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NAAC ACCREDITED 'A' GRADE



Topic: Flower

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Unit: 4

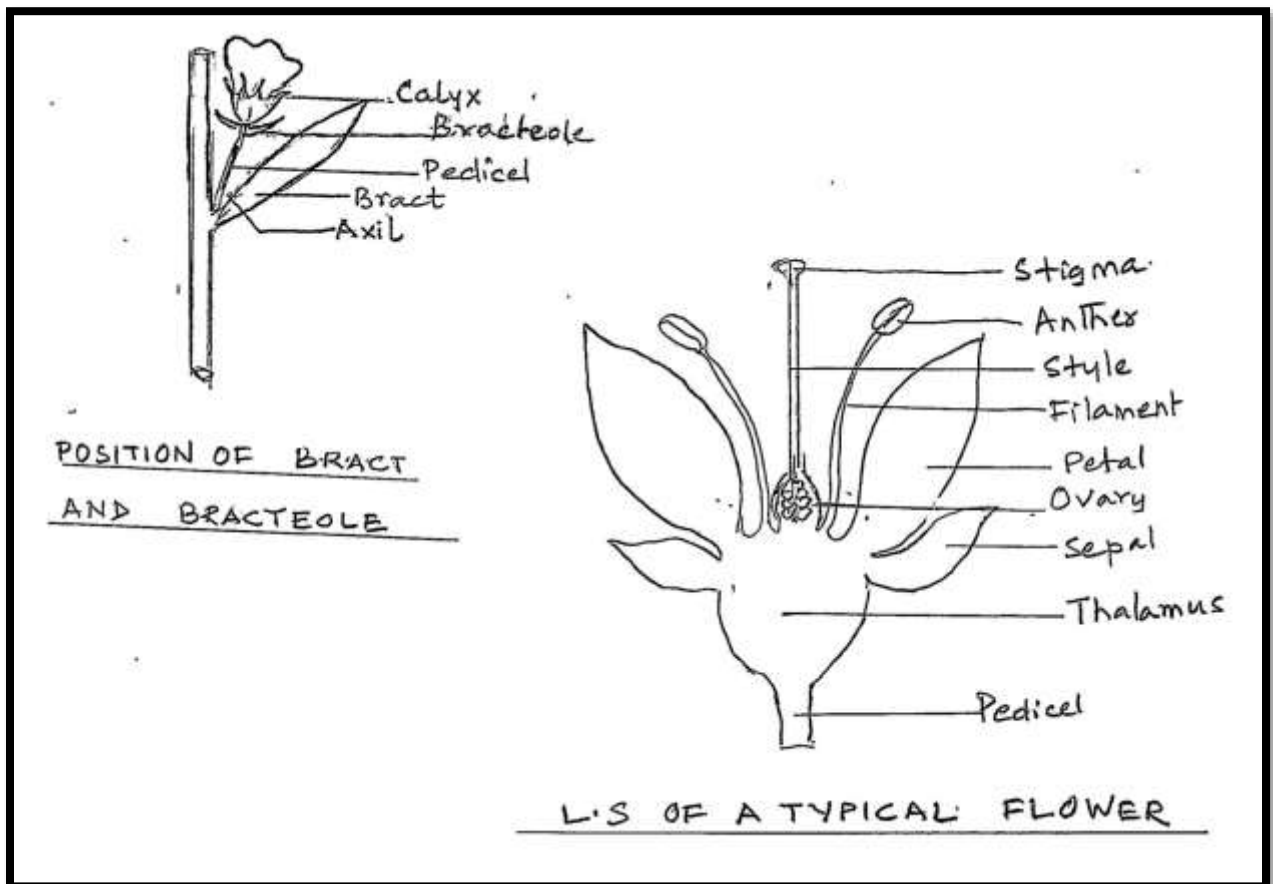
Semester: II

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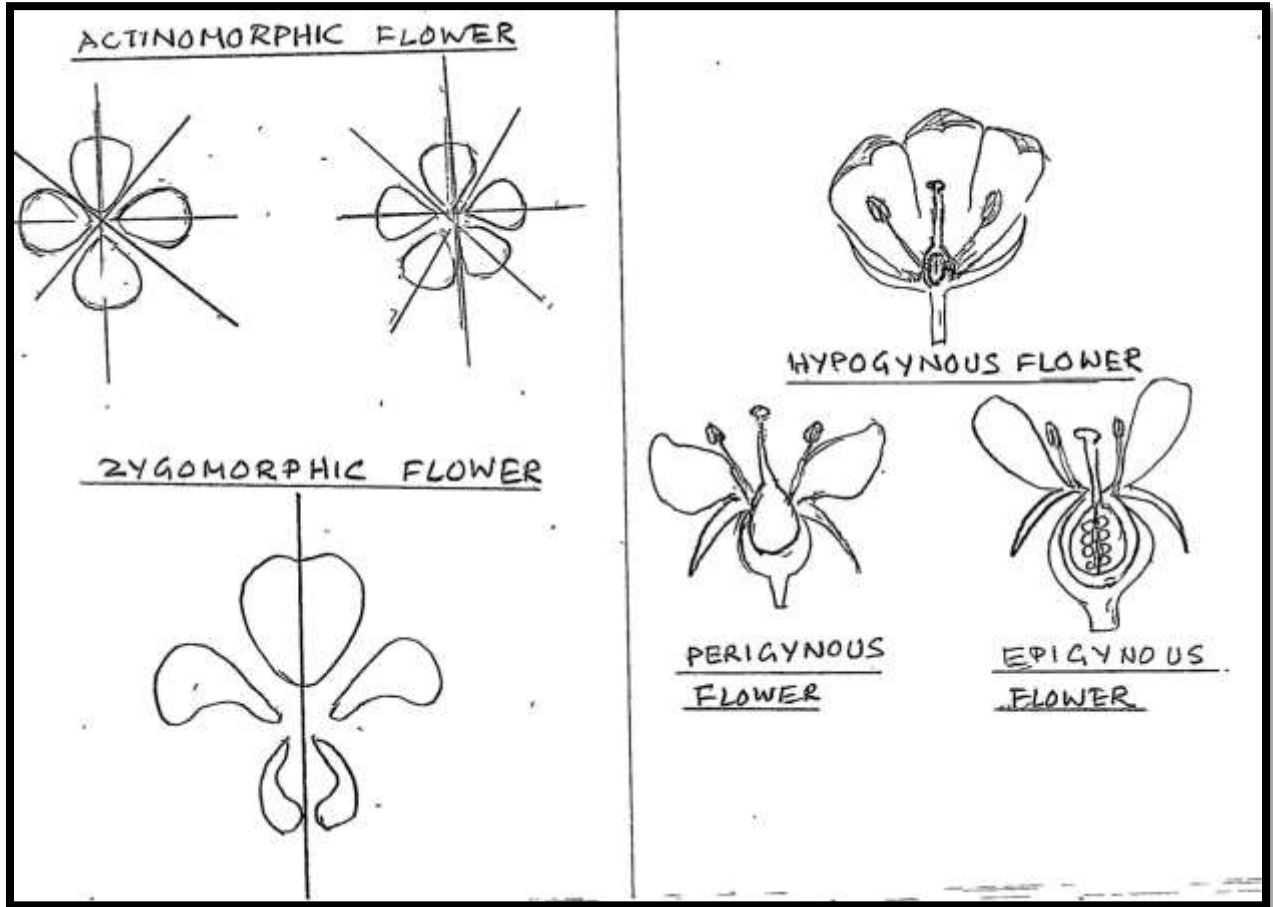
FLOWER

A flower is a modified reproductive shoot of definite growth. It is borne in the axil of a modified leaf called the **bract**. The stalk of the flower or **pedicel** is elongated into an axis called the **thalamus** on which the floral whorls are inserted. The outermost whorl is the **calyx**, followed by the **corolla**. Calyx and corolla together comprise the **accessory whorls** as they help in the process of reproduction but do not directly participate in it. The third whorl or **androecium**, is the male part of a flower followed by the innermost whorl, the **gynoecium**, the female part of a flower. The androecium and gynoecium together comprise the **essential whorls**, as they directly take part in the process of reproduction. **Bracteoles** are any leaf-like outgrowths on the pedicel between the bract and calyx.



