

Practical manual

Wood Anatomy

Course No. FPU -126 Credit Hrs. 3(2+1)

For B.Sc. (Hons.) Forestry II Semester

Dr. Amey Kale



2019

**College of Horticulture & Forestry
Rani Lakshmi Bai Central Agricultural University
Jhansi – 284003**

Syllabus: Study of primary growth in stems of typical dicots and monocots. Study of wood formation in typical dicot stem. Study of vascular bundles in monocots. Parts of the logs (woody trunks), and the three distinctive surfaces of wood (i.e. cross, radial and tangential planes). Timber identification and its importance. Procedures for field identification of timbers. Study of physical features of wood. Study of gross features of wood. Study of anatomical features of wood, pores or vessels, different types. Study of soft tissue in timbers and their different types distributions. Study of wood rays, and their different types. Study of the non-porous woods, their physical and anatomical description. Study of infiltration and inclusions in wood. Anatomical keys and methods to use them. Dichotomous keys, punched card keys and computer aided identification. Field identification of important timbers of Kerala.

Name of Student

Roll No.

Batch

Session

Semester

Course Name :

Course No. :

Credit

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Price: Rs.

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CERTIFICATE

This is to certify that Shri./Km.ID No.....
has completed the practical of course.....course
No. as per the syllabus of B.Sc. (Hons.) Agriculture/ Horticulture/ Forestry semester
in the year.....in the respective lab/field of College.

Date:

Course Teacher

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Objective: Study of the primary growth in dicot stem

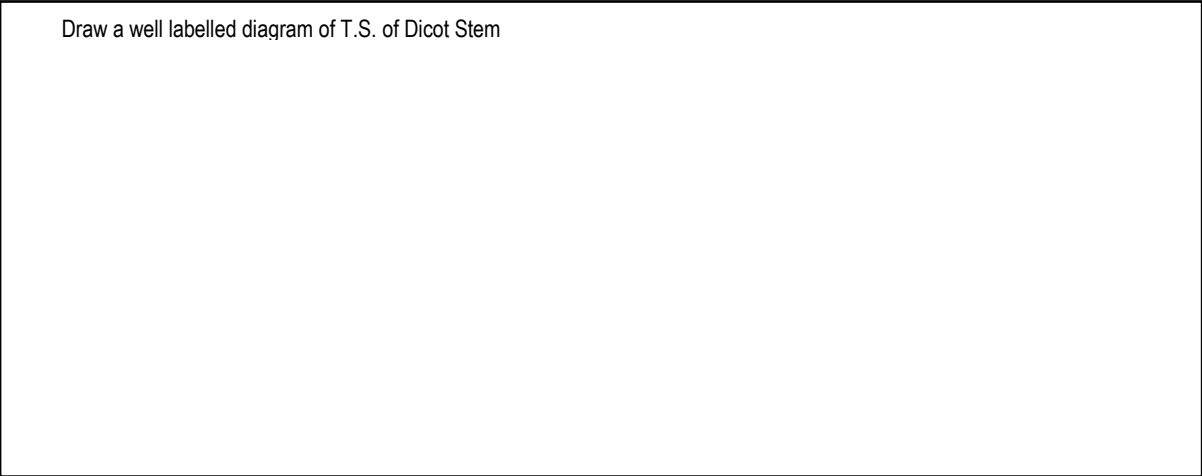
Material Required:

Procedure:

Sectioning -

Staining -

Specimen Mounting:



Observations:

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Practical No. 2

Objective: Study of the primary growth in monocot stem

Material Required:

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Procedure:

Sectioning -

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Staining -

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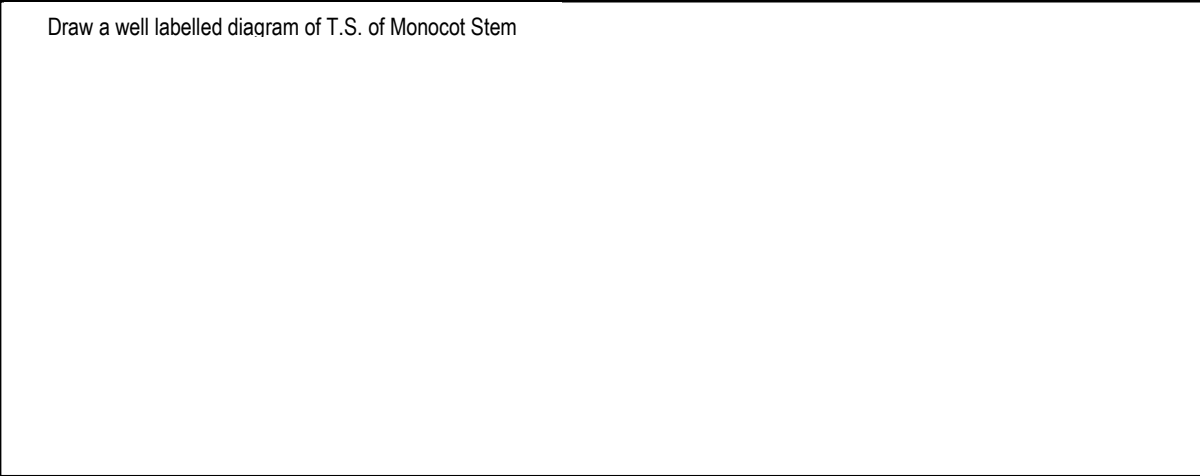
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Specimen Mounting:

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Observations:

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Practical No. 3

Objective: Study of Dicot and Monocot Roots

Material Required:

Procedure:

Sectioning -

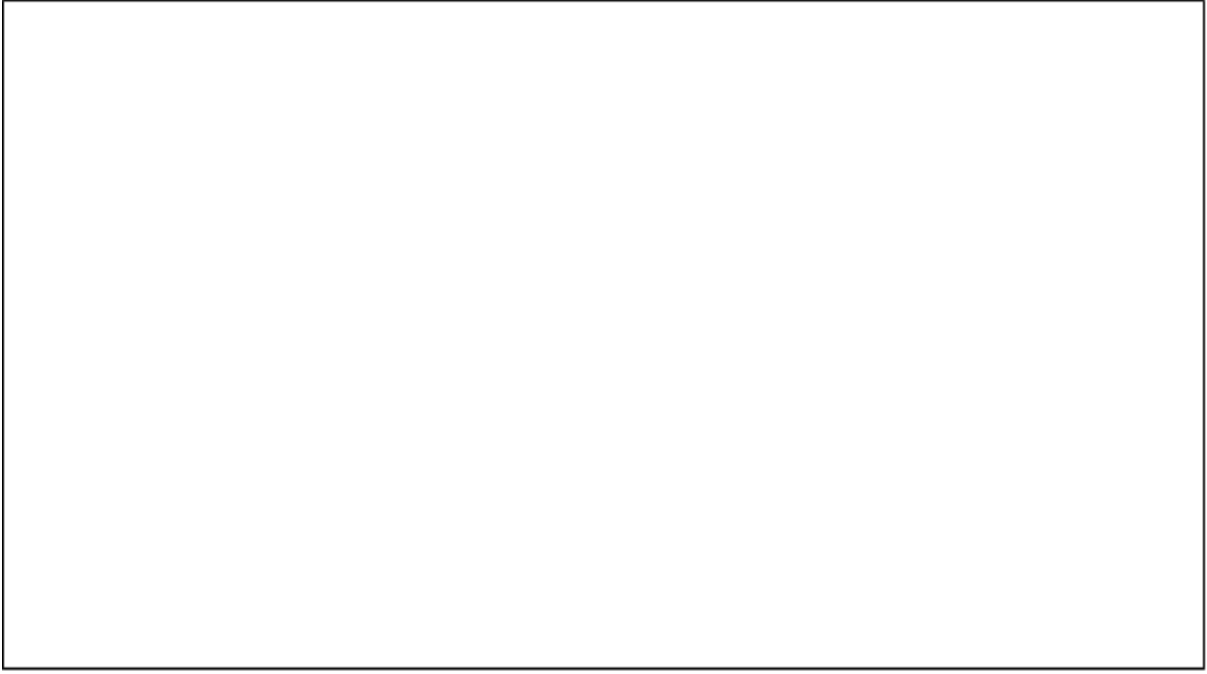
Staining -

Specimen Mounting-

Observations: -

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Draw a well labelled diagram of T.S. of Dicot Root



Draw a well labelled diagram of T.S. of Monocot Root



Objective: Study of Gross Features of Wood

Gross Features

Bark:

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Pith:

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Sapwood **and** **Heartwood:**

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Growth Rings (Annual Rings):

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Early wood and Latewood:

