

Anatomy of Flowering Plants

Introduction:-

- Study of internal structure of plants is called Anatomy.
- a Cells are the basic unit of organism.
- b Cells are organised into tissues and further tissues are organised into organs.
- c Different organs in plant show differences in their internal structure. Eg:- Xylem & phloem, parenchyma & collenchyma
- d Within the angiosperms, the monocots and dicots are also anatomically different.
- Internal structure also shows adaptation to diverse environment.

<u>Tissue System</u>		
<u>Epidermal tissue system</u>	<u>Fundamental or Ground tissue system</u>	<u>Vascular or conductive tissue system</u>
1) Epidermal cells 2) Stomata 3) <u>Epidermal appendages</u> Root hair Stem hair	1) Parenchyma 2) collenchyma 3) Sclerenchyma	Xylem & phloem → Radial / conjugate → open / closed

Tissue System:-

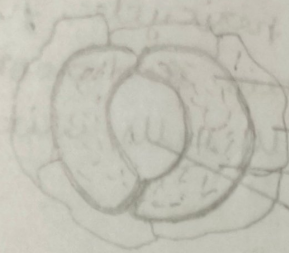
- Structure and function of tissue depend on its location
- ### Epidermal Tissue system:-
- It forms outermost covering of whole plant body.

Epidermal Cells:-

- Present in the outermost layer of the plant body.
- Made up of elongated, compactly arranged cells forms a continuous layer.
- Single layered
- Are parenchymatous; ^{having} small amount of cytoplasm, present in the lining of cell wall and large vacuole.
- Thick waxy layer present outside the epidermis is called cuticle.

which prevents the loss of water.
Absent in roots

Stomata:-



guard cells

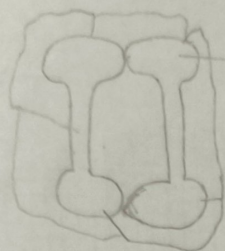
subsidiary cells

chlorophyll

stomatal aperture

stomatal apparatus

Dicots



dumbbell

Monocot

- Present in epidermis of leaf.
- Regulate transpiration and gaseous exchange.
- In dicots, stomata is composed of 2 bean or kidney shaped cells called guard cells enclosing the stomatal pore.
- In monocots (grass) guard cells are dumbbell shape.
- Outer walls are thin and inner walls are highly thickened.
- Guard cells have chloroplasts regulate opening and closing of stomata.
- Guard cells are surrounded by (vicinity) subsidiary cells.
- Stomatal pore }
guard cells } All are together called as stomatal apparatus.
subsidiary cells }

Epidermal Appendages:-

Root hair

- Unicellular
- Absorb water minerals from soil.

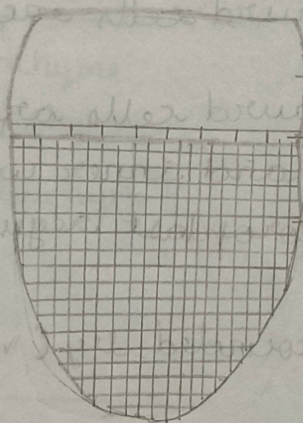
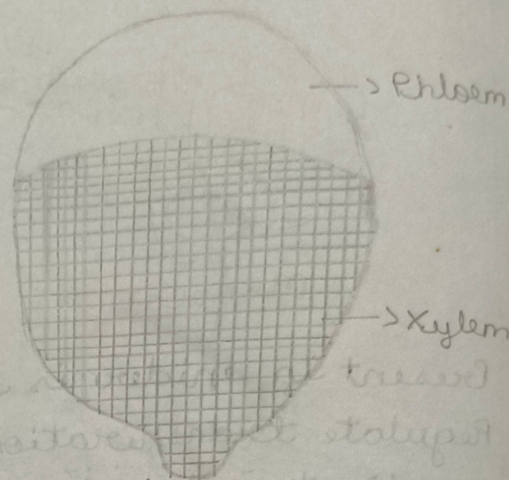
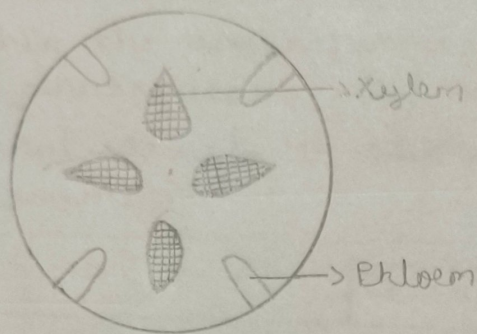
Stem hair

- Also called trichomes
- Trichomes are multicellular / branched or unbranched / soft or stiff / may be even secretory / prevent water loss during transpiration.

