# MORPHOLOGY OF FLOWERING PLANTS (ROOTS)

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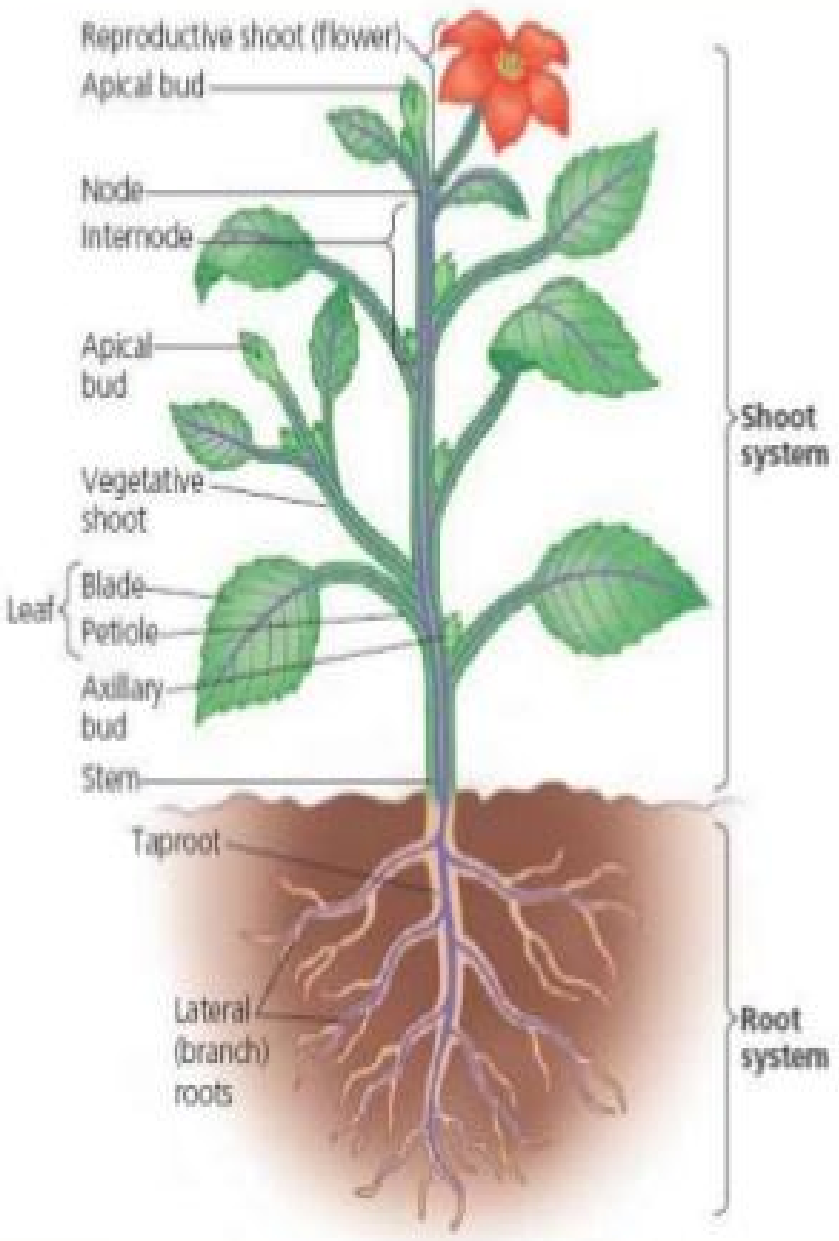
# Morphology of Plants




- Morphe= Form + Logos= Study
- Study of form and feature
- Root
- Stem
- Leaf
- Inflorescence
- Flower
- Fruit
- Seed

# Classification of Plants

- **Annuals:** Complete their life cycle in one year or **one growing season** or few weeks to a few months. eg. Mustard, corn, wheat, rice, lettuce, peas, watermelon, beans, zinnia and marigold.
- **Biennials:** Complete their life cycle in **two years growing** (**vegetative** and storing food in the first year, **flowering and fruiting** in second year). eg. Radish, Turnip, Carrot, Onion and Cabbage.
- **Perennials: Survives for several years.** Generally the top portion of the plant dies back each winter and regrows the following spring from the same root system. eg. Mango, Guava and Banana.

