Identification between Stem /Root & Monocot/Dicot

	Stem		Root	
1	Primary xylem- endarch		Primary xylem exarch	
2	Vascular bundles –conjoint		Vascular bundles-radial	
	Dicot	**Monocot**	**Dicot**	**Monocot**
1	Vascular bundles limited in number	Vascular bundles numerous	Limited no of xylem/phloem groups (3/4/5)	No of xylem/phloem groups nearly 10
2	Vascular bundles arranged in a ring	Vascular bundles scattered	Xylem vessels polygonal in outline	Xylem vessels round in outline
3	Xylem vessels polygonal in outline (mostly)	Xylem vessels round in outline	Small pith	Large pith
4	Well differentiated ground tissue	Ill differentiated ground tissue		

Example 1 : Dicot Stem Primary (*Centella*)

The given specimen is identified as a **stem** due to the following reasons

1. Primary xylem- endarch
2. Vascular bundles –conjoint

The specimen is identified as a **dicot** stem due to the following reasons

1. Vascular bundles limited in number
2. Vascular bundles arranged in a ring
3. Xylem vessels polygonal in outline
4. Well differentiated ground tissue

Because of the above reasons, material **A** is identified as a **dicot stem with primary structure**

Example 2: Dicot stem with Bicollateral Vascular Bundle (*Cephalandra*)

The given specimen is identified as a **stem** due to the following reasons

1. Primary xylem- endarch
2. Vascular bundles –conjoint

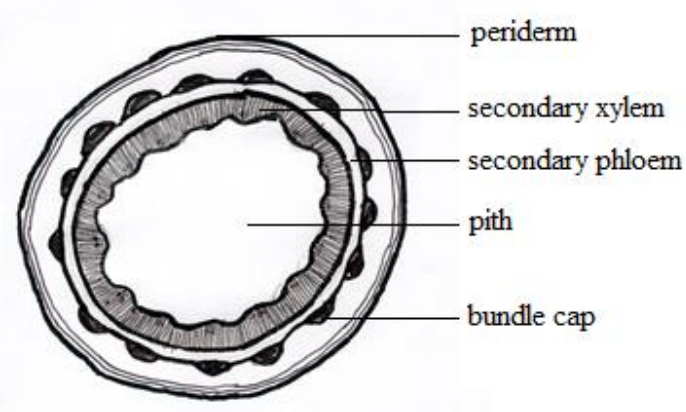
The specimen is identified as a **dicot** stem due to the following reasons

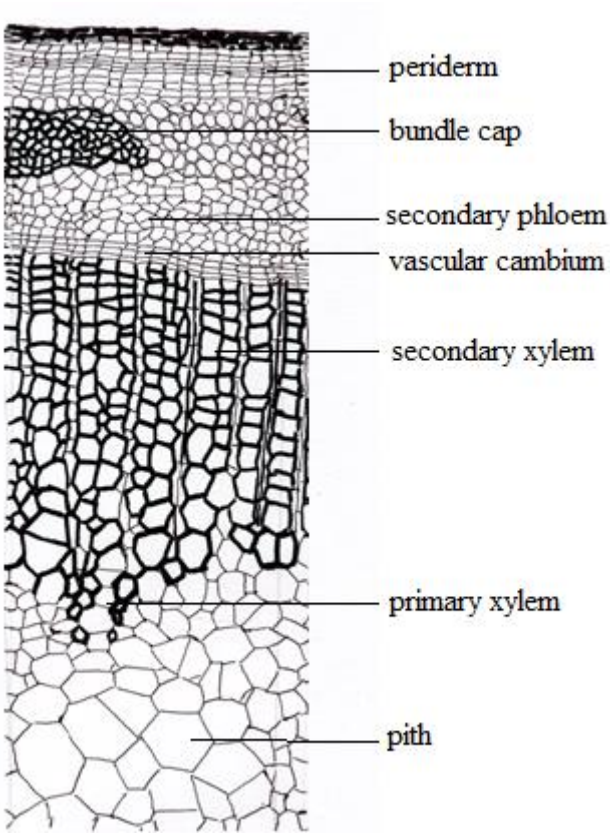
1. Vascular bundles limited in number
2. Vascular bundles arranged in a ring
3. Well differentiated ground tissue

The specimen shows vascular bundles with two patches of phloem located on inner and outer side of the xylem. This is a characteristic feature of Bicollateral vascular bundles.