Some important terminologies related to a flower:

- **Complete and Incomplete flower-** A flower is said to be complete when it has all the four floral whorls namely calyx, corolla, androecium and gynoecium. When any one or more whorls are absent, the flower becomes incomplete. *Hibiscus rosa-sinensis* has a complete flower, whereas the unisexual flower of *Cucurbita maxima* is incomplete.
- **Actinomorphic and Zygomorphic flower-**A flower is actinomorphic or regular when it can be divided into two equal parts along any vertical plane like *Hibiscus rosa-sinensis* or *Brassica nigra*. A zygomorphic or irregular flower can be cut into two equal halves only along one vertical plane like *Clitoria ternatea*.
- **Bisexual and unisexual flower-**A flower having both androecium and gynoecium is bisexual like *Hibiscus rosa-sinensis* or it may have any one of the two when it is called unisexual like *Cucurbita maxima*.
- **Hypogynous, Epigynous and Perigynous flower-** A hypogynous flower has a convex thalamus and the gynoecium is at the topmost position (superior ovary), the stamens, petals and sepals are inserted successively below it on the thalamus as in *Hibiscus rosa-sinensis*. An epigynous flower (*Cucurbita maxima*) has a deep concave cup-shaped thalamus fused with the calyx tube on the outside and the ovary on the inside. The stamens, petals and sepal lobes are inserted above the ovary, which is lowermost in position (inferior). A perigynous flower has a flat or concave thalamus with the ovary attached to its base and the stamens, petals and sepal lobes attached to its rim (*Lagerstroemia* sp.). Here the position of the ovary is half-inferior.



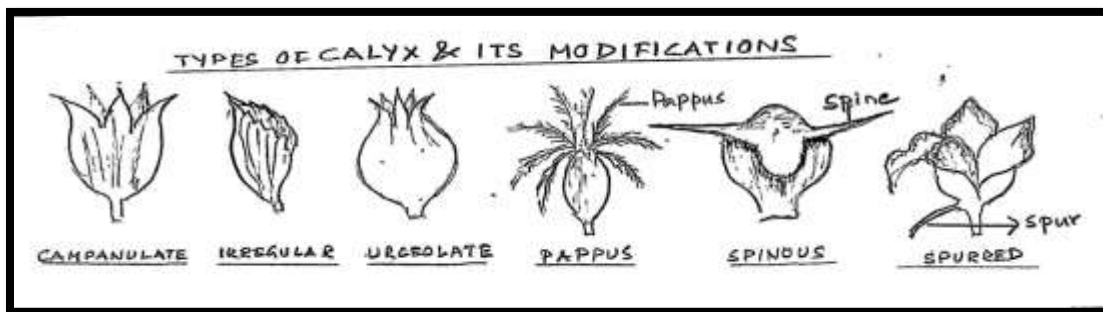
- **Neuter and nude flower-** In a neuter or sterile flower both androecium and gynoecium are absent as in the ray florets of many members of Asteraceae. In a nude flower the calyx and corolla are absent (male and female flowers of a cyathium inflorescence).
- **Pentamerous, Tetramerous and trimerous flower-** In a pentamerous flower each floral whorl has 5 (or multiples of 5) members as in *Hibiscus rosa-sinensis*. In a tetramerous flower each floral whorl has 4 members as in *Brassica nigra*. In a trimerous flower the floral whorls have 3 (or multiples of 3) members as in *Lilium sp.* There may be reduction in the number of stamens and carpels.

THE CALYX

The calyx is the outermost whorl of a flower. It is usually green and it not only protects the flower in the bud stage but also carries out photosynthesis. The units of the calyx or the sepals may either be free (polysepalous) or united (gamosepalous). The calyx may be regular (*Hibiscus* sp.) or irregular (*Leucas* sp.). The shape of the calyx may be tubular (*Datura* sp.), bell-shaped (*Hibiscus* sp.) or urceolate (*Hyocymus* sp.). Sometimes the sepals may be coloured like the corolla as in *Delphinium* sp.

Modification of the calyx:

- **Pappus**-Here the sepals are modified to hairy or scaly structures as in members of Asteraceae.
- **Spinous**- The sepals are modified to spines as in *Trapa bispinosa*.
- **Spurred**- The calyx is prolonged into a tubular beak-like structure called spur as in *Impatiens balsamina*.



Duration of the calyx- May be of the following types:

Caducous sepals fall off before the flower opens.

- **Deciduous** sepals fall off after fertilization.
- **Persitent** sepals remain even in the fruit. They may be of two types. **Acrescent**, when the sepals are enlarged or overgrown in the fruit as in *Dillenia indica* or **marcescent** when withered in the fruit as in *Psidium guajava*.

THE COROLLA

The corolla is variously coloured and help to attract the pollinating agents. Sometimes scale-like or hair-like appendages are present at the throat or base of the corolla, they are called corona. The different forms of corolla are discussed below.

