TRANSPORT IN PLANTS

Long distance transport occurs through vascular system,. xylem and phloem phloem called translacation through mass flow-
The direction of transiocation may be unidirectional as in ease of water and multidirectional as in minerals and **organic solutes_**

Simple Diffusiori-
■ Movement by diffusion is passive and flows along the concentration gradient through permeable membrane.
• **No energy expenditure takes place_ It occurs in liquid and gases_**
• Rate of diffusion are affected by gradient of concentration, permeability of membrane, temperature and pressure.

Facilitated Diffusion-
* **Lipid sok ble panicles easily pass through cell membrane but** the **hydrophilic solvie$ movement is foci** litated_
▪ For facilitated diffusion, membrane possesses aquaporins or water channels. Acp.raporins are membrane proteins **for passive transport of water soluble substances without utilization of energy_**
di The porins are proteins that forms huge pores In the outer membrane of the plastids, mitochondria etc.

Syrnnort.„ AntipDrt and Uniport-
▪ In **SYMPOIII,** both molecules cross the membrane in the same cli reotion-
• In **Aritipert. both** molecules moves **in opposite direction_**
* **'When** a molecule moves aCrOS5 a membrane independent pf other molecules,. the process **i5 r-Iled**

Active Transport
▪ **Llses energy to pump** molecules against **the concentration gradient. It i$ carried out by membrane proteins_**
di In active transport, movable carrier proteins are called ',Limps.
▪ **The pumps can transport substance from law concentration to high concentration. The carrier proteins are very** specific in what it carries across the 'membrane.

Plant Water Relationship
Terrestrial plants take It of water anti release most **of It in** form **of water vapour by** the process of **transpiration.**
Water Potential (‖.frw). Water potential is determined by solute potential (MN and pressure potential
- 'Water molecules possess kinetic energy. The greater the concentration of water In the system, the grey is **its kinetic energy or water potential_ So pure water has greatest water potential_**
- **Water potential is denoted by Greek symbol Psi (W} and is expressed in pressure unit Pascal (Pa).**
- **'Water pressure of pure water is taken as zero at standard temperature and pressure. A solution has IessE** water potential due to less water concentration.
- The magnitude of lowering of water potential due to dissolution of solute is called solute potential (P)e-**Solute potential is always negative. Mare the solute molecules in the solution lesser the solute potential,_.**
- If **a pressure greater than atmospheric pressure is applied to pure water or solution, its water potential** increases_ Pressure potential is usually positive. Pressure potential is denoted **by (WI***
- Water potential of a cell Is affected w both solute and pressure potential. The relationship is as follows.

kli wwWs+Wp

OSMOSIS is the diffusion of water across a semipermeable membrane. The net direction and rite Of osmosis depends upon the pressure .gradient and ConcentratiOn gradient_ Water will move from On region of higher cOncerbtration tO re ion of lower concentration until equilibrium is reached.

Osmotic potential is the pressure required to prevent water from diffusing_ !Vlore the solute concentration greater 'mill be the pressure required to prevent water from diffusing it.
Numerically osmotic pressure is equal to osmotic potential but sign is apposite. Osmotic pressure is the positive pressure while osmotic potential is negative-
I f the Surrounding. solution balances the osmotic pressure of cytoplasm, the solutiOn is Called haat*.
If the external solution is more dilute than cytoplasm, it is frrpotoirilc. The cells swell up when placed in hypotork solution.
If the external Sodution is more concentrated than ortioplasrn, it is hypertdelic. Cell will shrink in hyperWnric soluticin.

Plasrnolysis is the shrinkage of the cytoplasm of the cell from its cell wall under the influence of hyper tank solution_
r he pfeSStiVe of blagnolysis is usually reversible when the cell is placed In hyootonic solution.
The pressure build up against the wall due to movement of water inside is called torpor pressure_ It is responsible for enlargement and extension growth of cells.

Imbibitioc is a special rime of diffusion when water is absorbed Oy 5QI ill col loids causing them to increase in volume.
For example absorption of water by seeds and dry woods. Imbibition Is also a kind of diffusion because movement of water is from higher concentration to lower concentration.
■Water potential gradient between the absorbent and liquid Imbibed Is essential for imbibition.

