

Xylem

Definition of Xylem

----- .

Xylem:1- The xylem is the principle water conducting tissue in vascular plant .It is usually associated with phloem .the two tissue together are called **Vascular tissue or tissues.**

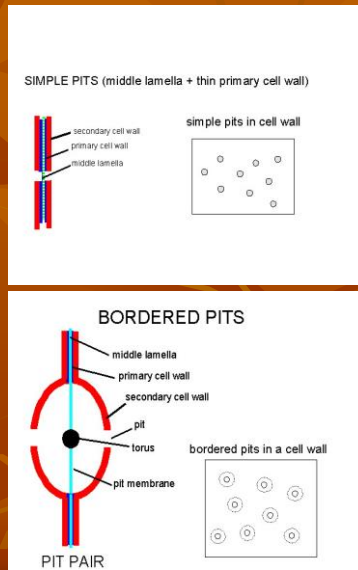
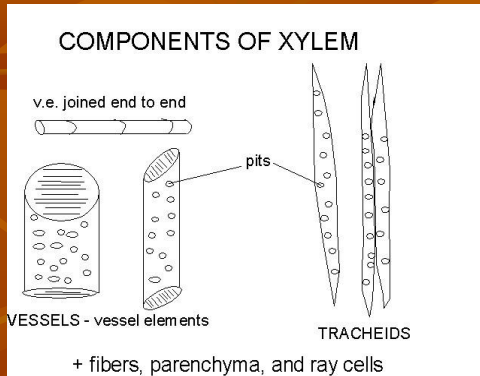
2-It is a complex permanent tissue, which is specialized for the conduction of water and mineral substances in the plant body. The term Xylem was introduced by Nageli(1858) from the Greek word xylos ,meaning wood .On the presence of vascular tissue or vascular system in the plant body led to a taxonomic segregation of plants having such system into one group ,the so called vascular plants or Tracheophyta e.g Ferns ,gymnosperms, and angiosperms. Because of its rigid walls the xylem is more conspicuous than the phloem ,it is better preserved in fossils and it may be studied with great ease. It is this tissue, rather than the phloem , that serve for the identification of vascular plant.

Xylem

It is a complex permanent tissue, which is specialized for the conduction of water and mineral substances in the plant body. Xylem is a heterogenous tissue made up of four different types of cellular elements. They are:

- Xylem tracheids
- Xylem tracheae or xylem vessels.
- Xylem fibers
- Xylem parenchyma

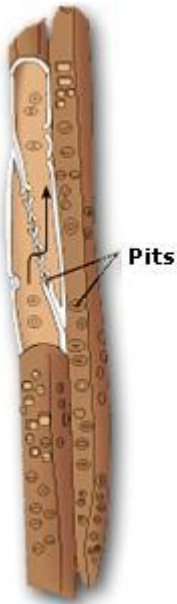
Xylem



Xylem Tracheids

They are found abundantly in pteridophytes, gymnosperms and primitive angiosperms. In these groups of plants, the tracheids represent the most active water conducting elements. In advanced angiosperms, the tracheids are found restricted to leaf margin and leaf tip.