Forms of corolla:

Polypetalous regular types

- **Cruciform-** Here the four free petals are arranged diagonally in the form of a cross. Each petal is clawed with a spreading limb. This type of corolla is found in members of family Cruciferae/ Brassicaceae (eg. *Brassica nigra*)
- **Rosaceous-** Here the five free petals each have a very short claw and wide spreading limb as in *Rosa* sp. *Camellia sinensis* etc.
- **Caryophyllaceous-** Here the five free petals each have a long claw and spreading limb at right angles to the claw as in members of family Caryophyllaceae (eg. *Dianthus chinensis*)

Polypetalous irregular type

- **Papilionaceous-** Here, there are five free petals, of which the outermost is the posterior median standard petal which overlaps a pair of clawed lateral wing petals, which in turn overlaps two anterior keel petals that form a boat-shaped structure. This type is found in all members of Papilionaceae (eg. *Clitorea ternatea*)

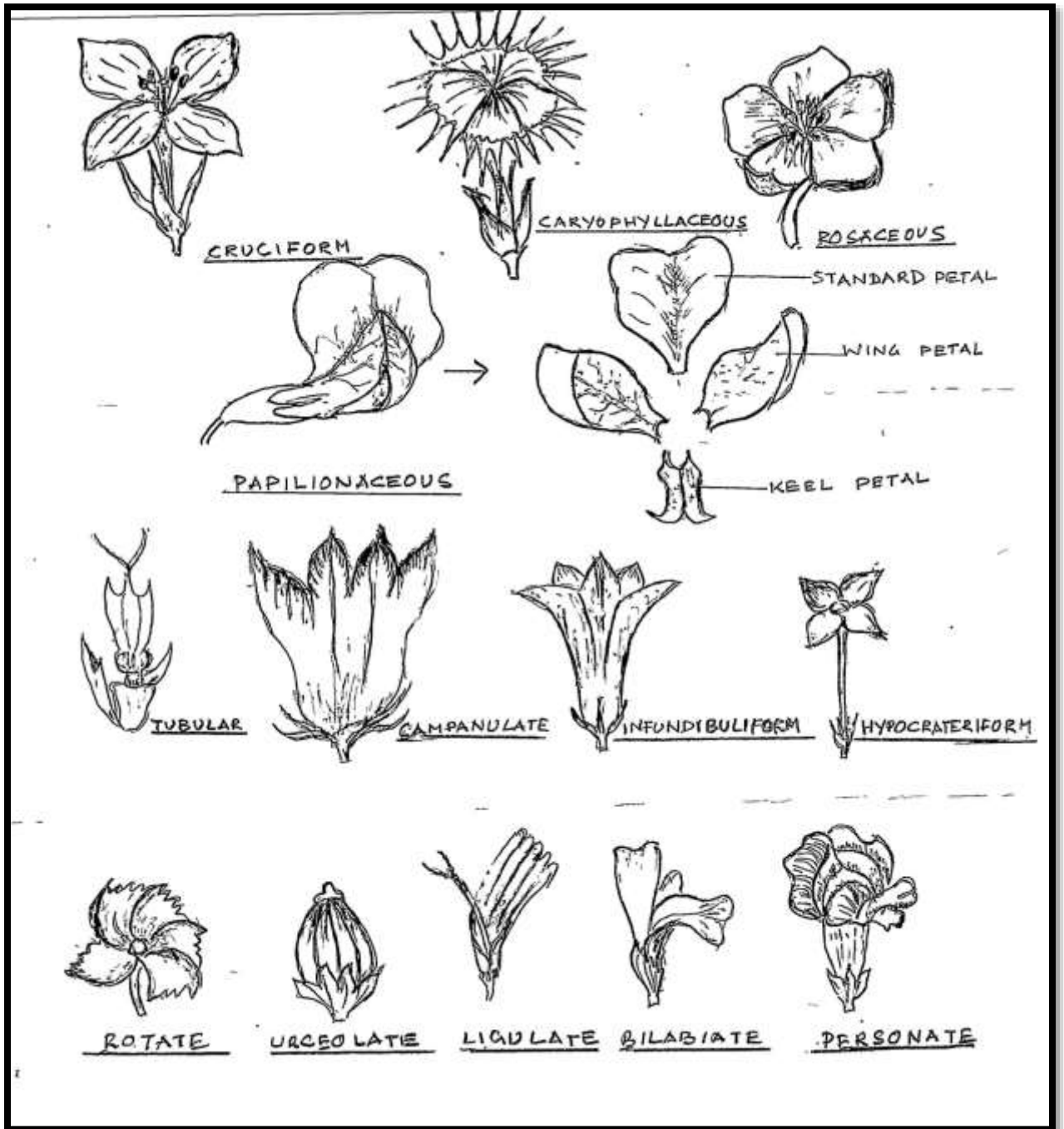
Gamopetalous regular types

- **Tubular**- Here the petals are united to form a tube-like structure as found in the disc florets of *Helianthus annuus*.
- **Campanulate**-Here the petals are united to form a bell-shaped structure as in *Cucurbita masima*.
- **Infundibuliform**-Here the petals are united to form a funnel-shaped structure with a gradually widening corolla tube to a spreading limb as in *Datura metel*.
