12 Plant Morphology-I (Root, Stem and Leaf)

The flowering plants are dominant plants on the earth with 3 lac species. They exhibit great variety as shown below :

- **Variety by size :** The smallest gymnospermic plant is *Zamia pygmaea* with 20–30 cm length while greatest gymnospermic plant is *Sequoia sempervirens* with 150 meter height. The smallest aquatic angiospermic plant is Lemna which is less than 1 cm and *Wolffia globosa* is about 2–5 mm in size and the tallest angiospermic plant is *Eucalyptus* sp. with 90–100 meter length.
- **Variety by forms :** Some plants are of Herb, Shrub or tree type, while some are of climber type.
- **Variety by life-span :** Some plants are Annual, while some are Biannual or perennials. e.g., Bodhigaya (Pipal) tree is 2500 years old.
- **Variety by Habitat (Life-style) :** Some plants are terrestrial, aquatic, xerophytic, epiphytic, parasitic, Halophytic in reference to their Habitat.

Normally, phanerogames have two parts : (1) Above ground axis (shoot system) and (2) Underground axis (Root System). Root system develops from Radicle and shoot system develops from plumule.

(1) Which option is correct for root which is developed from Radicle ?

(A) Assimilatory root of Tinospora (B) Prop root of Banyan tree

(C) Food storage root of carrot (D) Haustoria of cuscuta

(2) Which option is correct for classification of plants according to their forms ?

(i) Vinca (ii) Banyan (iii) Ocimum (iv) Eucalyptus (v) Papaya (vi) Bittergourd (vii) Pea

	Herb	Shrub	Tree	Climber
(A)	(i), (iii)	(vi), (v), (iv)	(ii)	(vii)
(B)	(iii), (vi)	(iv), (v)	(ii)	(vii), (i)
(C)	(v), (vi)	(i), (ii)	(ii), (iv)	(vii)
(D)	(i), (iii), (vii)	(v)	(ii), (iv)	(vi)

(3) Which option is correct for given Assertions ?

x : Bodhigaya tree (pipal) is 25,000 years old.

y : Zamia pygmaea and Lemna are smallest angiosperm and smallest gymnosperm plant respectively.

z : Sequoia and Eucalyptus are largest gymnosperm and largest angiosperm plant.

(A) All assertions are wrong (B) All assertions are right

(C) x, y are wrong, while z is right (D) x, z are wrong, while y is right

(4) Which option shows uniform life-form (Habitat) of plants ?

(A) Banyan, Passion flower, Maize, Bougainvillea, Lemna

(B) Bittergourd, Passion flower, Gloriosa, Tinospora, Pea

(C) Lemna, Wolffia, Avicennia, Lotus, Orchid

(D) Opuntia, Acacia, Rose, Maize, Orchid

(5) Which pair is matched ?

(A) Plumule - Fruit, seed (B) Radicle - Primary root, Flower

(C) Plumule - Primary root, Stem, Flower (D) Radicle - Flower, Fruit, Seed

(6) In which plant, Root system and shoot system are not clearly seen ?

(A) Avicennia, Muehlenbeckia (B) Marchentia, Moss (C) Cuscuta, Loranthus (D) Tinospora, Orchid

(7) Which care should be taken to cultivate Bean-seed to observe its germination ?

(A) To cultivate it so as to keep its plumule upper side and radicle lower side.

(B) To cultivate it so as to keep its plumule lower side and radicle upper side.

(C) To cultivate it so as to keep both plumule and radicle upper side.

(D) Bean can cultivate by keeping it at any angle.

Answers : (1-C), (2-D), (3-C), (4-B), (5-A), (6-B), (7-D)

- **Root :** Root is the underground part of the plant axis. It develops from the radicle. It is positively geotropic and hydrotropic and negatively phototropic. It lacks chlorophylls. It is of three types.

(a) **Tap root system :** When primary root develops from radicle and bears secondary and tertiary roots and the main axis develops perpendicular deep into the soil is called Tap-root. E.g., Mustard.

(b) **Adventitious root system :** When root develops from stem, leaves, that means from other than Radicle, it is called adventitious root. e.g., Prop root of Banyan tree.

(c) **Fibrous Root system :** In monocot plants, the primary root is short lived. Later on thin fibrous roots develop from the hypocoty and the basal region of stem. e.g, wheat.

- Normal functions of Root are as given below :

(a) **Fixation :** To anchor the plant to support (Soil)

(b) **Absorption :** To absorb water-minerals from Soil.

(c) **Conduction :** To conduct the absorbed water-mineral to the tip of stem.

(d) **Balance and protection :** In Pistia, root-tip is protected by root-pocket and keeps balance also.

- **Regions of Root :** Morphological root can be divided into four regions.

(a) **Root-cap :** In plant like Pandanus, the meristematic tissue at root-tip is protected, while in aquatic plant like Pistia it is in the form of loose covering.

(b) **Meristematic region :** In this region, meristematic cells are present, which are divisible, filled with protoplasm, thin walled and small in size.

(c) **Region of Elongation :** The cells of this region vigorouly expands in size and increases length-depth and thickness.

(d) **Region of Maturation :** This region is also called root-hair region, because it develops unicellular, thin and fibrous hair like structure. The cells undergo differentiation to form tissues. From above these regions, small lateral roots are developed.

(8) Normally, Root means ..... .

(A) Positively geotropic axis of plants (B) Positively phototropic axis of plants

(C) Negatively hydrotropic axis of plants (D) All of the given

(9) The structure which develops from Radicle is ..... .

(A) Fibrous Root (B) Adventitious Root (C) Tap Root (D) All of the given

(10) Which one is correct for root that is produced from stem or leaf ?

(A) It has originated from Radicle (B) It is a type of Tap Root

(C) It is also called Adventitious Root (D) None of the given

(11) Which is not applicable to cells of Meristematic region of root ?

(A) Continuous cell division (B) Filled with protoplasm

(C) Thin cell wall (D) Cells are large in size

(12) In which region of root, differentiation is seen ?

(A) Maturation region (B) Elongation region (C) Meristematic region (D) Root-cap region

(13) Which region of root is also known as root-hair region ?

(A) Elongation region (B) Maturation region (C) Root-cap region (D) Meristematic region

(14) From which region of root, lateral roots are arised ?

(A) Elongation region (B) Maturation region (C) Root-pocket region (D) Meristematic region

(15) Which pair is not matched ?

(A) Maturation region - Permanent region of root

(B) Meristematic region - Thin cell walled region of root

(C) Root-cap region - Meristematic region of root

(D) Elongation region - Fast growing in length and volume region

(16) Which function is not applicable to root ?

(A) Ascent of sap (B) Fixation

(C) Absorption of water-minerals (D) None of the given

(17) Which is applicable to a structure which is produced from Radicle ?

(A) It is developed perpendicular to soil and deep into soil.

(B) It absorbs water and minerals from soil

(C) It is called normal root or Tap root

(D) All of the given

(18) Which is applicable to root-hair ?

(A) It increases the surface for absorption (B) It conducts the mineral and water

(C) It anchors plant to the soil (D) All of the given

(19) Which is applicable to root which develops from Hypocotyl ?

(A) It is Tap root (B) It is seen always in perennial plants

(C) It will strongly fix the plants (D) None of the given

(20) What will happen if all the root-caps removed from all the lateral branches and main branch of plant root-system ?