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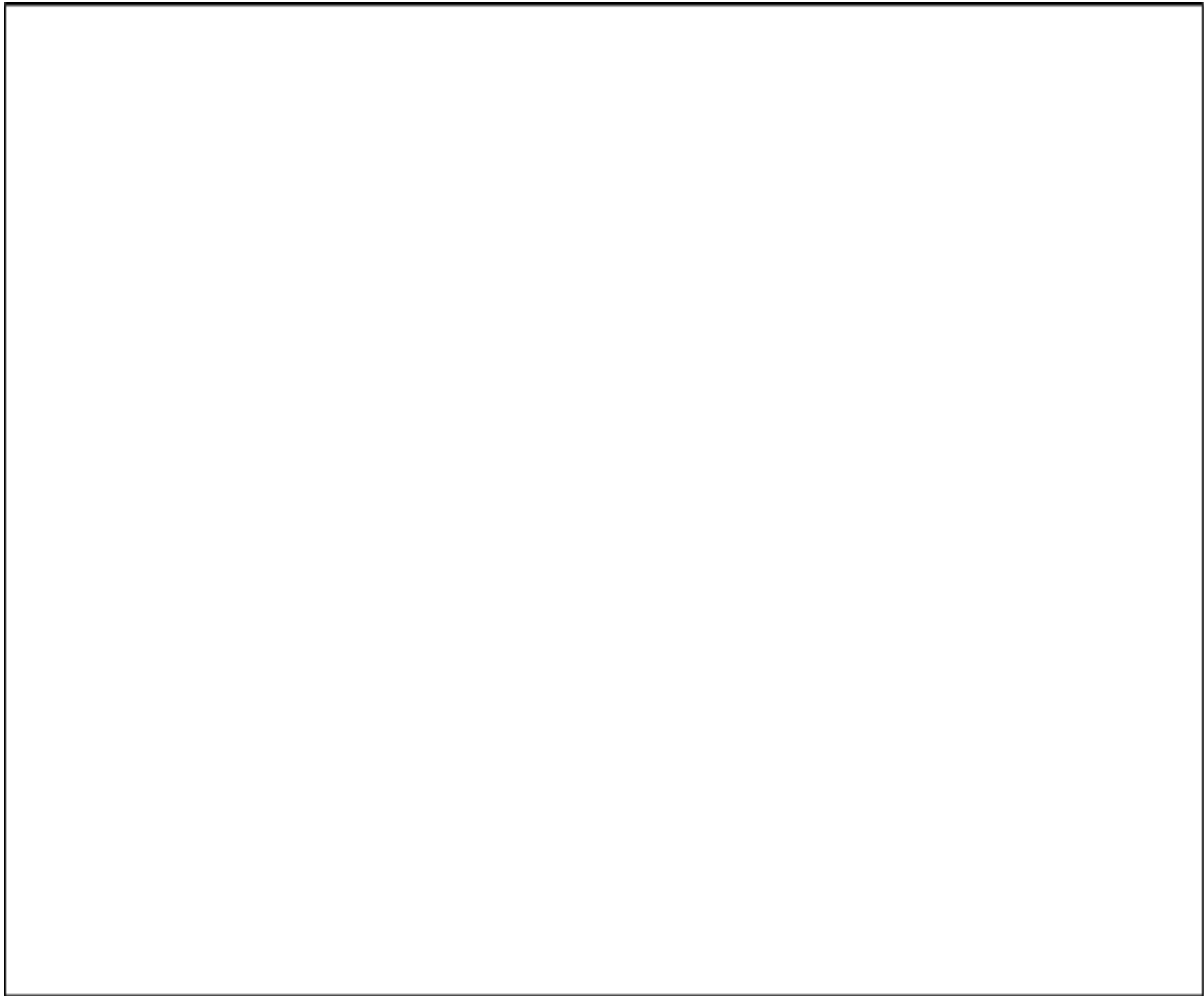
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Draw a well labelled diagram of But-end of the wood log showing gross features



Practical No. 5

Objective: Study of Wood Density and Specific Gravity

Material required:

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Density (ρ):

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Formula: $\rho = \frac{m}{V}$ m ; mass, V ; Volume

Volume measurement –

Geometrical **method**

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Water displacement method.....
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e.g. Volume of specimen = New water level – Original water level
= 1220 – 1000 = 220 ml

Mass of specimen = 520 g

Density = 520/220 = 2.36 g/ml

Since, 1 ml = 1 cm³;

Density of a specimen can be expressed as 2.36 g/cc

Specific Gravity (S):

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Formula: = $\frac{W_m}{V_g}$ W_m ; Weight of Oven dry wood, V_g ; Volume in green condition (Usually obtained by weight of an equal volume of water by immersion method)

Observation and Calculation

Sl. No.	Mass	Volume by geometry	Volume by water displacement	Density*	Density#	Oven dry weight	Specific Gravity

**density calculated using volume estimated by geometry method*

#density calculated using volume by water displacement

Note: Common temperate woods range in specific gravity (based on oven dry weight and green volume) from about 0.30 to 0.90.

Objective: Study of Physical Properties of Wood

Colour:
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Grain:
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Texture:
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- **Coarse Texture:**.....
- **Fine Texture:**
- **Even Texture:**
- **Uneven Texture:**

Lustre:
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- **Bright Lustre:**
- **Dull Lustre:**

Figure/Ripple marks:
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Odour.....

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Hardness:

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- **Soft to very soft – e.g.**
- **Moderately hard – e.g.**
- **Hard to very hard – e.g.**

Objective: Study of Three Surfaces of Wood

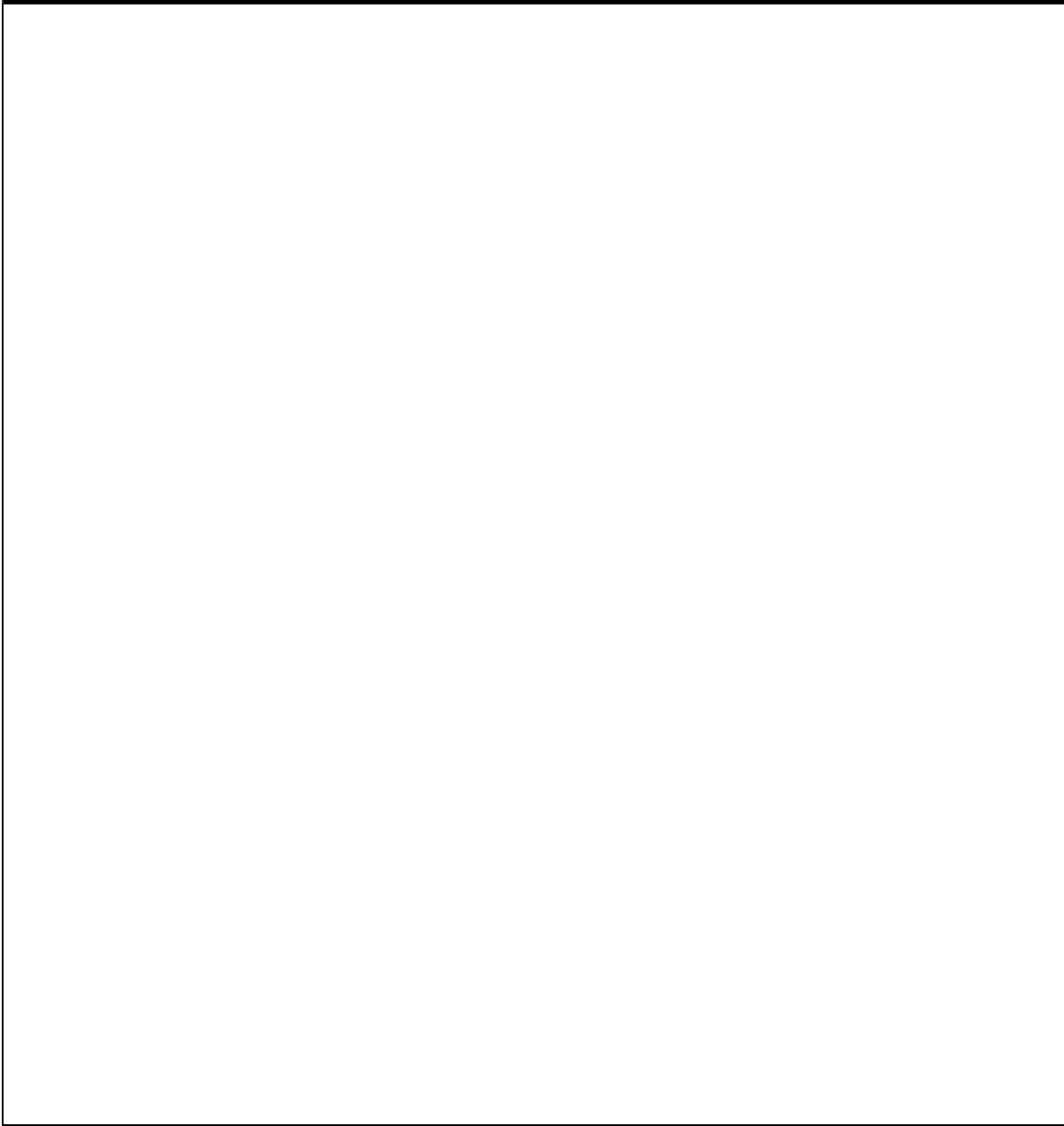
Transverse plane/face (Cress section)
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Radial plane of section
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Tangential plane of section
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Note - Radial and tangential sections are referred to as longitudinal sections because they extend parallel to the axial system (along the grain).

