³, 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 preservation
Perishable

Uses
Match splints and boxes; packing cases and boxes.

66. FILICIIIIUM DECIPlENS Thw.

Sapindaceae

Local name
niroli

Tree
Medium to large, 18-25m in height and up to 90 cm in diameter
Batk reddish-grey to blackish-brown, rough

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

Wood

Gross structure
Diffuse-porous

Growth rings
Indistinct

Vessels
Usually small, numerous to moderately numerous, mostly in radial multiples of 2-4, occasionally solitary; often plugged with whitish or reddish-brown gummy deposits

Parenchyma
Paratracheal — Vasicentric, in fine usually interrupted lines often delimiting growth rings
<table>
<thead>
<tr>
<th>Rays Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Very fine, rather closely spaced</td>
</tr>
<tr>
<td>Hardness</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Very heavy, 830 kg/m$^3$ at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture fine</td>
</tr>
<tr>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td>Drying</td>
<td>Quick conversion and close piling under cover recommended</td>
</tr>
<tr>
<td>Working properties</td>
<td>SAWING not difficult, machining easy, can be brought to a good finish</td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td>Moderately durable</td>
</tr>
<tr>
<td>Uses</td>
<td>Bears and posts in construction; tool handles; agricultural implements; low quality furniture; cart and carriages.</td>
</tr>
</tbody>
</table>

**67. FIRMIANA COLORATA** *(Roxb ) R. Br.*

*(Sterculia colorata* Roxb *)

Sterculisceae

<table>
<thead>
<tr>
<th>Local name</th>
<th>Malamparathi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium 10-20 m in height, with a clear bole of 6-9 m and 30-50 cm in diameter. Bark whitish-grey, fairly smooth fibrous.</td>
</tr>
<tr>
<td>Distribution</td>
<td>Sparingly found in West coast semi-evergreen and Southern moist mixed deciduous forests</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large to medium, few to moderately numerous, mostly solitary or in radial multiples of 2, 3 or in clusters</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Broad wavy or fairly straight tangential bands</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Broad to moderately broad and fine, widely spaced, forming conspicuous flecks on radial surface</td>
</tr>
<tr>
<td><strong>Gum canals</strong></td>
<td>Occasionally present, traumatic, arranged in long tangential bands</td>
</tr>
</tbody>
</table>

### 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% 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

Ways

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/m³ at 12% m.c.

Grain

Straight to interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>583.4</td>
<td>55,800</td>
<td>81</td>
</tr>
<tr>
<td>Air-dry</td>
<td>694.8</td>
<td>87,300</td>
<td>58</td>
</tr>
</tbody>
</table>

Processing

Drying

Green conversion and stacking under cover recommended

Shrinkage

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**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>gluta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>thenmavu, thodappei</td>
</tr>
<tr>
<td><strong>Tree</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very large, up to 35 m in height and 65-120 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark pinkish-grey, smooth</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confined to the West coast tropical evergreen and Southern hill-top tropical evergreen forests in South Kerala</td>
</tr>
<tr>
<td><strong>Wood</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Gross structure</strong></td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td><strong>Growth rings</strong></td>
<td>Indistinct</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>Large to medium, very few to moderately few, solitary or in radial multiples of 2 or 3; frequently filled with tyloses</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Fairly abundant; apotracheal – in long tangential bands; paratracheal scanty; brownish in colour</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Brownish; very fine to fine, closely spaced, occasionally moderately broad rays present at intervals</td>
</tr>
<tr>
<td><strong>Gum canals</strong></td>
<td>Horizontal in the rays, often traumatic vertical canals present in tangential rows</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>Sapwood pale grey with pinkish or yellowish tinge, heartwood reddish-brown or dark red</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>Hard to very hard</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Moderately heavy, 720 kg/m³ at 12%</td>
</tr>
<tr>
<td><strong>Grain</strong></td>
<td>Interlocked; texture fine</td>
</tr>
</tbody>
</table>
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>677.1</td>
<td>127,300</td>
<td>74</td>
</tr>
<tr>
<td>Air-dry</td>
<td>945</td>
<td>148,500</td>
<td>81</td>
</tr>
</tbody>
</table>

**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 hard

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

#### Grain
Straight to wavy; texture medium to coarse

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>492</td>
<td>70,200</td>
</tr>
<tr>
<td>Air-dry</td>
<td>543</td>
<td>77,400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm$^2$</td>
<td>Max. crushing stress kg, cm</td>
</tr>
<tr>
<td>Green</td>
<td>181</td>
<td>227</td>
</tr>
<tr>
<td>Air-dry</td>
<td>162</td>
<td>251</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>Tangential</td>
<td>Radial</td>
</tr>
<tr>
<td>Green</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Air-dry</td>
<td>75</td>
<td>68</td>
</tr>
</tbody>
</table>
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 workshop wood

Natural durability and preservation
Durable

Uses
Building construction; shipbuilding; Class I plywood for general purpose; furniture and cabinets; tool handles; artificial limbs and rehabilitation aids; textile mill accessories; cooperage; carrom draughts, tennis and badminton rackets; brushware; musical instruments; shoe-last; 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

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood greyish-white, heartwood light reddish-brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy, 640 kg/m³ at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture coarse but uniform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of Rupture</td>
<td>Modulus</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>of Elasticity</td>
</tr>
<tr>
<td>Green</td>
<td>396</td>
<td>49,000</td>
</tr>
<tr>
<td>Kiln-dry</td>
<td>633</td>
<td>83,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>121</td>
<td>216</td>
</tr>
<tr>
<td>Kiln-dry</td>
<td>207</td>
<td>389</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial</td>
<td>Tangential</td>
</tr>
<tr>
<td>Green</td>
<td>73</td>
<td>72</td>
</tr>
<tr>
<td>Kiln-dry</td>
<td>82</td>
<td>98</td>
</tr>
<tr>
<td>Working properties</td>
<td>Easy to work with tools but difficult to bring to a good finish</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td>Perishable. Treatable</td>
<td></td>
</tr>
<tr>
<td>Uses</td>
<td>Panelling in building construction; flush door shutters; Class III general purpose plywood; decorative plywood; blockboards; packing cases and boxes; mathematical, engineering and drawing instruments; bobbins; rehabilitation aids.</td>
<td></td>
</tr>
</tbody>
</table>

**72. GREWIA TILIIFOLIA Vahl**

Tiliaceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>dhaman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>chadachi, unnam</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium, up to 20 m in height, with a clear bole of 8 m and about 65 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark grey to blackish-brown, rough, fibrous, peels off in thin flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern moist mixed deciduous, Moist teak bearing and West coast semi-evergreen forests</td>
</tr>
<tr>
<td>Wood</td>
<td>Diffuse-porous to semi-ring-porous</td>
</tr>
<tr>
<td>Gross structure</td>
<td>Distinct</td>
</tr>
<tr>
<td>Growth rings</td>
<td>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</td>
</tr>
<tr>
<td>Vessels</td>
<td>Paratracheal — vasicentric; apotracheal-diffuse and also in tangential lines</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Moderately broad fine, widely spaced; very fine, closely spaced, with a tendency of storeyed arrangement</td>
</tr>
<tr>
<td>Rays</td>
<td></td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>912.9</td>
<td>148,200</td>
<td>91</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,301.9</td>
<td>163,900</td>
<td>124</td>
</tr>
</tbody>
</table>

