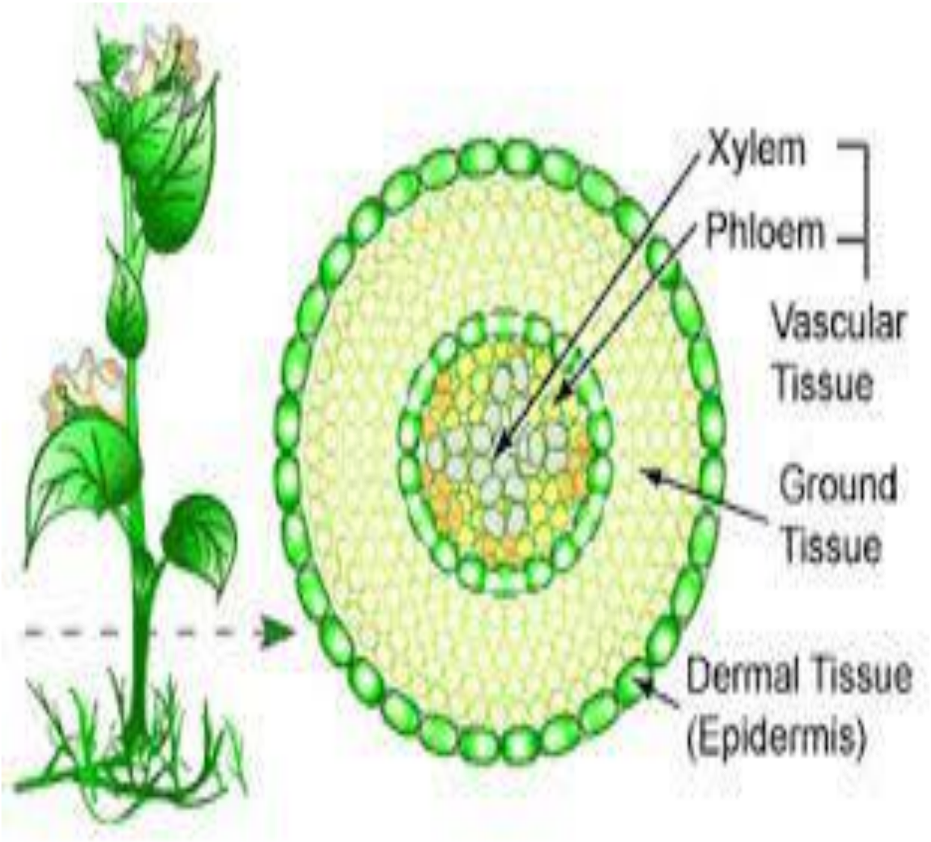
S.YBSc.Credit pattern Term II BO 241

Botany paper I.Plant Anatomy & Embryology

Chapter 3- Mechanical Tissue System



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What is Mechanical Tissue?

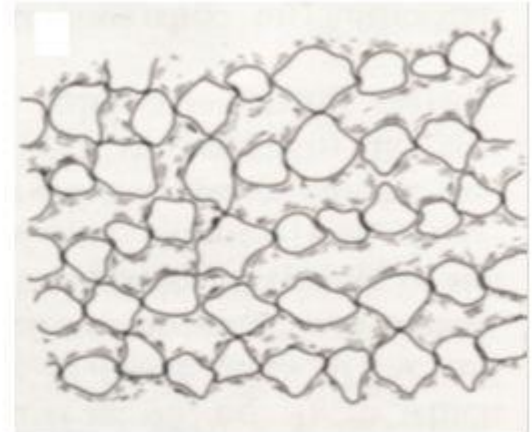
- Tissue which protect the plant from bending down , cutting down , leaf tearing , uprooting due to natural calamities & gives mechanical support is called mechanical tissue.
- Plant body is constructed to cope up different stresses like head or canopy load, bending stress , pulling forces or longitudinal tension etc.
- Chief mechanical tissue is
- 1.Collenchyma
- 2.sclerenchyma
- 3.xylem

Collenchyma

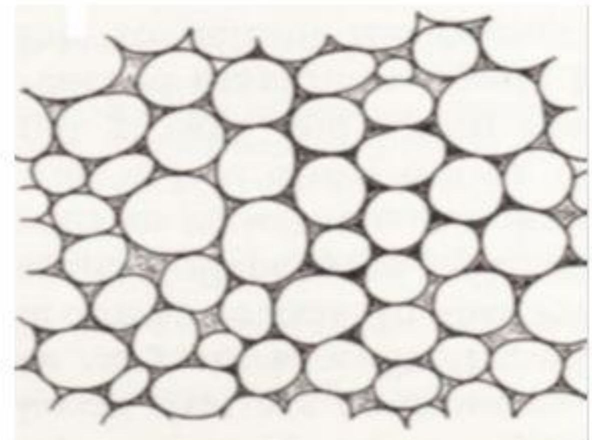
- Living, elongated cells with corners or intercellular spaces filled with cellulose & pectin
- Location- younger parts of plant i.e. growing stem , ,leaves .both sides of veins & margins of leaf blade.
- Function- to give mechanical support to younger plant parts.Gives tensile strength with flexibility & plasticity to root,stem

Types:

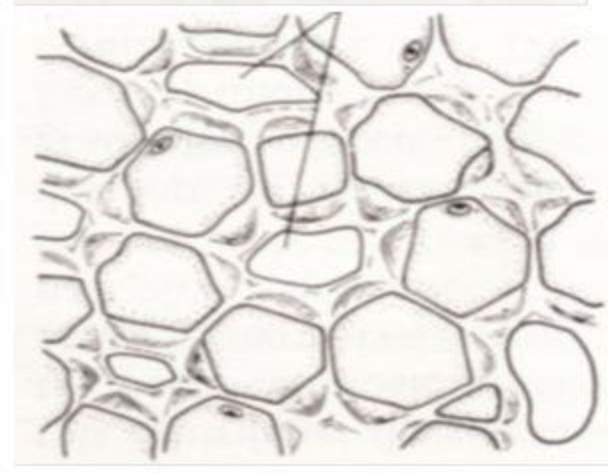
Lamellar: thickening on tangential walls.



