6. Flowers

Flowers are the reproductive organ of angiosperms (flowering plants), flower is defined as a modified, determinate shoot bearing sporophylls (**stamens** and **carpels** also called **pistils**), with or without outer modified leaves (the **perianth**). A major diagnostic feature of angiosperms is the flower, not only the flowers are bear the specific features of the male and female organs, but also due to the fact that their duration period is short and less exposed to environmental changes, therefore not affected by these changes and remain more stable. The **receptacle** is the tissue or region of a flower to which the other floral parts are attached. In some taxa the receptacle can grow significantly and assume an additional function. **Nectary**, a specialized structure that secretes nectar in many flowers. Nectaries may develop on the perianth parts, within the receptacle, on or within the androecium or gynoecium (below), or as a separate structure altogether. The **pedicel** is the flower stalk. (If a pedicel is absent, the flower attachment is sessile.) Flowers may be subtended by a **bract**, a modified, generally reduced leaf; a smaller or secondary bract, often borne on the side of a pedicel, is termed a **bracteole** or **bractlet**.

The two basic terms used are **complete**, for a flower having all four major series of parts (sepals, petals, stamens, and carpels), e.g. *Rosa*. and **incomplete**, for a flowering lacking one or more of the four major whorls of parts (e.g., any unisexual flower, or a bisexual flower lacking a corolla). Terms for absence of parts include **achlamydeous**, lacking a perianth altogether, e.g. *Euphorbia*, apetalous, having no petals or corolla, and **asepalous**, having no sepals or calyx. Pedicel is the flower-bearing stalk, a flower having a pedicel is called **pedicellate**, and without a pedicel is called **sessile**, and a flower having a minute or very short pedicel, in this case, is called **semi** or **subsessile** (figure 1.26).

Note/ 1. Androecium + Gynoecium = Reproductive organs (Essential organs).

2. Perianth = Sepals +Petals + Other parts (Accessory organs)

The **perianth** (also termed the **perigonium**) is the outermost, non-reproductive group of modified leaves of a flower. If the perianth is relatively undifferentiated, the individual leaf-like called **sepaloid**, as in *Beta vulgaris* and *Phoenix*. And the petal-like called **petaloid**, as in *Muscary, Allium, Tulipa, Anemon* and *Ornithogalum,* and the parts are termed **tepals,** in most flowers the perianth is differentiated into two groups. The **calyx** is the outermost series or whorl of modified leaves. Individual units of the calyx are **sepals**, which are typically green, leaf-like, and function to protect the young flower. The **corolla** is the innermost series or whorl of modified leaves in the perianth. Individual units of the corolla are **petals**, which

are typically colored (non-green) and function as an attractant for pollination (figures 1.27, 1.28, 1.29, 1.30, 1.31, 1.32, 1.33 and 1.34).

