

Chapter 4

MORPHOLOGY AND PHYTOGRAPHY

Syllabus:

B.Sc: Morphology and phytography: A detailed account of various morphological characters of root, stem, leaf, inflorescence, flower, placentation, and fruit types.

B.S: Morphology: a detailed account of various morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.

MORPHOLOGICAL CHARACTERS OF ROOT

The cylindrical plant organ without chlorophyll, growing towards the gravity is called root. Roots have following morphological characters.

Kinds of Roots

There are two groups of roots: Tap root and Adventitious roots.

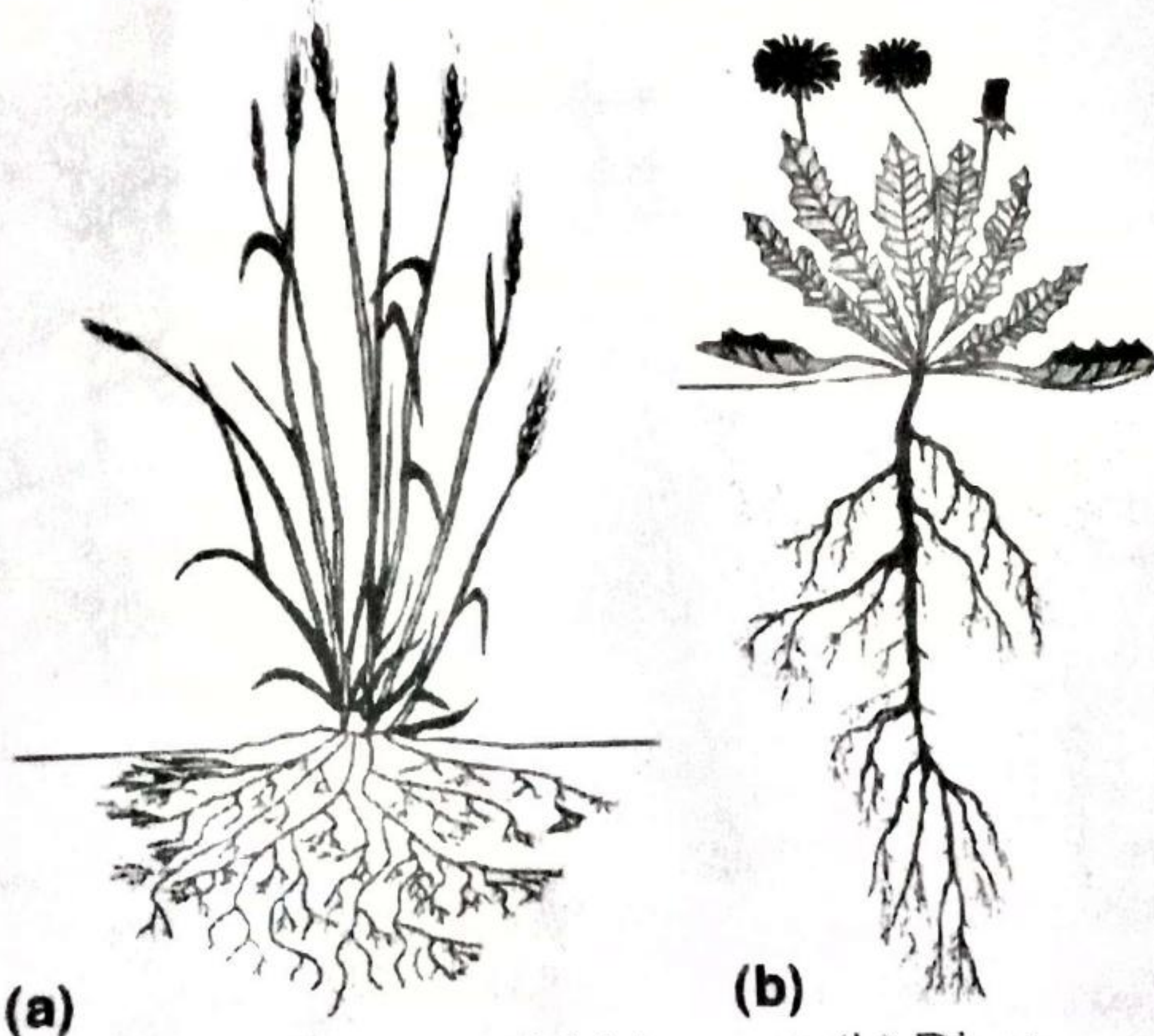


Fig: Fibrous Tap roots (a) Monocot, (b) Dicot

(a) Tap root

The root directly arised from the seed is called tap root. The first root which is formed by the elongation of radicle is called primary tap root. It gives rise to secondary and tertiary roots. The deep feeder plants have a long net work of tap root system. The surface

feeder plants have short tap roots. There are following forms of tap roots:

1. **Fibrous tap roots:** The long and slender tap root with slender branches is called **fibrous tap root**. In this case, root does not become thicker than lateral branches. It is found in many herbs like bean, pea etc. In some leguminous plants, the tap roots form **nodules**. Bacteria live in these nodules and fix atmospheric nitrogen. Bacteria provide the plants nitrates. In return, plant provides bacteria prepared food and protection. Thus this is a symbiotic relationship.
2. **Tuberous tap roots:** The thick or swollen tap roots with reserve food are known as **tuberous tap roots**. Such roots occur in biennial plants like carrot, turnip, radish etc. The biennial plants live in two seasons. In first season (before winter) they store food in the roots. They use this food in the second season (after winter). Tuberous roots may be:
 - a) **Conical:** These roots are swollen towards upper end but taper towards the lower end. Examples: carrot, radish.
 - b) **Fusiform:** These tap roots are spindle shape i.e. swollen in the middle. Examples: English carrot
 - c) **Napiform:** These tap roots are very much swollen above but abruptly taper towards the lower end. Examples: turnip and beet.