Ground Tissue System:-

- All tissues except epidermis and vascular bundle are called ground tissues.
- Parenchyma present in the cortex, pericycle, pith, medullary ray in the primary stem and roots.
- In leaves ground tissue has mesophyll cells with chloroplast.

Vascular Tissue System:-



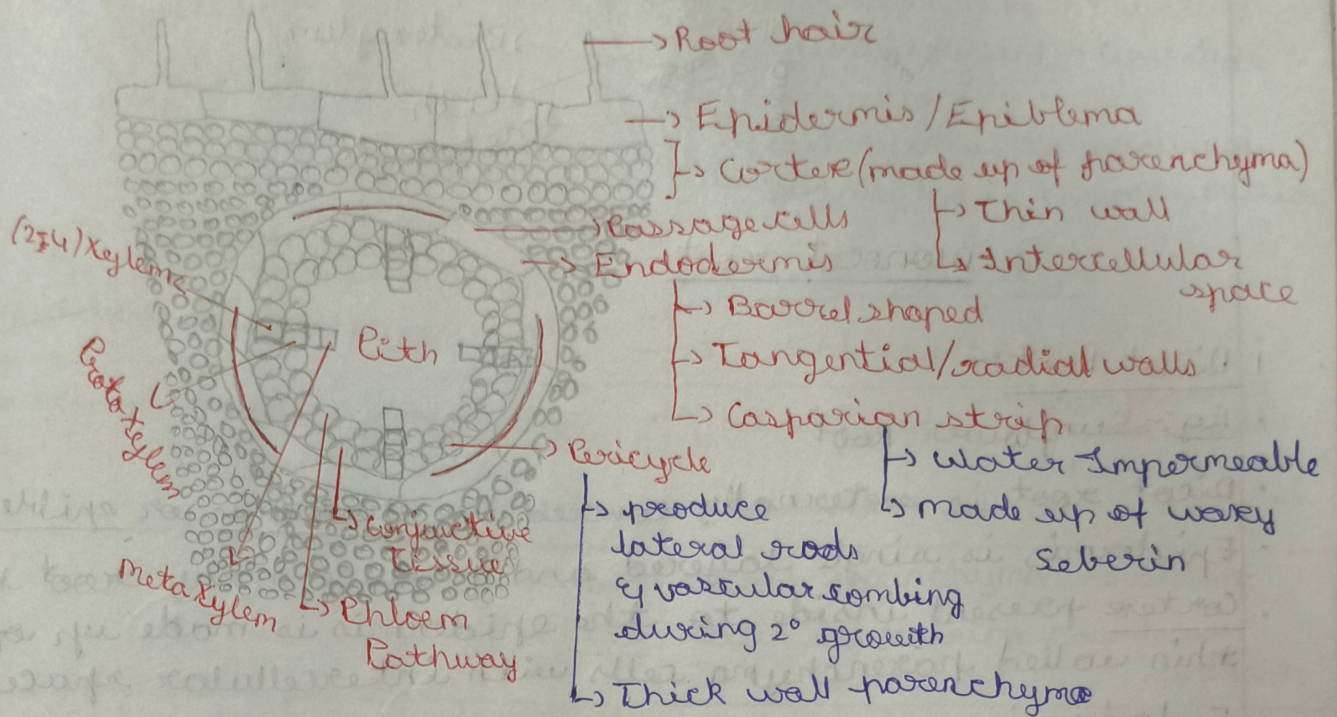
- Xylem and phloem both together called vascular bundle.
- In dicot stems cambium is present between Xylem and phloem. Therefore cambium can form secondary xylem and secondary phloem.
- Therefore it is called open vascular bundle.
- In monocots there is no cambium in vascular bundle.
- Therefore cambium cannot form secondary tissue so it is called closed vascular bundle.
- Xylem and phloem are arranged in different radius is called radial arrangement.
- Radial arrangement is seen in the roots.
- Xylem and phloem are arranged:

- Conjoint arrangement is seen in stems and leaves
- In conjoint xylem is present inside and phloem is present outside.