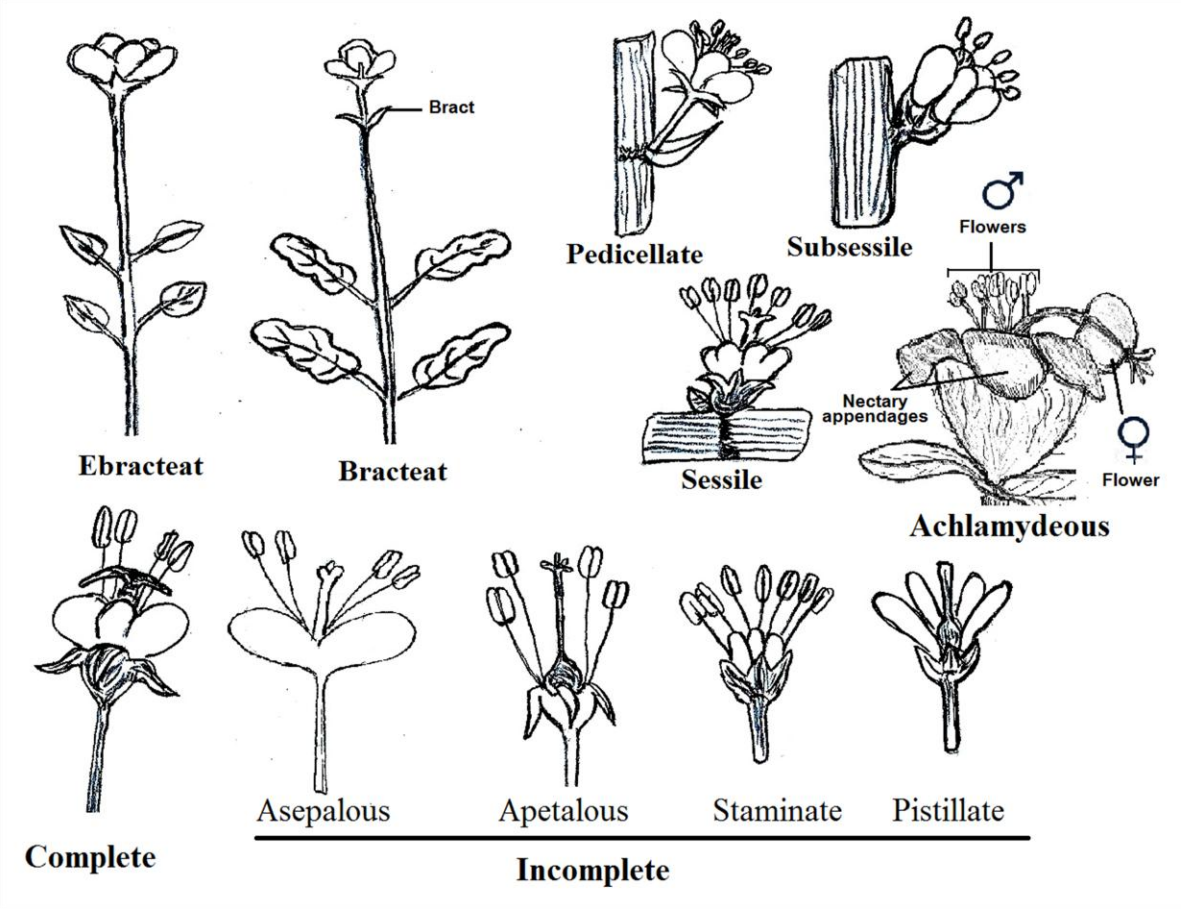

Figure 1.26: Flower types

6.1. Perianth terminology

6.1.I. Calyx (number of sepals) (figures 1.27)

1. Asepalous: having no sepals or calyx, e.g. *Salix, Juglan* and *Quercus*.
2. Dimerous: The floral calyx contains units in 2 sepals, as in *Papaver*.
3. Trimerous: The floral calyx contains units in 3 sepals, as in Liliaceae, *Iris*, and *Narcissus*.
4. Tetramerous: The floral calyx contains units in 4 sepals, as in Brassicaceae (e.g. *Brassica* spp. and *Galium*.
5. Pentamerous: The floral calyx contains units in 5 sepals, as in Rosaceae, *Petunia*, and *Convolvulus*.
6. Hexamerous: The floral calyx contains units in 6 sepals, as in *Solanum melongena*, and *Punica granatum*.
7. Polymerous: The floral calyx contains units more than 6 sepals, as in Cactacea, e.g. *Opuntia*.

8.

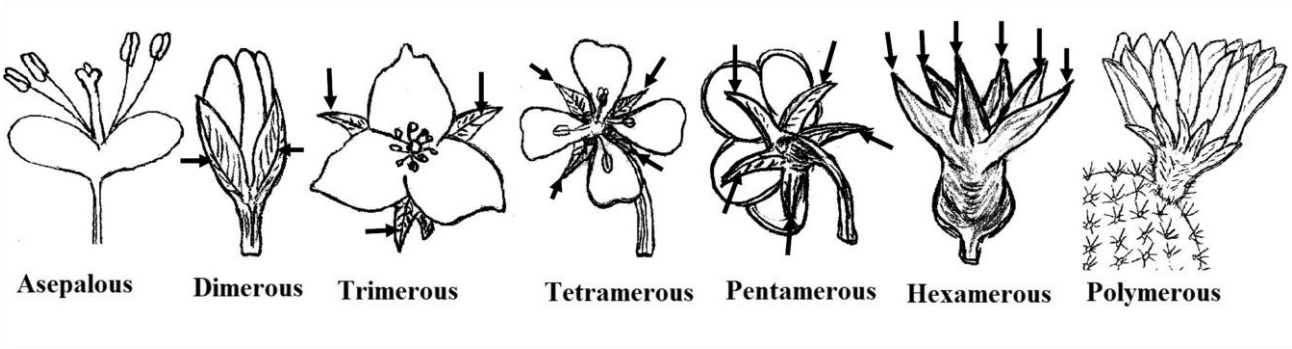

Figure 1.27: Number of sepals

6.1.II. Calyx (structural types) (figures 1.28)

