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BIOLOGY
PLANT
MORPHOLOGY
(Root, Stem, Leaf, Inflorescences)

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BIOLOGY

Plant Morphology

1. **Morphology** is the branch of biology of that deals with the study and forms of various parts of plants and their specific special features.
2. The roots, stems and leaves are **vegetative parts** , while flowers constitute the **reproductive part**.
3. **Annuals** –Complete their life cycle in **one year** or **single growing season** or few weeks to a few months. They pass the

unfavourable period in the form of seeds eg. **Mustard, Pea.**

4. **Biennials** –Complete their life cycle in **two years** growing, vegetative and storing food in the first year, flowering and fruiting in the second year. They die off after producing flowers and fruits eg. **Radish, turnip, carrot** are biennial in colder areas. They become annual in warmer places.

5. **Perennials** – Survives for **several years.** eg. **Mango, Banana, Guava**

6. **Roots** are non-green, underground, (+) **geotropic**, (-) **phototropic** and (+) **hydrotropic.**

7. Buds present for vegetative propagation in **sweet potato (Ipomea)** and **Indian red wood (Dalbergia)**

8. Roots do not bear **nodes and internodes.** Roots have **unicellular root hairs**

9. **Root Cap:** It is a cap like structure that covers the **apex of the root.** The main function of the root cap is to protect the root apex.

10. **Meristematic Zone or Zone of cell division:** This is the **growing tip** of the root. It lies a little beyond the root cap. The cells of this region are **actively dividing and continuously increase** in number.

11. **Zone of elongation:** It is a region that **lies just above** the meristematic zone. The cells of this zone increase in size. This zone helps in the **growth in length of the plant root.**

12. **Zone of cell differentiation:** (Cell maturation) This is a zone that lies above the zone of elongation. They form the tissues like the

epidermis, cortex and vascular bundles. In this region a number of **root hairs** are also present.

14. The **root hairs** are responsible for **absorbing water and minerals** from the soil.

15. **Tap root:** It develops from radicle and made up of one main branch and other sub branches. The primary roots and its branches constitute tap root system. e. g. **Dicot roots.**

16. Root developing from any part of the plant other than the radicle is called **adventitious root**

17. Fusiform roots: These root are **thicker in the middle** and **tapered on both ends.** In this type of roots both hypocotyl and root help in storage of food. **eg. Radish.**

18. **Conical roots:** These roots are **thicker at their upper side** and **tapering at basal end.** eg. Carrot.

19. **Napiform:** These roots become **swollen and spherical at upper end** and **tapered like a thread at their lower end.** eg. **Turnip (Brassica rapa) Sugar beet.**

20. **Tuberous root:** Such roots **do not have regular shape** and get swollen & fleshy at any portion of roots. eg. **Mirabilis**

21. **Nodulated root:** Nodules are formed on branches of roots by nitrogen fixing bacteria, **(Rhizobium).** eg. Plants of leguminosae family (Papilionatae) – Pea.

22. **Respiratory roots:** Halophyte or mangrove grow in **oxygen deficient marshy area.** Some branches of tap root in these plants grow vertically & comes out from soil. These roots are called **pneumatophores** through which air entered inside the plant. eg.

Rhizophora, Heritiera, Sonaratia and another mangrove plant.

23. **Stilt roots:** These adventitious roots arise from the first few nodes of the stem. These penetrate obliquely down in to the soil and give support to the plant. eg. **Maize, sugarcane and pandanus**

24. **Prop roots:** These roots give **mechanical support** to the aerial

branches as in banyan tree

25. **Epiphytic roots:** These are adventitious roots found in some **orchids** that grow as epiphytes upon the branches of other trees. These epiphytes develop special kinds of aerial roots which **hang freely in the air. Eg . Vanda**

26. **Parasitic roots or haustoria:** These roots are found in non-green parasitic plants. Parasitic plants are those plants which **cannot make their own food** and they have to obtain its food from the host

27. The **plumule** of the embryo grows into the stem which forms the main axis of the plant.

28. Lateral branches of the stem are **exogenous** in origin i. e they arise from the tissues which are in the periphery of the main axis (cortex)

29. **Caudex:** It is unbranched, erect, cylindrical stout stem and marked with scars of fallen leaves. Crown of leaves are present at the top of plant. eg.: **Palm**

30. **Culm:** Stem is jointed with **solid nodes & hollow internodes.** eg. **Bamboo (Gramineae)**

31. **Excurrent:** The branches arise from the main stem in

acropetal succession and the tree assumes a cone like appearance e. g. **Pinus, Eucalyptus, Casuarina.**

32. **Decurrent (Deliquescent):**

The lateral branches grow more vigorously and outcompetes the main trunk, giving a dome-shaped appearance, e. g. , **mango (Mangifera indica), shishem (Dalbergia sissoo) and banyan (Ficus bengalensis)**

33. **Reduced stem** – Stem reduced to a disc. eg. , Radish, Carrot, Turnip.

