



Biology

PLANT HORMONES



CLASS-10

CHAPTER -6



Chapter

SYLLABUS

- *Chemical coordination in Plants : A general study of plant growth regulators; Tropic movements in plants.*

PLANT GROWTH REGULATORS

Plant growth regulators are also called plant hormones or **phytohormones**. These are organic substances produced in one part of the plant body and act in another part of the body. They are mainly transported through **phloem**. Phytohormones are broadly classified as :

- (a) Growth promoters
- (b) Growth inhibitors

(a) Growth Promoters : These hormones promote the growth of the plant. The growth promoters may act as inhibitor if available in excess.

Growth promoters are of the following types :

1. Auxins
2. Gibberellins
3. Cytokinins

1. Auxins

Auxins were the first plant hormones to be discovered. The term auxin is used to represent a class of plant hormones which have major role in regulating the growth of plants. Auxins are produced by growing tips of stem and root. Indole acetic acid (IAA) is the example of most abundant and powerful (potent) naturally occurring auxin. Most of the other auxins are derivatives of IAA. The examples of synthetic auxins are Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA) and 2, 4, dichlorophenoxy acetic acid (2, 4-D).

The **physiological effects** are as under :

- (a) It causes elongation of stem.
- (b) It induces cell division.
- (c) It is responsible for apical dominance. **Apical dominance** is the phenomenon of dominating

effect of apical bud over the lateral buds. The auxin released by the apical meristem diffuses down and suppresses the growth of lateral buds. Removal of apical bud allows the lateral buds to grow making hedges more bushy.

(d) **Phototropism and Geotropism** : Auxin's high concentration in the area opposite to lighted area causes more elongation of cells of that side thus bending the tip of stem towards light. This is called **phototropism**.

Geotropism is the growth of roots towards gravity due to auxin.

(e) It prevents abscission, thus delays the premature falling of leaves and fruits.

(f) It induces parthenocarpy, i.e., formation of seedless fruits.

(g) It promotes femaleness in some flowers and suppresses the maleness.

2. Gibberellin (GA)

More than 100 types of gibberellic acids are known. Gibberellic acids are produced in young leaves plastids of immature seeds or even roots.

Their **physiological effects** are as follows :

(i) They cause elongation of internodes.

(ii) They promote flowering in long day plants.

(iii) They induce the formation of various enzymes during seed germination.

(iv) They promote maleness in some flowers.

(v) They help in production of parthenocarpic fruits.

(vi) They promote growth in genetically dwarf plants.

3. Cytokinin (Produced in meristems)

(i) It promotes cell division.

(ii) It promotes Cell enlargement.

(iii) It delays senescence (ageing of plants).

(iv) It opposes apical dominance.

(v) It promotes flowering in short day plants under long day conditions.

(vi) It is used in tissue culture to induce root and shoot formation.

(b) **Growth Inhibitors** : These plant hormones inhibit the growth and development at certain stage in the life cycle of a plant.

Two important growth inhibitors are :

1. Ethylene 2. Absciscic acid (ABA)

1. Ethylene

It is gaseous plant hormone. It has following **physiological functions** :

(i) It helps in fruit ripening.

(ii) It promotes senescence.

(iii) It promotes formation of female flowers.

2. Abscissic Acid (ABA)

- (i) It induces closure of stomata and thus acts as antistress hormone.**
- (ii) It causes premature fall (abscission) of leaves and fruits.**
- (iii) It promotes senescence in leaves.**
- (iv) It inhibits seed germination.**

TROPIC MOVEMENTS

The movements in plants in the form of growth in response to a unilateral stimulus is known as tropic movement. Some important tropic movement shown by plants are as follows :

1. Phototropism (Heliotropism)

Phototropism is the response of the plant to the unilateral stimulus of light. Shoot grows in the direction of light so shoot is **positively phototropic** whereas root grows away from light so root is **negatively phototropic**.

The response to light is influenced by auxin hormone. When shoot tip is exposed to light the concentration of auxin is found to be more on the shaded side, i.e., away from the source of light. The high concentration of auxin causes increased growth of the shaded side resulting in bending of tip towards light.