(A) No effect on growth and development of plant

(B) There is possibility of increase of height and depth

(C) There is possibility of absorption of water-mineral

(D) In place of root-caps, root-pocket will be developed

(21) In which plant the meristematic region is protected by root-pocket ?

(A) Banyan tree (B) Pandanus (C) Pistia (D) All of the given

Answers : (8-A), (9-C), (10-C), (11-D), (12-A), (13-B), (14-B), (15-C), (16-A), (17-D), (18-A), (19-D), (20-B), (21-C)

- **Adaptations of Root :**

(A) Storage of Food : Some time alongwith fruit, root also stores food to survive during adverse condition and dormat condition.

(A-1) Tap root : • Carrot : Conical shape • Radish : Fusiform shape • Beet : Napiform

(A-2) Adventetious root : • Sweet potato : Simple tuberous root • Asparagus and Dahila : Fasciculated tuberous root

(B) Mechanical support : When main stem of the plant is not capable of enough support to plant, root modifies for support.

(B-1) Stilt root of Maize : In Maize and Pandanus, adventitious roots arise from node of the stem nearer to the ground and these roots grow obliquely downwards.

(B-2) Prop roots of Banyan tree : Thick and pillar like prop roots develop from thick-heavy and horizontal branch of Banyan tree.

(C) Climbing : Due to weak stem in Pothos, long branched or unbranched, brown adventitious roots develops from nodes and internods of the stem. It secretes sticky material.

(D) Photosynthesis : Plants like Tinospora has few and small leaves, So, it develops suspended, smooth, thin and green thread like root from stem which is known as Assimilatory roots.

(E) Breathing : As the soil of creeks near coastal regions are saline and waterlogged, so it is devoid of oxygen. Plants like Rhizophora and Avicennia which are known as Mangroove plants, produces negatively geotropic and positively phototropic aerial roots from their underground roots which bears lenticels (pores) to exchange O_2 and CO_2. This root is called pneumatophores.

(F) Absorption of moisture : Orchids have no contact with soil. So, it grows on host plants for habitat only. It does not harm host, so it is called epiphytic. It produces adventitious long, green, thick and spongy roots, which has specialized velamen tissue to absorb water (or moisture) from surrounding atmosphere. The cells of this tissue are polygonal, thick walled and arranged in many layers.

(G) Parasitism : Plants depends for minerals, water, food on the host.

(G-1) Total parasite Cuscuta : Cuscuta is non green, leafless plant (climbers) which absorbs water, minerals and food from host by its suckers or haustoria.

(G-2) Partial parasite Loranthus : Loranthus absorbs water and minerals only from host by its suckers. It prepares the food in their leaves.

(H) Symbiosis : Leguminous plants like Bean, Groundnuts, etc. gives habitat and food to Rhizobium bacteria in its root. In return, bacteria fixes free atmospheric nitrogen as nitrogenous salts into roots.

(I) Vegetative Propagation : Adventitious buds occur on tuberous roots of sweet potato that takes part in reproduction.

(22) Although, Orchid grows on host, but still it is not called Parasite but Epiphyte.

(A) It acquires water and minerals only from host.

(B) It acquires only food from host.

(C) It utilizes host for its own protection.

(D) In grows on host for habitat only.

(23) Assimilatory roots means...

(A) Photosynthetic roots (B) Epiphytic roots (C) Parasitic roots (D) Breathing roots

(24) In Coastal regions plants have Breathing roots, Because ..... .

(A) They need more oxygen

(B) Oxygen is less due to salinity

(C) They do not get enough oxygen due to saline atmosphere

(D) All of the given

(25) Which option is correct for the purpose of adventitious bud ?

(A) Carissa - Protection (B) Lawsonia - Protection

(C) Sweet potato - Vegetative propagation (D) Passion flower - Climbing

(26) Loranthus is partial parasite while cuscuta is total parasite, because...

(A) The suckers are present in cuscuta, lacks in Loranthus.

(B) Cuscuta absorbs only water - mineral while Loranthus absorbs water, mineral, food from host.

(C) Loranthus have contact to soil, while cuscuta doesn't have.

(D) Cuscuta is leafless, while Loranthus is leafy plants.

(27) What is the function of Velamen tissue ?

(A) Reproduction (B) Photosynthesis (C) Assimilation (D) Absorption of Moisture

(28) Which pair is mismatched ?

(A) Assimilatory root - Tinospora (B) Stilt Root- Pandanus

(C) Breathing root - Rhizophora (D) Parasitic root - Nepenthes

(29) What is main aim of Assimilatory root ?

(A) To get O_2 through respiration (B) Nutrition through parasitism

(C) Nutrition through photosynthesis (D) Mechanical support

(30) Stilt root is present in Maize. Because...

(A) To absorb extra mineral-water (B) For mechanical support

(C) To absorb extra O_2 (D) For extra absorption of moisture

(31) To separate Breathing root from epiphytic root, which option is correct ?

(A) It is present in Rhizophora (B) It is having lenticels

(C) It is negatively geotropic (D) All of the given

(32) Which plants possesses suckers ?

(A) Rhizophora - Avicennia (B) Loranthus - Cuscuta

(C) Banyan tree - Maize (D) Sweet potato - Dahlia

(33) Which option is correct for location and function of sticky root ?

(A) Location : Pothos, Function : Climbing (B) Location : Tinospora, Function : Assimilation

(C) Location : Avicennia, Function : Breathing (D) Location : Orchid, Function : Nutrition

(34) What benefit does Bacteria (Rhizobium) gets from legume plants as rewards for Nitrogen fixation ?

(A) Protection-Respiration (B) Reproduction-Nutrition (C) Habitat-Nutrition (D) Protection-Reproduction

(35) Which characters are matched for negatively geotropic root ?

(A) Thick, Long, greenish (B) Thin, long, suspended

(C) Spongy, long, porous (D) Long, unbranched, grey coloured

Answers : (22-D), (23-A), (24-B), (25-C), (26-D), (27-D), (28-D), (29-C), (30-B), (31-D), (32-B), (33-A), (34-C), (35-C)

- **Stem :** It is plant axis which develops from plumule and is negative geotropic, positive phototropic and negative hydrotropic aerial part.
  - Node : It is condensed part of plant stem which produces leaves
  - Internode : Region between two successive nodes
  - Axil : An angle between leaf and stem
  - Apical bud : Meristematic region of Apex or tip of stem
  - Axillary bud : Meristematic region in the axil of leaf
  - Branching : Arrangement of branches on stem. It is of main two types

    (1) Dichotomous : Apical bud divides into two branches. e.g., Hyphaene (palm)

    (2) Lateral : Branches are produced from axillary bud. It is of two subtypes.

    (i) Racemose : Growth of apical bud remains constant and branches develop from axillary bud. e.g., Polyalthea and Cassuarina. All the branches arises from a single main axis. So the axis is called monopodial axis.

    (ii) Cymose : Apical bud becomes inactive after sometime, branches develops from axillary bud. It is of three types.

    (a) Uniparous : One branch develops only from axillary bud. It has two subtypes.

    (i) Helicoid : Branches are formed only on one side, either on left or right. e.g., Ashoka

    (ii) Scorpioid : Branches are formed alternately on both sides. e.g., vitis.

    (b) Biparous : Two branches develops. e.g., Mirabilis, Carissa.

    (c) Multiparous : More than two branches arises. e.g., Croton, Red oleander.

