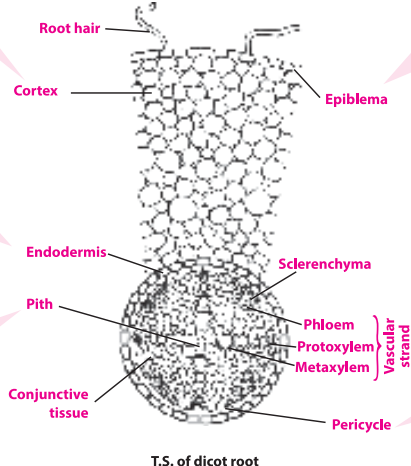


CONCEPT MAP

ANATOMY OF DICOTS

Anatomy is the study of internal structures of various parts of a living organism. Anatomy of dicot plants deals with the internal structures of stem, root and leaves of plants.

ANATOMY OF DICOT ROOT



- It is situated below epidermis and is made up of thin-walled parenchyma cells with intercellular spaces.
- Cortical cells store starch.

- Innermost layer of cortex is called **endodermis**. It is made up of single layer of barrel-shaped cells lacking intercellular spaces.
- Young endodermal cells possess **Casparian strips** (bands of thickening which run along their radial and tangential walls).
- Casparian strips prevent plasmolysis of endodermal cells and do not allow wall to wall movement of substances between cortex and pericycle.
- Endodermal cells opposite to protoxylem point lack Casparian strips and are called **passage cells**.

- It is found in the centre and is often reduced or absent in dicot root.
- If present, it consists of parenchyma cells without intercellular spaces.

- Xylem and phloem bundles are separated from each other by one or more layers of small thin-walled cells called conjunctive parenchyma.
- It becomes meristematic to form vascular cambium.

- It is the outermost layer of stem and is protective in function.
- Made up of compactly arranged, parenchymatous cells devoid of chloroplasts (except guard cells).
- The outer walls of epidermal cells are cuticularised.
- Stomata and multicellular hair are present in epidermis.

- Consists of thin-walled parenchymatous cells with intercellular spaces.
- Major function of cortex is food storage.

- It is the innermost boundary of cortex made up of compactly arranged barrel-shaped cells without Casparian strips.
- Endodermal cells of stem store starch grain and are often referred to as **starch sheath**.

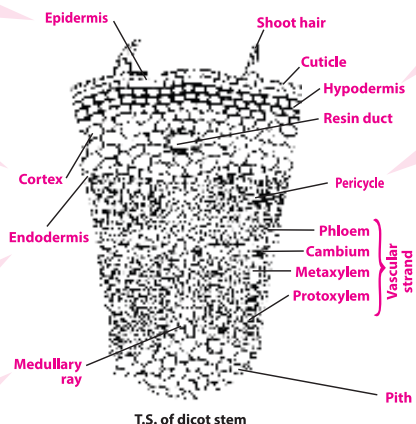
- They are radial strips of parenchyma which are present between adjacent vascular bundles.
- They connect pith with pericycle and cortex.
- Ray cells are larger than cortical cells.

- It is the outermost layer of root.
- Made up of compactly arranged, thin-walled, parenchymatous cells.
- Distinct cuticle and stomata are absent.
- Some cells of epidermis give rise to thin-walled tubular outgrowths called **root hairs**. These absorb water and mineral salts from the soil.
- Due to presence of root hairs, the epidermis is also called **piliferous layer**.

- Vascular bundles are **radial**, i.e., xylem and phloem are situated on different radii and **exarch**, i.e., protoxylem away from the centre and metaxylem towards the centre.
- Roots may be **diarch** (2 xylem bundles), **triarch** (3 xylem bundles), **tetrarch** (4 xylem bundles), **pentarch** (5 xylem bundles) or **hexarch** (6 xylem bundles).

- It is usually a single layered structure found below the endodermis and represents the outer boundary of stele.
- All lateral roots originate from pericycle.

ANATOMY OF DICOT STEM



- Hypodermis lies just below epidermis and consists of 3-5 layers of collenchymatous cells.
- The intercellular spaces are absent and corners of cells are thickened due to deposition of extra cellulose impregnated with pectic substances.
- These cells often possess chloroplasts.

- Pericycle is **heterogenous**, i.e., made up of alternating bands of parenchymatous and sclerenchymatous cells.
- Sclerenchymatous cells are situated in between endodermis and phloem cells of vascular bundles whereas parenchymatous cells are present above the medullary rays.