- **Hypocrateriform**- Here the petals are united to form a salver-shaped structure with the broad limbs arranged at right angles to the narrow corolla tube as found in *Ixora coccinea*.
- **Rotate**-Here the petals are united to form a short tube and a spreading wheel-shaped limb as in *Nyctanthes arbor-tristis*.
- **Urceolate**- Here the petals are united to form an urn-shaped structure which is swollen in the middle and tapering at both ends as found in *Bryophyllum pinnatum*.

Gamopetalous irregular types

- **Bilabiate**-Here there are five united petals forming a two-lipped structure. The upper lip is formed by union of two petals and the lower lip by three petals. The mouth of the corolla tube is open at the throat as in members of Lamiaceae (eg, *Leucas aspera*), many members of Acanthaceae like (*Andrographis paniculata*) and Scrophulariaceae (eg. *Mazus rugosus*).
- **Personate**- Here the five united petals form a two-lipped corolla but the mouth of the corolla tube is closed by a projection of the lower lip called the palate as in some members of Scrophulriaceae (eg. *Antirrhinum mazus*).
- **Ligulate**-Here the five united petals form a strap-shaped structure as is found in the ray florets of *Helianthus annuus*.

Different forms of corolla

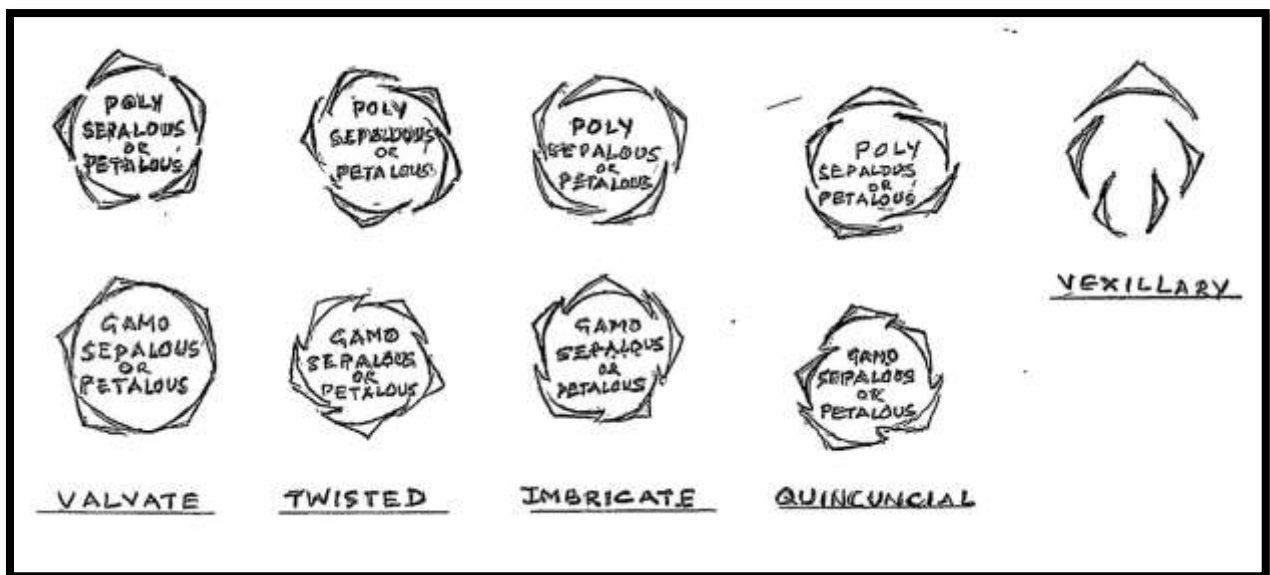


Aestvation of calyx and corolla:

Aestvation is the arrangement of the sepals and petals in relation to one another. It may be of the following types.