Note : If the axis of the stem is formed by union of many lateral branches, it is called Sympodial axis.

- **Types of stem :**

  (1) Aerial : It is erect, strong, woody, branched or unbranched. Sometimes in climbers or geoprostrated plants it is weak.

  (2) Underground : It is devoid of chlorophyll, posseses scaly leaves and sometime stores food. Sometime they produce aerial leaves.

- **Normal functions of stem :**

  (1) Proper arrangement of leaves, flowers, fruits and branches

  (2) Bidirectional conduction of food and water-minerals

  (3) To support different organs like branches, flower, fruits

(36) Which is not the characteristic of a structure formed from Plumule ?

(A) It is positive phototropic and negative geotropic

(B) It bears node, internode and leaves

(C) It bears apical bud and axillary bud

(D) It is chlorophyll-less throughout life

(37) Which is competible to plant which have sympodial axis ?

(A) All the branches develops from single axis

(B) A single axis is formed by union of many lateral branches

(C) Apical bud continuously divides into two branches

(D) Apical bud will not become inactive

(38) Which is not competible to branching of Vitis ?

(A) It has Dichotomous branching and monopodial axis

(B) It has scorpioid branching and sympodial axis

(C) It has cymose and uniparous branching

(D) All of the given

(39) Which pair is not matched ?

(A) Mirabilis - Multiparous branching

(B) Palm - Dichotomous branching

(C) Carissa - Biparous branching

(D) Ashoka - Helicoid branching

(40) Which is not the characteristic of a underground stem ?

(A) chlorophyll-less

(B) Strong and woody

(C) With scaly leaves

(D) Small size and food storing

(41) Which is not the function of a stem ?

(A) Bidirectional conduction of food

(B) Bidirectional conduction of mineral-water

(C) Provides support to different organs

(D) Arrangement of different organs

(42) In which type of branching plant becomes conical or pyramidal shape ?

(A) Dichotomous

(B) Cymose - Helicoid

(C) Racemose

(D) Cymose - Multiparous

(43) How Dichotomous branching differs from Biparous branching ?

(A) In Dichotomous, apical bud divides in to two branches.

(B) In Dichotomous, two branches are formed from axillary bud.

(C) Dichotomous and biparous branching are of same type.

(D) Dichotomous present in Palm and biparous present in vitis.

Answers : (36-D), (37-B), (38-B), (39-A), (40-B), (41-B), (42-C), (43-A)

- **Adaptations for stem :**

(A) Storage of food :

(1) Ginger and turmeric : Like root, it is pale yellowish and underground but it posseses node, internode, scaly leaves, adventitious roots, buds, so it is food storing adaptation of stem. It is called rhizome or rootstock.

(2) Potato : Apical bud of underground branches becomes round or oval after food storage. It is called tubers. The pits on potato is known as 'eyes' which is useful in vegetative propagation.

(3) Amorphophallus : Only one internode stores food and becomes condensed and is known as corm.

(B) Vegetative propagation :

(1) Grass, oxalis, Hydrocotyl : From axillary bud, a branch has 2–3 internodes and run parallel to ground and produces new plant from node. This modified branch is called Runner.

(2) Pistia - Eichhornia : From axillary bud short, thick, horizontal branches which are parallel to water surface arises. From the node of these branch new plant develops. This branches is called offsets.

(3) Nephrolepis and Strawberry : Branches arising from basal region grow obliquely like arches, come in contact with ground and produce new plants. This branch is called stolons.

(4) Mint : It shows runner; but it remains underground. So it is called suckers.

(C) Storage of food and reproduction :

In Dioscorea and Agave plants, axillary buds and floral buds respectively store food and become fleshy. Later on they separate from parental plant and produce new plants. Such modified bud is called bulbil.

(D) Protection :

(1) Carissa - Apical bud transform into bifid thorns.

(2) Lawsonia and Pomegranate - Axillary bud tranform into thorn which bears leaves - flowers in rainy seasons.

(3) Rose - Pointed, curved Prickles are produced from surface of stem.

- **Note :** Thorns are meant for protection against Herbivory animals.

(E) Climbing : In passion - flower, cucurbita and Bittergourd axillary bud are modified into touch sensitive tendrils, which twines the support and so is useful in climbing.

(F) Photosynthesis : To reduce the transpiration in xerophytic plants like opuntia and Muehlenbeckia, deciduous leaves are short leaved and shed off in short time. Their stem becomes green and flat and carry out photosynthesis. This stem is called phylloclades.

(44) Bulbil means...

(A) Food storing floral bud (B) Food storing Apical bud

(C) Food storing axillary bud (D) All of the given

(45) Why leaves are deciduous in plants having phylloclades ?

(A) To protect against Herbivory animals (B) To reduce rate of transpiration

(C) Reproduction by leaves (D) All of the given

(46) How many plants shows thorn to gain protection against herbivorous animals ?

Carrisa, Muehlenbeckia, Lawsonia, Passion flower, Pomegranate, Acacia, Zizyphus, Dioscorea

(A) 3 (B) 5 (C) 6 (D) 2

(47) Offset means ..... .

(A) Above ground and obliquely develops branch which comes in contact with soil

(B) Above ground branch and develops parallel to soil

(C) Above water surface branch and develops horizontally

(D) Underground branch develops parallel to soil

(48) Which pair is mis-matched ?

(A) Potato-Rhizome (B) Mint-Runner (C) Muehlenbeckia-Flower bud (D) All of the given

(49) Which modification of stem for protection is not considered actually modification for stem ?

(A) Bifid thorn of carrisa (B) Thorn of Pomegranate

(C) Prickles of Rose (D) None of the given

(50) Where does food stored in Amorphophallus ?

(A) Only in one node (B) Only in one internode

(C) Only in one apical bud (D) Through out whole stem

(51) What is true for thorn of Lawsonia ?

(A) It is uniparous and develops from apical bud

(B) It is biparous and develops from apical bud

(C) It is biparous and develops from axillary bud

(D) It is uniparous and develops from axillary bud

(52) Ginger, although underground, but is not root. Because...

(A) It bears scaly leaves and buds on it (B) It stores food and becomes fleshy

(C) It stores food and perform vegetative reproduction (D) It is completely unbranched

(53) Which characteristic is not of Muehlenbeckia ?

(A) Its stem is green and flat

(B) It bears deciduous leaves to reduce transpiration

(C) Both (A) and (B)

(D) None of the given

(54) How many plants shows tendrils ?

Croton, Passion flower, Dioscorea, Cucurbita, Muehlenbeckia, Pandanus, Bittergourd, Nepenthus

(A) 8 (B) 5 (C) 3 (D) 4

(55) 'Rhizome' and 'Eye' are present respectively in which plants ?

(A) Turmeric, Potato (B) Ginger, Amorphophallus (C) Potato, Ginger (D) Amorphophallus, Potato

(56) Which examples are correct as their thorn bears leaves ?

(A) Acacia - Zizyphus (B) Lawsonia-Pomegranate

(C) Opuntia - Agave (D) Carrisa - Lawsonia

(57) 'Stolon' shows which type of modification ?

(A) Food storage and vegetative propagation (B) Climbing and vegetative propagation

(C) Vegetative propagation (D) Protection and vegetative propagation

(58) How many plants shows double modifications ?

