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Pinus Internal Morphology

Stem

A young stem in cross section resembles a dicotyledonous stem in many respects. It is wavy in outline. The general arrangement of various tissues from the periphery to the center is as follows:

- **Epidermis:** It is the outer surface layer of the stem. It consists of a single layer of tubular close compact parenchymatous cells with a thick cuticle.
- **Hypodermis:** Below the epidermis, a hypodermis layer is preset. It consists of a few layers of lignified sclerenchymatous cells.
- **Cortex:** It consists of several layers of parenchymatous cells with copious resin ducts. A single layer of resin secreting glandular epithelial cells surrounds the resin duct.
- **Endodermis:** Outside of the pericycle, endodermis is present. It consists of a single layer of parenchymatous cells.

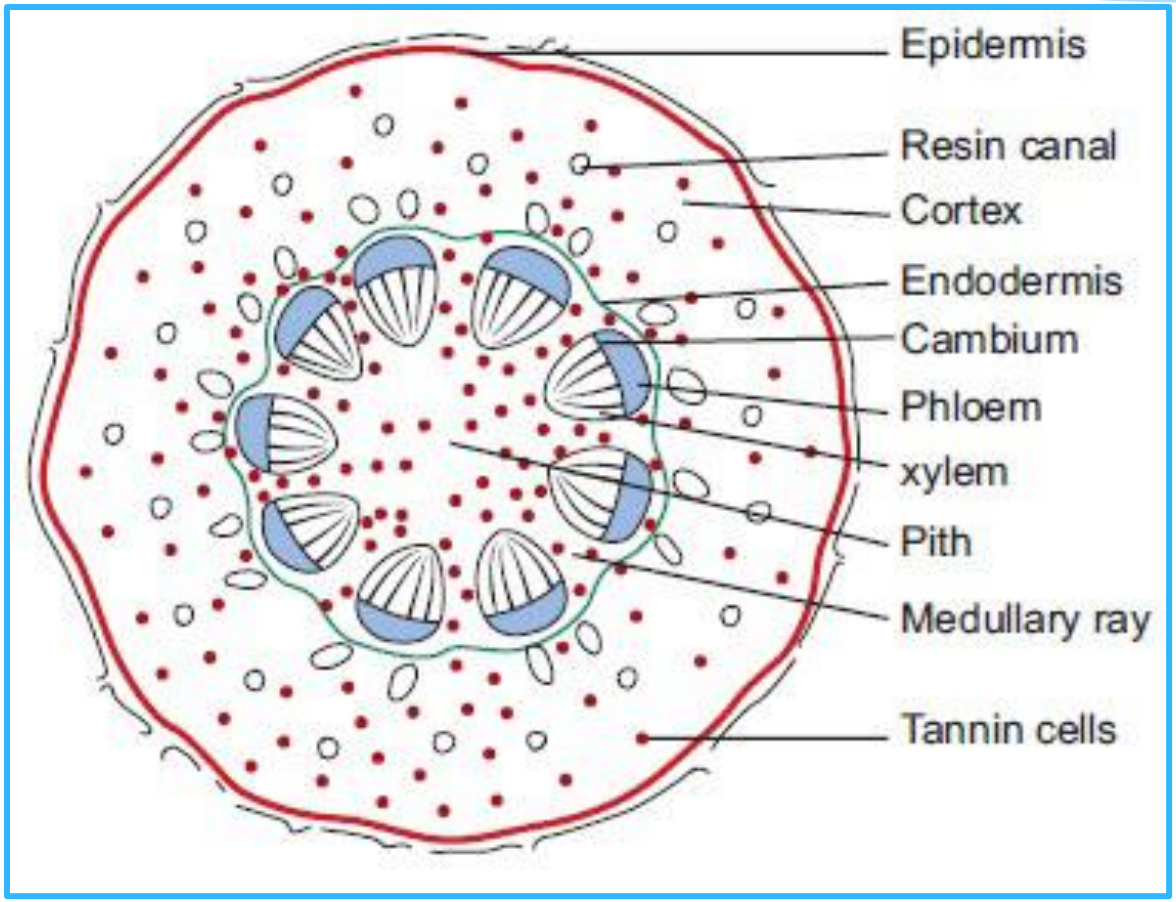

Fig 1. T.S stem of *Pinus roxburghii*

- **Pericycle:** It consists of several layers of parenchymatous cells which are located outer to the ring of vascular bundles
- **Vascular bundles:** They are conjoint, collateral, open, arranged in ring and endarch. In this case, protoxylem is directed towards the pith. Between xylem and phloem, a narrow strip of cambium is present. The xylem is composed of tracheids with bordered pits and xylem rays, without vessels. The phloem is composed of sieve tubes and phloem parenchyma without companion cells.
