Key for Identification

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Identifying characteristics of root

1. The vascular bundles are **radial and exarch**.
2. The endodermis is quite conspicuous and ring-like.
3. The epidermal hairs are **unicellular** and tubular.

Identifying characteristics of monocot root

1. Xylem and phloem bundles vary from **8 to many**.
2. Pith large and well developed.
3. The cambium is absent.

Identifying characteristics of dicot root

1. Xylem and phloem bundles vary from **2 to 6**, rarely 8.
2. Pith is small or absent.
3.The cambium may appears later.

Identifying characteristics of stem

1. Vascular bundles are **conjoint**, collateral/bicollateral and **endarch**.
2. The endodermis is inconspicuous and may or may not present.
3. The epidermal **hairs are multicellular**.

Identifying characteristics of dicot stem

1. The vascular bundles are conjoint, collateral and open.
2. The vascular bundles are arranged in a ring; generally they are uniform in size; no bundle sheath.
3. Phloem is represented by sieve tubes, companion cells and phloem parenchyma.
4. Cortex and pericycle are well marked and differentiated; usually hypodermis is collenchymatous.

Identifying characteristics of monocot stem

1. The vascular bundles are many.
2. The vascular bundles are many and lying scattered in the ground tissue of the axis; the larger bundles are towards the centre and smaller towards periphery.
3. The endodermis is not found.
4. The vascular bundle is conjoint, collateral and closed.
5. Each vascular bundle is surrounded by a well developed sclerenchymatous sheath.
6. Sclerenchymatous hypodermis present.
7. Usually epidermal hairs are not present.
8. The phloem parenchyma is not found. Phloem is represented by sieve tubes and companion cells only.
9. Pith is not marked out.

Identifying characteristics of maize stem

1.Vascular bundles are present only in the ground tissues not in the hypodermis.
2. Numerous vascular bundles are arranged scattered from periphery to centre.

3. Bundle sheath is present around the vascular bundle.

Identifying characteristics of rice stem

1. Vascular bundles present both in ground tissue and in hypodermis.
2. Vascular bundles are arranged in radial lines.
3. Centre of stem is hallow.
4. no chlorencyma or parenchyma in hypodermis

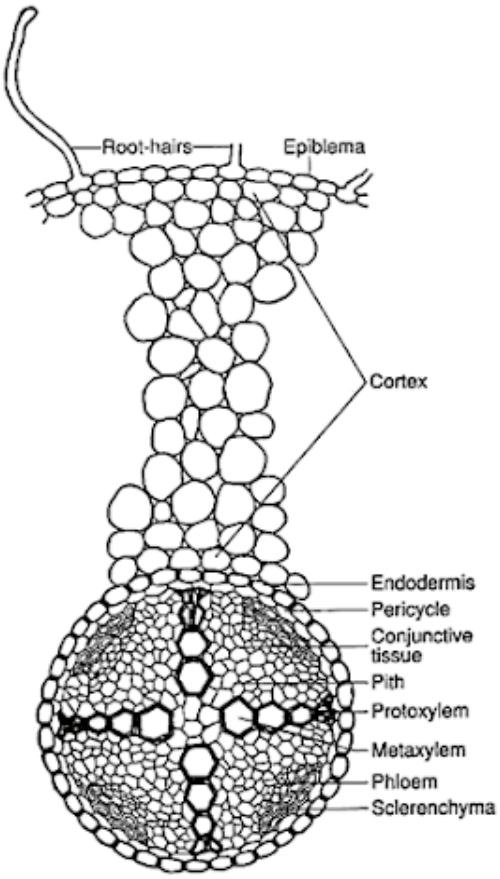
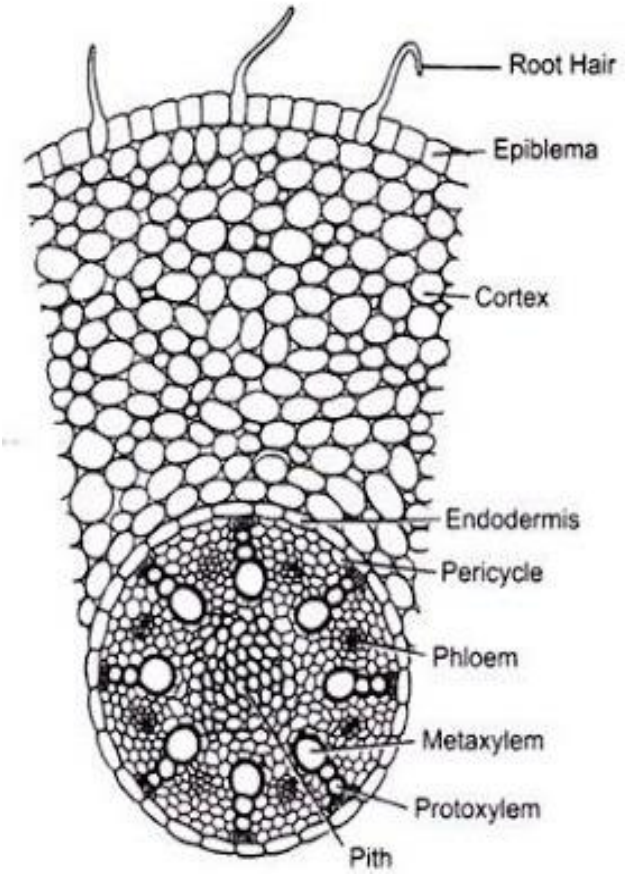
Identifying characteristics of jute stem