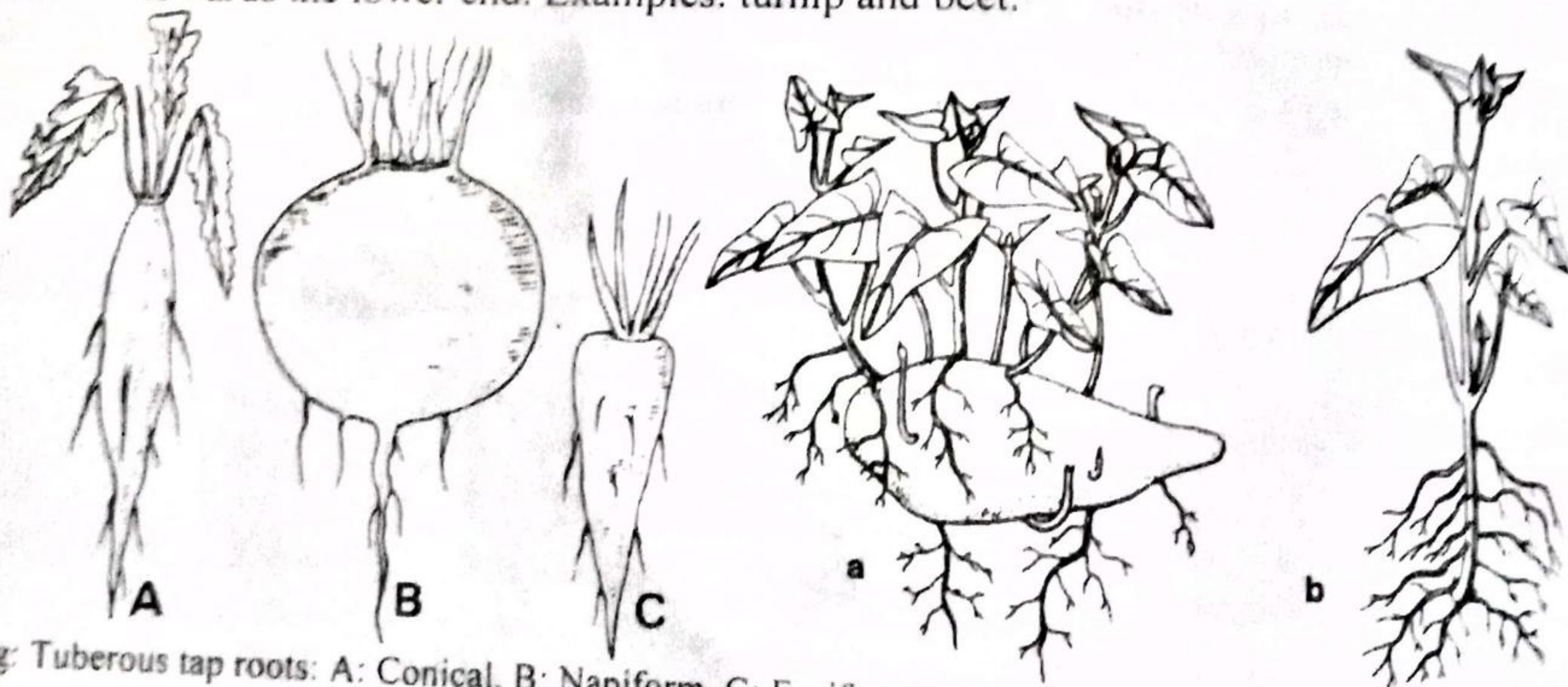
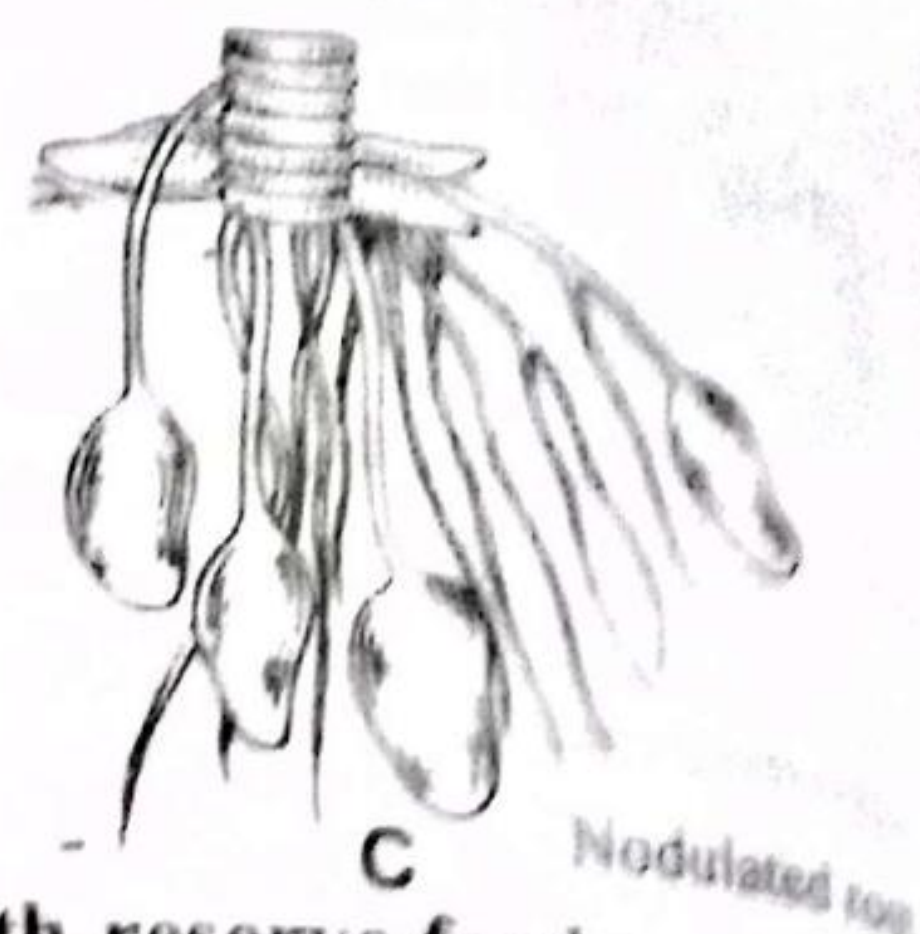


