MORPHOLOGY OF FLOWERING PLANTS

THE ROOT

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Introduction

Definition: Root is non-chlorophyllous and under ground part of plant. It is positive geotropic, positive hydrotropic and Negative phototropic.

The main characters of root are as follows:

(1) Roots usually develop from Radicle of seed.

(2) Roots do not bear nodes and internodes.

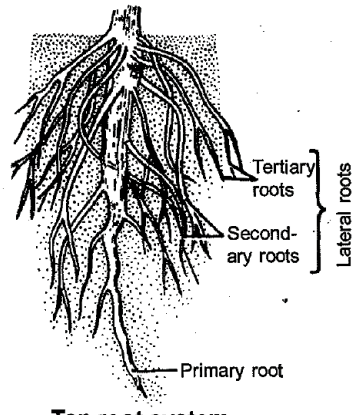
(3) Roots possess unicellular root hairs.

(4) Lateral roots arise endogenously from pericycle.

(5) Roots do not bear buds for vegetative propagation except sweet potato and Indian rose wood.

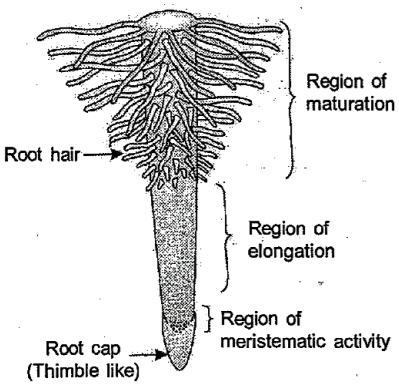
TYPES OF ROOTS

- Tap roots :- In most of the dicot plants, the direct elongation of the radicle leads to the formation of primary root. It bears lateral roots of several orders that are referred to as secondary. tertiary roots. etc. The primary roots and its branches constitute the tap root system. Eg. :- mustard plant
- Adventitious roots :- In some plants, like grass, Monstera and the banyan tree, roots develop from parts of the plant other than the radicle and are known as adventitious roots.
- Fibrous roots :- In monocot plants, the primary root is short lived and is replaced by a large number of roots. These roots originate from the base of the stem and constitute the fibrous root system. Eg. :- wheat plant



Tap root system

Fibrous root system



The regions of the root

Differences between Tap root and Adventitious root		
S.No.	**Tap root**	**Adventitious root**
1	They arise from the radicle of embryo.	They arise from stem as well as leaves.
2	It is single main root.	Many long roots arise in a group.
3	Main root is quite thick as compared to the others.	All the roots are fibrous.
4	Primary root is perennating.	Primary root is short lived.
5	They are always underground.	They may be underground or aerial.
6	Distinction of primary, secondary & tertiary roots is quite conspicuous.	There is no such distinction.

Regions of root:

(i) **Root cap:** It is a smooth cap shaped structure present at the apex of root. It secretes mucilage, which lubricates the passage of root through the soil. In Hydrophytes, root cap is either absent or replaced through root pockets. **e.g. Pistia, Eichhornia.**

(ii) **Region of meristematic activity: The cells of this region are very small, thin-walled and with dense protoplasm. They divide repeatedly.**

(iii) Region of elongation: The cells proximal to this region undergo rapid elongation and enlargement and are responsible for the growth of the root in length.

(iv) Region of Maturation: The cells of the elongation zone gradually differentiate and mature. Root hairs are also present in this zone, which help in absorption of water.

