FLOWER

- Study of flowers is called Anthology.
- It is specialized modified shoot, which meant for carrying out the sexual reproduction.
- It is reproductive unit in the angiosperm.
- The shoot on which the flower is borne is called Mother Axis.
- The side of the flower which is towards mother axis is posterior.
- A typical flower has four different kinds of whorls arranged successively on the swollen end of the stalk or pedicel, called thalamus or receptacle.
- These are **calyx, corolla, androecium** and **gynoecium**.
- Calyx and corolla are accessory organs, while androecium and gynoecium are reproductive organs.

(I) Attachment of flower:

(i) Sessile: When pedicel is absent. **e.g. *Morus, Adhatoda***.

(ii) Pedicellate: When pedicel is present **e.g. *Dianthus*.**

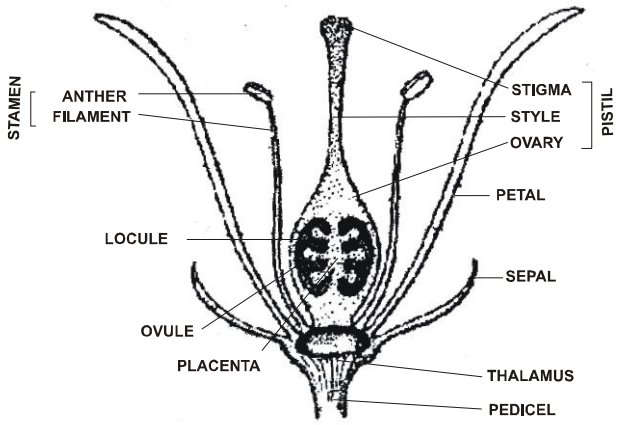


Fig :- V.S. of Flower

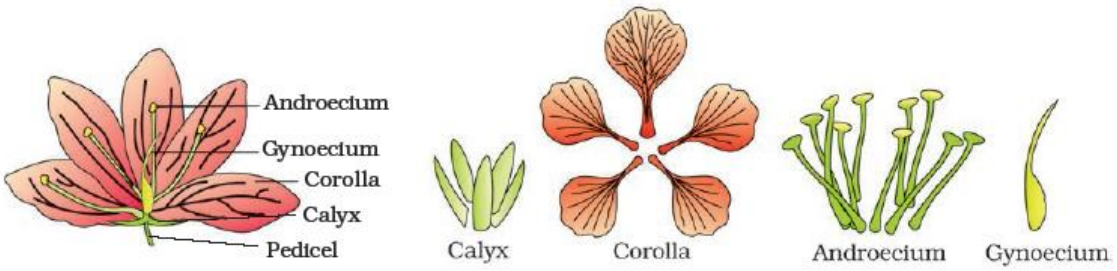


Figure : Parts of a flower

(II) Bracts and bracteoles:

- **Bract:** It is a leaf like structure present in the axil of flower or Inflorescence. Flowers with bracts are called bracteate and without bracts are called ebracteate.
- **Bracteole:** Some times thin small bract like structures are present at some point on the Pedicel of the flower. These structures are called bracteole.

(III) Presence of floral whorl:

(a) Complete: A flower bears all the four types of floral organs (Calyx, Corolla, Androecium and Gynoecium) is called complete flower. **e.g. *Solanum nigrum*.**

(b) Incomplete: The absence of any one or more of the floral organs makes the flower incomplete. **e.g. *Euphorbia* species**.

(IV) Symmetry:

(1) Actinomorphic (Radial): A cyclic flower which can be divided into two equal vertical halves by any vertical plane is known as Actinomorphic flower. **e.g. *Ipomea, Dianthus*, Mustard, *Datura*, Chilli.**

(2) Zygomorphic (Bilateral): A flower which can be divided into two equal vertical halves by one plane only is called zygomorphic flower. **e.g. Pea, *Adhatoda*, Gulmohur, Bean, *Cassia*.**

(3) Asymmetrical (irregular): A flower which cannot be divided in to two equal parts by any vertical plane is known as acyclic or asymmetric flower. **e.g. *Opuntia, Canna*.**

(V) Number of floral parts:

(i) Bimerous or Dimerous: Two or multiple of two parts in each type of floral organs. **e.g. Poppy.**

(ii) Trimerous: Three or multiple of three parts in each type of floral organs. **e.g. Onion, *Argemone*.**

