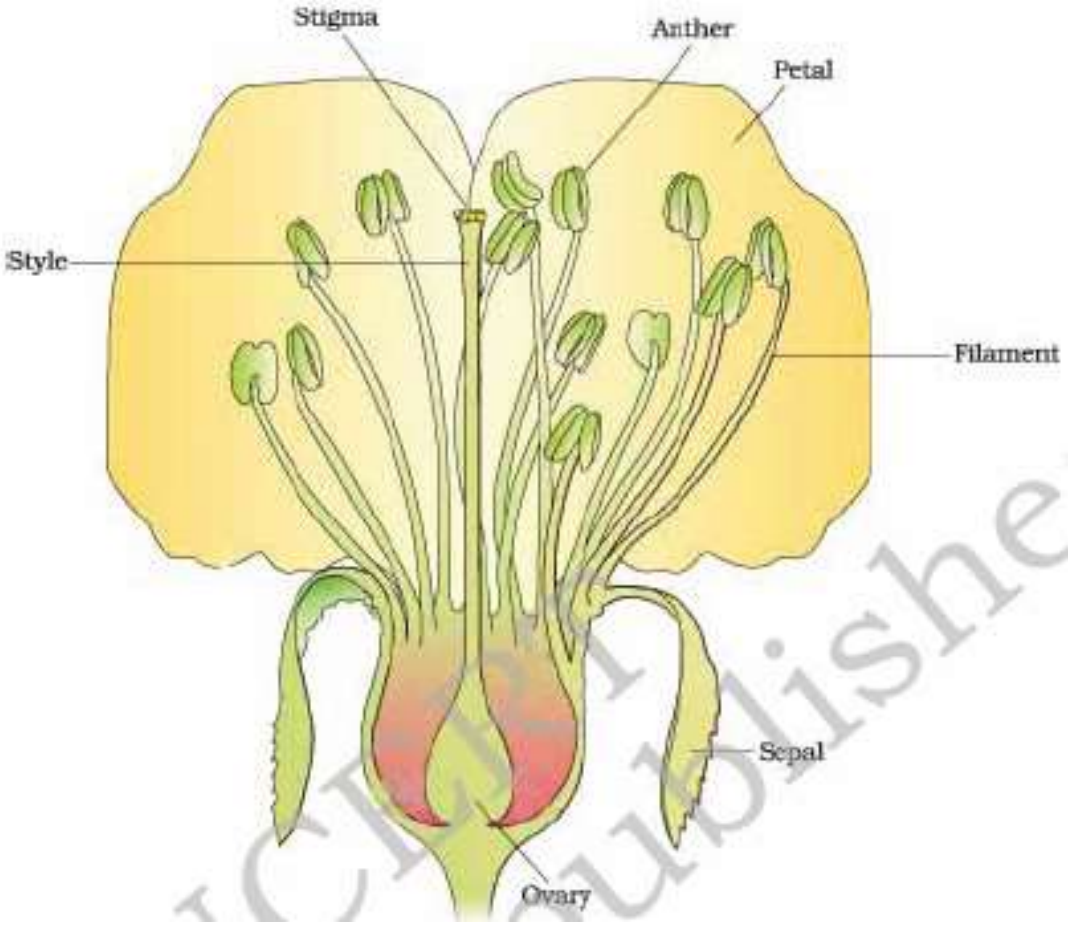
F L O W E R

Flower is defined as a highly modified shoot meant for sexual reproduction in plants

- PEDICEL
- THALAMUS
- FLORAL WHORLS

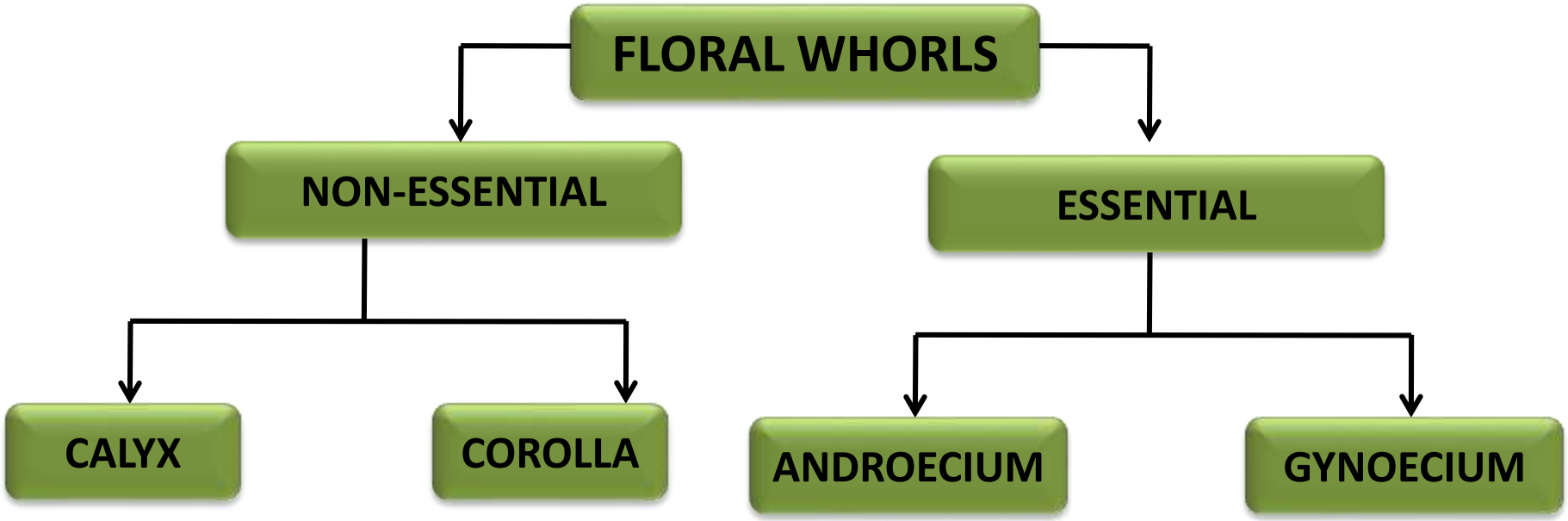


PEDICEL

Stalk of the flower
Flowers with pedicel are called **pedicellate**
Flowers without pedicel are called **sessile**

THALAMUS

Also called as **Receptacle** or **Torus**
Terminal end of pedicel is swollen or expanded to form the floral axis
4 nodes and 3 internodes
From each node a **whorl of modified leaves** is produced


