EXPERIMENT 2

Aim

To prepare and study the T.S. of dicot and monocot roots and stems.

THEORY

To study the transverse section, i.e.` internal morphology of roots and stems of monocot and dicot plants, we first need to understand their internal organization into various tissues. A tissue is a group of cells having a common origin and usually perform a common function. Plant body is made up of different kinds of tissues which help in proper body function by allowing division of labour. Tissue may be simple that contains only one type of cells, like parenchyma, sclerenchyma or collenchyma or may be complex (containing more than one type of cells) like xylem and phloem. Different types of cells in a tissue differ in their structure, shape, size, function and wall composition. The internal organisation of these tissues differs in roots, stems and leaves.

PROCEDURE

1. Sectioning of Different Tissues

(i) Take 2-3 cm long pieces of fresh root and stem of monocot and dicot plants.

(ii) Use pith of potato or raw papaya for embedding the material to be sectioned. Fix the piece in the pith properly.

(iii) Now, hold it properly between thumb and first finger of left hand in such a way that the tip of finger and outer smooth surface of material lie in a line.

(iv) Wet the surfaces of blade and cut the section of roots and stems with the help of it. Carefully move the blade horizontally over the surface of material in quick succession in a manner that in very thin and complete slice of the material is cut and obtained over the surface of razor.

(v) Select a thin, uniform and complete section and transfer it to the glass slide having a drop of water, with the help of needle and brush.

2. Staining of Tissues

(i) Put 2-3 drops of stain safranin over the section on the glass slide and allow it to stand for two minutes.

(ii) Wash away the excess stain with acid water.

(iii) Put a drop of glycerine as mounting medium over the section and cover it with the coverslip.

(iv) Observe the section under the microscope.

