Morphology of Flowering Plants

- **Morphology**
  - It is the branch of biology which deals with the study of external structures of plants and animals.
  - A plant consists of a root system (underground part) and a shoot system (above the ground parts).
  - Roots are the parts of the root system; and stem, leaves, flowers, and fruits are parts of the shoot system.
- **Roots**
  - It helps in anchoring plant and absorbing water and minerals.
  - Developed from the radicle part of a cotyledon
  - It consists of a region of meristematic activity covered by a root cap, a region of elongation, and a region of maturation having root hairs.
- **Types of roots system:**
  1. Tap root system
  - It consists of a primary root that grows deep inside the soil.
  - It also bears lateral roots referred to as secondary and tertiary roots.
  - Example- Dicotyledons (mustard)
- **2.Fibrous root system**
  - Primary root is short-lived and is replaced by a large number of secondary roots.
  - Example- Monocotyledons (wheat)
- **3. Adventitious roots**
  - Roots arise from parts other than the radicle.
  - Example- Banyan tree

- **Root modifications**
  - **Prop roots –** Example: banyan tree
  - **Stilt roots –** Example: maize and sugarcane
  - **Pneumatophores** (that helps in respiration) – Example: Rhizophora
- **Characteristics of Root for Absorbing Water**
  - Enormous surface area
  - Root hairs containing cell sap at higher concentration
  - Thin walled root hairs

Stem

- Bears branches, leaves, flowers, and fruits
- Conducts water and minerals to all parts of the plant body
- Bears nodes and internodes

Stem modifications

- For storage – Example: Potato, ginger, turmeric.
- For support – Tendrils in cucumber, pumpkins, watermelon.
- For protection – Thorns in *Citrus*, *Bougainvillea*.
- For vegetative propagation – Tubers and rhizomes in potato and ginger respectively.

Leaf

- Performs the function of photosynthesis
- Consists of leaf base, petiole, and lamina
- Veins help in the transport of water to all leaf parts.
- Arrangement of veins is known as **venation**.
- Parallel venation is found in monocots. Example: Banana
- Reticulate venation is found in dicots. Example: Mango
- Leaves may be simple or compound.
- Pattern of arrangement of leaves on the stem is known as **phyllotaxy**. It may be alternate as in china rose, opposite as in *Calotropis* or whorled as in *Alstonia.*

Leaf modifications

- Tendrils- Example: Peas
- Spines- Example: Cactus
- Fleshy leaves for storage- Example: Onion and garlic

Inflorescence

- Arrangement of flowers on the floral axis is termed as inflorescence.
- Racemose- In this, main axis continues to grow and flowers are borne laterally.
- Cymose- In this, main axis terminates in a flower.

Flower

- Flower is the reproductive unit in angiosperms.
- Bisexual flower has both androecium and gynoecium.
- Unisexual flower has either androecium or gynoecium.
- Actinomorphic flower has radial symmetry. Example: *Datura* and mustard
- Zygomorphic flower has bilateral symmetry. Example: Pea and bean
- Asymmetric flower cannot be divided into similar halves by any vertical plane. Example: Canna

Parts of flower

- Calyx is outermost whorl of a flower composed of sepals. It may be gamosepalous (united sepals) or polysepalous (free sepals).

- Corolla is composed of petals. Petals are brightly coloured to attract pollinators. It may be gamopetalous (united petals) or polypetalous (free petals).
- Androecium is the male reproductive part of a flower, composed of stamens.
- Based on attachment of anther with floral parts, it can be epiphyllous (attached with perianth) or epipetalous (attached with petals).
- Stamens can be monoadelphous (united in one bundle), diadelphous (united in two bundles), and polyadelphous (united in many bundles).
- A sterile stamen is called a staminode.
- Gynoecium is the female reproductive part of a flower, composed of pistil.
- Based on position of ovary, a flower can be hypogynous (ovary is superior), perigynous or epigynous (ovary is inferior).

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- Based on position of ovary, a flower can be hypogynous (ovary is superior), perigynous or epigynous (ovary is inferior).
- When carpels are fused, ovary is syncarpous; when carpels are free, ovary is apocarpous.
- A flower may be trimerous, tetramerous or pentamerous when the floral appendages are in the multiple of 3, 4 or 5, respectively.
- **Aestivation** is the arrangement of sepals and petals in a flower bud. It may be
- valvate – Example: *Calotropis*
- twisted – Example: China rose
- imbricate – Example: *Cassia*
- vexillary – Example: Pea
- **Placentation** is arrangement of ovules within the ovary. It can be
- marginal – Example: Pea
- axile – Example: Tomato
- parietal – Example: Mustard