Draw a well labelled diagram section of wood showing three distinctive surfaces



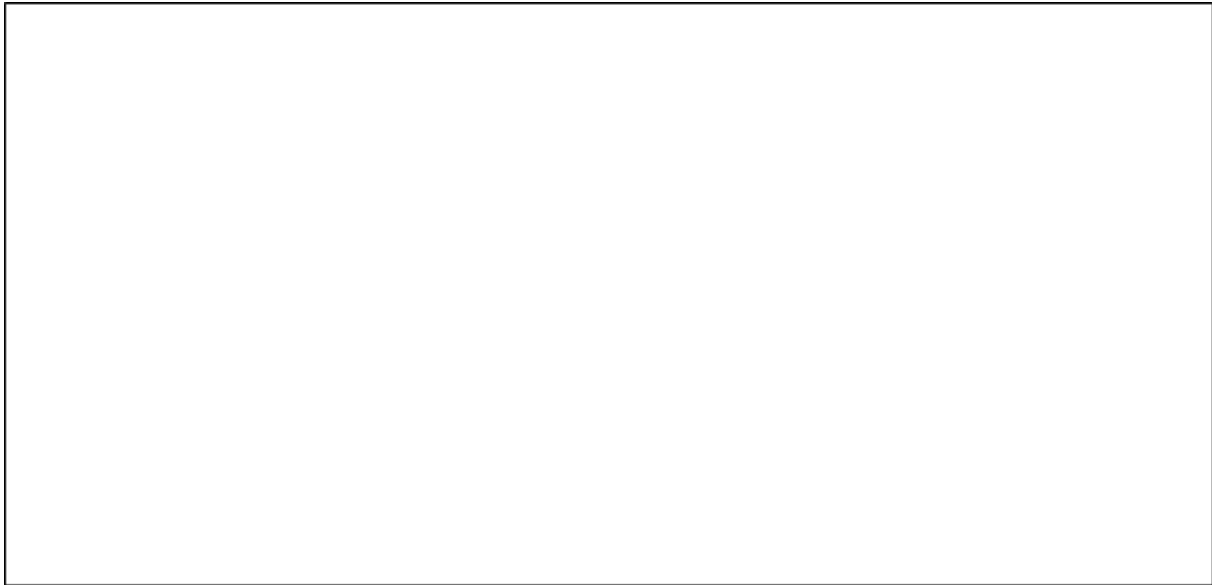
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**Axial
parenchyma**.....
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Intercellular canals (Gum Canals)
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Tyloses
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Draw a well labelled diagram section of wood showing macroscopic features of wood



Practical No. 10

Objective: Study of Arrangement of Vessels in Porous Woods

Arrangement of pores in porous wood/ hardwoods

Ring Porous wood

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Diffuse Porous wood

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Semi Ring Porous wood

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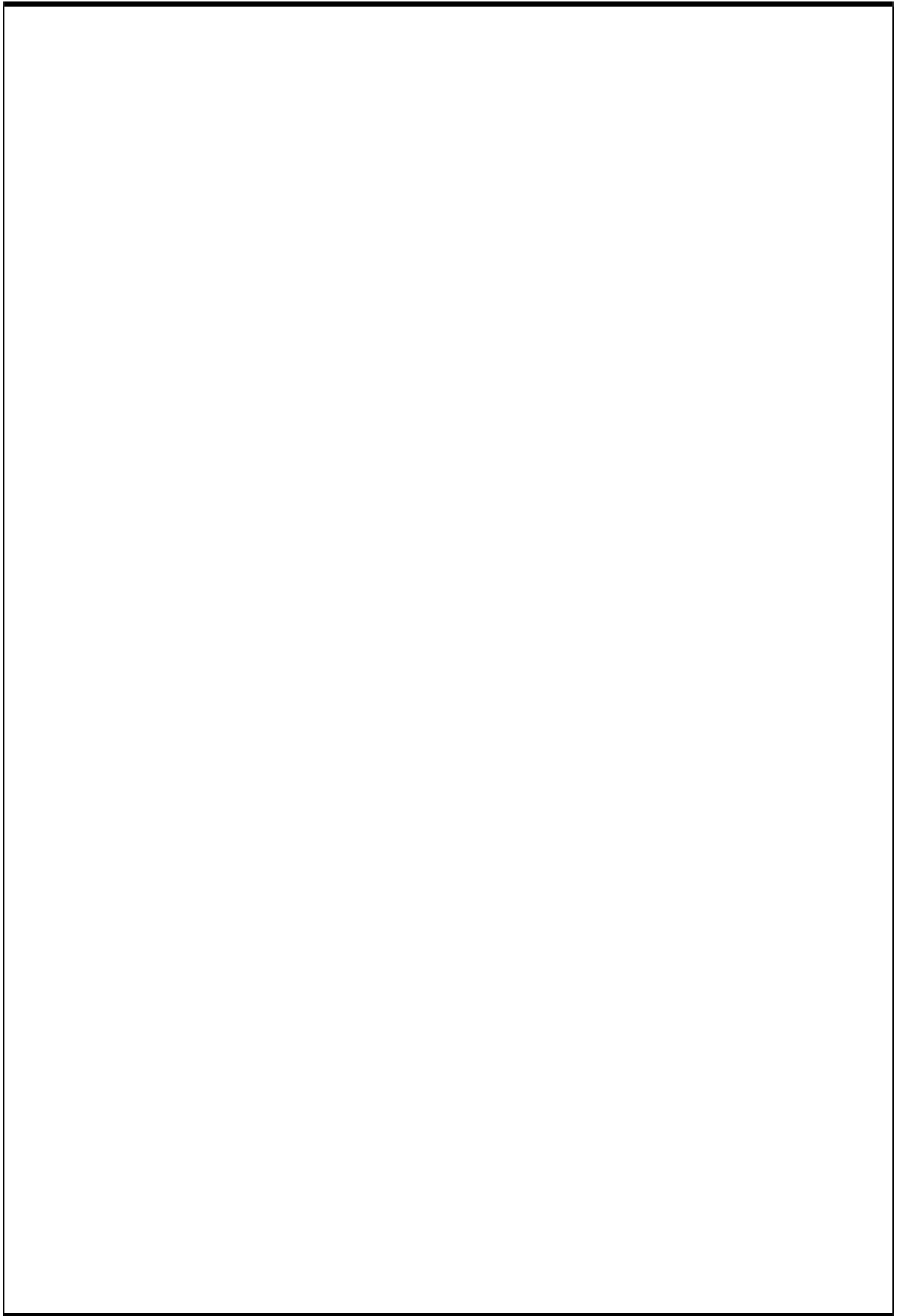
Pores in Long radial Multiples:

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Pores in oblique grouping:

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Draw a well labelled diagram of cross section of wood showing different pore arrangement



Practical No. 11

Objective: Study of Diagnostic Features of Non Porous Wood (Macroscopic Features)

Tracheids.....

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Axial parenchyma.....

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Rays.....

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Resin canals.....

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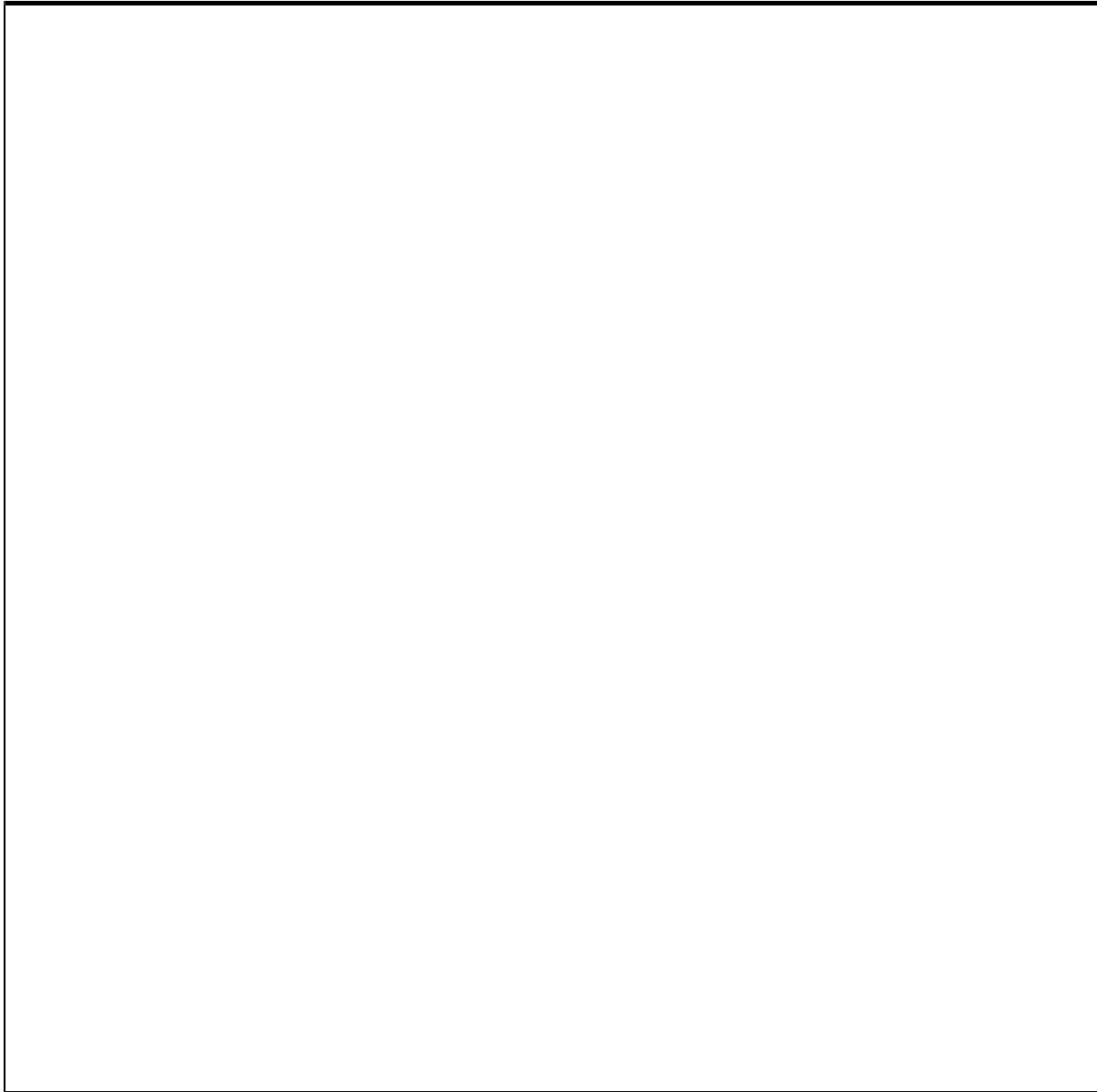
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Draw a well labelled diagram of cross section of Non Porous-wood showing anatomical features



