

Chapter - 15

PLANT GROWTH AND DEVELOPMENT

A. One mark questions

1. Define growth.

Ans: Growth is an irreversible permanent increase in size of an organ or its parts or even of an individual cell.

2. Define development.

Ans: Development includes all changes that an organism goes through during its life from germination of the seed to senescence.

3. Define differentiation.

Ans: Meristems undergo maturation to perform specific functions.

4. Define dedifferentiation.

Ans: Some of the living differentiated cells which have lost the capacity to divide can regain the capacity of division under certain conditions.

5. Define redifferentiation.

Ans: Dedifferentiated cells once again lose the capacity to divide but mature to perform specific functions.

6. Define indeterminate growth.

Ans: Plant growth is unlimited as they retain the capacity for unlimited growth throughout their life.

7. Define meristem.

Ans: Meristems are the immature and embryonic cells which have the capacity to divide.

8. Define growth rate.

Ans: The increased growth per unit time is termed as growth rate.

9. Why is abscisic acid also known as stress hormone?

Ans: Abscisic acid stimulates the closure of stomata that can increase the tolerance of plants to various kinds of stresses.

10. Which one of the plant growth regulators would you use if you are asked to induce rooting in a twig?

Ans: Auxin

11. Which one of the plant growth regulators would you use if you are asked to quickly ripen a fruit?

Ans: Ethylene

12. Which one of the plant growth regulators would you use if you are asked to delay leaf senescence?

Ans: Cytokinins

13. Which one of the plant growth regulators would you use if you are asked to Induce growth in axillary buds?

Ans: Auxins

14. Which one of the plant growth regulators would you use if you are asked to 'bolt' a rosette plant?

Ans: Gibberellins

15. Which one of the plant growth regulators would you use if you are asked to induce immediate stomatal closure in leaves?

Ans: Abscissic acid

16. What would be expected to happen if GA₃ is applied to rice seedlings?

Ans: Make them to grow taller.

17. What would be expected to happen if a rotten fruit gets mixed with unripe fruits?

Ans: unripe fruits get ripened.

18. What would be expected to happen if you forget to add cytokinins to the culture medium?

Ans: Cell division will be arrested.

19. Name the cells which help in growth of a plant.

Ans: Meristems

20. What is open form of growth?

Ans: It is a kind of growth wherein new cells are always being added to the plant body by the activity of the meristem.

21. Which meristem is responsible for primary growth?

Ans: Apical meristem

22. Which meristem is responsible for secondary growth?

Ans: Secondary meristem

23. What is arithmetic growth?

Ans: In arithmetic growth, following mitotic cell division, only one daughter cell continues to divide while the other differentiates and matures.

24. What is geometric growth?

Ans: In geometric growth, following mitotic cell division, all the daughter cells continues to divide.

25. Write the formula to calculate linear growth curve.

Ans: $L_t = L_0 + rt$

26. Name the phase during which growth is slow.

Ans: Lag phase

27. Name the phase during which growth is rapid.

Ans: Log phase

28. What is sigmoid growth curve?

Ans: If we measure growth of a plant against the time and plotted in a graph, we get a typical 'S' shaped curve.

29. Write the formula to calculate exponential growth.

Ans: $W_1 = W_0 e^{rt}$

30. What is absolute growth rate?

Ans: It is the measurement and the comparison of total growth per unit time.

31. What is plasticity?

Ans: It is the ability of plants to follow different pathways in response to environment or phases of life to form different kinds of structures.

32. What are plant growth regulators?

Ans: These are the phyto hormones which can promote or inhibit the growth of plant.

33. Name the plant growth regulator which is the derivatives of adenine.

Ans: Cytokinins

34. Name the plant growth regulator which is the derivatives of Carotenoids.

Ans: Absciscic acid

35. Name the plant growth regulator which is the derivatives of terpenes.

Ans: Gibberellic acid

36. Which plant hormone is called gaseous hormone?

Ans: Ethylene

37. What do you call a phytohormone that induces dormancy?

Ans: Absciscic acid

38. What do you call a phytohormone that induces abscission?

Ans: Absciscic acid

39. What do you call a phytohormone that induces ripening of fruit?

Ans: Ethylene

40. What is phototropism?

Ans: Growth of plant towards the source of light.

41. Name a plant in which Charles Darwin discovered photoperiodism.

Ans: Canary grass

42. Name the hormone which is isolated from the tip of coleoptiles of oat seedlings.

Auxin

43. Write the binomial nomenclature of the fungus that cause 'Bakane' disease in rice seedlings.

Gibberella fuzikuroi

44. Name a phytohormone which is isolated from human urine.

Auxin

45. Give an example for naturally occurring Auxins.

Ans: IAA (Indole acetic acid)

46. Give an example for synthetic Auxins.

Ans: NAA/IBA/2,4-D

47. What is apical dominance?

Ans: In higher plants, the growing apical bud inhibits the growth of lateral axillary buds, a phenomenon called apical dominance.