Anatomy of Root

Dicot Root

- It is seen in sunflower root



Inner parts of endodermis are:-

- Pericycle
 - Vascular bundle
 - Pith
- Stele

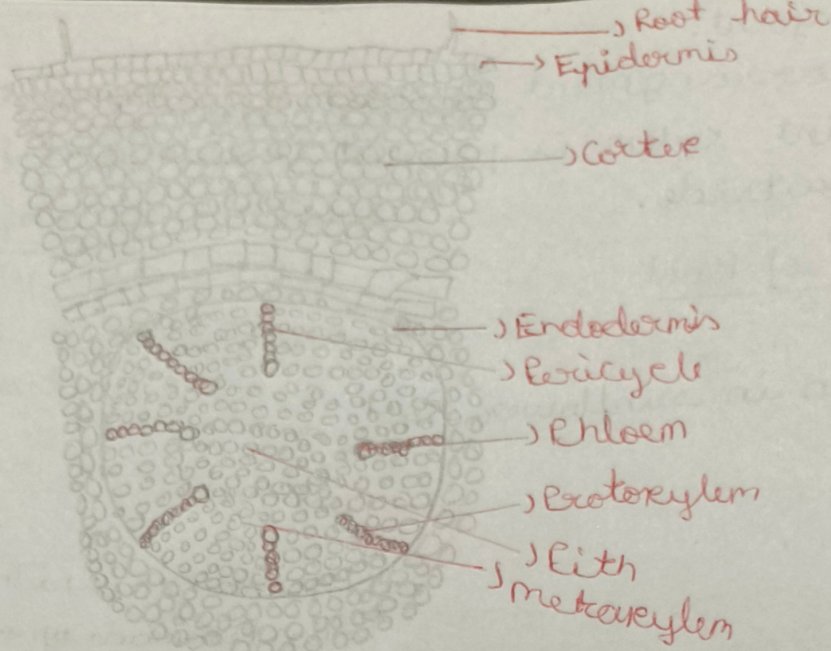
Difference between Dicot and Monocot

Dicot

- Epidermis/Epiblema
- 2-4 Xylem
- Pith - Small Inconspicuous
- ~~Dicot~~ Secondary growth is present

Monocot

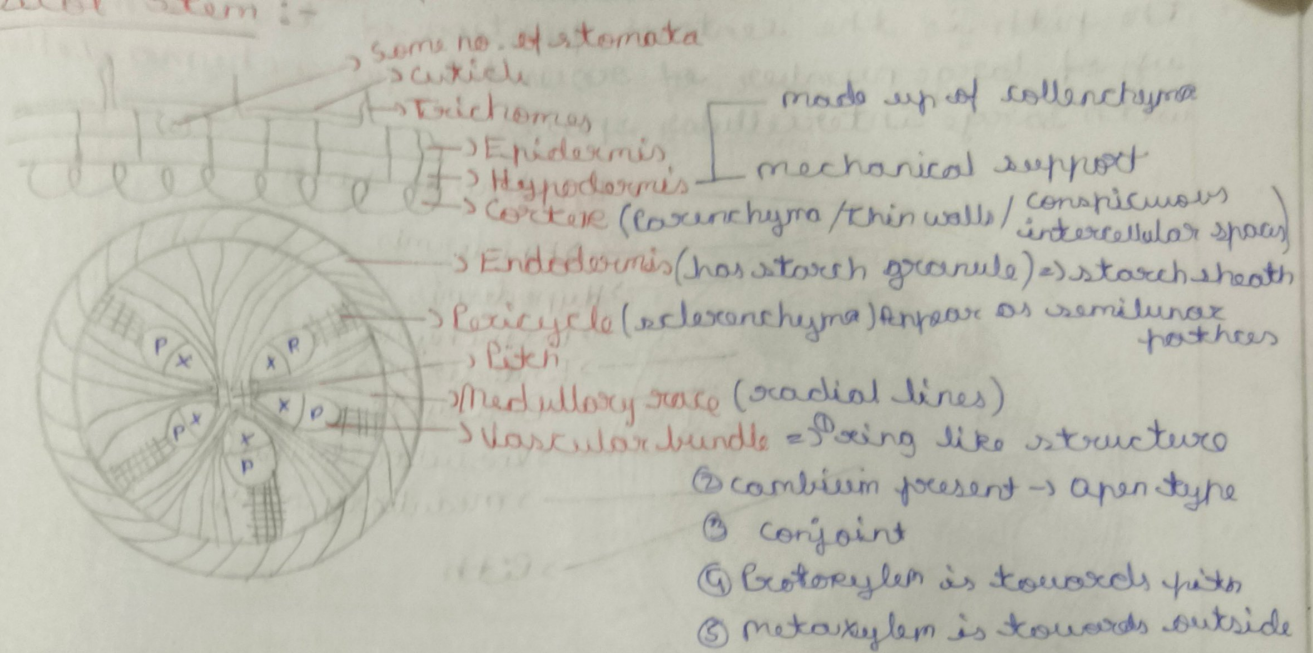
- Epidermis
- 6 Xylem (polyarch)
- Large and well developed pith.
- Secondary growth is absent.