i. Polysepalous: Sepals are free (not united with each other), as in *Roza* and *Vinca rosa*.
ii. Gamosepalous: Sepals are fused which each other, as in *Mirabilis*.
iii. Caducous: Sepals fall off (with flower opening, as in *Papaver*, or (after fertilization, as in *Brassica napus*).
iv. Persistent: Sepals do not fall off rather these remain with the developing fruits, as in *Solanum melongena* and *Lycopersicon esculentum***.**
v. Petaloid: Sepals are colored, as in *Punica granatum*.

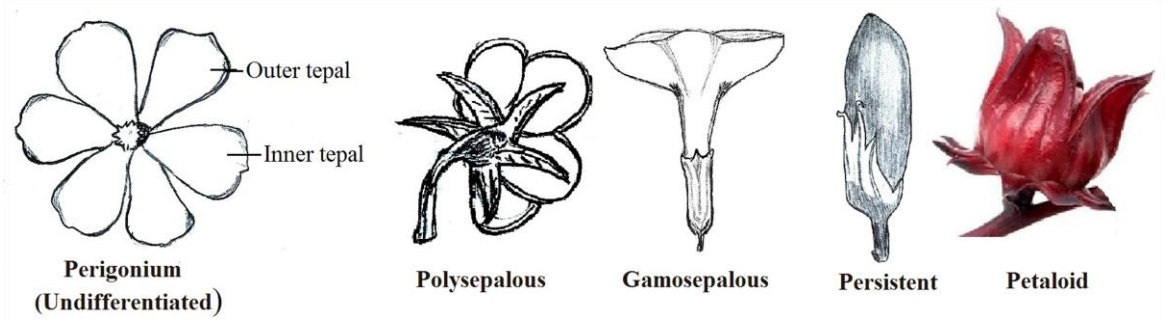

Figure 1.28: Calyx structural types

6.1.III. Modified calyx types (figures 1.29)

1. Succulent calyx: juicy, fleshy, soft and thickened calyx, as in *Hibiscus subdariffa*.
2. Bladdery: sepal fuses and forms a thin wall like the bladder of animal, as in *Physalis, Leontice,* and *Astragalus spinosa*.
3. Membranous: sepals are modified into parchment-like texture, as in *Helianthus annuas*.
4. Pappus: sepals are modified into hair-like structures, as in Asteraceae members, e.g. *Silybum, Sonchus, Onopordum*.

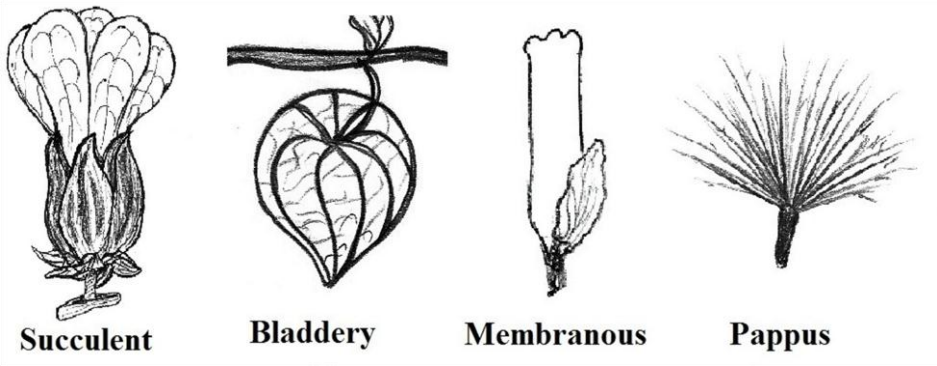

Figure 1.29: Modified calyx types

Corolla:

The corolla is the innermost series or whorl of modified leaves in the perianth. Individual units of the corolla are **petals**, which are typically colored (non-green) and function as an attractant for pollination.

