Aim

To study the external features of the root, stem, leaf and flower of monocot and dicot plants.

MATERIALS AND APPARATUS REQUIRED

Sample of monocot and dicot plants. 10-20 days prior soaked seeds which have shown germination, seeds of maize, wheat, green gram, and peas. Slide of T.S. of Monocot stem and Dicot stem, microscope.

THEORY

1. **Angiosperms:** All flower-bearing plants are called angiosperms. It has been divided into two categories, i.e., Monocotyledon and Dicotyledon.
2. **Cotyledon:** Seed leaves are called cotyledons.

Features	Monocotyledon	Dicotyledon
Cotyledon	Seeds have one cotyledon	Seeds have two cotyledon
Root system	Fibrous	Taproot
Leaf venation	Parallel	Reticulate
Vascular bundles in the stem	Are scattered and closed.	are arranged in a ring and open
Pollen flowers	Single furrow or pore	Three furrows or pores.
Stem	Is not woody, usually unbranched	Have woody stem and branched

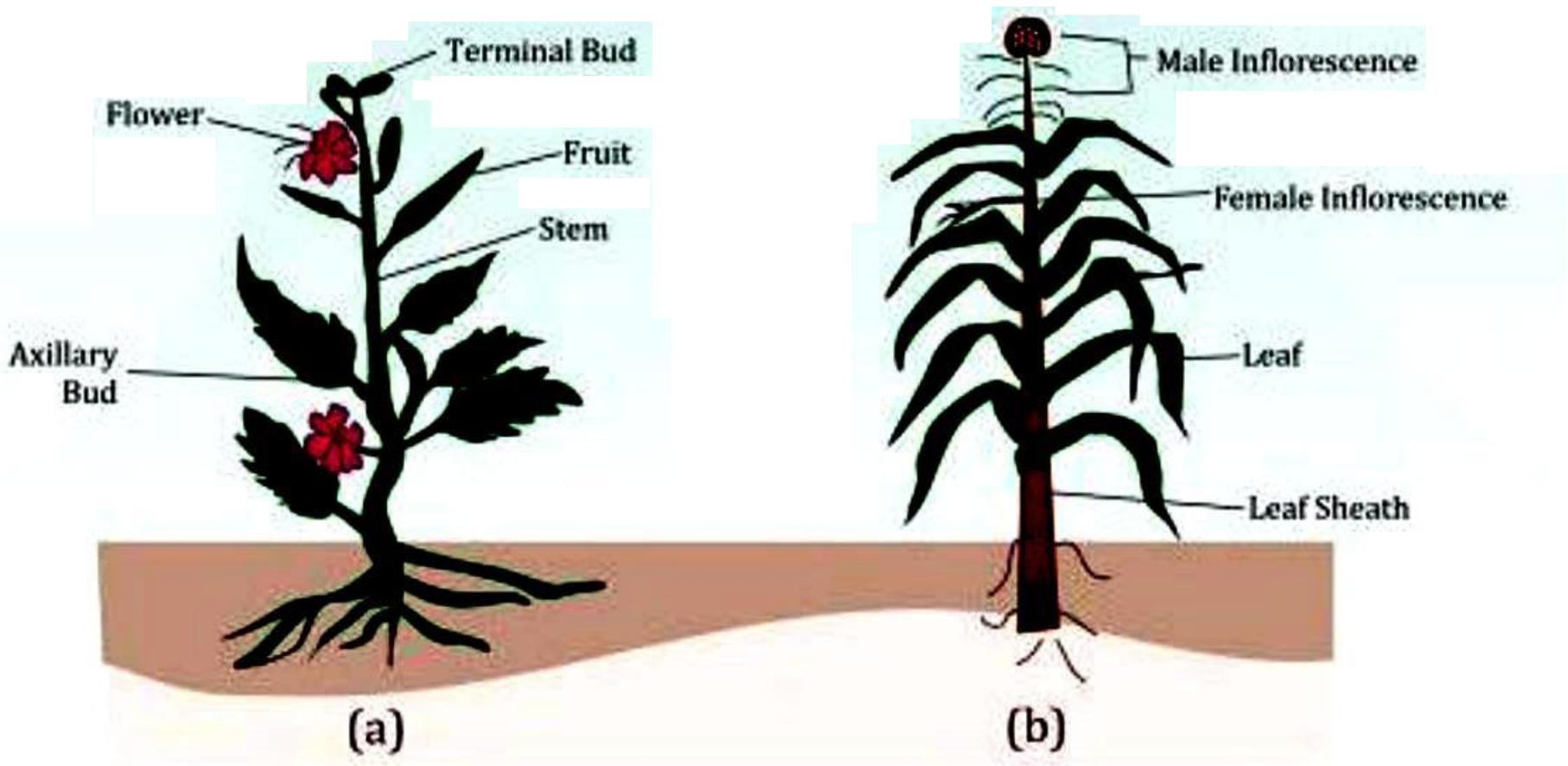
A. Monocotyledons or Monocots

(i) The seeds of these plants bear only one cotyledon.
(ii) The leaves are simple with a parallel venation.
(iii) Roots are fibrous and similar in shape.
(iv) The flowers are trimerous having three members in each floral whorl.
(v) Vascular bundles are closed (i.e., cambium is not found in closed bundles) and scattered in the parenchyma, and hence no secondary growth.