Objective: Study of Axial Wood Parenchyma/Soft Tissues

Wood

Parenchyma.....
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Classification

A. Apotracheal types.....
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1. Diffuse type.....
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2. Terminal **or** **Initial**
type.....
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3. Reticulate or Netlike type.....
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B. Paratracheal type.....
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1. Aliform
type.....

or

Eyelet

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2. Banded type.....

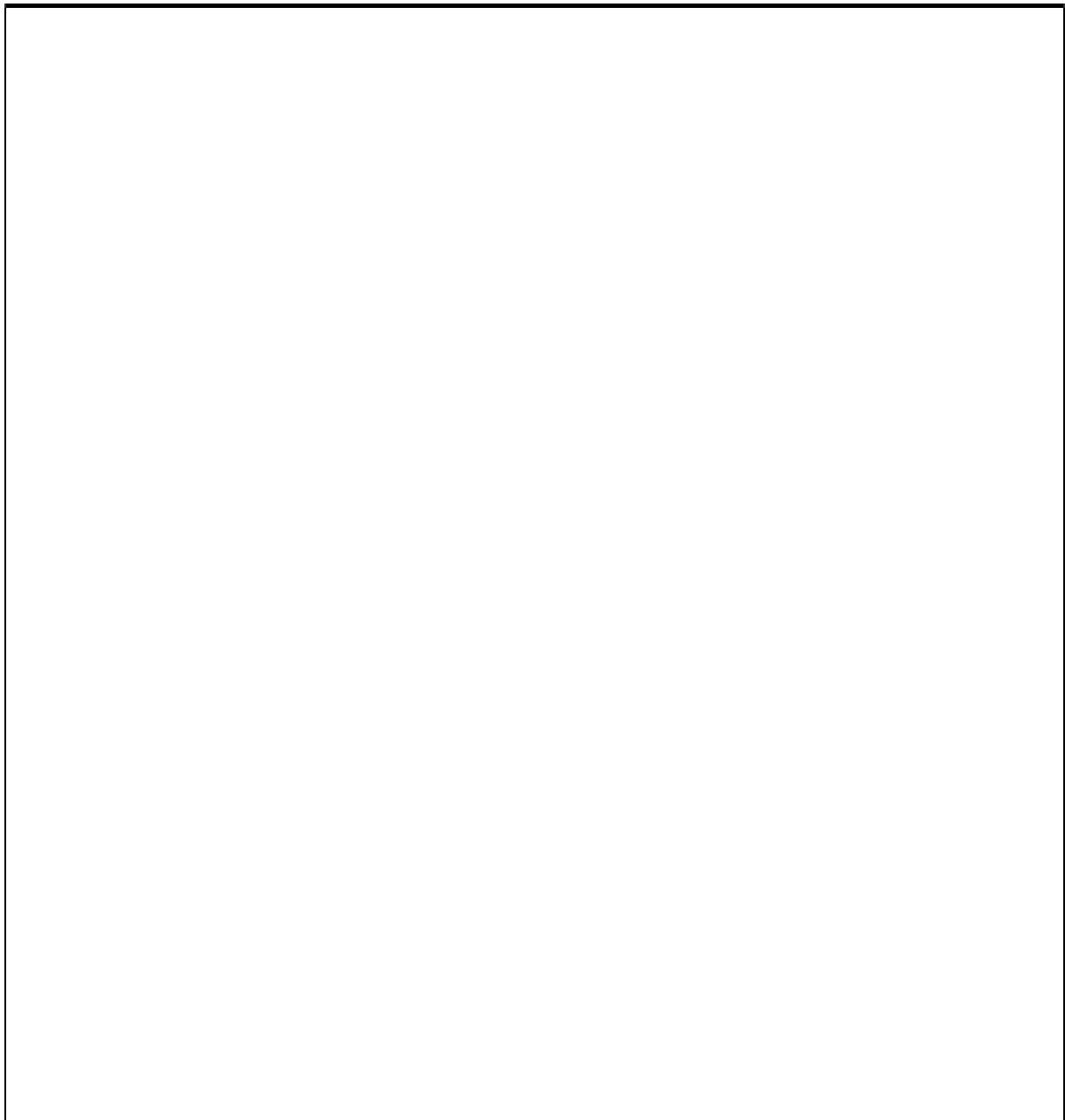
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Draw a well labelled diagram of cross section of wood showing different arrangement of Parenchyma tissues



Objective: Study of Horizontal Ray Elements of Wood

Rays.....
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Classification of rays

A. Based on cell arrangement

1. Serrate rays.....
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2. Aggregate rays.....
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3. Fused Ray.....
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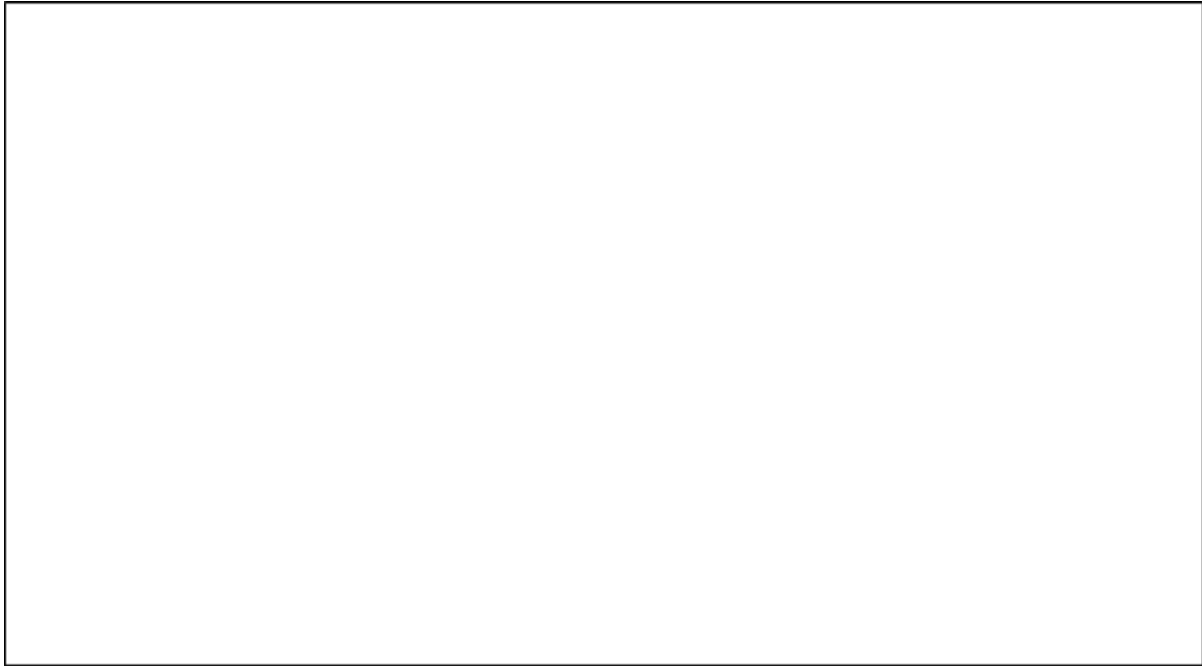
B. Based on Visibility

1. Broad to very broad.....
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2. Moderately broad.....
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3. Fine to very fine.....

