QUICK REVISION NOTES
For NEET
BIOLOGY CLASS 11

Morphology of Flowering Plants

The Root

- **Tap root:** Primary root is formed by elongation of the radicle and it bears secondary and tertiary roots, present in dicot plants, e.g. gram, mustard, etc.
- **Fibrous root:** found in monocotyledons. A large number of roots originate at the base of the stem, e.g. rice, wheat, etc.
- **Adventitious root:** Primary root is not formed from the radicle, e.g. grass, banyan tree, maize, etc.

Modification of the Root

- **For storage:** taproots- carrot, turnip; adventitious roots- sweet potato
- **For support:** Prop roots of Banyan tree, that arise from branches; stilt root of maize and sugarcane, that comes out of lower stem nodes
- **For aeration:** pneumatophores present in mangroves help them in respiration as it grows in swampy areas. These roots grow upwards above the ground, e.g. *Rhizophora*
- **For nitrogen fixation:** root nodules of leguminous plants

The Stem

- Plumule develops into stem
- The part of the stem which bears leaves is called a node and the part between two nodes is known as internode

Modification of the Stem

A. **Underground Stem:** They help plants sustain unfavourable conditions for growth
    1. **Rhizome-** runs parallel to the ground and has nodes, internodes, buds, e.g. ginger, banana
    2. **Tubers-** the end part gets swollen as in potato
    3. **Corm-** it grows vertically below the ground, e.g. colocasia, etc.
    4. **Bulb-** stem is reduced and surrounded by scaly leaves, e.g. garlic, onions
B. **Stem Tendrils:** these are a coiled structure that supports tender stem of the plant and help in climbing, e.g. grapes, cucumber, pumpkin
C. **Thorn:** axillary bud gets modified into pointed thorns and protects plants from grazing animals, e.g. Bougainvillea, citrus
D. **Subaerial Weak Stem**
    1. **Offsets-** internode of lateral branches decreases resulting in the rosette of leaves, e.g. Eichhornia, Pistia
    2. **Suckers-** lateral branches arise from the underground portion of the stem, e.g. chrysanthemum, banana, pineapple

3. **Runners-** stem run horizontally above the ground and roots arise at nodes, e.g. grasses, strawberry
4. **Stolon-** lateral branches arise normally but then bend down and touch the soil where the root grows and the new daughter plant arises, e.g. mint

E. **Aerial modification-** The stem is completely metamorphosed for various adaptations, e.g. **Phylloclade** of xerophytic plants. The stem becomes fleshy and green having photosynthetic pigments to prepare food as leaves are reduced to thorns to check water loss by transpiration, e.g. Euphorbia, Opuntia

The Leaf

- Leaves originate from the apical meristem of a shoot
- Normally a leaf consists of three parts; leaf base, lamina and petiole
- Leaf base attaches to stem and may have two small leaf-like structures known as stipule

Types of venation:

1. **Reticulate-** present in dicotyledons, there is a network of veins present, which are irregularly distributed
2. **Parallel-** present in monocotyledons, veins are parallel to each other

Types of Leaves:

1. **Simple-** lamina is complete and incision doesn't reach midrib
2. **Compound-** incision touches midrib, that divides a leaf into a number of leaflets
    - **Pinnately compound-** the leaflets are present on the common axis, i.e. midrib, called the **rachis**, e.g. Neem
    - **Palmately compound-** leaflets are attached at the petiole tip, e.g. silk cotton

Phyllotaxy: pattern of arrangement of leaves around the stem

1. **Alternate type-** single leaf present at each node, e.g. *Hibiscus, Brassica*
2. **Opposite type-** each node bears a pair of leaves, e.g. *Psidium guajava, Calotropis*
3. **Whorled type-** more than two leaves arise at the node to form a whorl, e.g. *Alstonia*

Modification of Leaves

- **Tendrils-** leaves modified to form a long thread-like structure, it gives support to climbers, e.g. peas
- **Spine-** in xerophytic plants to reduce water loss, e.g. cactus, aloe
- **For storage-** e.g. garlic, onion
- **Phyllodes-** petiole gets modified to form a leaf-like structure and function, e.g. Acacia
- Pitcher in pitcher plant is a modified leaf which traps insects inside

Inflorescence

- The arrangement of the flowers around the floral axis

- The two main types of inflorescence are
    1. **Racemose:** the main axis grows indefinitely, flowers are present laterally in acropetal succession i.e. older flowers at the bottom and the younger ones at the top. Types of racemose inflorescence: raceme, spike, umbel, capitulum, corymb, catkin, spadix, etc.
    2. **Cymose:** the main axis terminates in flower and has limited growth. Flowers are borne in a basipetal order i.e. older flowers are at the top and new flowers are at the bottom. Types of cymose inflorescence: monochasial cyme, dichasial cyme, etc.
- **Special types of Inflorescence**
    1. **Verticillaster:** sessile flowers arranged in dichasial cyme, e.g. Ocimum, Salvia
    2. **Cyathium:** involucre of bracts form cup shape structure, single female flower is surrounded by numerous male flowers, e.g. Euphorbia
    3. **Hypenthodium:** both male and female flowers are present in a cavity with an apical opening called ostiole, e.g. Fig