34. **Erect stem** - It is strong and upright e. g. , maize, wheat, mango.

35. **Weak stems** –These are thin, soft and weak and need support. They can be upright or prostrate.

36. **Runner** – When stem grows and **spread on the surface of soil**. Roots are developed at lower side and leaves from upper side from node eg. **Cynodon dactylon (Doob grass), Oxalis.**

37. **Stolon** – In its branches are **small and stem condensed and grow in all direction**. After some time, of growing, their apical region comes out from the soil. eg. Fragaria(Wild strawberry), Jasmine Peppermint.

38. **Sucker** – In it the main stem grows in the **soil horizontally**

and branches develop obliquely from nodes above the soil, eg.

Mint, Pineapple, Chrysanthemum

39. **Offset**– A lateral branch with **short internode** and each node bearing a rosette of leaves and tuft of roots at base. eg. **Pistia, Eichhornea.**

40. **Tuber** – The tips of underground branches become swollen in the soil. Eyes are found on them which are axillary buds and covered with scaly leaves. eg. **Potato, Helianthus tuberosus**

41. **Rhizome** – It is fleshy and horizontally stem found below in soil. Small nodes and internodes are found which are covered by scaly leaves. eg. **Ginger, Turmeric, Canna, Water lily, Banana.**

42. **Corm** – It is condensed structure which grow vertically under the soil surface. They are having spherical node and internode eg. **Colocasia, Alocasia, Zaminkand, Saffron, Gladiolus, Colchicum**

43. **Bulb**– This stem is reduced and has disc like structure and surrounds with numerous fleshy scaly leaves. Many roots arise from its base. Food is stored in fleshy leaves. They show apical growth eg.

Onion, Garlic.

44. Phylloclade – It is **green photosynthetic** flattened or rounded succulent stem with leaves either feebly developed or modified into spines e. g. , **Opuntia, Casuarina, Euphorbia, Cactus.**

45. Thorn – It is **modification of axillary bud**, e. g. , Bougainvillea, Duranta, Carissa. Thorns of Alhagi possess flowers, while thorns of Duranta bears leaves.

46. Cladode – Phylloclade usually having **one or two inter node long** & succulent is called cladode, e. g. , Asparagus, Ruscus.

47. Stem tendrill– it is a leafless, spirally coiled structure found in climbers. It may be a **modification of Axillary bud**, e. g. Passiflora

or **terminal bud** e. g. , Vitis

48. A condensed , axillary fleshy bud is called **bulbils**. It helps in vegetative reproduction. eg. , **Dioscorea, Globba, Agave, Oxalis**

49. Leaf base (Hypopodium):
The part of the leaf which is attached to the stem or a branch is called leaf base.

50. In some plants the leaf has a swollen leaf base. It is known as **pulvinus. Eg . Fabaceae**

51. In monocots the leaf base is **very broad and flat**, and it clasps a part of the node of the stem as in maize and in banana. It is called **sheathing leaf base**.

52. In most of the dicotyledonous plants, the leaf-base bears two lateral appendages called the **stipules**. The main function of the stipule is to protect the leaf in the bud

53. Leaves which have the stipules are called **stipulate**. The leaves without stipules are called **exstipulate**.

54. **Petiole** connects the lamina with the stem or the branch.

55. A leaf is said to be **petiolate** when it has a petiole

56. A leaf is said to be **sessile** when it does not have a petiole

57. **Leaf blade or Lamina** is the most important, green part of the leaf which is mainly concerned with the manufacture of food.

58. The arrangement of veins in the leaf blade or lamina is called **venation**.

59. **Reticulate Venation:** This type of venation is common all **dicot leaves**. In this type of venation there is a prominent vein called

the **midrib** from which arise many small veins which finally form a net like structure in the lamina.

60. **Parallel Venation:** In this type of venation all the veins run parallel to each other. Most of the **monocot leaves** have parallel venation.

61. **Simple Leaf** – A leaf which may be incised to any depth, but not down to the midrib or petiole, then this type of leaf called simple leaf. eg. **Mango, Chinrose, Ficus.**

62. **Compound leaf** –A leaf in which the leaf blade is incised up to the midrib or petiole, thus dividing it into several small parts, known as leaflets. This type of leaf is known as compound leaf eg. **Neem**

63. **Pinnately compound leaf** – In this type of leaf mid rib is known as rachis. Leaflets are arranged on both sides of rachis. eg. **Neem**

64. **Unipinnate** – In this type of leaf, division **occurs only once**, and leaflets are directly attached on both sides of rachis.

65. If the number of leaflets is **even**, then leaf is known as **paripinnate**. eg. Cassia fistula, Sesbania

66. If the number of leaflets is **odd**, it is known as **imparipinnate**. eg. Rose, Neem.

67. **Bipinnate** – A **twice pinnate** compound leaf eg. Acacia, Gulmohar, Mimosa.

68. **Tripinnate** – A **thrice pinnate** compound leaf eg. Moringa.

69. **Decompound** – A compound leaf, which is **more than thrice pinnate**. eg. Carrot, Coriander.