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. GYMNASCRANTHERA 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 solitary 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/m³ 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

<table>
<thead>
<tr>
<th>Trade name</th>
<th>haldu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>manja-kadambu</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to very large, 15–35 m in height and up to 110 cm in diameter; often buttressed</td>
</tr>
<tr>
<td></td>
<td>Bark grey, soft, thick, exfoliating in small irregular flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern moist mixed deciduous, Moist teak bearing and West coast semi-evergreen forests</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>657</td>
<td>89,290</td>
</tr>
<tr>
<td>Air-dry</td>
<td>735</td>
<td>101,600</td>
</tr>
</tbody>
</table>

cm

79

66
<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>217</td>
<td>320</td>
</tr>
<tr>
<td>Air-dry</td>
<td>228</td>
<td>421</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>75</td>
<td>89</td>
</tr>
<tr>
<td>Air-dry</td>
<td>82</td>
<td>94</td>
</tr>
</tbody>
</table>

**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; bent-wood articles and toys; shoe-last; battery separators.
75. **HERITIERA PAPIPIO 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 23 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/m³ 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 |
Natural 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 tangential 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 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  
churu

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  
Indistinct

Growth rings  
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

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

79 **HOLOPTELIA IMTEGRIFOLIA** (Roxb.) Planch.

**Ulmaceae**

<table>
<thead>
<tr>
<th>Trade names</th>
<th>Indian elm, kanju</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>aval</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to large, 15-25 m in height and up to 80 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark whitish-grey, thin, exfoliating in irregular flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast semi-evergreen and occasionally in Moist teak bearing forests</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm(^2)</td>
<td>Modulus of Elasticity kg/cm(^2)</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>598</td>
<td>74,600</td>
<td>94</td>
</tr>
<tr>
<td>Air-dry</td>
<td>719</td>
<td>91,500</td>
<td>66</td>
</tr>
</tbody>
</table>

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
Nan-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; bent-wood articles and toys.
### HOPEA GLABRA Wight & Arn.

(H. wightiana var. glabra Bedd.)

Dipterocarpaceae

| Trade name | hopea |
| Local names | ilapongu, puzha-pongu |
| Charcoal | 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

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross structure</td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td>Growth rings</td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Very small, numerous, solitary or in radial multiples of 2–5 or in oblique grouping; partly filled with tyloses and brownish-yellow deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Apotracheal — diffuse-in-aggregate, paratracheal — vasicentric to aliform, short or long tangential bands embedding resin ducts</td>
</tr>
<tr>
<td>Rays</td>
<td>Moderately broad to fine, closely spaced: brownish-yellow granules and crystals often present</td>
</tr>
<tr>
<td>Resin ducts</td>
<td>Vertical, distinct under lens as tangential lines, irregularly spaced; whitish-yellow deposits present</td>
</tr>
</tbody>
</table>

### Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Light greyish or creamy brown often with dark streaks, sapwood and heartwood not distinct, lustrous when freshly cut</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy to very heavy, 1,075 kg/m³ at 12%</td>
</tr>
<tr>
<td>Grain</td>
<td>Interlocked; texture fine</td>
</tr>
</tbody>
</table>
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of</td>
<td>Modulus of</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>Rupture</td>
<td>Elasticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>1,067.3</td>
<td>147,900</td>
<td>124</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,263.7</td>
<td>160,700</td>
<td>180</td>
</tr>
</tbody>
</table>

### 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
- 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, thambagam, 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

Growth rings

diffuse-porous

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

Predominantly 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, sapwood and heartwood not distinct

Hardness

Hard to very hard

Weight

Heavy to very heavy, 930 kg/m³ at 12% m c.

Grain

Broad, shallowly interlocked; texture fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>927.8</td>
<td>130,300</td>
<td>94</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,353.7</td>
<td>145,100</td>
<td>127</td>
</tr>
</tbody>
</table>
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/m³ 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 treatment

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 aliform

Rays

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

Resin ducts

In concentric uniseriate or short tangential lines; often filled 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/m³ at 12% m.c

Grain

Shallowly interlocked; texture fine to very fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>impact</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus</td>
<td>Modulus</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>of Rupture</td>
<td>of Elasticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>1,254.7</td>
<td>169,200</td>
<td>135</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,510.7</td>
<td>187,200</td>
<td></td>
</tr>
</tbody>
</table>
### Processing
**Drying**
Difficult to season, liable to surface cracks; green conversion and close stacking under cover recommended.

<table>
<thead>
<tr>
<th>Shrinkage</th>
<th>Radial</th>
<th>Tangential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green to oven-dry</td>
<td>4.8%</td>
<td>8.2%</td>
</tr>
</tbody>
</table>

### Working properties
Difficult to saw and to plane to a smooth surface.

### Natural durability and preservation

### 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

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>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</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal — aliform to fluent</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to very fine, closely spaced</td>
</tr>
</tbody>
</table>
Properties

Colour
Sapwood light brown, heartwood dark purple

Hardness
Moderately hard to hard

Weight
Light to moderately heavy, 530–710 kg/m³ 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/m³, 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 |
| 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 |
| Colour | White to light yellowish or brownish-grey, sapwood and heartwood not distinct, fairly lustrous |
Hardness
Weight
Grain
Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress cm kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>393</td>
<td>64,300</td>
<td>5%</td>
</tr>
<tr>
<td>Air-dry</td>
<td>563</td>
<td>79,700</td>
<td>43</td>
</tr>
</tbody>
</table>

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.)

Caesaihipiniaceae

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-brown 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 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-brown, fairly lustrous

Hardness

Moderately hard

Weight

Moderately heavy, 610 kg/m³ at 12% m.c.

Grain

Straight to interlocked: texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>660.8</td>
<td>106,200</td>
<td>69</td>
</tr>
<tr>
<td>Air-dry</td>
<td>913.2</td>
<td>124,200</td>
<td>71</td>
</tr>
</tbody>
</table>

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-black, 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
<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>414</td>
<td>83,200</td>
<td>46</td>
</tr>
<tr>
<td>Air-dry</td>
<td>572</td>
<td>105,900</td>
<td>51</td>
</tr>
</tbody>
</table>

**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

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Bending</td>
<td>parallel to grain</td>
</tr>
<tr>
<td></td>
<td>kg/cm$^2$</td>
<td>kg/cm$^2$</td>
<td>cm</td>
<td>kg/cm$^2$</td>
</tr>
<tr>
<td>At 14.4% m.c.</td>
<td>483.4</td>
<td>72,700</td>
<td>43</td>
<td>237.2</td>
</tr>
</tbody>
</table>

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 ply-wood; match splints.
91. LAGERSTROEMIA MICROCARPA Wight

(*L. lanceolata* Wall. ex Clarke)

Lythraceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>benteak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>venthekku</td>
</tr>
<tr>
<td>Tree</td>
<td>Large, about 20-30 m in height and up to 110 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark yellowish-grey, smooth, exfoliating in large papery flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Semi-ring-porous to ring-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large in early wood, medium to small in late wood, solitary or in radial multiples of 2 or 3; usually filled with abundant tyloses</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal — predominantly aliform to aliform-confluent</td>
</tr>
<tr>
<td>Rays</td>
<td>Very fine, closely spaced</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood grey or pink, heartwood light reddish-brown to walnut brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy, 640 kg/m³ at 12%</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight to somewhat interlocked; texture medium</td>
</tr>
</tbody>
</table>
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>682</td>
<td>110,500</td>
<td>83</td>
</tr>
<tr>
<td>Air-dry</td>
<td>926</td>
<td>126,500</td>
<td>96</td>
</tr>
</tbody>
</table>

### 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; bent-wood 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/m³ at 12% m.c.