Dioscorea, Muehlenbeckia, Croton, Nepenthus, Carrisa, Pandanus

(A) 1 (B) 2 (C) 3 (D) 5

Answers : (44-D), (45-B), (46-B), (47-C), (48-D), (49-C), (50-B), (51-D), (52-A), (53-D), (54-C), (55-A), (56-B), (57-C), (58-A)

- **Leaf :** It develops from node, green, flat, broad and has limited lifespan and determinate growth and bears axillary bud. It has different parts as given below :

(1) Leaf-base : Stipules are developed laterally from leaf-base. In maize, it is sheathing type of leaf-base.

(2) Petiole : It is stalk like and arranges leaf-blade in a proper manner. Leaf can be divided into two types on base of petiole.

(i) Petiolate : Petiolated leaves show petiole. e.g., sunflower, Vinca **(ii) Sessile :** Petiole is absent. e.g., Maize, Gloriosa

(3) Lamina : It bear veins. Veins forms the skeleton of lamina. There are main two types of venation.

(i) Reticulate : (Dicot leaves) : (i) Unicostate and (ii) Multicostate

(ii) Parallel : (Monocot leaves) (i) Unicostate and (ii) Multicostate

- **Normal function of leaf :** (1) Photosynthesis (2) Exchange of air for respiration (3) Transpiration
- **Phyllotaxy :** "Arrangement of leaves"

(1) Alternate : Alternate development of leaves on axis. e.g., Mustard, Sunflower, Hibiscus

(2) Whorled : More than two leaves arises from node. e.g., Red oleander, Alstonia

(3) Opposite : Leaves arises opposite to each other from node.

(i) Opposite superimposed : e.g., Quisqualis, Guava **(ii) Opposite decussate :** e.g., Calotropis

(59) Which is not function of decussate leaf ?

(A) Gaseous exchange (B) Mechanical support (C) Food-production (D) Food-storage

(60) In which plant, leaf base covers the inter-node ?

(A) Lemon (B) Acacia (C) Moringa (D) Maize

(61) Which structure forms skeleton of leaf-blade ?

(A) Phyllotaxy (B) Venation (C) Petiole (D) Leaf-base

(62) Which option is true for venation ?

(A) In maize, parallel venation is present

(B) In sunflower, Reticute venation is present

(C) Multicostate venation can be divided into convergent and divergent type

(D) All of the given

(63) What is main aim of petiole for leaf ?

(A) Skeleton formation for leaf (B) Helps in function of leaf-blade

(C) Arrange leaf-blade (D) Keeps leaf-blade erect

(64) Which pair is not matched ?

(A) Mustard - opposite to superimposed phyllotaxy (B) Alstonia - whorled phyllotaxy

(C) Calotropis - opposite decussate phyllotaxy (D) Hibiscus - Alternate phyllotaxy

(65) Which option is true for phyllotaxy of Guava ?

(A) Alternate (B) Opposite superimposed (C) Opposite deccusate (D) Whorled

(66) Which option is correct for a plants, whose node forms more than two leaves ?

(A) Red-oleander-whorled (B) Mustard-Alternate

(C) Calotropis-opposite deccusate (D) Guava-opposite superimposed

(67) Which character is not applicable to leaf ?

(A) It arises from node (B) It is green, flat and broad

(C) It has infinite life-span and growth (D) None of the given

(68) Whose function is to connect leaf to node ?

(A) Leaf-base (B) Stipule (C) Petiole (D) Lamina

Answers : (59-B), (60-D), (61-B), (62-D), (63-C), (64-A), (65-B), (66-A), (67-C), (68-A)

- **Types of leaf :** It has two types :

(1) Simple leaf : It has axillary bud in its axil and sometime shows dissected lamina but the incisions does not reach to the mid rib.

(2) Compound : When incision of lamina is upto midrib and leaf-blade divides into small leaf-lets. Leaf-lets do not have axillary bud. It has two types :

(i) Pinnate compound leaves : Leaflets arranges lateral side of midrib.

(a) Unipinnate : Leaflets directly arises on midrib. e.g., Cassia

(b) Bipinnate : Leaflets arises on secondary branch. e.g., caesalpinia, Acacia

(c) Multipinnate : Leaflets arises on tertiary branch. e.g., Moringa

(ii) Palmate compound leaves : Leaflets arranges on tip of mid rib.

(a) Unifoliate : Only one leaflet on tip of Mid-rib. e.g., Lemon

(b) Bifoliate : Two leaflets are present on tip of mid rib. e.g., Balanites

(c) Multifoliate : More than two leaflets on tip of midrib. e.g., Bombax, Aegle.

Note : Scaly leaf, Floral leaf, Bract, Cotyledons, etc. are some other types of leaves.

- **Modification of leaves :**

(1) Food storage : Concentrically arrange long leaves stores food at their leaf-base and they are arranged on underground condensed and disc-like stem. This is called tunicated bulb. Outer most leaf-base remains dry and papery. e.g., Onion.

(2) Support and climbing : In smilax stipules, in Gloriosa leaf-opex, in pea apical 3–5 leaflets transforms into tendrils and in Bignonia apical three leaflets transform into hook or claws for climbing.

(3) Protection : To protect themselves from grazing animals in Acacia and Zizyphus stipules, in Agave leaf apex and in opuntia whole leaf modified into spines.

(4) Photosynthesis : In Pea, stipulas becomes leaflike and is known as foliaceous stipulas. While in Australian accacia, petiole becomes green flat and called phyllode.

(5) Insectovory : In Nepenthus leaf is modified into a pitcher, in Utricularia leaf is modified into bladder for capturing insects. Such plants are rich in Protein, Although they are autotrophic plants.

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(69) Which is the mode of nutrition in Utricularia plant ?

(A) Autotrophic (B) Insectivory (C) Parasitic (D) Saprophytic

(70) Which content is comparative in high amount in insectivory plants ?

(A) Lipid (B) Protein (C) Carbohydrates (D) All of the given

(71) Phyllode is modification for...

(A) Protection (B) Photosynthesis (C) Support and climbing (D) None of the given

(72) Which two modifications are present in Pea plant ?

(A) Insectivory - Reproduction (B) Reproduction - Climbing

(C) Food Storage - Protection (D) Photosynthesis - Climbing

(73) What is correct for Bignonia ?

(A) Petiole becomes flat and performs photosynthesis

(B) Stipules modified into spines for protection

(C) Apical leaflets transform into tendrils for climbing

(D) Stipules transforms into tendrils for climbing

(74) Which option (pair) is correct ?

(A) Pea - Stipules for climbing (B) Gloriosa - Leaf for protection

(C) Bignonia - petiole for climbing (D) Smilax - Stipules for climbing

(75) Which option is incorrect for Agave ?

(A) Leaf apex is transformed into spine to protect against grazing animal

(B) Floral bud is transformed into Bulbil for reproduction

(C) Axillary bud is transformed into tendril for climbing

(D) None of the given

(76) Which is tunicated bulb ?

(A) Sweet potato (B) Dahlia (C) Onion (D) Amorphophallus

(77) In which plant, foliaceous stipules are present ?

(A) Pea (B) Muehlenbeckia (C) Dioscorea (D) Australian acacia

(78) In which plant concentric leaves and food is stored in leafbase ?

(A) Amorphophallus (B) Onion (C) Dahlia (D) Garlic

(79) Which pair is true ?

(A) Lemon - Unipinnate compound leaf (B) Balanites - Bipinnate compound leaf

(C) Aegle - Bifoliate palmate compound leaf (D) Moringa - Multipinnate compound leaf

(80) Which pair is not matched ?