Fig: Tuberous tap roots: A: Conical, B: Napiform, C: Fusiform Fig: Sweet potato (a) Tuberous roots, (b) Fibrous roots

(b) Adventitious roots

The roots arise from the stems or sometimes leaves are called **adventitious roots**. It has following forms:

1. **Underground or subterranean adventitious roots:** These roots arise from some part of stem which is in contact with the soil. They may be fibrous or tuberous.
 - (a) **Fibrous adventitious roots:** These are long and slender roots. These commonly

develop on creeping and underground stems like grasses.

(b) **Tuberous adventitious roots:** These are swollen and fleshy roots. These roots contain stored food material. Examples: Asparagus, sweet potato (تشرکندی). Number of roots swollen to form tuberous roots in sweet potato. These tuberous roots have stored food.

2. **Partly subterranean adventitious roots:** These roots are partly above and partly below the ground. These roots may be stilt roots, prop roots and aerating roots.

(a) **Stilt roots:** In this case, adventitious roots arise from the lower portion of stem and grow into soil. They develop normally in soil. These roots fix the plant firmly in soil. They also absorb water and minerals. Such types of roots are found in corn, sugar cane, bamboo etc.

(b) **Prop roots:** In this case, roots hang down in the air from the aerial branches of stem. These roots absorb moisture of air. In some cases, these roots enter the soil. They also absorb water and mineral from the soil. Ultimately, they form props. Props support the branches of plant. Props are also involved in vegetative propagation in some plants. Example: banyan (بورڈ) rubber tree etc.

(c) **Aerating roots or pneumatophores:** These roots grow vertically upward and project above the soil surface. These roots have openings for the entry of air. These are spongy in texture. Such roots are found in marshy plants like mangroves. These roots absorb air from the surface for marshy plants. This air is used by roots for respiration.