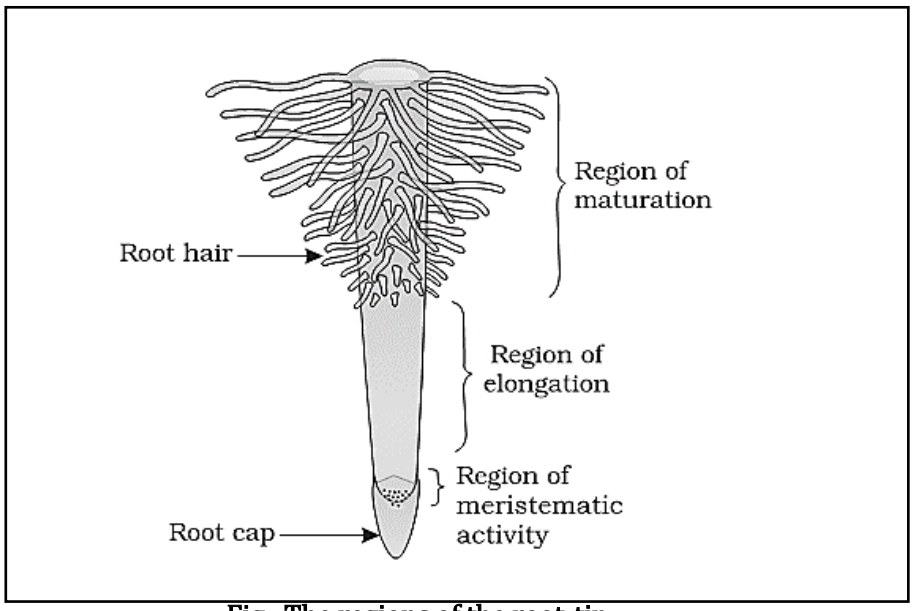


Fig.: The regions of the root-tip

Functions of the root system :-

(i) Absorption of water and minerals,

(ii) provide a proper anchorage to the plant parts,

(iii)storage of reserve food material (Carrot, radish, turnip, sweet potato and Asparagus)

(iv) synthesis of PGR (plant growth regulators).

MODIFICATIONS OF ROOTS:

Modifications of Tap roots:

1. **Fleshy taproot :** They are modified for storage of food.
   (i) **Fusiform :** It is thickest at middle and spindle shaped. **e.g. Radish.**
   (ii) **Conical :** It is cone shaped. It is thickest at the base and gradually tapering at the apex. **e.g. Carrot**.

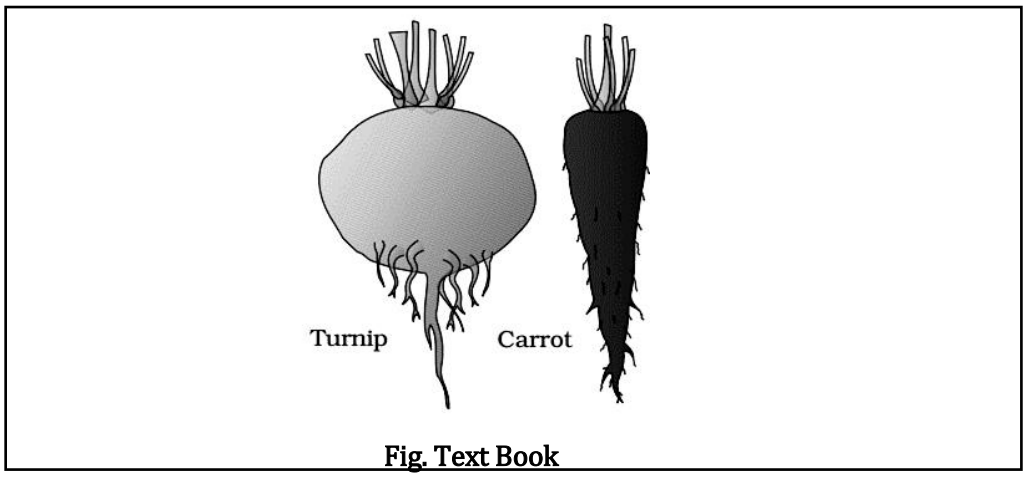


Fig. Text Book

(iii) **Napiform:** It is quite thick at the base and abruptly tapering at the apex. **e.g. Turnip and beet root.**

(iv) **Tuberous:** They are swollen taproots and do not possess any definite shape **e.g. Mirabilis jalapa.**

2. **Nodulated roots:**

- These are found in the plants of sub-family Papilionaceae.
- The secondary, tertiary roots and sometimes the primary root develop numerous small or large irregular swellings called root nodules.
- The latter contains symbiotic nitrogen fixing bacteria Rhizobium. **e.g. Pea, groundnut and soyabean.**

3. Reproductive Roots:

- Adventitious buds develop at some taproots or their branches that help in vegetative reproduction **e.g. Dalbergia, Populus.**