Because of the above reasons, material **A** is identified as a **dicot stem with bicollateral vascular bundles**

Example 3 : Dicot Stem Secondary (*Vernonia/Polyalthia*)





The given specimen is identified as a **stem** due to the following reasons

1. Endarch Primary xylem is retained towards the inner side of the xylem cylinder, near the pith.
2. Bundle caps are retained in the cortical region opposite to each primary xylem path. This is an evidence of occurrence of conjoint vascular bundles in the primary structure.

The specimen is identified as a **dicot** stem due to the following reasons

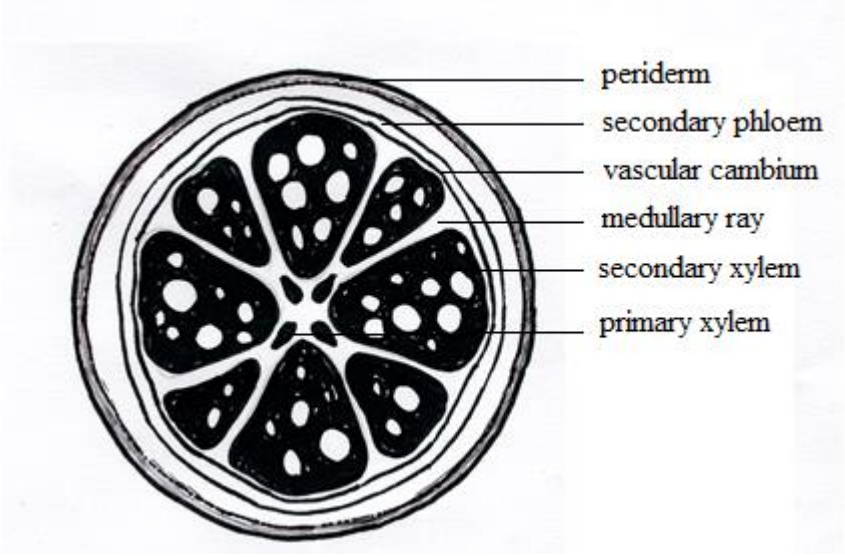
1. Vascular bundles limited in number and arranged in a ring (evident from the occurrence of limited no of bundle caps and primary xylem patches)
2. Xylem vessels polygonal in outline
3. Well differentiated ground tissue

Other features:

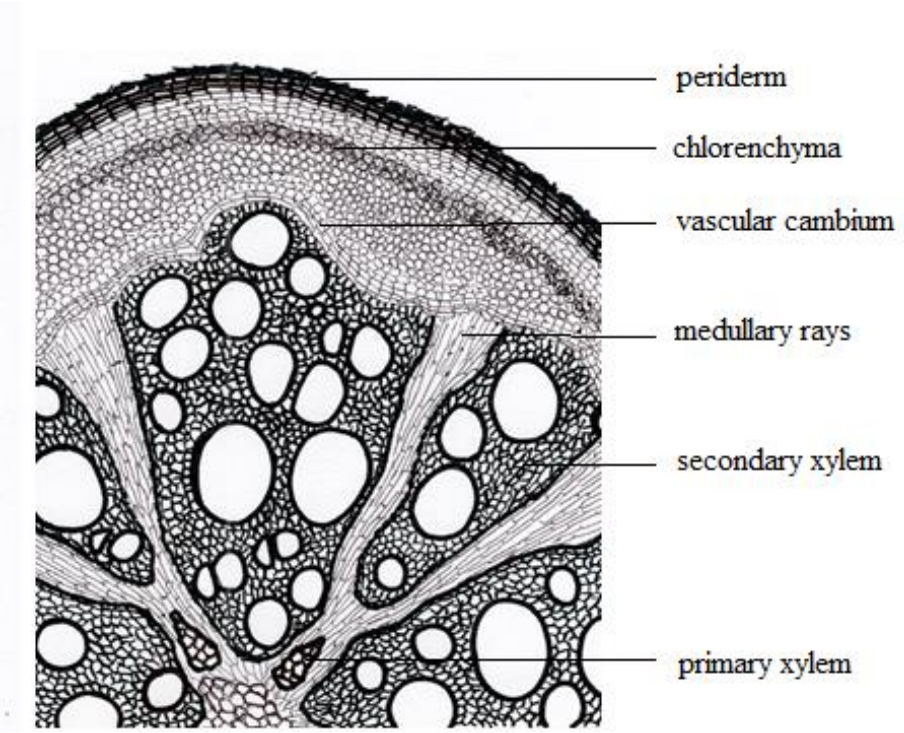
1. The specimen shows a thick cylinder of secondary xylem, which is surrounded by a thin ring of secondary phloem.
2. A crushed pith is present at the centre.

Because of the above reasons, material **A** is identified as a **dicot stem with secondary growth**

Example 4 : Dicot Root Secondary (*Ficus/Tinospora)*



Tinospora



The given specimen is identified as a **root** due to the following reasons

1. Exarch Primary xylem is retained at the centre, near the pith.
2. Vascular bundles are radial

The specimen is identified as a **dicot** root due to the following reasons

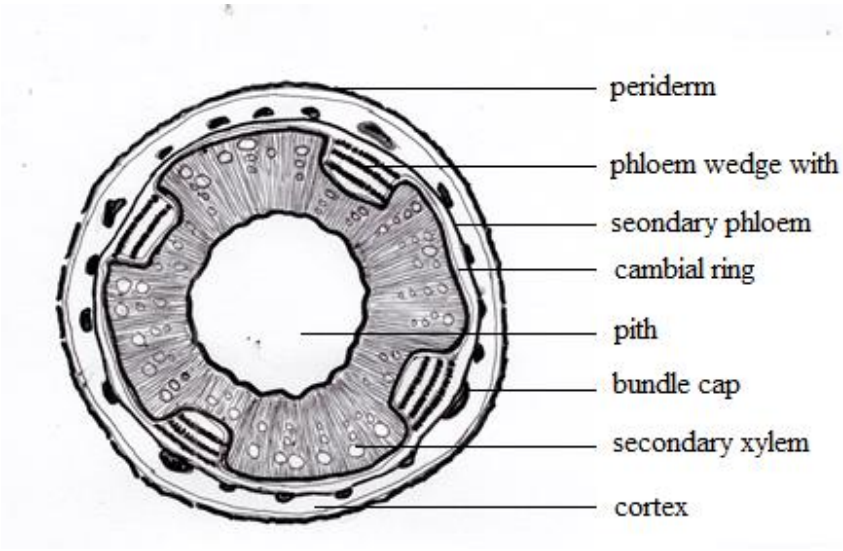
1. Primary ascular bundles limited in number (3/4/5)
2. Primary ylem vessels polygonal in outline
3. Small pith