6.1.IV. Corolla (number of petals) (figures 1.30)

1. Apetalous: having no petals or corolla, e.g. *Euphorbia*.
2. Dimerous: The floral corolla contains units in 2 petals; this type is very rare as shown sometime in Poaceae members, termed as lodicules; the lodicules of grasses, which are reduced perianth parts that, upon swelling, open up the grass floret.
3. Trimerous: The floral corolla contains units in 3 petals, as in *Tradescantia* and *Canna musa*.
4. Tetramerous: The floral corolla contains units in 4 petals, as in Brassicaceae, *Galium* and *Prosopis*.
5. Pentamerous: The floral corolla contains units in 5 petals, as in Rosaceae, *Ranunculus*, and *Convolvulus*.
6. Polymerous: The floral corolla contains units more than 5 or multiple of 5 petals, as in *Citrus* and *Dianthus*.

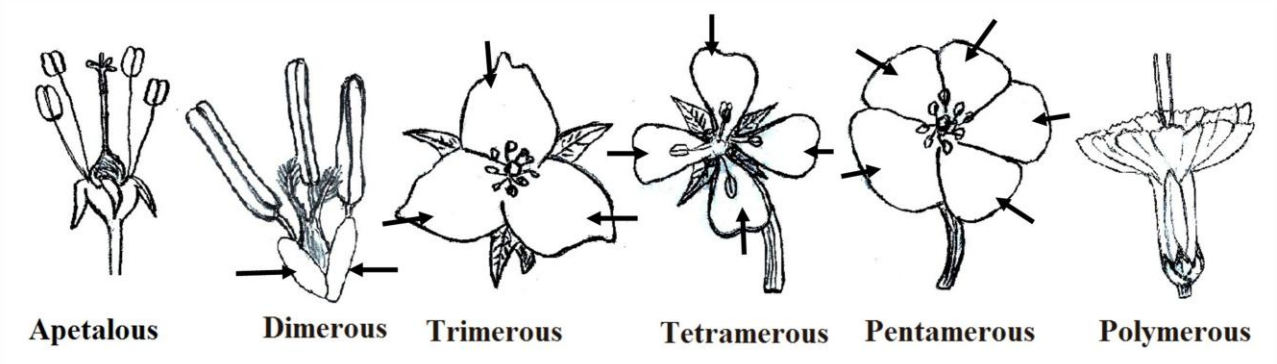

Figure1.30: Number of petals

6.1.VII. Gamopetalous shape and types (figures 1.31)

Specific perianth types include the following:

1. **Campanulate**: bell-shaped, with a basally rounded flaring tube about as broad as long and flaring lobes, as in *Campanula*.
2. **Funnel form** or **Infundibular**: funnel-shaped, with a tubular base and continuously expanded apex, as in *Ipomoea*, *Petunia* and *Campsis*.
3. **Salver form**: trumpet-shaped; with a long, slender tube and flaring limbs at right angles to tube, as in *Vinca rosea*.
4. **Rotate:** with a short tube and wide limbs oriented at right angles to the tube, as in *Anagallis* and *Anchusa*.
5. **Ligulate**: ray, having a ligulae /ray, strap or tongue-shaped, as in certain Asteraceae (*Helianthus* and *Calandula*).
6. **Tubular**: **disk**, having an actinomorphic, tubular corolla with flaring lobes, as in some Asteraceae (*Carthamus tinctorius*).
7. **Urceolate:** urn-shaped, expanded at base and constricted at apex, as in many Ericaceae and *Muscari*.
8. **Bilabiate**: two-lipped, with two, generally upper and lower segments, as in many Lamiaceae, *Mentha* and *Salvia*.
9. **Personate**: two lipped, with the upper arched and the lower protruding into the corolla throat, as in *Antirrhinum*.
10. **Papilionaceous**: with one large posterior petal (banner or standard), two inner, lateral petals (wings), and two usually apically connate lower petals (keel), the floral structure of the Faboideae (Fabaceae).