monocot root

i Dicot Root:-

- Eg:- Sunflower Root
- Dicot root is externally covered by epidermis or epiblemma.
- Epidermis is single layered and produce many root hairs.
- Cortex present inside to the epidermis is made up of thin walled parenchyma cells with intercellular spaces.
- Endodermis present inside the cortex is made up of barrel shaped cells.
- The tangential or radial walls of endodermis has casparian strips.
- These strips are water impermeable and made up of waxy substance.
- Pericycle present inside the endodermis made up of thin walled parenchyma.
- Pericycle leads to the initiation of lateral roots and vascular cambium during secondary growth.
- The tissue present between xylem and phloem patches is called conjunctive tissue.
- Cambium ring is present between xylem and phloem.
- Pith is small and inconspicuous.
- All the tissues present inside epidermis (pericycle + vascular bundle + pith) is called stele.
- Secondary root growth is present.
- Inner layer of endodermis is called pericycle.



Dicot Stem

Hypoderm - Collenchyma

Vascular bundle → ring like
→ Cambium present

conjoint / open

Epidermis is a outermost protective layer covered by thin layer of cuticle and it bears lower trichomes and fused stomata.

Cortex consists of 3 sub zones

a) Hypodermis is the outermost layer of cortex made up of collenchyma cells and provide mechanical strength to the stem. young stem

b) Cortex present below hypodermis consist of thin walled parenchyma cells with conspicuous intercellular spaces.

c) The inner most layer of cortex is called endodermis is rich in size grain and so called starch sheath.

Pericycle is present inside the endodermis and above the phloem looks like semilunar patches of sclerenchyma.

Medullary rays are the radial lines present between the vascular bundles with parenchyma cells.

The vascular bundle of dicot stem are ring like arrangement, conjoint, open and with endarch protoxylem

monocot stem

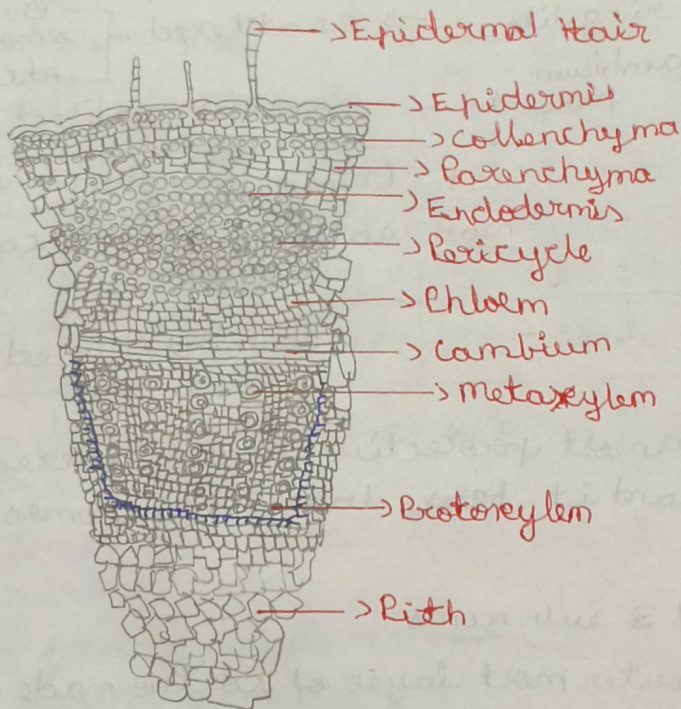
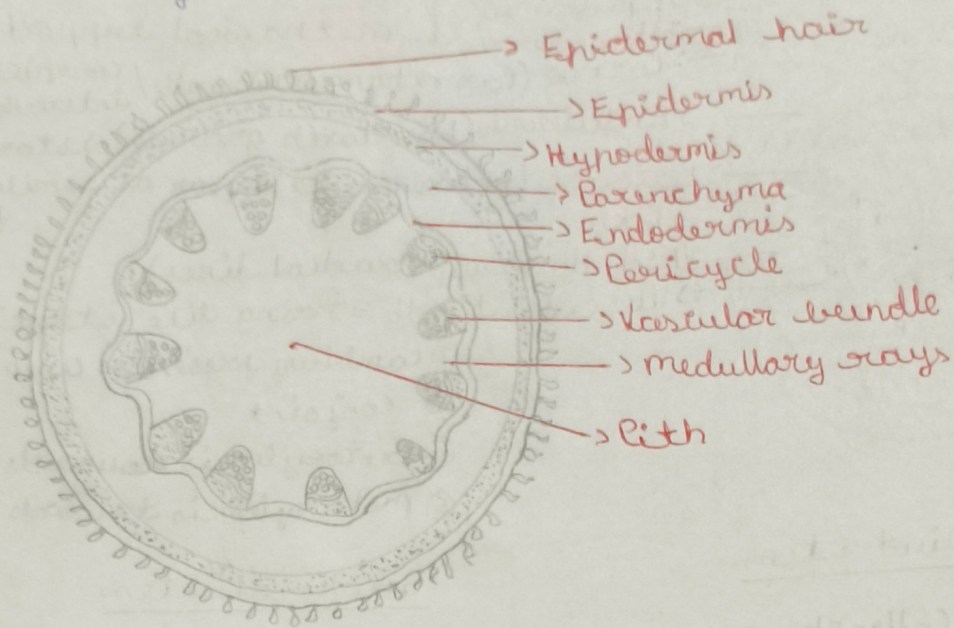
→ Sclerenchyma