(iii) Tetramerous: Four or multiple of four parts in each type of floral organs. **e.g. Mustard.**

(iv) Pentamerous: Five or multiple of five parts in each type of floral organs. **e.g. *Solanum nigrum*.**

Position of floral organs on thalamus:

(i) Hypogynous:

- Ovary develops at its top called **superior ovary** while other floral whorls like sepals, petals, stamens are borne successively below.
- It is called hypogyny.
- A flower having hypogyny is called hypogynous. **e.g. *Citrus*, Mustard, China rose, Brinjal.**

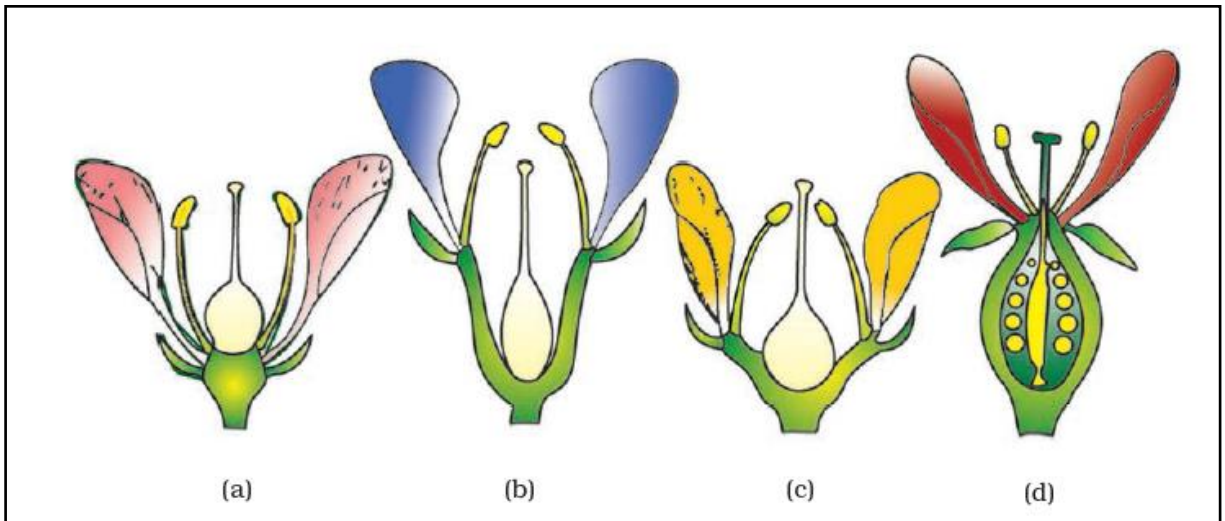


Figure : Position of floral parts on thalamus : (a) Hypogynous (b) and (c) Perigynous (d) Epigynous

(ii) Perigynous :

- Ovary and other floral organs sepals, petals and stamen lie at the same level.
- This ovary is said to be **half inferior. e.g. Plum, Peach, Rose.**

(iii) Epigynous :

- Ovary is **inferior** while the other floral organs are borne at the top of the ovary as margin of thalamus grows upward **enclosing the ovary completely** and fused with it. **e.g. Ray florets of Sunflower, Cucumber, Guava, Coriander**.

Some Important terms:

1. **Bisexual flower:** A flower having both Androecium and Gynoecium is described as Bisexual flower or hermaphrodite.
2. **Unisexual flower:** If only one of the two essential floral organs (either androecium or Gynoecium) is present.
3. **Monoecious plant:** If both the types of unisexual flowers (staminate and pistillate) may be present on the same plant. It is called Monoecious plant. **e.g. *Zea mays, Ricinus communis*.**
4. **Dioecious plant:** When staminate and pistillate flower borne on different plant. It is known as Dioecious. **e.g. Date palm, Mulberry, Papaya.**
5. **Trioecious:** A plant bearing three types – male, female and bisexual separately, **e.g. *Silene*.**
6. **Polygamous:** A single plant bearing staminate, bisexual (intersexual) and neuter flowers but males are more **e.g. *Mangifera* (mango), *Anacardium* (cashew-nut)**.