Grain
Straight or occasionally wavy; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Rending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5% m.c</td>
<td>917.5</td>
<td>107,380</td>
<td>507.5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>426.3</td>
<td>56,300</td>
<td>58</td>
</tr>
<tr>
<td>Air-dry</td>
<td>663.3</td>
<td>71,600</td>
<td>56</td>
</tr>
</tbody>
</table>

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

### Gross structure

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Medium to small, moderately numerous to numerous, mostly in radial multiples of 2 or 3, rarely 6 and occasionally solitary; often filled with tyloses and yellowish-brown gummy deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Rays</td>
<td>Moderately broad to fine, fairly close spaced</td>
</tr>
</tbody>
</table>

### Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Yellowish-grey or olive-grey to olive-brown or greyish-brown</td>
</tr>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy, 690 kg/m(^3) at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Fairly straight to somewhat wavy; texture medium to coarse</td>
</tr>
</tbody>
</table>

### Processing

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying</td>
<td>Seasons well, provided green conversion and slow seasoning adopted</td>
</tr>
<tr>
<td>Working properties</td>
<td>Sawing and machining difficult, takes fairly good polish</td>
</tr>
</tbody>
</table>

### Natural durability and preservation

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural durability and preservation</td>
<td>Moderately durable</td>
</tr>
</tbody>
</table>

### Uses

Agricultural implements; locally for building 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/m³ at 12% m.c.

**Grain**
Straight; texture somewhat coarse

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture (kg/cm²)</td>
<td>Modulus of Elasticity (kg/cm²)</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>423.0</td>
<td>73,300</td>
<td>46</td>
</tr>
<tr>
<td>Air-dry</td>
<td>601.6</td>
<td>85,500</td>
<td>41</td>
</tr>
</tbody>
</table>
Processing

Drying

Refactory 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 III general purpose plywood; furniture and cabinets; packing cases and boxes; match splints; artificial 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 exceptionally well under water. Heartwood very refractory to treatment

Uses  Beams in building construction; tool handles; agricultural implements; boat and shipbuilding.

97. MADHUCA NERIIIFOLIA (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

Growth rings  Diffuse-porous

Vessels  Distinct

Large to medium, numerous, rarely solitary, mostly in radial or slightly oblique multiples 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; boatbuilding; 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 lustrous

Hardness  
Moderately hard

Weight  
Heavy, 770 kg/m³ at 12% m.c.

Grain  
Straight; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>542</td>
<td>75.100</td>
<td>107</td>
</tr>
<tr>
<td>Air-dry</td>
<td>822</td>
<td>89,700</td>
<td>97</td>
</tr>
</tbody>
</table>

Processing

Drying  
Seasons fairly well, liable to warping and shrinkage

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; pulp-
99. **MANGIFERA INDICA Linn.**  
*Anacardiaceae*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>mango</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>mavu</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to large, 15–30 m in height and 50–100 cm in diameter. Bark brown or dark grey, rough.</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen and West coast semi-evergreen forests; cultivated extensively.</td>
</tr>
</tbody>
</table>

**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/m³ at 12%
- **Grain**: Straight to somewhat interlocked; texture medium to coarse
## Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>612</td>
<td>91,200</td>
</tr>
<tr>
<td>Air-dry</td>
<td>904</td>
<td>111,800</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>199</td>
<td>294</td>
</tr>
<tr>
<td>Air-dry</td>
<td>277</td>
<td>448</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>82</td>
<td>93</td>
</tr>
<tr>
<td>Air-dry</td>
<td>92</td>
<td>93</td>
</tr>
</tbody>
</table>

### 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**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Persian lilac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Small to medium, 7–15 m in height and up to 50 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark greyish-brown to dark grey with vertical fissures</td>
</tr>
<tr>
<td>Distribution</td>
<td>Native of West Asia, grown as avenue trees</td>
</tr>
</tbody>
</table>

**wood**

**Gross structure**

<table>
<thead>
<tr>
<th>Growth rings</th>
<th>Distinct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>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</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal — vasicentric, forming sheaths around pores in irregular patches and also in tangential lines delimiting growth rings</td>
</tr>
<tr>
<td>Rays</td>
<td>Browinsh; moderately broad, rather widely spaced, ray flecks distinct on radial surface</td>
</tr>
<tr>
<td>Gum canals</td>
<td>Vertical, traumatic, often in tangential rows</td>
</tr>
</tbody>
</table>
Properties

Colour
Sapwood yellowish-white, heartwood reddish-brown

Hardness
Moderately hard

Weight
Moderately heavy, 710kg/m³ at 12% m.c.

Grain
Straight; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress cm kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>598.7</td>
<td>81,300</td>
<td>130 176</td>
</tr>
</tbody>
</table>

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, rarely 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/m³ at 12% m.c.

Grain
Straight; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Bending</td>
<td>parallel to grain</td>
</tr>
<tr>
<td>Green</td>
<td>Modulus kg/cm²</td>
<td>Modulus kg/cm²</td>
<td>cm</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>399.84</td>
<td>51,759</td>
<td>212</td>
<td>94</td>
</tr>
</tbody>
</table>

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  
Distinct  

Growth rings  
Medium and small to very small, moderately few, solitary or in radial multiples of 2-4 or in clusters  

Vessels  

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/m³ 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**
Indistinct

**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 abruptly

**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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/m²</td>
<td>Modulus of Elasticity kg/m²</td>
</tr>
<tr>
<td>Green</td>
<td>1,214</td>
<td>172,900</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,735</td>
<td>207,900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressivp stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>405</td>
<td>633</td>
</tr>
<tr>
<td>Air-dry</td>
<td>529</td>
<td>960</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
<td>Radial kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>147</td>
<td>157</td>
</tr>
<tr>
<td>Air-dry</td>
<td>195</td>
<td>226</td>
</tr>
</tbody>
</table>

### Processsing

#### 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/m³ at 12% m.c.
Grain Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>563</td>
<td>83,900</td>
<td>66</td>
</tr>
<tr>
<td>Air-dry</td>
<td>634</td>
<td>95,100</td>
<td>61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>210</td>
<td>283.0</td>
</tr>
<tr>
<td>Air-dry</td>
<td>281</td>
<td>415.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>66.2</td>
<td>70.5</td>
</tr>
<tr>
<td>Air-dry</td>
<td>73.0</td>
<td>82.0</td>
</tr>
</tbody>
</table>

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 and drawing instruments; shoe lasts; battery separators.

| 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/m³ at 12% |
| Grain         | Straight; texture medium |

106, MILIUSA TOMENTOSA (Roxb.) Sinclair
(Saccopetalum tomentosum Hook. f. & Thoms.)