OBSERVATION

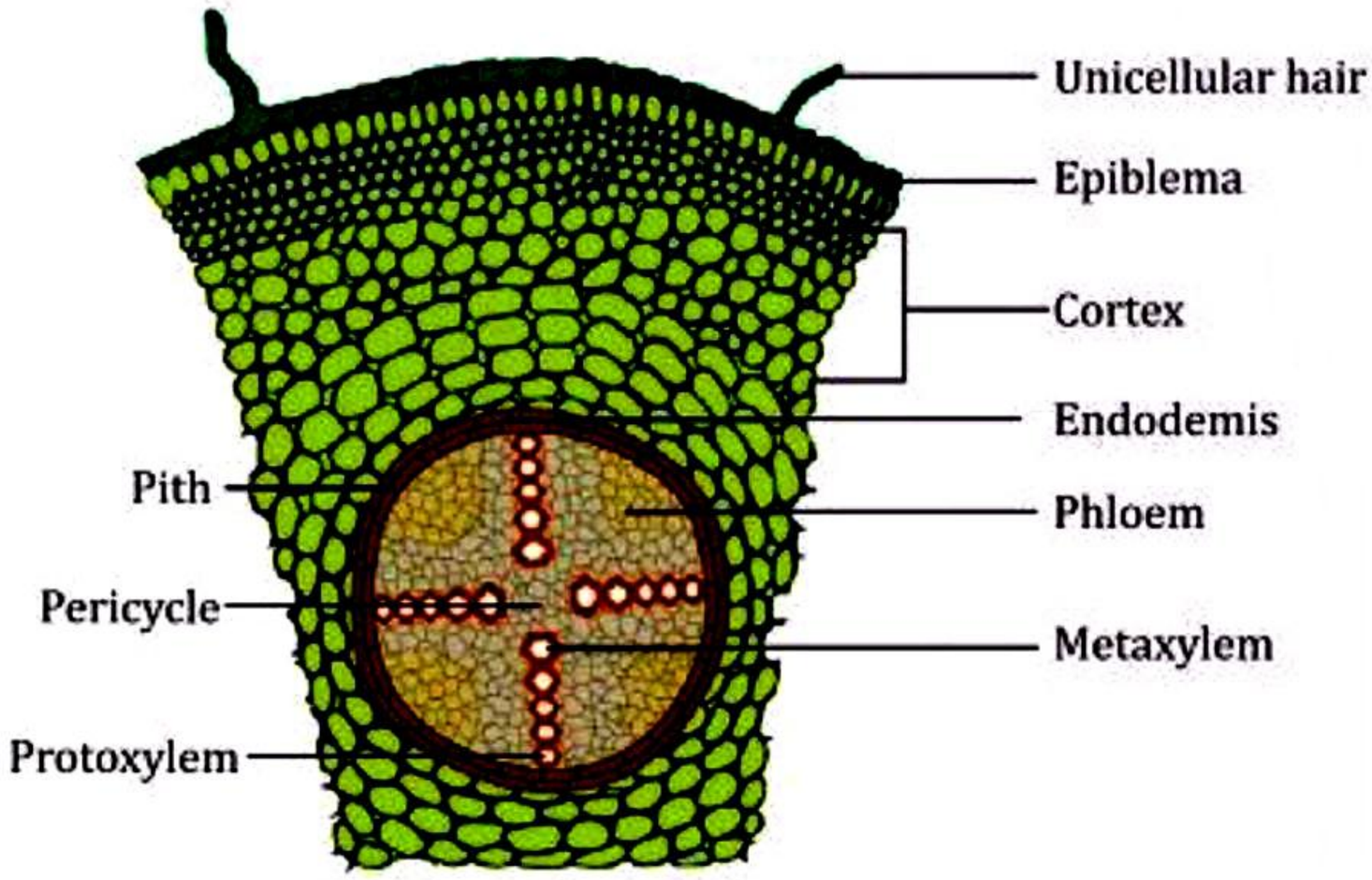
T.S. OF DICOT ROOT

T.S. of a dicot root show following features:

Epiblema or Piliferous layer: It is a single, outermost layer of thin walled, compactly arranged cells. Some cells have an outward extension to form the unicellular root hair that increases the area of absorption of water and mineral salts from soil.

Cortex: Below the layer of epiblema lies many layers of thin-walled parenchyma cells with intercellular spaces. This is called cortex.

Endodermis: It is a single, circular layer of compactly arranged, barrel-shaped cells. There are no intercellular spaces between the cells. This layer separates the cortex from vascular tissues. Sometimes a band of thickening, called casparian strip, is found on the radial and inner walls of endodermial cells.



Pericycle: It is a single circular layer of parenchyma cells which lies internal to the endodermis.

Vascular bundle: In a dicot root, vascular bundle is arranged in a ring. 2-6 alternately arranged bundles of xylem and phloem called radial vascular bundle because they are present on separate radii. Xylem bundle shows exarch condition, i.e. protoxylem lies towards the periphery and metaxylem towards the centre.

Conjunctive tissues: Xylem and phloem cells in vascular bundles are separated from each other by the parenchyma cells called conjunctive tissues.

Pith: It is poorly developed or mostly absent in a dicot root. It consists of parenchyma cells with beg intercellular spaces.

Examples of dicot root: Phaseolus radiatus, Ranunculus, Cicer, Ficus.