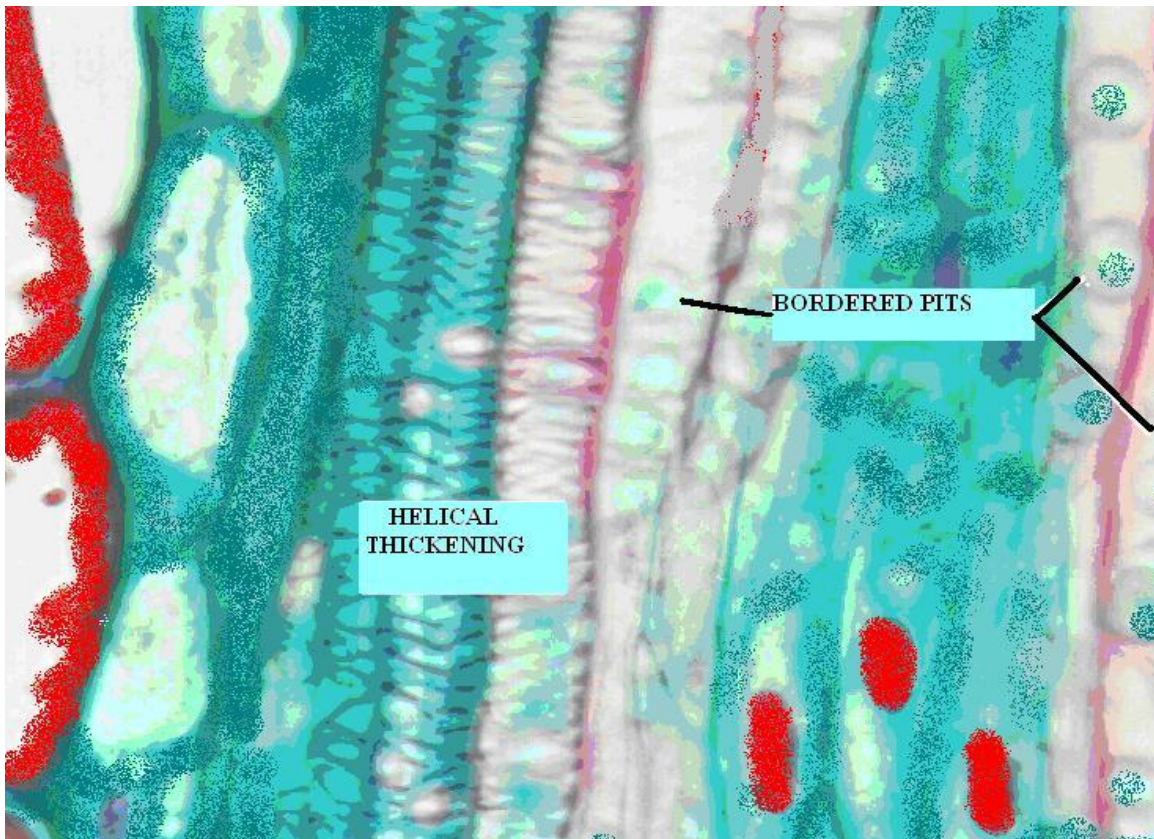
The tracheids are elongated, dead cells, with tapering ends. They are characterised by the presence of a thick cell wall consisting of primary wall and a secondary wall. The primary wall is composed of cellulose where as the secondary wall is made up of lignin. There is a spacious lumen that extends throughout the length of the tracheid. In some cases, due to the deposition of lignin, the primary wall develops numerous concave depressions called pits. When pits are present, the tracheid is described as pitted and when pits are absent, it is described as simple.



Function of Tracheids - Thickening in Tracheids

It possesses secondary thickening of any of the following types on the inner surface of the cell wall.

1. Annular: ring like bands of thickening.
2. Spiral: thickenings are in the form of spiral or helical bands
3. Reticulate: bands of thickenings form a reticulum or network.
4. Scalariform: thickenings occur in the form of transverse plates. They give a ladder like appearance.
5. Pitted: a uniformly thickened secondary wall is deposited except for minute unthickened areas called pits. Unthickened area in the region of pit is called chamber or cavity. The area of primary wall and middle Lamella form the pit membrane.



Depending upon the morphology of its chamber or cavity, a pit called simple (uniform width) and bordered (narrow mouth and flask-shaped chamber). In surface view, pits may appear circular, elliptical or angular. Usually pits occur in pairs, one each over the two adjacent cells. They are called blind pits if they occur singly. Half-bordered pit pair consists of bordered pit on one side and simple pit in the other side.

The unthickened areas in the walls of tracheids are permeable to water. It passes from one tracheid to another quite rapidly. Tracheids are the only conducting or treachery elements in non-flowering plants. 95% of gymnosperm wood is formed of tracheids. In angiosperms, hardly 5% of wood consists of tracheids.

Conclusion of Function of Tracheids

The main function performed by the xylem tissue is carried over by the tracheids that is the function of conduction of water and minerals is done by tracheids with the help of vessels.

Vessels.