- **Pith:** It is composed of a mass of parenchymatous cells.
- **Pith rays:** It is composed by a narrow strip of cells running from the pith outwards between the vascular bundles.

Leaf

A transverse section of foliage leaf shows the following structure under the microscope. It is semi-circular in outline (centric type of leaf).

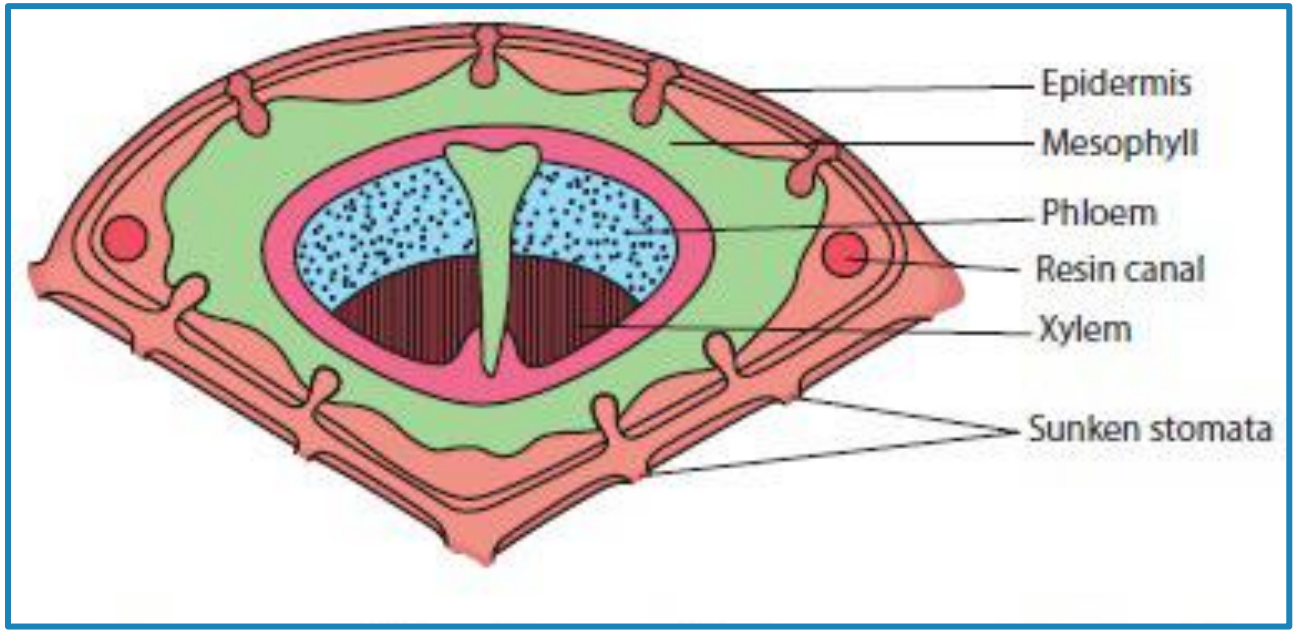

Fig 2. T.S of *Pinus* needle leaf

- **Epidermis:** It consists of a single layer of thick walled cells with a heavy sheet of cuticle and sunken stomata.
- **Hypodermis:** It consists of two or three layers of very thick walled sclerenchymatous cells with resin ducts, which are broken up by stomata. It is placed just underneath the epidermis. It strengthens the tissue of the leaf.
- **Mesophyll:** It consists of a few layer of chloroplast containing parenchyma cells with peg-like projections. In this case, wall projecting occurs inside the cell cavity which is known as arm palisade.
- **Endodermis:** It consists of a single layer of barrel shaped cells which is present outside of the pericycle.
- **Vascular bundles:** They are collateral, closed and two in number.
- **Pericycle:** It consists of albuminous cells and tracheidal cells. In this case, albuminous cells lie close to the phloem while tracheidal cells lie adjacent to the xylem. Albuminous