PARTS OF THE FLOWER

Calyx :

- It is an outer most **accessory** whorl of flower, which is green, flattened, or foliaceous floral organ and provide protection to the other floral parts in the bud condition.
- Calyx are either **gamosepalous (sepals united) eg. Cotton, *Datura*, Brinjal** or **polysepalous (sepals free) eg. Mustard, Radish.**

Duration of calyx:

(1) Caducous: Falling down immediately after opening of flower. **e.g. Poppy.**

(2) Deciduous: Falling down at the time of withering of flower. **e.g. Mustard.**

(3) Persistant: Sepals persisting in the fruit. **e.g. Rose.** It is of two types-

(a) Accrescent: Calyx grow along with the fruit. **e.g. *Physalis, Shorea robusta*.**

(b) Marcescent: Calyx remain small and dried up form before being shed. **e.g. Guava.**

Modifications in Sepals:

(i) Pappus: Sepals are modified into white hairy processes in the plants of family Asteraceae which is helpful in dispersal of fruits. **e.g. Sunflower, *Sonchus*.**

(ii) Spinous: In some plants, sepals are modified into spines. **e.g. *Trapa*.**

(iii) Leafy: In several plants, sepals are modified into large coloured, leaf like structure which are called petaloid. **e.g. *Mussaenda*.**

Corolla:

- It is a second accessory whorl of floral parts, which consists of petals.
- The petals are usually coloured and helps to attract the pollinator.
- Corolla are either **Polypetalous or gamopetalous**.
- The shape and colour of corolla vary greatly in plants. Corolla may be tubular, bellshaped, funnel-shaped or wheel-shaped.

Aestivation:

It is the arrangement of ac**c**ess**o**ry floral organs (Petals & sepals) in relation to one another in the floral bud.It is of following types.

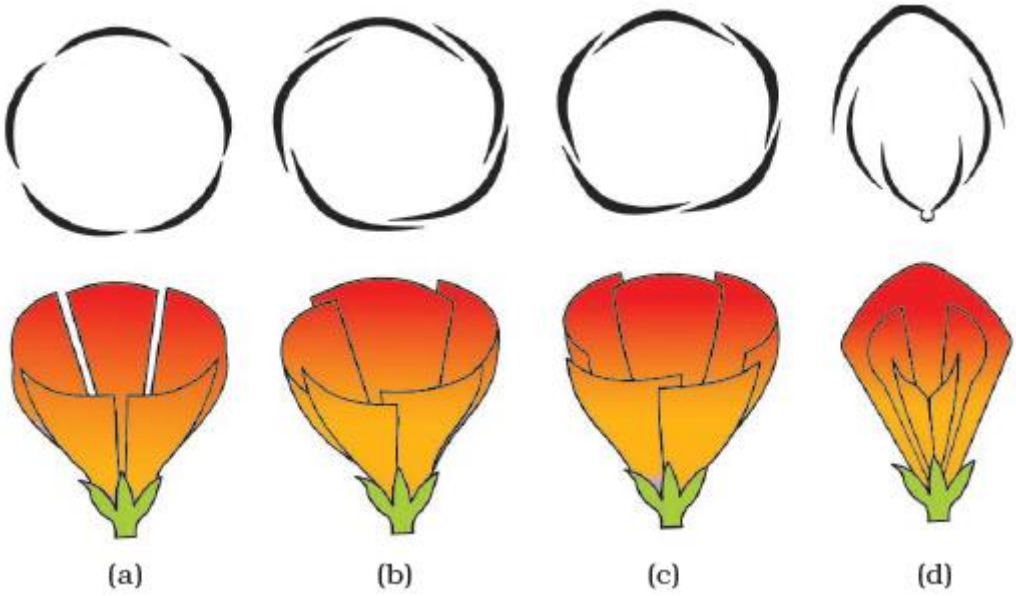


Figure : Types of aestivation in corolla : (a) Valvate (b) Twisted (c) Imbricate (d) Vexillary

(1) Valvate: Margins of adjacent petals touch each other with out overlapping. **e.g. Mustard, *Calotropis***

(2) Twisted or contorted: One margin of a petal overlaps regularly the margin of an adjacent petal and vice versa. **e.g. China rose, Lady's finger and Cotton (Malvaceae family).**

(3) Imbricate: One petal External one internal and in the remain three petals; one margin external while their other margin is internal or margins of sepals or petals overlap one another but not in any particular direction. **e.g. *Cassia*, Gulmohur.**

