Subject : Botany stage : one class : C

college of science / biology department

Lec. 5

External plant parts

Plant organs: it represents the external plant structures like leaves, stems, roots, flowers, fruits and seeds. Each organ is an organized group of tissues that work together to perform a specific function.

**plant organs divide into two groups:

1-sexual reproductive

2-vegetative

**sexual reproductive: it produces seed, they include flower buds, flowers, fruit and seeds.

vegetative parts: it include roots, stems, shoots, nodes, buds and leaves, they are not directly involved in sexual reproduction. And they are often used in **asexual forms of reproduction.

**kinds of asexual reproduction forms in plants:

1-cutting 2-budding 3-grafting

The Root Structure

Young roots reveals four regions of develops, three of them are not sharply defined and it extent varies considerably depending on the species involved.

The function of roots:

1-anchor the plant into the soil.

2- Prevent soil degradation.

3- Absorb water and minerals from soil.

4- storage, the roots serve as storage organs for water and carbohydrates.

5- specialized roots have other functions such as photosynthesis, aerating, etc.

*****Root regions:**

1-Root cap

2-the region of cell division

3-the region of elongation

4-the region of maturation

*****Root cap:** it composed of a thimble-shaped mass of parenchyma cells covering the tip of each root. (Root cap is absent in stems)

**the function of root cap:

1-protect the root delicate tissue behind the cap from damage as the young root tip pushes through the soil.

2-the dictyosomes of the root caps outer cells secret and release a slimy substance that lodges in the walls and eventually passes to the outside.

3-the cells, which are replaced from the inside constantly slough off forming a slimy lubricant that facilitates the root tips movement through the soil. And this mucilaginous lubricant also provides a medium favorable to the growth of beneficial bacteria that add to the nitrogen supplies available to the plant.

****region of cell division:** it composed of an apical meristem in the center of the root tip which produce the surrounding root cap (most of cell divisions take place next to the root cap at the edges. And behind the base of the meristem the cells here divides every 12 to 30 h. while at the base of the meristem the cells divides only ones in every 200-500 h.

****the region of cell division:** the cells in this region is characterized :

1-cells are cubical shaped.

2-the cells are relatively large, more or less centrally located nuclei.

3-the cells have few small vacuoles.

***the apical meristem in both root and stem is subdivided into three meristematic areas:

1-Protoderm: give rise to an outer layer of cells(epiderm).

2-ground meristem: it's to the inside of protoderm, it produces parenchyma cells of the cortex.

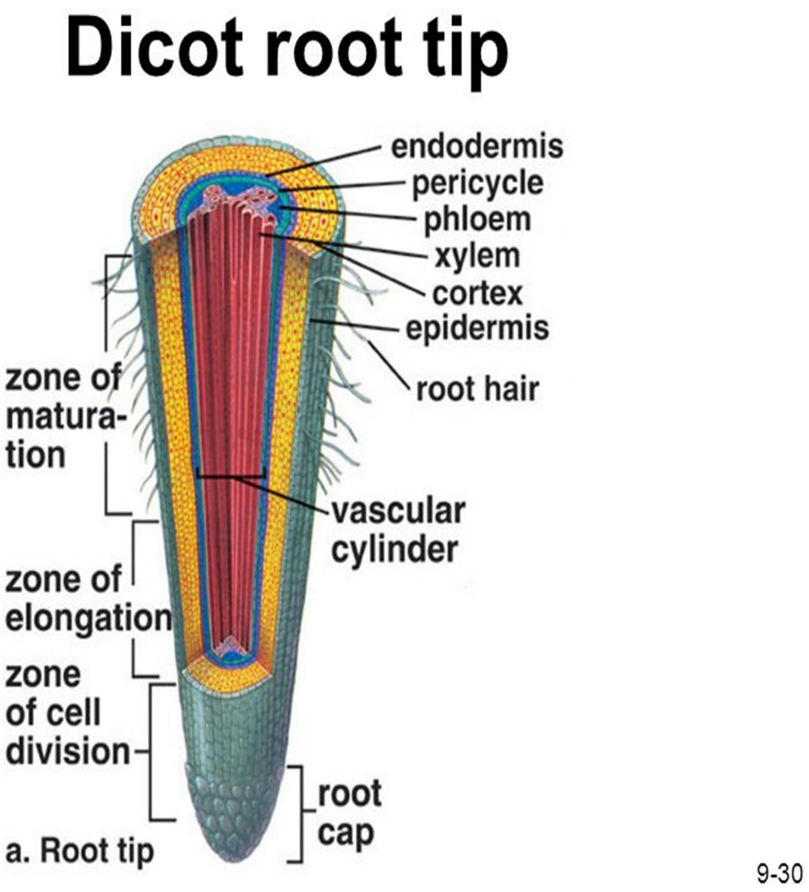
3-procambium: it appears as a solid cylinder in the center of the root, produces primary xylem and primary phloem.