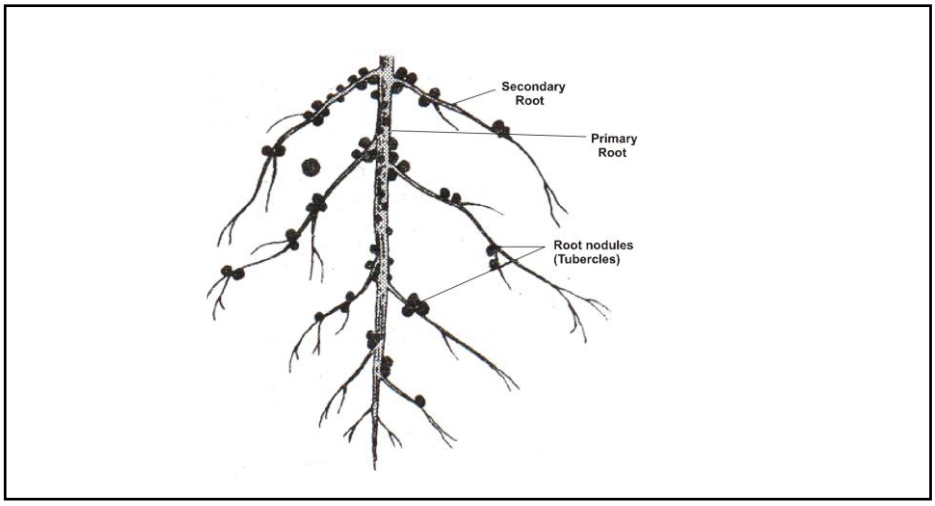


Fig. Nodulated root of alegume.

4. Pneumatophore or Respiratory roots:

- These are found in plants growing in mangroves or saline swamps near of the seashore. **e.g. Rhizophora, Sonerattia, Avicennia.**

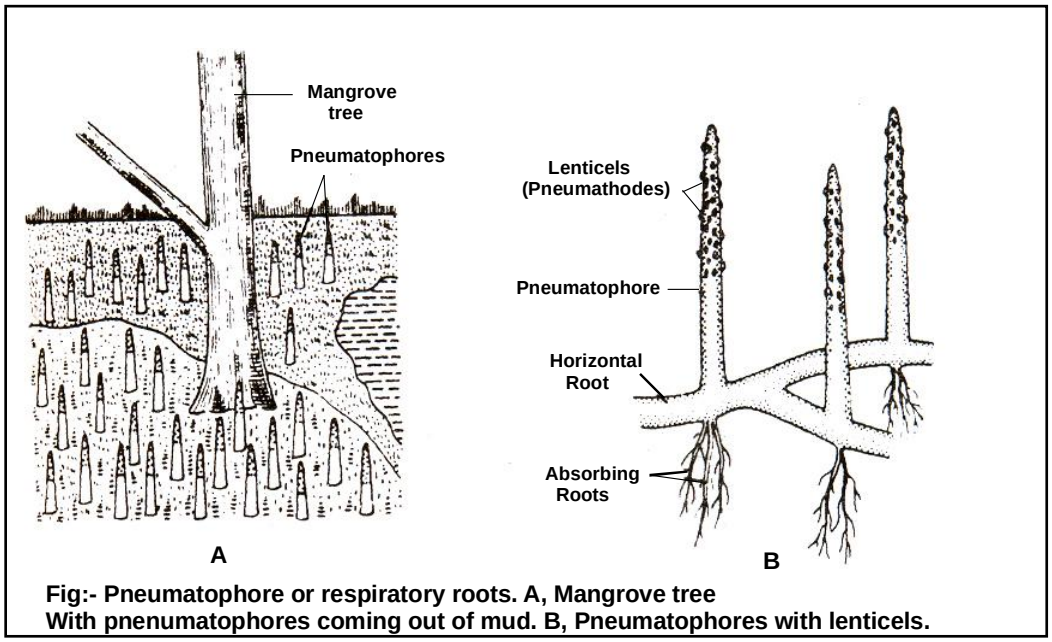
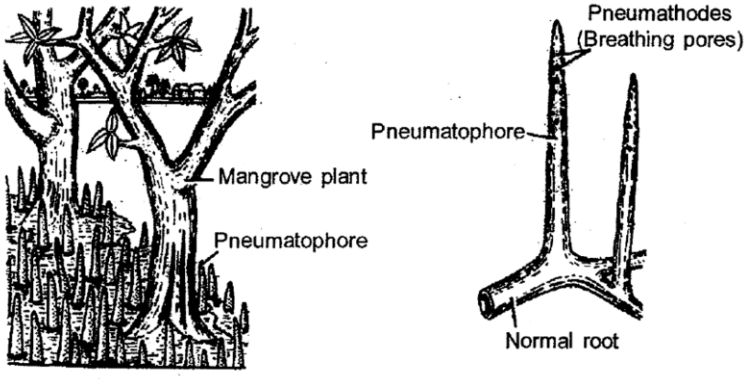


Fig:- Pneumatophore or respiratory roots. A, Mangrove tree With pnenumatophores coming out of mud. B, Pneumatophores with lenticels.