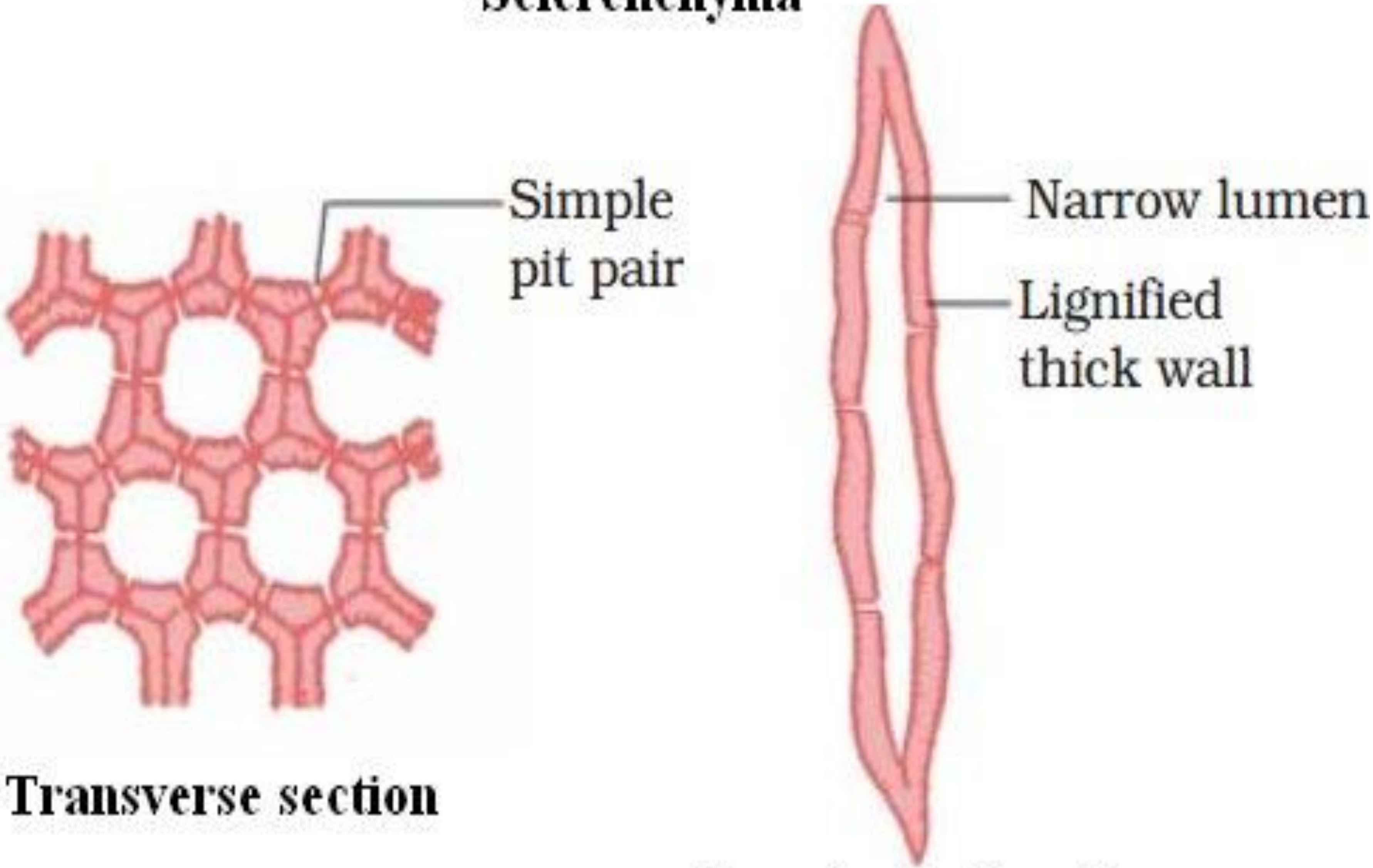
Angular: thickening on angles between the cells.



Lacunar: thickening on walls facing the intercellular spaces.

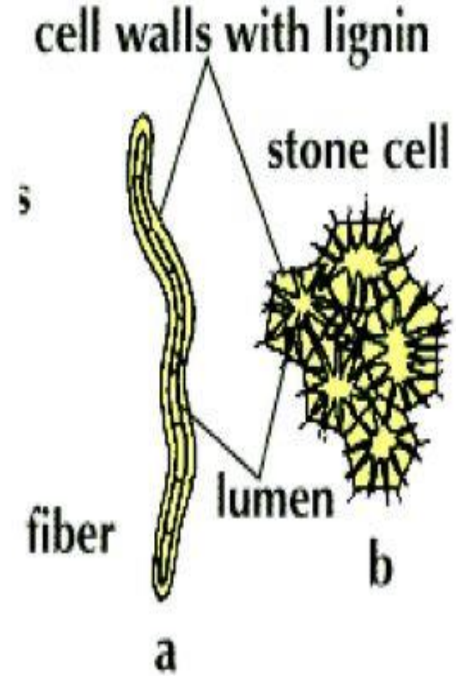


Sclerenchyma



Sclerenchyma Cells

- Two types of sclerenchyma: Fiber and sclereids
- **Fibers:** long, slender cells as strands or bundles, vary in length (0.8-16 mm in jute and 9-70 mm in flax)
- **Sclereids:** variable in shapes and often branched, relatively short cells compared to the most fibers.
- Found singly or aggregated throughout the ground tissue
- Seed coats of many seeds, shells of nuts, the stone endocarp) of stone fruits (olives, peaches, cherries) ad gritty texture of pears