(A) Caesalpinia - Bipinnate compound leaf (B) Acacia - Multipinnate compound leaf

(C) Bombax - Multifoliate palmate compound leaf (D) Cassia - Unipinnate compound leaf

(81) In which plants, more than two leaflets are present on the tip of midrib ?

(A) Bombax (B) Lemon (C) Balanites (D) Moringa

Answers : (69-B), (70-B), (71-B), (72-D), (73-C), (74-D), (75-C), (76-C), (77-A), (78-B), (79-D), (80-B), (81-A)

(82) Match the column I and II :

Column - I	**Column - II**	
(1) Carrot	(p) Root becomes tendrillar	(A) (1-p), (2-q), (3-r), (4-t)
(2) Gloriosa	(q) Leaf apex becomes tendrillar	(B) (1-u), (2-q), (3-r), (4-s)
(3) Passion flower	(r) Axillary bud becomes tendrillar	(C) (1-p), (2-t), (3-q), (4-r)
(4) Bignonia	(s) Leaflets becomes tendrillar	(D) (1-u), (2-q), (3-t), (4-s)
	(t) Stipules becomes tendrillar	
	(u) Root stores food	

(83) Match the column I, II and III :

Column - I	**Column - II**	**Column - III**
(1) Opuntia	(v) Vegetative propagation	(p) Modification of Axillary bud
(2) Pea	(w) Climbing	(q) Modification of Adventitious root
(3) Tinospora	(x) Support	(r) Modification of Stipules
(4) Dioscorea	(y) Protection	(s) Modification of leaflets
	(z) Photosynthesis	(t) Modification of whole leaf

(A) (1-y-p), (2-z-r), (3-x-s), (4-v-t) (B) (1-y-t), (2-w-s), (3-z-q), (4-v-p)

(C) (1-x-p), (2-z-r) (3-v-q), (4-w-t) (D) (1-z-t), (2-w-s), (3-x-q), (4-v-p)

(84) Match the column I and II :

Column - I	**Column - II**	
(1) Pea	(p) Vegetative propagation - protection	(A) (1-t), (2-s), (3-q), (4-p)
(2) Sweet Potato	(q) Photosynthesis - protection	(B) (1-r), (2-p), (3-q), (4-s)
(3) Opuntia	(r) Food storage - protection	(C) (1-t), (2-p), (3-r), (4-q)
(4) Agave	(s) Reproduction - Food storage	(D) (1-q), (2-s), (3-r), (4-t)
	(t) Climbing - Photosynthesis	

(85) Match the column I and II :

Column - I	Column - II	
(1) Caesalpinia	(p) Three leaflets at tip of midrib	(A) (1-q), (2-p), (3-s), (4-t)
(2) Moringa	(q) Leaflets on tertiary branch	(B) (1-p), (2-t), (3-s), (4-r)
(3) Bombax	(r) Leaflets on secondary branch	(C) (1-r), (2-q), (3-p), (4-t)
(4) Lemon	(s) Two leaflets at tip of midrib	(D) (1-r), (2-q), (3-s), (4-p)
	(t) One leaflet at tip of midrib	

(86) Match the column I and II :

Column - I	Column - II
(1) Super imposed two opposite leaves from node	(p) Mustard
(2) More than two leaves from node	(q) Calotropis
(3) Two opposite decussate leaves from node	(r) Hibiscus
(4) Alternate one leaf from node	(s) Red oleander
	(t) Quisqualis

(A) (1-t), (2-s), (3-r), (4-p) (B) (1-q), (2-t), (3-p), (4-r)
(C) (1-s), (2-t), (3-r), (4-p) (D) (1-t), (2-s), (3-q), (4-p)

(87) Match the column I and II :

Column - I	Column - II	
(1) Bulbil	(p) Photosynthesis	(A) (1-t), (2-r), (3-s), (4-p)
(2) Offset	(q) Climbing	(B) (1-r), (2-s), (3-t), (4-p)
(3) Moisture absorbing root	(r) Food storage and Reproduction	(C) (1-p), (2-s), (3-r), (4-q)
(4) Phylloclade	(s) Vegetative propagation	(D) (1-s), (2-r), (3-p), (4-q)
	(t) Epiphytic root	

(88) Match the column I and II :

Column - I	Column - II	
(1) Food storage modification of internode	(p) Dioscorea	(A) (1-r), (2-q), (3-p), (4-t)
(2) Suckers form for Parasitism	(q) Loranthus	(B) (1-r), (2-u), (3-s), (4-t)
(3) Axillary bud modifies for vegetative propagation	(r) Amorphophallus	(C) (1-s), (2-q), (3-p), (4-t)
(4) Climbing modification of stipules	(s) Muehlenbeckia	(D) (1-r), (2-u), (3-t), (4-s)
	(t) Smilax	
	(u) Cuscuta	

(89) Match the column I and II

Column - I	Column - II
(1) Muehlenbeckia	(p) Petiole - Climbing
(2) Strawberry	(q) Stem - Photosynthesis
(3) Groundnut	(r) Stem - Reproduction
(4) Australian acacia	(s) Petiole - Photosynthesis
	(t) Root - Symbiosis

(A) (1-q), (2-r), (3-s), (3-p) (B) (1-r), (2-u), (3-s), (4-t)
(C) (1-q), (2-r), (3-t), (4-s) (D) (1-p), (2-r), (3-q), (4-s)

Answers : (82-B), (83-B), (84-A), (85-C), (86-D), (87-B), (88-A), (89-C)

- **True - False (T - F) type questions :**

(90) Assertion x : In Pistia; vegetative propagation takes place by runner.

Assertion y : For vegetative purpose, bulbil is present in Muehlenbeckia.

Assertion z : Tap root of sweet potato vegetatively reproduces by adventitious bud.

(A) x and y are wrong, z is right (B) x, y and z all are right

(C) x is right, while y and z are wrong (D) x, y and z all are wrong

(91) Assertion x : Bignonia climbes by hook or claws.

Assertion y : Gloriosa is stem tendrillar plant.

Assertion z : Pothos is a plant which climbes by root.

(A) x, y wrong, while z is right (B) x, z wrong, y is right

(C) y is wrong, x and z are right (D) y, z wrong, x is right

(92) Assertion x : In Pea, leaflets modified for climbing and stipules modified for photosynthesis.

Assertion y : In agave, leaf-base modified for protection and flower bud modified for vegetative propagation.

(A) x is right, y is wrong (B) x is wrong, y is right

(C) x and y both are wrong (D) x and y both are right

(93) Assertion x : Pneumatophore of Avicennia, absorbs moisture from atmosphere due to velamen tissue.

Assertion y : Assimilatory root of Tinospora, Secretes sticky material and by photosynthesis, it compensate the requirement of food.

(A) x is right, y is wrong (B) x is wrong, y is right

(C) x and y both are wrong (D) x and y both are right

(94) Assertion x : In maize, prop root gives extra mechanical support to the plant.

Assertion y : In Australian acacia, petiole transforms into phyllode for photosynthesis.

(A) x is right, y is wrong (B) x is wrong, y is right

(C) x is y both are wrong (D) x and y both are right

(95) Assertion x : Although, *Utricularia plant* "eats" insect, still is known as Autotrophic.

Assertion y : For the purpose of vegetative propagation, sometimes bud transform into bulbil by storing food.