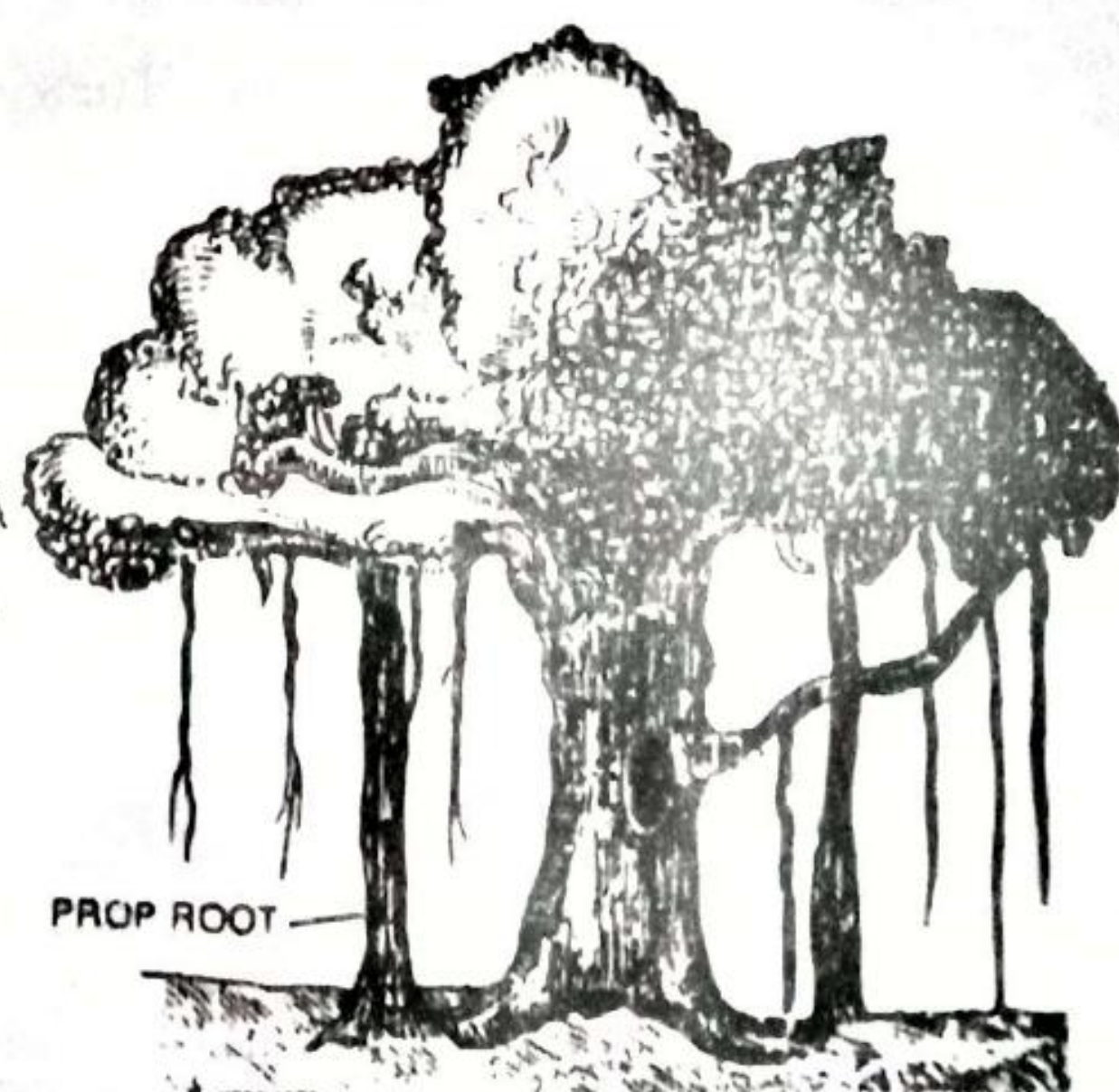
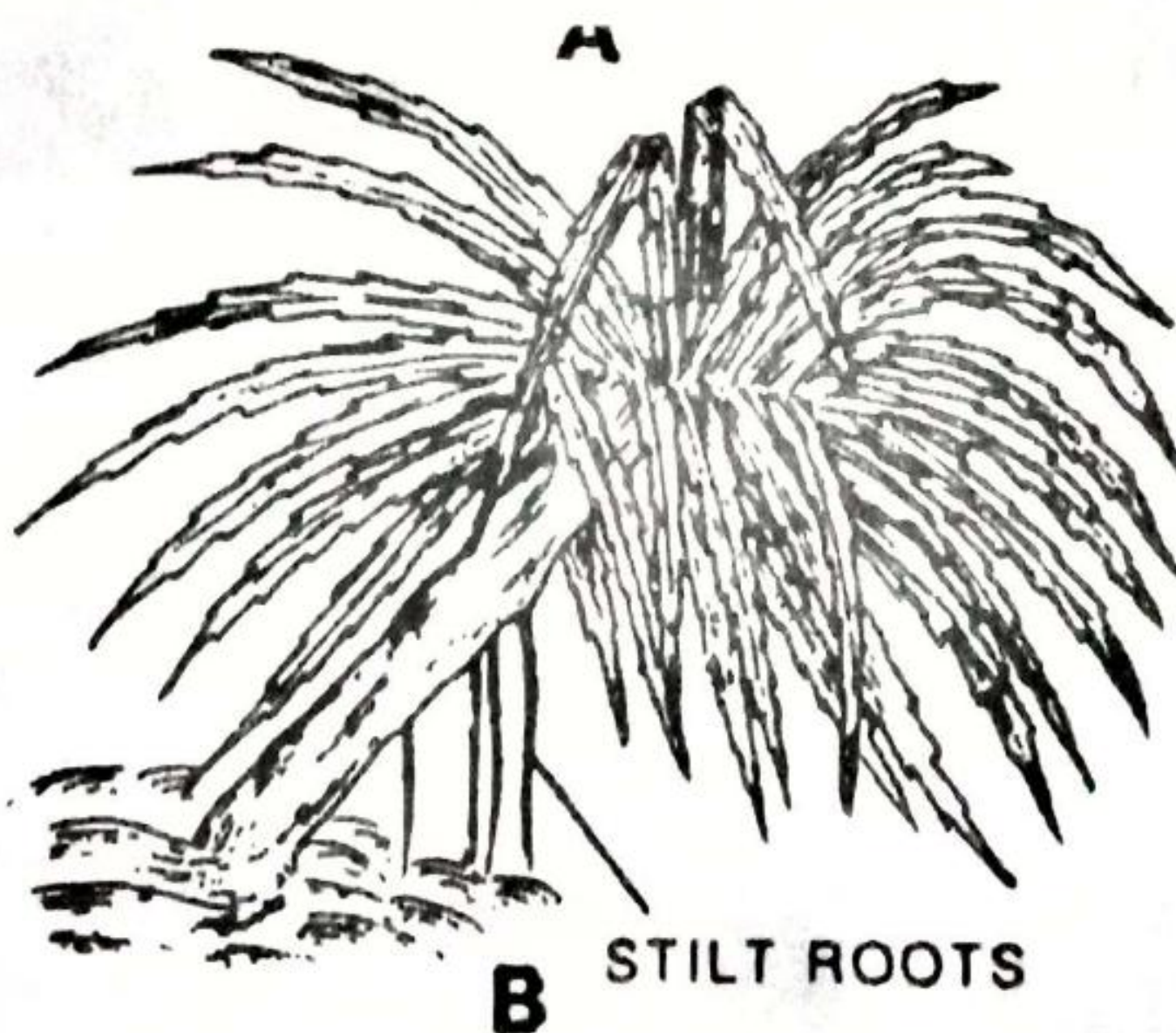
