

## The Vascular Tissue Systems

### Vascular Tissue Definition

Vascular tissue is an arrangement of multiple cell types in vascular plants which allows for the transport of water, minerals, and products of photosynthesis to be transported throughout the plant. Non-vascular plants, such as some algae and moss, do not have vascular tissue and therefore cannot easily transport water and nutrients. Vascular plants use their vascular tissue to transport water and nutrients to great heights, able to feed the tops of trees hundreds of feet high.

**Vascular Tissue System:** It consists of xylem and phloem tissues which are found as strands termed as vascular bundles. The main function of xylem is to conduct water, materials to different parts of the plant body. The main function of phloem is transportation of food materials in different parts of the plant.

**There are three different types of vascular bundles (Fig. 3.5):**

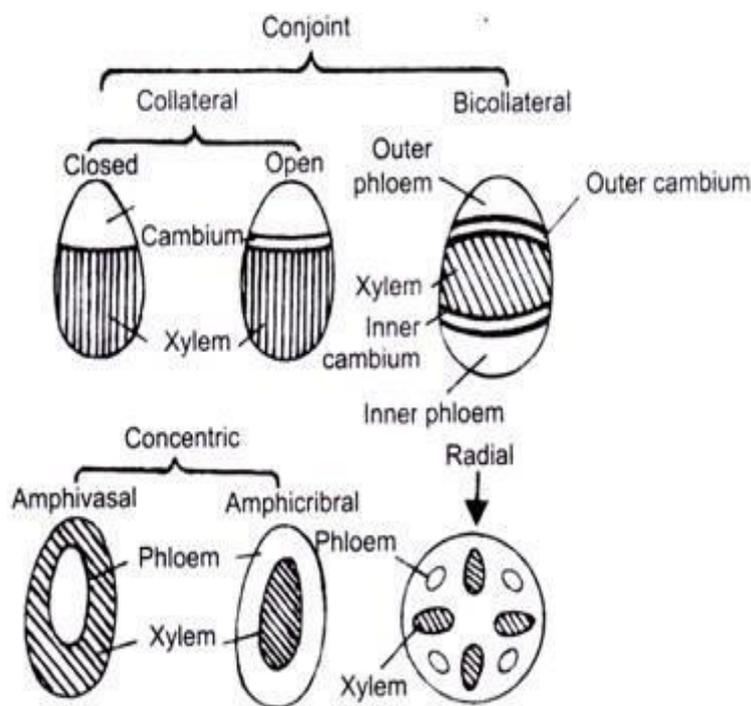


Fig. 3.5 Different types of vascular bundles

(i) **Radial Bundles:** Xylem and phloem strands are located on alternate radii in radial vascular bundles. These are mainly found in roots.

(ii) **Conjoint bundles:** Xylem and phloem combine together into one bundles, Xylem lies towards the centre and phloem towards the periphery. There are two types of conjoint bundles.

## **Types of Vascular Bundles:**

The complex tissues, xylem and phloem, are usually associated in the formation of the vascular bundle. According to mode of occurrence of the elements, the vascular bundles are of the following types:

### **1. Collateral**

This is the most common type of vascular bundle in the stems and leaves of angiosperms and gymnosperms. Xylem and phloem lie on the same radius, xylem towards the centre and phloem towards the periphery. When cambium is present in collateral bundles, such bundle is called open, e.g. in dicot stems and collateral bundle without cambium is called closed, e.g. in monocot stems.

In the stems of most dicotyledons and gymnosperms, a strip of lateral meristem, the cambium, occurs between xylem and phloem (Fig. 573A). The bundles in those cases is called open, whereas those without cambium, e.g., monocotyledons, are said to be closed.

### **2. Bicollateral**

In this type of bundle, the phloem strands are present on both outer and inner side of xylem. These are collateral bundles, where, in addition to the external phloem, another patch of phloem occurs on the inner side, what may be called internal phloem. Though rather uncommon, this type occurs in the family Cucurbitaceae.

Two strips of cambium and two patches of phloem are present on the outer and inner sides of Xylem. Naturally the sequence is outer phloem, outer cambium, Xylem, inner cambium and inner phloem. Obviously the bundles are always open.

### **3. Concentric Bundles**

In this type of vascular bundle, one tissue is completely surrounded by the other. These are of two types Amphivasal and Amphicribal.

**Amphivasal or leptocentric bundles:** In this type of vascular bundle xylem surrounds the phloem, e.g. *Dracaena*.

**Amphicribal or hadrocentric bundles:** In this type, phloem surrounds the xylem, e.g. in Ferns.

Though less common, the amphivasal bundles occur in some monocotyledons, particularly in the nodal regions and in some rhizomes. In dicotyledons the medullary bundles are amphivasal.

Amphicribal ones are frequently found in the ferns. The small bundles of flowers; fruits and some leaves of dicotyledons are of this type. The concentric vascular bundles are always closed.

#### **4. Radial Bundles**

These bundles are fundamentally different from the types mentioned above, in view of the fact that here Xylem and phloem occur in separate patches on alternate radii on the axis intervened by non-conducting tissues.

Early workers used the term 'conjoint' for all the types discussed above with Xylem and phloem occurring on the same radius, as opposed to the radial arrangement. Radial vascular bundles are characteristic of the roots.

These are the common types of vascular bundles. But variations in structure may occur and intergradations of the types are also possible, even with transitional conditions. In some grasses the bundles are collateral, where xylem occurs in form of letter V, the two metaxylem occupying the flanks and phloem located between them.

The same bundle may differ in the arrangement of the elements along its course, so much so that it may be collateral at one level, amphivasal at another and even transitional somewhere between the two levels.

The internal phloem in the stems of some plants, e.g., family Solanaceae, may be detached from other parts of the bundle and occur as independent patches in the pith. In some families like Piperaceae, Amarantaceae, etc., even all the vascular bundles may be scattered in the pith. These are referred to as medullary bundles (Fig. 649), which are usually amphivasal.

Similarly bundles may occur in the cortex in members of families Melastomaceae, Cactaceae, Oleaceae, etc. They are called cortical bundles.

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