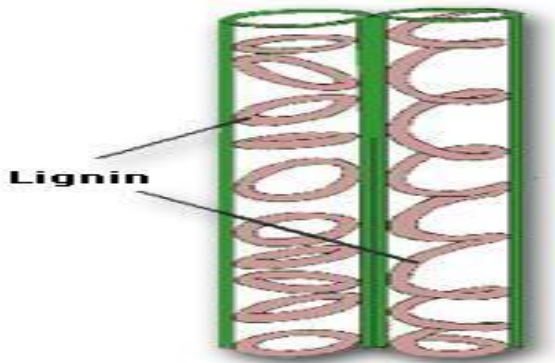
-----.

Xylem Tracheae

They are commonly known as xylem vessels. They are the most active water conducting elements in all higher angiosperms. The tracheae are found arranged parallel to each other, extending from one end of the plant body to another.

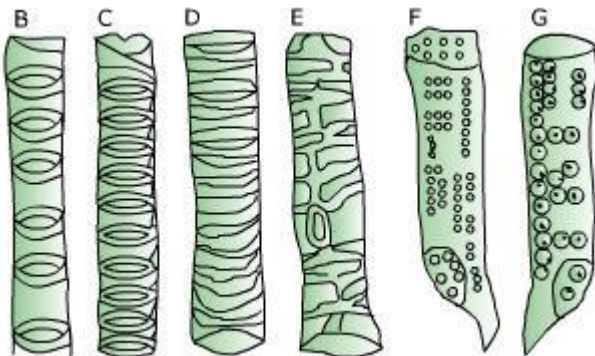
The tracheae are long cylindrical dead cells. They are characterised by a thick cell wall consisting of a primary wall and a secondary wall. The primary wall is made up of cellulose where as the secondary wall is made up of lignin. There is a spacious lumen that extends throughout the length of the trachea. The deposition of lignin in the secondary wall is not always uniform. As

a result, the xylem vessels exhibit different types of secondary thickenings. On this basis, xylem vessels can be distinguished into five types.



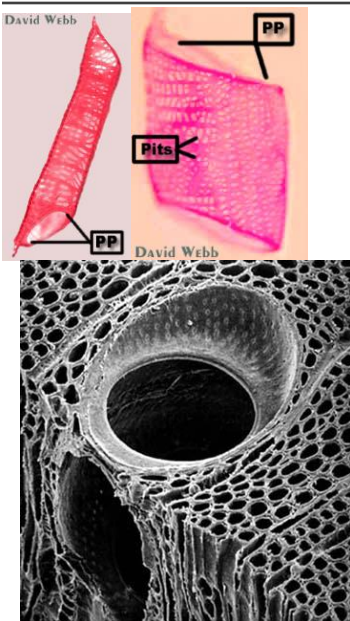
Xylem Tracheae, vessel element in LS

- Annular vessels in which the secondary thickening is in the form of rings placed more or less at equal distance from each other.
- Spiral vessels in which the secondary thickenings are present in the form of a helix or coil.
- Scalariform vessels in which the secondary thickenings appear in the form of cross bands resembling the steps of a ladder.
- Reticulate vessels in which the secondary thickenings are irregular and appear in the form of a network.
- Pitted vessels in which the secondary thickenings result in the formation of depressions on the primary wall called pits.



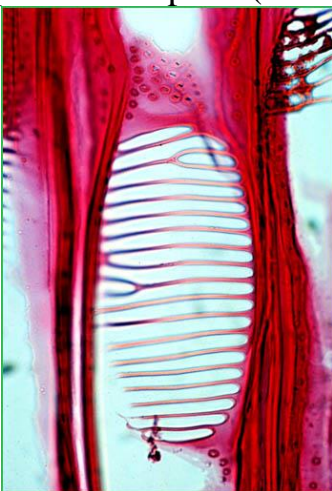
Perforation Plates (of Vessel Members)

- Simple (one hole)
- Multiperforate (more than one hole)
 - Scalariform
 - Reticulate
 - Foraminate



Simple perforation plate:- A perforation plate with single hole.