## Morphology of Root

Root is a downward growth of the plant into the soil. It is positively geotropic and hydrotropic. Radicle from the germinating seed grows further into the soil to form the root. It produces similar organs. Root does not have nodes and internodes. Branching of the root arises from the pericyclic tissues. Roots are covered by root caps or root heads.

**THE ROOT**

LOCATION- grows underground

TYPES OF ROOTS-

1) Primary- formed directly from axis of embryo plant.

2) Lateral- arises from primary.



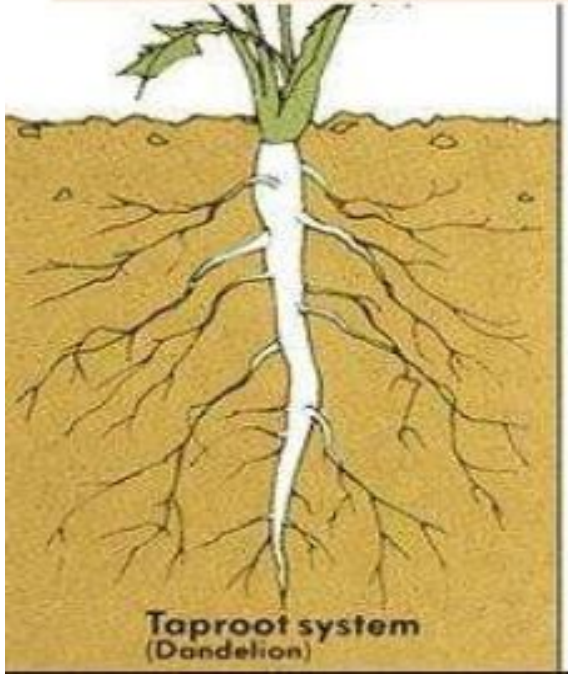
**Developing Seedlings**

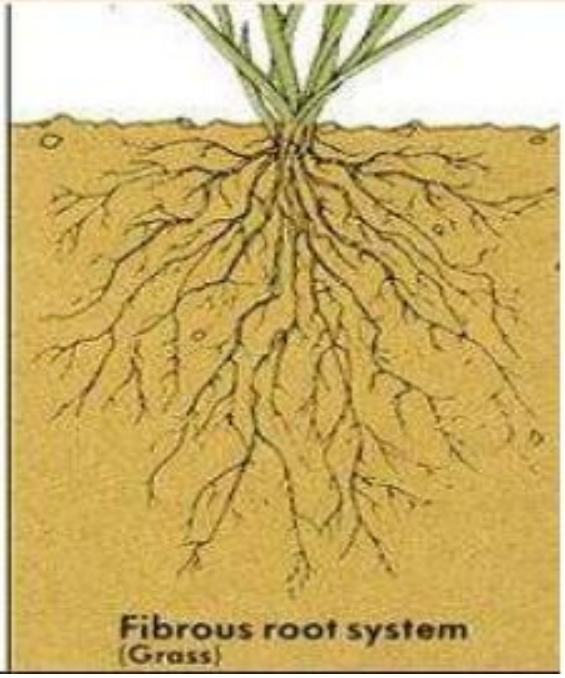
Soybean

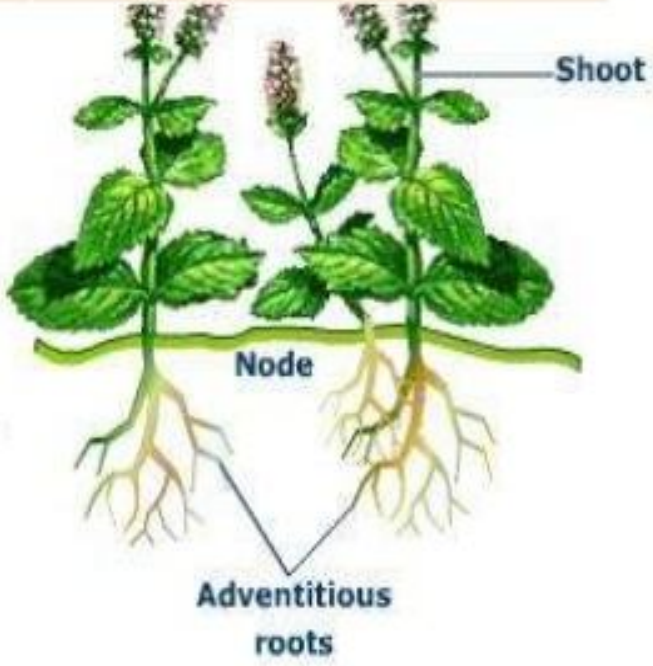
Corn

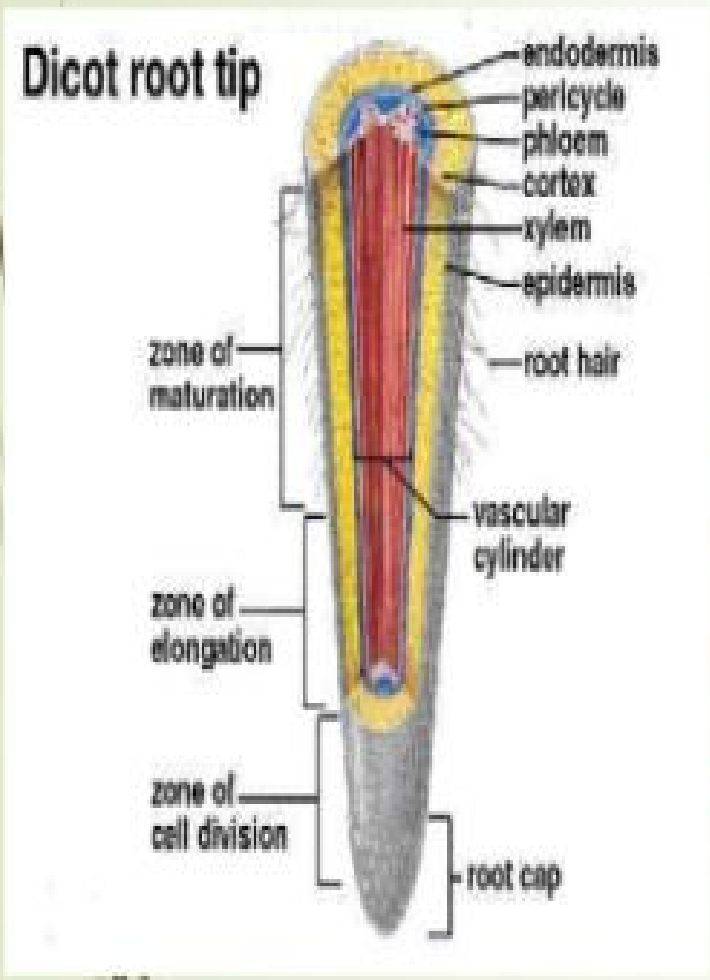
# TYPES OF ROOT SYSTEMS

| TAP ROOTS | FIBROUS ROOTS | ADVENTIOUS ROOTS |
|---|---|---|
| •Prominent in dicot | •Prominent in monocots | •They develop from organs |
| •Primary roots grow & becomes stout. | •Roots develop from lower nodes | Of shoot system |
| •Secondary & tertiary grow from primary root | •They have same length & diameter | |