Annonaceae
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>740.4</td>
<td>110,600</td>
<td>89</td>
</tr>
<tr>
<td>Air-dry</td>
<td>950.7</td>
<td>126,800</td>
<td>89</td>
</tr>
</tbody>
</table>

### 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/m³ at 12% m.c.

Grain  
Straight; texture medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>583.8</td>
<td>79,200</td>
<td>69</td>
</tr>
<tr>
<td>Air-dry</td>
<td>767.2</td>
<td>93,200</td>
<td>56</td>
</tr>
</tbody>
</table>

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*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>bulletwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>elengi</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to large, 15-25 m in height and about 65 cm in diameter;  Bark dark grey, rough, with vertical fissures</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest</td>
</tr>
</tbody>
</table>

**Wood**

**Gross structure**

- Diffuse-porous
- Fairly distinct

**Growth rings**

- 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

**Vessels**

- Apotracheal — as fine broken tangential lines
- Fine to very fine, fairly close spaced

**Parenchyma**

**Rays**

**Properties**

**Colour**

- Sapwood pale reddish-brown, heartwood dark reddish-brown
- Very hard
- Very heavy, 1.070 kg/m³ at 12% m.c.

**Grain**

- Fairly straight to irregular or shallowly interlocked; texture fine

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>864</td>
<td>129,900</td>
<td>114</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1.178</td>
<td>137,800</td>
<td>107</td>
</tr>
</tbody>
</table>
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, sap-wood and heartwood not distinct
### Hardness
Moderately hard

### Weight
Moderately heavy, 640 kg/m³ at 12% m.c.

### Grain
Straight to wavy; texture fine

### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rup'ure kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>630</td>
<td>78,200</td>
<td>102</td>
</tr>
<tr>
<td>Air-dry</td>
<td>787</td>
<td>94,500</td>
<td>53</td>
</tr>
</tbody>
</table>

### 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 durable under cover. Heartwood treatable but complete penetration not always obtained

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

### Local names
manja-pavatta, manjanathi

### Tree
Small to medium, 7–12 m in height and about 30 cm in diameter
Bark brown or grey, corky, deeply cracked

---

**110. MORINDA COREIA Buch.-Ham.**

*(M. tinctoria* Roxb.)*

**Rubiaceae**

Local names

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

### 111. NOTHOPEGIA COLEBROOKEANA BI.

**Anacardiaceae**

<table>
<thead>
<tr>
<th>Local name</th>
<th>macheru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium, about 15 m in height and 30 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark pale greyish-brown, smooth or flaky, thin</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest</td>
</tr>
</tbody>
</table>
**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Fairly distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Very small, moderately numerous, solitary or in radial multiples of 2 or 3</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal — wavy tangential lines enclosing vessels, often vasicentric to aliform</td>
</tr>
<tr>
<td>Rays</td>
<td>Pale brown; fine to very fine, rather closely spaced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Properties</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>White to pale pink, turning light brown on exposure</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Very heavy, 875 kg/m³, air-dry</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight to Interlocked; texture fine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Working properties</td>
<td>Not difficult to work, can be planed to a smooth shiny surface</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Natural durability and preservation</th>
<th>Non-durable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Tool handles; turnery.</td>
</tr>
</tbody>
</table>

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

(O. lagopus Sw.)

Bombacaceae

<table>
<thead>
<tr>
<th>Trade name</th>
<th>balsa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>balsa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tree</th>
<th>Medium, 20 m or more in height with a clear bole of 6-9 m and about 60 cm in diameter</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Native of Tropical America, raised in small scale plantations</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Wood</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross structure</td>
<td>Diffuse-porous</td>
</tr>
</tbody>
</table>
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/m³ at 12% m.c.

**Grain:** Straight; texture, medium to coarse.

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress cm</td>
</tr>
<tr>
<td>Green</td>
<td>143</td>
<td>25,500</td>
<td>10</td>
</tr>
<tr>
<td>Air-dry</td>
<td>219</td>
<td>35,600</td>
<td>15</td>
</tr>
</tbody>
</table>

**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 sandwich 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 diameter |
| Distribution | West coast tropical evergreen and Southern hill-top tropical evergreen forests |

**Wood**

- **Gross structure**: Diffuse-porous
- **Growth rings**: Indistinct
- **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 reticulum with rays
- **Rays**: Fine to very fine, fairly close spaced

**Properties**

- **Colour**: Sapwood pale red, heartwood light reddish-brown
- **Hardness**: Moderately hard
- **Weight**: Moderately heavy, 690 kg/m³ at 12% m.c.
- **Grain**: Straight to wavy; texture medium

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>697</td>
<td>8,600</td>
<td>71</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,080</td>
<td>141,500</td>
<td>86</td>
</tr>
</tbody>
</table>
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. Can be easily peeled.

Natural durability and preservation


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 100 cm 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/m³ at 12% m.c.
Grain: Straight; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallal to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>510</td>
<td>76,300</td>
<td>69</td>
<td>252</td>
</tr>
<tr>
<td>Air-dry</td>
<td>580</td>
<td>7,900</td>
<td>71</td>
<td>297</td>
</tr>
</tbody>
</table>

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.)*

**Caesalpinioideae**

<table>
<thead>
<tr>
<th><strong>Trade name</strong></th>
<th>kanchan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local name</strong></td>
<td>arampuli</td>
</tr>
</tbody>
</table>
| **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**

<table>
<thead>
<tr>
<th><strong>Gross structure</strong></th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth rings</strong></td>
<td>Indistinct</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Paratracheal — broad or fairly irregular tangential bands and in patches around vessels</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Fine to very fine, closely spaced</td>
</tr>
</tbody>
</table>

**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/m³, 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of</td>
<td>Modulus of Elasticity</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>Rupture</td>
<td>Elasticity</td>
<td>kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>1,119.7</td>
<td>162,700</td>
<td>117</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,609.1</td>
<td>217,500</td>
<td>130</td>
</tr>
</tbody>
</table>
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
debbaru

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
Apotheca - 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kglm</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>659</td>
<td>92,900</td>
<td>142</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,236</td>
<td>163,700</td>
<td>152</td>
</tr>
</tbody>
</table>

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/m³ at 12% m.c.
Grain             Straight; texture fine
Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>538.8</td>
<td>92,000</td>
<td>56</td>
</tr>
<tr>
<td>Air-dry</td>
<td>684.3</td>
<td>109,500</td>
<td>61</td>
</tr>
</tbody>
</table>
Processing
Drying

Somewhat difficult to season
Shrinkage
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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>Max. crushing stress kg/cm$^2$</td>
</tr>
<tr>
<td>Green</td>
<td>594.0</td>
<td>91,500</td>
<td>112</td>
</tr>
<tr>
<td>Air-dry</td>
<td>981.2</td>
<td>122,800</td>
<td>122</td>
</tr>
</tbody>
</table>

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
deva

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/m³ at 12% m.c.