1. Bast fibre bundles are arranged in pyramid shaped structure.
2. Bundle cap absent over the phloem.

Identifying characteristics of leaf

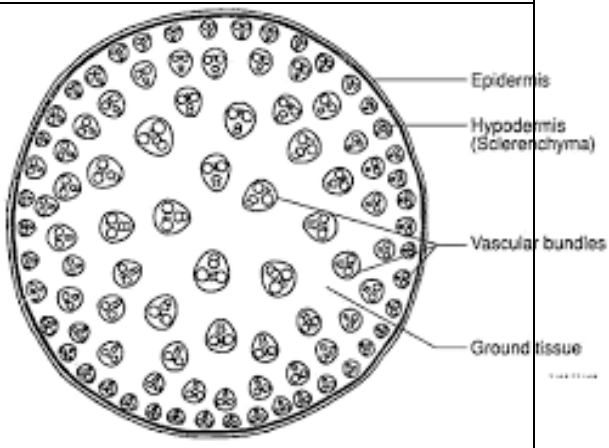
1. Epidermis contains stomata.
2. Ground tissue is composed of parenchyma which is known as mesophyll tissue.

Table: Difference between dicotyledonous and monocotyledonous root

Features	Dicotyledonous root	Monocotyledonous root
1. Xylem bundles	The number varies from two to six (di-hexarch), rarely more.	Usually they are numerous, rarely a limited number (e.g. onion).
2. Pith	It is small or absent.	It is large and well developed.
3. Pericycle	It gives rise to lateral roots and secondary meristems, i.e., cambium and cork-cambium.	It gives rise to lateral roots only.
4. Cambium	It appears later as a secondary meristem.	It is altogether absent.
5. Figure  **Figure: Transverse section (T.S.) of gram**		 **Figure: T.S. of maize (monocot) root**

(dicot) root	

Table: Difference between dicotyledonous and monocotyledonous stem

Features	**Dicotyledonous stem**	**Monocotyledonous stem**
1. Epidermal hair	Multicellular epidermal hair may present	Usually epidermal hairs are not present.
2. Hypodermis	Collenchyma (generally)	Sclerenchymatous
3. Endodermis	Found generally	Not found
4. Vascular bundles	The vascular bundles are **limited**.	The vascular bundles are **many**. The vascular bundles are many and lying scattered in the ground tissue of the axis; the larger bundles are towards the centre and smaller towards periphery.
5. Cambium	Found. The vascular bundle is conjoint, collateral/bicollateral and **open**.	Not found generally. The vascular bundle is conjoint, collateral and **closed**.
6. Bundle sheath	Parenchymatous generally	Sclerenchymatous generally
7. The phloem parenchyma	Phloem parenchyma is present generally	8. The phloem parenchyma is not found generally. Phloem is represented by sieve tubes and companion cells only.
8. Pith	Well developed pith is present	9. Pith is not marked out.
Figure		 Fig. 5.94 : Diagrammatic view of the transverse section of a young maize stem