- Long distance transport of water in plants takes place by mass or bulk How system_ It is the movement of su bstance in bulk from one point to another as a result of pressure difference between two points,
  The bulk movement of substances through the conducting. or vascular tissue of plants is called Tranclocitlogt.
  Xylem is associated with translocation of water and mineral salts, some organic nitrogen and hormone from roots to aerial parts of plants..
- Phloem transport organic and inorganic solutes from leaves to other part of plants.

Absorption of water by planks

* Water is absorbed along with mineral solutes by roots hairs by diffusion_ The absorbed water passesto deeper layer of by two pathways.
Apoplast pathway and $yrnplast pathway
Alporilast pathway con slsts of nonliving parts of plants body such as cell wall and intercellular spaces ...whereas Syrriplast pathway consists of living parb of plant body such as protoplast connected to plasmodesrrota.

- Most of the water flows in roots via a poplast pathway because cortical cells are loosely packed and offers no reSinaince to water movement.

a The inner boundary of cortex. endodermis Is impervious *to* water due *to* suberized matrix. called Casperian strig)
Water molecules are directed through wail regions that are not suberizecl_
* Water flows through the different layers of roots to reach the xylem tissues as follows.
• A nnycorrhiza is the symbiotic association between a fungus and a ngiosperic roots. The fungal filaments forms 4=1,
network around the young root to have large surface area that 'mineral ions and water from the soil. The fungus
provide minerals and waters and roots in turn provide organic and nitrogen containing compounds.

Ascent of tap Trarktioeatitio of water}

The upward movement of water from maim towards the tips of stem branches and their leaves is called ascent of sap.

Theories of Ascent of Sap

I. Vital force theory was forwarded by J_C.Bose in 1923. This theory believes that the innerrnost cortical cells of the root absorb. water from the cuter s.icla and pump the same into xylem channels.

Root pressure theory was forwarded by Priestley in 1916, Root pressure Is positive pressure that develops In the xylem sap of the root of plants. It can be responsible for pushing up water to small heights in plants_

Loss of water in liquid phase by herbaceous plants from the tips of leaf blades is known as gustation.

X Water rises in tulatiS Of Small diameters, kept in vessels having water due to force of surface tension. Similarly water rises up in the walls of xylem channels clue to adhesion and cohesion. This theory i5 called The of

Tension theory was put forwarded bv Dixon and Joly in Ina. According to this theorrwater 15 mostly pulled due to driving force of transpiration from the leaves. The water molecules remain attached with one another by cohesion force. The water molecule does not breaks in vessels and tracheid due to adhesive force between their walls and water molecules. Ors account of tension crated by transpiration, the water column of plant is pulled up passively from roots to great heights.

Transpiration is the loss of water in form of water Va pow from aerial parts of plants_

Phloem transport; Flow from Source to Sink

Food (sucrose) is transported by phloem form source to sink_ The part of plant that synthe.si.ze the food is called source and part where food is used or stored.

The sou rce and sink can be reversed by the plants depending upon the season or plant's need. So, the direction of movement in the phloem is bi-directional.

> Phloem sap is mainly water and sucrose taut other sugars., hormones and amino acids are also translicated through it_

Pressure Prow or MassIlow hypothesis

- It is the most accepted theory for the translocation of sugar from source to sink. Glucose is prepared at cfci source by photosynthesis which is converted into disaccha rides sucrose Sucrose moves into cornpaniorE cells and then into sieve tube cells by active transport-

Loading of phloem at source creates a water potential gradient that facilitate the mass movement in theE CD phloem.

.P Sieve tube cells of phloem 153VrVB a long column with holes in their wall called sire plates. Cytoplasmic rzi., wands. pa54 through the whole i n the sieve plates Do form conti nuous filament Hydrostatic pressu re developed in siege tube cells moves the sap in the phloem, g, ci) ci)

At sink incoming sugar is actively moved out of the phloem as com plex carbohydrates_ The loss of solute pnaduc high water potential in the phloem and water passes out and returning into xylem.