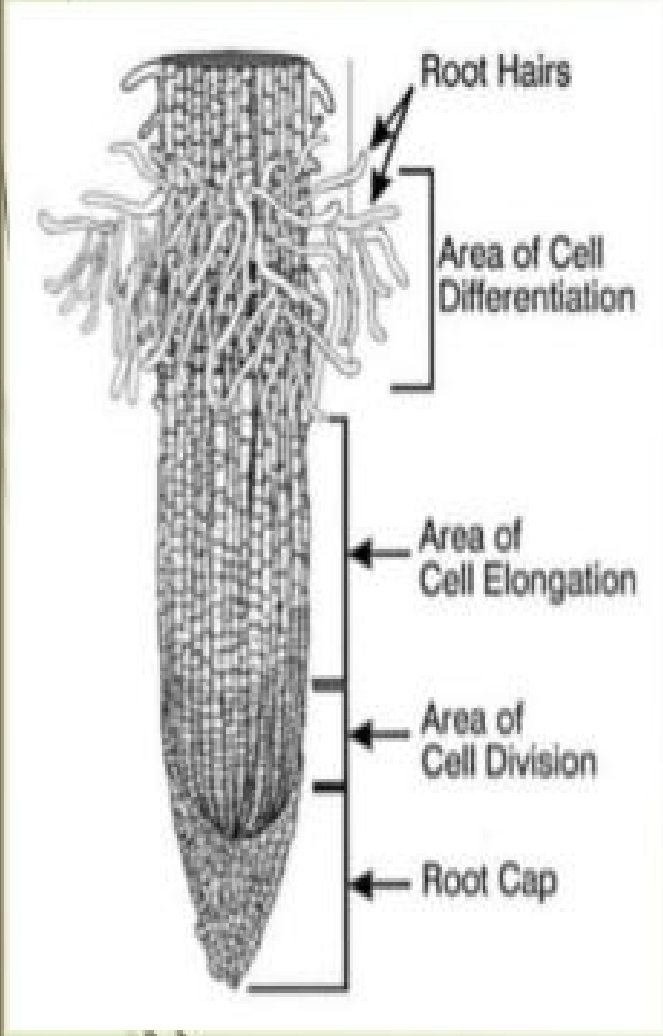



## 1. Region of root cap:

- The tender apex of the root is protected with a multicellular like structure called root cap.
- The cells of the root cap secrete **mucilage** for lubricating the passage of root through the soil.
- In many hydrophytes like *Pistia* and *Eichhornia*, root cap is replaced by **root pocket**.

## 2. Region of cell division or meristematic region:

- It is a small region about 1mm in length.
- This is the **growing part** of the root and is protected by the root cap.
- It is made up of thin walled, compactly arranged **meristematic** cells which have the power of division.
- This region helps in longitudinal growth by the addition of new cells.