→ scattered → Peripherally smaller vascular
At centre big sized vascular.
→ cambium absent

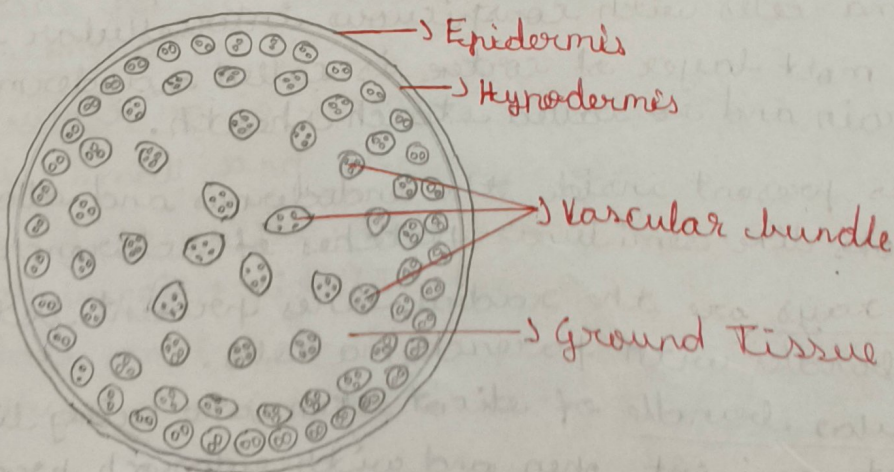
Note Phloem parenchyma is absent
Note water containing cavity is present.

Conjoint / closed

- The pith is the central portion of the stem made up of large number of rounded, parenchyma cells with large intercellular spaces.