- Valvate- Here the sepals and petals are placed adjacent to one another without any overlap. Example-Sepals of *Hibiscus* sp.
- Twisted or contorted-Here the sepals and petals show a regular overlap. Example-Petals of *Hibiscus* sp.
- Imbricate- Here one member is completely internal, one is completely external and the rest are twisted. Example-Petals of *Luffa* sp.
- Quincuncial-Here two members are internal, two are external and one is twisted. Example-Petals of *Cassia* sp.
- Vexillary-A large median unit overlaps two lateral ones which in turn overlaps two inner ones. Example- Petals of *Pisum* sp.

Different types of aestivation



THE ANDROECIUM

The androecium is the male part of a flower and is composed of stamens or microsporophylls. Each stamen has a stalk called the **filament** with a pollen containing part at the top called the **anther**. The anther remains attached to the filament by the **connective**. The anther has one or two lobes each of which has two chambers called microsporangia. The microsporangia contain **pollen grains** or microspores. The stamens may not all be of the same size. In Brassicaceae for example, the stamens are in two whorls, the outer has two short stamens and the inner has four long stamens. This arrangement is called **tetradynamous**. In Lamiaceae, Scrophulariaceae, Acanthaceae etc. there are four stamens in one whorl of which two are short and two are long. This arrangement is called **didynamous**. When the number of stamens is same as that of sepals and petals it is called **isostemonous**.

Cohesion and adhesion of stamens:

Stamens may remain united with one another (connate) or with other floral whorls (adnate). The various types of connation (cohesion) and adnation (adhesion) are discussed below.

Types of cohesion

- **Adelphy**-Here the stamens remain united with one another by their filaments only, the anthers remaining free. There are three types in this category.

Monadelphous, where the stamens are united into one bundle as in members of Malvaceae.

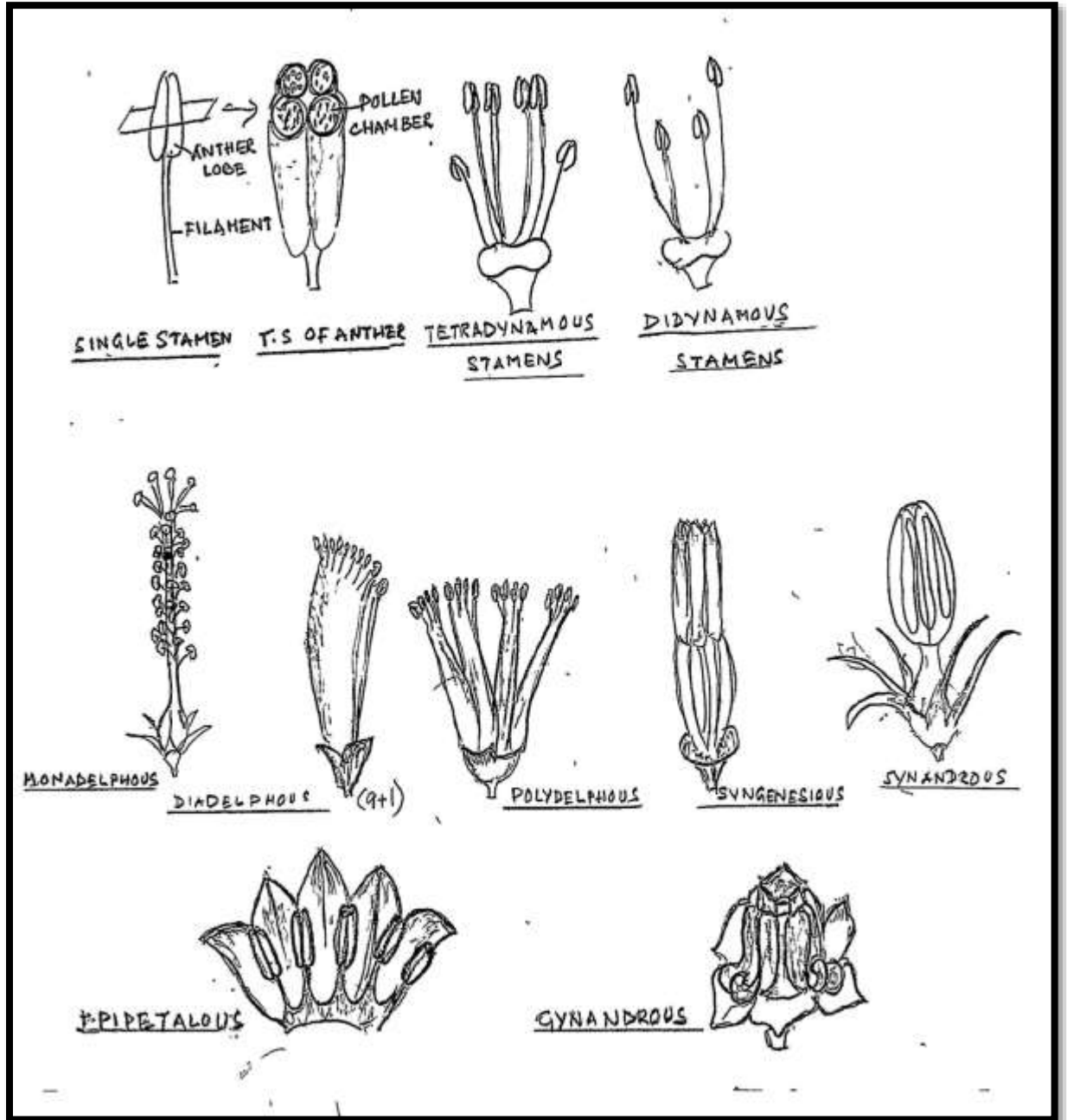
Diadelphous, where the stamens are united into two bundles as in *Clitoria* where nine stamens form one bundle, bridged by the tenth free stamen (9+1) or *Smithia* where there are two bundles of five stamens each (5+5).