Examples: Maize (Zea mays), rice (Oryza sativa), sugar cane (Saccharum officinarum), wheat (Triticum aestivum), onion (Allium cepa), coconut, grasses and banana.

B. Dicotyledons or Dicots

(i) The seeds of these plants bear two cotyledons.
(ii) Venation in the leaves is reticulate.
(iii) Root system includes tap root with primary and secondary roots.
(iv) Vascular bundles are arranged in a ring and are of open type, i.e., possess cambium which is responsible for secondary growth.
(v) Flowers have five or multiple of five petals.



(a) A Dicot Plant (Brassica Campestris - Mustard)

(b) A Monocot Plant (Zea Mays - Maize)

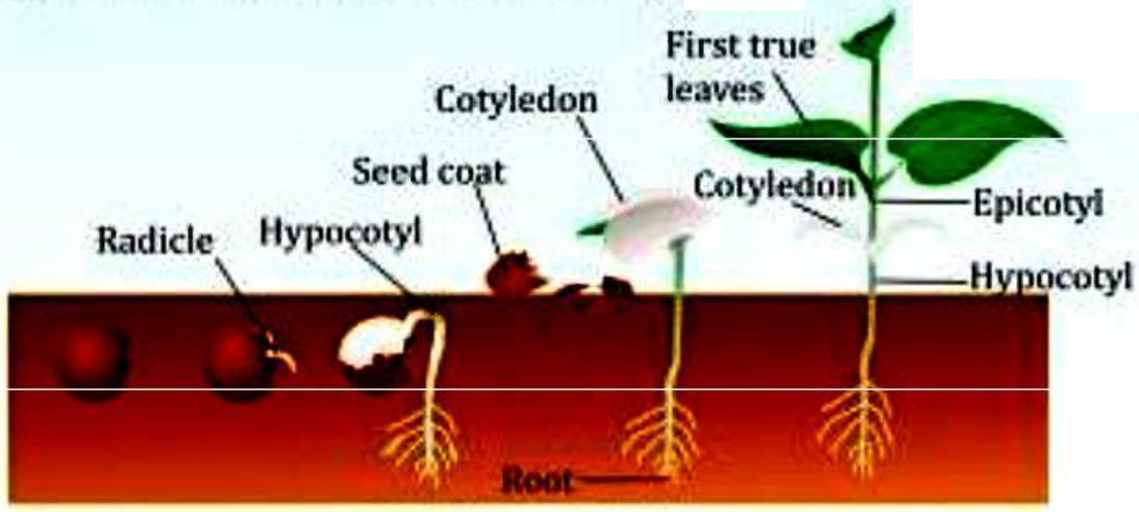
Examples: Potato (Solanum tuberosum), pea (Pisum sativum), sunflower (Helianthus annuus), rose (Rosa indica), neem (Melia indica), apple (Malus silvestris), banyan (Ficus religiosa), etc.

Differences between extreme features of Monocots and Dicots

Monocot vs Dicot		
Seed	1 Cotyledon	2 Cotyledon
Root	Fibrous roots	Tap roots
Flower	Have petals in multiples of 3	Have 4 or 5 petals
Leaf	Narrow, Parallel veins	Oval or palmate, net-like veins
Vascular Bundles	Scattered	Ringed
Pollen Grains	Have 1 pore or furrow	Have 3 pores or furrow

DIAGRAMMATIC REPRESENTATION

Germination: The growth of radicle and plumule from the seed is called germination. The seed swells and the radicle break out through the seed coat at the Micropyle.



Seed Germination

Micropyle: It is the weak spot in the seed coat where the radicle escapes into the growing medium.