70. **Palmate compound leaf** – In this type incision of leaf are directed from leaf margin to apex of petiole and all leaflets are attached on the upper end of petiole.

71. **Unifoliate** – When **single leaflet** is found. eg. Lemon

72. **Bifoliate** – When **two leaflets** are present. eg. Bauhinia, Regnelidium, Bignonia.

73. **Trifoliate** – When **three leaflets** are attached. eg. Oxalis, Aegle, Trifolium

74. **Tetrafoliate** –When **four leaflets** are attached to the petiole. eg. Marsilea

75. **Multifoliate** – when **more than four leaflets** are found, then leaf is called multifoliate palmate compound leaf. eg. Silk cotton

76. The arrangement of leaves on the stem or the branches is known as **phyllotaxy**.

77. **Alternate phyllotaxy**: In this type the leaves are arranged

alternatively in the nodes. There is **only one leaf** at each node. eg. Polyalthia

78. **Opposite Phyllotaxy:** In this type of arrangement **two leaves** are present at each node, lying opposite to each other Eg: Guava

79. **Ternate Phyllotaxy:** In this type there are **three leaves** attached at each node eg. Nerium

80. **Whorled:** In this type, **more than three leaves** are present in a whorl at each node eg. Alamanda.

81. **Leaf tendril** – In it, whole leaf is modified into **thin thread like** structure which is called leaf tendril eg. Lathyrus aphaca(wild pea).

82. **Leaflet tendril** – When leaflet is modified into **tendril like** structure than it is called leaflet tendril. eg. Pisum sativum (Garden pea), Lathyrus odoratus (sweet pea).

83. **Leaf spine** – Leaves or any part of leaflet are modified into **pointed spine**. eg. Asparagus, Opuntia, Aloe, Argemone.

84. **Leaf scale** – In it, leaves become thin, dry and form a membrane or paper like structure and serve to protect axillary buds as in Ficus and Tamarix, Ruscus, Casurina.

85. **Leaf pitcher** – Leaves of some plants are modified to **pitcher shape**. eg. Nepenthes, Dischidia.

86. **Leaf bladder** – In some plant, leaves are modified into **bladder like structure** eg. Utricularia.

87. **Leaf Hooks** – In some plants terminal leaflets are modified into **curved hooks** for helping the plant in climbing. eg. Argemone, Opuntia, Aloe, Cat's nail (Bignonia unguis – cati)

88. **Phyllode** – In its, petiole becomes **flat structure** and function as normal leaf. eg. Australian acacia.

89. **Flashy leaves** – In onion and garlic **food storing flashy leaves** are present

90. Arrangement of flower on floral axis is called **inflorescence**.

91. In plants like *Callistemon* the inflorescence is found in between the **stem**. This is called **intercalary inflorescence**.

92. **Raceme** –When peduncle (main axis) is elongated and flowers are pedicellate. eg. Radish, characteristic feature of Cruciferae family

93. **Spike** –In its peduncle is elongated but flowers are bisexual and sessile. eg. Achyranthes

94. **Catkin** –In its peduncle is thin, long and weak, and flowers are sessile and unisexual.

Peduncle is pendulus. eg. mulberry, betula, oak.

95. **Spadix** –In its peduncle is thick, long and fleshy and have small sessile and unisexual male and female flowers covered with one or more green or colourfull bracts known as spathe. eg. Colocasia, Maize, Aroids, Palms.

96. **Corymb** –In its peduncle is short and all flowers are present at same level because the lower flower has much long pedicel than the upper one eg. Candytuft (Iberis amara).

97. In mustard **corymbose raceme** type of inflorescence is present

98. **Umbel** –An inflorescence in which the flower stalks of different flowers are of more or less equal length, arise from the same point. At the base of flowers stalks, there is whorl of bracts forming the involucre. eg. Centella

99. **Scapigerous umbel** is found in onion

100. **CYMOSE:** In this type of inflorescence, the peduncle terminate in a flower.

101. **Thyrus:** The main axis of the inflorescence shows a number of simple dichasial cymes arranged in a racemose manner eg. Ocimum.

102. **Verticillaster:** A pair of dichasial cymes arise from the axils of opposite flowers. Later this grow as monochasial scorpioid cymes around the stem eg. Leucas.

103. **Mixed Spadix:** In Musa several cymose clusters are arranged on the **swollen inflorescence** axis from base to apex. Each cymose cluster is surrounded by a large bract called spathe.

104. **Cyathium-** The bracts or the involucre become fused to form a **cup shaped structure** on the margin. In the central part of cup shaped structure, a single female flowers is found, which mature earlier.

105. **Coenanthium:** In Dorsitenia, the receptacle becomes **saucer shaped** and its margins are slightly curved.

106. **Hypanthodium** – In its peduncle is modified in **narrow cup** like structure. At the base of cup female flowers develop while towards mouth male flower develops. All **three types of flowers** are present in this inflorescence. eg. Banyan, Peepal, Ficus species.