Sclerenchyma Tissue

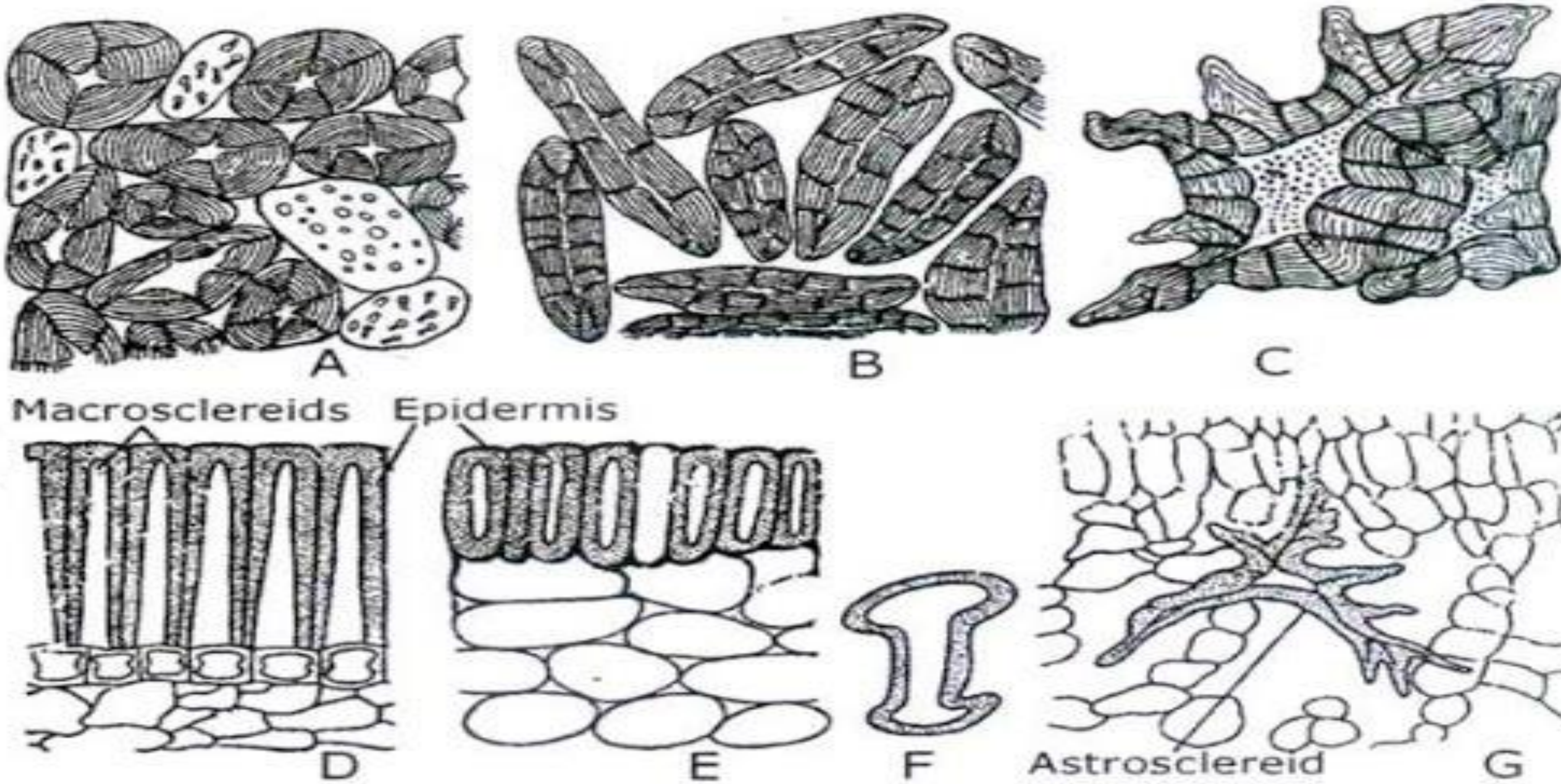
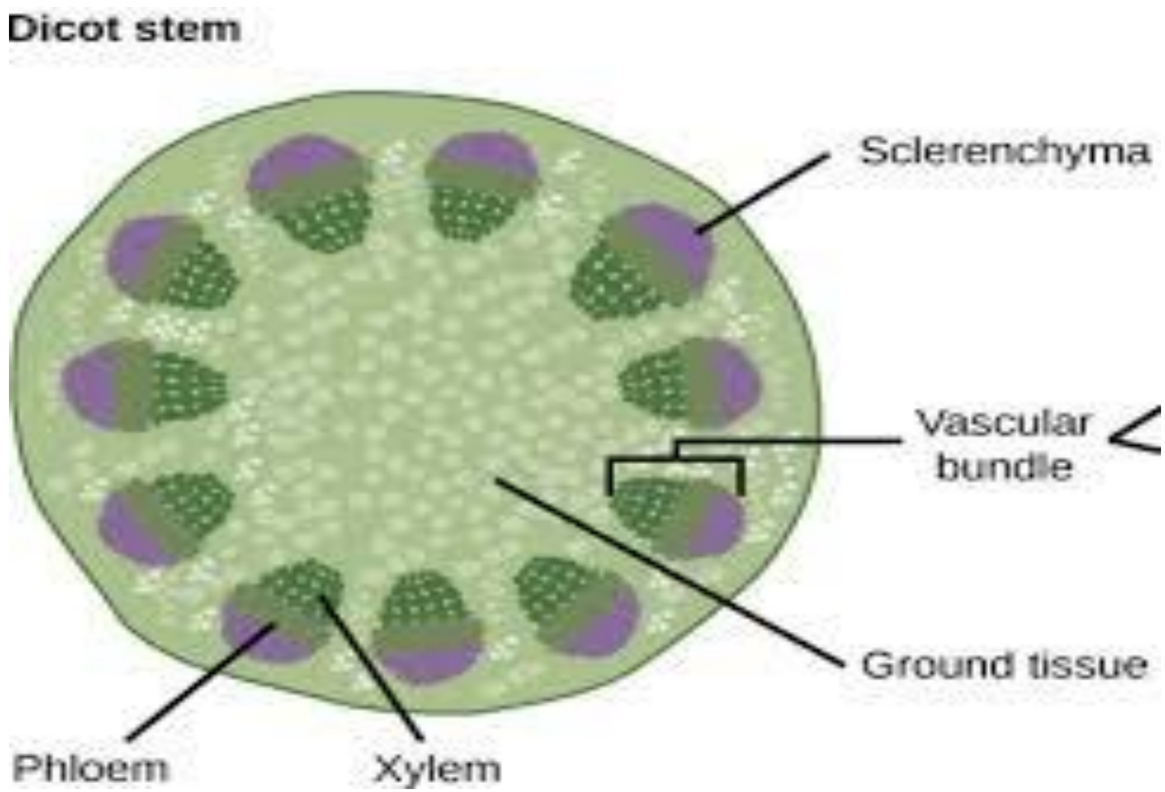