T.S. OF MONOCOT ROOT

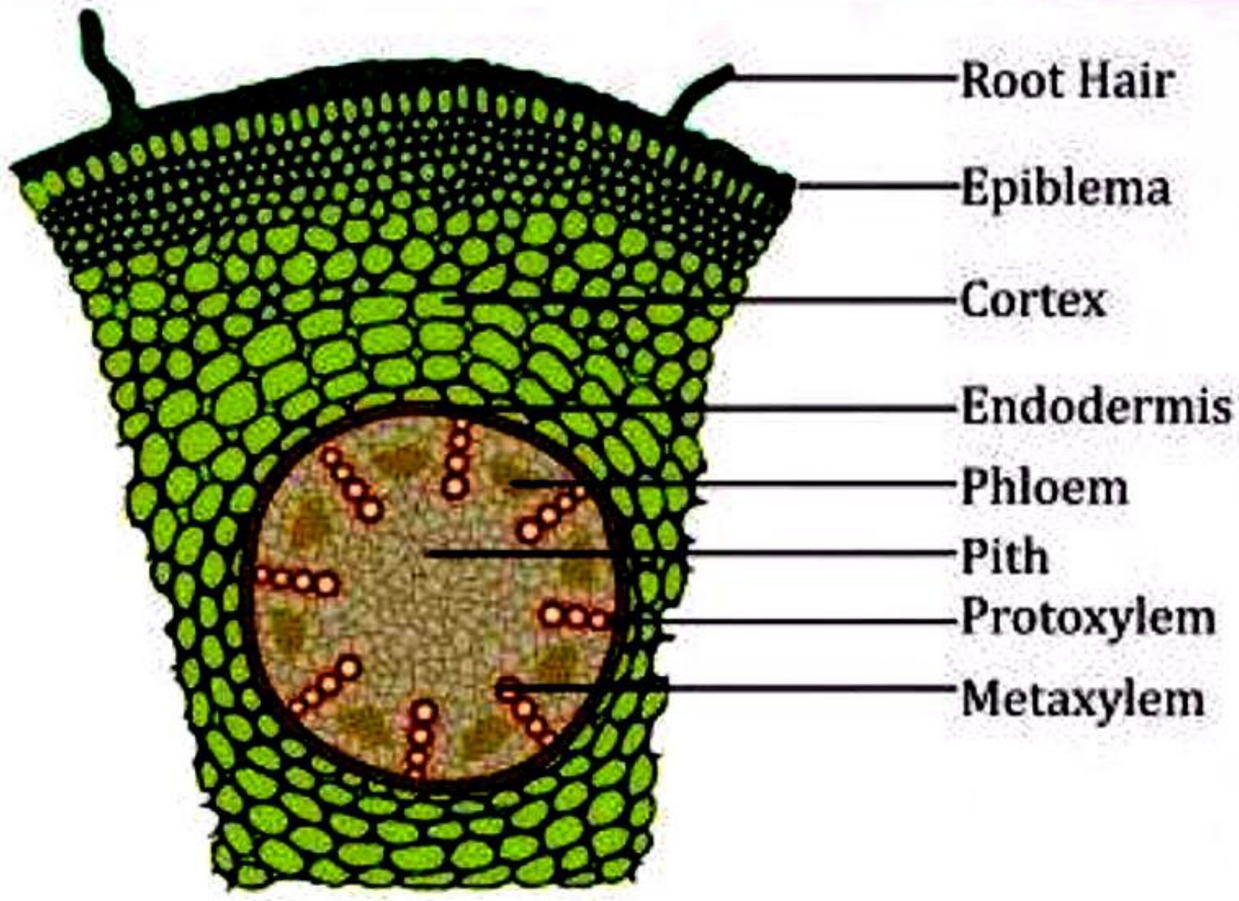
Following are the structural features of monocot root which are different from dicot root.

Vascular bundles: Vascular bundles are radial, i.e. xylem and phloem lie on different radii and are polyarch. Exarch xylem condition is seen, i.e. protoxylem lies towards the outer side and metaxylem towards the centre. Xylem vessels are rounded or oval in shape and phloem consists of sieve tubes, companion cells and phloem parenchyma.

Conjunctive tissue: The parenchymatous cells that lie between the xylem and phloem and also separate them are called conjunctive tissues. These are also called as packing tissues.

Pith: The well-developed pith formed of parenchymatous cells with intercellular spaces is found in monocot roots.

Examples of monocot root: Canna, Zea mays, Smilax, Allium cepa.



T.S. OF DICOT STEM

In T.S. of the dicot stem, the following features are shown:

Epidermis: It is composed of parenchymatous rectangular cells. Multicellular **trichomes** or epidermal hairs are present. It is the outermost protective layer of the stem.

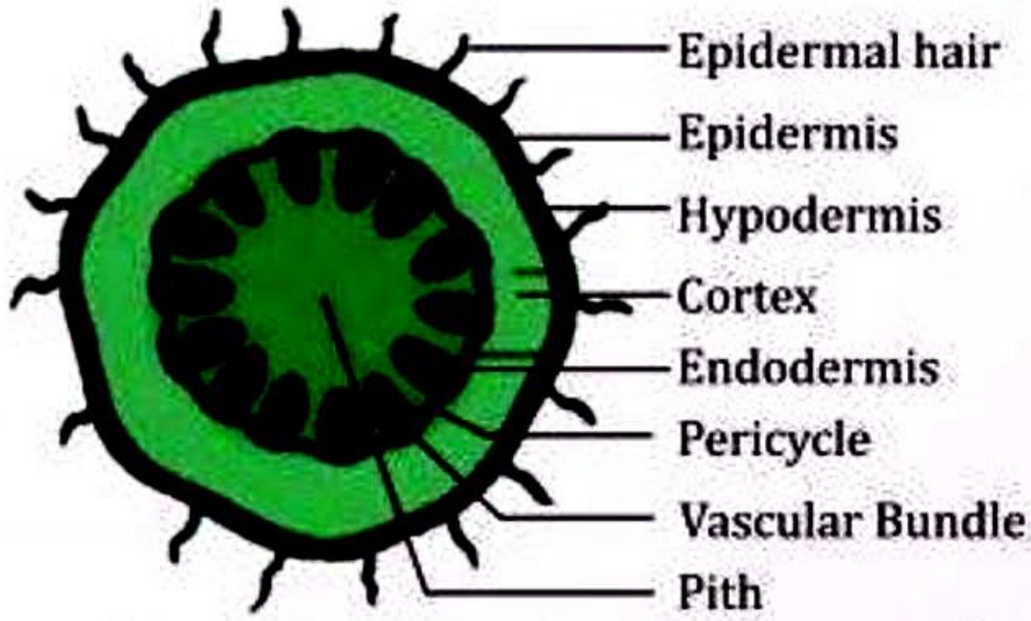
Hypodermis: The 3-4 layers of collenchymatous cells form the hypodermis. It primarily gives mechanical strength to the young growing stem mainly.