Compounded perforation plate:- more than one hole. The hole or opening in compound perforation plate(Multiple perforation plate) are arrange in parallel series 1- Scalariform perforation plate (from the Latin ,scalaris, ladder)

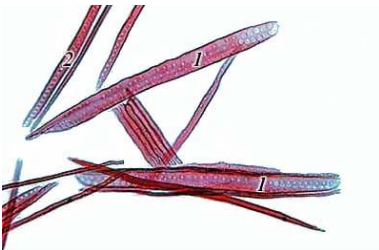


Scalariform perforation plate

2- Reticulate perforation plate:- A type of perforation plate form a net like pattern (from the Latin ,net)



3-Foraminate perforation plate :- A group of approximately circular hole as in Ephedra



Evaluations of vessels remember:- short and wide vessels member more advance than long vessels member. Simple perforations plate more advance than other type e.g. scalariform and foraminate . simple perforations plate more common in the plant.

Differences between Tracheids and Vessels :

<i>Tracheids</i>	<i>Vessels</i>
L. Found in all vascular plants. Gymnosperms	1. The vessels are found in angiosperms .
2. They are shorter and dead at maturity.	2. They are very big and dead at maturity.
3. Lumen is narrow.	3. Lumen is wider.
4. Tracheid has pointed	4. End walls mostly

end.	absent.
------	---------

Types of xylem fibres

There are three main types of xylem fibres namely, fibre-tracheids , libriform fibre and Gelatinous fiber

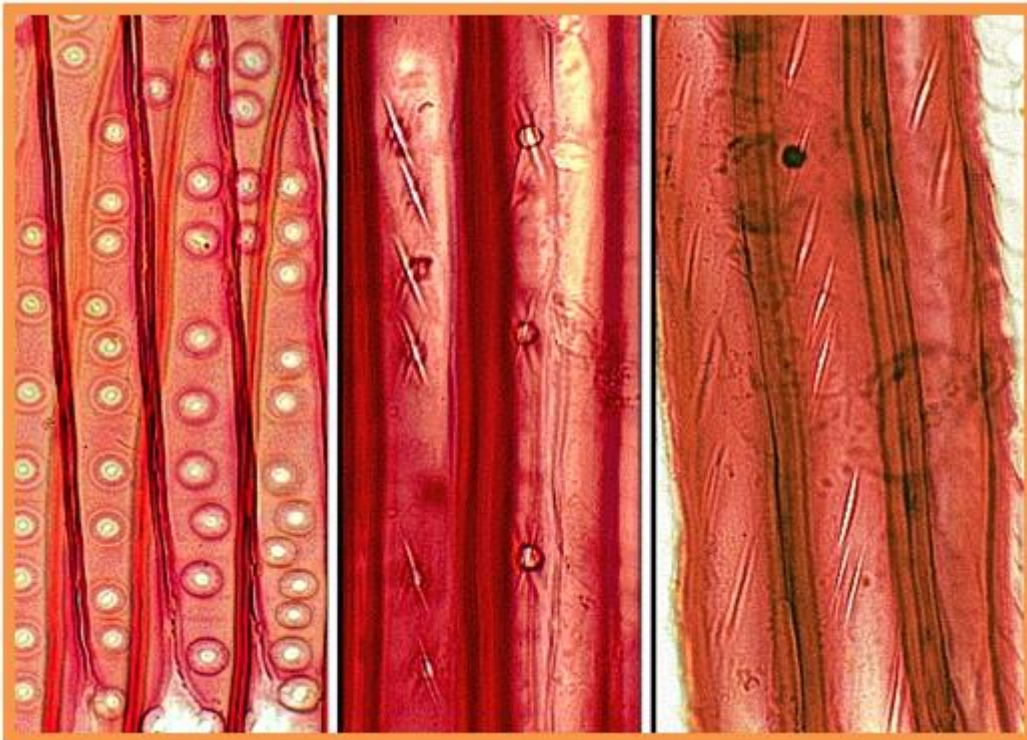
Fibre-tracheids

Fibre-tracheids and libriform fibre are distinguished on the basis of cell wall thickness and type and amount of pits. The fibre-tracheid is a cell in the xylem that is interlink between a tracheid and a libriform fibre and their walls are of medium thickness not as thick as those of the libriform fibres but thicker than those of tracheids. The pits are bordered but their pit chambers are smaller in size than those of tracheids.

