

Quadrant II

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Notes

Unit – 8 Plant Growth Regulators

Introduction

Definition: Plant growth regulators are organic compounds other than nutrients which in small amounts promote, inhibit or otherwise modify any physiological process of plants.

Location: detected in various plants and crystallized in pure form. So far, nine categories of phytohormones have been identified. These include Auxins, Cytokinins (CK), Gibberellins (GA), Abscisic acid, (ABA), Ethylene (ET), Brassinosteroids (BR), Salicylates (SA), Jasmonates (JA), and Strigolactones (SL) (Su et al., 2017).

About Cytokinins: Cytokinins have specific effects on cytokinesis. Zeatin has effect on cell division and leaf senescence and synthetic Cytokinins, kinetin, are useful in promoting lateral bud development and inhibition of senescence. CKs are not only produced by plants but are also produced by plant associated microorganism, microalgae and insects.

Discovery of Cytokinins

- ✓ The discovery of Cytokinins dates back to 1921, when an Austrian Plant Physiologist, G. Haberlandt discovered that vascular tissues of various plants contained an unknown diffusible factor, which stimulated cell division.
- ✓ Johannes Van Overbeek found that milky endosperm of immature coconut also had this factor which stimulated cell division and differentiation in very young *Datura* embryos.
- ✓ Jablonski and Skoog, (1954) extended the work of Haberlandt and reported that a substance present in the vascular tissue was responsible for causing cell division in the pith cells.
- ✓ Miller and his co-workers, (1954) isolated and purified the cell division substance in crystallized form, from autoclaved herring fish sperm DNA. This active compound was named as Kinetin because of its ability to promote cell division and was the first Cytokinin to be named. Kinetin was later on identified to be 6-furfuryl-amino purine. Later on the generic name kinin was

suggested to include kinetin and other substances having similar properties.

- ✓ Burstran used term kinetinoid, (1961)
- ✓ Dendolph used term Phytokinin, (1963)
- ✓ Phytocytomine used by Pilet, (1965) for kinetin like substance.
- ✓ The term cytokinin was coined by Lentham, 1964
- ✓ Lentham discovered first natural cytokinin in unripe Maize grain, 1964. He called it Zeatin because it produced from *Zea mays*.

Physiological Effects of Cytokinins

1. Cell division:

They promote cell division, however, only in the presence of auxins.

2. Induce Cell enlargement:

Like auxins and gibberellins, the kinetin may also induce cell enlargement. Cell enlargement has been observed in kinetin treatment in leaf discs cut from etiolated leaves of *Phaseolus vulgaris*.

3. Delay in senescence:

Cytokinins are their ability to delay normal process of senescence in leave. Disappearance of chlorophyll and degradation of proteins are the two important symptoms of senescence.

4. Breaking of dormancy:

Cytokinins break the dormancy of seeds and promote seed germination.

5. Counteraction of apical dominance

Cytokinins play a role in initiating the growth of lateral buds.

6. Initiation of inter-fascicular cambium:

Kinetin can induce formation of inter - fascicular cambium.

7. Morphogenesis

Kinetin also has ability to cause morphogenetic changes in an otherwise undifferentiated callus.

8. Promotion of chloroplast development

Cytokinins are known to enhance conversion of etioplasts into chloroplast when etiolated seedlings after treatment with cytokinins are exposed to light.

9. Delay of senescence: The Richmond –Lang Effect

The ageing process of the leaves usually accompanies with loss of chlorophyll and rapid breakdown of proteins. This is called senescence. Richmond and Lang showed that this senescence could be postponed to several days in detached Xanthium leaves by kinetin treatment.

10. Other roles/ effects: Some other roles or effects of cytokinins are- differentiation of interfascicular cambium and lignification, accumulation of solutes, stimulation of several enzymes especially those concerned with photosynthesis, etc.

Commercial applications of Cytokinins

- Cytokinins are used to break dormancy of seeds.
- Cytokinins are regularly used in tissue culture labs to induce callus formation.
- In tissue culture, callus tissue culture develops chlorophyll in the chloroplasts when Cytokinins are applied exogenously.
- Cytokinins prevent senescence in vegetables.