FLORAL WHORLS
NON-ESSENTIAL
ESSENTIAL
CALYX
COROLLA
ANDROECIUM
GYNOECIUM

Flowers

A flower normally arises In the axil of a small leaf-like structure called as the **bract**
Flowers with bracts are called as **bracteate** and those without bracts are called as **ebracteate**

A flower is said to be **complete** when all the four floral whorls are present

A flower is said to be **incomplete** when any one or more of the four floral whorls are absent

A flower is said to be **Bisexual / Hermaphrodite** when both the essential floral whorls viz.the **Androecium and Gynoecium** are present

A flower is said to be **Unisexual** when any one of the essential floral whorls viz.the **Androecium or Gynoecium** is absent

A **Unisexual** may be **male / staminate** when only androecium is present

OR

A **Unisexual** may be **female / pistillate** when only gynoecium is present

A flower is said to be **Neuter** when both the essential floral whorls are absent

Flowers w.r.t symmetry

A flower is said to be regular or **Actinomorphic** when it can be divided into 2 equal halves along any of the radii, passing through the centre

A flower is said to be **Zygomorphic** when it can be divided into 2 equal halves only along 1 radius, passing through the centre

A flower is said to be **Aymmetrical** when it cannot be divided into 2 equal halves from any palne.

Flowers w.r.t no. of floral leaves in each whorl

1. **ISOMEROUS FLOWER** : Flowers which have the same no. of floral leaves in each of its whorl are called as **Isomerous** flowers

   a) **Dimerous** : Floral leaves are 2 or in multiples of it

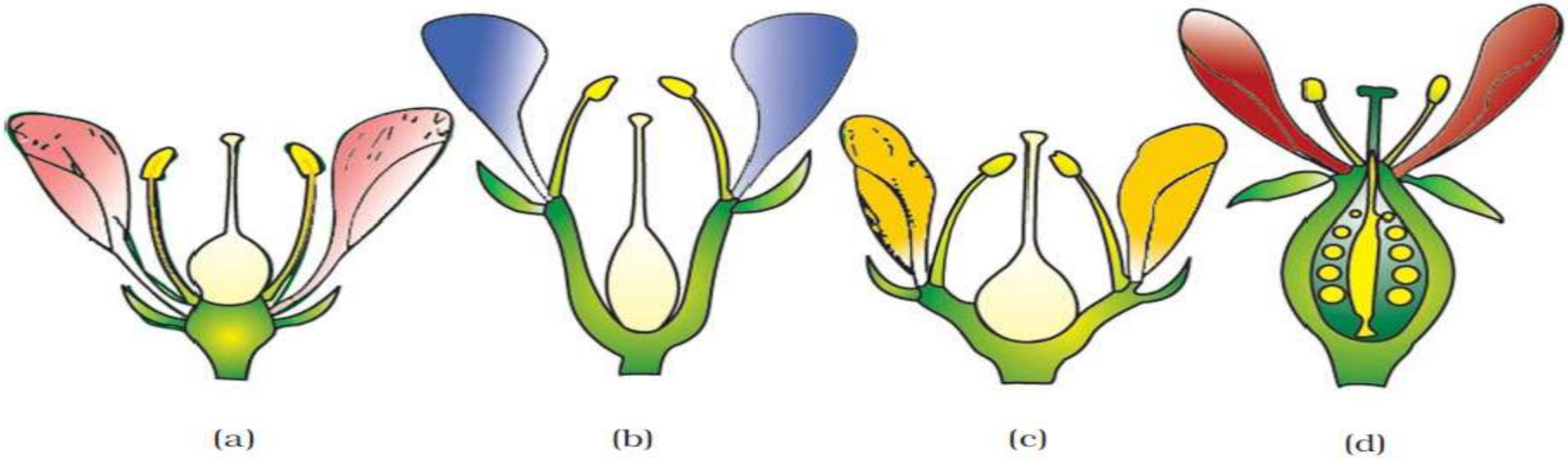
   b) **Trimerous** : Floral leaves are 3 or in multiples of it e.g **monocots**

   c) **Tetramerous** : Floral leaves are 4 or in multiples of it

   d) **Pentamerous** : Floral leaves are 5 or in multiples of it e.g **dicots**

2. **HETEROMEROUS FLOWER** : Flowers which have the diff no. of floral leaves in each of its whorl are called as **Heteromerous** flowers

Insertion of floral leaves



HYPOGYNOUS

- Conical Thalamus

- Ovary has **superior** position

- The rest of the floral whorls are inserted **below gynoecium**

e.g. Brinjal, Mustard, China rose

PERIGYNOUS

- Thalamus **cup / saucer** shaped

- Ovary has **half superior** position **half inferior**

- The rest of the floral whorls are inserted **around the gynoecium**

e.g. Rose , pea, bean .

EPIGYNOUS

- Thalamus grows upwards enclosing the ovary completely

-Ovary has **inferior** position

-The rest of the floral whorls are inserted **above gynoecium**

- e.g. sunflower, Guava

CALYX

-**Outermost whorl** of the flower
-Individual members of the whorl are **GREEN** and are called as **SEPALS**

SEPALS
- **Free** – POLYSEPALOUS e.g *Brassica*
- **Fused** – GAMOSEPALOUS e.g China rose

SEPALS
- **Caducous** : Sepals fall off as soon as the flower opens e.g *Argemone*
- **Decidous** : Sepals survive till the withering of petals e.g *mustard*
- **Persistent** : Sepals remain even after fruit formation e.g *brinjal*

FUNCTIONS :

1. **Protection** of flower in the bud condition
2. **Photosynthesis**
3. **Petaloid sepals** attract insects for pollination
4. **Hairy calyx (Pappus)** help in dispersal of fruits

C O R O L L A

-**Second whorl** of the flower , **larger** in size and **inner** to calyx
-Individual members of the whorl are called as **PETALS ,** which are **coloured** and **scented**

PETALS →
- **Free** – POLYPETALOUS e.g *Rose*
- **Fused** – GAMOPETALOUS e.g *Datura*

<u>FUNCTIONS</u> :

1. **Attraction :** The bright colour attracts birds and insects for pollination.
2. **A tubular gamopetalous corolla** can store nectar for attraction
3. **Protection** of inner essential whorls.

