

CONCEPT MAP

FLORAL MORPHOLOGY

A flower is a highly condensed and modified shoot. It contains reproductive organs of the flowering plants, which develop fruits and seeds. There are four types of floral organs viz. **sepals, petals, stamens and carpel or pistil**. A flower having all the four types of floral organs is known as **complete flower** e.g., cotton. One or more of the floral organs are absent it is called **incomplete flower** e.g., cucurbits. A flower having both the essential organs i.e., stamens and carpel called **hermaphrodite** or **bisexual flower**, e.g., China rose, whereas a flower having only one of the two essential organs is known as **unisexual flower** e.g., mulberry. Flowers having only stamens are called **staminate** flowers and those having only carpels are called **pistillate** flowers. On the basis of symmetry flower can be **actinomorphic** (two equal halves in any plane), **zygomorphic** (two equal halves in one plane), or **asymmetrical**.

GYNOECIUM

- Central, female reproductive part which develops from thalamus and consists of **carpels (megasporophylls)**.
- Each carpel consist of **stigma** (the tip which receives pollen), **style** (elongated structure connecting stigma and ovary), **ovary** (lower swollen part containing ovules).
- On the basis of number of carpels present, it can be **monocarpellary** (one carpel only) or **multicarpellary** (many carpels) which can be **apocarpous** (carpels free e.g., *Ranunculus*) or **syncarpous** (carpels fused e.g., *Petunia*).
- On the basis of number of locules (chamber) present in the ovary, it can be **unilocular** (pea), **bilocular** (mustard), **trilocular** (*Asparagus*), **tetralocular** (*Ocimum*), **pentalocular** (China rose) or **multilocular** (*Althaea*).

- The stamens may be **equal** or **unequal** in length. When there is two long and two short stamens, the condition is called **didynamous**, e.g., *Ocimum*. When out of six stamens, four are longer in inner whorls and two in outer whorl are shorter, the condition is called **tetradynamous**, e.g., mustard.
- Dehiscence of anthers** to expose the pollen grains can be **longitudinal** (long slits appear lengthwise e.g., mustard), **transverse** (breadthwise slits, e.g., *Malva*), **porous** (pores appear at the tip e.g., *Solanum* or base e.g., *Cassia*), **valvular** (split at several places by lifting of surface layers, e.g., *Barberry*), **irregular** (e.g., *Najas*).
- Longitudinal dehiscence may be **laterorse** (slits on sides), **introrse** (slits towards the inner side or centre of the flower), **extorse** (slits lie towards the outer side of flower).

PLACENTATION

- Arrangement of placenta (which bear ovules) on the ovary wall which can be:
 - Marginal**: One or two longitudinal alternate rows of ovules along the ventral suture in unilocular ovary, e.g., pea, *Cassia* etc.
 - Parietal**: Ovules on walls of bi-multicarpellary but unilocular ovary e.g., *Argemone*.
 - Axile**: In multicarpellary, syncarpous, multilocular gynoecium; margins fuse at the centre of the ovary to form an axis which bears ovule e.g., *Solanum*.
 - Free central**: Unilocular ovary with ovules borne on central axis e.g., *Dianthus*.
 - Basal**: Ovary unilocular with a single ovule at its base, e.g., sunflower.
 - Superficial**: Multicarpellary, syncarpous gynoecium bears a large number of ovules that are borne on the walls of loculi without specific order, e.g., *Nymphaea*.

THALAMUS (Torus/Receptacle)

- Broadened or swollen part of the flower which lies at the tip of the pedicel and bears floral organs.
- In most flowers the thalamus is condensed but in some, one or more internodes elongate viz. **anthophore** (internode between calyx and corolla e.g., *Dianthus*), **androphore** or **gonophore** (internode between corolla and androecium, e.g., *Passiflora*), **gynophore** (internode between androecium and gynoecium, e.g., *Capparis*), **gynandrophore** or **androgyonophore** (both androphore and gynophore present, e.g., *Gynandropsis pentaphylla*), **carpophore** (the thalamus in between the two carpels elongates and after bifurcation protrudes out of the two carpels, e.g., *Coriandrum*).
- On the basis of relative position of floral organs on thalamus flower may be **epigynous** (ovary inferior, placed below other whorls, e.g., guava), **hypogynous** (ovary superior, e.g., China rose), or **perigynous** (ovary half superior or half inferior and thalamus may be disc e.g., pea, cup e.g., *Prunus* or flask e.g., rose shaped).

PEDICEL OR STALK

- Lower internode of flower. A flower with pedicel is called **pedicellate** and one without it, is **sessile**. It may bear **bracteoles** along with the bracts.