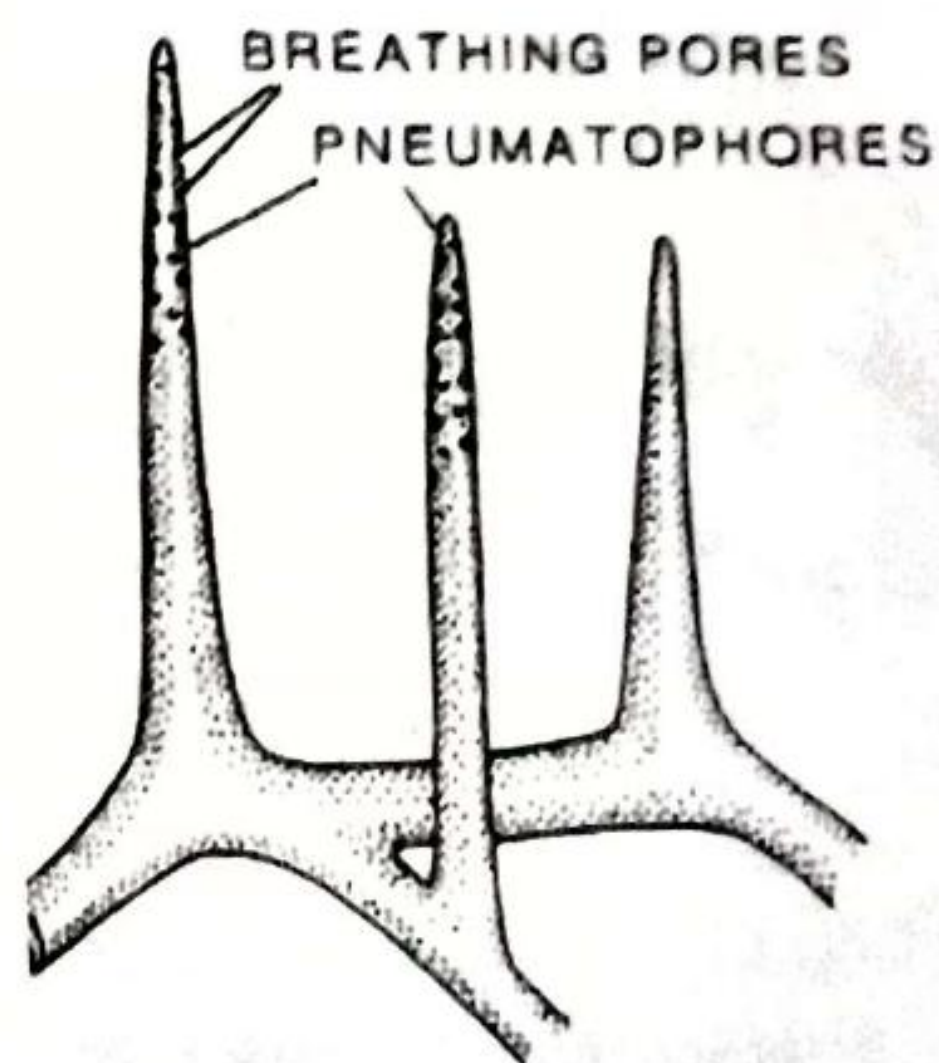