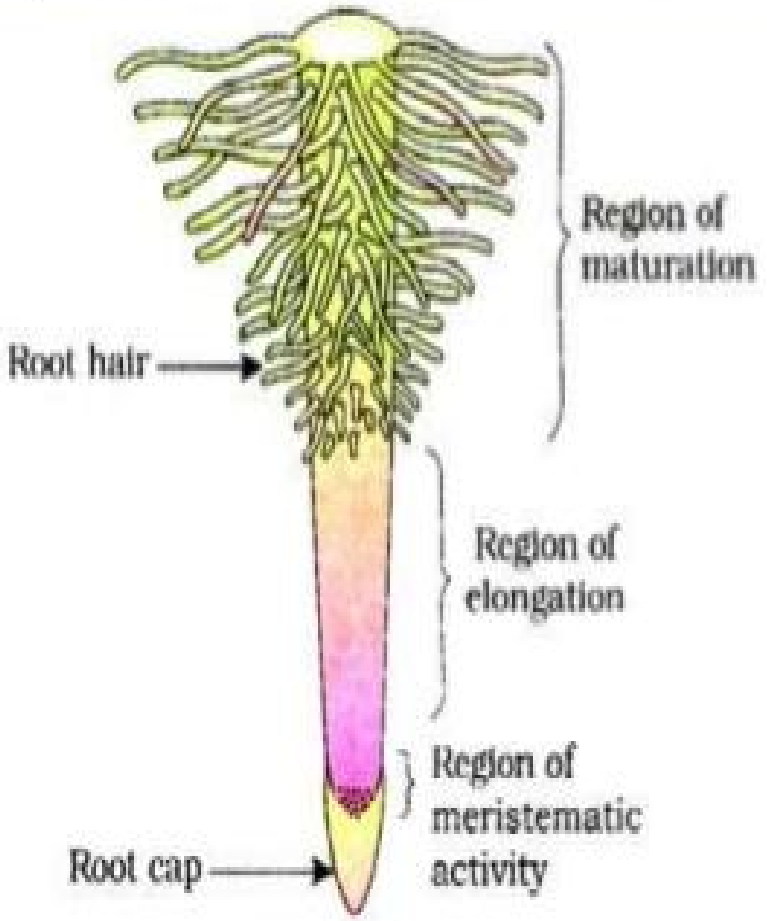

## 3. Region of elongation:

- It lies just above the meristematic region.
- The cells of this region are newly formed and they **elongate** rapidly. This increases the **length** of the root.
- The cells of this region help in the absorption of **mineral** salts

## 4. Region of root hair or root absorption:

- Surface of this area is covered with numerous **root hairs**.
- The cells of the outer layer known as **piliferous** layer or **epiblema** produce root hair.
- The root hairs are elongated, single celled, tubular structures which remain in contact with soil particles.
- The root hairs increase the **surface area** of absorption.
- They are short lived and are **replaced** by new root hairs after every 10 to 15 days and is responsible for absorption of **water**.

## 5. Region of maturation or cell differentiation:




The regions of the root-tip

- It forms the **major part** of the root.
- The outermost layer of this region has thick walled **impermeable** cells.
- The enlarged cells undergo **differentiation** to form different types of primary root tissue like cortex, endodermis, xylem, phloem, etc. This region helps in **fixation** of plant body into the soil and also in **conduction** of absorbed substances.
- **Lateral roots** also develop from this region of the root.