Draw a well labelled diagram of cross section of wood showing wood rays



Draw a well labelled diagram of tangential face of wood showing ray types



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Draw a well labelled diagram of macerated tissues observed

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Dichotomous

Keys.....
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A Dichotomous Key for Identification eight Indian Timbers

1	Wood Non Porous	2
1	Wood Porous	5
2	Resin Canals Absent	3
2	Resin Canals Present	4
3	Wood without any odour and white	Fir (<i>Abies pindrow</i>)
3	Wood with pungent odour, light yellowish-brown, moderately hard. Sapwood and heartwood distinct.	Deodar (<i>Cedrus deodara</i>)
4	Resin canals scattered. Wood white, without odour	Spruce (<i>Picea smithiana</i>)

	4	Resin canals in long tangential bands. Wood light yellowish with pungent odour.	Deodar (<i>Cedrus deodara</i>)
5		Wood ring porous or semi ring porous	6
5		Wood diffuse porous	7
	6	Ripple marks present. Water extract gives strong fluorescence. Wood golden brown, without odour.	Bija sal (<i>Pterocarpus marsupium</i>)
	6	Ripple marks absent, water extract without any fluorescence. Wood with golden brown colour, with characteristic leather odour.	Teak (<i>Tectona grandis</i>)
7		Ripple marks present	8
7		Ripple marks absent	9
	8	Soft tissues predominantly wavy bands. Pores large, filled with reddish brown gummy deposits. Golden brown colour, Water extract gives strong fluorescence	Bija sal (<i>Pterocarpus marsupium</i>)
	8	Soft tissues predominantly Aliform, occasionally connecting adjacent pores. Pores medium sized filled with whitish gummy deposits. Pale yellow wood, water extract without any fluorescence	Kanju (<i>Holoptelia integrifolia</i>)
9		Pores predominantly in radially oblique manner, soft tissues in tangential bands ending abruptly. Fine rays, visible only under lens, wood light red, lustrous	Poon (<i>Calophyllum spp.</i>)
9		Pores mostly solitary and in short radial multiples. Soft tissues Vasicentric forming a narrow sheath round the pores. Rays fairly broad, distinct to eyes. Wood light red in colour, somewhat dull.	Babul (<i>Acacia nilotica</i>)

Practical No. 18

Objective: Study of anatomical features of some important Indian Timbers

Species 1

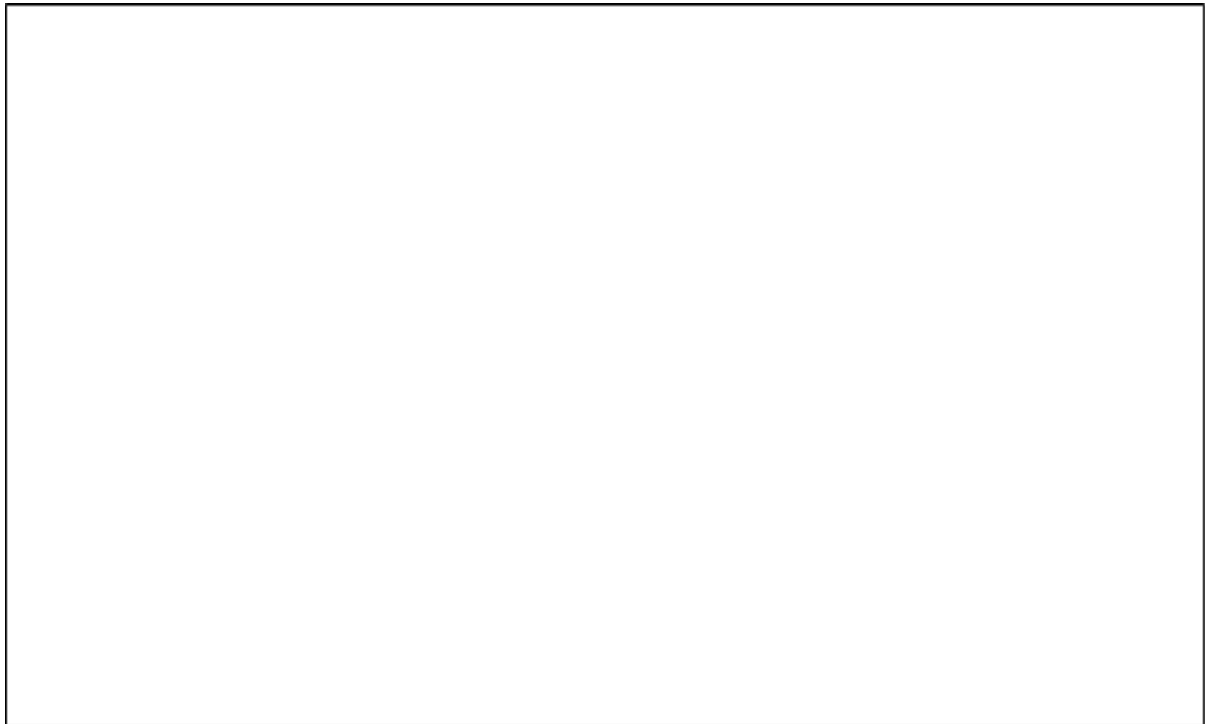
Physical Features:

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Macroscopic Anatomical Features:

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Species 2

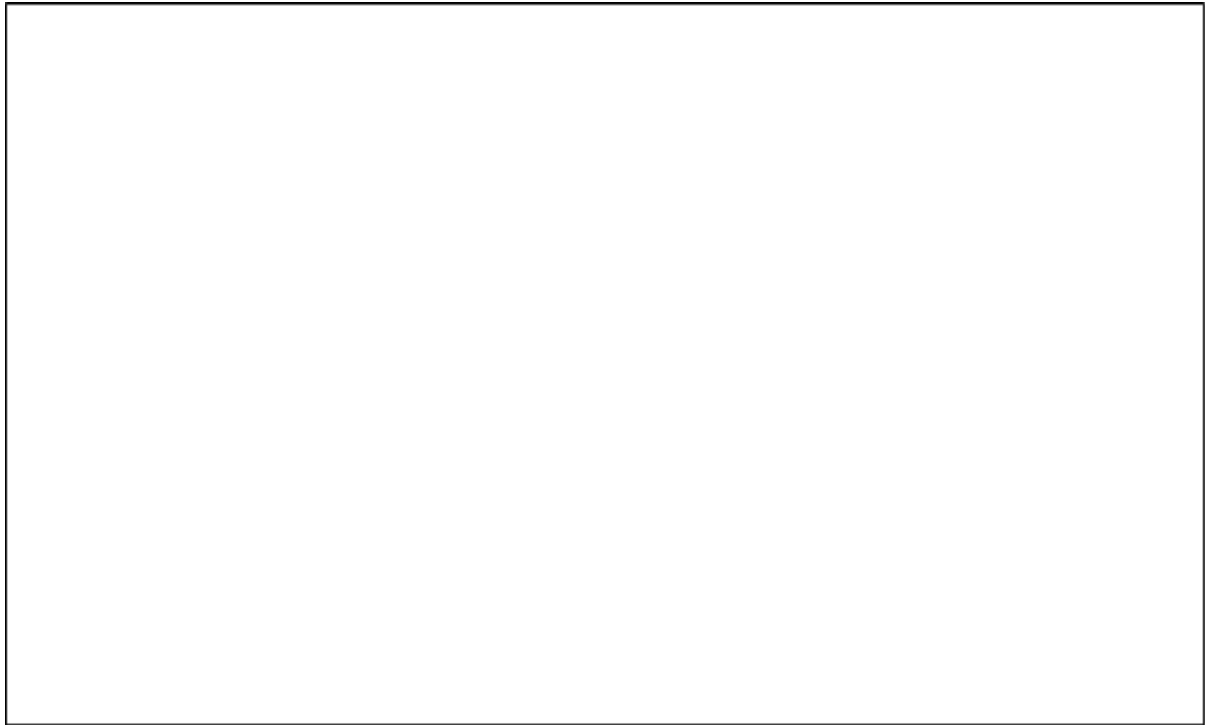
Physical Features:

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Macroscopic Anatomical Features:

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Species 3

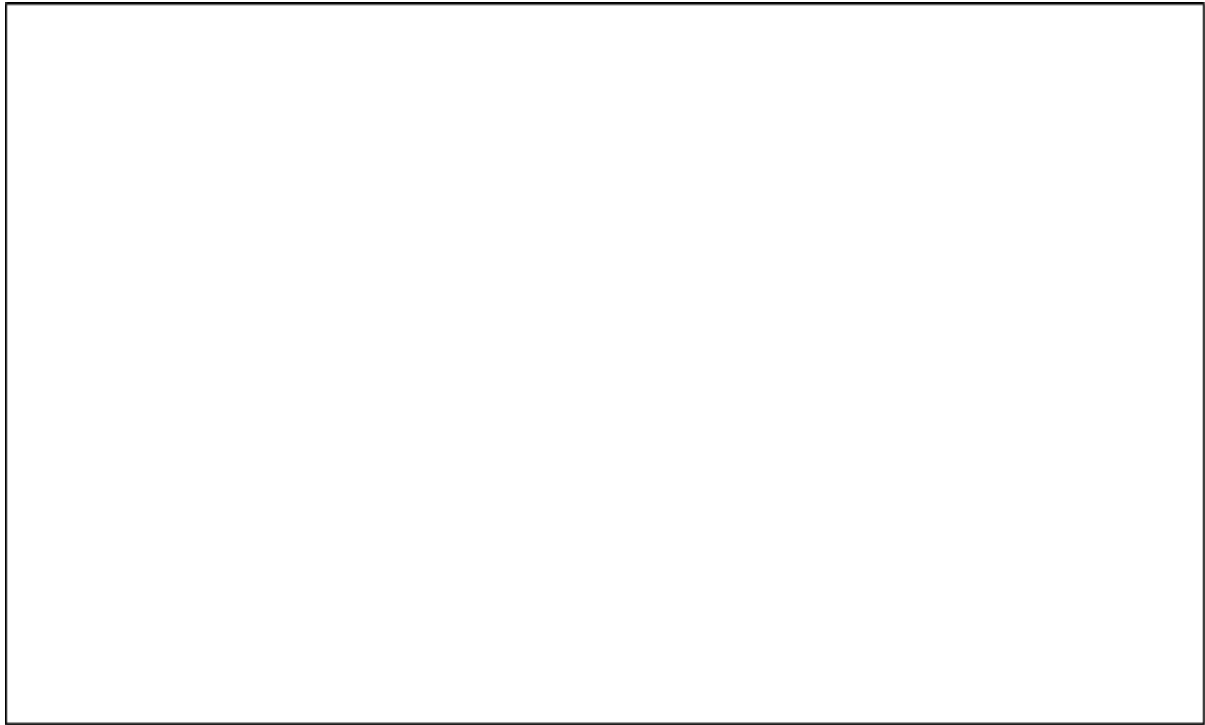
Physical Features:

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Macroscopic Anatomical Features:

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Species 4

Physical Features:

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Macroscopic Anatomical Features:

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Species 5

Physical Features:

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Macroscopic Anatomical Features:

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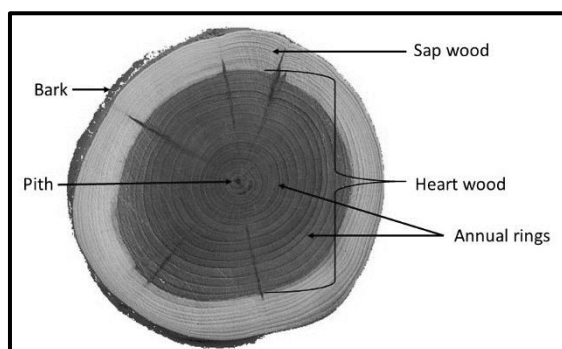


APPENDICES

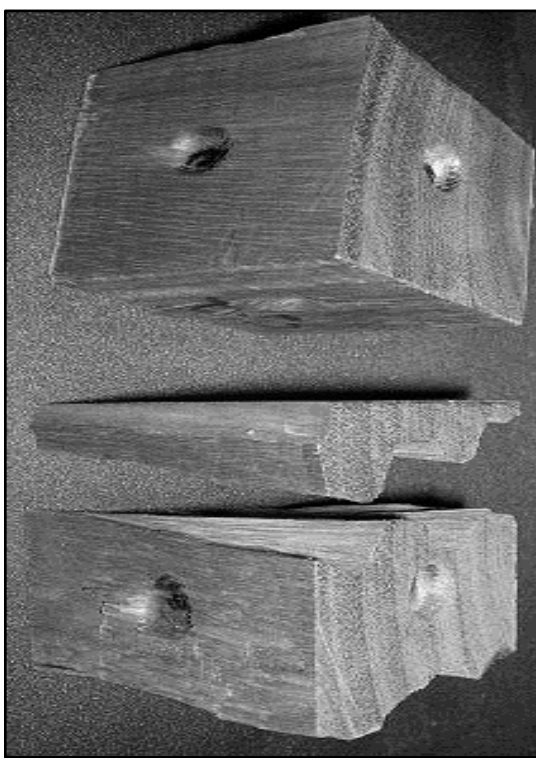
PERFORMA FOR DESCRIBING THE WOOD

S. No.	Feature	Details					
1	Sapwood & Heart wood	Distinct	Non-Distinct				
2	Colour	Yellow	Shades of red	shades of brown	Black	purple	Others
3	Hardness	Soft to very soft	Moderately hard	Hard to very hard			
4	Weight	Light to very light	Moderately heavy	heavy to very heavy			
5	Odour	Yes	No				
6	Lustre	Shiny	Dull				
7	Grain	Straight	Spiral	Interlocked	Wavy		

8	Fluorescence	yellow	Orange	reddish	brown	other	
9	Texture	Course	Fine	Even	Uneven		
10	Rays	Broad to very broad	Moderately broad	Fine to very fine			
11	Pores	Porous*	Non-Porous				
12	*Pore Size	large to Very large	Medium	Small to Very Small			
13	*Pore Distribution	Numerous to highly numerous	Moderately Numerous	Scanty			
14	*Arrangement of the Pores	Diffuse	Ring Porous	Semi Ring Porous	Solitary	Solitary & Short Radial Multiples	Long radial multiples Oblique
15	*Vessel Inclusions	Yellow	white Chalky	Red			
16	*Tyloses	Present	Ascent	Abundant	Scanty		
17	*Soft Tissues+	Apotracheal	Paratracheal				
18	*+Distribution	Indistinct/Absent	Diffuse/ Scattered	Diffuse in aggregate/in fine lines			
19	*+Arrangement	Vasicentric	Aliform	Aliform Confluent	Banded	Banded narrow	Banded broad
20	Ripple Marks	Present	Absent				
21	Gum Canals/ Resin Canals	Band	Solitary	Small Group			



End Section of Wood Log Showing Gross Features of Wood



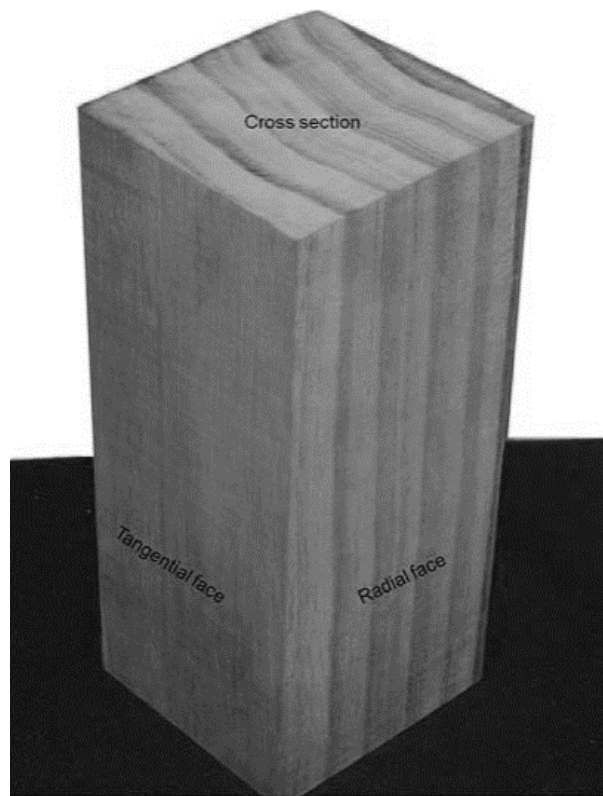
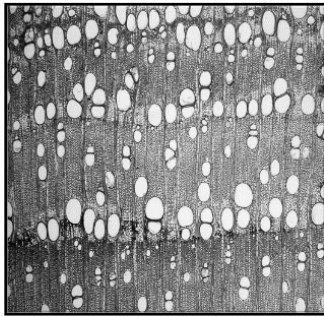
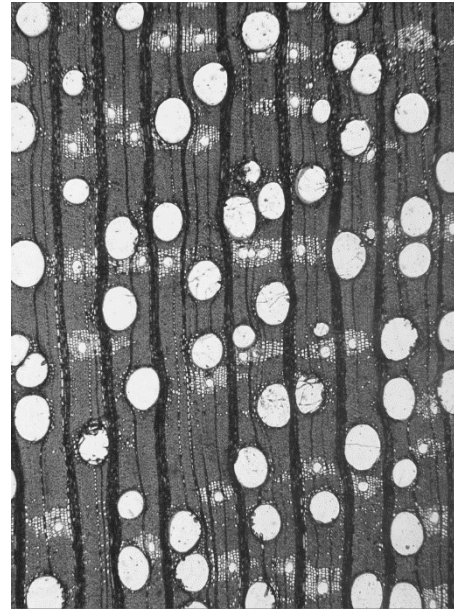
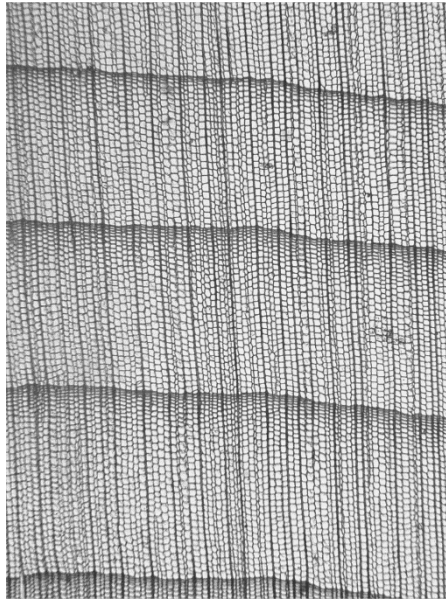


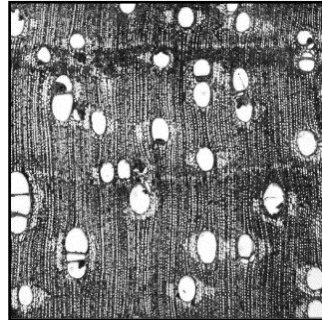
Illustration of three surfaces

Non-Porous Wood (Softwood)