Assertion z : In carrisa apical bud bifids, while in pomegranate axillary buds transforms into spines.

(A) x, y and z all are wrong (B) x, y and z all are right

(C) x, y wrong, z is right (D) x, y right, z is wrong

(96) Assertion x : All the branches arises from main axis in vitis.

Assertion y : More than two leaves arises from a single node in whorled type of phyllotaxy.

(A) x is right, y is wrong (B) x is right, y is right

(C) x is wrong, y is right (D) x and y both are wrong

Answers : (90-D), (91-C), (92-A), (93-C), (94-B), (95-B), (96-C)

(97) The phyllotaxy shown in figure can be seen in this plant.

(A) Sunflower, Hibiscus

(B) Quisqualis, Guava

(C) Red oleander, Alstonia

(D) Calotropis, Mustard

(98) Which type of leaf is there in figure ? In which plant is it present ?

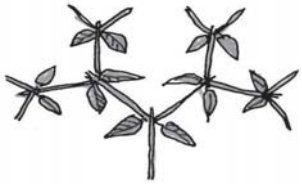
(A) Unipinnate leaf - cassia

(B) Unifoliate palmate leaf - Lemon

(C) Bipinnate leaf - Acacia

(D) Bifoliate palmate leaf - Balanites

(99) Which type of Branching is present in given figure ?



(A) Dichotomous - Palm

(B) Dichotomous - Mirabilis

(C) Biparous - Mirabilis

(D) Biparous - Palm

(100) The branching shown in figure is of ..... ?

(A) Ashoka

(B) Vitis

(C) Balanites

(D) Croton

(101) What is correct for "x" in the given figure ?

(A) Root hair arises from there

(B) New cells constantly added from there

(C) Maximum water-mineral absorbs from there

(D) Maximum size acquired by the cells of this region

Answers : (97-A), (98-B), (99-C), (100-B), (101-B)

- **A - Assestion and R - Reason type questions :**

  The answer should be given by following options :

  (A) A and R both are correct, R is correct explanation of A.

  (B) A and R both are correct, R is not correct explanation of A.

  (C) A is right, R is wrong

  (D) A is wrong, R is right

(102) Assertion A : Nepenthes is reach in protein.

Reason R : Due to insectivory it is reach in protein.

(A) (B) (C) (D)

(103) Assertion A : Leguminous plants are reach in protein.

Reason R : It gets extra protein by bladder like structure which performs insectivory.

(A) (B) (C) (D)

(104) Assertion A : Loranthus absorbs moisture from host by velamen tissue.

Reason R : Loranthus is partial parasite as it is leafy plant.

(A) (B) (C) (D)

(105) Assertion A : Corm is condensed from of rhizome.

Reason R : In Corm, food is stored only in a single node.

(A) (B) (C) (D)

(106) Assertion A : Palm is an example of biparous branching.

Reason R : In Palm, apical bud continuously divides.

(A) (B) (C) (D)

(107) Assertion A : In opuntia, leaves are modified for protection, while stem is for photosynthesis.

Reason R : As it is xerophytic plants, it shows these type of modifications.

(A) (B) (C) (D)

(108) Assertion A : To reduce the rate of Transpiration, in Australian acacia, compound leaf shed off with petiole.

Reason R : As this is xerophytic plant, so, its show this type of modification.

(A) (B) (C) (D)

(109) Assertion A : Carpels is also called megasporophyll leaf.

Reason R : In course of evolution, leaf transforms into carpels for reproduction purpose.

(A) (B) (C) (D)

Answers : (102-A), (103-C), (104-D), (105-C), (106-D), (107-A), (108-D), (109-A)

- **NEET Questions :**

(110) Ochreate stipules present in which plant family ?

(**Note :** When two stipules joins together to form tubular structure, it is called ochreate stipules.)

(A) Fabaceae (B) Polygonaceae (C) Solanaceae (D) Liliaceae

(111) In which family Nodulated root is present ?

(A) Solanaceae (B) Malvaceae (C) Papilionaceae (D) Liliaceae

(112) What is true for thorn and spine ?

(A) Spine is modified leaf, while thorn is modified stem

(B) Spine is soft while thorn is woody and hard

(C) Both (A) and (B)

(D) None of the given

(113) In which plant, offset is present ?

(A) Mint (B) Eichhornia (C) Cynodon dactylon (D) Pandanus

(114) In which plant, largest leaf-blade is present ?

(A) *Refflesia arnoldii* (B) Nerium (C) Victoria regia (D) Banana

(115) In which plant, Pneumatophores are present ?

(A) Terrestrial plants (B) Xerophyte plants

(C) Halophyte plants (D) Hydrophyte plants

(116) Food storing and beaded root is present in...

(A) Pandanus (B) Ginger (C) Bittergourd (D) Sweet potato

(117) In which plant multicostate convergent reticulate venation is present ?

(A) Cucurbita (B) Cotton (C) Castor (D) All of the given

(118) In plant like Camphor, Hibiscus and Tejpat the venation type is...

(A) Unicostate reticulate (B) Unicostate parallel

(C) Multicostate convergent reticulate (D) Multicostate divergent reticulate

(119) In which plant Radical leaves are present ?

(**Note :** Radical leaf : During favourable season, leaves develop from the nodes of underground stem and seem that they are arising from root.)

(A) Radish (B) Carrot (C) Both (A) and (B) (D) Bryophyllum

(120) How many leaflets are seen on tip of petiole of compound leaf of Marsilia ?

(A) 2 (B) 3 (C) 4 (D) More than four

(121) Which pair is mis-matched for shape of lamina and its related example ?

(A) Grass - Linear (B) Lanceolate - Nerium

(C) Betelnut - Cordate (D) None of the given

(122) Which type of venation is present is Palm and Coconut ?

(A) Multicostate divergent parallel (B) Multicostate convergent parallel

(C) Multicostate divergent reticulate (D) Multicostate convergent reticulate

(123) In which plant more than three multipinnate compound leaf is present ?

(A) Carrot, Coriandrum (B) Sweet potato, Betelnut (C) Grass, Bamboo (D) Radish, Beet

(124) Peripinnate and imperipinnate unipinnate compound leaf respectively present in...

(**Note :** If number of leaflet is odd or even, the unipinnate compound leaf is known as imperipinnate and peripinnate respectively)

(A) Sesbania, Rose (B) Cassia fistula, Neem

(C) Both (A) and (B) (D) Carrot, Coriandrum

(125) In which plant the Intrapetiolar stipules are present ?

(**Note :** When four stipules of two leaves join to form two stipules, are called interpetiolar stipules.)

(A) Gardenia (B) Ixora (C) Hibiscus (D) Desmodium

(126) Which type of stipules are present in Ixora ?

(A) Intrapetiolar (B) Free lateral (C) Foliage (D) Interpetiolar

(127) Ex-stipulated leaves are present in...

(A) Solanaceae (B) Liliaceae (C) Both (A) and (B) (D) Fabaceae

(128) Adnate stipules which are connected to its petiole, is seen in ..... ?