Grain
Interlocked; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact</th>
<th>Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>745</td>
<td>102,500</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,379</td>
<td>133,900</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Compression parallel to grain</td>
<td>Compression perpendicular to grain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------</td>
<td>-----------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Compressive stress at elastic limit kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>279</td>
<td>365</td>
<td>108,000</td>
<td>71</td>
</tr>
<tr>
<td>Air-dry</td>
<td>330</td>
<td>683</td>
<td>121,600</td>
<td>158</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>Air-dry</td>
<td>116</td>
<td>128</td>
</tr>
</tbody>
</table>

**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 BI.

(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/m³ 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**

<table>
<thead>
<tr>
<th><strong>Local name</strong></th>
<th>malayuram</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tree</strong></td>
<td>Medium, about 20 m in height and 30-50 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark pale brown, rough</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>West coast semi-evergreen and West coast tropical evergreen forests</td>
</tr>
</tbody>
</table>

## Wood

### Gross structure
- **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/m³ 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kglm</td>
<td>Modulus of Elasticity kg/cms</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>668.2 kg/cms</td>
<td>109,500 kg/cms</td>
<td>99 cm</td>
</tr>
<tr>
<td>Air-dry</td>
<td>957.1 kg/cms</td>
<td>115,400 kg/cms</td>
<td>84 cm</td>
</tr>
</tbody>
</table>

#### 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 and 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.)

Bignoniaceae

Local name
- vedingkorana

Tree
- Medium, about 15 m in height and up to 55 cm 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/m³ at 12% m.c.

**Grain**
Straight to irregularly interlocked; texture medium to coarse

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>660.77</td>
<td>85,287</td>
<td>83.82</td>
</tr>
<tr>
<td>Air-dry</td>
<td>803.61</td>
<td>102,035</td>
<td>40.64</td>
</tr>
</tbody>
</table>

**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 fine 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/m³ 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-evergreen 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
Weight
Grain
Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static</th>
<th>Bending</th>
<th>Impact</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>392</td>
<td>51,900</td>
<td>132</td>
<td>180</td>
</tr>
</tbody>
</table>

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; pencil-holders, 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 m 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

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Very small, numerous, mostly solitary, occasionally multiples of two in radial or tangential rows; often filled with orange-brown gummy deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to very fine, fairly close spaced</td>
</tr>
</tbody>
</table>

Properties

<table>
<thead>
<tr>
<th>Colour</th>
<th>Sapwood whitish or pale brown, heartwood light yellowish-brown to dark brown, lustrous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Heartwood scented with characteristic odour</td>
</tr>
<tr>
<td>Hardness</td>
<td>Hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy, 945 kg/m³ at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight to slightly wavy; texture fine</td>
</tr>
</tbody>
</table>

Processing

<table>
<thead>
<tr>
<th>Drying</th>
<th>Seasons well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working properties</td>
<td>Easy to saw, turns well to a fine smooth surface and takes good polish. Easy to carve</td>
</tr>
</tbody>
</table>

Natural durability and preservation

<table>
<thead>
<tr>
<th>Uses</th>
<th>Very durable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnery and carvings chess pieces; decorative panelling; fancy work and curio items. Heartwood mainly used for extraction of oil.</td>
<td></td>
</tr>
</tbody>
</table>
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 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; locally for house construction; agricultural implements.
**130. SARACA ASOCA (Roxb.) de Wilde**
(S. *indica Auct.* non Linn.)

*Caesalpiniaceae*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>asok</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>asokam</td>
</tr>
<tr>
<td>Tree</td>
<td>Small, about 10 m in height and 20-30cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark brownish-black, smooth</td>
</tr>
<tr>
<td>Distribution</td>
<td>Sporadic in West coast tropical evergreen forest</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Gross structure</td>
<td>Diffuse–porous</td>
</tr>
<tr>
<td>Growth rings</td>
<td>Fairly distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Medium to small, few to moderately few, solitary or in radial multiples of 2, 3 or rarely more</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal — vasicentric to aliform, rarely confluent and as fine lines delimiting growth rings</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine to very fine, closely spaced</td>
</tr>
<tr>
<td>Properties</td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>Pale yellowish–brown, sapwood and heartwood not distinct</td>
</tr>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy, 600 kg/m³, air-dry</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture medium to coarse</td>
</tr>
<tr>
<td>Uses</td>
<td>Agricultural implements.</td>
</tr>
</tbody>
</table>
131. SCHLEICHERA OLEOSA (Lour.) Oken

(S. trijuga Willd.)

Sapindaceae

Trade name
Local name
Tree
Distribution

kusum
poovani

Medium to large, 15-25 m in height and up to 100 cm in diameter
Bark grey, exfoliating in small, irregular flakes

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

wood

Gross structure
Growth rings
Vessels
Parenchyma
Rays

Diffuse-porous
Fairly distinct, undulating, delimited by somewhat dark and dense late wood fibres
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
Apotracheal — diffuse; paratracheal — very scanty, usually indistinct
Very fine, numerous, closely spaced

Properties

Colour
Hardness
Weight
Grain

Sapwood greyish-white, heartwood light reddish-brown
Very hard
Very heavy, 1,090 kg/m$^3$ at 12%
Straight to somewhat interlocked; texture medium
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>1,126.6</td>
<td>162,900</td>
<td>142</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,582.9</td>
<td>181,000</td>
<td>140</td>
</tr>
</tbody>
</table>

### 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

Grossstructure

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/m³, 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

Aпотracheal — 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 ducts

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 to 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 handles; cart and carriages; boarbuilding.
### 134. SPONDIAS PINNATA (Linn. f.) Kurz

(*S. mangifera* Willd.)