P E R I A N T H

-When **Calyx and Corolla** are **similar**
-Individual members of the whorl are called as **TEPALS**

TEPALS →
- **Free** – POLYPHYLLOUS
- **Fused** – GAMOPHYLLOUS

TEPALS →
- **Green**– SEPALOID
- **Coloured**– PETALOID

FUNCTIONS :

1. Both as Calyx and Corolla. **Protects** the essential whorls in bud condition
2. A SEPALOID perianth performs **Photosynthesis**
3. A PETALOID perianth **attracts** insects for pollination

AESTIVATION

Mode of arrangement of Sepals and Petals in a flower w.r.t. the members of the same whorl.

VALVATE

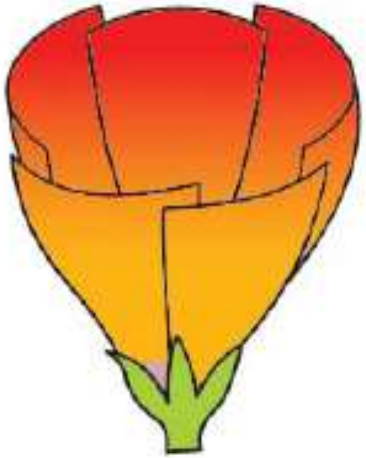
Margins of Sepals or Petals remain in **close contact** or lie **close to each other** but **do not overlap** e.g *Datura*

T W I S T E D

One margin is inwards and overlapped
Other margin is outwards and overlaps the margin of adjacent one. e.g. *China rose*

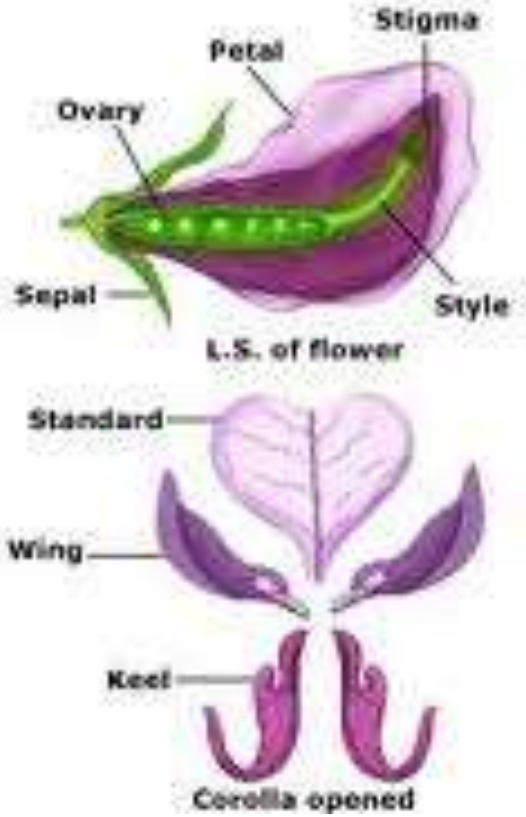
I M B R I C A T E

One Sepal/Petal is **overlapped at both margins**
One Sepal/Petal **overlaps at both margins.**
Rest of the Sepal/Petals are like Twisted Variety
e.g. *Bauhinia*



V E X I L L A R Y

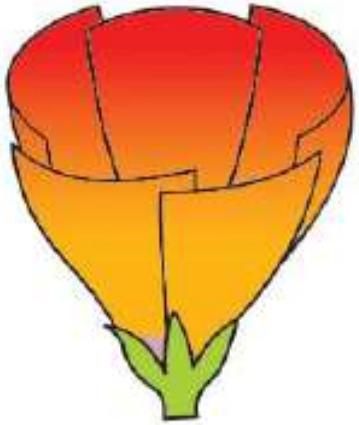
Corolla is **butterfly shaped** and has **5 petals**
Outermost --- largest ---- **Standard/Vexillium**
Two Lateral --- **Wings**
Two smaller **--- nearly fused – boat shaped--- keel/karina**
e.g. *Pea*



VALVATE

TWISTED

IMBRICATE



VEXILLARY

A N D R O E C I U M

Male Reproductive Whorl made up of **STAMENS** also called as a **MICROSPOROPHYLL**

STAMENS
- **FREE – POLYANDROUS**
- **FUSED – COHESION**

STAMEN

FILAMENT

-Stalk of stamen with anther at its tip

-If Filaments fuse and Anthers are free

it is called as **ADELPHY**

monadelphous – Hibiscus

diadelphous – Pea

polyadelphous – Citrus

If anthers are fused and filaments remain free the the condition is called as **SYNGENY** (sunflower)

ANTHER

Upper Swollen **fertile** part of stamen

1 lobe- monothecous (china rose)

2 lobes – dithecous

Each lobe having **2 chambers/locules**

Called **pollen sacs/ microsporangia** in which **pollen grains or microspores** are produced

MONO ADELPHOUS

DIADELPHOUS

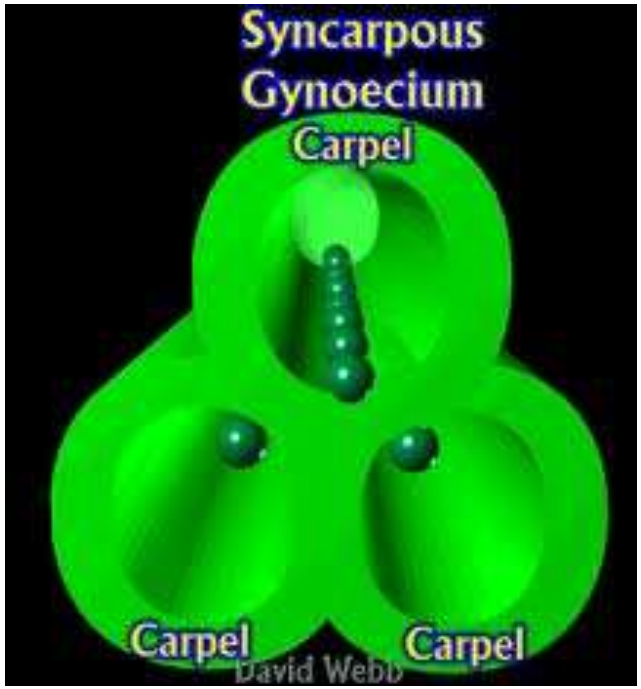
POLYADELPHOUS

G Y N O E C I U M (PISTIL)

Female Reproductive Whorl made up of **CARPELS** also called as a **MEGA SPOROPHYLL**