Dicot Stem





Epidermis

Hypodermis

Vascular bundle

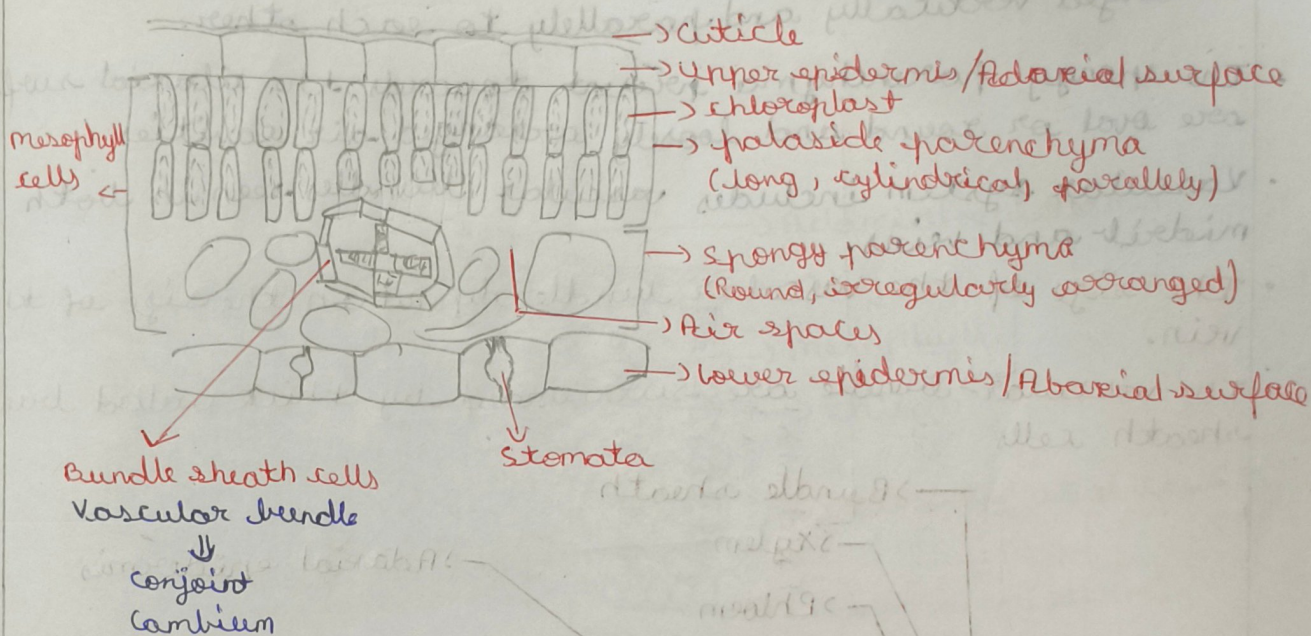
Chloem

Ground Tissue

Xylem

Monocot Stem

Dicot Leaf :-



Monocot Leaf :-

- on both surface the stomata are present
- No palisade & spongy parenchyma
- All cells look similar
- Bulliform cells :- Some of the epidermal cells of (large, empty, colourless) Adaxial cells modify into some specialized cells

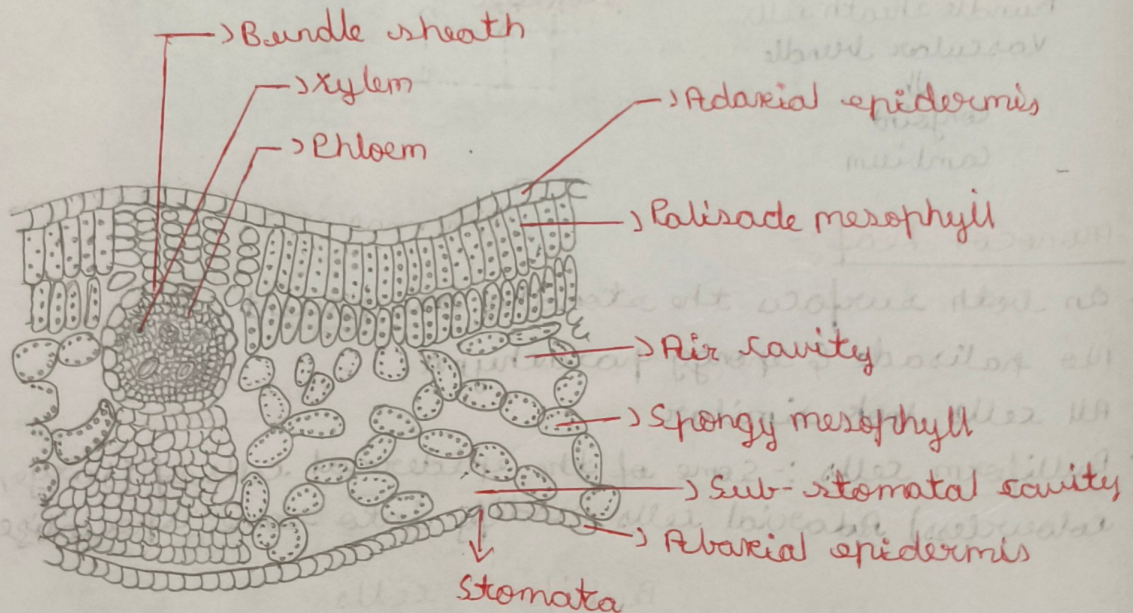
Bulliform cells

If they filled with water cells become turgid and makes the leaf surface to expose sunlight