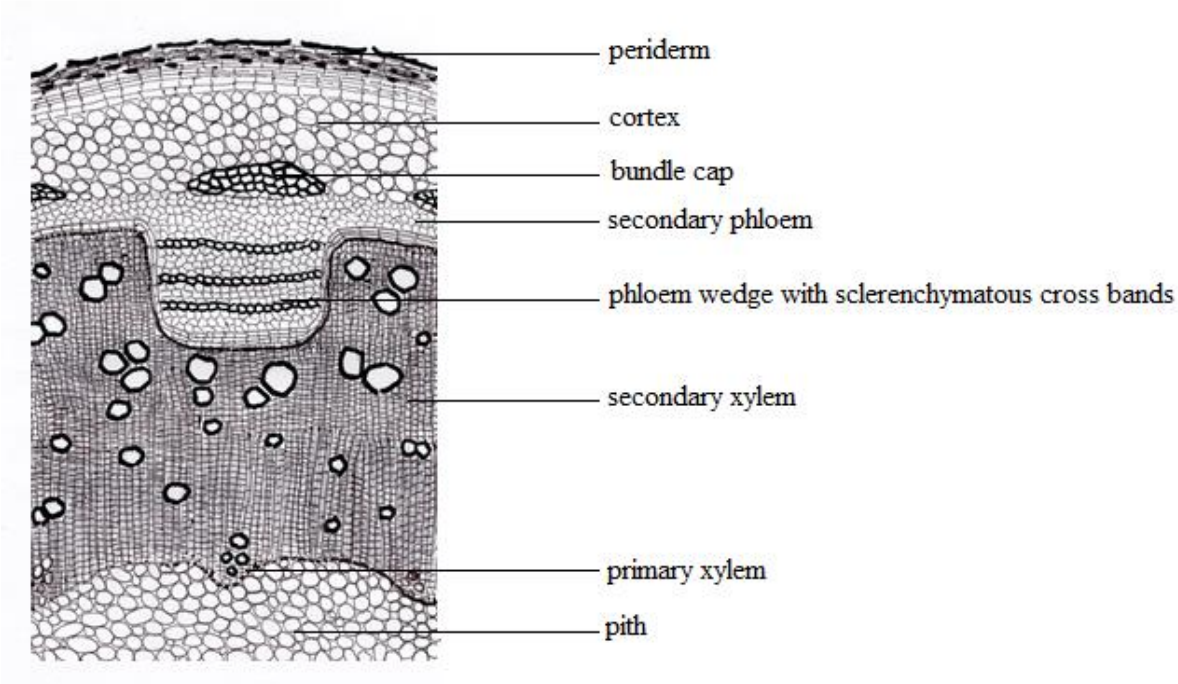
Other features:

1. The specimen shows a thick cylinder of secondary xylem with very large vessels
2. Wide secondary medullary rays are present opposite to each primary xylem groups
3. A crushed pith is present at the centre.

Because of the above reasons, material **A** is identified as a **dicot root with secondary growth**

Example 5 : Anomalous secondary growth in Dicot stem - *Bignonia*





The given specimen is identified as a **stem** due to the following reasons

1. Endarch Primary xylem is retained towards the inner side of the xylem cylinder, near the pith.
2. Bundle caps are retained in the cortical region opposite to each primary xylem path. This is an evidence of occurrence of conjoint vascular bundles in the primary structure.

The specimen is identified as a **dicot** stem due to the following reasons

1. Vascular bundles limited in number and arranged in a ring (evident from the occurrence of limited no of bundle caps and primary xylem patches)
2. Xylem vessels polygonal in outline
3. Well differentiated ground tissue

It is assumed that the specimen has undergone **secondary growth,** due to the following reasons