*Anacardiaceae*

<table>
<thead>
<tr>
<th>Trade names</th>
<th>amra, Indian hogplum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>ambazham</td>
</tr>
<tr>
<td>Tree</td>
<td>Large, about 25 m in height and up to 70 cm in diameter</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast semi-evergreen and Moist teak bearing forests</td>
</tr>
</tbody>
</table>

#### 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/m³, 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**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>pinari</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>potta–kavalam</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium, about 18 m in height and 60 cm in diameter</td>
</tr>
<tr>
<td>Distribution</td>
<td>Occasional in Southern moist mixed deciduous forest</td>
</tr>
</tbody>
</table>

**Wood**

- **Gross structure**: Diffuse-porous
- **Growth rings**: Scarcely distinct
- **Vessels**: Large to 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*

<table>
<thead>
<tr>
<th>Local names</th>
<th><strong>peenari kithondi</strong></th>
</tr>
</thead>
</table>
| **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**

<table>
<thead>
<tr>
<th><strong>Gross structure</strong></th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth rings</strong></td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>Large to medium, few to moderately few, solitary or in radial multiples of 2, 3 or often in clusters</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Apotracheal — in broken lines across the rays</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Very broad to moderately broad, widely spaced; fine, closely spaced</td>
</tr>
<tr>
<td><strong>Gum canals</strong></td>
<td>Traumatic, in tangential bands</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th><strong>Colour</strong></th>
<th>Yellowish-white or grey to greyish-brown, lustrous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardness</strong></td>
<td>Soft to very soft</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Light to very light, 315 kg/m$^3$, air-dry</td>
</tr>
<tr>
<td><strong>Grain</strong></td>
<td>Straight; texture coarse</td>
</tr>
</tbody>
</table>

**Processing**

<table>
<thead>
<tr>
<th><strong>Drying</strong></th>
<th>Quick conversion followed by open stacking under cover recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working properties</strong></td>
<td>Easy to saw and work, but difficult to bring to a good finish</td>
</tr>
</tbody>
</table>

**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 moderately 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/m³ 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.

Sterculiaeae

**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**  
Scarcey distinct

**Vessels**  
Large to medium, few to moderately few, solitary 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**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>padri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>kariyam</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium, about 20 m in height and 50 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark grey, exfoliating in large irregular flakes</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southern moist mixed deciduous and Moist teak bearing forests</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td><strong>Gross structure</strong></td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td><strong>Growth rings</strong></td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Parenchyma</strong></td>
<td>Paratracheal — aliform–confluent, discontinuous wavy bands, often connecting the vessels</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>Moderately broad to fine, fairly close spaced</td>
</tr>
<tr>
<td>Properties</td>
<td></td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>Sapwood grey with faint yellowish cast, heartwood yellowish-brown, fairly lustrous</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>Moderately hard</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Moderately heavy to heavy, 575-975 kg/m(^3) at 12%</td>
</tr>
<tr>
<td><strong>Grain</strong></td>
<td>Straight; texture coarse</td>
</tr>
</tbody>
</table>
192

### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of</td>
<td></td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>Rupture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modulus of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elasticity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>cm</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>666</td>
<td>147</td>
<td>314</td>
</tr>
<tr>
<td>Air-dry</td>
<td>876</td>
<td>130</td>
<td>513</td>
</tr>
</tbody>
</table>

### 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/m³ at 12% m.c.

Grain
- Straight; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>820</td>
<td>110,800</td>
<td>121</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,009</td>
<td>124,700</td>
<td>126</td>
</tr>
</tbody>
</table>

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*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>nux-vomica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>kanjiram</td>
</tr>
<tr>
<td><strong>Tree</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Wood</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Gross structure</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Growth rings</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Vessels</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Rays</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Included phloem</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>nux-vomica</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>nux-vomica</td>
</tr>
</tbody>
</table>

Medium, 15-20 m in height and up to 70 cm in diameter
Bark dark grey or yellowish-grey, covered with minute tubercles
Southern moist mixed deciduous; Southern dry mixed deciduous and Moist teak bearing forests

Diffuse-porous
Indistinct
Medium to very small, few, mostly solitary or in radial multiples of 2-6 or in oblique clusters
Paratracheal — tangential lines connecting the vessels
Moderately broad to fine, fairly close spaced
Conspicuous, circular, oval or irregular areas between the rays, evenly distributed
Creamy-white to yellowish grey or light brown, often with reddish-brown lines marked by numerous strands of included phloem
Hard
<table>
<thead>
<tr>
<th>Weight</th>
<th>Heavy, 880 kg/m³ at 12% m.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Straight or irregularly interlocked; texture medium</td>
</tr>
<tr>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td>Drying</td>
<td>Difficult to season, liable to surface cracks</td>
</tr>
<tr>
<td>Working properties</td>
<td>Moderately hard to saw, difficult to work with hand tools and machine, does not give a good finish</td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td>Moderately durable to durable</td>
</tr>
<tr>
<td>Uses</td>
<td>Axe handles and hammer shafts; cart wheels; legs of cots.</td>
</tr>
</tbody>
</table>

142. **SYZYGIUM CUMIMI** (Linn.) Skeels

*(Eugenia jambolana* Lamk.)*

**Myrtaceae**

<table>
<thead>
<tr>
<th>Trade name</th>
<th>jaman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local names</td>
<td>njaval, njara</td>
</tr>
<tr>
<td>Tree</td>
<td>Medium to very large, 15-35 m in height and up to 120 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark light grey with dark patches</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen and West coast semi-evergreen forests. Often planted as shade trees</td>
</tr>
<tr>
<td>Wood</td>
<td></td>
</tr>
<tr>
<td>Gross structure</td>
<td>Diffuse-porous</td>
</tr>
<tr>
<td>Growth rings</td>
<td>Scarcely distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Medium to small, numerous, solitary or in radial multiples of 2 or 3; often filled with tyloses and white deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Paratracheal -- wavy or confluent bands</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine, numerous, closely spaced</td>
</tr>
</tbody>
</table>
Properties

**Colour**  
Pale reddish-grey to brownish-grey, sapwood and heartwood not distinct, lustrous

**Hardness**  
Moderately hard

**Weight**  
Moderately heavy, 670 kg/m³ at 12% m.c.

**Grain**  
Interlocked or curly; texture medium to coarse

**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture (kg/cm²)</td>
<td>Modulus of Elasticity (kg/cm²)</td>
<td>Max. crushing stress (kg/cm²)</td>
</tr>
<tr>
<td>Green</td>
<td>798</td>
<td>109,400</td>
<td>99</td>
</tr>
<tr>
<td>Air-dry</td>
<td>950</td>
<td>126,500</td>
<td>66</td>
</tr>
</tbody>
</table>

**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*

<table>
<thead>
<tr>
<th>Trade name</th>
<th>jaman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local name</td>
<td>karinjaval</td>
</tr>
</tbody>
</table>
| 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**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rings</td>
<td>Fairly distinct</td>
</tr>
<tr>
<td>Vessels</td>
<td>Large to medium' and small, numerous, mostly solitary or in radial multiples of 2 or 3; often filled with tyloses and white deposits</td>
</tr>
<tr>
<td>Parenchyma</td>
<td>Fine wavy tangential bands, often forming reticulum with rays</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine, closely spaced; filled with reddish-brown deposits</td>
</tr>
<tr>
<td>Gum canals</td>
<td>Traumatic, horizontal canals occasional</td>
</tr>
</tbody>
</table>

**Properties**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Reddish-brown, sapwood and heartwood not distinct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Hard to very hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Heavy to very heavy, 970 kg/m³ at 12%</td>
</tr>
<tr>
<td>Grain</td>
<td>Interlocked; texture medium to fine</td>
</tr>
</tbody>
</table>

**Processing**

<table>
<thead>
<tr>
<th>Drying</th>
<th>Green conversion followed by stacking under cover recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working properties</td>
<td>Difficult to saw the seasoned wood, machines fairly well, finishes to a smooth surface</td>
</tr>
</tbody>
</table>
Natural durability and preservation
Non-durable. Heartwood refractory to treatment

Uses
Country boats; fence posts; packing cases, temporary construction; low quality furniture.