Fig: Absorbing roots,

Stilt roots

Prop roots

3. **Aerial roots:** These roots are entirely exposed in air. These roots perform special functions. There are two kinds of aerial roots.

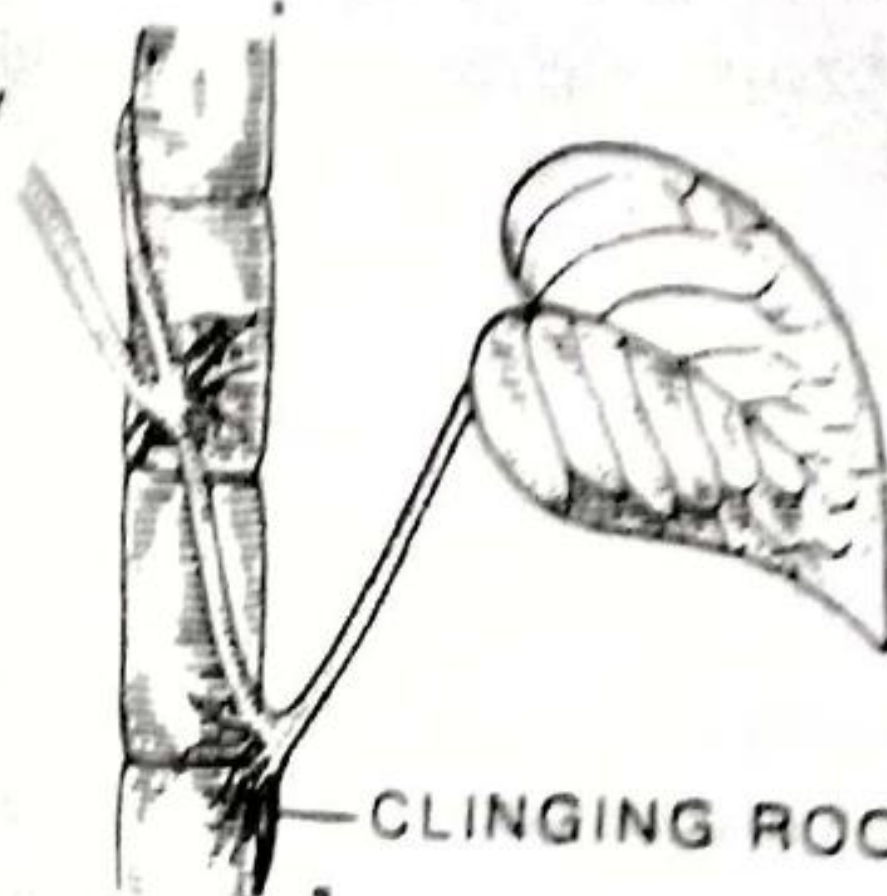
(a) **Climbing roots:** These roots are developed by stem in climbing plants. These roots firmly attach the plants with some support like wall, tree trunk. These roots are very sensitive for touch. These roots secrete sticky fluid for attachment. In

some cases, they also develop disc like structures at their apices. These discs help them to attach the support firmly. Examples: These roots are developed in long pepper etc.

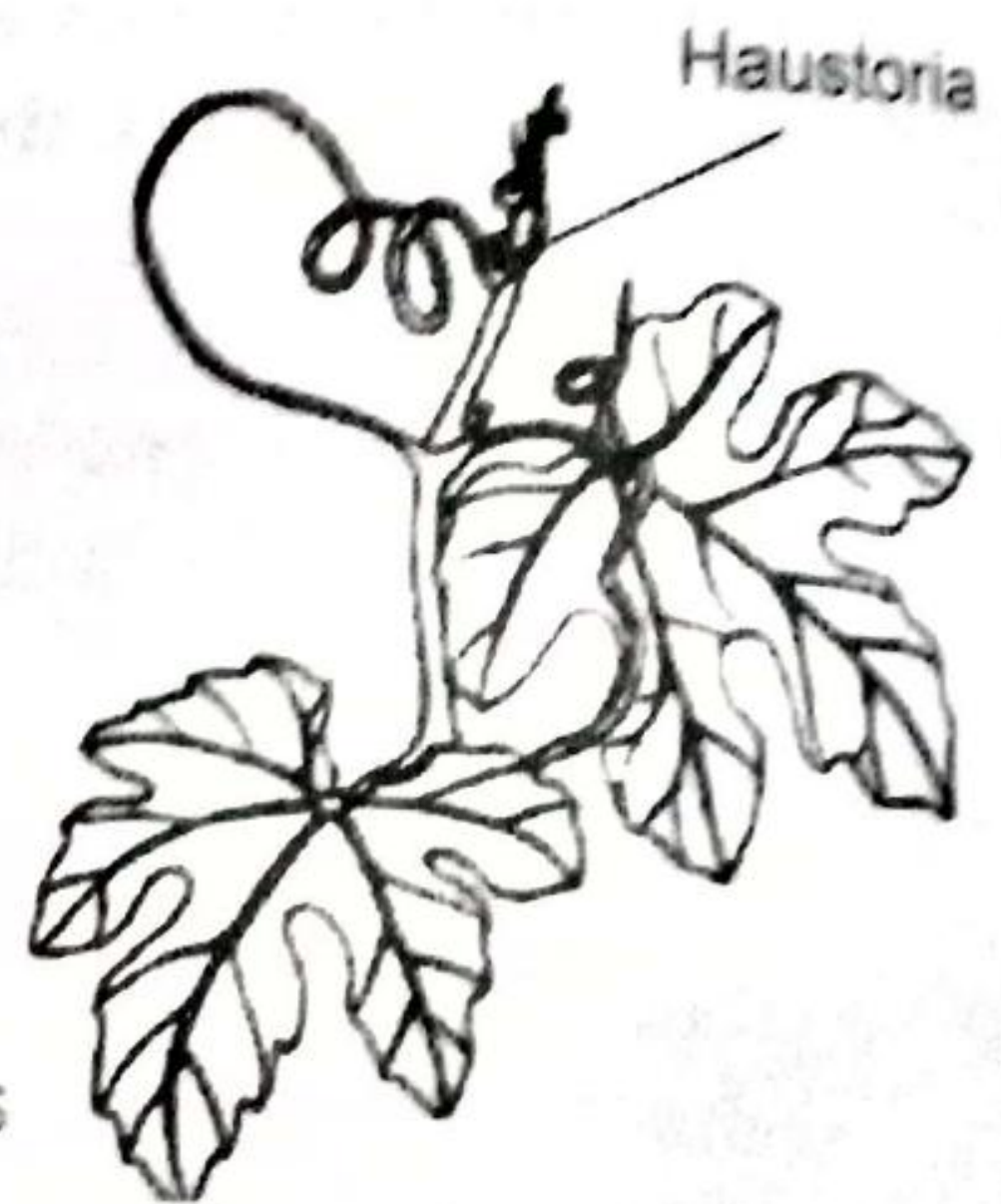
- (b) **Absorbing roots:** Some epiphytes develop long roots in air for absorption of moisture. These roots are called absorbing roots. These roots hang freely in the atmosphere. Such plants with absorbing roots are found in tropical rain forests. These forests have high humidity. These are small plants. Such plants live on taller plants as epiphytic plants. They have no connection with the soil. Their absorbing roots hang freely and help them for absorption of moisture from air. These roots are developed in epiphytic orchids. In some orchids, the absorbing roots are covered with **velamen**. Velamens are dead spongy tissues. Velamen absorbs and stores water.