If they are free with water, then cells become flaccid & makes the leaf to curl towards stem to prevent water loss

1 Dicot Leaf :-

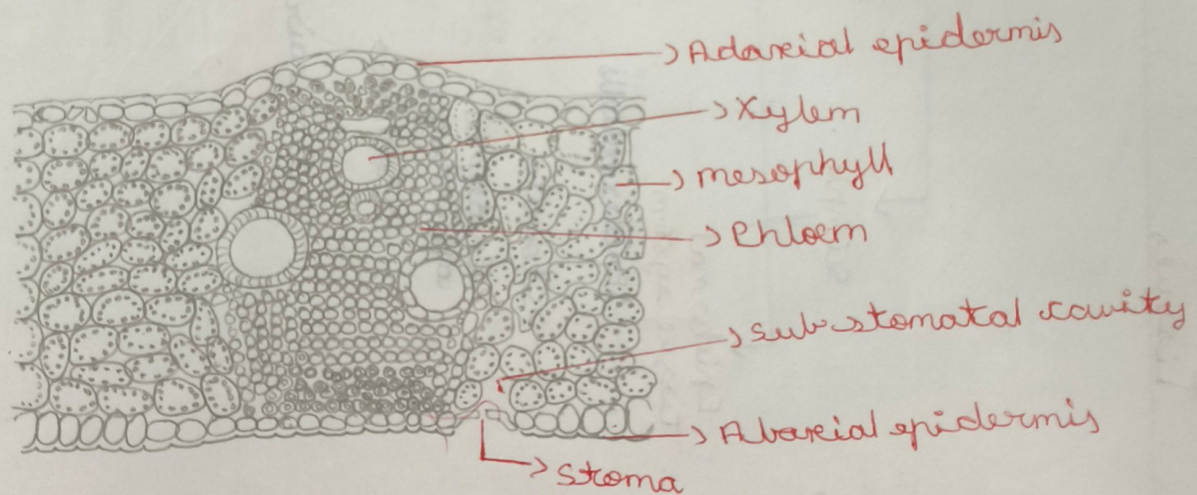
- The vertical section of dicot leaf shows epidermis, mesophyll, vascular system.
- Epidermis covers both the upper surface (adaxial surface) and lower surface (abaxial surface).
- Epidermis externally covered by conspicuous cuticle.
- more number of stomata are present on the abaxial surface than adaxial surface.
- mesophyll is the tissue present between upper and lower epidermis.
- mesophyll cells have chloroplast, perform photosynthesis, made up of parenchyma.
- The two types of cells present in mesophyll tissue a palisade parenchyma and spongy parenchyma.
- Palisade parenchyma is placed towards adaxial are arranged vertically and parallelly to each other.
- The spongy parenchyma present towards the abaxial surface are oval or round and loosely arranged air cavities.
- Vascular system includes vascular bundles seen in both midrib and veins.
- The size of the vascular bundle depend on the size of the vein.
- The vascular bundle are surrounded by thick walled bundle sheath cells



Dicot Leaf

2 Monocot Leaf :-

- In isobilateral leaf stomata are present on both surfaces of epidermis.
- mesophyll cells are not differentiated into palisade and spongy parenchyma.
- In grasses, some adaxial epidermal cells along with their veins modify into large, empty, colourless cells called bulliform cells.
- a) If the bulliform cells absorb water then they become turgid and makes the leaf surface to expanse.
- b) If the cells are flaccid due to water stress then leaves curl inwards and minimize the water loss.
- The parallel venation in monocot leaf is reflected in the size of the vascular bundles (except in the main veins) as seen in verticle section of the leaves.



Monocot Leaf

Anatomy of flowering plants

Tissues

meristematic

- Apical meristem
- Lateral meristem
- Intercalary meristem

Present only in meristems
Eg:- grasses

Simple

Epidermal Tissue system

- Epidermal cells
- Stomata
- Epidermal appendages
 - Root hair
 - Stem hair

Ground Tissue System

- Parenchyma
- Collenchyma
- Sclerenchyma

Complex

Vascular or conductive tissue system

- Xylem
- Phloem

Vascular bundle

Resistant

Stamens