Monocarpellary – pea
Bicarpellary – Datura
Tricarpellary – cucurbita
Pentacarpellary - Hibiscus

CARPELS → **FUSED – SYNCARPOUS**
CARPELS → **FREE – APOCARPOUS**



CARPEL

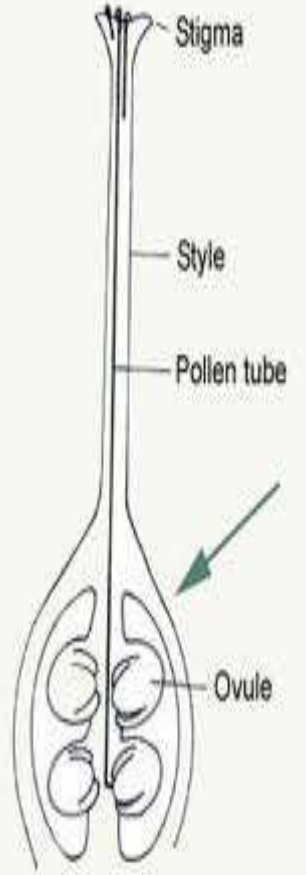
STIGMA : Terminal part of Carpel, rough and sticky
Site of pollination
Receives pollen grain for pollination

STYLE : Narrow elongated thread like structure connecting Stigma with the Ovary

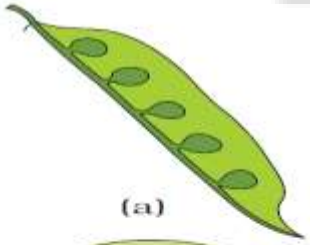
OVARY : Basal Swollen part having chamber called as **LOCULE**

unilocular(pea) , bilocular (Mustard) / trilocular (Asparagus), tetralocular (Ocimum) pentalocular (china rose)

Each locule contains **OVULES** on a fertile tissue Called as **PLACENTA**



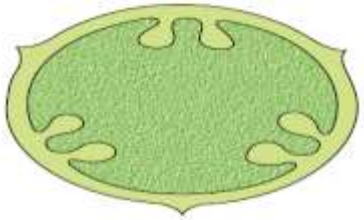
P L A C E N T A T I O N


(a)

MARGINAL : Ovules are borne at the fused margins of unilocular ovary e.g. pea


(b)

AXILE : Ovules are produced on a central axis of multilocular ovary e.g. China rose


(c)

PARIETAL : Ovules are borne on the inner wall of unilocular ovary of multicarpellary syncarpous gynoecium e.g. Cucumber


(d)

FREE CENTRAL : Ovules are borne on central axis and septa are absent e.g. Primrose


(e)

BASAL : Single Ovule is borne at the base of unilocular ovary e.g Sunflower

INFLORESCENCE

INFLORESCENCE

- A natural group (cluster) of flowers produced on a special reproductive axis (peduncle) of a plant is called an inflorescence.
- When produced **singly**, it is called a **solitary flower**, and when produced in a **group**, that group is called an **inflorescence**.
- flowers are arranged in a definite **pattern** on a special reproductive **branch** (axis). This branch is called **peduncle**

SIGNIFICANCE OF THE INFLORESCENCE:

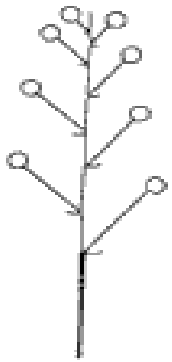
- It makes flowers more **conspicuous** and **attractive;** therefore it is more effective in attracting pollinating agents such as insects or birds.
- Moreover, many flowers can be pollinated in a single visit of an agent.
- In an inflorescence, flowers open (mature) **successively** and not simultaneously.
- This improves chances of pollination as flowering has a **longer period**.
- Different **genera** of same family often produce flowers in a particular pattern specific to that family; therefore it is one of the criteria for **identification** and **classification** of flowering plants

RACEMOSE INFLORESCENCE:

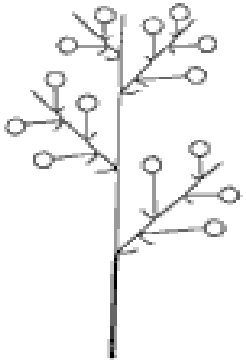
1. also known as **indefinite** inflorescence because its peduncle (axis) shows **continued growth** for an indefinite period. This is possible because the peduncle has an active terminal bud.
2. The inflorescence axis never terminates in a flower, i.e. the apical bud of the peduncle is **never** converted into a **terminal flower**.
3. Flowers are arranged in **acropetal succession** on the peduncle i.e., **older** flowers in the inflorescence are lower **down** on the axis, while the **younger** ones are nearer the **apex**.
4. The order of opening of flowers in a racemose inflorescence is always **centripetal,** i.e. flowers which are peripheral (or **lower**) in the inflorescence are older and mature (**open**) **earlier**, while the flowers, which are in the centre (or nearer to the **apex** of inflorescence axis) are younger and mature **later**.
5. *e.g. Gulmohur, Caesalpinia, etc.*