ANDROECIUM

- Third and male whorl of the flower made up of **stamens (microsporophylls)** which consist of **filament** (lower stalk-like part which may be absent in some), **anther** (upper swollen part usually having two lobes or theca i.e., **bithecos** or in some **monotheicos**, e.g., *Althaea*) and **connective** (sterile band which connects two anther lobes). In *Salvia*, connective forms a long curved structure, its one end has a fertile anther lobe and other has a sterile anther lobe. Stamens may be shorter than other whorls (**inserted**) or may protrude out of the flower (**exserted**).
- On the basis of attachment to the filament, anthers can be **adnate** (filament runs along the back of the anther or becomes continuous with the connective, e.g., *Ranunculus*), **basifixed** (filament fixed at anther its base, e.g., *Datura*), **dorsifixed** (filament attached to back and anther immobile, e.g., *Passiflora*), **versatile** (filament attached to back and the anther can swing freely, e.g., grasses).
- The cohesion between the stamens may be **monadelphous** (all the filaments united into a single bundle, anthers free, e.g., China rose), **diadelphous** (filaments united in two bundles, anthers free, e.g., pea), **polyadelphous** (filaments united into more than two bundles, anthers free, e.g., castor), **syngenesious** (anthers united into a bundle, filaments free, e.g., sunflower), **syndandrous** (anthers as well as filaments united throughout the length, e.g., *Colocasia*). The free stamens are called **polyandrous**.
- On the basis of adhesion of stamens to flower, it can be **epiphyllous** (attached to perianth, e.g., *Asphodelus*), **epipetalous** (attached to petals, e.g., *Datura*), **gynandrous** (attached to gynoecium, e.g., *Calotropis*).

COROLLA

- Second whorl inner to calyx made up of petals which protects the inner whorls and attracts insects for pollination. Corolla may be **polypetalous** (petals free) or **gamopetalous** (petals fused).
- Polypetalous corolla** may be **cruciform** (four clawed or unguiculate petals arranged cross wise e.g., mustard), **caryophyllaceous** (five unguiculate or clawed petals with limbs placed at right angles, e.g., *Dianthus*), **rosaceous** (five or more sessile or shortly clawed petals with limbs spread regularly outwards, e.g., rose), **campanulate or bell-shaped** (e.g., *Physalis*), **papilionaceous** (five unequal or irregular petals viz. 1 standard or vexillum – posterior largest–, 2 wings or alae –lateral, smaller– and 2 anterior petals fused together to form keel or carina).
- Gamopetalous corolla** may be **campanulate** (bell-shaped or inverted cup shaped e.g., *Campanula*), **urceolate** (urn-shaped e.g., *Bryophyllum*), **tubular** (tube-like or cylindrical e.g., disc floret of sunflower), **infundibuliform** (funnel shaped e.g., *Petunia*), **rotate** (corolla with short tube having limbs placed transversely like a saucer or the spokes of a wheel, e.g., *Solanum nigrum*), **salver shaped or hypocrateriform** (tubular corolla with spreading lobes, e.g., *Clerodendrum*), **bilabiate** (bilipped corolla with gaping, wide open mouth, e.g., *Ocimum*), **personate** (bilipped corolla with closed lips, e.g., *Antirrhinum*), **ligulate or strap-shaped** (short and narrow tube-like corolla with upper part flattened like a strap, e.g., ray floret of sunflower), **spurred** (one or more petals drawn out like a beak or spur, e.g., *Larkspur*).

AESTIVATION

- Arrangement of petals (or sepals) in a flower bud with respect to members of the same whorls which can be **open** (margins of adjacent petals sufficiently apart from each other), **valvate** (margins of the adjacent petals lie close, without overlapping, e.g., mustard), **twisted or crossed** (one margin of a petal overlaps the margin of an adjacent petal (external) and the other margin is overlapped (internal) by the margin of adjacent petal, e.g., China rose), **imbricate** (one petal external, one internal; and of the remaining three petals one margin is overlapped, other overlapping, e.g., *Cassia*), **quincuncial** (special type of imbricate aestivation in which two petals external, two internal and in one petal one margin is overlapped, one is overlapping, e.g., calyx of *Cucurbita maxima*), **vexillary** (posterior petal overlapping the two lateral petals, the latter overlapping the two anterior petals, e.g., pea).

BRACTS

- Specialised leaves from the axil of which flower arise. They can be **foliaceous** (leaf-like e.g., *Adhatoda*), **petaloid** (like petals, e.g., *Bougainvillea*), **scaly** (membranous, small e.g., sunflower), **spathy** (large, boat-shaped bract enclosing an inflorescence, e.g., banana, maize), **glumes** (small, dry, scaly as in spikelet of Poaceae).
- There are one or more whorls of bracts found at the base of calyx which form **epicalyx** in most members of Malvaceae, e.g., China rose. Sometimes, bracts are in one or more whorls around and below the entire inflorescence, e.g., coriander and are called **involucre**.

CALYX

- Outermost whorl made up of sepals which are usually green but sometimes coloured (i.e., **petaloid**). They protect the inner whorls and carry out photosynthesis when green.
- The sepals may be free (**polysepalous**) or fused (**gamosepalous**). They can be **caducous** (fall just at the time of opening of bud, e.g., poppy), **deciduous** (attached till the flower withers, e.g., mustard), **persistent** (remain attached to the fruit, e.g., tomato).
- Sepals can be modified to form **pappus** (hairy structure which helps in dispersal e.g., sunflower), **leafy petaloid** (large leaf like coloured structure, e.g., *Mussaenda*), **spinous** (persistent and modified into spines, e.g., *Trapa*), **spurred** (drawn out into beak or spur, e.g., *Larkspur*), **hooded** (modified into a hood, covering the whole flower, e.g., *Aconitum*) or **bilabiate** (two-lipped, e.g., *Salvia*).