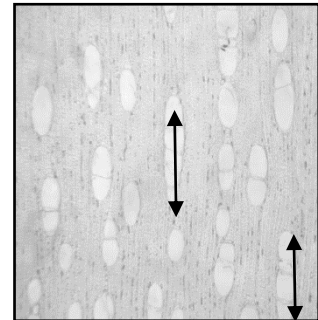
Porous Wood (Hardwood)



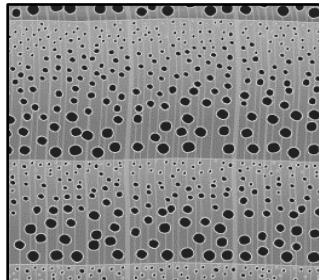
Ring Porous



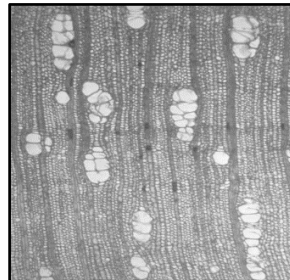
Diffuse Porous



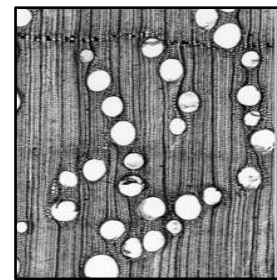
Long radial Multiples



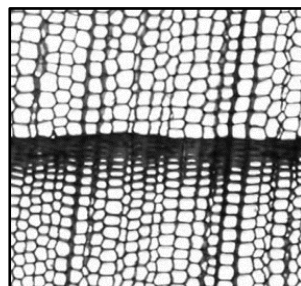
Semi-Ring Porous



Pore Clusters

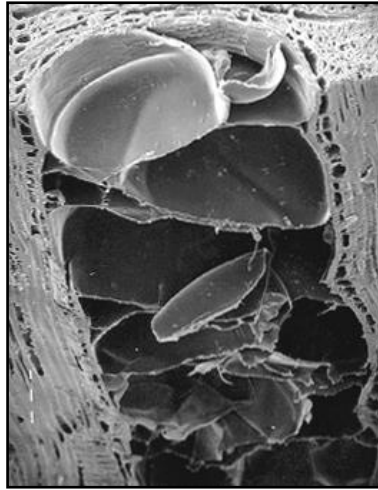


Oblique Grouping

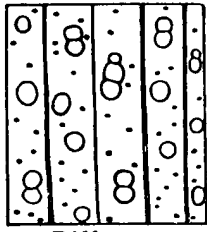


Non-Porous

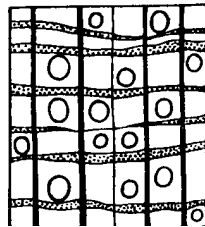
ARRANGEMENT OF PORES



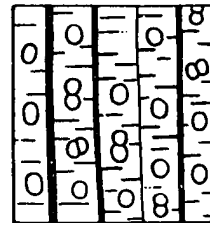
Tyloses



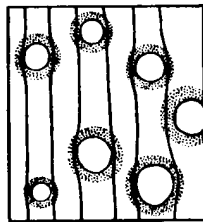
Diffuse type



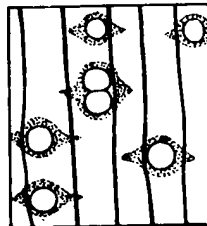
Terminal or Initial



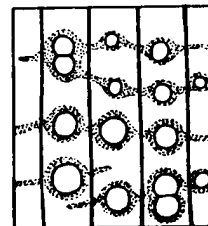
Reticulate or Netlike



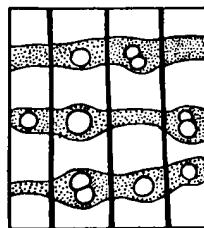
Vasicentric



Aliform



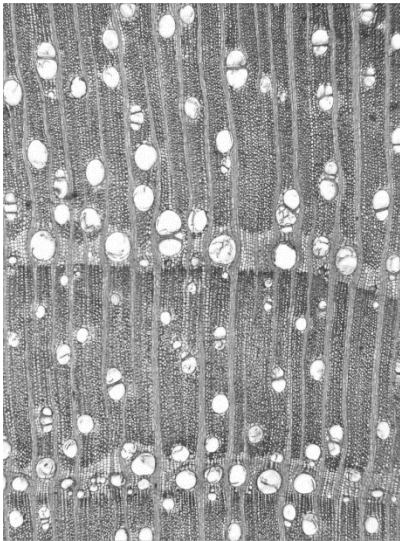
Aliform confluent



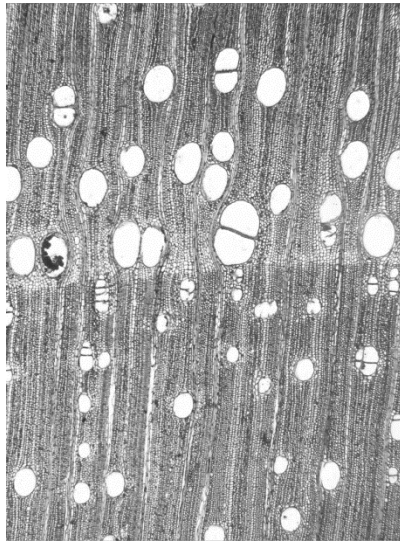
Banded

PARENCHYMA DISTRIBUTION

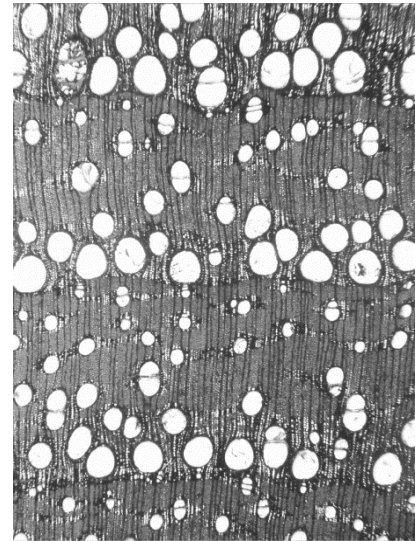
T.S. OF TIMBER SPECIES SHOWING ANATOMICAL FEATURES



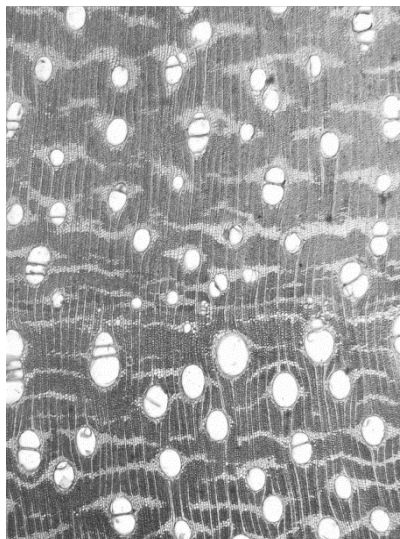
Tectona grandis (Teak)



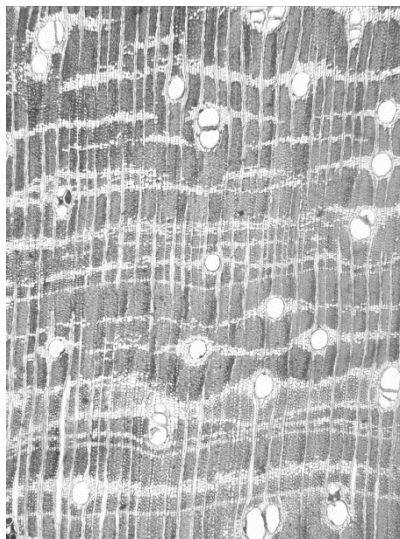
Toona ciliata (Toona)



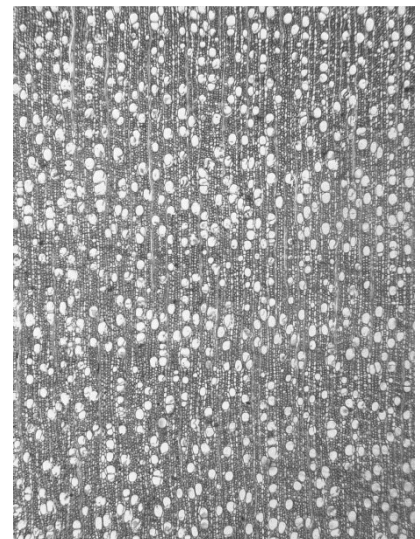
Lagerstroemia lanceolata (Benteak)



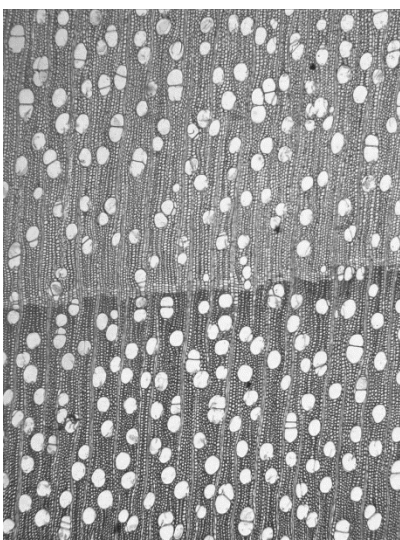
Pterocarpus marsupium (Bijasal)



