

CONCEPT MAP

ANATOMY OF MONOCOTS

Monocots or monocotyledonous plants are those plants whose seeds contain only one cotyledon. Anatomy of monocots deals with the internal structures of root, stem and leaves.

- It is the outermost layer having thin walled, uncultinised colourless cells and are without intercellular spaces. It is characterised by the presence of unicellular hairs.
- It is also called **rhizodermis** (Piliferous Layer).
- Root hairs take part in absorption of water and mineral salts.

- Below the epiblema, cortex is present.
- It is very wide region of parenchymatous cells that encloses intercellular spaces for the exchange of gases.
- In older roots, the outer one (e.g., *Smilax*) or more layers (e.g., maize) of the cortex become thick walled and suberised and constitute **exodermis**. (It is protective and to some extent absorptive in function).
- The function of cortex in a monocot root is
 - Conduction of water from the root hairs to the inner tissues.
 - Production of protective exodermis in older roots.
 - Storage of food.

- The centre of monocot root is occupied by pith.
- It consists of parenchymatous cells (thin or thick walled) which may be rounded or angular.
- Intercellular spaces are present amongst the pith cells.
- The function of pith cells is to store food.

- It is the outer boundary of vascular bundle below the endodermis.
- Pericycle is composed of thin-walled parenchymatous cells in the young root. But in many monocots, it becomes thick-walled in later stages.
- Pericycle may be uniseriate, (e.g., maize) or multiseriate (e.g., *Smilax* and *Salix*).
- The pericycle does not form cambium (in monocots) but produces lateral roots only.

- It is the outermost layer of the stem composed of compactly arranged, transparent, elongated and rectangular barrel-shaped parenchyma cells.
- The outer wall of epidermal cells possess deposition of silica (provides stiffness) and cutin. The epidermal cells are cutinised which prevent the evaporation of water from the stem.
- Hairs are absent.
- Epidermis possess two dumb-bell shaped guard cells of pores called stomata (for gaseous exchange).

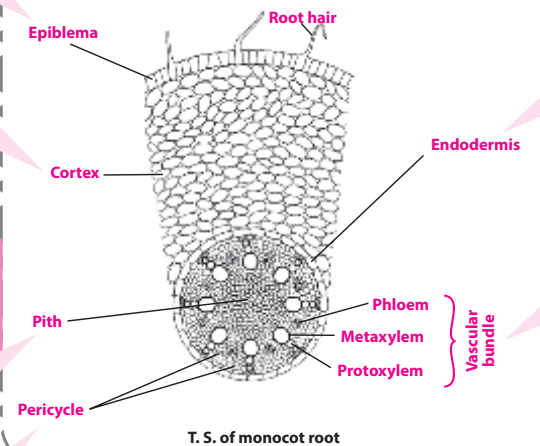
- It possess two to three layers of sclerenchyma below the epidermis.
- Intercellular spaces are absent in this tissue.
- Provides rigidity and mechanical strength to the plant and acts as heat screen

- The entire mass of parenchymatous cells next to hypodermis form ground tissue.
- There is no differentiation between cortex, endodermis, pericycle and pith.
- The cells contain reserve food materials due to the presence of chlorenchymatous cells.
- In the peripheral ground tissue, the cells are smaller, polygonal and compactly arranged while towards the centre, they become loosely arranged, rounded and are bigger. Vascular bundles are embedded in this tissue.
- Abundant intercellular spaces are present.

- There is an upper and lower layer of epidermis, covering both the surfaces respectively.
- Both the layers are composed of a single layer of cells and possess stomata hence, called **amphistomatic**.
- Some cells in the upper epidermis become large and are called **bulliform cells** or **motor cells** (helps in rolling of leaves during drought) and occur in group.
- The epidermal cells are cuticularised, therefore, protect from microbial attack and drought, besides regulating transpiration.

- The mesophyll is not differentiated into **palisade** and **spongy parenchyma**.
- Its cells are chlorenchymatous, large isodiametric, enclose small intercellular spaces and are irregularly arranged.

ANATOMY OF MONOCOT ROOT



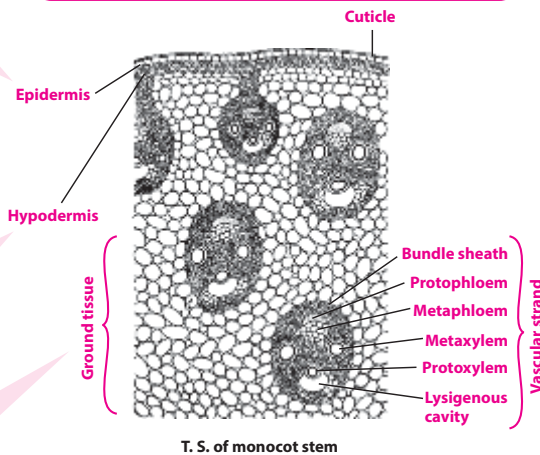
T. S. of monocot root

- There is not much distinction between a young and an old root of monocot plants due to the absence of secondary growth in the monocot roots.