(4) Vexillary/Descending imbricate/Papilionaceous: In which posterior petal **(standard)** overlapping the two lateral petals **(wings)** the latter overlapping the two anterior petals **(keel)**. **e.g. Pea, Beans.**

Androecium:

- Male reproductive organ of flower and it consists of one or more stamens.
- Stamen is a part of flower, which produces pollen.
- Each stamen is made up of a stalk like filament and knob like Anther and connective.
- Usually each Anther has two lobes. It is called **Dithecous**. **e.g. Most of the plants.**
- In some plants, Anther has only one lobe. It is known as **Monothecous**. **e.g. China rose (Malvaceae family).**
- Each lobe has two chambers called **pollen sacs & pollen** grains are found in it.
- Sterile and undeveloped stamens are known as Staminodes.

Cohesion of stamens:

Fusion among themselves**.**

(1) Polyandrous: Stamens are free **e.g. Papaya.**

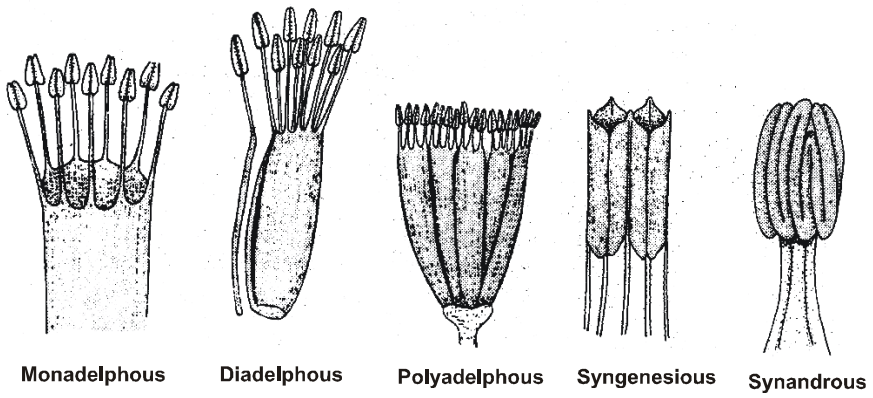


Fig:- Types of cohesion of stamens.

(2) Monoadelphous: The stamens are fused by means of their filaments in one bundle. **e.g. China rose, *Althea*.**

(3) Diadelphous: When the filaments are fused into two bundles & the anthers remain free. **e.g. Pea.**

(4) Polyadelphous: When the filaments are united into more than two bundles but anthers are free. **e.g. Lemon, *Citrus*.**

(5) Syngenesious: Stamens are fused by Anther only. The filaments are free. **e.g. *Sonchus*.**

(6) Synandrous: Stamens are united by both their Anthers as well as filaments. **e.g. *Cucurbita*.**

Adhesion of stamens: Fusion with other floral parts**.**

(1) Epipetalous: In which stamens are fused to the petals. **e.g. China rose, *Solanum, Ocimum*, Brinjal**

(2) Epiphyllous: When stamens are united to perianth. **e.g. *Asphodelus*, Lily.**

(3) Gynandrous: In which stamens are attached to Carpels, either throughout their whole length or by their anthers only. **e.g. *Calotropis*.**

Length of filament:

(1) Didynamous : Out of four stamens, two long and two short filamented stamens. **e.g. *Ocimum*.**

(2) Tetradynamous : Four long and two short. **e.g. Mustard.**

(3) Inserted : Stamens shorter than the corolla of flower are known as Inserted. **e.g. *Ixora, Mussaenda*.**

(4) Exerted : Stamens protrude out of the corolla of flower are termed as exerted. **e.g. Passion flower.**

(5) In *Salvia* the connective is highly elongated so its one end bears fertile while other end bears sterile anther lobe.

Attachment of filament to the Anther:

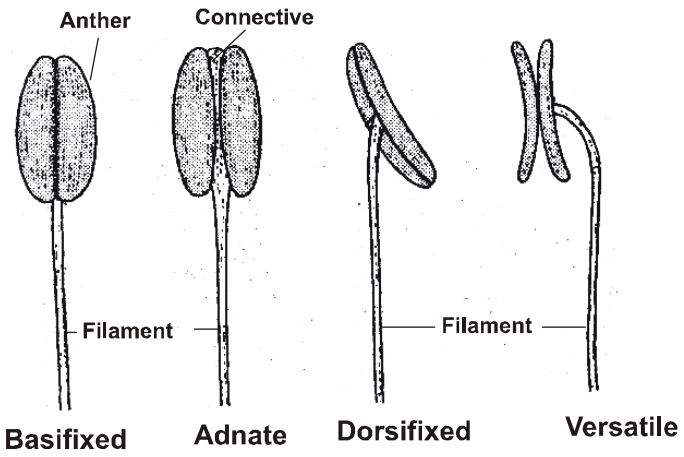


Fig :- Types of Attachment of filament to the anther

(1) Dorsifixed: The filament is firmly fixed to the back of the Anther. **e.g. *Bauhinia variegata*.**