The Flower

- A flower has four whorls; calyx, corolla, androecium and gynoecium. These are attached to the swollen terminal of pedicel called the thalamus
- **Flower symmetry:**
    1. **Actinomorphic-** radially symmetrical flowers, e.g. chilli, datura, mustard
    2. **Zygomorphic-** when a flower can be divided into two equal parts in only one vertical plane, e.g. *Cassia,* pea, etc.
- Flowers can be trimerous, tetramerous or pentamerous depending on the multiple of floral appendages present 3, 4 or 5
- Types of flowers depending on the presence or absence of bracts (reduced leaf present at the base of pedicel); **Bracteate or Ebracteate**
- Types of flowers based on the position of the ovary:
    1. **Hypogynous-** gynoecium occupies the highest place, above all the other parts. The ovary is known as **superior**, e.g. brinjal, china rose, mustard
    2. **Perigynous-** gynoecium is present at the same level as the rest of the parts of a flower. The ovary is known as **half inferior,** e.g. peach, plum, rose
    3. **Epigynous-** thalamus encloses the ovary completely and other parts are present above it. The ovary is known as **inferior**, e.g. ray florets of a sunflower, guava, cucumber

Parts of a Flower

Calyx: A flower's outermost whorl is made up of leaf-like structures called **sepals**

Gamosepalous- sepals united

Polysepalous- sepals free

Corolla: made up of bright coloured petals. Present after sepals

Gamopetalous- petals united

Polypetalous- petals free

Aestivation: It is the mode of arrangement of sepals and petals. The main types of aestivations are:

- **Valvate-** sepals or petals just touch each other and don't overlap in a whorl, e.g. *Calotropis*
- **Twisted-** sepal or petal overlaps the next sepal or petal and the same continues in a whorl, e.g. cotton, china rose, lady's finger
- **Imbricate-** margins of sepal and petals overlap each other randomly and not in one direction, e.g. Gulmohar, *Cassia*
- **Vexillary-** the largest petal overlaps two petals (wings) present laterally on both the sides and that overlaps the two anterior petals (keel) in the same way. It is also called papilionaceous, e.g. beans, peas

Androecium: It is a male reproductive part. It consists of stamens. Each stamen is made up of filament and anthers.

- **Staminode-** sterile stamen
- **Epipetalous-** stamens are attached to petals
- **Polyandrous-** stamens are free
- **Monadelphous-** stamens are united and present as one bundle
- **Diadelphous-** stamens are united and present in two bundles
- **Polyadelphous-** stamens are united and present in more than two bundles

Gynoecium: It is a female reproductive part. It consists of carpels. Each carpel has three parts; stigma, style and ovary.

- **Apocarpous:** more than one carpels present, which are free, e.g. rose, lotus
- **Syncarpous:** more than one carpels present, which are united, e.g. tomato, mustard

Placentation: The specific arrangement of ovules in the ovary is called placentation. Types of placentation:

1. **Marginal-** e.g. pea
2. **Axile-** e.g. lemon, china rose
3. **Parietal-** e.g. *Argemone,* mustard
4. **Free central-** e.g. *Primrose, Dianthus*
5. **Basal-** e.g. marigold, sunflower

The Fruit

It is a matured and ripened ovary after fertilisation.

- **Parthenocarpic fruit: the fruit** formed without fertilisation, it makes seedless fruits, e.g. pineapple
- Seed and pericarp make a fruit. The fleshy pericarp is made up of three layers; epicarp, mesocarp and endocarp

The Seed

After the fertilisation, the ovule develops into a seed.

- A seed has a seed coat and an embryo. An embryo is made up of radicle, embryonal axis and one or two cotyledons in monocotyledons (maize, wheat) and dicotyledons (pea, gram) respectively.

Dicotyledonous seed	**Monocotyledonous seed**
The seed coat is made up of two layers; outer **testa** and inner **tegmen** There is a scar present through which the seed was attached to the fruit while developing, it is called the **hilum** **The micropyle** is a pore above the hilum	The seed coat is fused to the fruit wall and membranous
The embryo consists of an embryonal axis and two cotyledons	The embryo consists of one large cotyledon known as **scutellum**
Cotyledons store food	The endosperm is bulky and stores food
Mostly non-endospermic seeds. In castor, an **endospermic seed** is present- endosperm is formed due to double fertilisation and stores food	Mostly endospermic seeds. Some seeds like orchids are non-endospermic. **Aleuron** (a proteinaceous layer), is the outermost layer of endosperm, which separates the embryo
Radicle and plumule are present at the two ends of the embryonal axis	Plumule is enclosed in **coleoptile** and radicle is enclosed in **coleorhiza**