Polydelphous, where the stamens are united into several bundles as in *Hypericum*.

- **Syngeny**- Here the stamens are united with each other by their anthers only, filaments remaining free. Syngenesious stamens are found in the disc florets in members of Asteraceae.
- **Synandry**- Here the stamens are united with each other by both their filaments and anthers to form a compact structure called the synandrium. Synandrous stamens are found in the male flowers of Cucurbitaceae.

Types of adhesion

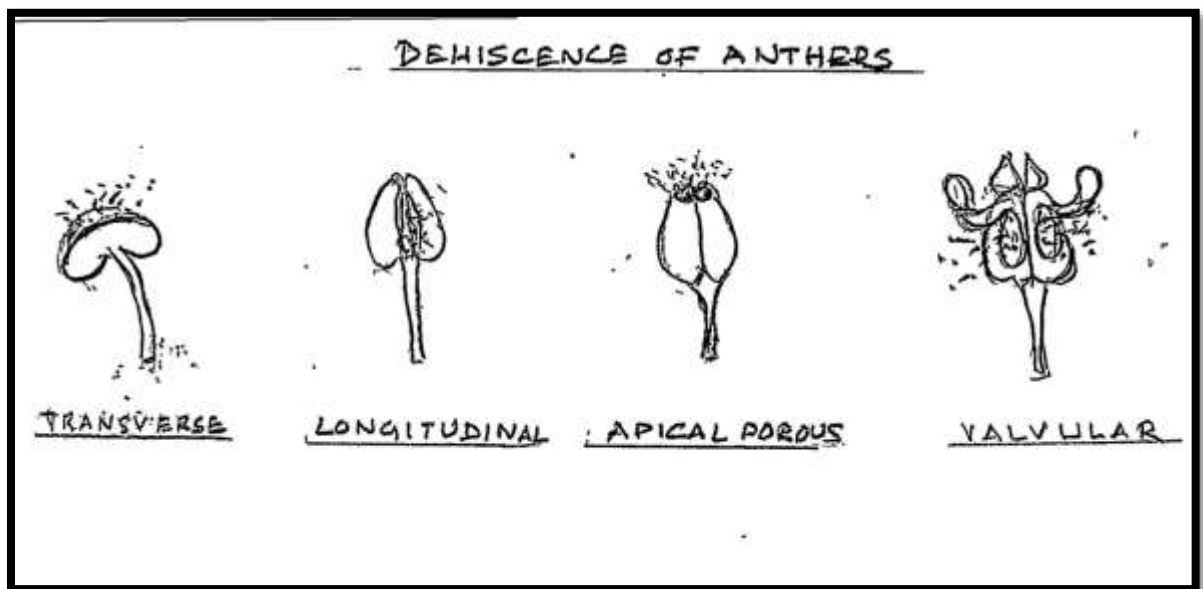
- **Epipetaly**- Here the stamens are united to the petals. Epipetalous stamens are found in *Solanum nigrum*.
- **Epiphyly**- Here the stamens are united to the members of the perianth or tepals. Epiphyllous stamens are found in *Polianthes tuberosa*.
- **Gynandry**- Here the stamens are united with the carpel to form a gynostegium or gynostemium (Asclepiadaceae, Orchidaceae).