- It is an inner boundary of the cortex and is usually single layered.
- It is made up of barrel-shaped cells which do not enclose intercellular spaces.
- Endodermal cells are characterised by the presence of **Casparian strips** (an internal strip of suberin and lignin) and get thickened.
- Some endodermal cells (opposite to protoxylem) remain unthickened and devoid of casparian strips and are called **passage cells** or **transfusion cells**.
- Functions of endodermis are
 - It functions as a mechanical protective layer.
 - Maintenance of the root pressure.
 - It regulates the flow of fluid both inwardly as well as outwardly by functioning as biological check post.

- Vascular bundle is in the form of several alternate and radial xylem and phloem bundles.
- The vascular bundles are embedded in a cylinder of sclerenchymatous conjunctive tissue (e.g., maize).
- The vascular bundles are arranged in the form of ring around a central pith.
- The xylem bundles are **exarch** i.e., protoxylem lies towards the outside while the metaxylem faces inwards.
- Xylem of monocot root is **polyarch** i.e., presence of numerous xylem bundles.
- The xylem provides mechanical strength and helps in the conduction of water and mineral salts.
- Phloem bundles alternate with the xylem bundles. These two are separated from each other by means of narrow strip of **conjunctive tissue**.
- The cells of conjunctive tissue store food if parenchymatous and provide mechanical strength on becoming sclerified but they do not take part in formation of cambium.
- The function of phloem is conduction of organic food.

ANATOMY OF MONOCOT STEM

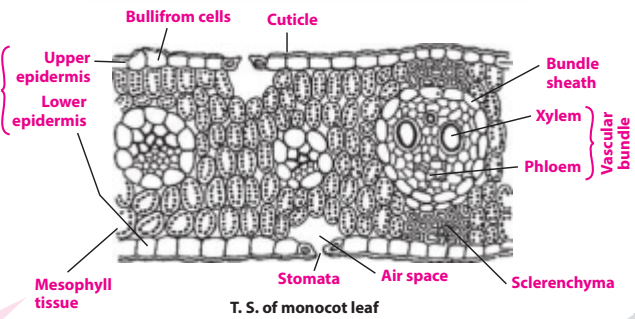


T. S. of monocot stem

- A monocot stem lacks secondary growth. Therefore, it possess only the primary permanent tissues.
- The stem can be **solid** (E.g., maize, *Asparagus*) or **fistular** (with central cavity, e.g., grass).

- The vascular strand is in the form of **atacostele** (where a large number of vascular bundles lie scattered throughout the ground tissue).
- Each vascular bundle is surrounded by a sclerenchymatous bundle sheath. This sheath is extensively developed at the upper and lower faces of vascular bundles.
- Vascular bundles are conjoint, collateral but closed and endarch in condition.
- The vascular bundles are almost oval in outline and are made up of xylem and phloem only.
- (a) **Phloem** : It is found above the xylem and made of sieve tubes and companion cells.
- Phloem parenchyma is absent.
- Phloem can be distinguished into an outer protophloem and inner metaphloem.
- The protophloem gets crushed in the later stages.
- (b) **Xylem** : It consists of vessels, tracheids and xylem parenchyma.
- The metaxylem and protoxylem elements are arranged in the form of letter 'Y'.
- The divergent ends of 'Y' are occupied by two big, oval metaxylem vessels with pitted thickenings.
- In between, there are small tracheids.
- The protoxylem is positioned radially towards the centre (lower arm of Y), consisting of two smaller vessels with annular and spiral thickenings.
- In a completely mature vascular bundle, a schizolysigenous cavity is formed by disintegration of protoxylem and these cavities are filled with water.

ANATOMY OF MONOCOT LEAF



T. S. of monocot leaf

- It is also called **Isobilateral leaf** and are generally vertical where both the surfaces are equally green.
- The thick cuticle, sclerenchyma patches and **motor cells** are the **xerophytic** features of the leaf.

- There are a number of large and small vascular bundles.
- Each bundle is surrounded by a layer of thin-walled cells called bundle sheath.
- The cells of bundle sheath contains starch.
- The large bundles have prominent sclerenchyma patches on both the upper and lower sides extending from vascular bundle to epidermis.
- The larger bundles have a distinct phloem towards the lower epidermis and xylem towards upper epidermis.
- The xylem consists of two pitted metaxylem vessels (oval in shape). In between them, tracheids are also present.
- Protoxylem is represented by a lysigenous cavity, which faces the upper epidermis (**adaxial side**).
- The smaller bundles are surrounded by individual sheaths and contain phloem and xylem.
- Phloem is present towards lower epidermis (**abaxial side**).
- The vascular bundles are conjoint, collateral and closed.