48. Name a hormone that is used as herbicides.

Ans: 2,4-D (2,4-dichlorophenoxy acetic acid)

49. Name a hormone that is used to speed up the malting process in brewing industry.

Ans: GA₃ (Gibberellic acid)

50. What is bolting?

Ans: Gibberellins promotes intermodal elongation just prior to flowering is called bolting.

51. Name a phyto hormone that induces bolting.

Ans: Gibberellins

52. Name naturally occurring cytokinins.

Zeatin

53. Name a phytohormone present in coconut milk.

Ans: Cytokinin

54. Name a hormone synthesized in ripened fruit.

Ans: Ethylene

55. Which phyto hormone do you use to induce female flowers in cucumbers to increase yield.

Ans: Ethylene

56. Name a hormone that inhibits the germination of seeds.

Ans: ABA (Abscissic acid)

57. Name the hormone that stimulates closure of stomata.

Ans: ABA

58. Which hormone is regarded as stress hormone?

Ans: ABA

59. Define photoperiodism.

Ans: It is the duration of light to which the plants are exposed for flowering.

60. What are long day plants?

Ans: The plants require longer duration of light than the critical duration for flowering.

61. What are short day plants?

Ans: the plants require short duration of light than critical duration for flowering.

62. What are day neutral plants?

Ans: the plants show flowering irrespective duration of light.

63. Define vernalisation.

Ans: Flowering occurs in the plants when they are exposed to low temperature (cold treatment).

64. What do you call a phenomenon, if shape of leaf in coriander/cotton/larkspur during juvenile plants differs in mature plants?

Ans: Plasticity

B. Two marks questions

1. Why is not any one parameter good enough to demonstrate growth throughout the life of a flowering plant?

Ans: Because in flowering plants growth can be measured by a variety of parameters some of which are, increase in dry weight, fresh weight, length, area, volume and cell number, hence it can't be demonstrated throughout the life.

2. Describe briefly Sigmoid growth curve.

Ans: When a growth of a plant is measured and plotted in a graph, we get a typical 'S' shaped curve. In the growth curve three phases can be identified such as, lag phase, log phase and steady phase.

3. Describe briefly absolute and relative growth rates.

Ans: Absolute growth is the measurement and the comparison of total growth per unit time. Whereas, relative growth is the growth of the given system per unit time expressed on a common basis (per unit initial parameter).

4. 'Both growth and differentiation in higher plants are open'. Comment.

Ans: Growth in a higher plant is achieved by apical meristem and secondary meristem which is open. The cells derived from the meristem undergo differentiation to form mature cells which is also open.

5. Would a defoliated plant respond to photoperiodic cycle? Why?

Ans: No, because the hormonal substance called phytochrome responsible for flowering produced in the leaf that migrate to the shoot apices for inducing flowering only when the plants are exposed to the necessary inductive photoperiod.

6. What are the parameters used to measure growth of a plant?

Ans: Various parameters used to measure growth of a plant are increase in amount of protoplasm, dry weight, fresh weight, length, area, volume and cell number,

7. Name the three phases of growth.

Ans: Phase of meristematic (phase of cell division), phase of cell elongation, phase of cell maturation.

8. What are plant growth promoters? Give an example.

Ans: The phytohormones which induce (promotes) growth of a plant. Ex: Auxins/Gibberellins/Cytokinins

9. What are plant growth inhibitors? Give an example.

Ans: The phytohormones which inhibit growth of a plant. Ex: ABA/Ethylene

10. Write any two inhibitory effects of ethylene on plants.

Ans: It accelerates abscission in flowers and fruits, promotes senescence.

11. Which hormone is regarded as stress hormone? Why?

Ans: ABA. Abscissic acid stimulates the closure of stomata that can increase the tolerance of plants to various kinds of stresses.

12. Define photoperiodism. Mention the types of photoperiod plants.

Ans: It is the duration of light to which the plants are exposed for flowering. Long day plants, short day plants and day neutral plants.

13. Define vernalisation. Mention two varieties of plants based on vernalisation.

Ans: Flowering occurs in the plants when they are exposed to low temperature (cold treatment). Wheat, barley etc.,

14. What are the two structural changes that occur during the differentiation of a cell to become tracheary elements?

Ans: Loss of protoplasm and lignocellulosic secondary cell wall.

15. Name two types of cambium formed due to dedifferentiation.

Ans: Interfascicular cambium and cork cambium.