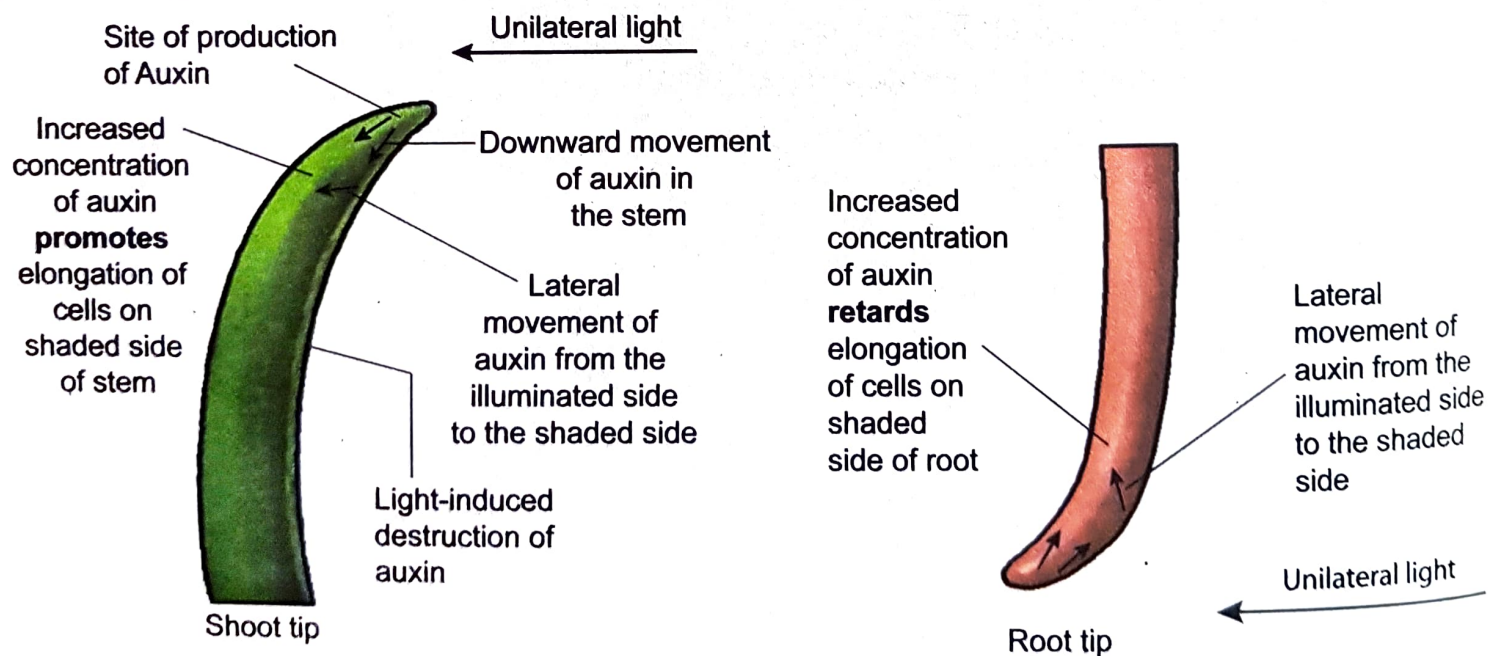


Fig. 1. Role of auxin in phototropic response in root tip and shoot tip

2. Geotropism

Response of the roots to the unilateral stimulus of gravity is known as geotropism. Roots grow in the direction of gravity so roots are positively geotropism. The relative response of shoot and root to the same concentration of auxin is opposite. The concentration of auxin, which stimulates growth in shoot is inhibitory for roots.

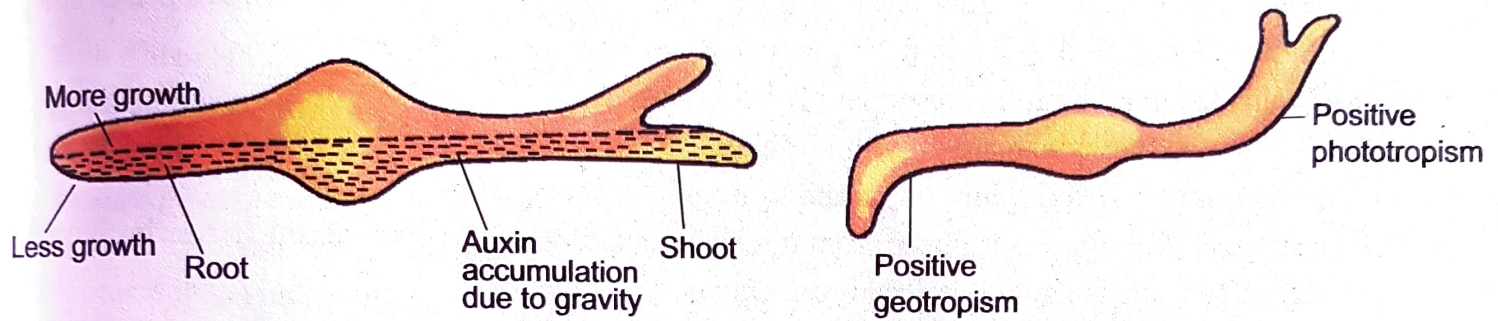


Fig. 2. Demonstration of geotropism

In an embryo, at the time of germination auxin accumulates on the lower side due to gravity. High concentration of auxin on the lower side of shoot will cause it to bend in upper direction, i.e., direction of light, whereas high concentration of auxin on the lower side of root will inhibit its growth, thus, bending roots towards gravity because the upper side of the root surface will keep on growing normally.

