

Complex tissue

Vascular connecting system

Vascular tissue system: specialized in conducting, consist of:

- 1- xylem
- 2- phloem

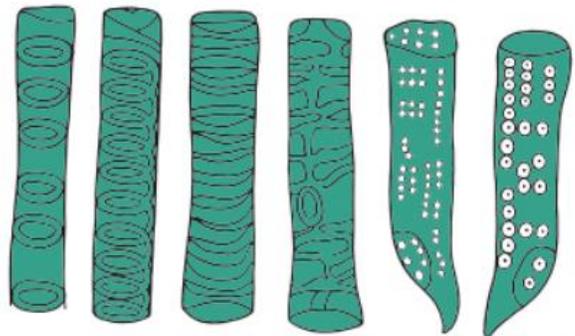
1. Xylem tissue

Xylem is a complex tissue, the main function is **transport**

- in angiosperm (مغطاة البذور) xylem tissue consist of tracheids, vessel, fibers and parenchyma cells.
- gymnosperm (عاريات البذور) the conduct element is tracheid only.

Xylem elements:

A. tracheid: Long cells died at maturity its function transport and support. The wall of tracheids are thickness in different type **like annular, spiral, reticular, scalariform and pitted.**



Annular Spiral Reticulate Scalariform Pitted thickening

B. Vessels: Tubular structure, multicellular, each cell of vessel called element.

2. Phloem tissue

A complex tissue, combine with xylem to form the vascular tissue system, the main function of it is food **transportation** ex: *Zea mays* stem C.S.

The phloem in Angiosperms (مغطاة البذور) plants consist of:

1. Sieve tubes.
2. Companion cells.
3. Parenchyma cell
4. Fibers

A- The sieve tubes

it's a chain of cells named sieve tube elements, each one of these elements has sieve plate at the terminal walls, these sieve plates have numerous pores that cytoplasmic strands cross through it. ex: *Cucurbita stem C.S.*

There are two kinds of sieve plate

1-**Simple sieve plate** (pores diffuse irregularly) ex: *Cucurbita stem C.S.*

2-**Compound sieve plate** (pores arrange in groups named sieve area) which probably found at lateral walls ex: *Vitis stem L.S.*

B- companion cell

its parenchyma cell with big nucleus and dense cytoplasm, each one of these cells companies one element from sieve tube elements, and both of them derived from same mother cell.

The phloem in Gymnosperms (عاريات البذور) plants consist of:

1-Sieve cells.

2-Parenchyma cells (Albuminous cell).

3-Fibers.

There are two kinds of phloem tissue:

1- Primary phloem, derived from pro-cambium, in plants don't have secondary growth ex: *Zea mays*.

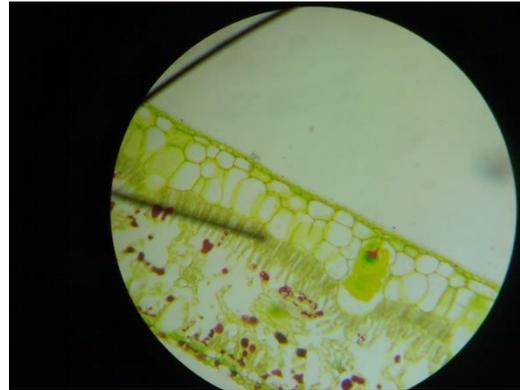
2- Secondary phloem, derived from vascular cambium (in secondary growth plants).

Epidermis

Epidermis is primary tissue system in the primary state of development, it represents the protective tissue which surrounds the plant organs (the young stem, young root, leaves, flower, etc.)

Epidermis can be classified according to the number of layers to:

1. Simple when it contains **one layer** of cells in *Zea mays* leaf
2. Double when it contains two layers of cells
3. Multiple when it contains many layers of cells in *Ficus*



Epidermis cell types

1. Ordinary epidermal cells

Ordinary epidermal cells represent the most common types of epidermis cells which are living, less differentiated, less specialized, and lack chloroplast

2. Guard cells

Highly specialized cells, exist in pair, kidney shaped, each pair surrounding stomata have chloroplast, it found only in aerial parts, function for it is **regulation the exchange of gases, photosynthesis, respiration & transpiration.**

