**Dr. Rima Kumari: Date: 08/09/2020**

Online class and e- content for BSc IIIrd year students

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| Date and Time | Online class medium  | E. content topic |
| 08/09/202001:00 p.m to 1.50 p.m | Via Google meetLink: Meeting URL: https://meet.google.com/dep-dpjt-fhx | **Plant Movement (contd.)** |

1. **Phototropism (Heliotropism):** When a plant organ curves due to unilateral light stimulus it is called phototropism. Some parts of the plant e.g., stem moves towards light. These organs are called positively phototropic. Some other organs e.g., roots move away from light and they are called negatively phototropic. If we keep a plant in a dark chamber (Heliotropic chamber) with an opening on one lateral side the stem tip moves towards light i.e., towards opening. Phototropism of stem and root are due to differential hormonal effect. Violet blue light is most effective. Photoreceptor seems to be a carotenoid. Young stems are positively phototropic, leaves diaphototropic,
2. shoots of Ivy plagio-phototropic, roots either non phototropic or negatively phototropic (e.g., white mustard, Sunflower). Mechanism is believed to be Cholodny-Went theory which states that unilateral light produces more auxin (IAA) and hence more growth on the shaded side resulting in bending.

(ii) **Geotropism** (Gravitropism) : Growth of movements induced by the stimulus of gravity are known as geotropism. Generally, the primary root grows towards the force of gravity and hence is positively geotropic. The stem coloptile and pneumatophores grows away from the force of gravity and is negatively geotropic. The secondary roots and stem branches arise at angle less than 90o. They are thus plageotropic. Certain undergorund stems such as rhizomes, stolons of potato are oriented at right angle to the direction of force gravity and are called diageotropic. Some of the lateral organs (e.g., coralloid roots of Cycas) possess little or no geotropic sensitivity, they are called ageotropic.

If some seedlings are kept in a dark chamber in different directions, root always move downwards and shoot away from the gravitational force. According to Cholodny-Went theory there is more auxin on the lower side of both stems and roots. In stem higher auxin concentration increases growth while in roots it inhibits growth. Therefore, stem grow more on the lower side while roots grow more on the upper side causing the stem to bend upwardly and roots to bend downwardly. Another theory is statolith theory which states that perceptive regions contain statoliths (microscopic particles). Change in their position causes irritation and hence differential growth. Clinostat / Klinostal is a instrument which can eliminate the effect of gravity and allow a plant to grow horizontly by slowly rotating it.

The main axis of which is attached to a rod. On the top of the rod is attached a flower pot. The clinostat is kept in a horizontal position. When the clock axis rotates the flower pot also rotates. As a result of this the plant grows horizontally as the effect of gravity is nullified by clinostat. If the clock of the clinostat is stopped the rotation of the plant stops, the shoot apex moves upward (negative geotropism) and the root apex moves downwards (positive geotropism).

(iii) **Hydrotropism** : Growth movements in response to external stimulus of water are termed as hydrotropism. Roots are positively hydrotropic (i.e., bend towards the source of water).

Stem are either indifferent or negatively hydrotropic. Positive hydrotropic movement of the roots is stronger than their geotropic response. In case of shortage of water, roots bend towards the sewage pipes and other sources of water in disregard to the stimulus of gravity.

(iv) **Thigmotropism** (Haptatropism) : The movement which are due to contact with a foreign body. It is most conspicuous in tendrils which coil around support and help the plant in climbing. e.g., Tendrils of cucurbitaceae, petiole of clematis, leaf apex of Gloriosa.

(v) **Chemotropism** : When a curvature takes place in response to a chemical stimulus. The growth of pollen tube through stigma and style towards the embryo sac occurs with the stimulus of chemical substances present in the carpel or movement of fungal hyphae towards sugars and peptones.

(vi) **Thermotropism** : Curvature of plant parts towards normal temperatures from very high or very low temperatures. e.g., peduncles of Tulip, Anemone.

**Variation movements (Turgor movements)** : These movements are caused by turgor changes especially due to efflux and influx of K+ ions. (swelling or shrinkage of living cells due to change in osmotic potential) and are reversible. Variation movements are further divided into two types :

**(1) Autonomic variation movement** : These movement of variation, which occurs without the external stimulus. Rhythmic autonomic turgor changes produce jerky rising and falling of two lateral leaflets in Indian Telegraph plant (Desmodium gyrans). Here, large thin walled motor cells found at the leaflet bases regularly lose and gain water bringing about changes in turgor pressure.

Motor (Bulliform) cells present in the epidermal cells of some grasses cause their folding and unfolding movements (hydronasty).

(2) **Paratonic variation movement** (Nastic movements): These movements of variation are determined by some external stimuli such as light, temperature or contact but the direction of response is prefixed (not determined by the direction of stimuli). Nastic movements are of the following types :

(i) **Nyctinastic** (sleeping) movements : The diurnal (changes in day and night) movements of leaves and flowers of some species which take up sleeping position at night are called nyctinastic movement. Depending upon the stimulus they may be photonastic (light stimulus) or thermonastic (temperature stimulus). Maranta (Prayer plant), an ornamental house plant provides most common examples of nyctinastic response.

(ii) **Photonastic movements** : Leaves of Oxalis take up horizontal position in sunlight and droop down during night. Many flowers open during the day and close during night or cloudy sky e.g., Oxalis.

(iii) **Thermonastic** movements : Flowers of tulips and crocus open during high temperatures and close down during low temperatures.

(iv) **Thigmonastic** (Haptonastic) movements : When marginal glandular hair of Drosera come in contact with some foreign body e.g., body of insect, they show haptonastic movements. Due to this the insect comes in contact with the central glandular hair which after being stimulated bring the marginal glandular hair on the body of insect. These later movements are chemotropic whereas the previous movements of marginal glandular hair is chemonastic movement Drosera shows both nyctinasty and thigmonasty movements.

(v**) Seismonastic movements** : This type of movement is brought about in response to external stimulus of shock or touch. The best example of seismonastic movement is the leaves of sensitive plant Mimosa pudica (Touch me not). It shows both nyctinastic (Sleeping movement) and seismonastic movement (shock movements).