<table>
<thead>
<tr>
<th>144. TAMARINDUS INDICA Linn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caesalpiniaceae</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Local name</th>
<th>Tree</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>imli</td>
<td>puli</td>
<td>Large to very large, about 30 m in height and up to 150 cm in diameter</td>
<td>Native of Africa. Cultivated</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Growth rings</th>
<th>Vessels</th>
<th>Parenchyma</th>
<th>Rays</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffusa-porous</td>
<td>Fairly distinct</td>
<td>Small to very small, moderately few to moderately numerous, solitary or in radial multiples of 2-4; occasionally filled with white deposits</td>
<td>Paratracheal aliform and fine lines delimiting growth rings</td>
<td>Fine to very fine, closely spaced</td>
<td>Sapwood yellowish-white to greyish-brown, heartwood dark purplish-brown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardness</th>
<th>Weight</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard to very hard</td>
<td>Heavy to very heavy, 915 kg/m$^3$ at 12%</td>
<td>Straight to interlocked and wavy; texture medium to coarse</td>
</tr>
<tr>
<td>Condition</td>
<td>Static Bending</td>
<td>Impact Bending</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>571.7</td>
<td>56,300</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,040.4</td>
<td>96,500</td>
</tr>
</tbody>
</table>

Processing

**Drying**
- Moderately refractory to air-seasoning
- 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 diameter
- 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/m³ at 12% m.c.

Grain
Straight; texture fine and uneven

Odour
Characteristic odour

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
</tr>
<tr>
<td></td>
<td>kg/m²</td>
<td>kg/m²</td>
</tr>
<tr>
<td>Green</td>
<td>841</td>
<td>109,700</td>
</tr>
<tr>
<td>Air-dry</td>
<td>953</td>
<td>119,600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td></td>
<td>kg/cm²</td>
<td>kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>311</td>
<td>415</td>
</tr>
<tr>
<td>Air-dry</td>
<td>376</td>
<td>532</td>
</tr>
<tr>
<td>Condition</td>
<td>Shear parallel to grain</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Air-dry</td>
<td>97</td>
<td>108</td>
</tr>
</tbody>
</table>

**Processing**

**Drying**

Seasons very well, the best model wood for air-seasoning. Kiln-seasoning also gives very good results.

Shrinkage

<table>
<thead>
<tr>
<th>Radial</th>
<th>Tangential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>2.3%</td>
</tr>
<tr>
<td>over-dry</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm$^2$</td>
<td>Modulus of Elasticity kg/cm$^2$</td>
<td>~</td>
</tr>
<tr>
<td>Green</td>
<td>678.5</td>
<td>101,900</td>
<td>94</td>
</tr>
<tr>
<td>Air-dry</td>
<td>995.5</td>
<td>122,800</td>
<td>112</td>
</tr>
</tbody>
</table>

### Processing

#### Drying
- Moderately refractory to seasoning; green conversion followed by open stacking under cover recommended. Kiln-seasoning offers no difficulty

<table>
<thead>
<tr>
<th>Shrinkage</th>
<th>Green to oven-dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>4.7%</td>
</tr>
<tr>
<td>Tangential</td>
<td>7.7%</td>
</tr>
</tbody>
</table>
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/m³ at 12% m.c.

### Grain
Interlocked; texture medium to fine

### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture (kg/cm²)</td>
<td>Modulus of Elasticity (kg/cm²)</td>
<td>Max. crushing stress (kg/cm²)</td>
</tr>
<tr>
<td>Green</td>
<td>853.1</td>
<td>123,700</td>
<td>102</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,076.6</td>
<td>141,800</td>
<td>94</td>
</tr>
</tbody>
</table>

### 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/m³ at 12% m.c. |
| Grain | Straight to interlocked; texture coarse |

### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Static Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>735</td>
<td>105,400</td>
<td>112</td>
</tr>
<tr>
<td>Air-dry</td>
<td>905</td>
<td>118,330</td>
<td>61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>266</td>
<td>377</td>
</tr>
<tr>
<td>Air-dry</td>
<td>279</td>
<td>556</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>92</td>
<td>109</td>
</tr>
<tr>
<td>Air-dry</td>
<td>105</td>
<td>122</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Shrinkage</th>
<th>Green to oven-dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>4.7%</td>
</tr>
<tr>
<td>Tangential</td>
<td>7.7%</td>
</tr>
</tbody>
</table>
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 whitish 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/m³ at 12% m.c.

Grain: Straight to wavy; texture medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td>Green</td>
<td>846.7 kg/cm²</td>
<td>132,200 kg/cm²</td>
<td>84 cm</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,117.7 kg/cm²</td>
<td>142,400 kg/cm²</td>
<td>102 cm</td>
</tr>
</tbody>
</table>

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; boatbuilding; 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/m³ at 12% m.c.

Grain
Interlocked; texture coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>290 kg/cm²</td>
<td>48,800 kg/cm²</td>
<td>30</td>
</tr>
<tr>
<td>Air-dry</td>
<td>433 kg/cm²</td>
<td>60,700 kg/cm²</td>
<td>41</td>
</tr>
</tbody>
</table>
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/m³ at 12% m.c.

Grain
Straight to somewhat interlocked; texture medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm²</th>
<th>Bending Modulus of Elasticity kg/cm²</th>
<th>Impact Bending cm</th>
<th>Compression parallel to grain kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>945.2</td>
<td>103,600</td>
<td>160</td>
<td>450.9</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,204.8</td>
<td>119,200</td>
<td>137</td>
<td>574.3</td>
</tr>
</tbody>
</table>

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.
### TOONA CILIATA Roemer

*Trade name*

- **Cedrela toona** Roxb. ex Rottler

*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 bearing forests

*Wood*

<table>
<thead>
<tr>
<th>Gross structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-ring-porous to ring-porous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth rings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinct</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parenchyma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paratracheal — scanty, faintly delimiting growth rings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately broad to fine, rather few, fairly wide spaced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gum canals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical, traumatic, occasional</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pith flecks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often present</td>
</tr>
</tbody>
</table>

*Properties*

<table>
<thead>
<tr>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sapwood pinkish-brown, heartwood reddish-brown, rather lustrous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft to moderately hard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light to moderately heavy, 515 kg/m³ at 12% m.c.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight; texture coarse and uneven</td>
</tr>
</tbody>
</table>
### Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
</tr>
<tr>
<td>Green</td>
<td>436 kg/cm²</td>
<td>63,980 kg/cm²</td>
</tr>
<tr>
<td>Air-dry</td>
<td>562 kg/cm²</td>
<td>78,530 kg/cm²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Compression parallel to grain</th>
<th>Compression perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compressive stress at elastic limit kg/cm²</td>
<td>Max. crushing stress kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>162</td>
<td>215</td>
</tr>
<tr>
<td>Air-dry</td>
<td>184</td>
<td>321</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Shear parallel to grain</th>
<th>Tension perpendicular to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radial kg/cm²</td>
<td>Tangential kg/cm²</td>
</tr>
<tr>
<td>Green</td>
<td>58</td>
<td>70</td>
</tr>
<tr>
<td>Air-dry</td>
<td>79</td>
<td>110</td>
</tr>
</tbody>
</table>