and tracheidal cells together form the transfusion tissue which helps to flow of nutrients. The xylem is surrounded by pericycle.

Root

- The internal organization of tissues in the root of *Pinus* is almost similar to that in a dicotyledonous root.
- A cross section of young root shows an epiblema (piliferous layer) with root hairs, a multilayered cortex and a diarch to pentrarch vascular cylinder and Y-shaped xylem bundles.
- The 2-3 layered pericycles surround the vascular bundles while the cortex consists of a few layers of thin walled parenchymatous cells.
- A single layered endodermis is present which is followed by a pericycle.
- The root is mycorrhizal because fungus grows on the surface of the root.

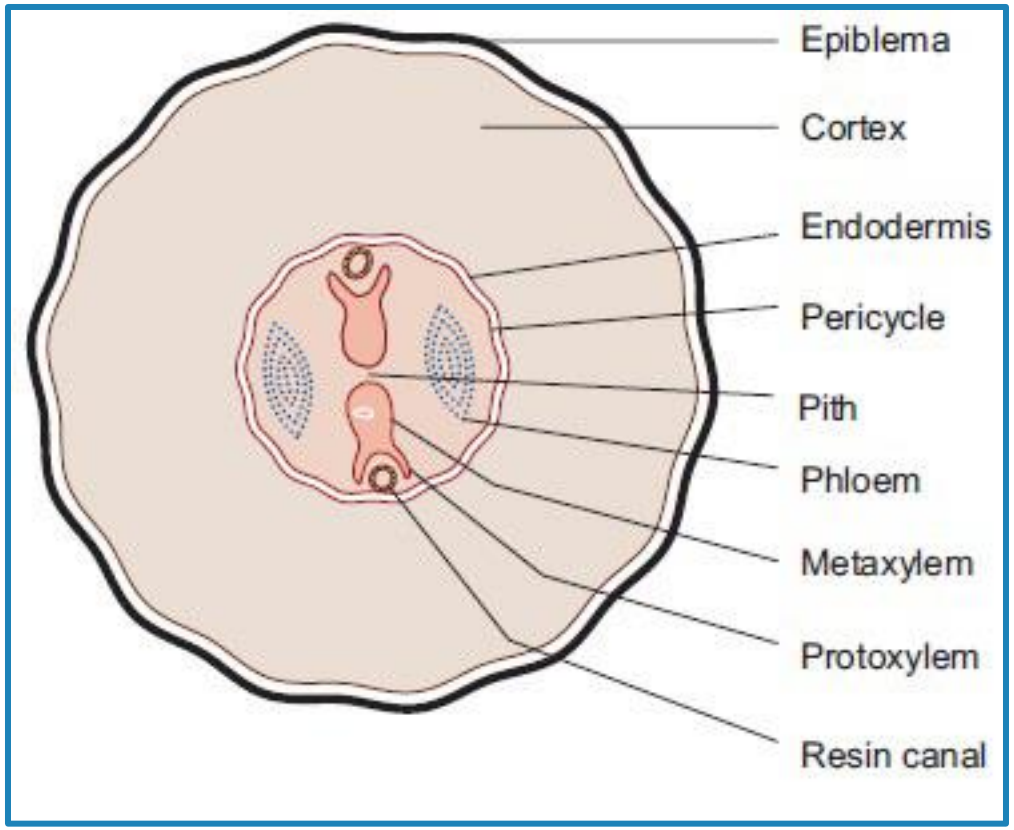

Fig 3. T.S. of *Pinus* root