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STUDY OF DIFFERENT TYPES OF PLANT ROOT ACCORDING TO THEIR FUNCTION : A REVIEW

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ABSTRACT

There are numerous plants present on the earth. The plant kingdom is composed of a numerous plants of different kind and forms which are growing in greater or less abundance over most of the surface of earth. The study of angiospermic plants is based on deep knowledge of external characteristics of plants. To know the natural resources of the earth one requires vast understanding of plants. The root is the soil borne part of the axis develops into root system. The root develops from radicle. It grows in absence of light. The root consists of main axis and tap root. The lateral branched of tap root are termed as secondary roots. The secondary roots further give rise to lateral branches which are termed as tertiary roots. There is great variation shape size and function of plant roots. The types of roots were collected and described in taxonomic language. The plant roots are sorted according to their functions.

In this study 28 types of roots grouped according to their function are described in detail.

KEYWORDS : Plant roots types, Root functions.

RESEARCH PAPER

INTRODUCTION

The root is the descending part of the plant axis, which is positively geotropic hence grow down ward into the soil. The root is the soil borne part of the axis develops into root system. The root develops from radicle. It grows in absence of light. The root consists of main axis and tap root. The lateral branched of tap root are termed as secondary roots. The secondary roots further give rise to lateral branches which are termed as tertiary roots. There is no difference between secondary and tertiary branches of root except their size. The root helps in absorption of water and inorganic nutrients from the soil. The tip of root consists of a pad of meristematic tissue which is termed as apical meristem.

The study of morphology of root is one of the very important in identification of plants.

MATERIAL AND METHOD

There is great variation shape size and function of plant roots. The types of roots were collected and described in taxonomic language. The plant roots are sorted according to their functions. Different types of plants roots are collected which are listed according to function for further study.

LIST OF PLANT ROOTS OBSERVED

Types of roots observed and grouped according to their function are as follow:

- Pnematophore or respiratory roots
- Adventitious root (Nodal root)
- Contractile or pull roots
- Parasitic roots (Haustorial root)
- Food storage roots
- Water storage roots
- Buttress roots (Tubular root)
- Stranglers or Prop roots or Stilt roots
- Foliar root or epiphyllous root
- Propagative roots
- Shallow roots
- Mycorrhizae
- Coarse roots
- Proteoid roots (Cluster Roots)
- Fine roots
- Hygroscopic or Epiphytic roots (Aerial root)
- Nodulose root
- Nodular roots or bacterial nodules
- Haptera or hold fast
- Fasciculated root
- Moniliform or Beaded root
- Assimilatory roots
- Sucking root
- Respiratory root

- Surface roots
- Annulated root
- Coralloid roots
- Rootless plants

- **Pnematophore or respiratory roots:** Te roots of trees and shrubs which grow in marshy places suffer from lack of oxygen. In such plants the branches of root grow vertically above the ground. The plants which grow in salty water close to seashore do not get enough oxygen such plant produce roots which are negatively geotrophic. A large number of such types of roots grow around the plant. They are large in numbers which are known as pnematophore. There are many pores occur on surface of pnematophore. The pore is the natural openings which are termed as lenticels. The lenticels used for exchange of gases. Hence these roots are also termed as respiratory roots. The roots are externally protected by a thick corky layer. Even the apex is covered with cork layer. The pnematophore originated from the horizontal branches of plant root.
- **Adventitious root (Nodal root):** These are the supporting roots which are not used for absorption of water and mineral. These are originated from the lower nodal region of the plants which is just above the soil surface .Exm : Jowar
- **Contractile or pull roots:** The roots that possess spiral thickenings on the surface. It resembles a corkscrew. These are the special type of roots that contract or swell to maintain the proper shape of the underground parts at the proper level inside the soil region. Such roots develop from the bulbous part of plants. These are thicker, short sized roots.
- **Parasitic roots (Haustorial root or sucking):** The sucking roots are also termed as haustorial roots. Certain angiosperms are deficient of minerals or water, such plants absorb mineral and water from the host plant. Such semi parasites which grow on root system of higher plants and absorb minerals and water by penetrating sucking root in to the host cells such types of roots termed as sucking roots or haustorial roots. These are modified for absorption of food. Exm : *Loranthus* (Semi parasite). There are certain angiospermic plants which are parasitic on flowering plants are called as angiospermic parasites, there parasitic plants usually grow on the root system of host plant and by penetration of haustoria absorb food material as per its requirements. The