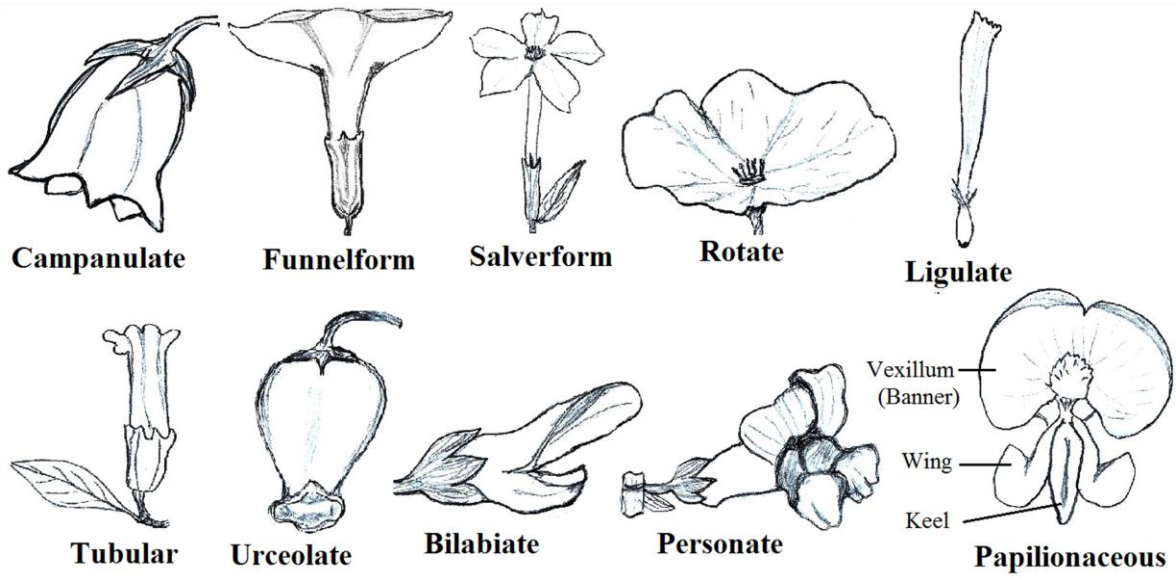

Figure 1.31: Gamopetalous shape and types

6.1.IX. Flower symmetry

Flower symmetry is an assessment of the presence and number of mirror-image planes of symmetry (figure 1.32).

1. **Actinomorphic** or **radial:** symmetry (also called **regular**) is that in which there are three or more planes of symmetry, such that there is a repeating structural morphology when rotated less than 360º about an axis, as in *Vinca rosea* and *Rosa* spp.
2. **Biradial** or **Bilateral symmetry:** means having two (and only two) planes of symmetry. (The difference between biradial and radial symmetry is sometimes not recognized, both being termed radial symmetry or actinomorphy. As in Cruciferae (Bsassicaceae).
3. **Zygomorphic:** symmetry (also called **irregular**) is that in which there is only one plane of symmetry. As in *Antirrhinum* and *Vicia* spp.
4. **Asymmetric:** flower lacks any plane of symmetry, usually the result of twisting of parts. As in *Iris germanica* and *Canna* spp.

