

## Unit-IV-Plant Growth and Development

### Synopsis

- Plant growth is an irreversible change in the body of the plant over a period of time.
- Plant growth can be studied under vegetative growth and reproductive growth. In contrast to growth differentiation is establishment of localized differences in structural organization (due to hormones). Development encompasses the activities resulting from growth and differentiation.
- Environment influences the growth and development patterns.
- Growth curves of plants are in 's' shape showing the first period the lag phase, the exponential growth phase called log phase, the period of reduced size after log phase called senescence phase.
- Factors like temperature, light, hormones affect the growth and development of the plant.
- Plant hormones are different from animal hormones. The concept of hormones of animals is a total failure in explaining the plant hormones.
- Plant hormones are referred as growth regulators –as some of them promote (auxin, gibberellins, cytokinin) and some retard (ethylene, abscisic acid).
- Auxins are chemical substances that promote curvature in the *Avena* coleoptiles. F.W.Went developed the bioassay for this group of chemicals.
- They are synthesized in the plants in the apical regions and move basipetally. Acropetal movement is very low. (3:1). they are synthesized from amino acid Tryptophan. Microelement zinc is essential for the synthesis.
- Indole-3-acetic acid (IAA), Phenyle acetic acid (PAA), 4-chloro indole acetic acids are natural auxins. Active centre is indole ring. By substituting the side chain synthetic auxins are synthesized (Indole butyric acid, Naphthalene acetic acid, 2,4-dichlorophenoxy acetic acid, 2,4,5 trichlorophenoxy acetic acids). Most of them are highly toxic to human life.
- Major physiological effects of auxins are- cell elongation, Root initiation in low concentrations, tropic movements (Cholodny-Went theory), Apical dominance (Thimann and Skoog explanation).
- Parthenocarpy is promoted in some plants. Female flowers are increased in Cucurbits.
- Auxins are destroyed in the sun light and by IAA oxydase.
- In agriculture they are used in promotion of root growth (NAA) and as weedicides (2, 4 D & 2, 4, 5 T). In developing parthenocarpic fruits also it is utilized.

- Gibberellins were discovered, isolated and characterized from 'bakane' (Foolish seedling disease) diseased paddy plants.
- Sawada discovered the fungus *Gibberella fujikuroi* as the causative agent. Kurasawa, Yabuta and Sumukhi isolated and characterized.
- These are 19 or 20 carbon diterpenes. Synthesized in apical tissues. Many gibberellins were isolated from plants (more than 100)
- Major physiological effects are—Removal of genetic dwarfism, Seed germination (of cereal grains), Bolting and flowering, Parthenocarpy (in stone fruits).
- Male flowers are found to be increased in *Cucurbits* and *Cannabis*.
- During germination of seeds gibberellins help in the activation of enzymes present in aleurone layer.
- Bolting found to occur in rosette plants.
- Gibberellins are used in agriculture in producing seedless grapes. Sweetness of grapes are increased.
- Gibberellic acid is generally referred as 'flowering hormone'
- Cytokinins are aminopurines synthesized in mostly in roots and transported to apical regions.
- They help in cell division. Delay in senescence by acting on pigments is another major activity. They act on potassium concentration in guard cell and open stomata.
- They are extensively used in tissue culture and increasing shelf-life period of leafy vegetable.
- Abscisic acid is a 15 carbon terpenoid.
- It induces dormancy, senescence of leaves, and closure of stomata and encourages perennating buds.
- It is referred as stress hormone.
- Ethylene is a gaseous form hormone promoting ripening of fruits. It shows triple response growth in seedlings (loss of linear growth, increase lateral growth, loss of geotropism)
- In agriculture they are used in ripening of fruits, synchronization of flowering in pine apples, increasing colour in coffee berries, leaf yellowing in tobacco etc.
- Photoperiodism is flowering response of plants to duration of light. If plants flower when exposed to light duration more than critical period they are Long day plants (Spinach, Beet) If flowers develop when exposed to durations less than critical time period they are Short day plants (Xanthium, soybean, mammoth variety of tobacco). Critical time period

need not be 12 hours. Pigment Phytochrome is responsible for these reactions. Phytochrome absorb light at 660nm and 730nm .730 form is physiologically active.

- Temperature also influences the reproductive growth of the plants.
- Inducing flowers in the plants by exposing them to cold temperatures is called as vernalization.

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