Fig: Climbing roots in Pepper



A Climbing root of betel



Hauatoria of Cuscuta

4. **Parasitic roots or Haustoria:** These roots are developed in parasitic plants like Cuscuta (اگاس (بیل). Stem develops these roots for absorption of food from host. These roots penetrate into the host tissues. They get connected to the conducting tissues of host plant and absorb prepared food, mineral and water.

5. **Aquatic roots:** These roots are developed in water plants. These roots arise from stem and spread in water. Example: Hydrilla

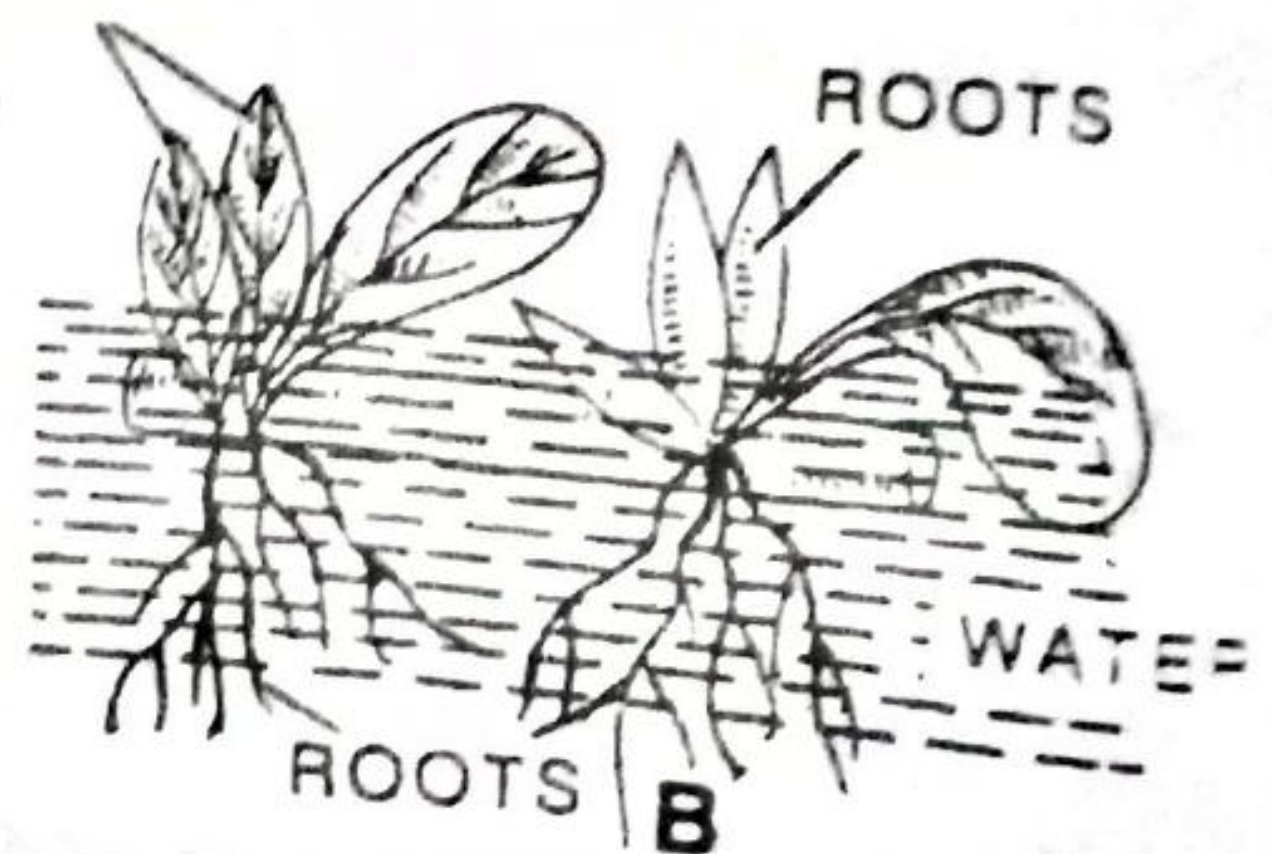


Fig: Aquatic roots

Functions of Roots

1. Roots anchor the plant to the soil.
2. They absorb water and minerals for plants.
3. They store reserve food. Roots of turnip, radish and carrot are used for storing of food.
4. Some roots are used for clinging. Its examples are props and haustoria.
5. Some roots are used for vegetative growth. For example, tuber of plants like sweet

potato is used for vegetative reproduction.

