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قسم النبات

Plant Anatomy

Write on the following:

1. **Activity of vascular cambium.**
2. **Distribution of axial parenchyma.**
3. **Abnormal (anomalous) secondary growth.**

1- Activity of vascular cambium

The cambium is made up of a single layer of living cells, which usually divided in a tangential plane during the formation of secondary phloem and xylem. The single layered cambium is made up of two types of cells: 1- the fusiform initials and 2- the vascular ray initials. The fusiform initials when seen in a tangential longitudinal section are elongated parenchymatous cells which sometimes may achieve a length of 5,000u.these cells form the axial system of secondary vascular tissue e.g. sieve cells, companion cells, phloem parenchyma, phloem fibers, tracheids, xylem fibers, and xylem parenchyma. The vascular ray initials of the cambium are small isodiametric cells, which, by their division, give rise to the radial systems of the vascular tissue e.g. the phloem and the xylem rays. In a tangential section the fusiform initial of the cambium show two types of arrengements in different plants. In one type, fusiform cells are arranged in horizontal rows with the ends of the cells at the same level. Such an arrangement is called storied or stratified arrangement and the cambium is called stratified or stratified cambium. In case the fusiform cells show no regular arrangement and their ends overlap the cambium is called non-stratified or non-storied cambium. The former type of cambium rise to storied wood where other type gives rise to non-storied wood.

The cells of the cambium divided periclinally and cut of derivatives either towards inside or towards outside. The derivatives produced towards the primary xylem will mature into secondary xylem elements and those produced towards the primary phloem will mature into secondary phloem elements. The xylem and phloem derivatives are exactly like the cambial cell and possess primary walls. It is difficult to distinguish between the derivative cells and the cambial cells. The cambium, therefore, appears to be many-layered.it is actually one layered and the xylem and the phloem derivatives along with the cambium are designated as cambial zone. The activity of the cambial cells produces radial files of xylem derivatives towards the inner side and the phloem derivatives towards the outer side. The xylem and phloem derivatives under go one or more periclinal divisions before maturing into xylem and phloem cells.

2- Distribution of axial parenchyma:

The axial parenchyma distributed in two main patterns: apotracheal and paratracheal parenchyma. Apotracheal parenchyma not definitely associated with the vessels while the paratracheal parenchyma consistently associated with the vessels. The apotracheal parenchyma is further subdivided into: diffuse, single parenchyma cells or parenchyma strands scattered among fibers; apotracheal banded; boundary or marginal parenchyma, with single cells or a band at the end or at the beginning of a growth layer. Diffuse apotracheal parenchyma may be sparse. The paratracheal parenchyma appears in the following forms: scanty vasicentric, forming complete sheaths around vessels; aliform vasicentric with wing like tangential extensions; and conflount, closed aliform forming irregular tangential or diagonal bands. If septate fibers instead of axial parenchyma occur in the xylem, they show distributional patterns similar to shoes assumed by the axial parenchyma.

3-Abnormal (anomalous) secondary growth.

There are many plants in which deviation from the normal type of secondary growth have been reported. They are very common in the flora of temperate regions and can be listed in the following:

1- Unusual position of the cambium. Structural changes due to unusual position of the cambium are commonly found in the lianas or the woody climbers and can be listed as follow:
   a- Cambium raised into folds and ridges. In this case the cambium is not in the form of a smooth or a circular ring but gives a folded and ridges appearances. The ridges of the cambium get separated and act each as individual cambium forming its own vascular cylinder or stele. As a result, the secondary structure of the stem consists of several steles each with its own secondary phloem and secondary xylem thus giving the mature stem a peculiar shape.
   b- Cambium in the form of separate strips. In some of the Sapindaceous tendril climbers the primary stems possess separate strips of cambium which surround individual xylem strand, or portions of primary xylem. As the secondary growth proceeds, its own cambium ring surrounds each strand and thus separate cylinders of secondary vascular tissue are formed. Each cylinder has its own cambium with secondary phloem towards its outer side and secondary xylem towards its inner side. The stem in the secondary state appear to be made up of several stems have fused together. Later due to the development of periderm the outer layers of each vascular cylinder die and the stem in this condition is seen to be made up of several smaller stems that appear close to each other.
   c- In Baulinia langsdorffiana. In this case the secondary parenchyma formed both in secondary xylem and secondary phloem is excessive amounts. This results in rupture of cambium ring into several strips and even the vascular cylinder is broken into numerous parts.
2- Abnormal functioning of the cambium. In many woody climbers or the lianase, the cambium is normal in position but functions in an abnormal, way. This produces peculiar types of secondary

structures. For examples; in *Aristolochia* and *Vitis*, the cambium ring complete but the whole does not produce secondary vascular tissues. Large portion of it produce parenchymatous tissue so the secondary vascular tissue appears to consist of discrete vascular bundle; in *Bauhinia* due to the variation in the activity of the cambium ring the secondary vascular cylinder appears in the form of ridges and grooves.

3- Formation of more than one ring of vascular cambium.
4- Formation of extra-stelar cambial ring. In some dicot families e.g. Amaranthaceae, Chenopodiaceae,..etc. the first ring of cambium arises de novo in the pericycle as a complete ring or in the form of separate strips or arc of meristem. Such a ring cambium, in contradistinction to the normal type, which develops between the vascular bundles, is called extrastelar cambial ring. In such cases no normal type of cambial ring is formed. The activity of the extrastelar cambium differs in different plants.
5- Formation of interxylary phloem. It is also called included phloem and develops within the secondary xylem. Included phloem is of great significance to some xerophytic plant, which possesses it. In such plants the included phloem remains active of functional even during long summer drought. It retains its functional capacity even other tissues dry and become nonfunctional included phloem serve to carry food to the bud which develops into branches at the commencement of favorable season.
6- Formation of interxylary cork. A cork layer may be develops between two growth rings of secondary xylem.

The secondary tissue produced as a result of the above mentioned deviations constitutes abnormal or anomalous secondary growth.