In fibre-tracheids the pit canal is elongated and the inner pit aperture usually becomes slit-like due to thickening of the wall. The inner layers of the secondary wall of some fibre-tracheids, for example in tension wood may be gelatinous and enlarge with uptake of water.

Libriform Fibre

The libriform fibre is a cell in the xylem that is long and thin without border in the pits and it is also called as xylary fibre to differentiate from extraxylary fibre (occur in the phloem are often called as bast fibres). Libriform fibre resembles phloem fibres and they are longer than the tracheids of the plant in which they occur. In both fibre-tracheid and libriform fibre the inner pit apertures of a pit-pair are generally at right angles to each other.



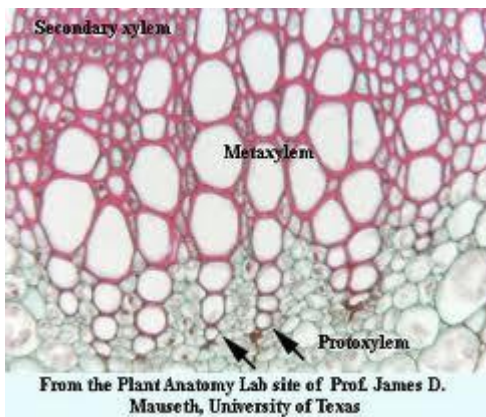
Gelatinous fiber:- A fiber with little or no lignification secondary cell wall . Cell wall has a gelatinous appearance .

3. Xylem parenchyma

These are parenchymatous cells which occur in xylem. They may be thin or **thick** walled. Xylem parenchyma store food, oil, tanniferous compound and also assist in **conduction** of water. Living parenchyma cells occur in both primary and secondary xylem. In the latter they are commonly present in two forms :- **Axial parenchyma** derived from the fusiform cambial initials and **Ray parenchyma** formed by ray initials of cambium

a) Primary xylem

This xylem develops from Procambium of root and shoot apex .Primary xylem consist of the same basic cells of xylem i.e.it is formed from tracheids ,vessels, parenchyma and fibers ,some time fibers not bresent. Primary xylem usually consists of an earlier part,**the protoxylem and** the later part, **the metaxylem** . protoxylem differentiates in the part of the plant body that not completed their growth , the protoxylem mature among activety elongation tissues and is, their for subjected to stresses and it may destroyed while metaxylem mature after the elongation is completed. It is therefore less effected.



Protoxylem	Metaxylem
1. It is represented by vessels that are formed earlier.	It is represented by vessels that are formed later.
2. Lumen is narrow.	Lumen is wider.
3. Vessels exhibit annular and spiral type of thickenings.	Vessels exhibit scalariform, reticulate and pitted type of thickenings.

Secondary Xylem

Secondary xylem is the xylem that is formed during secondary growth. It is derivative of secondary meristem. It is a characteristic feature of only dicots. Secondary xylem is commonly known as wood. It is of commercial importance since it is extensively used in the manufacturing of doors, windows and furniture.

Difference between Primary and Secondary xylem

Q. 15. Distinguish between primary and secondary xylem.

Ans. The following table shows the difference between primary and secondary xylem:

<i>Primary Xylem</i>	<i>Secondary Xylem</i>
1. It is developed from procambium.	It is developed from vascular cambium.
2. There are no medullary or any rays in primary xylem.	There are rays in the secondary xylem.
3. It is concerned with the growth of the primary plant body.	It is concerned with the secondary growth of the plant.
4. It is associated with the formation of patches inside the vascular bundle around the piths.	It constitutes the continuous cylinder around the pith.
5. The xylem parenchyma is not arranged into ray parenchyma and axial parenchyma.	The xylem parenchyma is arranged into ray parenchyma and axial parenchyma.

6.	The wall thickening	The secondary wall
	may be annular, spiral	thickening is only of pith
	scalariform, reticulate	type.
	and pith.	