Stamen and its types

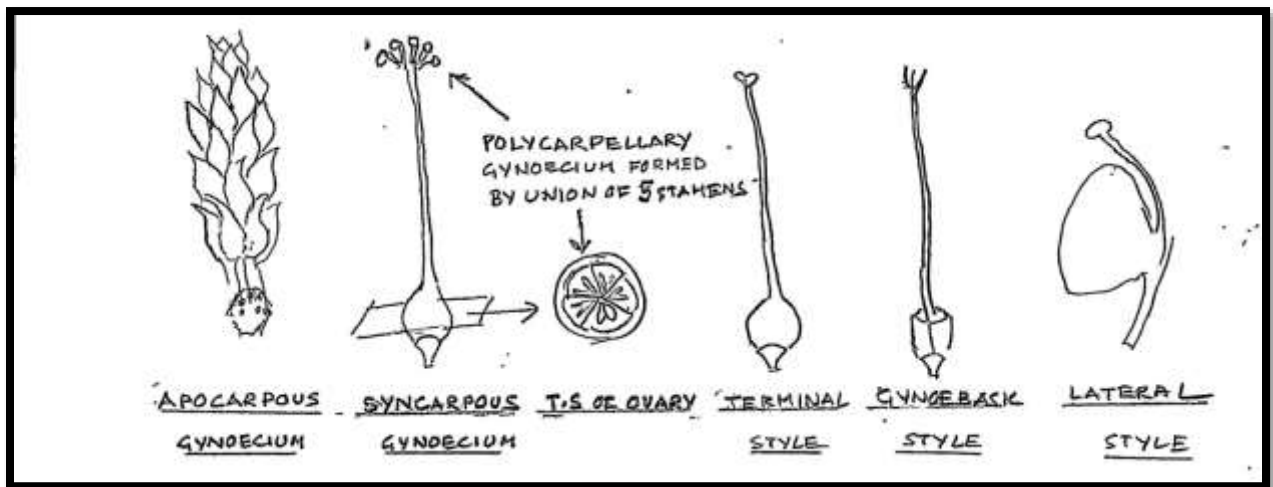
Dehiscence of Anthers: When the pollen grains mature the anther splits open in the following ways to release them.

- **Tranverse**-Here the anther is one-celled and splits open by a horizontal slit as in Malvaceae.
- **Lonitudinal**-Here the anther is two-celled and splits open lengthwise as seen in most families (Acanthaceae, Lamiaceae etc.).
- **Apical porous**-Here the anther is two celled and splits open through small pores at the apex as in *Solanum* sp.
- **Valvular**-Here the anthers split open by trap door like valxes as in *Barberis*.



THE GYNOECIUM

The gynoecium is the female part of the flower comprising of the **carpel** or **pistil**. The carpel has a basal swollen portion called the **ovary** which contains the ovules. The ovary protrudes into a stalk-like **style**. The style is usually terminal but sometimes it may seem to arise from the base of the ovary (gynobasic as in Lamiaceae) or may be lateral (*Mangifera indica*). The style ends in a receptive tip called the **stigma** which receives the pollen grains. The stigma may be knob-like or capitate, bilobed or bifid. There may be a single carpel (monocarpellary) or two/ more carpels (bicarpellary or polycarpellary). When there are two or more carpels they may be free from each other (apocarpous) or united with one another (syncarpous).



Placentation: Placenta is the tissue through which the ovules are attached to the ovary. Placentation is the arrangement of the placental tissue within the ovary. It may be of the following types.

- **Marginal**-Here the gynoecium is monocarpellary. Placenta develops all throughout the fused margins of the carpel along the ventral suture and ovules are borne in a double row along this suture (Fabaceae).
- **Parietal**-In this type the gynoecium is polycarpellary and single chambered in which the carpels unite along the ventral suture. Placentas develop on the ventral suture bearing ovules (Brassicaceae, Cucurbitaceae)
- **Axile**-Here the gynoecium is polycarpellary and many chambered. The ventral sutures of the carpels meet at the centre. The placenta bearing ovules arises from the central axis (Malvaceae).
- **Free central**-This is a modification of the axile type. Here the partition walls between the chambers of the ovary are degraded and the ovules remain attached to the central axis (Caryophyllaceae).
- **Basal**-Here the ovary is single chambered and the placenta bearing ovules arises from the base of the ovary (Asteraceae).
- **Superficial**-Here the gynoecium is polycarpellary. The ovary is many chambered and placental tissue is distributed all along the inner surface of each chamber (Nymphaeaceae).