(2) Basifixed: The filament is fixed to the base of the Anther. **e.g. Mustard.**

(3) Adnate: The filament Joints throughout the length of the Anther. **e.g. *Ranunculus, Magnolia, Nymphaea*.**

(4) Versatile: The filament is attached to the back of the anther and the anther can swing freely. **e.g. Grasses (Graminae family).**

Gynoecium:

- It is female reproductive organ of flower and is made up of one or more carpels.

Carpel:

- It is a structural unit of pistil. It consists of **swollen ovary, a stalk like style and terminal receptive part stigma.**
- Sterile & undeveloped pistil is known as **pistillode.**
- When **gynoecium** bears **only one carpel**, it is called **Monocarpellary (Papilionaceae), two- bicarpellary (Solanaceae), three- tricarpellary (Liliaceae), many-polycarpellary.**

Cohesion of carpels:

(1) Apocarpous: Carpels free. **e.g. *Ranunculus*, Rose, Lotus, *Michelia* (AIPMT).**

(2) Syncarpous: Carpels more than two and fused. **e.g. Most of the plants (mustard, tomato), Poppy**

Number of locules:

Ovary has locules and may be unilocular, bilocular, trilocular, tetralocular, pentalocular or Multilocular.

Placentation:

The arrangement of ovules on placenta with in the ovary is called placentation. It is of following types.