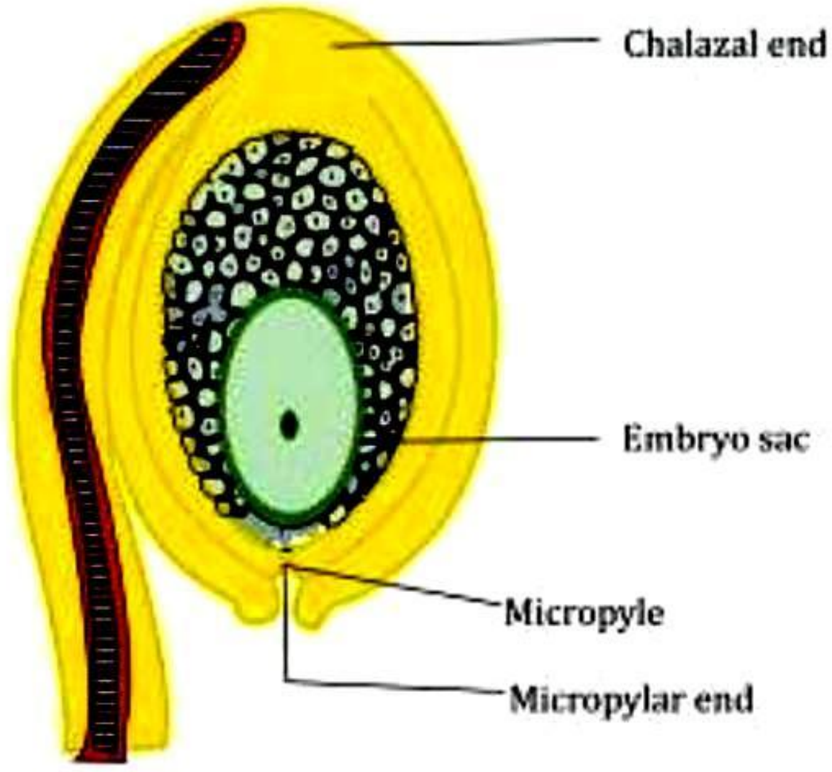
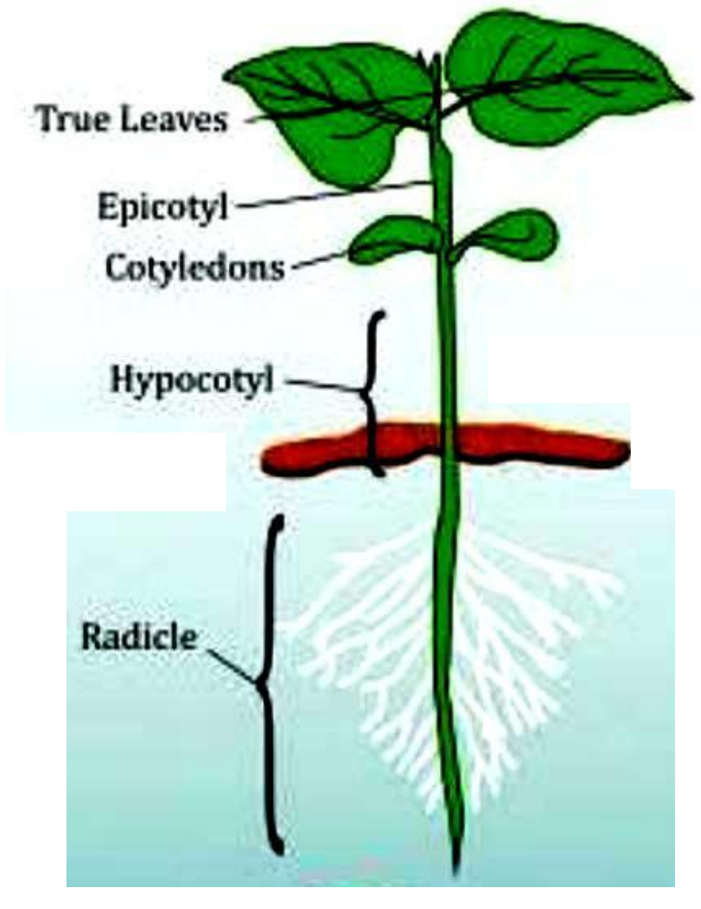


Fig. Embryo sac

Hypocotyl: The connection between the radicle and the cotyledon, which develops into the hook and pushes the growing seed towards the surface.

Epicotyl: It is the mature shoot which begins to grow.



PROCEDURE

1. Take two seeds of maize and peas each and soak them in water. Allow them to become tender. The next day tries to split the seed. Observe whether the seeds break into two halves.
2. Take the germinated seeds, bearing root leaves, stems, and flowers and have turned them into plants.
3. Observe the root system in both maize and peas, and the type of venation in leaves. Record your observations.
4. Now look at the stem of both plants, woody, fleshy, branched, unbranched etc.
5. Observe the flowers for both maize and pea plant and carefully see the number of sepals, petals, and type of pollens in each flower.
6. Observe the transverse section of the slide showing the Monocot and Dicot stem with an arrangement of vascular bundles.
7. Record your observation in the table and draw diagrams of all the parts studied by you.