### 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. TREVIA 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, closely 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Modulus of Rupture kg/cm$^2$</th>
<th>Static Modulus of Elasticity kg/cm$^2$</th>
<th>Static Bending cm</th>
<th>Impact Bending of Modulus of Elasticity kg/cm$^2$</th>
<th>Max. crushing stress kg/cm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>392</td>
<td>68,500</td>
<td>66</td>
<td></td>
<td>192</td>
</tr>
<tr>
<td>Air-dry</td>
<td>562</td>
<td>70,100</td>
<td>53</td>
<td></td>
<td>369</td>
</tr>
</tbody>
</table>
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 around 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/m³ at 12% m.c.,

Grain
Fairly straight to narrowly interlocked; texture medium to coarse

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>573.1</td>
<td>109,500</td>
<td>51</td>
</tr>
<tr>
<td>Air-dry</td>
<td>770.8</td>
<td>129,800</td>
<td>71</td>
</tr>
</tbody>
</table>

Processing

Drying
Easy to season; quick surface drying by vertical stacking followed* by horizontal stacking under cover recommended, as liable to 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

**Dipterocarpaceae**

**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/m³, 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/m³ at 12%
Grain  Interlocked; texture fine and even

Processing

Drying  Easy to season
Shrinkage  
   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/m³ at 12%

Grain

Straight to interlocked or wavy; texture medium to coarse
**Strength**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture</td>
<td>Modulus of Elasticity</td>
<td>Max. crushing stress</td>
</tr>
<tr>
<td>Green</td>
<td>909 kg/cm²</td>
<td>130,100 kg/cm²</td>
<td>97 cm</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,169 kg/cm²</td>
<td>149,400 kg/cm²</td>
<td>81 cm</td>
</tr>
</tbody>
</table>

**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
<table>
<thead>
<tr>
<th>Vessels</th>
<th>Small to very small, moderately few to moderately numerous, mostly solitary or in radial multiples of two or in tangential clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parenchyma</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Rays</td>
<td>Fine, closely spaced</td>
</tr>
<tr>
<td>Properties</td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>Light greyish-brown, sapwood and heartwood not distinct, slightly lustrous</td>
</tr>
<tr>
<td>Hardness</td>
<td>Moderately hard</td>
</tr>
<tr>
<td>Weight</td>
<td>Moderately heavy, 625 kg/m³ at 12% m.c.</td>
</tr>
<tr>
<td>Grain</td>
<td>Straight; texture fine</td>
</tr>
<tr>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td>Drying</td>
<td>Difficult to season</td>
</tr>
<tr>
<td>Working properties</td>
<td>Moderately easy to saw and work, finishes to a smooth surface, machining satisfactory</td>
</tr>
<tr>
<td>Natural durability and preservation</td>
<td>Moderately durable</td>
</tr>
<tr>
<td>Uses</td>
<td>Constructional purposes; furniture; carts and carriages.</td>
</tr>
</tbody>
</table>

**159. WALSURA TRIFOLIA (A. Juss.) Harms**

*(W. piscida* Roxb.)*

**Meliaceae**

<table>
<thead>
<tr>
<th>Local</th>
<th>periila-pacha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Medium to large, 15–27 m in height and about 60 cm in diameter</td>
</tr>
<tr>
<td></td>
<td>Bark greyish-brown, tessellated in rectangular pattern, thin</td>
</tr>
<tr>
<td>Distribution</td>
<td>West coast tropical evergreen forest in South and Central Kerala</td>
</tr>
</tbody>
</table>

**Wood**

<table>
<thead>
<tr>
<th>Gross structure</th>
<th>Diffuse-porous</th>
</tr>
</thead>
</table>
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/m³ 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/m³ 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

Fairly 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 — diffuse; 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/m³ at 12% m.c

Grain

Straight to interlocked; texture medium to fine

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compressive strength parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>812.5</td>
<td>116,400</td>
<td>76</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,097.8</td>
<td>142,100</td>
<td>74</td>
</tr>
</tbody>
</table>
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

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/m³, kiln-dry

Grain

Straight to somewhat wavy; texture medium

Strength

<table>
<thead>
<tr>
<th>Condition</th>
<th>Static Bending</th>
<th>Impact Bending</th>
<th>Compression parallel to grain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modulus of Rupture kg/cm²</td>
<td>Modulus of Elasticity kg/cm²</td>
<td>cm</td>
</tr>
<tr>
<td>Green</td>
<td>775.6</td>
<td>130,200</td>
<td>114</td>
</tr>
<tr>
<td>Air-dry</td>
<td>1,296.0</td>
<td>154,200</td>
<td>137</td>
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</table>

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.
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

II  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 outlines are not distinct
         c. Large and very large  Pores distinctly visible to the eye
      2. Distribution (Pores/mm²)
         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
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

<table>
<thead>
<tr>
<th>Use</th>
<th>Indian Standard Specification</th>
<th>Serial number of the species</th>
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<tr>
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<td>IS : 1003 - 1977</td>
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<td>(b) Bridge</td>
<td>IS : 3629 - 1966</td>
<td>1,6,9,15,20,25,31,35,38,53,54,62,63,64,68,72,75,80,81,82,83,88,91,92,106,120,143,145,148,149,161,162</td>
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<td>II PILES</td>
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<td>(a) General purpose</td>
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<td>Use</td>
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<td>Class III1</td>
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<td>(b) Tea chests</td>
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<td>(c) Flush door shutters</td>
<td>IS : 2202 - 1973</td>
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<td>(d) Blockboards</td>
<td>IS : 1659 - 1969</td>
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<td>(f) Aircraft plywood</td>
<td>IS : 4859 - 1968</td>
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<td>(g) Marine plywood</td>
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<td>Uses</td>
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<td>VII PACKING CASES AND BOXES</td>
<td>IS : 6662 - 1972</td>
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<td>XXVI TENT</td>
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<tr>
<td>ACCESSORIES</td>
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</table>
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 capable 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 general term for permanence or resistance to deterioration. Frequently used to refer to the degree of resistance of a species of 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 is considered edge-grained when the angle between surface and growth ring lies 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 appearance 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 heat and pressure in a hot press to a density of 500 kg/m³ 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 **porous wood**, in contrast to the 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 wood.

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 ($\mu$), 10-cm; also expressed as micrometer ($\mu$m).

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 several 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) or 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 parenchyma:** 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 inner 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 little or no variation in size indicative of seasonal growth.

**Preservative:** any substance that, for a reasonable length of time, is effective 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 disulfide.

**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 wood 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 artificial 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 by 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. Sometimes 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 the 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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Nair, P.N. and Nair, C.S. 1970. An Index to the Important Forest Plants of Kerala. Forest Department Publication No. 4, Kerala Forest Department, Trivandrum, 113p.


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