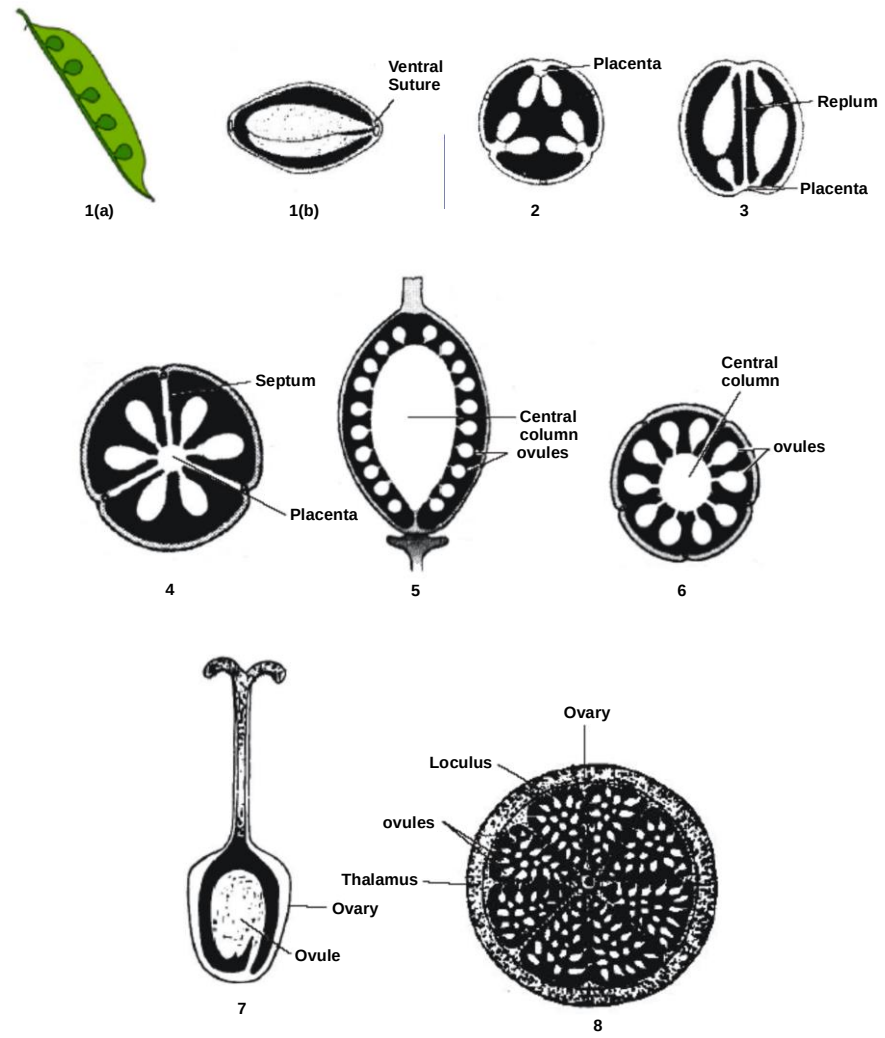


Fig. 1 (a) & 1(b) Marginal placentation, 2,3 - Pariental placentation, 4 - Axile placentation, 5,6 - free central placentation, 7 - basal placentation 8- Superficial placentation.

(i) Marginal:

- It is found in monocarpellary gynoecium.
- In which placenta developing along the junction of the two margins of the carpel on which one or two alternate rows of ovules occur. **e.g. Pea, *Cassia*, *Acacia*.**

(ii) Parietal:

- Ovary is one chambered.
- Two or more longitudinal placentae develop along the wall of a syncarpous pistil.
- The number of placentae correspond to the number of fusing carpels.
  e.g. Radish, Papaya. Parietal placentation is found in family **Cruciferae**.
- In which a f**alse septum** called **replum** develops between the two parietal placentae resulting the ovary becomes bilocular.
  eg. **Mustard, *Argemone.***

(iii) Axile placentation:

- It is found in syncarpous pistils.
- The ovary is partitioned into two or more chambers.
- Placentae occur in the central region where the septa meet so that on axile column bearing ovules is formed.
  e.g. Potato, Tomato, China rose, Lemon.

(iv) Free central:

- The pistil is polycarpellary and syncarpous but the ovary is unilocular.
- The ovules are borne around a central column, which is not connected with the ovary wall by any septum.
  e.g. *Dianthus*, Primrose.

(v) Basal:

- Ovary is unilocular and the placenta develops at the base of ovary on thalamus and bears a single ovule.
  e.g. Sunflower, Marigold.

(vi) Superficial :

- The ovules develop on the septa, if present.
- Superficial placentation is found in both **monocarpellary (e.g. *Butomus*) and Syncarpous (e.g. *Nymphaea*) pistils.**

Thalamus :

- ❖ It is the swollen and broaden part of flower, which lies at the tip of pedicel and bears floral organs.
- ❖ Thalamus is similar to a dwarf shoot in which growth is definite and the internodes are very short.Rarely internodes become elongated as –

(i) Anthophore : Internode between calyx and corolla is elongated. **e.g. *Silene*.**

(ii) Androphore : Between corolla and Androecium. **e.g. *Passiflora*.**

(iii) Gynophore : Between androecium and Gynoecium. **e.g. *Capparis*.** Sometimes the thalamus is prolonged into gynoecium to form central axis called **Carpophore. e.g. Coriander.**

(iv) Androgynophore or Gynandrophore : When gynophore associate with androphore eg. *Cleome gynandra* (*Gynandropsis*).

Resonate the Concept

❖ **Arrangement of floral organs:**

(i) Spirocyclic : In which some floral organs are borne in spirals and other organs in whorls. **e.g. *Ranunculus***.

(ii) Cyclic : Floral organs are borne on the thalamus in whorls. **e.g. *Solanum*.**

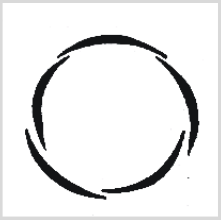
(iii) Acyclic : When floral organs are borne on the thalamus in spirals. **e.g. *Nymphea*.**

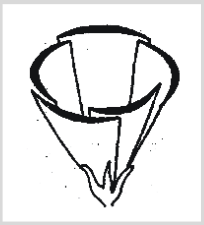
❖ The sepal, which lies in line with the mother axis, is called odd sepal. It is either anterior. **e.g. Leguminosae** or posterior**. e.g. *Petunia*.**

❖ Aestivation is also considered in calyx and Perianth.

❖ **Induplicate valvate:** It is a type of valvate aestivation in which margins of petals are turned towards innerside. **e.g. *Ipomoea*.**

❖ **Quincuncial :** Two petals external, Two internal, and fifth with one margin external while its other margin is internal. **e.g. *Duranta***. (It is considered as a type of imbricate aestivation).