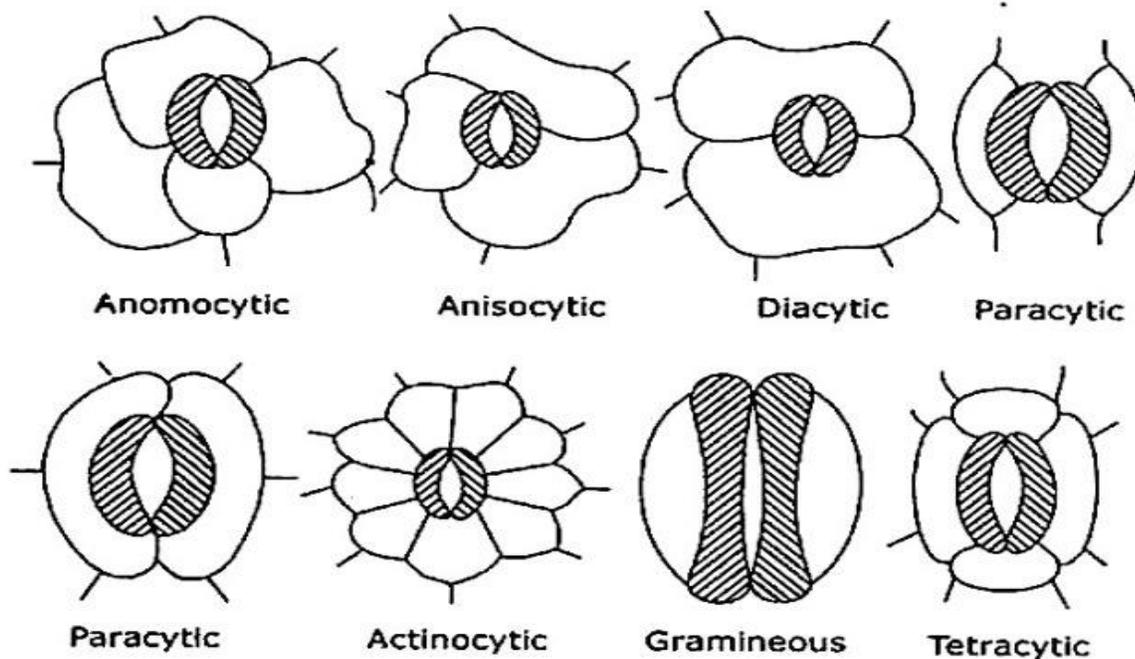
3. Subsidiary cells

Somewhat specialized epidermal cells associated directly with guard cells and are absent in some plant such as *Vicia faba*. These cells that found in epidermal levels, and may also found in a descending (sunken stomata), this case of **adaptation occurs when the plant try to reduce the water loss in hot environment**, such as *Pinus*.

The arrangement of subsidiary cells and guard cells is refer to stomatal complex

Stomatal complex:

1. Graminea type.
2. Paracytic type.
3. Diacytic type.
4. Anisocytic type.
5. Actinocytic type.
6. Anomocytic.



4. Motor cells

These cells are living and big size, plastid free, thin wall, storage a large amount of water and play important role in reduce water loss.

5. Lithocyte

Big cell contain cystolith crystal in side

The Trichomes

Is one of epidermal appendages, they have many types and functions.

The trichomes can be divided in two groups:

1. **Non glandular trichomes**, such as:

- **Peltate hair** it's like tooth margin (disk with stalk)
- **Pointed unicellular** (uniserrate) hair
- **Pointed multicellular** (multiserrate) hair
- **Stellate** unicellular

2. **Glandular trichome** It has secretion function such as:

Colletors in *Rosa* petiole

Stinging hair in *Urtica* leaf

Pits

Pits define as depressions or cavities on cell walls.

Pits consist of :

- 1- **Pit membrane** (consist of middle lamella and thin layer of primary cell wall).
- 2- **Pit cavity** (located between pit membrane and pit aperture)
- 3- **Pit aperture** (The opening that joins the pit with cell cavity)

Types of pits

1- Primary pit fields (a depressions on primary cell wall & usually associated with plasmodesmata .) in *Allium cepa* stripped of epidermis

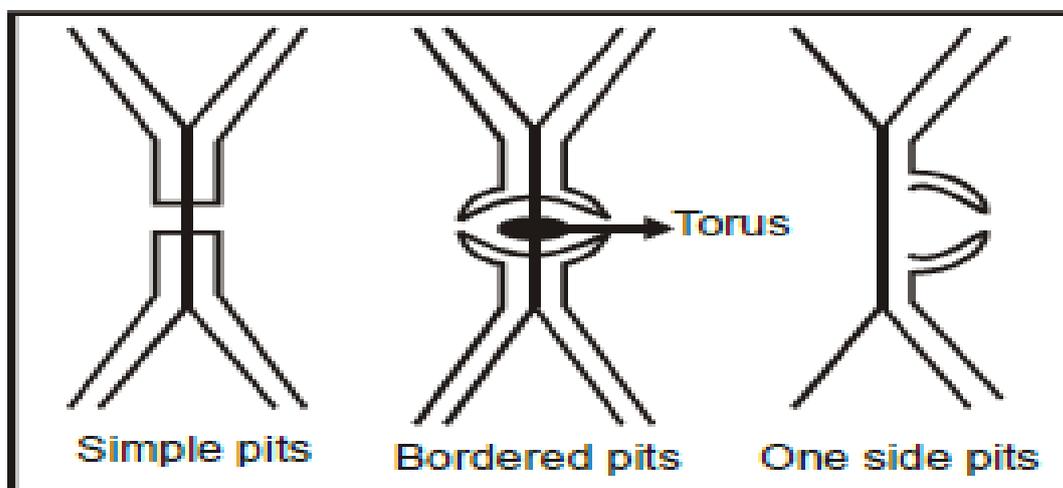
2- Simple pits (a cavity in secondary cell wall).

3- Bordered pits (Occurs when the secondary wall separates from the pit membrane extends into the cell forming a Border) associated **with xylem transport elements** [tracheids and vessels] in *Pinus* Xylem R.L.S

The bordered pits consist of:

1- Border 2- Torus 3- Pit chamber 4- Pit membrane 5- Pit aperture

4-Ramiform or Branched pits (occurs when the secondary cell wall become more thick , so it's become like a canal connected between cell lumen and surface) in *Pyrus communis* (pear fruit) stone cell or brachysaclereids



Pit combination

When the pit on one side of the cell wall is associated with one or more similar or different pits on the other side of the cell wall, the two associated pits are called Pit pair

1- **Simple pit pair** (Occurs if you meet two simple pits in **two parenchyma** cells)

2- **Bordered pit pair** (Occurs if you meet two bordered pits in **xylem transport elements**)

3- **Half bordered pit pair or Semi bordered pit pair** (Occurs if a simple pit in parenchyma cell is met with a bordered pit in xylem transport elements) in *Pinus* Xylem TLS.

4- **Aspirated pit** (happened when the torus closed the pit aperture of only one pit in Bordered pit pair to be un functional) in *Pinus* Xylem TL.S.