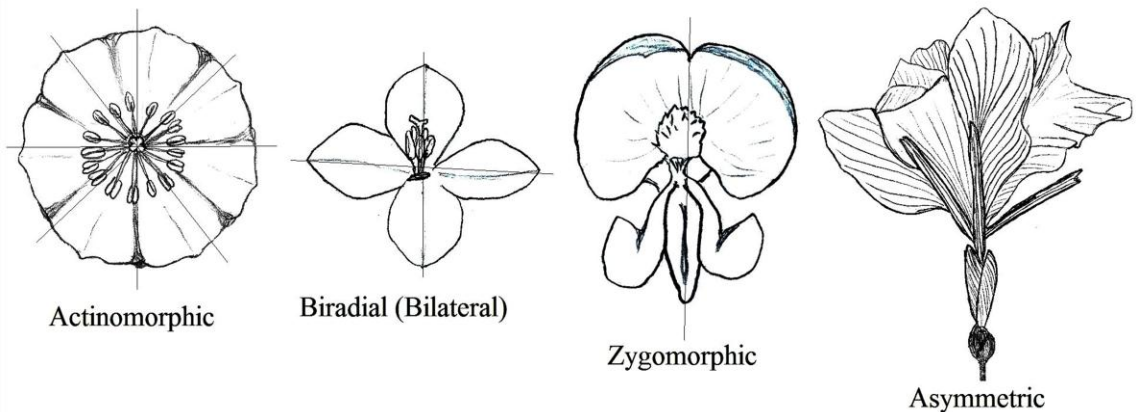

Figure 1.32: Flower symmetry

6.2. Androecium

Androecium refers to all of the male organs of a flower, collectively all the stamens. A **stamen** is a microsporophyll, which characteristically bears two thecae (each theca comprising a pair of microsporangia; Stamens can be leaf-like (laminar), but typically develop as a stalk-like **filament**, bearing the pollen-bearing **anther**, the latter generally equivalent to two fused thecae.

6.2.I. Stamen attachment

Stamen attachment refers to the presence or absence of a stalk, being either **filamentous**, with a filament present, **sessile**, with filament absent, or **subsessile**, with filament very short and rudimentary (figure 1.33).

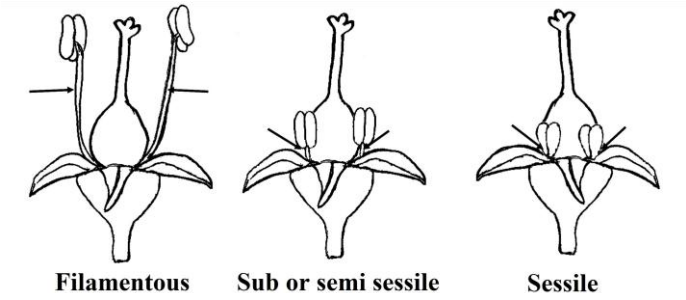

Figure 1.33: Stamen attachment types

6.2.III. Stamen fusion

Stamen fusion refers to whether and how stamens are fused. **Monadelphous**, with one group of stamens connate by their filaments. **diadelphous**, with two groups of stamens, each connate by filaments only. **Polyadelphous,** Stamens with fused filaments arranged in several groups. A **syngenesious stamen** is a form of anther fusion in that the anthers of stamens are fused into a tube and the filaments remain freed not united (figure 1.34).

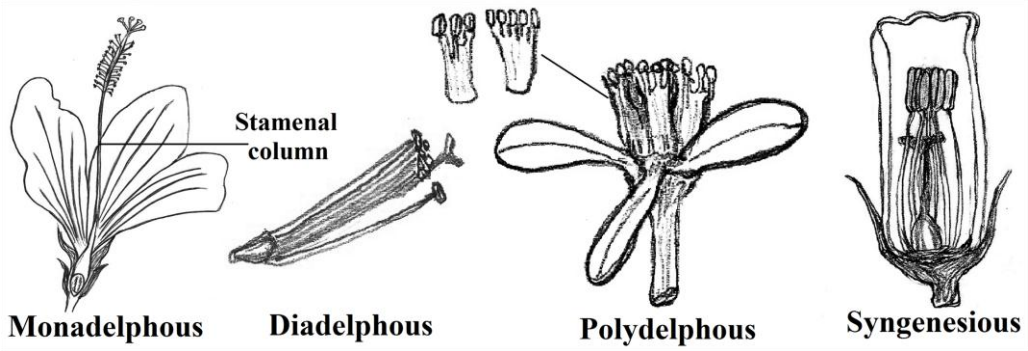

Figure 1.34: Stamen fusion types

6.2.IV. Anther attachment

Anther attachment refers to the position or morphology of attachment of the filament to the anther. Standard anther attachment types. **Basifixed**, anther attached at its base to apex of the filament. **Dorsifixed**, anther attached dorsally and medially to the apex of the filament. **Versatile** anther attachment is one in which the anther freely pivots (teeter - totters) at the point of attachment with the filament (figure 1.35).

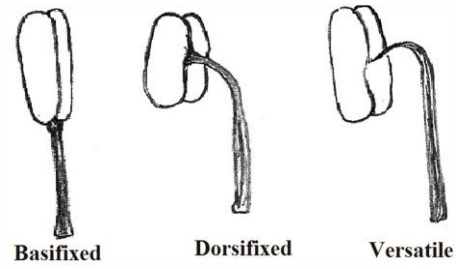

Figure 1.35: Anther attachment types