(A) Zizyphus (B) Smilax (C) Rose (D) Pea

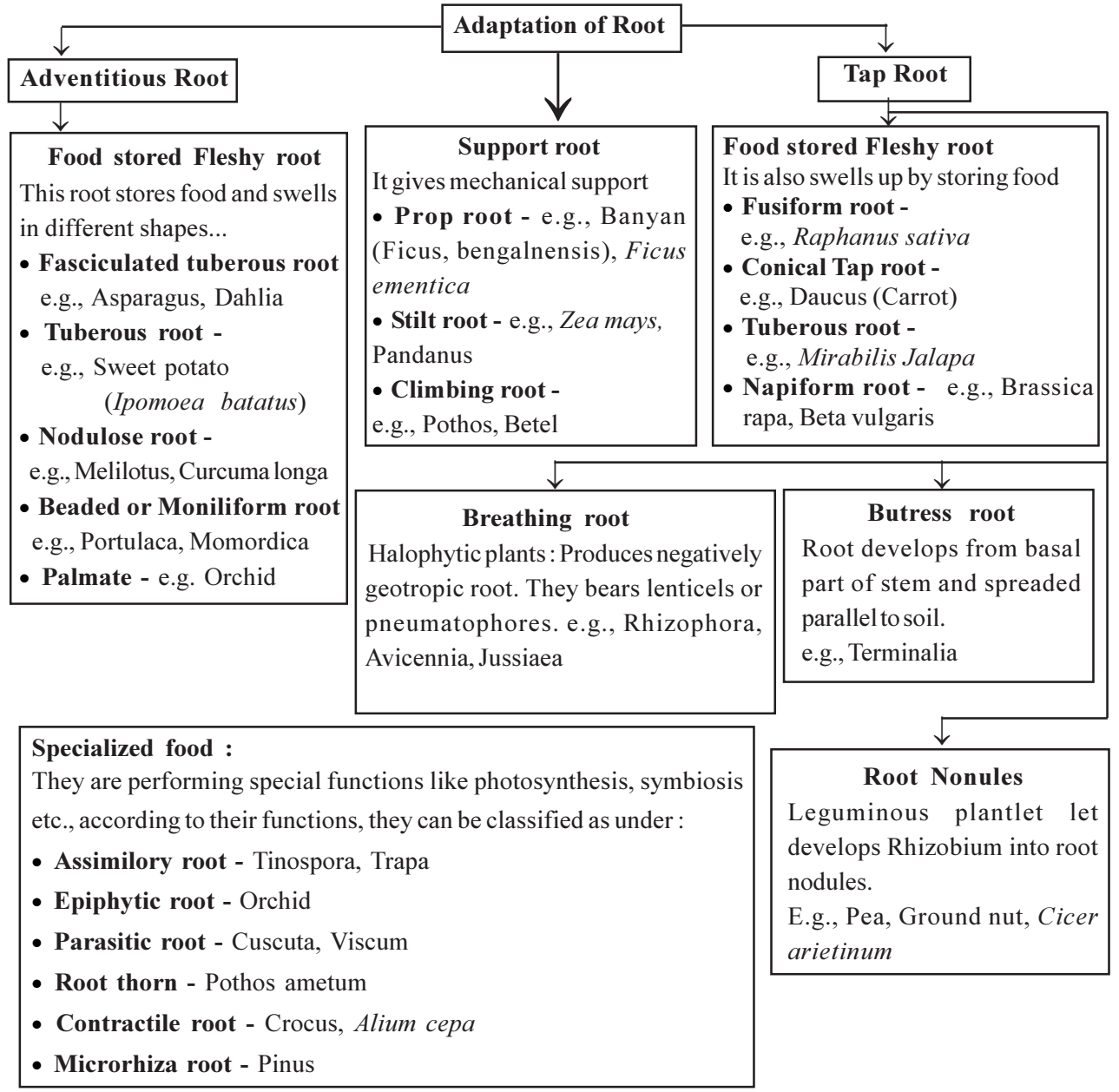
(129) Phylloclade is present in ..... ?

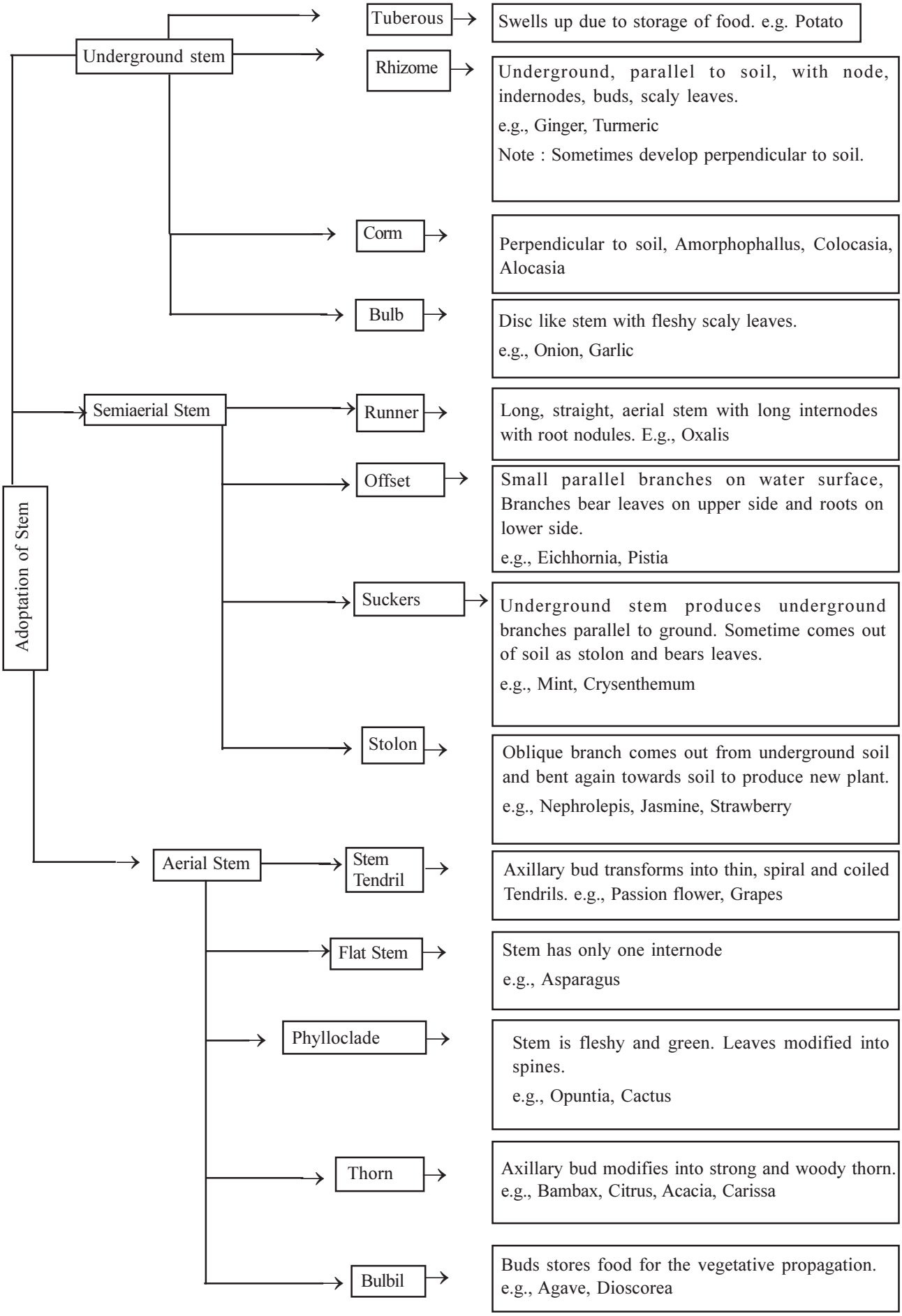
(A) Australian acacia (B) Pea (C) Passion flower (D) Cactus