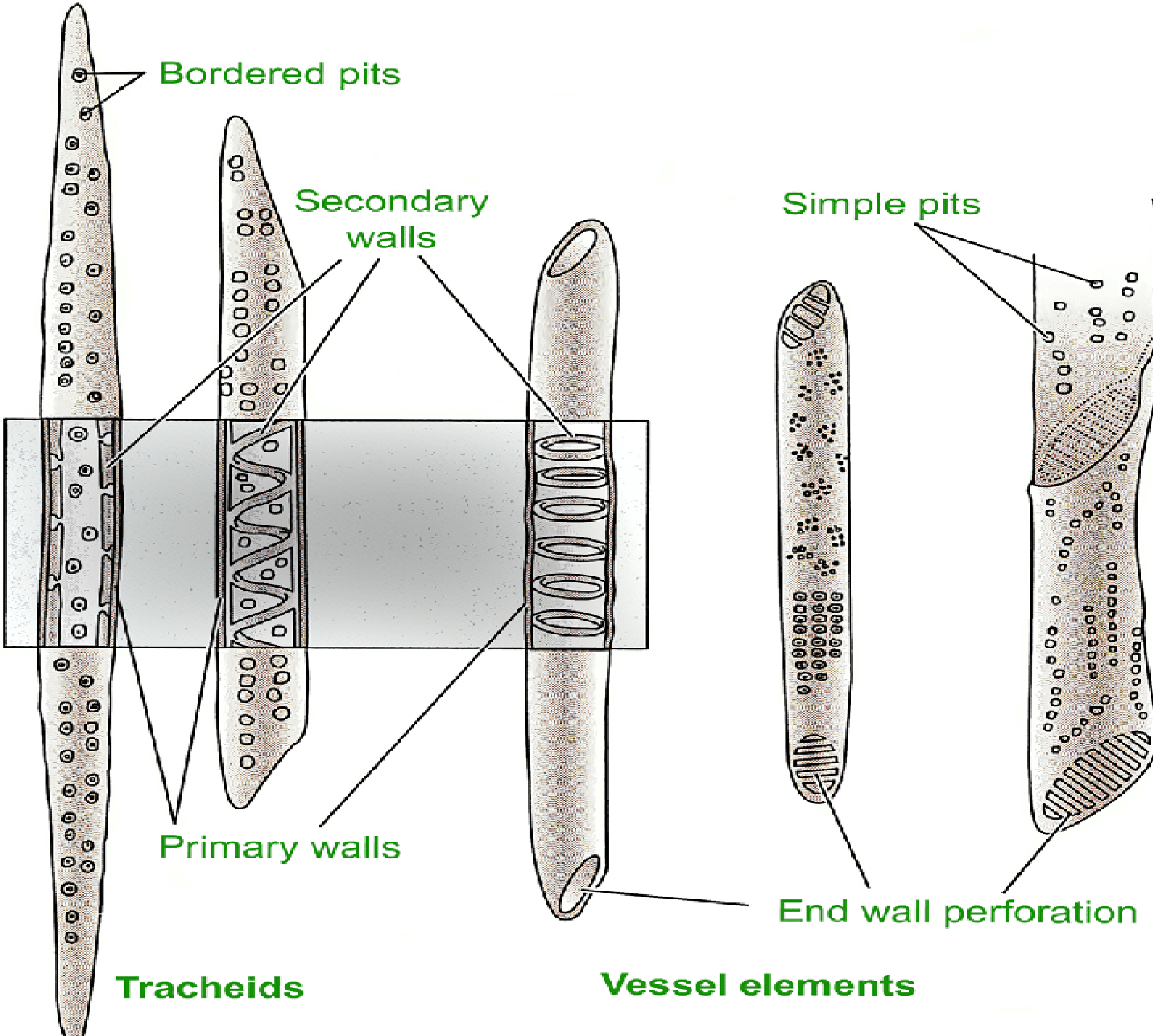
Figure 8.5

Sclereids. A. Brachysclereids from flesh of *Pyrus*. B. Same from *Cocos*. C. Irregular sclereids from *Tsuga*. D. Macrosclereids from epidermis of *Phaseolus* and E. from epidermis of *Allium sativum*. F. Osteosclereids from seed coat of *Pisum*. G. Astrosclereid from a leaf.