Cortex: It is composed of many layers of thin-walled, oval or rounded parenchyma cells possessing big intercellular spaces. Sometimes **oil ducts** are present in sunflower stem which are surrounded by a glandular parenchymatous layer.

Endodermis: It is the innermost layer of the general cortex. It consists of a single layered barrel-shaped cells which is devoid of intercellular spaces. Endodermis in sunflower stem contains starch therefore, it is called as starch sheath.

Pericycle: It is multi-layered with alternating bands of parenchyma and sclerenchyma cells present. It lies in between the endodermis and the vascular bundles.

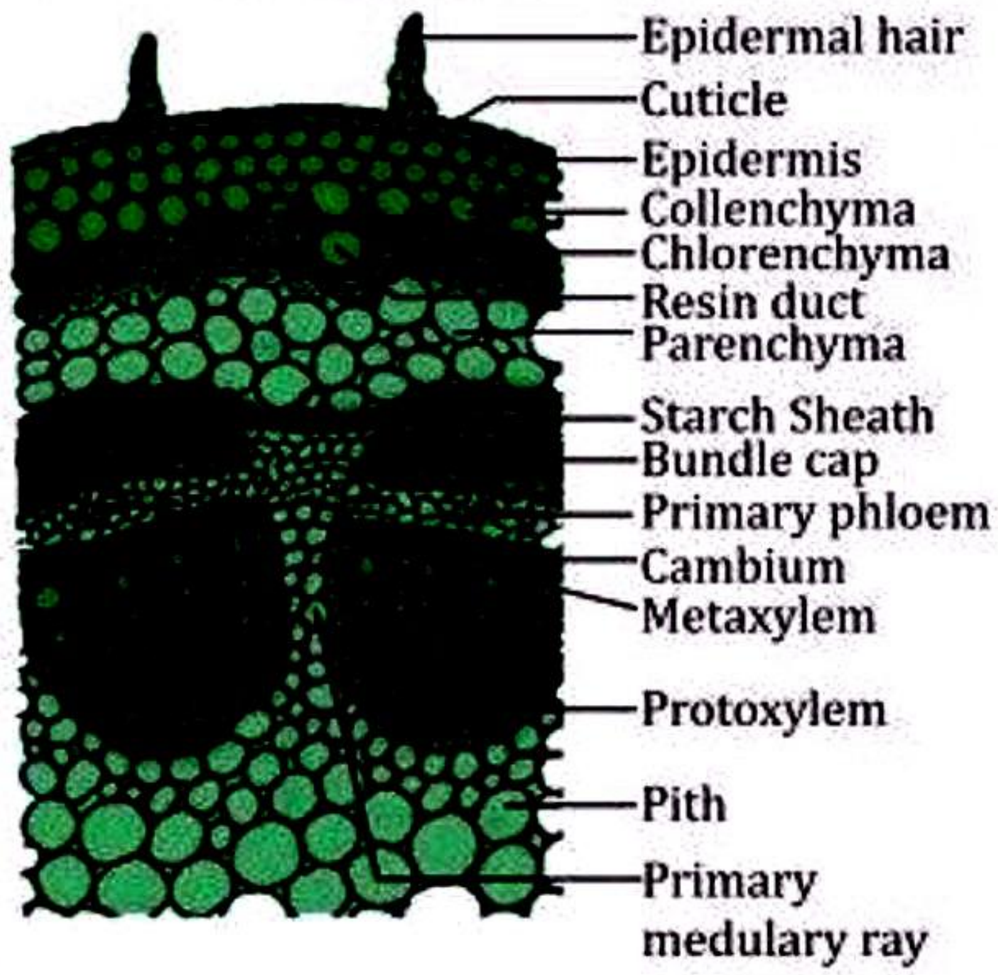
Vascular bundles: These are conjoint, collateral and open and are arranged in the form of a ring. Each vascular bundle is composed of phloem, xylem and cambium (fascicular). They are Endarch.