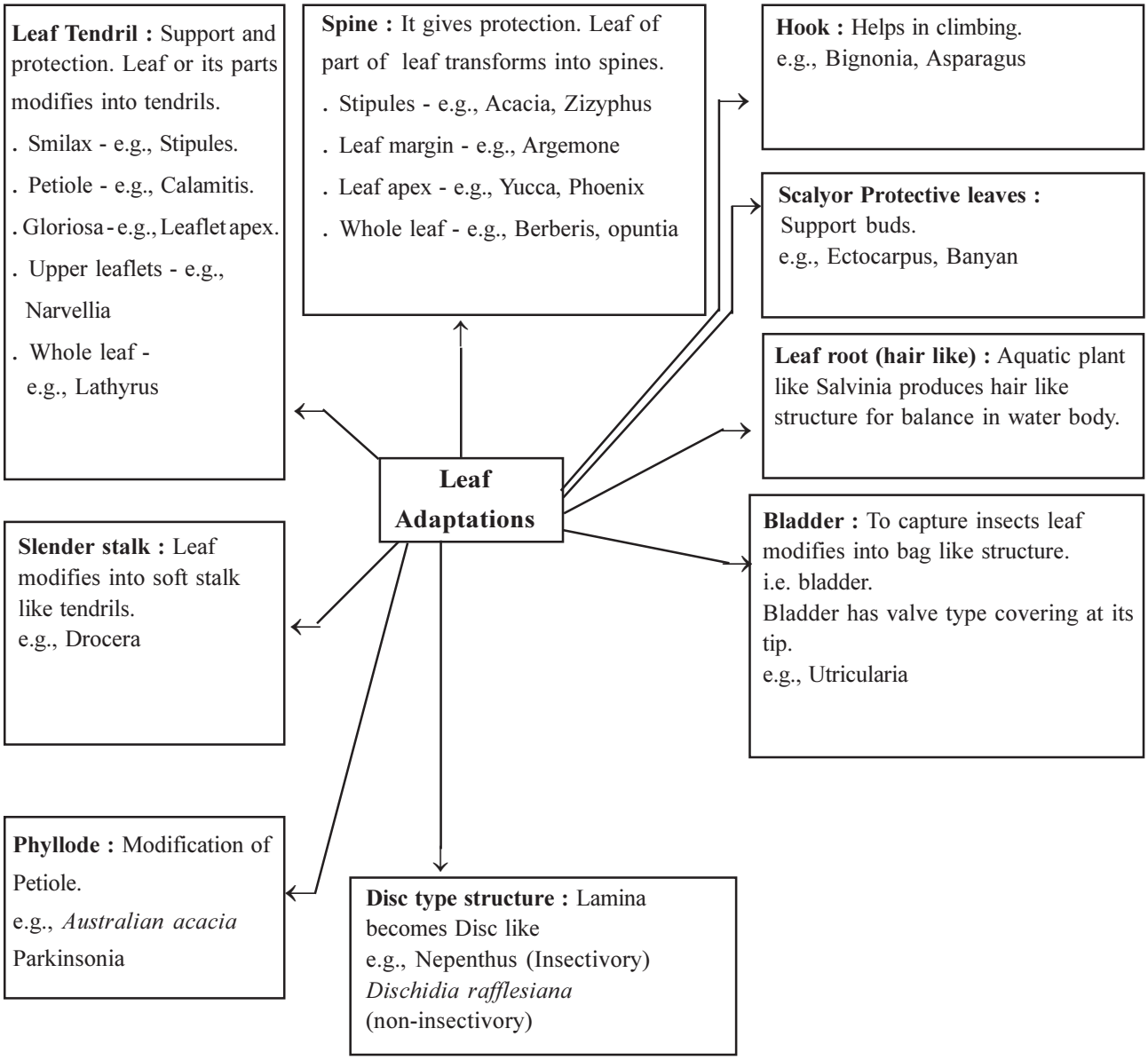
(130) Which plant vegetatively propagate by leaf ?

(A) Dioscorea (B) Bryophyllum (C) Muehlenbeckia (D) Agave

Answers : (110-B), (111-C), (112-C), (113-B), (114-C), (115-C), (116-C), (117-D), (118-D), (119-C), (120-C), (121-D), (122-A), (123-A), (124-C), (125-A), (126-D), (127-C), (128-C), (129-D), (130-B)




Adoptation of Stem
Underground stem
Tuberous
Swells up due to storage of food. e.g. Potato
Rhizome
Underground, parallel to soil, with node, indernodes, buds, scaly leaves.
e.g., Ginger, Turmeric
Note : Sometimes develop perpendicular to soil.
Corm
Perpendicular to soil, Amorphophallus, Colocasia, Alocasia
Bulb
Disc like stem with fleshy scaly leaves.
e.g., Onion, Garlic
Semiaerial Stem
Runner
Long, straight, aerial stem with long internodes with root nodules. E.g., Oxalis
Offset
Small parallel branches on water surface, Branches bear leaves on upper side and roots on lower side.
e.g., Eichhornia, Pistia
Suckers
Underground stem produces underground branches parallel to ground. Sometime comes out of soil as stolon and bears leaves.
e.g., Mint, Crysenthemum
Stolon
Oblique branch comes out from underground soil and bent again towards soil to produce new plant.
e.g., Nephrolepis, Jasmine, Strawberry
Aerial Stem
Stem Tendril
Axillary bud transforms into thin, spiral and coiled Tendrils. e.g., Passion flower, Grapes
Flat Stem
Stem has only one internode
e.g., Asparagus
Phylloclade
Stem is fleshy and green. Leaves modified into spines.
e.g., Opuntia, Cactus
Thorn
Axillary bud modifies into strong and woody thorn.
e.g., Bambax, Citrus, Acacia, Carissa
Bulbil
Buds stores food for the vegetative propagation.
e.g., Agave, Dioscorea


Leaf Adaptations
Leaf Tendril : Support and protection. Leaf or its parts modifies into tendrils.
. Smilax - e.g., Stipules.
. Petiole - e.g., Calamitis.
. Gloriosa - e.g., Leaflet apex.
. Upper leaflets - e.g., Narvellia
. Whole leaf - e.g., Lathyrus
Spine : It gives protection. Leaf of part of leaf transforms into spines.
. Stipules - e.g., Acacia, Zizyphus
. Leaf margin - e.g., Argemone
. Leaf apex - e.g., Yucca, Phoenix
. Whole leaf - e.g., Berberis, opuntia
Hook : Helps in climbing.
e.g., Bignonia, Asparagus
Scalyor Protective leaves : Support buds.
e.g., Ectocarpus, Banyan
Leaf root (hair like) : Aquatic plant like Salvinia produces hair like structure for balance in water body.
Bladder : To capture insects leaf modifies into bag like structure.
i.e. bladder.
Bladder has valve type covering at its tip.
e.g., Utricularia
Slender stalk : Leaf modifies into soft stalk like tendrils.
e.g., Drocera
Phyllode : Modification of Petiole.
e.g., Australian acacia
Parkinsonia
Disc type structure : Lamina becomes Disc like
e.g., Nepenthus (Insectivory)
Dischidia rafflesiana
(non-insectivory)