INFLORESCENCE

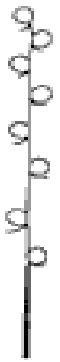
racemose



raceme

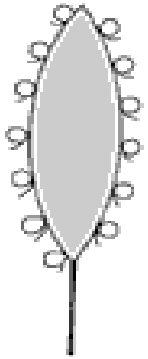


compound raceme

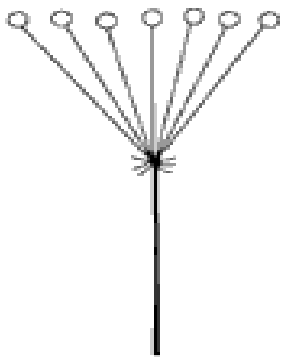


spike

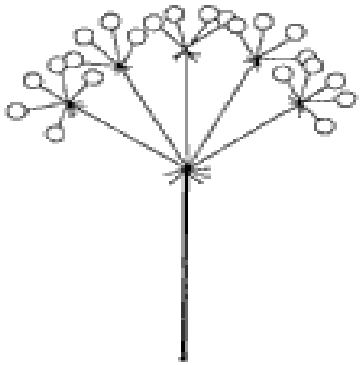
catkin



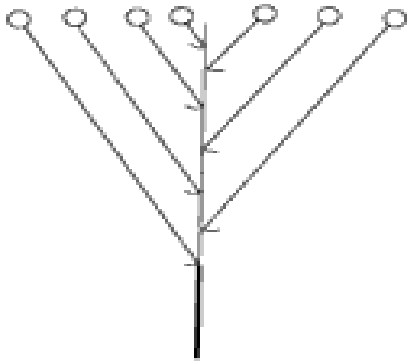
spadix



umbel

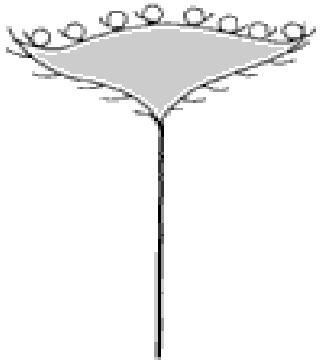


compound umbel



corymb

head



capitulum

INFLORESCENCE

Racemose inflorescence is of following types

(a) Raceme : peduncle has bisexual and pedicellate flowers arranged acropetally, e. g., Larkspur, radish.

(c) **Spike**. Peduncle has bisexual and sessile flowers, e. g., Achyranthes, Adhathoda.

(d) **Spikelet**. It is a small, special spike. Flowers are produced in the axil of fertile bracts called lemma,
e. g., wheat, grasses (Poaceae).

(e) **Catkin.** It is pendulous spike in leaf axis which bears unisexual flowers, e. g., Morus, Birch, Oak, Acalypha,

INFLORESCENCE

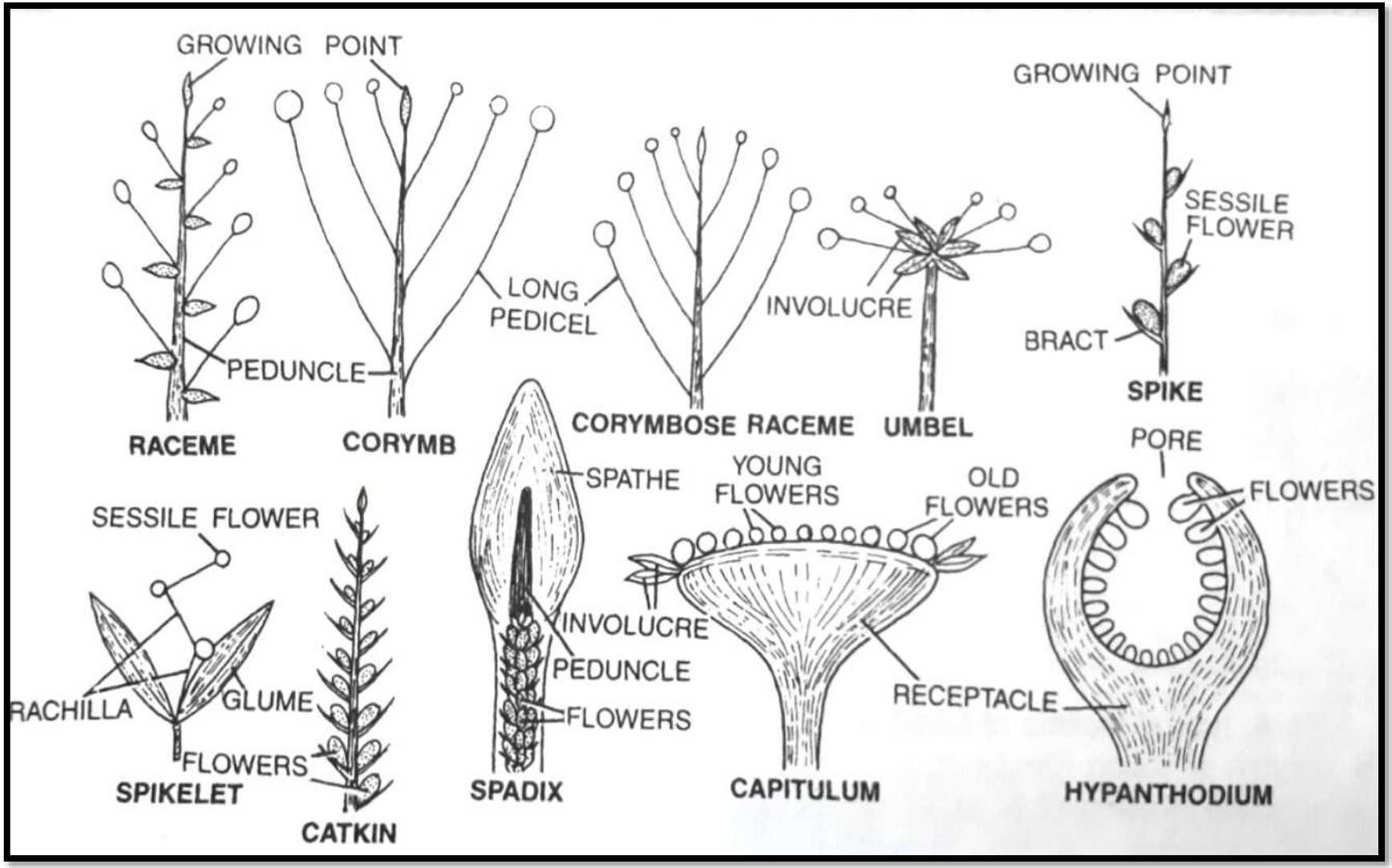
(f) **Spadix**. It is spike with fleshy axis and having both male and female flowers. It is surrounded by large coloured bracts called spathe, e. g., Musa, Palm, Colocasia, Alocasia (characteristically found in monocots).

(g) **Corymb**. The main axis is short. Lower flowers have long pedicels than upper ones so that all the flowers are brought more or less to the same level, e. g., Iberis, Capsella. **Compound corymb**, e. g., Cauliflower. Corymbose raceme is found in mustard.

(h) **Umbel**. The main axis is reduced very much and all flowers appear to be arising from the same point
At the base of flowers, cluster of bracts form an involucre, e. g., Hydrocotyl.
Compound umbel e. g., Coriander.

(i) **Capitulum or head**. Main axis becomes flat and called receptacle. It bears many sessile and small florets. Peripheral florets called ray florets are pistillate or neuter and zygomorphic, whereas disc floret are bisexual and actinomorphic e. g., Sunflower, Zinnia, Cosmos (Asteraceae).

