THE FLOWER

The flower, a crucial reproductive structure in angiosperms, represents a modified shoot dedicated to sexual reproduction. Its structure is organized into four distinct whorls arranged successively on the thalamus or receptacle, which is the swollen termination of the pedicel or stalk.

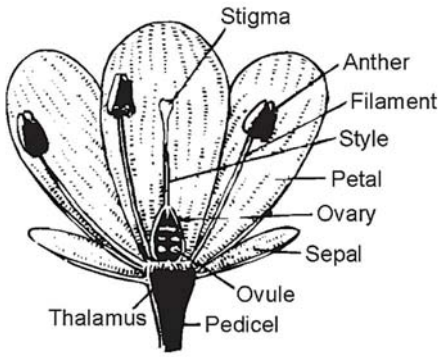

Fig. : Parts of a Typical Flower

Terminology Regarding Flowers:

- **Bisexual Flower:** A flower is termed bisexual when it possesses both androecium and gynoecium. Examples include the pea and hibiscus.
- **Unisexual Flower:** A unisexual flower has either stamens (androecium) or carpels (gynoecium) but not both. Maize is an example of a unisexual flower.
- **Trimerous Flower:** In a trimerous flower, all floral appendages (whorls) occur in multiples of three.
- **Tetramerous Flower:** A tetramerous flower exhibits floral appendages in multiples of four.
- **Pentamerous Flower:** A pentamerous flower features floral appendages in multiples of five.
- **Bracteate Flower:** A bracteate flower is characterized by the presence of bracts, which are reduced leaves located at the base of the pedicel.
- **Ebracteate Flower:** An ebracteate flower lacks bracts.

Symmetry of Flowers:

- **Actinomorphic Flower (Radial Symmetry):** Actinomorphic flowers can be divided into two equal radial halves in any radial plane passing through the center. Mustard, Datura, and chili are examples of actinomorphic flowers.
- **Zygomorphic Flower (Bilateral Symmetry):** Zygomorphic flowers can be divided into two similar halves only in one specific vertical plane. Examples include pea, gulmohur, bean, and Cassia.
- **Asymmetric Flower (Irregular):** Asymmetric flowers cannot be divided into two similar halves by any vertical plane passing through the center. Canna is an example of an asymmetric flower.

Position of Floral Parts on Thalamus

The positioning of the calyx, corolla, androecium, and gynoecium in relation to the ovary on the thalamus categorizes flowers into three types: hypogynous, perigynous, and epigynous.

- **Hypogynous Flowers:** Hypogynous flowers have the gynoecium (ovary), the female reproductive part, occupying the highest position, while the other floral parts are situated below it. These flowers are characterized by a superior ovary. Examples of hypogynous flowers include mustard, China rose, Brinjal, and Petunia.
- Perigynous Flowers: Perigynous flowers have the gynoecium located in the center, and the other parts of the flower are positioned on the rim or periphery of the thalamus, nearly at the same level as the

ovary. In perigynous flowers, the ovary is described as half-inferior. Examples of perigynous flowers include plum, rose, and peach.

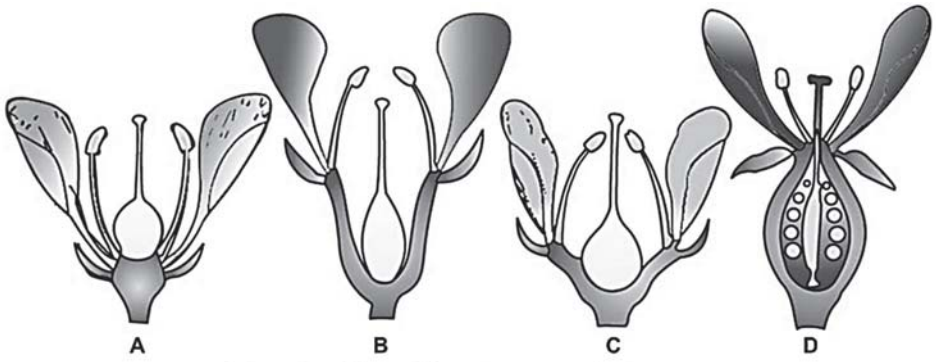

Fig. : Position of floral parts on thalamus :
A. Hypogynous, **B.** Perigynous, **C.** Perigynous, **D.** Epigynous

- **Epigynous Flowers:** Epigynous flowers are characterized by the margin of the thalamus growing upward, completely enclosing the ovary and fusing with it. In such flowers, the other parts of the flower arise above the ovary. Epigynous flowers have an inferior ovary. Examples include guava, cucumber, bitter gourd, and the ray floret of sunflower.