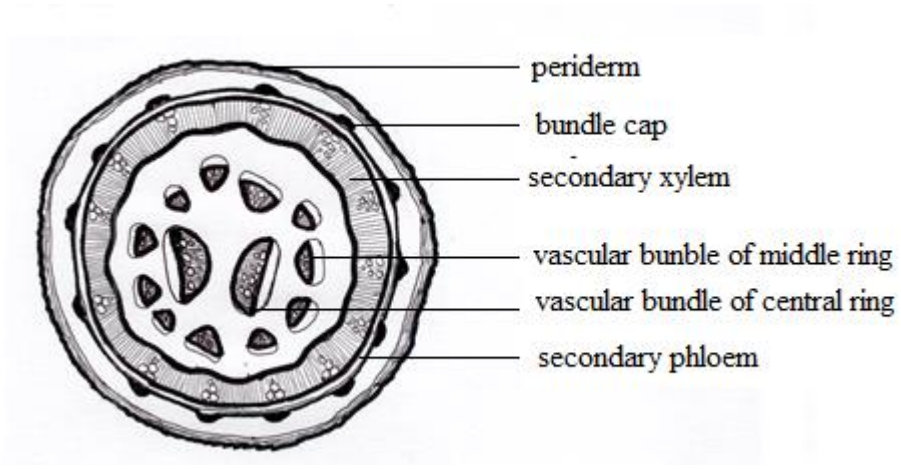
1. The specimen shows a thick cylinder of secondary xylem, which is surrounded by a thin ring of secondary phloem.
2. A crushed pith is present at the centre.

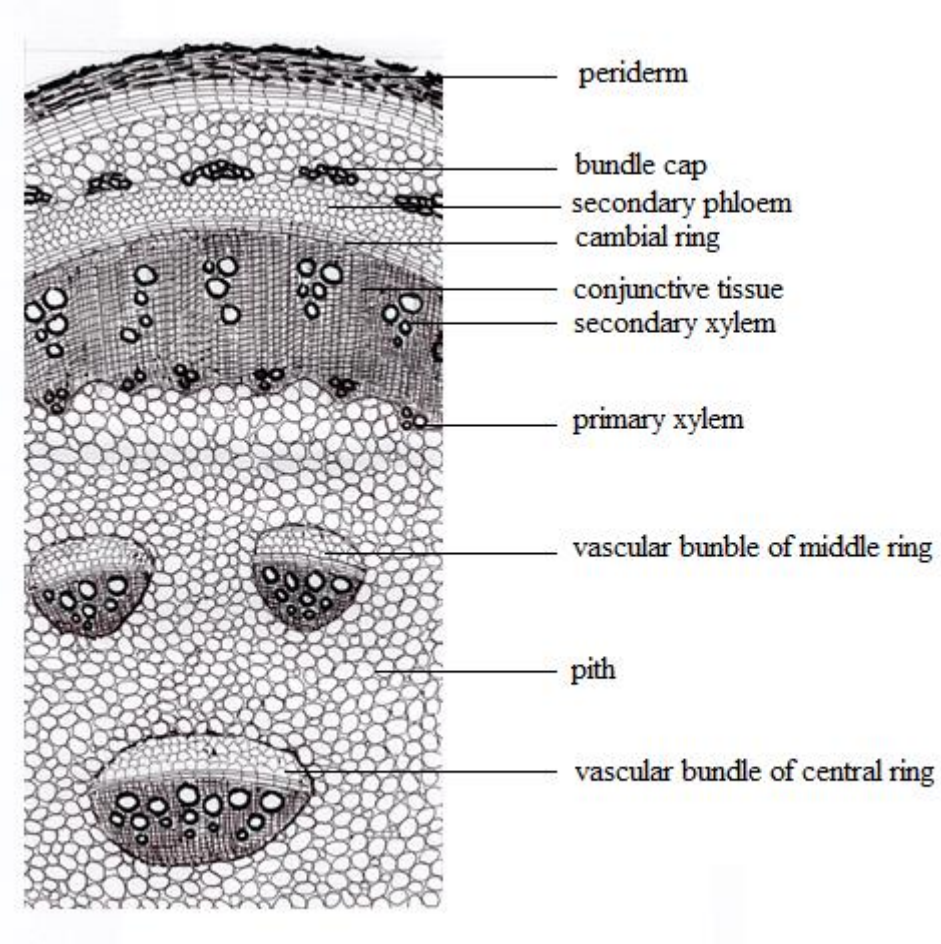
It is assumed that the specimen has undergone **anomalous secondary growth,** due to the following reasons