# Types of Roots:

**Modifications**

**Tap Root**

1. Storage of food
2. Respiration

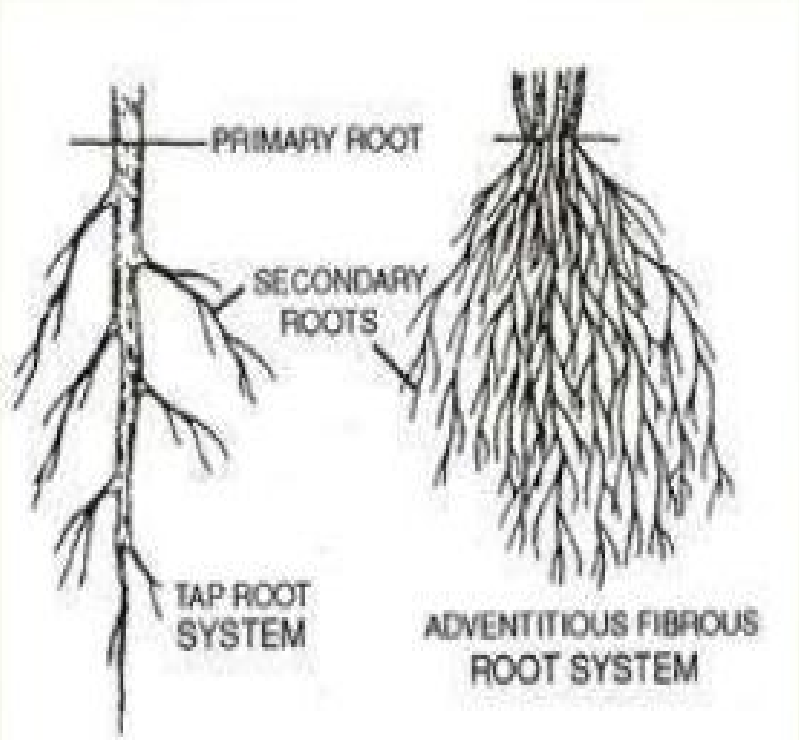
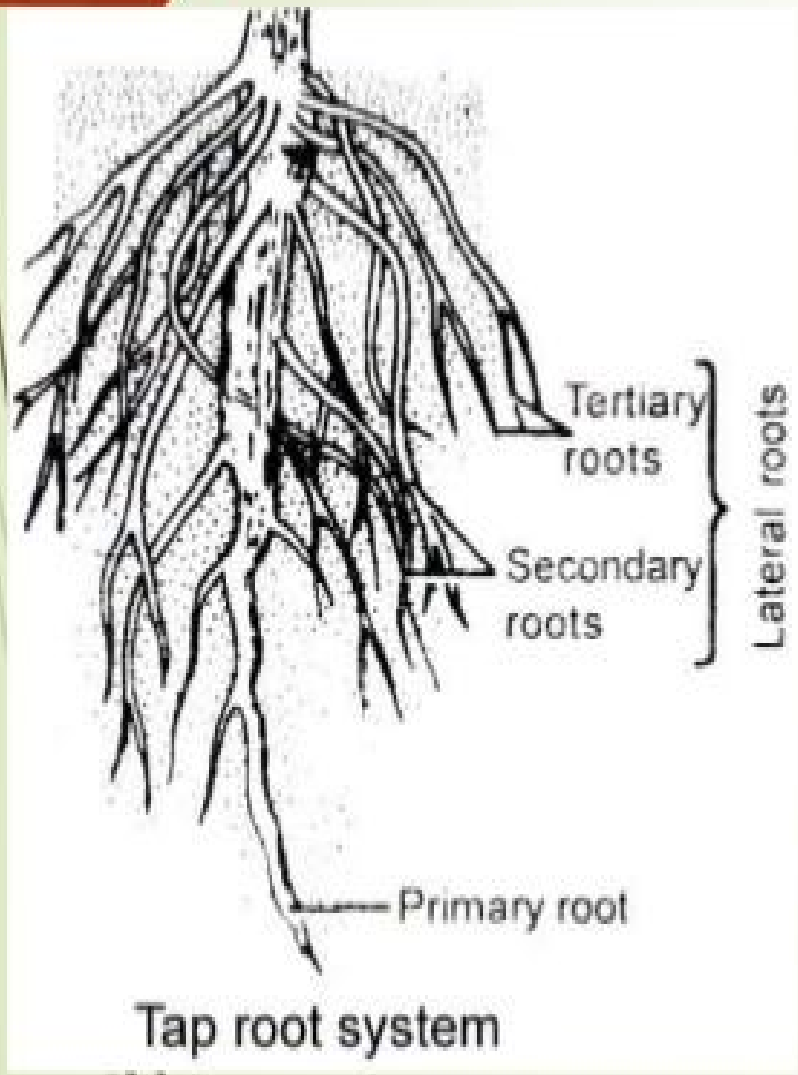



Fig. 5.24. Tap and adventitious root systems.