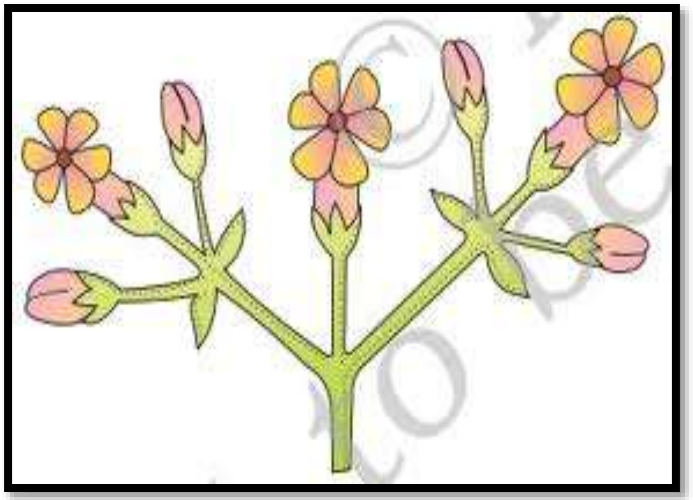
INFLORESCENCE



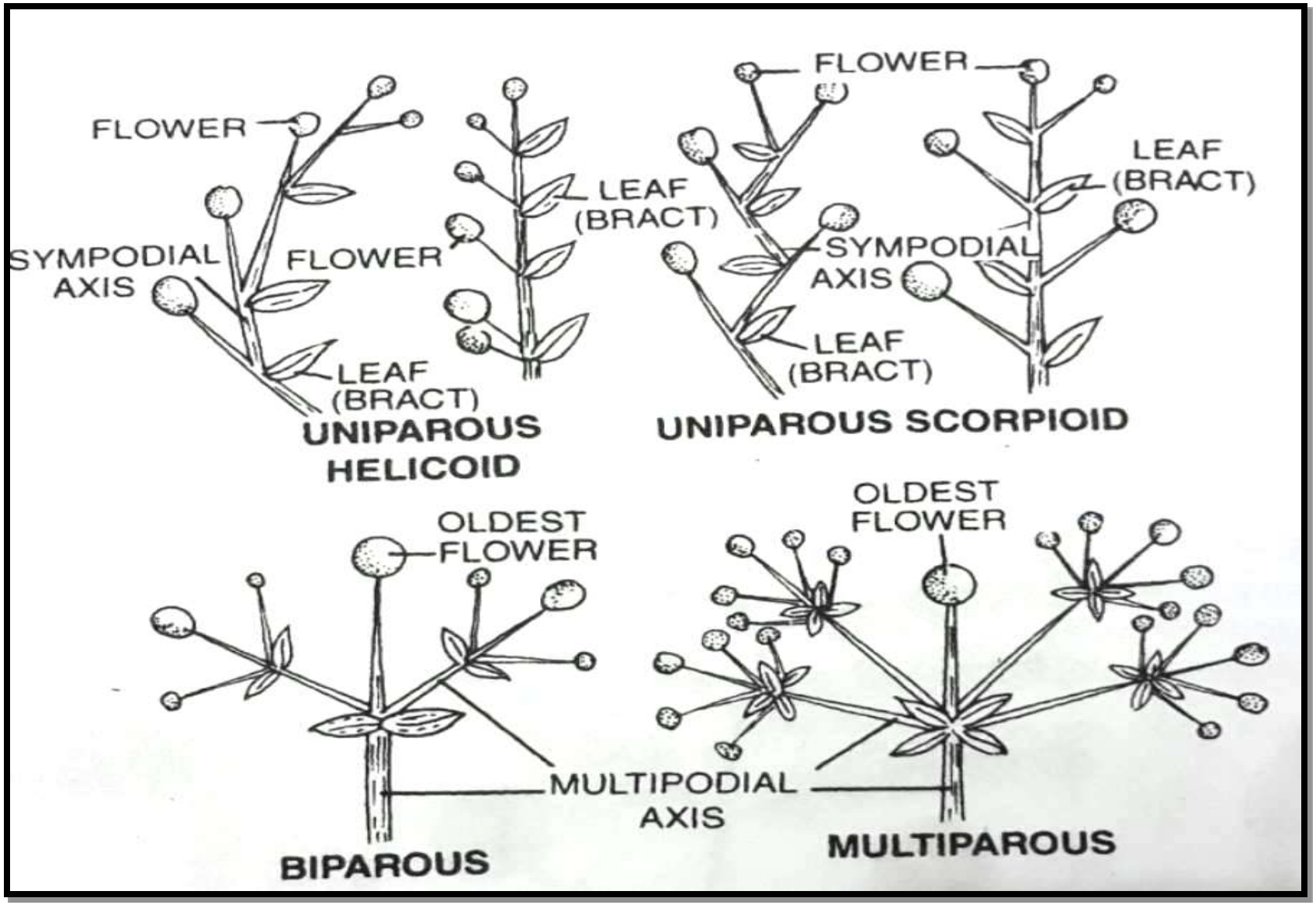
dr.aarif

CYMOSE INFLORESCENCE:

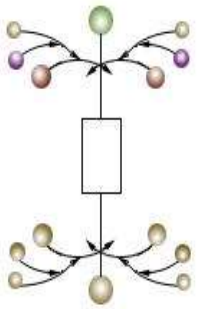
1. The cymose inflorescence is also called the **definite** inflorescence as its peduncle has a **limited growth**. This is because the **apical bud** of the peduncle is converted into a **flower**.
2. Below this apical bud, **one or more lateral branches** may develop on the main peduncle. These branches terminate into flower.
3. The flowers are thus arranged in **basipetal succession** on the peduncle, i.e. the first formed and the **oldest** flower is **terminal** in position, while the flowers produced later (**younger** flowers) are **lower** down in position on the peduncle.
4. The order of opening of the flowers **is centrifugal.** The **central** (terminal) flower is the oldest and opens **first**, while the **peripheral** flowers are younger & open **later**
5. ,e.g. *Jasmine, Clerodendron, etc.*