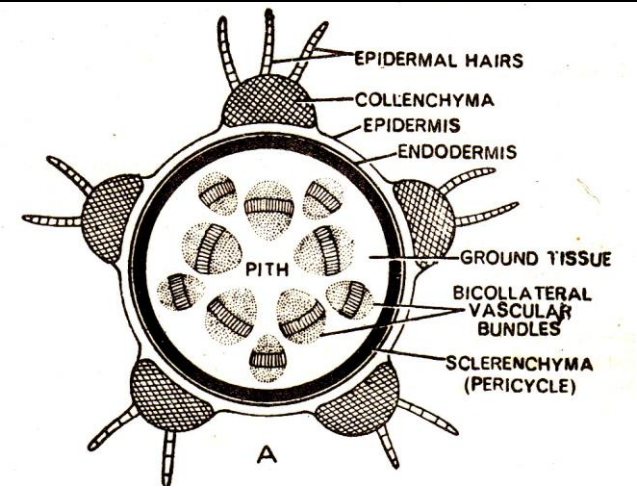


Figure: Transverse section (T.S.) of sweet gourd stem

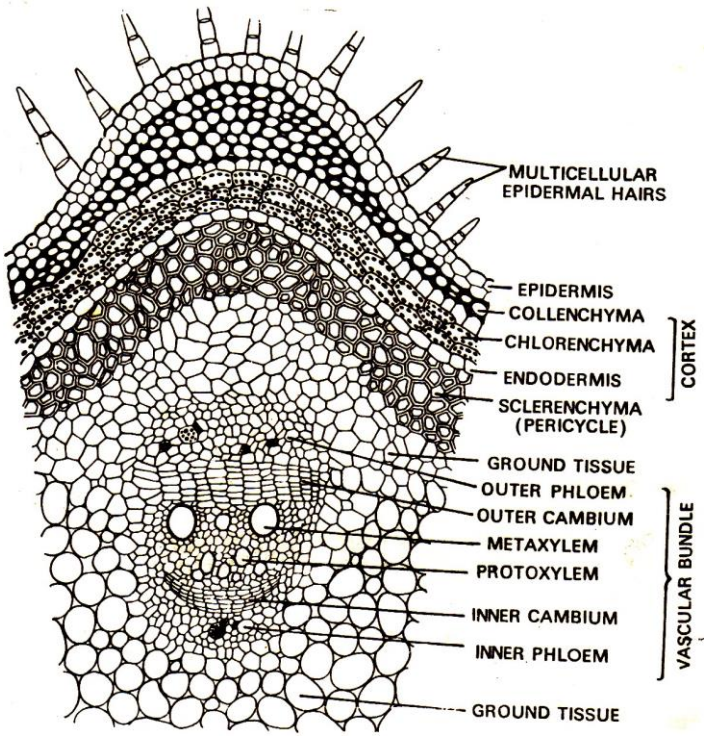


Figure: T.S. of sweet gourd stem

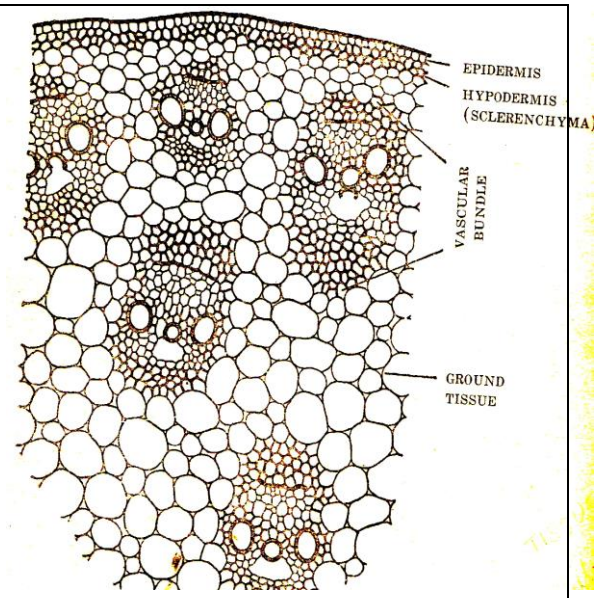


Fig: T.S. of maize stem

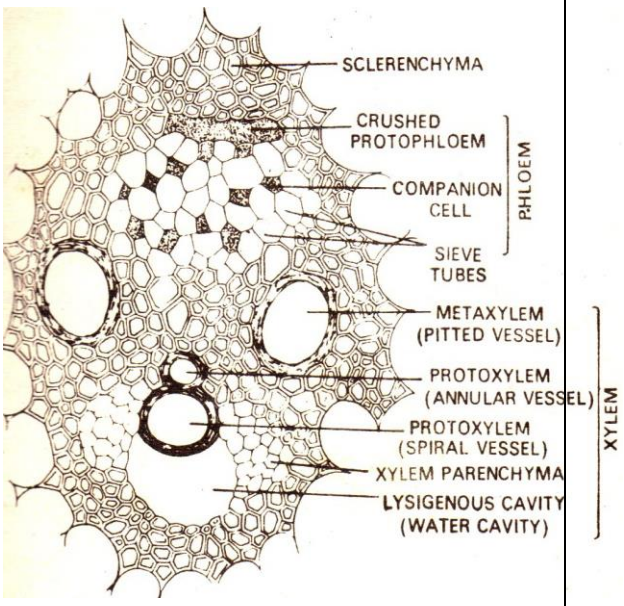


Figure: T.S. of vascular bundle of maize (monocot) stem

Table: Difference between monocot and dicot leaf

Features	Dicot leaf	Monocot leaf
1. Symmetry	Dorsiventral	Isobolateral
2. Shape	Broad or palmate	Long and slender
3. Color of leaf surfaces	Upper leaf surface is dark green and lower leaf surface is light green	Both the upper and lower surfaces are equally green
4. Veins	Reticulate or net	
Cuticle	The cuticle of the upper surface of leaf is thicker, compared to the lower leaf surface.	Cuticle layer is more or less equal in both surface.
5. Stomata	Found in lower surface	Equally distributed in both the surfaces
6. Arrangement of stomata	Present randomly	Arranged in parallel rows
7. Guard cells	Kidney shaped  Kidney shaped guard cell	Dumb-bell shaped  Dumb-bell shaped guard cell
8. Mesophyll	Differentiated: palisade and spongy parenchyma. Palisade parenchyma presents towards upper epidermis and spongy parenchyma remains towards lower epidermis.	Undifferentiated
9. Bundle sheath	Single layered	One or more than one layer
10. Colour of bundle sheath	Colourless	Coloured due to abundance of chloroplast
11. Extensions of bundle sheath	Parenchymatous	It is both Parenchymatous and Schlerenchymatous
12. Lateral wall	Sinuous/Curvy	Straight
13. Bulliform/Motor cells	Absent	Present
14. Vascular bundles	Large	Small and large both
15. Arrangement of vascular bundles	Present in rows	Present randomly
16. Intercellular space	Large	Small
17. Silica deposition on epidermal cells	Absent	Present

18. Hypodermis of mid rib	Collenchymatous	Schlerenchymatous
19. Trichome	Absent	Present
Examples	Leguminous plants (pea, beans, peanuts etc.), tomato, brinjal, oak, mango leaf etc.	Leaf of grains (Wheat, corn, rice etc.), banana, bamboo etc.

