**Dr. Rima Kumari: Date: 06/08/2020**

Online class and e- content for BSc IIIrd year students

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| Date and Time | Online class medium | E. content topic |
| 06/08/2020  01:40 p.m to 2.40 p.m | Via Google meet  Link: Meeting URL: https://meet.google.com/skj-mnnb-hhg | **Introduction of Growth Hormone,**  **Growth Hormone: Auxin** |

**Plant growth regulators:**

Light, water, oxygen and nutrition is obligate requirement for plants to grow and develop into fully matured plants. Along with these environmental factors, plants also produce intracellular chemicals which help in their growth and development. These factors are called plant growth regulators. They are intrinsic factors. Plant hormones (also known as phytohormones) are signal molecules, produced within plants that occur in extremely low concentrations. Plant hormones are not nutrients, but chemicals that in small amounts promote and influence the growth. So, Plant Growth Regulators are simple chemicals produced naturally by plants to regulate their growth and development. These chemicals are having diverse chemical composition. They are also referred to as plant growth substances, phytohormones or plant hormones. Based on their chemical nature and mode of actions important plant growth regulators are ethylene (gaseous form), auxin, gibberellic acid, cytokinin, abscisic acid. . The biosynthesis of plant hormones within plant tissues is often diffuse and not always localized. Plant hormones control all aspects of plant growth and development, from embryogenesis, the regulation of organ size, pathogen defense, stress tolerance and through to reproductive development. Many hormones required for cell growth, such as auxins, gibberellins, brassinosteroids, ethylene, jasmonates, salicylic acid, strigolactones and cytokinins which able to accelerate or promote growth, but, some hormone-like abscisic acid has an adverse effect on growth which increases seed dormancy by inhibiting cell growth. Also, plant hormones are able to breakdowns dormancy for many plants and can alleviate abiotic stress (salinity, extreme temperatures and, drought etc) which led to enhance germination and improve growth for many plants, whether naturally occurring in the plant or by adding it to the plant in its artificially formed or in the form of bio- or nano-fertilization in order to increase the productivity and improve its efficiency under extreme conditions.

Based on their action, they are broadly classified as follows:

**Plant Growth Promoters** – They promote cell division, cell enlargement, flowering, fruiting and seed formation. Examples are auxins, gibberellins and cytokinins.

**Plant Growth Inhibitors** – These chemicals inhibit plant growth and promote dormancy (temporary inactive phase) and abscission in plants (natural detachment/ falling off of dead leaves and riped fruit. An example is an abscisic acid.

Ethylene helps in fruit ripening. It can be a promoter or an inhibitor, but is largely a Plant Growth Inhibitor.

**Natural auxins:**

**Discovery**

The first naturally occurring auxin was isolated by Kogl and Haagen-Smit (1931) from human urine. Auxins were the first growth hormone to be discovered. They were discovered by observations of Charles Darwin and his son, Francis Darwin. The Darwins observed that the apical coleoptile (protective sheath) in canary grass grows and bends towards the source of light. This phenomenon is ‘phototropism’. In addition, their experiments showed that the coleoptile tip was the site responsible for the bending. Finally, this led to the isolation of the first auxin by **F.W. Went** from the coleoptile tip of oat seedlings. He work on oat (*Avena sativa*), he reported that If the growing tip of oat coleoptile is removed, the remaining portion of coleoptile will show a marked decrease in growth which will ultimately stop. That showed that chemical present in growing tip of oat coleoptile help in plant elongation. This substance is t/a IAA (indole-3-acetic acid), natural auxin..

**Natural and Synthetic Auxins:**

Indole 3-acetic acid (IAA) are naturally occurring auxins in plants and therefore; regarded as phytohormones. is the best known and universal auxin. It is found in all plants and fungi. Besides IAA, indole-3-acetaldehyde, indole -3-spyruvic acid, indole ethanol, 4-chloro-idole aerie acid (4-chloro-­IAA) Indole butyric acid (IBA), phenylacetic acid (PAA), indole-3-propionic acid (IPA). Natural auxins are found in growing stems and roots coleoptile from where they migrate to their site of action. Naphthalene acetic acid (NAA) and 2, 4-dichlorophenoxyacetic (2, 4-D) are examples of synthetic auxins.

**Bio-Assay test:**

Bioassay means the testing of substance for it's activity in causing a growth response in a living plant or it's parts.

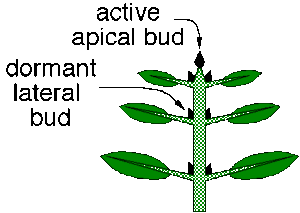
(i) **Avena curvature test**: Avena curvature test carried out by F.W. Went (1928), demonstrated the effect of auxins on plant growth by performing some experiments with the oat (Avena sativa) coleoptile.

(ii) **Root growth inhibition test:** are bioassays for examining auxin activity.

**Physiological Effects and Applications of Auxin**

1. **Apical Dominance** (Characteristic function of auxin): The phenomenon in which apical bud dominates over the growth of lateral buds is called Apical Dominance. Prunning in gardens promotes densing of hedge.

**Apical Dominance (definition):** The growing apical bud in higher plants due to auxin at apical region inhibits the growth of the lateral buds. This phenomenon is ‘Apical Dominance’. Removal of the apical bud allows the lateral buds to grow. This technique is commonly used in tea plantations and hedge-making.



**Apical dominance**

1. **Cell Division & Cell Enlargement/Callus formation** Auxin is important in Tissue culture & Grafting. It stimulates division of intrafascicular cambium. Also in healing of wounds.
2. **Shortening of Internodes:** a-NAA induces the formation of dwarf shoot or spurs in apple, pear etc., thus number of fruits increases.
3. **Prevention of lodging:** Auxin spray prevents lodging of crops, immature leaves & fruits.
4. **Root initiation:** Rooting on stem cuttings is promoted by IEA & NAA (Root growth inhibited by auxin).
5. **Potato dormancy**: MH (Maleic-Hvdrazide). a-­NAA., induces dormancy of lateral buds in potato tubers & potato can stored for long duration.
6. **Prevention of Abscission:** IAA, NAA prevents premature abscission of plant organs.
7. **Flower initiation:** Auxin is inhibitor of flowering but it promotes uniform flowering in Pine apple & Litchi plants.
8. **Parthenocarpy**: Seed less fruits can produced by spray of IAA. (By Gusteffson)
9. **Selective weed killer:** Dicot broad leave weeds can be eradicated by 2, 4-D & 2, 4, 5-T.
10. **Femaleness:** Feminising effect in some plants.
11. **Flower & Fruit thinning**: Certain trees like mango form less number of fruits in alternate years. But auxins can produced normal fruit crops every year. This is known as fruit thinning.
12. Control xylem differentiation
13. Cell division: Auxins help in cell division
14. Induce parthenocarpy i.e. the production of fruit without prior fertilization.
15. When Antiauxin (TIBA-Tri-Iodo-Benzoic acid) are sprayed on mature cotton field then cotton balls can picked easily.