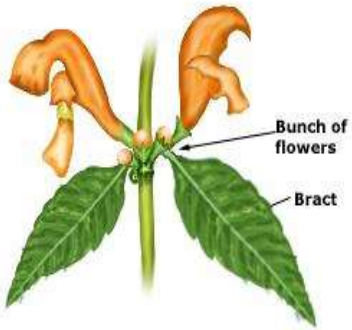


INFLORESCENCE



INFLORESCENCE





Verticillaster inflorescence (Ocimum) A. Outline plan, B. Actual inflorescence

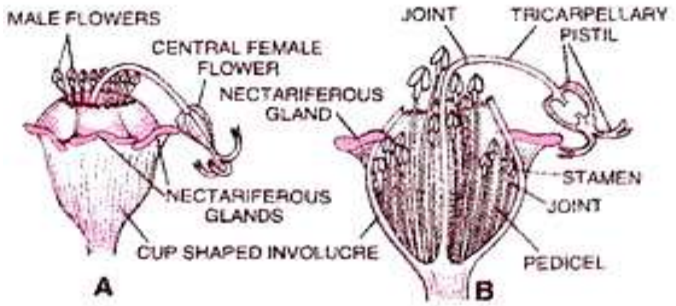
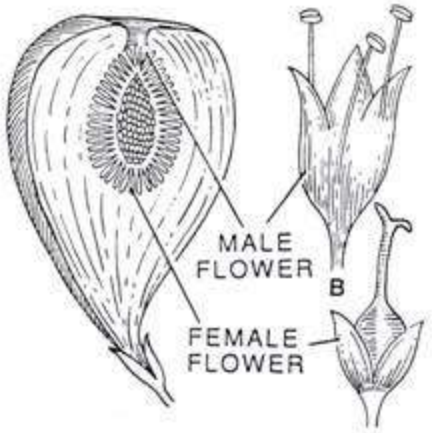


Fig. 5.82. Cyathium. A, unopened cyathium; B, cyathium cut open.



(a) Verticillaster e. g., Ocimum , (Tulsi) Salvia (Lamiaceae).
(b) Cyathium: Poinsettia (Euphorbia pulcherrima),
(c) Hypanthodium:. Ficus (Banyan, Fig, Gular)


FRUITS

FRUITS

- A fruit is defined as the metamorphosed or a ripened ovary without or with one or more seeds.
- **after** successful **fertilization** an **ovary** develops to form a fruit.
- fruits developed **without** fertilization are called **parthenocarpic fruits .**

1. When a fruit is developed exclusively from the **ovary** of a flower, it is called a **true fruit, e.g.** *mango*.

2. Sometimes, other floral parts, like **thalamus**, or receptacle may develop as a part of the fruit, such fruits are called **false fruits** or **pseudocarps.**

3. For example in *apple* and *pear* the thalamus grows around the ovary and becomes fleshy to form the main edible part of the fruit.

FRUITS

A fruit mainly consist of two parts - **pericarp** or fruit wall and **seed(s).**

PERICARP- It is the **wall** of a fruit, which is developed from ovary wall. In some plants the pericarp is differentiated into three parts, epi, meso and endocarp.

- EPICARP - It is the **outer** part of the fruit wall, which forms the **skin** or protective covering of the fruit.

- MESOCARP - It is the **middle** part of the fruit wall, which forms the major pulpy or **juicy** part of a fruit as in *Mango*.

- ENDOCARP - It is the **inner** part of the fruit wall, which may be thin and **membranous** as in orange or hard and **stony** as in *mango, plum and coconut.*

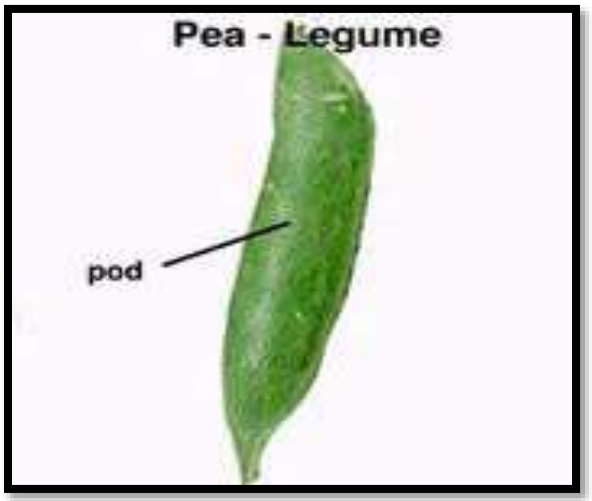
In some plants, pericarp is single, **not differentiated** into such parts, e.g. *Pea, Beans, etc.*

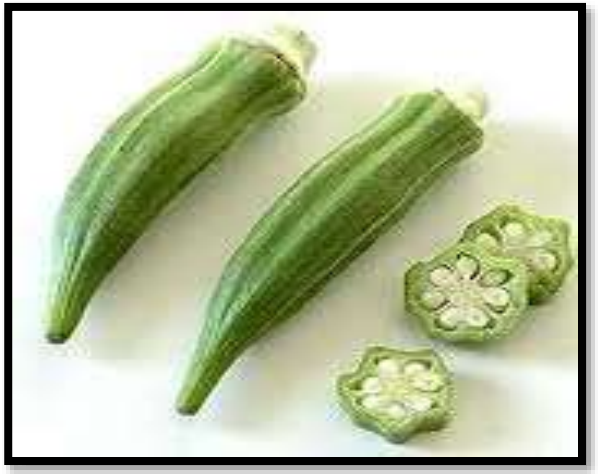
SEEDS- The fruit wall may enclose one or more seeds which develop from fertilized **ovules**.

CLASSIFICATION OF FRUITS:

1) SIMPLE FRUITS :

- When the ovary of a single flower with or without other accessory floral parts develops into a **single** fruit, the fruit is said to be a simple fruit.
- Ovary may be **monocarpellary** or **polycarpellary** and **syncarpous.**
- It may be further divided into **dry** *(e.g. cotton, pea, lady's finger etc.)* and **fleshy** fruits *(e.g. tomato, guava, mango etc.).*
- In dry fruits, pericarp becomes dry and thin at maturity. The **dry** fruits are further classified into **dehiscent** and **indehiscent** fruits on the basis of presence or absence of natural dehiscence or **breaking** of their pericarp at maturity.
- **Legume** and **capsule** are dry and dehiscent fruits.