Medullary rays: These are parenchymatrus non-vascular areas present in between the vascular bundles. They help in the radial conduction of food and water.

Pith: It is the central part of the stem and consists of rounded, oval or polygonal parenchymatous cells. Intercellular spaces are present between them and these cells store food material and water products.

Examples of dicot stem: Helianthus, Tinospora, Ricinus, Xanthium.



T.S OF MONOCOT STEM

T.S. of a monocot stem show following specific features:

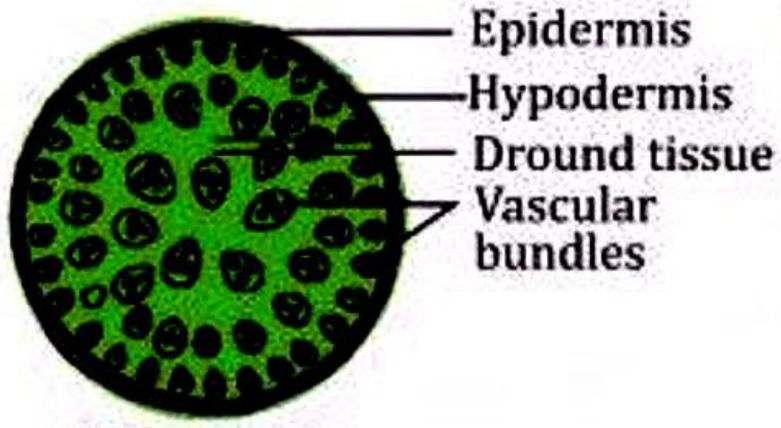
Epidermis: It is the outermost layer of thin-walled, compactly arranged, barrel-shaped, parenchymatous cells. It is uniserate and covered with a thick cuticle. Epidermal hairs are absent and stomata are present.

Hypodermis: It is 2-3 layered, lignified and consists of sclerenchymatous cells which lie just below the epidermis and provide mechanical strength to the stem.

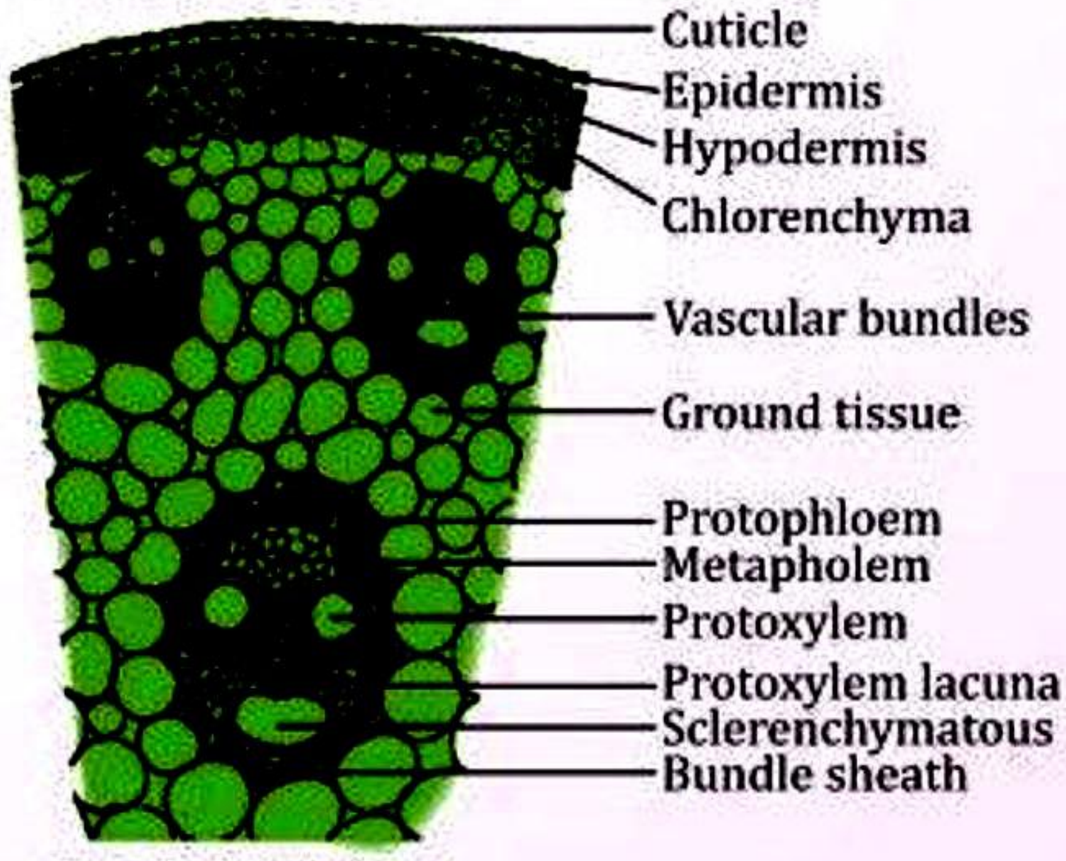
Ground tissue: The ground tissue is made up of rounded parenchymatous cells with distinct intercellular spaces.