OBSERVATION TABLE

Character	Maize (Monocot)	Pea (dicot)
1. Seed-soaked in water	Does not break into two halves	Breaks into two halves
2. Cotyledons	One	Two
3. Root system	Fibrous	Tap/adventitious
4. Leaf venation	Parallel	Reticulate
5. Stem (external structure)	Secondary growth is not present	Secondary growth present
6. Arrangement of vascular bundles inside the stem	No arrangement/scattered	Regular arrangement
7. Flower's number of petals, number of sepals pollen	Multiples of 3	Multiples of 5

CONCLUSION

Monocot and dicot plants have many distinctive features which reveal the difference between them.

PRECAUTIONS

1. Seeds should be soaked for a day or two. (In winter soak the seeds in lukewarm water)
2. During germination of the seed, put the seeds in wet cotton initially.
3. The colour of sepals and petals in most of the monocots may be the same (tepals), do not get confused over this.

VIVA VOCE

Q1. Which plants have you taken for the experiment?

Ans. Maize and Pea

Q2. Which root system is present in the pea plant?

Ans. Tap root system.

Q3. What are the identification features of the tap root system?

Ans. In the tap root system, one main root is present. From this secondary root, and secondary roots tertiary roots arise. In other words, we can say in the tap root system, roots are differentiated into primary, secondary and tertiary roots.

Q4. Can you categorise the plants into monocots and dicots by looking at their leaves?

Ans. Yes, dicot plants have reticulate venation while monocot plants have parallel venation.

Q5. What is venation?

Ans. The arrangement of veins in a leaf is called venation.

Q6. Name two plants in which venation is parallel and two plants in which venation is reticulate.

Ans. **Parallel venation** - Wheat and rice.
Reticulate venation - China rose and mustard.

Q7. What are pentamerous flowers?

Ans. Flowers having parts in multiples of five (five, ten, etc.) are called pentamerous flowers.

Q8. How can we identify whether a seed belongs to a monocot or dicot plant?

Ans. By counting the number of cotyledons present in a seed we can identify whether a seed belongs to a monocot plant or a dicot plant.

Q9. How many cotyledons are present in a dicot seed?

Ans. Two

Q10. What is the role of cotyledon in the seed?

Ans. The cotyledons are the "seed leaves" produced by the embryo. They serve to absorb nutrients packaged in the seed until the seedling can produce its first true leaves and begin photosynthesis.

Q11. How do we differentiate between the fibrous root system and the tap-root system?

Ans. **Tap root**- It has a main root with lateral roots growing on the primary root.
Fibrous roots- It has no main root; all roots grow like fibres.

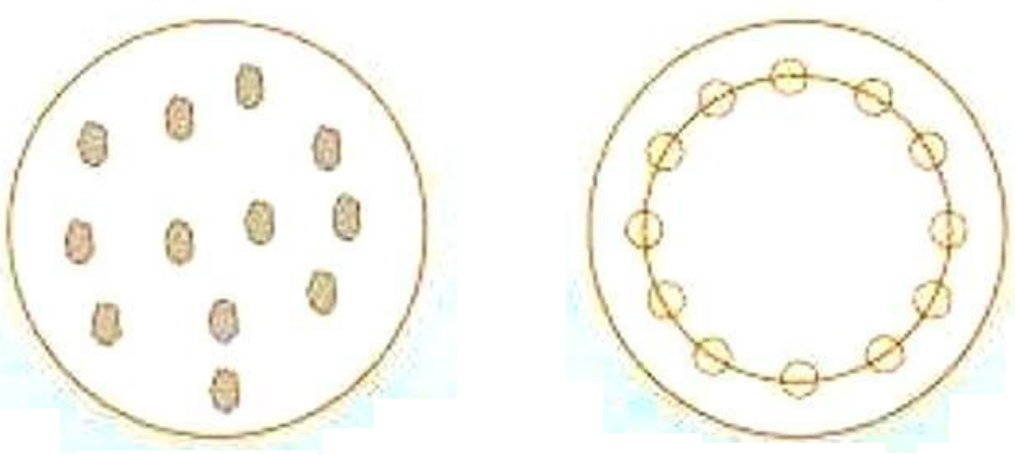
Q12. A plant has leaves with reticulate venation and floral parts consisting of 5 sepals, 5 petals, 5 stamens, and 5 carpels. In which group of angiosperms would you place this plant? Give reasons.

Ans. The plant is dicot as the flowers are pentamerous i.e., floral parts are five in number.

Q13. Do all flowers have all the floral parts? Explore.

Ans. No, all the flowers may not have all the floral parts.

Q14. The vascular tissues diagram is shown below, the correct identification is.



A **B**

Ans. **(A)In monocot the vascular bundles are scattered in the stem, but in dicot, it is in a ring shape.**

Q15. Seeds were soaked in water; some seeds were soft and were easily broken into two halves it is.

Ans. **Dicot seeds have 2 cotyledons.**