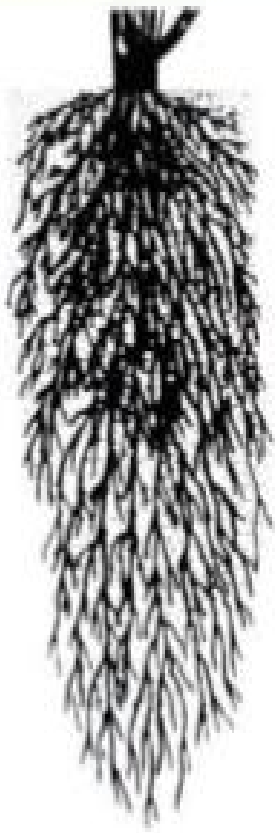
**Adventitious Root**

1. Storage of food
2. Support
3. Special functions




## Tap Roots or True Roots:

- It develops from radicle and made up of one main and other sub branches.
- The primary roots and its branches constitute tap root system. e.g. Dicot roots
- Presence of a tap root system is a characteristic feature **dicotyledonous** plants. The **tap** root normally grows **vertically** downwards to a lesser or greater depth, while **secondary** and **tertiary** roots grow **obliquely** downwards or some grow horizontally outwards.
- All lateral branches are produced in **acropetal** i.e., the older and longer branches are near the base the younger and shorter ones are near the apex of the main root.



Adventitious root
Fibrous root system

**Adventitious roots :**

- In some plants, after sometime of the growth of tap root which arises from radicle, stops and then roots, develop from other part of plant, which are branched or unbranched, fibrous or storage, are known as adventitious roots and constitute fibrous root system. e.g. Monocot roots.

## Modified tap root for storage :

- **Fusiform roots :** These root are thicker in the middle and tappered on both ends. In this type of roots both hypocotyl root help in storage of food. **eg. Radish**.
- **Conical roots :** These roots are thicker at their upper side and tapering at basal end. **eg. Carrot.**
- **Napiform :** These roots become swollen and spherical at upper end and tappered like a thread at their lower end. **eg. Turnip (*Brassica rapa*), Sugarbeet**
- **Tuberous root :** Such roots do not have regular shape and get swollen & fleshy at any portion of roots.**eg. Mirabilis.**

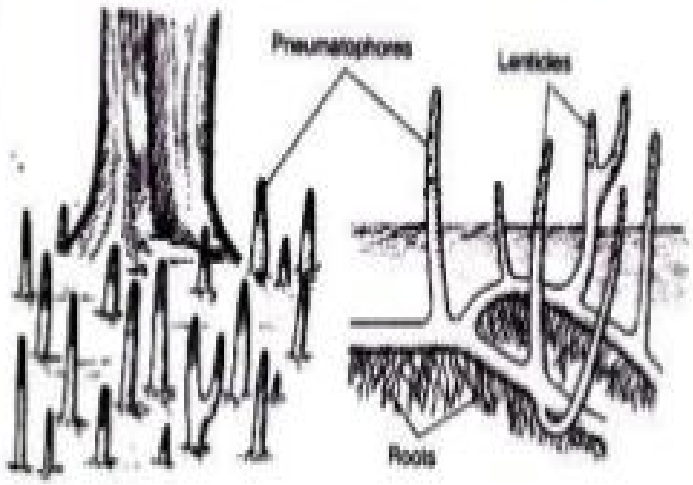



Fig. 10.1. Pneumatophores of mangrove plant.

## Modified tap root for Respiration :

- Halophyte or mangrove grow in oxygen deficient marshy area. Some branches of tap root in these plant grow vertically & comes out from soil in the form of conical spikes.
- These roots are called pneumatophores through which air entered inside the plant. **eg. *Rhizophora, Heritiera, Sonaratia* and other mangrove plant**

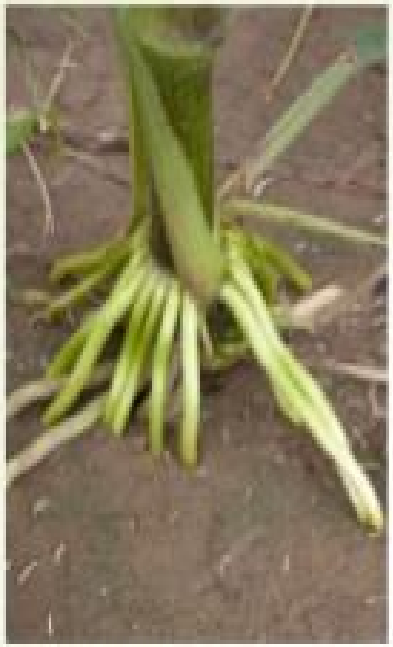
## 1. Modified Adventitious roots for storage :

### 1. SIMPLE TUBEROUS ROOTS:

- These roots become **swollen** and do not assume a definite shape.
- They are always borne **singly**.
- These roots arise from the **nodes** of the stem and enter in the soil. e.g. *sweet potato or shakarkand* (Ipomoea batatas).