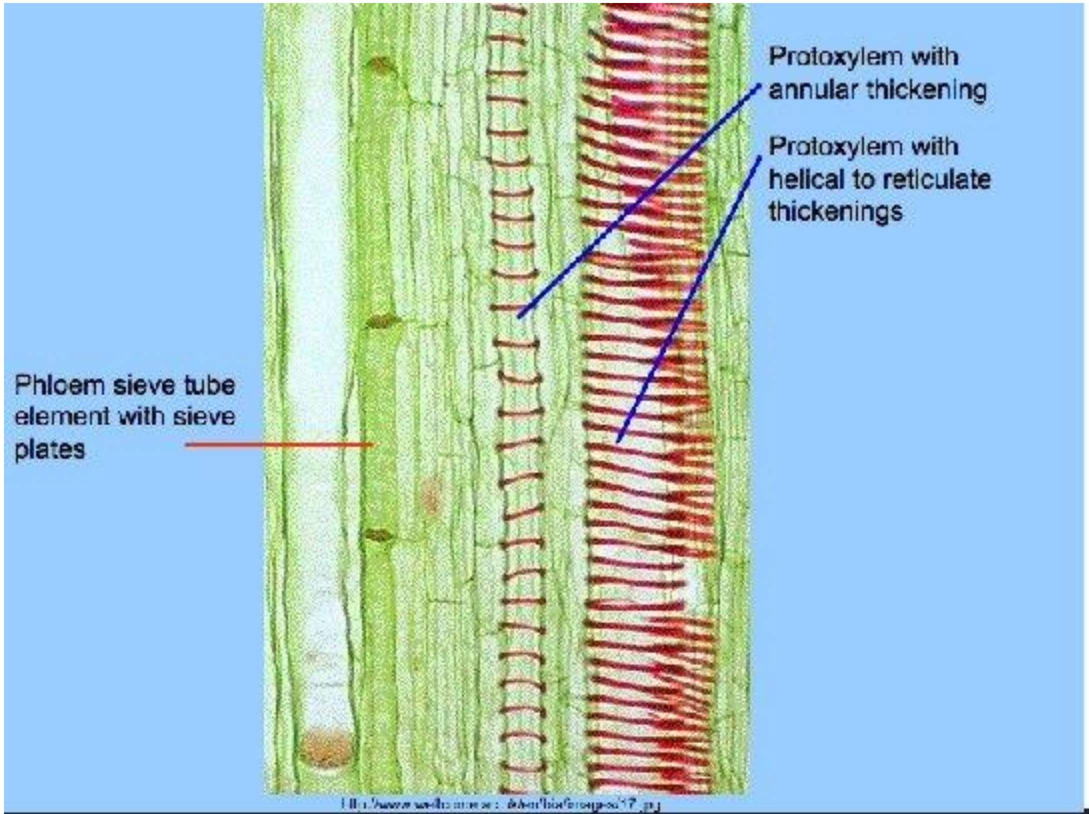
Complex tissue
xylem & phloem

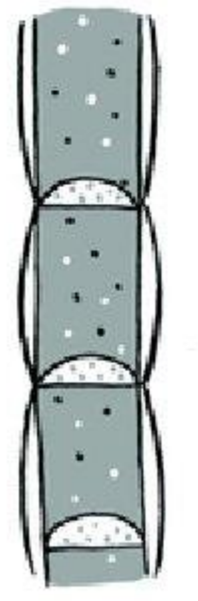
- 1.Xylem – Elements
- 1.Trachea , 2. Vessels , 3. Xylem parenchyma 4. Xylem sclerenchyma
- 2. phloem – elements
- 1.siew tube 2. siew plates .3.ph.parenchyma 4.ph.sclerenchyma


Dicot stem
Sclerenchyma
Vascular
bundle
Ground tissue
Phloem
Xylem



Bordered pits
Secondary walls
Simple pits
Primary walls
End wall perforation
Tracheids
Vessel elements



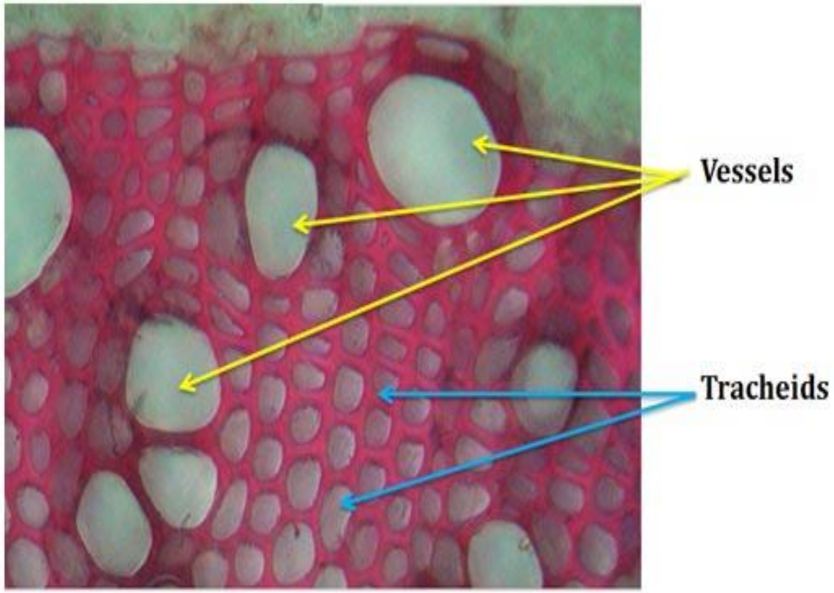


Phloem

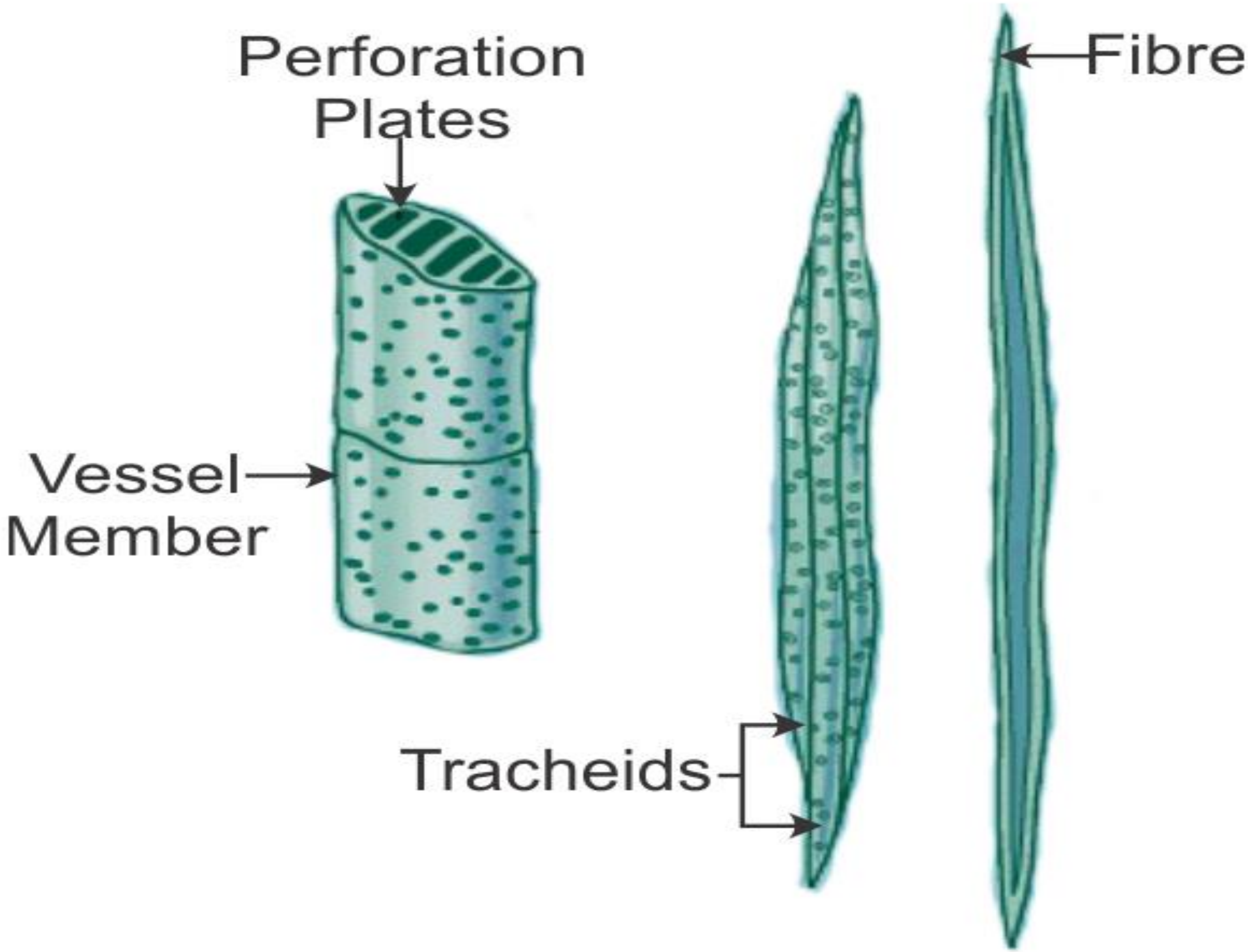
Interesting Fact:
Do you remember that sucrose is made up of glucose and fructose monosaccharides? Plants transport sucrose rather than glucose because it is less reactive and has less of an effect on the water potential.