16. Plant growth is determinate or indeterminate, what is your answer? Give reason.

Ans: Plant growth is determinate. Because entire plant growth is due to the division of meristem.

17. Differentiate between determinate and indeterminate growth.

Ans: If a growth of the plant is limited in its life time is called determinate. But growth of a plant is indeterminate as it continues to grow because of meristematic activity.

C. Four marks questions

1. Write any four practical applications of Auxins.

- i. Initiates rooting in stem cuttings, an application widely used for plant propagation.
 - ii. Promotes flowering in pineapples
 - iii. Prevents premature fall of fruits and leaves
 - iv. The exhibit the phenomenon like apical dominance that is, the growing apical bud inhibits the growth of the lateral buds
2. Write any four practical applications of gibberellins.
 - i. They induce fruits like apple to elongate and improve in shape
 - ii. Induce length of the stem in sugarcane that enhances sugar content
 - iii. Hastens the maturity period in conifers leading to early seed production
 - iv. Promotes bolting (internodal elongation just prior to flowering) in beet
3. Write any four practical applications of cytokinins.
 - i. Induce rapid cell division
 - ii. Helps to produce new leaves, chloroplasts in leaves
 - iii. Induce the formation of lateral shoot growth and adventitious shoot formation
 - iv. Help to overcome apical dominance
4. Write any four practical applications of ethylene.
 - i. Initiates seed germination of seeds in peanuts
 - ii. Induce sprouting of potato tubers
 - iii. Promotes rapid internode/petiole elongation in deep water rice plants
 - iv. Promotes root growth and root hair formation, thus helping the plants to increase their absorption surface
5. Write any four practical applications of abscissic acid.
 - i. Inhibits seed germination
 - ii. Stimulates closure of stomata and increases the tolerance of plants to various kinds of stresses (hence the name stress hormone)
 - iii. By inducing dormancy it help the seed to withstand desiccation and other factors unfavourable for growth.
 - iv. Induce the formation of abscission

D. Five marks questions

1. List five main groups of natural plant growth regulators. Write a note on discovery, physiological functions and agricultural/horticultural applications of any one of them.

Ans: a) Growth Promoters: i) Auxins ii) Gibbeellins iii) Cytokinins
 b) Growth Inhibitors: i) Ethylene ii) Absciscic acid

Auxins

- a) Discovered by Charles Darwin
- b) They promote growth of plants
- c) Agricultural/Horticultural applications
 - i. Initiates rooting in stem cuttings, an application widely used for plant propagation.
 - ii. Promotes flowering in pineapples
 - iii. Prevents premature fall of fruits and leaves
 - iv. They exhibit the phenomenon like apical dominance that is, the growing apical bud inhibits the growth of the lateral buds

2. What do you understand by photoperiodism and vernalisation? Describe their significance.

Ans: Photoperiodism: It is the duration of light to which the plants are exposed for flowering. Long day plants, short day plants and day neutral plants.

Vernalisation: Flowering occurs in the plants when they are exposed to low temperature (cold treatment).

3. Explain five practical applications of auxins.

- i. Initiates rooting in stem cuttings, an application widely used for plant propagation.
- ii. Promotes flowering in pineapples
- iii. Prevents premature fall of fruits and leaves
- iv. They exhibit the phenomenon like apical dominance that is, the growing apical bud inhibits the growth of the lateral buds
- v. Induce parthenocarpy

4. Explain five practical applications of gibberellins.

- i. They induce fruits like apple to elongate and improve in shape
- ii. Induce length of the stem in sugarcane that enhances sugar content
- iii. Hastens the maturity period in conifers leading to early seed production
- iv. Promotes bolting (internodal elongation just prior to flowering) in beet
- v. Speed up the malting process in brewing industry

5. Explain five practical applications of cytokinins.

- i. Induce rapid cell division
- ii. Helps to produce new leaves, chloroplasts in leaves
- iii. Induce the formation of lateral shoot growth and adventitious shoot formation
- iv. Help to overcome apical dominance
- v. Delays the senescence

6. Explain five practical applications of ethylene.

- i. Initiates seed germination of in peanuts
 - ii. Induce sprouting of potato tubers
 - iii. Promotes rapid internode/petiole elongation in deep water rice plants
 - iv. Promotes root growth and root hair formation, thus helping the plants to increase their absorption surface
 - v. Initiate flowering and for synchronizing fruit set in pineapples
7. Explain five practical applications of abscissic acid.
- i. Inhibits seed germination
 - ii. Stimulates closure of stomata and increases the tolerance of plants to various kinds of stresses (hence the name stress hormone)
 - iii. By inducing dormancy it help the seed to withstand desiccation and other factors unfavourable for growth.
 - iv. Induce the formation of abscission
 - v. It acts as antagonist to Gas