The pith: it's a parenchyma tissue produced by the ground meristem, found in stems but its absent in most dicot roots (monocot and grass root plants have pith).

****the region of elongation:** its merges with the apical meristem, usually extends about 1 centimeter or less from the tip of the root, the cells here become longer and wider.

*****the region of maturation**: (its also region of differentiation or root hair zone) here most of the cells mature and differentiate into distinctive cell types of the primary tissues in this region.

****the root hair that develops from the epidermal cells help absorb water and minerals and adhere tightly to soil particles with the aid of microscopic fibers.



Specialized roots

**most plants produce either: 1- fibrous root system 2- tap root system 3-or commonly combination of the two types above.

** some plants have root modifications that adapt them to perform specific function as well as the absorption of water and minerals.

** Types of specialized roots:

1-food-storage roots: the roots here are enlarged and store starch and carbohydrates, which can be used later for extensive growth(e.g. **sweet potato**).

2- water storage roots: some members of pumpkin family(cucurbitaceae)produce huge water –storage roots in plants that live in arid areas. e.g. ***Cucurbita pepo*** .

3- Propagative roots: many plants produce adventitious buds(buds that appears in places other than stems) along the roots that grow near the surface of the ground, the buds develop into aerial stems called suckers, which have additional rootlets at their bases and the rooted suckers can be separated from the original root and grown individually ,e.g. **tree of heaven** which can produce propagative roots in 10 m length.

4- Pneumatophores: plants grown in water may not have enough oxygen available for normal respiration in their root cells, so they develop special spongy roots, called pneumatophores which extend above the water surface and enhance gas exchange between the atmosphere and the surface of roots, e.g. swamp plant called **black mangrove.**

5- Aerial roots: (velamen roots) of orchid is a type of aerial root which is several cells thick, it aids in absorption of rain water, and also function in preventing loss of moisture from the root.

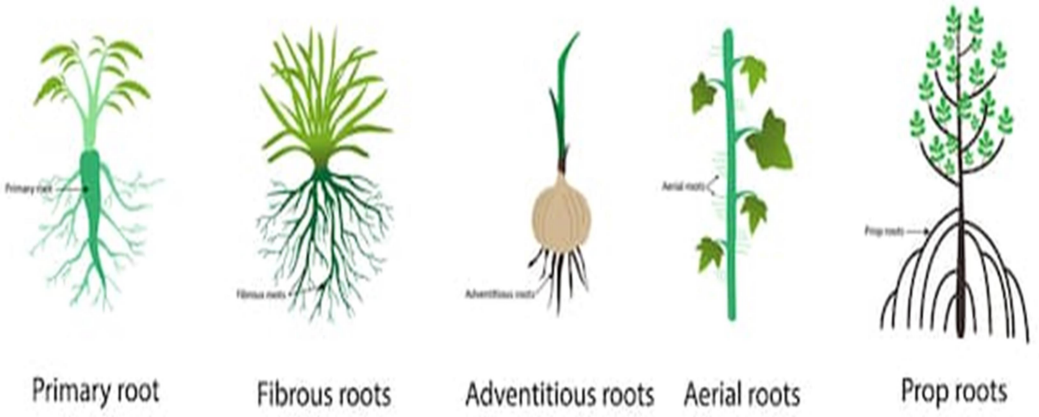
*many tropical figs produce roots that grow down from the branches until they contact the soil, then they continue secondary growth and look like additional trunks.