Vessel elemens	Tracheids
Main conducting cells of angiosperms	Main conducting cells of gymnosperms and ferns
Short cells arranged in rows forming large tubes	Long cells with overlapping ends
Large inner diameter and thinner cell walls	Small inner diameter and thicker cell walls
Small and abundant pits	Large and less abundant pits
Perforated plates	No perfporated plates
Higher efficiency in water conduction	Lower efficiency in water conduction

Tracheids	Vessels
Presence	
In all vascular plants	In angiosperms
Type of cells	
Imperforated	Perforated
Cell wall	
Thin	Thick
Connection	
Lateral	End to end
Cross section	
Polygonal	Circular
Water conduction	
Inefficient	Very efficient



CS of Dicot Stem showing Vessels & Tracheids


Perforation
Plates
Fibre
Vessel
Member
Tracheids

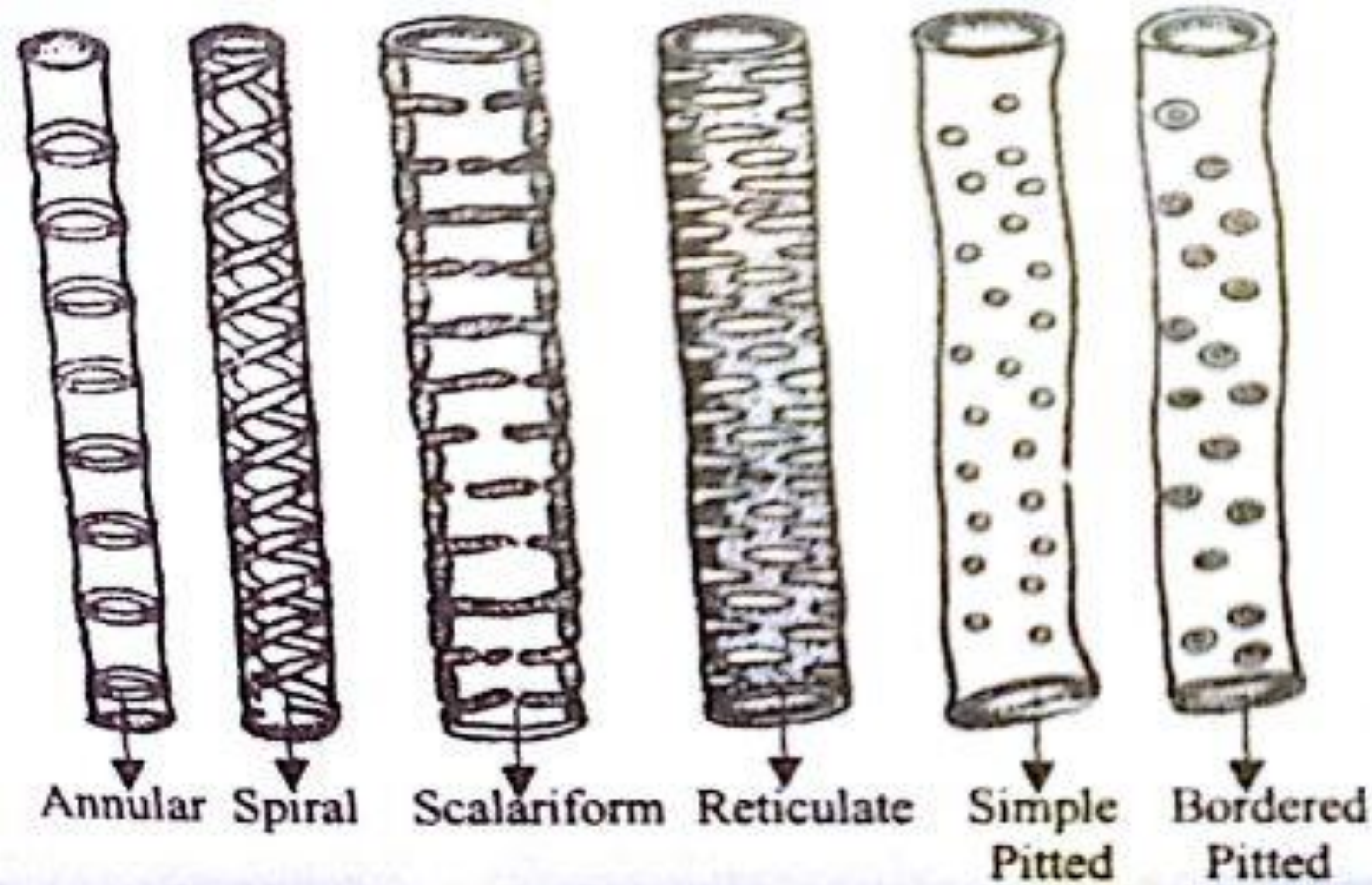


Fig: Vessel cells of different thickness

Principles involved in distribution of Mechanical Tissue

- 1.Inflexibility- the aerial cylindrical stem is subjected to bending forces of wind.The capacity of cylindrical stem to with stand or face bending stress is called inflexibility.
- The mehanical tissues are distributed in the form of ‘I” shape girder.The principle of ‘ I ‘ girder is also used in constrution of buldings.
- ‘I’ girder is a beam with two upper & lower flanges or straps & are connected to plate called Web.
- Upper flange is loaded in middle, so it is compressed,it is subjected to curveture.Lower flange is subjected to tension.so it is become convex.

