TOPIC: ANATOMY OF FLOWERING PLANTS: CLASSIFICATION OF TISSUES-II

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Complex Tissues

Xylem –

- Xylem functions as a conducting tissue for water and minerals from roots to the stem and leaves.
- It also provides mechanical strength to the plant parts.
- It is composed of four different kinds of elements, namely, tracheids, vessels, xylem fibres and xylem parenchyma.

Tracheids –

- Tracheids are elongated or tube like cells with thick and lignified walls and tapering ends.
- These are dead and are without protoplasm.
- The inner layers of the cell walls have thickenings which vary in form.
- In flowering plants, tracheids and vessels are the main water transporting elements.

Vessels –Vessel is a long cylindrical tube-like structure made up of many cells called vessel members, each with lignified walls and a large central cavity.

- The vessel cells are also devoid of protoplasm.
- Vessel members are interconnected through perforations in their common walls.
- Gymnosperms lack vessels intheir xylem. The presence of vessels is a characteristic featureof angiosperms.

Xylem fibres –

- They have highly thickened walls and obliterated central lumens.
- These may either be septate or aseptate.

Xylem parenchyma –

- Cells are living and thin-walled,and their cell walls are made up of cellulose.
- They store food materials in the form of starch or fat, and other substances like tannins.
- The radial conduction of water takes place by the ray parenchymatous cells.

- **Primary xylem** is of two types – protoxylem and metaxylem. The first formed primary xylem elements are called **protoxylem** and the later formed primary xylem is called **metaxylem.**

1. **Endarch –**Instems, the protoxylem lies towards the centre (pith) and themetaxylem lies towards the periphery of the organ. This typeof primary xylem is called **endarch**.
2. **Exarch –**In roots, the protoxylemlies towards periphery and metaxylem lies towards the centre.Such arrangement of primary xylem is called **exarch.**

Phloem –

- It transports food materials, usually from leaves toother parts of the plant.
- Phloem in angiosperms is composedof sieve tube elements, companion cells, phloem parenchyma and phloem fibres.
- Gymnosperms have albuminous cells and sieve cells. They lack sieve tubes and companion cells.

- **Sieve tube elements –**
  - They are also long, tube-like structures, arranged longitudinally and are associated with the companion cells.
  - Their end walls are perforated in a sieve-like manner to form the sieve plates.
  - A mature sieve element possesses a peripheral cytoplasm and a large vacuole but lacks a nucleus.

- **Companion cells –**
  - The functions of sieve tubes are controlled by the nucleus of companion cells.
  - The **companion cells** are specialised parenchymatous cells, which are closely associated with sieve tube elements.

- The sieve tube elements and companion cells are connected by pit fields present between their common longitudinal walls.
- The companion cells help in maintaining the pressure gradient in the sieve tubes.

- **Phloem parenchyma –**
  - Itis made up of elongated, tapering cylindrical cells which have dense cytoplasm and nucleus.
  - The cell wall is composed of cellulose and has pits through which plasmodesmatal connections exist between the cells.
  - The phloem parenchyma stores food material and other substances like resins, latex and mucilage.
  - Phloem parenchyma is absent in most of the monocotyledons.
- **Phloem fibres** (bast fibres)**–**
  - They are made up of sclerenchymatous cells.
  - These are generally absent in the primary phloem but are found in the secondary phloem.
  - These are much elongated, unbranched and have pointed, needle like apices.
  - The cell wall of phloem fibres is quite thick.

- At maturity, these fibres lose their protoplasm and become dead.
- Phloem fibres of jute, flax and hemp are used commercially.

- The first formed primary phloem consists of narrow sieve tubes and is referred to as **protophloem** and the later formed phloem has bigger sieve tubes and is referred to as **metaphloem**.

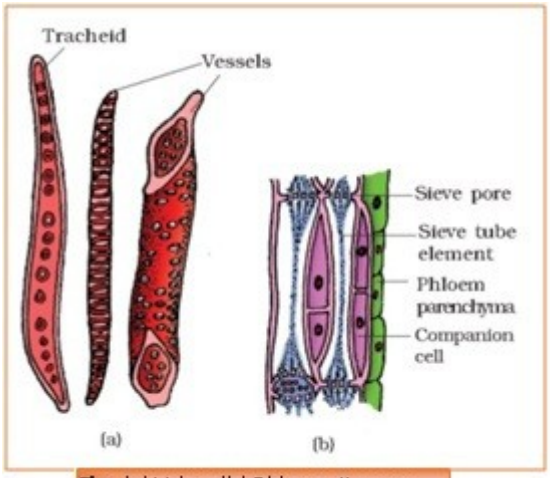

Fig: (a) Xylem (b) Phloem tissues