1. Four wedges of phloem are seen inserted into the xylem cylinder in a cross shape, formed due the abnormal activity of vascular cambium at four opposite points.
2. The phloem wedges are supported by sclerenchymatous cross bands, as a protective band preventing the delicate phloem from being crushed. (acting as shock absorbers while the stems of the woody climbers twine around the support)

Due to the above reasons, the specimen **A** is identified as ***Bignonia*** **stem (dicot) with anomalous secondary growth**

Example 6 : Anomalous secondary growth in Dicot stem - *Boerhaavia*





The given specimen is identified as a **stem** due to the following reasons

1. Vascular bundles show endarch xylem
2. Vascular bundles are conjoint

The specimen is identified as a **dicot** stem due to the following reasons

1. Vascular bundles limited in number and arranged in rings
2. Xylem vessels polygonal in outline
3. Well differentiated ground tissue

It is assumed that the specimen has undergone **secondary growth,** due to the following reasons

1. The specimen shows a thick cylinder of secondary xylem, which is surrounded by a thin ring of secondary phloem.

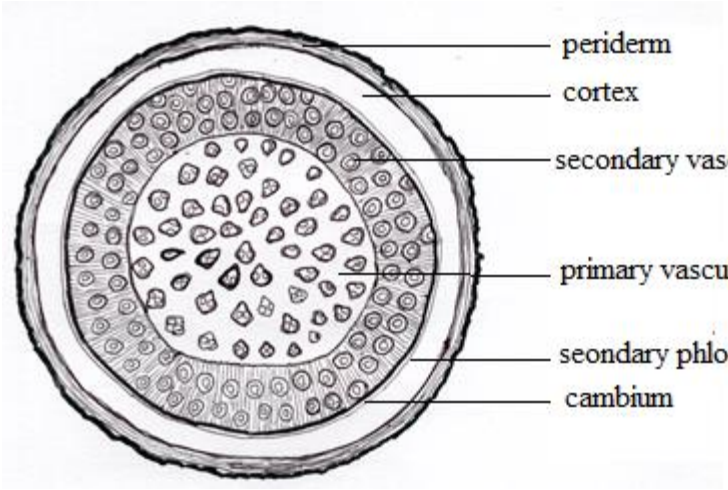
The specimen shows many anomalous features like:

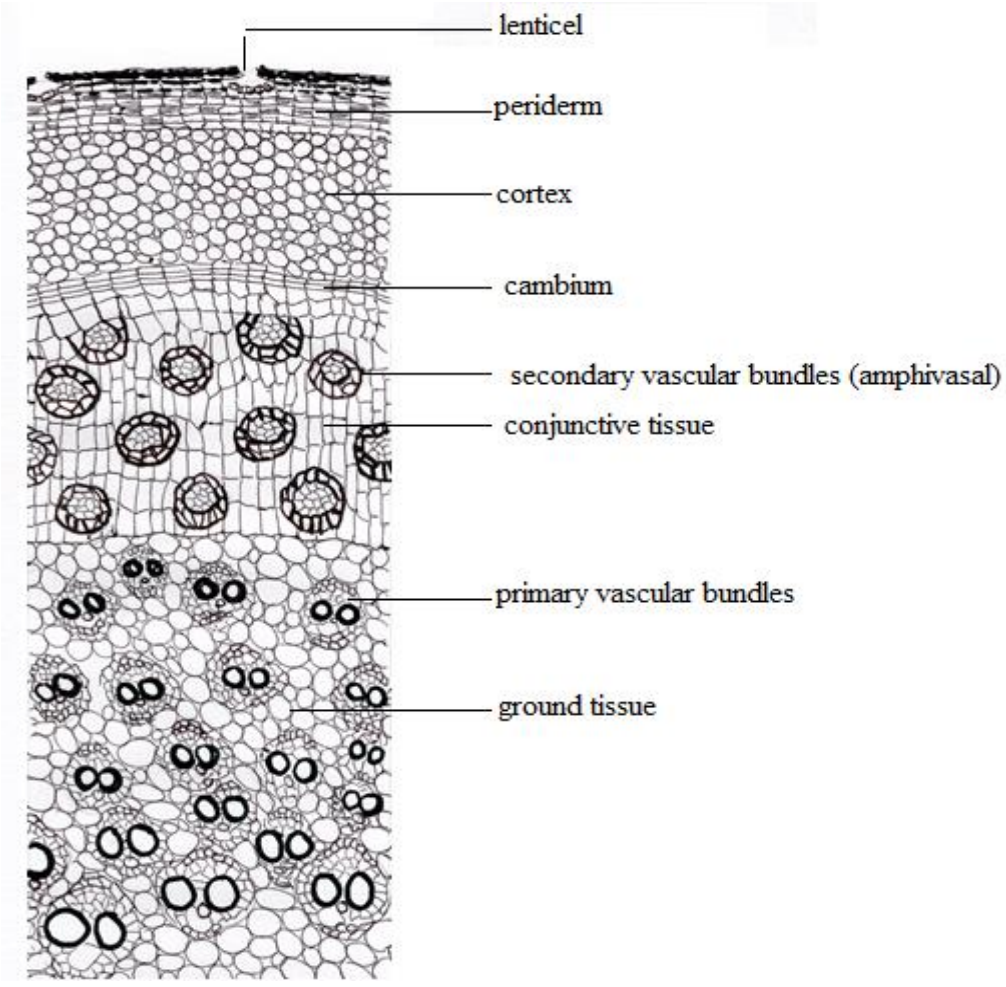
1. Vascular bundles are arranged in three rings
2. The central ring consists of two large vascular bundles seen embedded in the pith (medulla) region (medullary bundles).
3. This is surrounded by a middle ring of 6-14 smaller vascular bundles.
4. This is surrounded by an outer ring of 15-20 still smaller vascular bundles (as evident from the number and arrangement of bundle caps and primary xylem)
5. Secondary growth in central large bundles and the middle ring bundles are limited within the bundle (bundle nature has not destroyed).
6. Secondary growth in the outer rings leads to the development of a thick cylinder of secondary tissues, due to the development of ring shaped vascular cambium.

7. Towards the inner side, this ring produces secondary xylem in the intrafascicular region and conjunctive tissue in the interfascicular region.
8. Towards the outer side, the cambial ring produces secondary phloem above the secondary xylem and parenchyma cells above the conjunctive tissue.

Due to the above reasons, the specimen **A** is identified as ***Boerhaavia*** **stem (dicot) with anomalous secondary growth**

Example 7 : Anomalous secondary growth in Monocot stem - *Dracaena*





The given specimen is identified as a **stem** due to the following reasons

1. Primary Vascular bundles show endarch xylem
2. Vascular bundles are conjoint

The specimen is identified as a **monocot** stem due to the following reasons

1. Vascular bundles are numerous
2. Xylem vessels rounded in outline
3. Ill differentiated ground tissue

It is assumed that the specimen has undergone **anomalous secondary growth,** due to the following reasons

1. Cambium-like meristem produces secondary tissues towards the inside of the stem.
2. Only a very small amount of tissue, which will differentiate solely into parenchyma, is produced toward the outside.
3. The cells produced towards the inner side are partly parenchymatous and partly vascular in nature.
4. The cells formed towards the centre are arranged in radial files.
5. The ground parenchyma, later on get lignified and form conjunctive tissue.
6. Embedded in this tissue are numerous amphivasal vascular bundles

Due to the above reasons, the specimen **A** is identified as ***Dracaena*** **stem (monocot) with anomalous secondary growth**