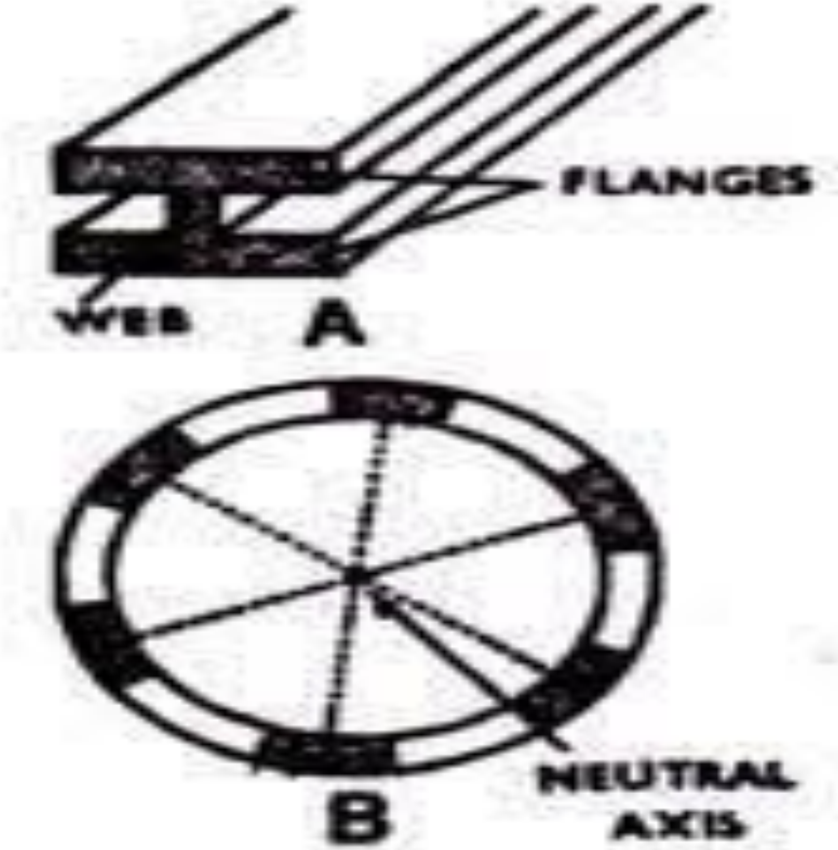


FIG. 551. I-girders (diagrammatic). A. Single girder. B. A system of girders.

Fig. The mechanical tissue – Girder – The wide portions at the top and bottoms are the flanges; the narrow connection is the web.

‘I” Girder Inflexibility

- ➢ Two flanges are made up of dead tissues like sclerenchyma , xylem or living collenchyma .
- ➢Since these are the region of greater strength
- ➢Web is made up of Non-strenthening tissue like soft parenchyma , chlorenchyma i.e. cortex & pith tissue

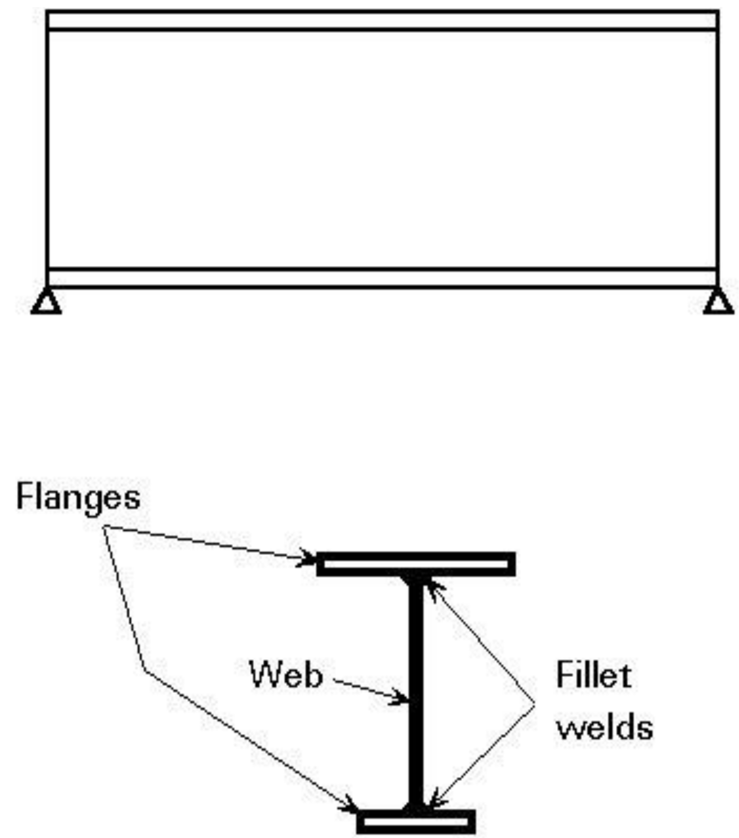


Figure 1 Plate girder composed of three plates

Incompressibility

- Ability of stem to withstand or bear head load or weight of branches , leaves ,fruits is called as incompressibility.
- In dicot stem secondary tissue i.e. secondary xylem is formed due to activity of cambium.so sec.xylem i.e. sec. vessels , sec. trachea, medullary rays.
- become bear head/canopy load therefore incompressibility.
- Monocot stem are short heighted plant .in monocot stem vascular bundles provides support.

Inextensibility in root

- Ability of organ to face longitudinal tension is known as inextensibility
- Roots are subjected to pulling action due to heavy wind blowing , tornados i.e. logitudinal tension.
- In order to protect uprooting action ,root requires special distribution pattern of mechanical tissue .It is called rope requirement.
- Mechanical tissue in mature root is secondary xylem i.e. sec. vessels ,trachea, medullary rays.