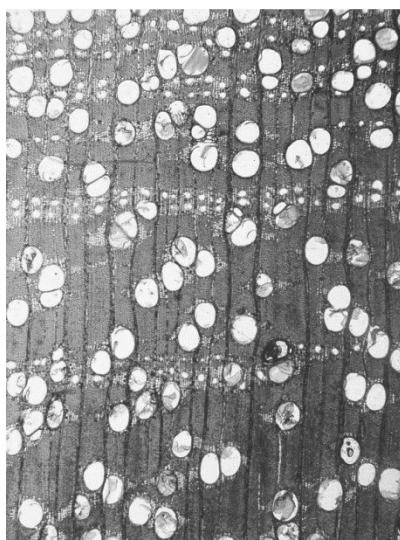
Dalbergia latifolia (Rosewood)



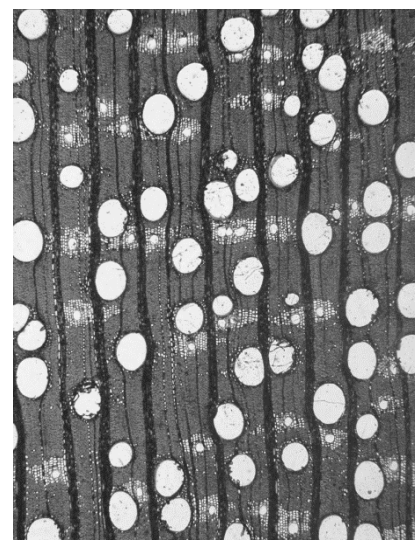
Haldina cordifolia (Haldu)



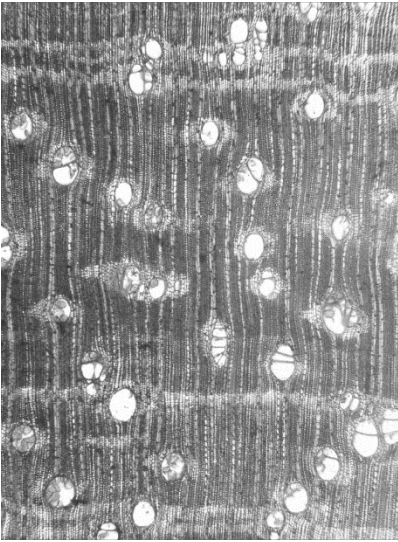
Michelia champaca (Champ)



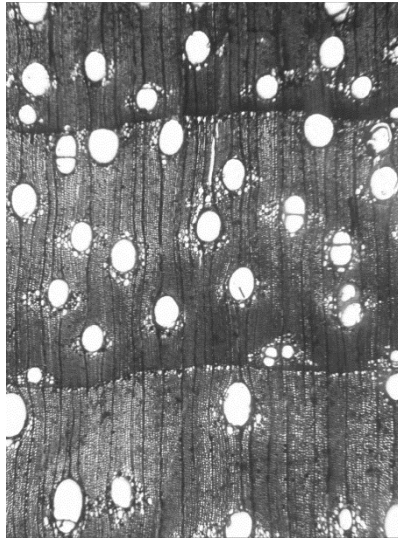
Shorea robusta (Sal)



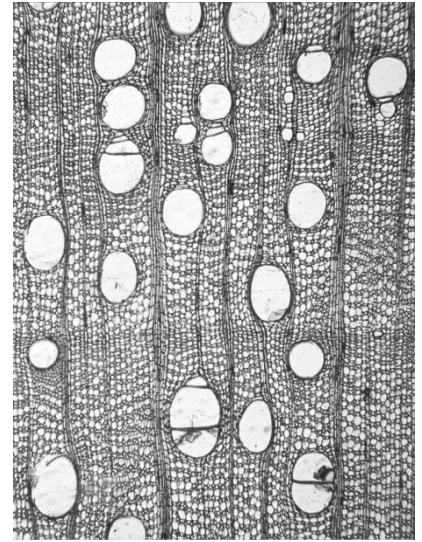
Dipterocarpus spp. (Gurjan)



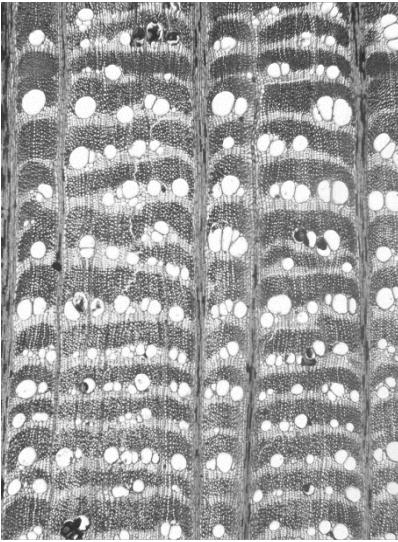
Mangifera indica (Mango)



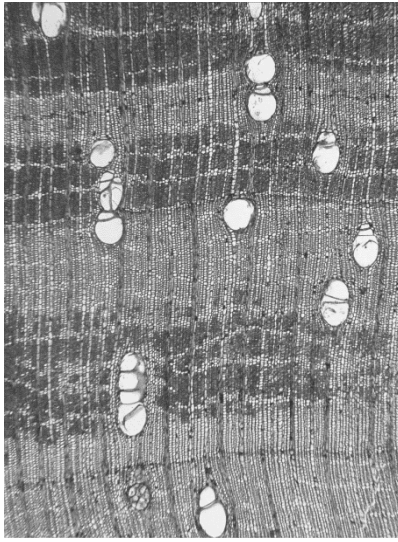
Terminalia alata (Laurel)



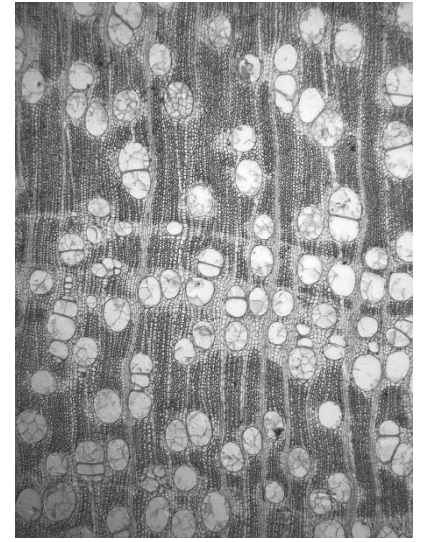
Bombax ceiba (Semul)



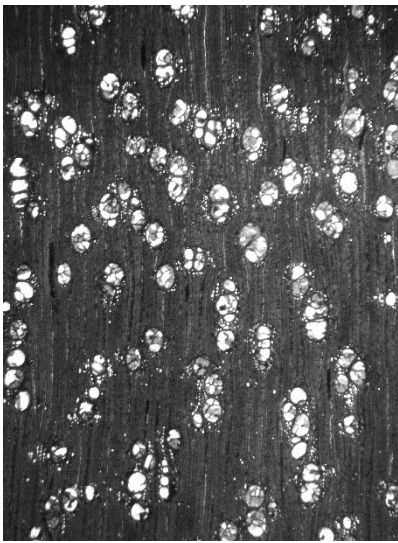
Grevillea robusta (Silver oak)



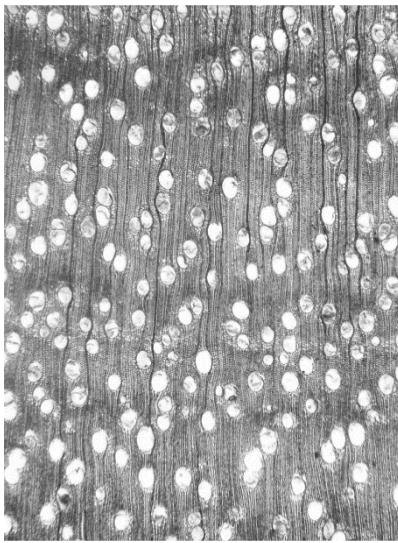
Hevea brasiliensis (Rubberwood)



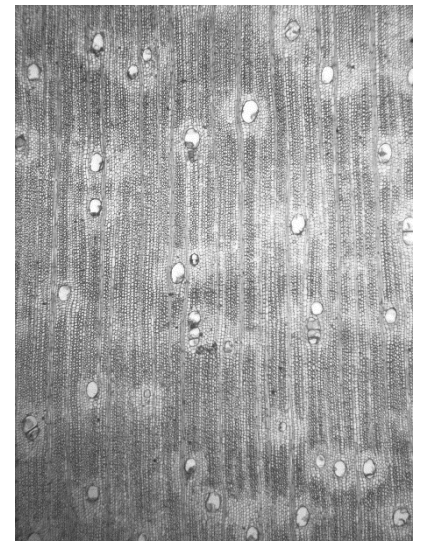
Gmelina arborea (Gamari)



Eucalyptus citriodora (Eucalypts)



Eucalyptus tereticornis (Eucalypts)



Artocarpus heterophyllus (Kathal)