- free central – Example: *Dianthus*
- basal – Example: Sunflower

- **Seed Germination**
- It is the process of the seed develops into an individual plant utilizing the reserve nutrients present in the cotyledons.
- **Conditions necessary for germination**

  1. Water

  2. Oxygen

  3. Favourable temperature

- **Process of germination**

  1. The seed takes up water and swells.

  2. The embryonic radicle and plumule start growing and force the seed coat to rupture.

  3. The radicle comes out first and forms the root followed by the plumule which develops into the shoot.

- **Types of germination**

1. **Epigeal germination:** in this method the cotyledons are lifted above the ground and they act as the first leaves as a result of the rapid elongation of the hypocotyl. It takes place in seeds like Castor, cotton, sunflower etc.

2. **Hypogeal germination:** in this germination the cotyledons remain inside the soil and the epicotyls elongates and pushes the plumule above. It takes place in seeds like pea, maize, mango etc.

3. **Viviparous germination:** A special mode of germination in which seed starts germinating inside the fruit while it is still attached to the parent plant. Once

germinated, the seedling is dropped into the soil where it fixes itself by developing roots. It takes place in mangrove plants, like *Rhizophora* and *Sonneratia.*

Floral Formulae

Floral formulae are represented by symbols. Some of them are-

Br	Bracteate
K	Calyx
C	Corolla
P	Perianth
A	Androecium
G	Gynoecium
$\underline{G}$	Superior ovary
$\overline{G}$	Inferior ovary
♂	Male
♀	Female
⚥	Bisexual
⊕	Actinomorphic
%	Zygomorphic
Enclosing figure within brackets	Fusion
Line drawn over symbols of floral parts	Adhesion

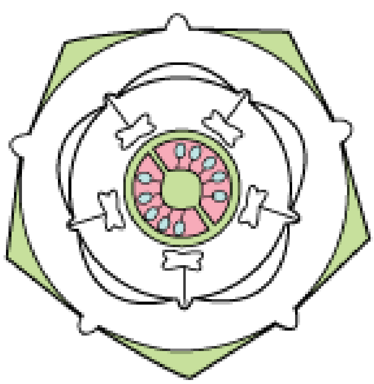
Family Solanaceae

- Floral characters include :

- Inflorescence : Solitary, axillary or cymose
- Flower : Bisexual and actinomorphic
- Calyx : Five sepals, gamosepalous, valvate aestivation
- Corolla : Five petals, gamopetalous, valvate aestivation
- Androecium : Five stamens, epipetalous
- Gynoecium : Bicarpellary, syncarpous, superior ovary, bilocular, many ovules
- Fruit : Berry or capsule

- Floral formula : $\oplus$ ⚥ $K_{(5)}\ \widehat{C_{(5)}\ A_5}\ \underline{G}_{(2)}$

- Floral diagram



Family Fabaceae

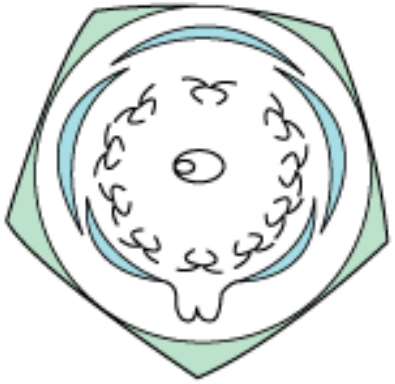
- Floral characters include :

- Inflorescence : Racemose
- Flower : Bisexual and zygomorphic
- Calyx : Five sepals, gamosepalous, imbricate aestivation

- Corolla : Five petals, polypetalous, posterior standard, 2 lateral wings, anterior keels (2),
    - Vexillary aestivation.
- Androecium : Ten, diadelphous, anther dithecous
- Gynoecium : Ovary superior, monocarpellary, unilocular ovary, single style
- Fruit : Legume, one to many seeds, non-endospermous

- Floral formula : $\% \, ♀ \, K_{(5)} \, C_{1+2+(2)} \, A_{(9)+1} \, \underline{G}_1$

- Floral diagram



Family Liliaceae

- Floral characters include :

- Inflorescence : Solitary, cymose
- Flower : Bisexual, actinomorphic
- Calyx : Six tepals (3 + 3), united into tube, valvate aestivation
- Androecium : Six stamens (3 + 3)
- Gynoecium : Tricarpellary, syncarpous, superior ovary, trilocular with many ovules, axile placentation .
- Fruit : Capsule, rarely berry, endospermous

- Floral formula : Br ⊕ ♀ $P_{(3+3)}$ A_{3+3} $\underline{G}_{(3)}$

- Floral diagram