Dark black colour in the section indicate mechanical tissues

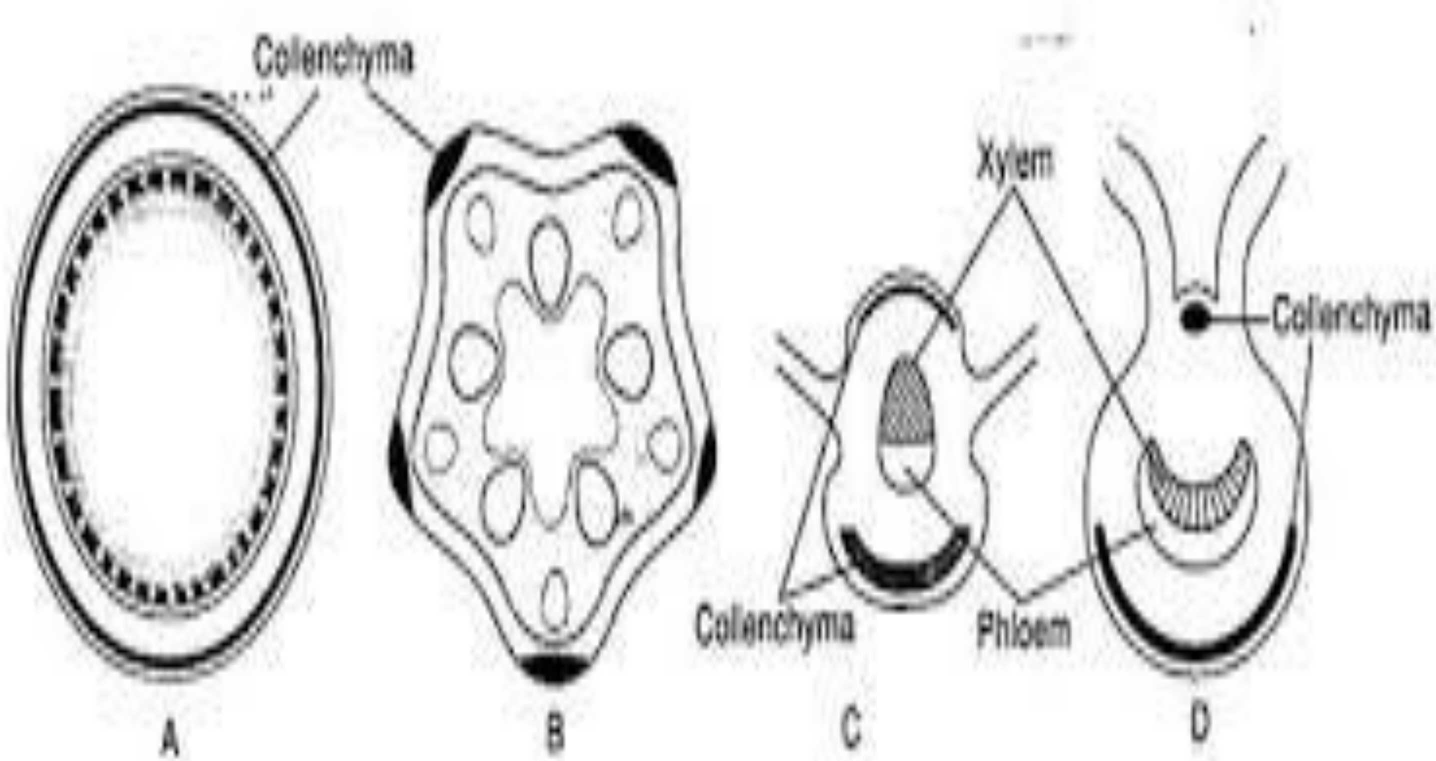


Fig. 5.67 : Diagrammatic representation of the distribution of collenchyma in t.s. of stems and leaves : A. *Sambuscus* stem. B. *Cucurbita* stem. C and D. Mid veins of leaves

Shearing stress in leaf

- Ability to face wind action , to face torned off action.
- Margins of leaves get tear or break due to heavy wind .so to protect it vascular bundles of veins are arranged in parallel way (monocot leaf) or network like (dicot leaf)
- In Jamun plant leaf posses intra-marginal veins
- In eucalyptus arrow headed or sagittate patch of collenchyma tissue is present to protect from breaking
- The best example of finest architecture of leaf vennation is *Victoria amazonica* –giant water lily.

➢In monocot leaves ,parallel ‘I’ girder formed by fibrovascular bundles.

sagitate or arrow shape patch of sclerenchyma at the tip of leaf for protection

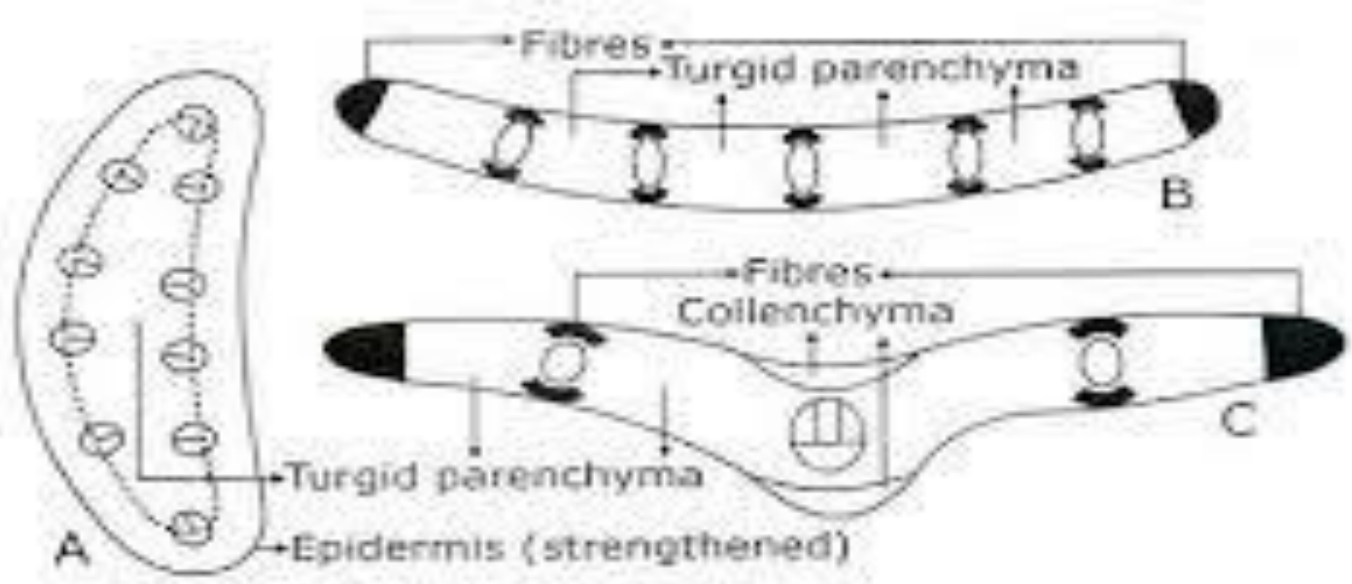


Figure 13.5

Diagrammatic representation of distribution of mechanical cells (fibres, collenchyma and turgid parenchyma) in A. succulent leaf of *Gasteria* (Liliaceae), B. monocotyledonous leaf and C. in a dicotyledonous leaf.

Victoria amazonica –giant water lily.