Parts of a Flower

A typical flower is composed of four distinct whorls, namely calyx (sepals), corolla (petals), androecium (stamen), and gynoecium (carpel).

- **Calyx (Sepals):** The calyx, positioned as the outermost whorl, consists of individual members known as sepals. Sepals are generally green and exhibit a leaf-like structure, serving to protect the flower during its bud stage. Calyx can exhibit two types of arrangements: gamosepalous, where sepals are fused, and polysepalous, where sepals remain separate.

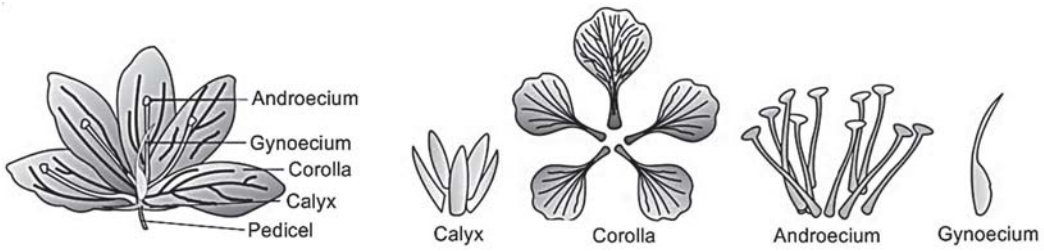

Fig. : Parts of a Flower

- **Corolla (Petals):** The corolla represents the second whorl of the flower, with each individual leaf segment referred to as a petal. Petals are often characterized by bright colors and fragrances, enhancing the overall attractiveness of the flower. These features play a crucial role in attracting insects for pollination. The corolla's shape and structure vary across different flowers, encompassing forms such as tubular, bell-shaped, funnel-shaped, and wheel-shaped. Similar to the calyx, the corolla may be either free (polypetalous) or united (gamosepalous).

Aestivation:

Aestivation refers to the arrangement of sepals or petals within a floral bud concerning the other members of the same whorl. Various types of aestivation include:

- **Valvate:** In valvate aestivation, the margins of sepals or petals within a whorl are in close contact, touching each other without any overlap. There is no overlapping observed between adjacent sepals or petals. An example illustrating valvate aestivation is Calotropis.
- **Twisted:** Twisted aestivation involves the overlapping of one petal or sepal's margin with the margin of the adjacent successive petal or sepal, creating a twisted arrangement. This pattern is observed in flowers such as China rose, lady's finger, and cotton.
- **Imbricate:** Imbricate aestivation exhibits overlapping margins of petals or sepals, but the overlap occurs in no specific direction. Cassia and gulmohur are examples of plants demonstrating imbricate aestivation.
- **Vexillary:** Vexillary aestivation features the largest petal, known as the standard, overlapping the two smaller lateral petals (wings), which, in turn, overlap the two smallest anterior petals (keel). This arrangement is exemplified by flowers like Pea and bean.

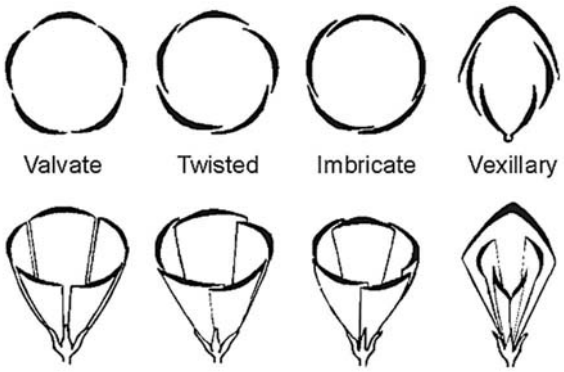

Fig. : Types of Aestivation in Corolla

Androecium:

The androecium, constituting the third whorl of the flower, is situated inner to the corolla. It serves as the male reproductive system and is comprised of stamens. Each stamen consists of two main parts: the filament and the anther. Typically, anthers are bilobed, with each lobe containing two microsporangia or pollen sacs where pollen grains are produced. In some cases, a staminode refers to a sterile stamen. Variability in filament length may exist within a flower, as seen in Salvia and mustard.