### 2.FASCICULATED TUBEROUS ROOTS:

- A **cluster** of adventitious roots of some plants become **thick** and fleshy due to the storage of food.
- These are known as fasciculated tuberous roots, as there are many tuberous roots at the base of the stem. E.g. *Dahlia and Asparagus.*



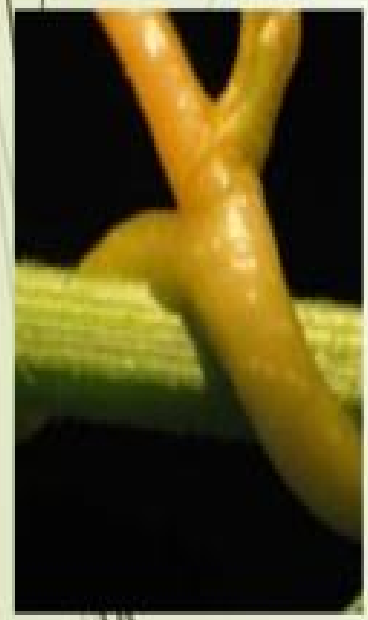

## 2. Modified Adventitious roots for Mechanical Support :

**1. Stilt roots or brace roots :** When root arises from lower nodes and enter in soil obliquely, known as stilt roots **eg. Maize, Sugarcane, *Pandanus* (screwpine)**

**2. Prop root or pillar roots :** when root arises from branches of plant and grows downward towards soil. It function as supporting stem for the plant. **eg. Banyan**.

**3. Butteress root –** Such roots appear from the basal part of stem and spread in different directions in the soil. **eg. *Ficus, Bombax , Terminalia.*** It is a characteristic characteristic feature of tropical rain forest.

**4. Climbing roots –** These roots arise from nodes and helps the plant in climbing. **eg. Money plant (*Pothos*), Betel, Black pepper, *Techoma*.**



## 3. Modified Adventitious roots for Special Functions

1. **Foliar roots or Epiphyllous roots –** When roots arise from leaf they are called as foliar roots. **eg.** ***Bryophyllum, Bignonia.***

2. **Sucking or haustorial roots or Parasitic roots :** In parasitic plant roots enter in the stem of host plant to absorbed nutrition from host. **eg.** ***Dendrophthoe, Cuscuta,***

# FUNCTIONS OF THE ROOT:

## PRIMARY FUNCTIONS

- The normal functions of the roots are fixation **anchorage** of the plant body.
- **absorption** of water and minerals from the soil
- **conduction** of absorbed materials up to the base of the stem.

## SECONDARY FUNCTIONS

- In some plants roots perform certain special functions and such roots undergo necessary modifications. Some roots become fleshy or swollen for the **storage** of food materials e.g. *carrot, radish, asparagus, sweet potato, Dahlia,* etc.
- After becoming green some roots manufacture food by **photosynthesis** e.g. *Tinospora, Trapa, Orchids etc.*
- Some roots help in exchange of gases (**respiration**) e.g. *Rhizopora, Sonneratia* etc.
- In parasitic plants like *Cuscuta,* adventitious roots **penetrate the host stem** to obtain food and water.
- Sometimes roots also take part in **vegetative reproduction** e.g. *Sweet potato.*
- Aerial roots absorb **moisture** from the air e.g. *Orchids.* Thus modified roots perform different functions.


THANK YOU