- Vascular bundles are arranged in a ring and are **conjoint** (with both phloem and xylem), **collateral** (phloem and xylem on same radius) and **open** (with a strip of cambium between phloem and xylem). Xylem is situated towards the inner side of each vascular bundle whereas phloem lies towards the pericycle on the outer side of vascular bundle.
- Xylem is **endarch** (protoxylem towards the centre).

- It is extensively developed central portion of ground tissue, made up of large thin-walled polygonal parenchymatous cells with intercellular spaces.

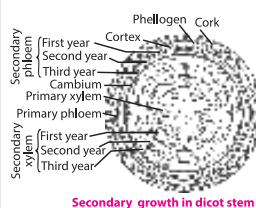
Secondary growth in dicots

Secondary growth in dicot stem

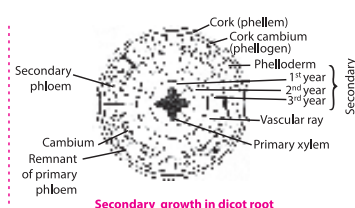
In a typical dicot stem the cambium is present in between the xylem and phloem. It is called **fascicular** or **intrafascicular** cambium. Along with this cambium, some medullary ray cells also become active forming **interfascicular** cambium. Interfascicular and intrafascicular cambia together form a ring of cambium. Cambial cells give rise to secondary phloem on the outer side and secondary xylem on the inner side. **Phellogen** or cork cambium arises from permanent living cells of hypodermis or outer cortex. It divides to give rise to phellem (cork) on the outside and phelloderm (secondary cortex) on the inner side.

Secondary growth in dicot root

In dicot roots cambium develops at the time of secondary growth. First of all parenchyma cells interior to the phloem become meristematic, and strips of cambia are formed. Later, these strips divide tangentially again and again and produce secondary tissues. The cells of pericycle lying opposite to each protoxylem divide and form a few layers of cell. Thus, a wavy continuous cambium ring is produced which cuts-off secondary xylem internally at all places and secondary phloem at all places externally. Cork cambium arises as a result of the tangential division of the outer cells of pericycle. The activity of cork cambium is similar to that found in dicot stem so it produces cork cells on the outer side and parenchyma on the inner side.

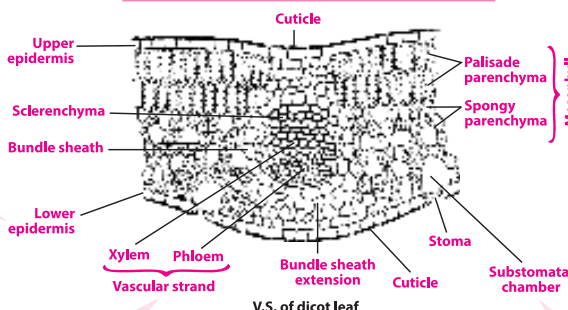


Secondary growth in dicot stem



Secondary growth in dicot root

ANATOMY OF DICOT LEAF



- Consists of a single layer of tightly packed rectangular barrel-shaped parenchymatous cells usually devoid of stomata and chloroplasts.
- Outer walls of epidermal cells are cuticularised.

- This is like upper epidermis but with stomata and chloroplasts (in guard cells only).
- Outer walls of cells are cuticularised.

- The tissue between upper and lower epidermis is called mesophyll.
- It is differentiated into 2 regions:

(i) **Palisade parenchyma**: It lies below upper epidermis and consists of 1-3 layers of vertically elongated closely placed, columnar or cylindrical cells. These cells have numerous chloroplasts and take part in photosynthesis.

(ii) **Spongy parenchyma**: It is found below palisade tissue. The cells are almost spherical and irregularly arranged with intercellular spaces. They also possess chloroplasts but fewer than present in palisade parenchyma and take part in photosynthesis.

- Vascular bundles are generally found at the boundary between the palisade and spongy regions.
- Vascular bundles are **conjoint** and **collateral**.
- Around each vascular bundle a sheath of parenchymatous cells called **bundle sheath** is present.
- The midrib contains a number of vascular bundles which are embedded in parenchymatous ground tissue.

- Substomatal chamber is present below the stomata which helps in exchange of gases and is also called **respiratory cavity**.