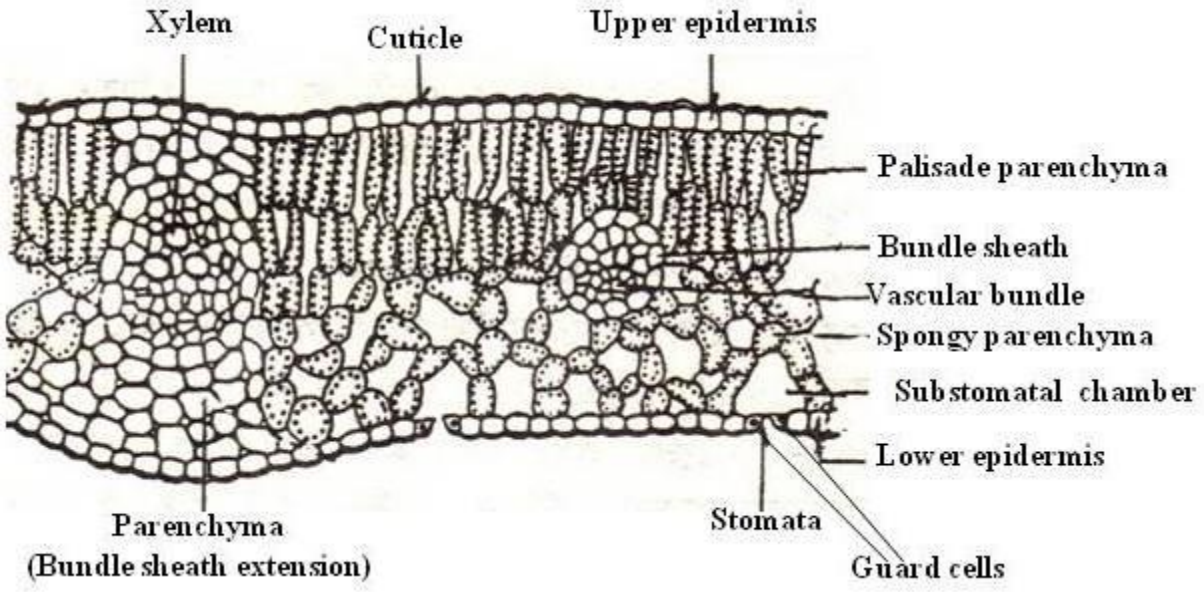


Figure: T.S. of mango (dicot) leaf

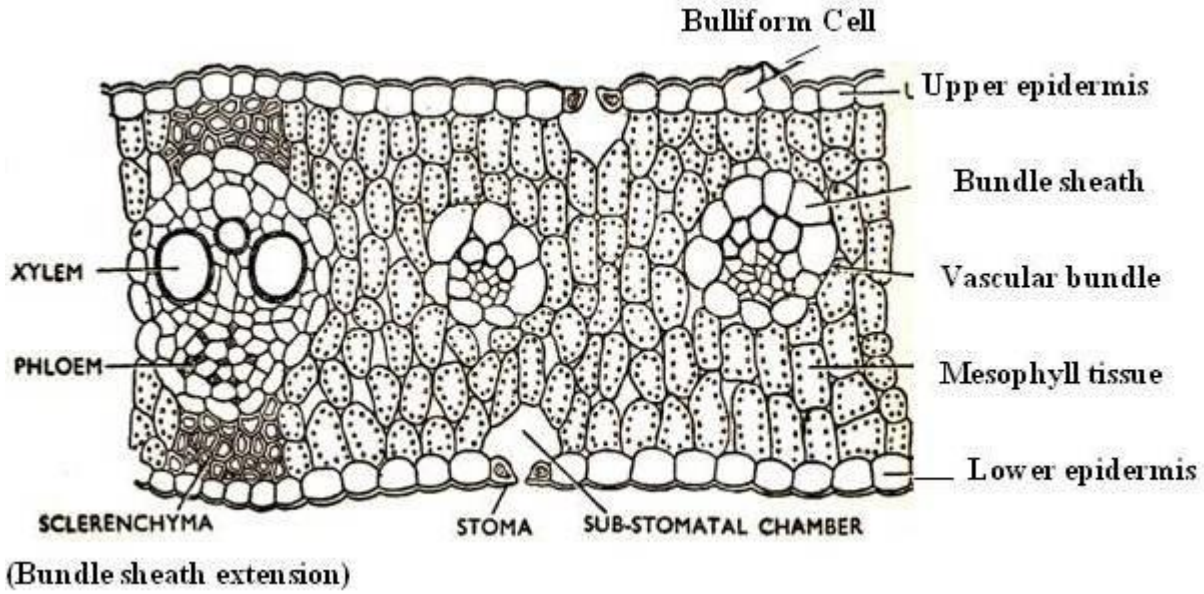
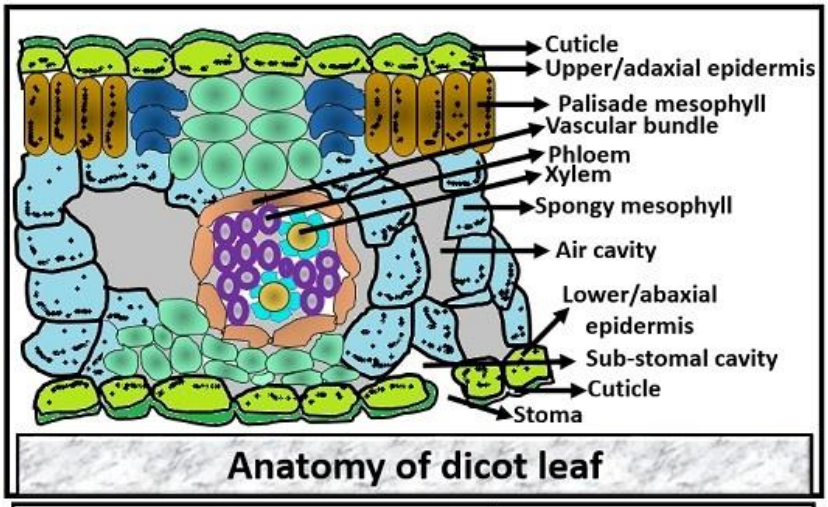
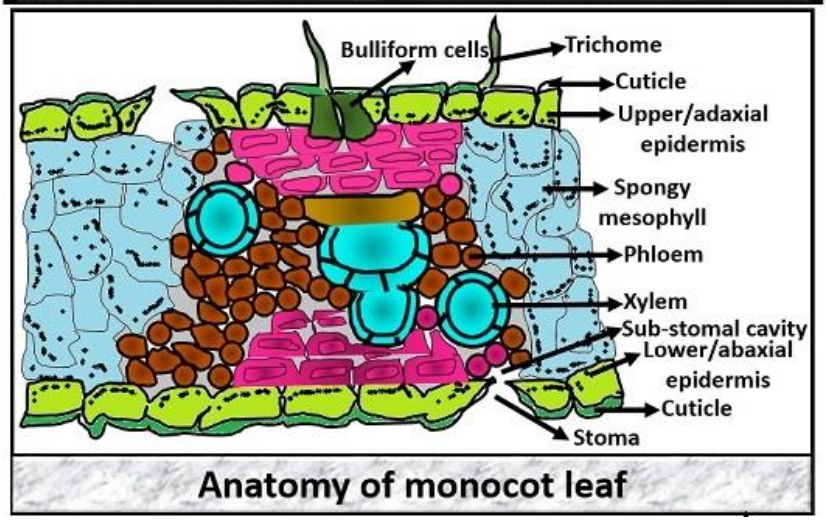


Figure: T.S. of maize (monocot) leaf


Cuticle
Upper/adaxial epidermis
Palisade mesophyll
Vascular bundle
Phloem
Xylem
Spongy mesophyll
Air cavity
Lower/abaxial epidermis
Sub-stomal cavity
Cuticle
Stoma
Anatomy of dicot leaf


Bulliform cells
Trichome
Cuticle
Upper/adaxial epidermis
Spongy mesophyll
Phloem
Xylem
Sub-stomal cavity
Lower/abaxial epidermis
Cuticle
Stoma
Anatomy of monocot leaf