❖ **Epicalyx :** It is a whorl of 5-8 bracteoles outside to the calyx, which are green sepals like floral organs. They provide protection to the other floral organs. **e.g. Malvaceae and Rosaceae.**

❖ **Perianth :** When there is no distinction of sepals and petals then they are collectively called perianth. Each part of perianth is called tepal. **e.g. Lily.**

❖ **Seploid :** When perianth is green and as sepal like. **e.g. *Asphodelus*.**

❖ **Petaloid :** When perianth is coloured as petals. **e.g. Date palm.**

❖ **Monocarpic plant** : The plant which produces flowers and fruits only once in life. **e.g. Annual plants, Bamboo.**

❖ **Polycarpic plant :** The plant which produces flowers and fruits many times in life. **e.g. Mango, pear.**

❖ **Thalamus or Receptacle :** It is swollen and broadened part of flower on which the Internodes are condensed. It bears floral organs.

❖ **Androdioecious:** Some plants are staminate and others of same species are bisexual.

❖ **Gynodioecious:** When some plants are female and others of same species are bisexual.

❖ **Gynomonoecious:** A plant with bisexual and female flowers on same plant, **e.g. Sunflower**.

❖ **Andromonoecious:** A plant with bisexual and male flowers on same plant, **e.g. Some lilies**.

❖ **Achlamydeous:** A flower without perianth (sepals and petals) **e.g. *Euphorbia***.

❖ **Monochlamydeous:** A flower with only one whorl of perianth (non essesntial floral organ), **e.g. *Ricinus***.

❖ **Dichlamydeous:** A flower with both the non essential floral whorls of perianth, **(Calyx and corolla) e.g. *Brassica***.

❖ **Homochlamydeous:** When the two whorls possess same colour **e.g. lily**.

❖ **Heterochlamydeous :** When the two whorls possess different colours **e.g. *Petunia***.

❖ Style:

On the basis of origin, style is of three types.

(1) Terminal : It originates from tip of ovary. **e.g. *Petunia*.**

(2) Lateral : Arising from side of ovary. **e.g. Mango.**

(3) Gynobasic - Arising from mid basal part of ovary. **e.g. *Salvia, Ocimum*.**

❖ Stigma:

It is a part of Gynoecium, which receives pollen grains. It is of following types

(i) Capitate	**(ii) Discoid**	**(iii) Plumose**
(iv) Bifid	**(v) Knob like**	**(vi) Drum-shaped**
(vii) Dumbell shaped	**(viii) Dome shaped**	**(ix) Sticky**
(x) Linear	**(xi) Radiate hood like.**	

- ❖ When the different parts of each series of a flower are similar in size, shape, colour and origin then the flower is known as Regular flower.
- ❖ When a flower shows any irregularity in any types of its floral organs, whether in size, shape, colour or origin is termed as irregular flower.
- ❖ Lotus or *Nelumbo nucifera* is National flower of India.
- ❖ Longest style is present in Maize or *Zea mays*.
- ❖ Obdiplostemonous: - Stamens occur in two whorls out of them outer whorl is opposite to petals while inner whorl is alternating with petals. e.g. *Spergula, Stellaria*.
- ❖ Diplostemonous: Stamens occurs double the number of petals and present in two whorls. The outer whorl is alternating with petals while inner whorl is opposite to petals eg. *Cassia.*

Test your Resonance with concept

1. Flower is complete when it has

(1) Calyx, corolla, androecium and gynoecium (2) Calyx and corolla

(3) Androecium and gynoecium (4) Corolla, androecium and gynoecium

2. Which is correct about flower? It is modified

(1) Root (2) Shoot (3) Leaf (4) Inflorescence

3. Arrangement of sepals or petals with respect to each other is called

(1) Venation (2) Vernation (3) Aestivation (4) Phyllotaxy

4. A flower which can be divided into two exactly equal halves by any vertical division passing through centre is called

(1) Zygomorphic (2) Hypogynous (3) Actinomorphic (4) Epigynous.

5. Marginal placentation is found in

(1) Solanaceae (2) Cruciferae

(3) Fabaceae/Leguminosae (4) Asteraceae/Compositae.

Answers

1. (1) **2.** (2) **3.** (3) **4.** (3) **5.** (3)