6. Roots of plants are involved in absorption of moisture and oxygen from air.
7. The roots of leguminous plants develop nodules. Bacteria live in these nodules. They fix the atmospheric nitrogen and increase the fertility of soil.

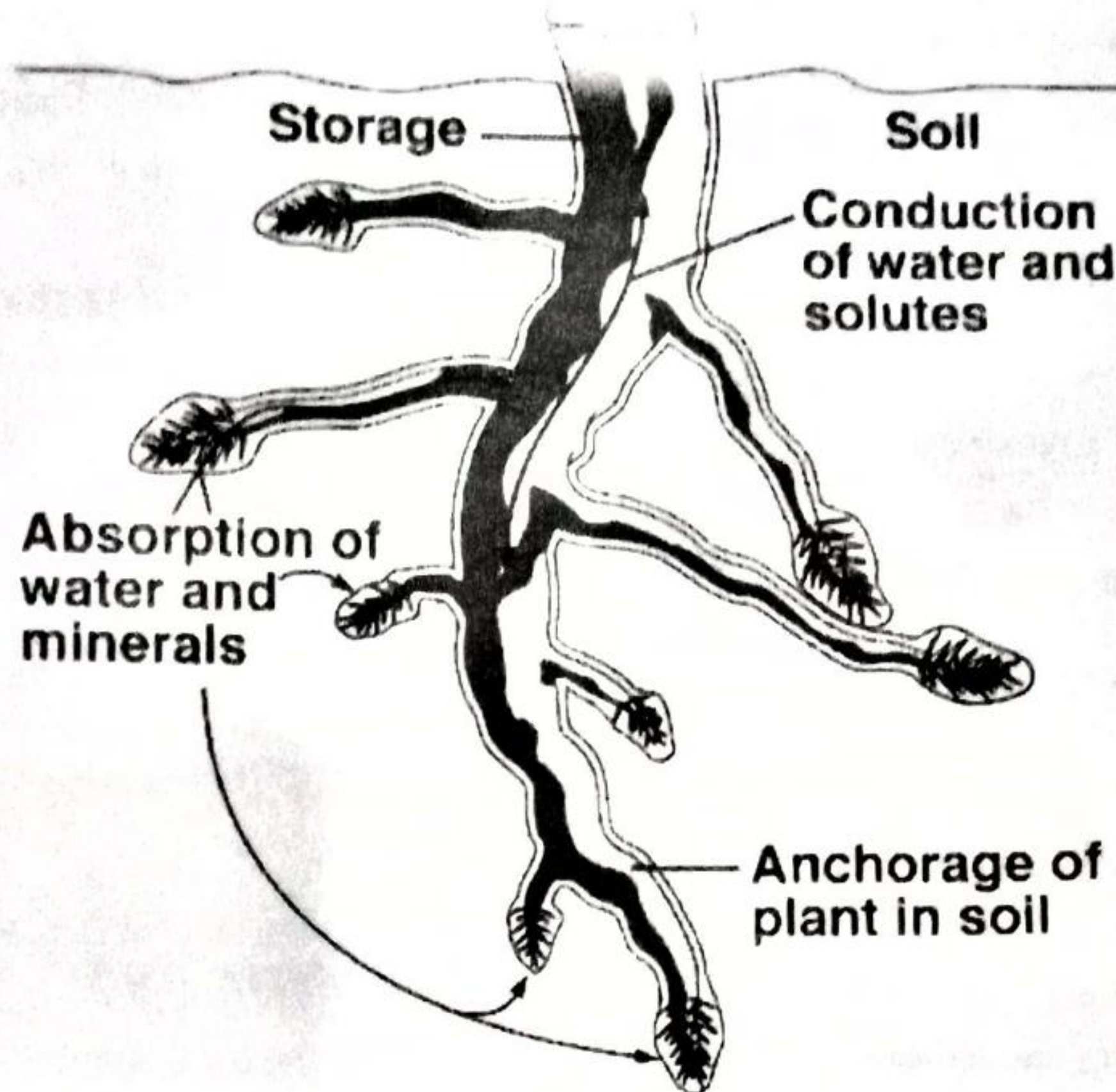


Fig: Functions of roots

COMPARISONS/DIFFERENCES

Taproot and Adventitious Roots

Tap root	Adventitious Root
1. The root directly arised from the seed is called tap root.	1. The roots arised from the stems or sometimes leaves are called adventitious roots.
2. It has persistant primary root called tap root.	2. Primary root is short lived in them.
3. There is one main root called primary root. It produces secondary roots. Secondary roots give rise to tertiary roots.	3. A number of main roots develop at one spot which gives off secondary and tertiary branches.
4. Single main root is thicker than other branches.	4. All the main roots have nearly same thickness except storing roots.
5. This system grows deep into the soil.	5. Adventitious root does not grow deep in the soil.
6. Tap root system is always underground.	6. It may be underground or aerial.
7. Examples: Turnip, beet	7. Examples: Asparagus, sweet potato, rose