3 Hydrotropism

The response of plant roots to the stimulus of water is hydrotropism. The response of roots to the stimulus of water is more strong than the response to the stimulus of gravity.

To demonstrate the hydrotropism in a wooden box a mesh with moist saw dust is placed obliquely. A few germinating seeds are placed on this moist saw dust. The saw dust is always kept moist after few days it is observed that the radicle grows downward but as soon as it loses contact from the moist saw dust it starts growing upward towards moist saw dust.

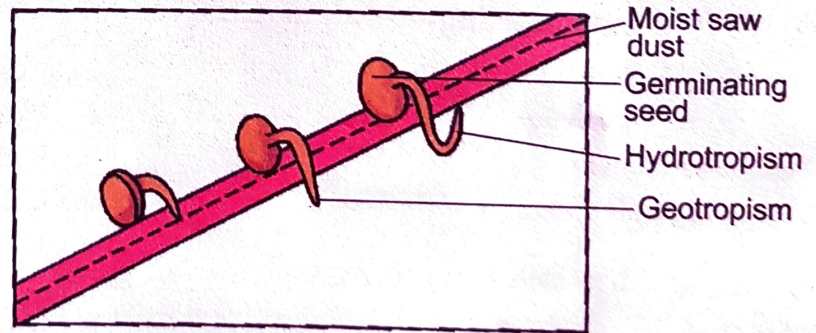


Fig. 3. Demonstration of stronger effect of hydrotropism over geotropism

4. Thigmotropism (Haptotropism)

The twiners and lianas coil around a tree. Similarly tendrils of cucurbits and petiole of *Clematis* also show thigmotropism. These movements are caused when these structures come in contact with a support. The growth is less on the side of contact but is more on the side away from the contact.

5. Chemotropism

The growth movement due to the chemical stimulus is known as chemotropism, e.g., pollen tube grows towards ovary due to chemotropism.

List different classes of plant hormones and categorise them into growth promoters and growth inhibitors.

Name the growth tissues present in a plant and write their location.

Why is differentiation of cells important?

Identify the plant hormone

- (a) Helps to prevent fruit and leaf drop at early stages but promotes the abscission of older mature leaves and fruits.
- (b) Enhances stomatal opening.
- (c) Inhibits seeds germination.
- (d) Can lead to development of seedless fruits.
- (e) Acts in concert with auxins.
- (f) Promotes root growth and root hair formation helping the plants to increase their absorption surface.

Why are gibberellins and abscisic acid called antagonists?

Write the difference between a plant hormone and an animal hormone.

What are nastic movements? Give an example.

What is phototropism? How is it different from photonasty?

A potted plant is made to lie horizontally on the ground. Which part of the plant will show

- (i) positive geotropism, and
- (ii) negative geotropism?

Why are shoots called negatively geotropic?

Differentiate between tropic and nastic movements in the plants. Give one example of each.

Give an example to prove that chemotropism is a directional movement.

Which kind of movements are under the control of phytohormones?

1. Describe the changes in a plant during growth and development?
2. What are plant hormones? Write their characteristics and functions in a plant.
3. Name the five types of plant hormones. Write the location of each hormone in a plant.
4. Discuss the functions carried out by plant growth promoters.
5. Why are plant growth inhibitors called so? Support your answer with examples.

E. Name the plant hormone associated with the following

1. Fruit ripening
2. Apical dominance
3. To overcome genetic dwarfism
4. To induce parthenocarpy
5. To reduce the rate of transpiration
6. Phototropism and geotropism
7. Used in plant tissue culture

F. Structure (Diagram based)

1. Shoot of a plant was exposed to unilateral light for 24 hours. Its response was as shown in the diagram given alongside.

- a. What was the direction in which the light source was placed (A or B)?
- b. Name and define the type of response shown by the shoot tip.
- c. Name the substance responsible for this type of response.
- d. Where is this substance produced in the plants?
- e. Name the tissue through which this substance is transported in the plant.