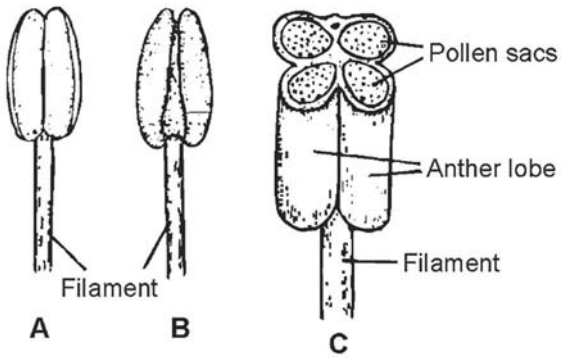

Fig. : Parts of a Stamen

- **Adhesion of Stamens:** The attachment of stamens to other floral organs, such as petals or sepals, introduces specific terms. When a stamen is attached to a petal, it is termed epipetalous, as observed in Brinjal. If the stamen is attached to the perianth, it is referred to as epiphyllous, as seen in lilies.

- **Cohesion of Stamens:** Stamens can exhibit varying degrees of cohesion. When stamens are free from each other, the arrangement is termed polyandrous. In cases where stamens are united into a single bundle, it is designated as monoadelphous, exemplified by China rose. If stamens are united into two bundles, it is termed diadelphous, as seen in peas. When stamens are united into more than two bundles, the arrangement is known as polyadelphous, as observed in Citrus. Understanding the adhesion and cohesion of stamens contributes to the characterization of floral morphology and aids in the classification of different plant species.

Gynoecium:

Constituting the fourth and final whorl of the flower, the gynoecium represents the female reproductive part. Comprising one or more carpels, these carpels may exhibit distinct configurations. When carpels remain free, as observed in lotus and rose, they are termed apocarpous. Conversely, if carpels are fused, as seen in mustard and tomato, they are referred to as syncarpous. A carpel itself comprises three essential parts.

- **Ovary:** The ovary, the basal and swollen segment of the carpel, serves as the lower region bearing one or more ovules. These ovules, maturing into seeds post-fertilization, are attached to a flattened, cushion-like structure known as the placenta. The ovary contains chambers or loculi, and its classification is based on the number of these chambers. A unilocular ovary has one chamber, bilocular has two, trilocular has three, and so forth. Post-fertilization, the ovary wall transforms into the pericarp, constituting the fruit wall.
- **Style:** The style, a tubular structure, connects the stigma to the ovary and is positioned above the ovary within a carpel.
- **Stigma:** Usually located at the tip of the style, the stigma functions as the receptive organ for pollen grains during the process of pollination. Following fertilization, ovules develop into seeds, and the ovary undergoes maturation into a fruit. Understanding the intricate structure of the gynoecium is essential for comprehending the reproductive mechanisms and fruit development in flowering plants.

Placentation

Placentation, a crucial aspect of flower anatomy, pertains to the arrangement of ovules on the cushion-like structure known as the placenta within the ovary. The ovary, responsible for housing and nurturing ovules, may feature one or more placentas. Placentation manifests in various types, each exhibiting distinct spatial arrangements of ovules on the placenta.

- **Marginal Placentation:** In marginal placentation, the placenta forms a ridge along the ventral suture of the ovary. Ovules are arranged in two alternate rows along this ridge. An illustrative example of marginal placentation is evident in the pea plant.
- **Axile Placentation:** Axile placentation involves the placement of the placenta in the axial position, with ovules attached to it in a multilocular ovary. This pattern is observed in flowers such as China rose, tomato, and lemon.
- **Parietal Placentation:** In parietal placentation, the ovary is initially unilocular but develops into a two-chambered structure due to the formation of a false septum. Ovules either develop on the inner wall or the peripheral part of the ovary. This type is exemplified by mustard and Argemone.

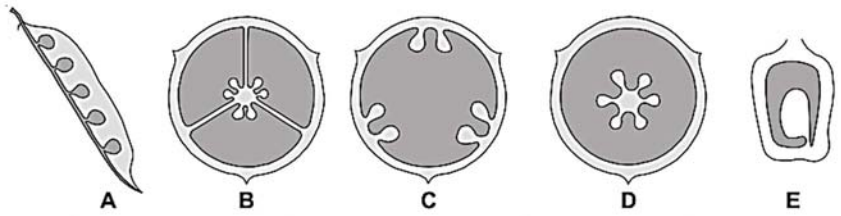

Fig. : Types of placentation : **A.** Marginal, **B.** Axile, **C.** Parietal, **D.** Free central, **E.** Basal

- **Free Central Placentation:** Free central placentation features ovules borne on a central axis, and septa are notably absent in the ovary. Primrose and Dianthus are examples illustrating free central placentation.
- **Basal Placentation:** In basal placentation, the placenta develops at the base of the ovary, with a single ovule attached to it. This type is observed in flowers such as sunflower and marigold. Understanding the diverse patterns of placentation is crucial for gaining insights into the reproductive structures and mechanisms in flowering plants.