Vascular system: A large number of vascular bundles lie scattered throughout the ground tissue. These are smaller in size and are more in number towards periphery than centre. Each vascular bundle is surrounded by sclerenchymatous bundle sheath. Each vascular bundle is conjoint, collateral and closed. These are endarch, i.e. protoxylem towards centre and metaxylem towards periphery. These are arranged in the form of letter Y or V. A water containing cavity called lysigenous cavity is present in association with the protoxylem.

Examples of monocot stem: Zea mays, Canna, Asparagus, Doob grass.



Diagramatic



Detailed Structure

PRECAUTIONS

1. Sharp blade or razor without any pick should be used for cutting section.
2. The section should be thin, even and transparent.
3. Keep the sections dipped in water because they may get dried out and cells will not be visualised clearly if kept outside.
4. Brush should be used while handling the section.
5. Air bubble should be avoided by placing coverslip very gently over the stained section.
6. Extra glycerine and stains should be avoided by wiping it gently with the help of a filter paper

VIVA VOCE

Q1. Arrange the following sequentially as you would see in a T.S. of a dicot stem. pericycle, epidermis, pith, cortex, xylem and phloem.

Ans. The correct sequence of tissues in a T.S. of a dicot stem is as follows: epidermis, cortex, pericycle, phloem, xylem and pith.

Q2. Where do you find radial, conjoint, collateral and open vascular bundles?

Ans. Radial vascular bundles are found in dicot root and monocot root, whereas, vascular bundles are conjoint, collateral and open (cambium present) and are arranged in rings in a dicotyledonous stem.

Q3. What type of xylem arrangement would be seen in T.S. of root of lily plant?

Ans. T.S. of root of lily (monocotyledonous plant) shows exarch condition, i.e. protoxylem lies towards outer side and metaxylem towards centre or pith.

Q4. Which part of a dicot stem is meristematic?

Ans. The cambium present in between xylem and phloem in vascular bundle has the ability to divide rapidly, hence it is the meristematic tissue in a dicot stem.

Q5. Where do we find the scattered vascular bundle?

Ans. Scattered vascular bundle are the characteristic feature of monocot stem.

Q6. What is radial vascular bundle?

Ans. When the xylem and phloem lie on different radii alternating with each other, the vascular bundle is called radial. The xylem and phloem bundles are separated by parenchymatous tissues. These are found in monocot and dicot roots.

Q7. Where are casparian rings found?

Ans. The casparian rings are the bands of thickening found in the endodermis layer.

Q8. Give the role of xylem and phloem in vascular bundle.

Ans. Xylem is responsible for the conduction of water and minerals from soil to various plant parts, while phloem helps in the transport of prepared food from the leaves to other parts of plant.

Q9. Where are tracheids and vessels found?

Ans. Tracheids are found in ferns and gymnosperms while, vessels are found in angiosperms.