roots which are produced by a parasitic plant for absorption of food from the host are termed as sucking roots. The sucking roots are also termed as haustoria. The haustoria make connection with vascular tissue of the host plant. Example: *Loraanthus.*

- **Food storage root:** In some plants especially all the root vegetable consists of thick roots. The food storage root made up of huge mass of parenchymatous cells used for storage of food. Exm: Carrot, Radish, all root vegetables.
- **Water storage root:** Most of the members of cucurbitaceae family produce root containing excess of water than their weight. The growing regions retain water for longer duration.
- **Buttress roots (Tubular roots):** These roots grow horizontally and that gives support to the plant. These are large, cylindrical and thick. These are produced from the basal region of trunks of *Ficus bengalensis*.
- **Stranglers or Prop roots or Stilt roots:** Actual the prop roots are the aerial roots. These are produced from the branches of trees which gives vast mechanical support to the plant. Exm: *Fucus bengalensis.* These are also called as shallow roots or stranglers.
- **Foliar roots or Epiphyllous root:** In certain plant like *Bryophyllum*, the leaf is the structure of vegetative propagation. At maturity the margin of leaf produces very small delicate roots at the marginal region and then a small adult plant is developed. Such adult plants are detached from the parental plant and develop into a new daughter plant. During development of such seed plant the roots are produced at the marginal region of leaf that is termed as foliar roots.
- **Propagative or reproductive roots:** The root systems of plant produce adventitious buds and serve as organ of reproduction. The example is Potato (buds found in axils of scales on tubers). The buds can regenerate into new shoots. Such roots are called propagative or reproductive roots. Planting in many garden plants is done by using reproductive roots. Potato and many grasses are propagated by root cuttings.
- **Shallow root:** It is a type of root which absorbs water from atmospheric moisture or rainfall or irrigation water for utilization of plant. There are many evergreen broad leaved plant and certain shrubs of deciduous habit possesses this type of root system. Exm: Aloe vera

- **Mycorrhizae:** In many plants the numerous branches of fungal hyphae envelope the main root and resemble root hairs called mycorrhiza. The relation of actual root and fungal hyphae is symbiotic. The Mycorrhizae absorb mineral for plant. These are also called fungal roots. The fungus may be ecto or endotrophic. The mycorrhizal plants often fail to grow in the absence of mycorrhizal fungi.
- **Coarse roots:** These roots show secondary thickenings and turn woody. It grows deep in soil for absorption of water and minerals.
- **Proteoid roots or Cluster roots:** As in Asparagus the roots divided into many rootlets which form a cluster.
- **Fine roots:** These are very small primary roots which absorb water & minerals. These roots are short lived. The main root system of dicot plant is a tap root system. The fine roots are developed on the surface of tap root to increase area of absorption.