6- contractile roots: some herbaceous dicot and monocot have contractile roots that pull the plant deeper into the soil, e.g. lily bulb pulled deeper into soil each year until they reach a stable temperature.

7- Buttress roots: some tropical trees growing in shallow soils produce huge, buttress like roots toward the base of the trunk giving them great stability, except for their angular appearance these roots look like a part of the trunk.

8- Parasitic roots: some plants like dodders, broomrapes, have no chlorophyll and have become dependent on chlorophyll-bearing plants for their nutrition. They parasitize their host plant through peglike roots.

Types of root



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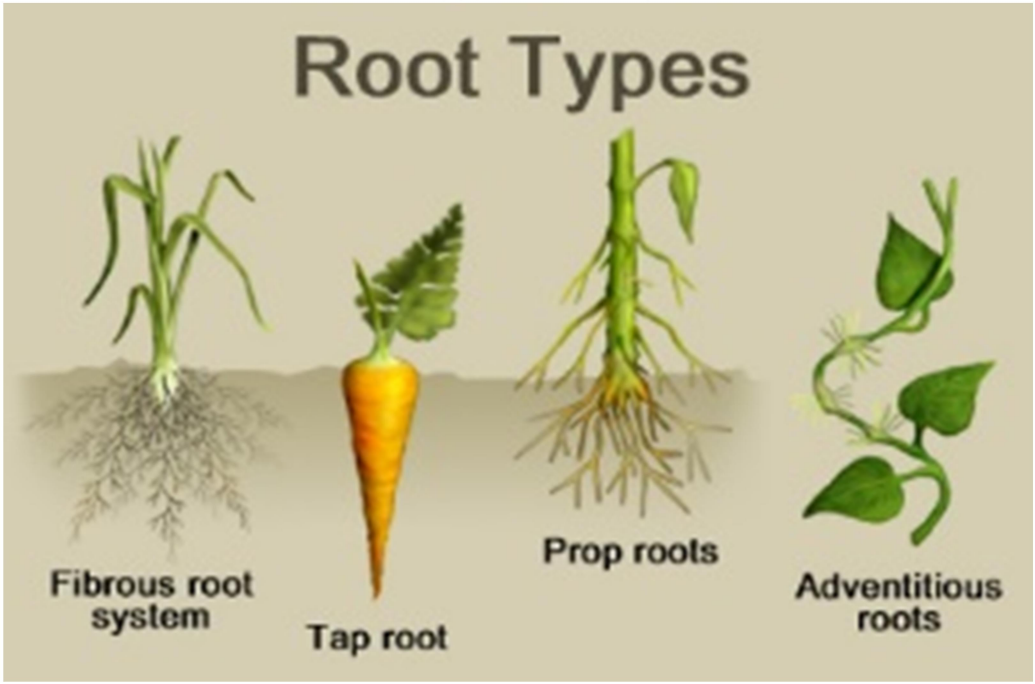

****Mychorrhiza**: more than ¾ of all seed plants have various fungi associated with their roots, the association is mutualistic, that fungus and root benefit from it (mutualism is a form of symbiosis). The fungus is able to absorb and concentrate phosphorus much better than it can be absorbed by the root hairs. These fungus-root (mycorrhiza) are essential to the normal growth development of forest trees and many herbaceous plants.(e.g. orchid seeds will not germinate until mycorrhiza fungi invade their cells).

****root nodules:** almost 80% of our atmosphere consist of nitrogen gas , although plants cannot convert the nitrogen gas to usable form, so a few species of bacteria which produce enzymes that convert nitrogen into nitrate readily absorbed by roots. Members of the Legume family (Fabaceae) e.g. alfalfa, beans could form association with these bacteria resulting in the production of numerous small swellings called root nodules that visible to the eye. The nodules contain large numbers of nitrogen-fixing bacteria called **Rhizobium** bacteria

****soil:** it's a dynamic, complex, constantly changing part of the earth crust which extend from few cm-hundreds of m. deep its important to the existence of all organisms. Soil consist of: sands/ rocks/ pebble/ clay/ dead leaves and twigs / organic matter/ bacteria/ earth worm/ fungi/ air and water.

Rhizobia nodules