Tap root modified for respiration: In marshy/swampy areas, scarcity of oxygen is found. Some branches of tap root of the plants which grow in this region, grow vertically upward and comes on the surface. These roots are called pneumatophores which have minute pores called pneumathodes or lenticels by which air enters in the plant and plant gets oxygen for respiration Pneumatophores are negatively geotropic

E.g. Rhizophora, Heritiera, (Mangrove plants)



Respiratory roots (Pneumatophores) of Rhizophora

Modification of adventitious roots :

(i) **Fasciculated roots -** These are adventitious roots occuring in clusters and all of them are swollen.
Eg. Asparagus, dahlia

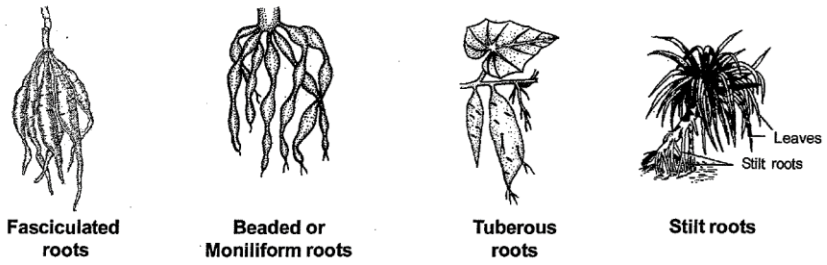
(ii) **Beaded or moniliform roots -** Root swells up like a bead at different places after a regular interval.
Eg. Vitis(grapes), Momordica (bitter gourd), Portulaca.

(iii) **Tuberous adventitious roots :** The food is stored in these roots, therefore they become swollen and irregular. These roots have no definite shape

Eg. Sweet potato (Ipomoea batatus)

(iv) **Stilt roots or brace roots -** These roots arise from lower node and enter in the soil. These roots are supporting roots.

Eg. Maize, sugarcane, Pandanus (screwpine).



Fasciculated roots | Beaded or Moniliform roots | Tuberous roots | Stilt roots

(v) Prop roots or pillar roots - These hanging roots arise from branches of plant and grow downward towards the soil. These roots support the tree.

Eg. Banyan (Ficus bengalensis)

(vi) Climbing roots - These roots arise from nodes and help in climbing

Eg. Money plant (Pothos), Monstera, betel (Piper betel}, black pepper.

(vii) Foliar roots or Epiphyllous roots :- When roots arise from leaf then they are called foliar roots.

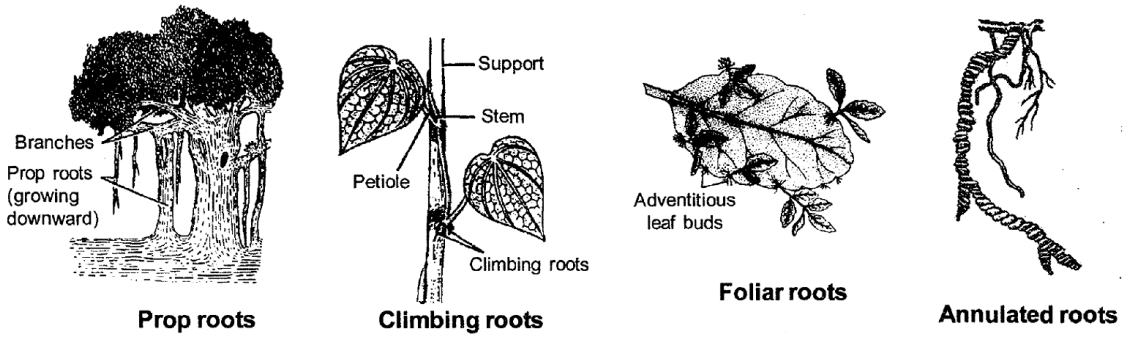
Eg. Bryophyllum, Begonia.

(viii) Sucking roots or Haustorial roots or Parasitic roots :- In parasitic plants, roots enter in the host plant to absorb nutrition from the host.

Eg. Dendrophthoe, Cuscuta, Viscum.

(ix) Annulated roots: In these roots swelling occurs in a series of rings on the roots.

Eg. Ipecac.



Prop roots | Climbing roots | Foliar roots | Annulated roots