  The fine roots are usually 2 mm in diameter that have the function of water and nutrient uptake. They are often heavily branched and support mycorrhiza. These roots may be short lived, but are replaced by the plant in an ongoing process of root 'turnover'.
- **Hygroscopic or Epiphytic roots (Aerial root)**: The hygroscopic roots have ability to absorb atmospheric moisture for its parental plant. Such water loving roots one called as hygroscopic roots exm. The roots which grow above soil surface are termed as aerial roots. These are supporting roots. The plants grow on branches of large trees produce aerial roots. The hygroscopic roots are very sensitive to water that readily absorbs moisture. These roots absorb water from air. Eq. : orchids
- **Nodulose root:** The root which are thicker at the end are termed nodulose root. These roots are swollen near the apex hence these are called as nodulose roots. eq. Turmeric, Mango, ginger.
- **Nodular roots or bacterial nodules:** The nodules develop on the roots of papilionaceous plants due to infection of nitrogen fixing bacteria. The roots consisting of nodules are termed as nodulose root. The nodules are caused due to entry of certain nitrogen fixing bacteria which is a soil borne bacterium. It penetrates the cortex of root through the root hairs.
- **Haptera or hold fast:** These roots are branched thalloid roots which grow and penetrate the rock to fix the plant.

- **Fasciculated root:** It in a modification of adventitious root. The roots are developed in a cluster at the basal region of stem. It is a cluster of tuberous roots. These types of roots are termed as fasciculated roots. These are thick, tuberous helps in storage of food, Exm. *Asparagus, Dahlia*
- **Moniliform or beaded root:** At a certain interval, the root show swelling, it appears like a beaded chain hence these are called as beaded roots. Exm: *Monordica sp.*
- **Assimilatory roots:** These are the adventitious roots in certain plants consists of chlorophyll in the epidermal layer, hence in presence of light photosynthesis occurs in it. Such types of roots are green in colour. These roots are termed as assimilatory roots. Exm. *Tinospora cordifolia.*
- **Respiratory roots:** The branches of certain aquatic plants produce some roots which are spongy, light in weight, soft & colorless. The roots mostly develop above water surface and store air. These roots are termed as respiratory roots. These are also useful in floating of parental plant.
- **Surface roots**: These proliferate close below the soil surface, exploiting water and easily available nutrients. Where conditions are close to optimum in the surface layers of soil, the growth of surface roots is encouraged and they commonly become the dominant roots.
- **Annulated root:** The root shows several rings like thickening on root surface. The ring like region is slightly raised. The example is Cinchona.
- **Coralloid roots:** These are profusely branched coral shaped roots. They are typically dichotomous. These roots show apogeotropic type of growth. These roots consist of endophytic algae like Nostoc, Anabaena so that perform the function of photosynthesis.

ROOT FOR STORAGE OF FOOD


Napiform root


Fusiform root


Tuberous root


Conical root

TYPES OF ROOT ACCORDING TO FUNCTION


Food storage root


Butress roots


Propagative roots


Stranglers or Prop roots or Stilt roots

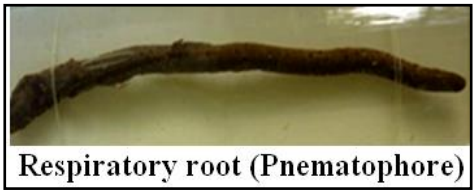

Proteoid roots or Cluster roots


Hygroscopic root or Epiphytic roots


Adventitious root


Shallow root


Stilt root


Respiratory root (Pnematophore)

Result: To perform such a specific function the roots are modified. The types of root modification are observed on the basis of size, shape & their function. The plants which grow near sea water do not get enough oxygen such plant produce roots which are negatively geotrophic which are known as pnematophore. There are many pores occur on surface of pnematophore. The pore is the natural openings which are termed as lenticels. The lenticels used for exchange of gases. The carrot, radishes are roots modified for storage of food. The hydrophytic roots of orchids made for absorption of aerial water. About 27 types of roots are described according to their function.

Conclusion: The roots are modified in certain plants to perform a specific function besides its normal function. The modification is a change in structure due to change in function. The main function of root is to fix the plant in soil and absorb water and minerals from the soil and transfer it to all parts of the plant. The roots also store food, in certain plants roots helps in respiration, reproduction etc. The tap root gets modified for storage of food. The main root becomes fleshier and the secondary roots remain small and thin. The swollen food storing root acquires a typical shape hence the types of food storing roots made on the basis of their shape.

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