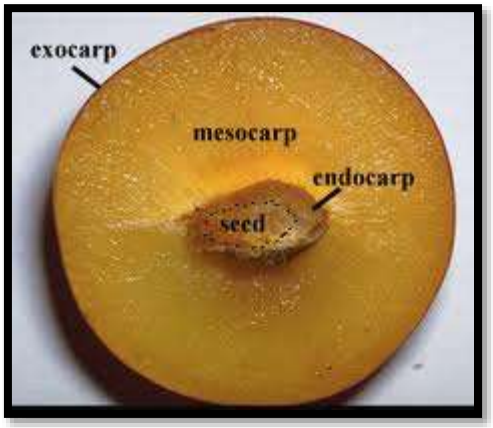




CLASSIFICATION OF FRUITS:

1) SIMPLE FRUITS :

- In **fleshy** fruits, the pericarp is thick and fleshy and may or may not be differentiated into : all the three parts i.e. outer epicarp, middle mesocarp and inner endocarp or only epicarp (skin of the fruit) and fleshy mesocarp.
- Fleshy fruits are mostly **indehiscent**.
- **Drupe** (one seeded) and **Berry** (many seeded) are fleshy fruits.



CLASSIFICATION OF FRUITS:

AGGREGATE FRUITS OR ETAERIOS:

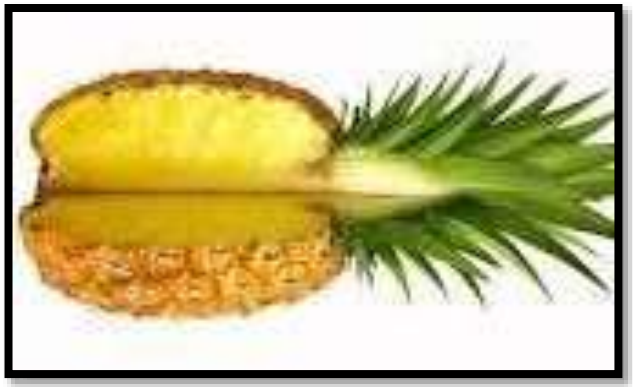
- A fruit which develops from a **polycarpellary apocarpous gynoecium** of a **single** flower is called, an aggregate fruit or etaerio.
- In such a case, the carpels are **free** and ovary of **each** carpel develops into a small, simple **fruitlet**.
- A **collection** or a group of simple fruitlets makes an aggregate fruit.
- An aggregate fruit is further classified into sub-types on the basis of characters of fruitlets.
- In *custard apple (Anona squamosa)* the **apices** of all fruitlets become thick, hard and fuse along their margins to form a common **covering** around the fruit.

CLASSIFICATION OF FRUITS:

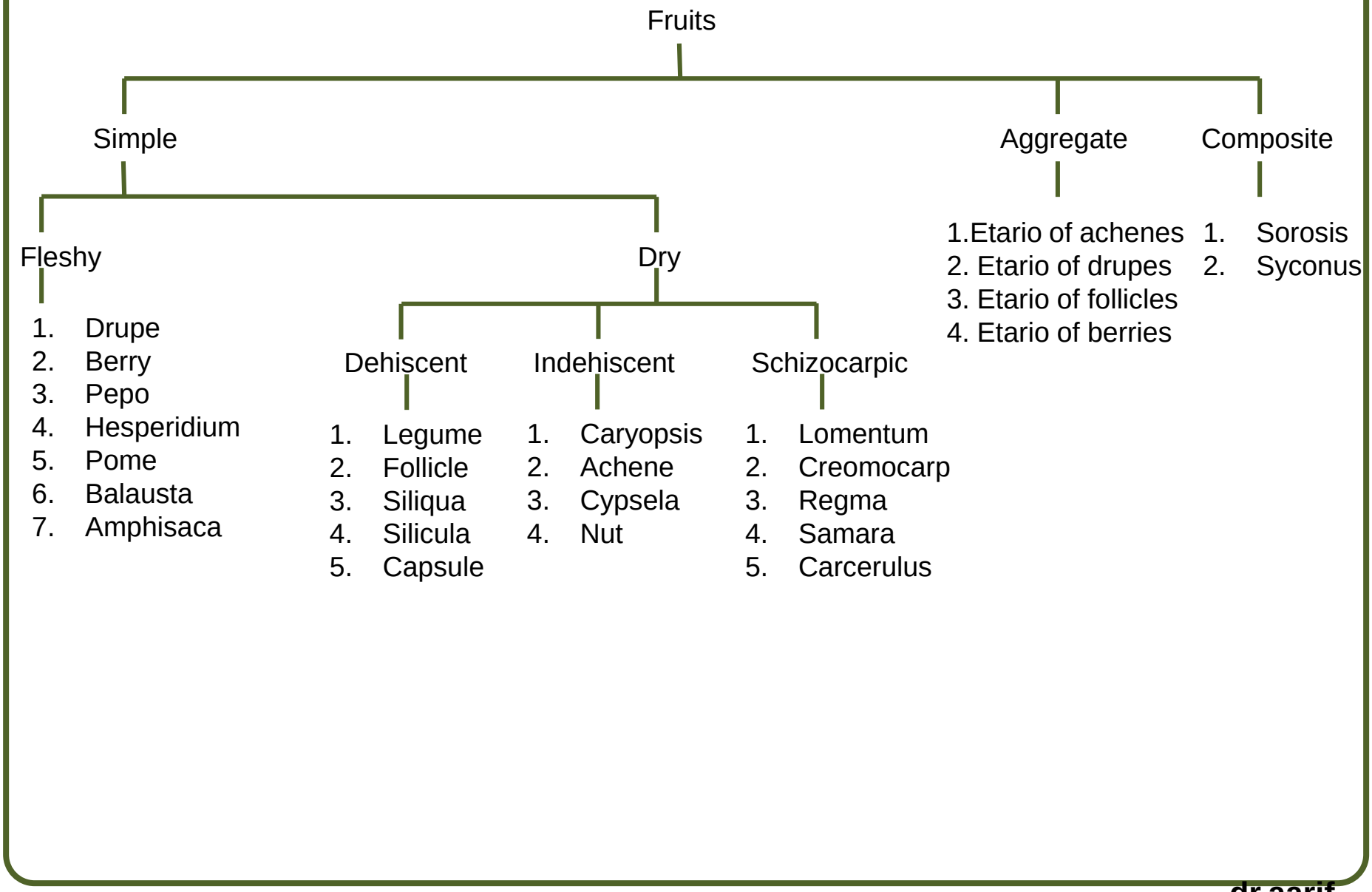
COMPOSITE OR MULTIPLE FRUITS:

- A composite or multiple fruit develops from the entire **inflorescence.**
- In such fruits, along with the ovaries and other floral parts, the **peduncle** also takes part in the formation of the fruit.

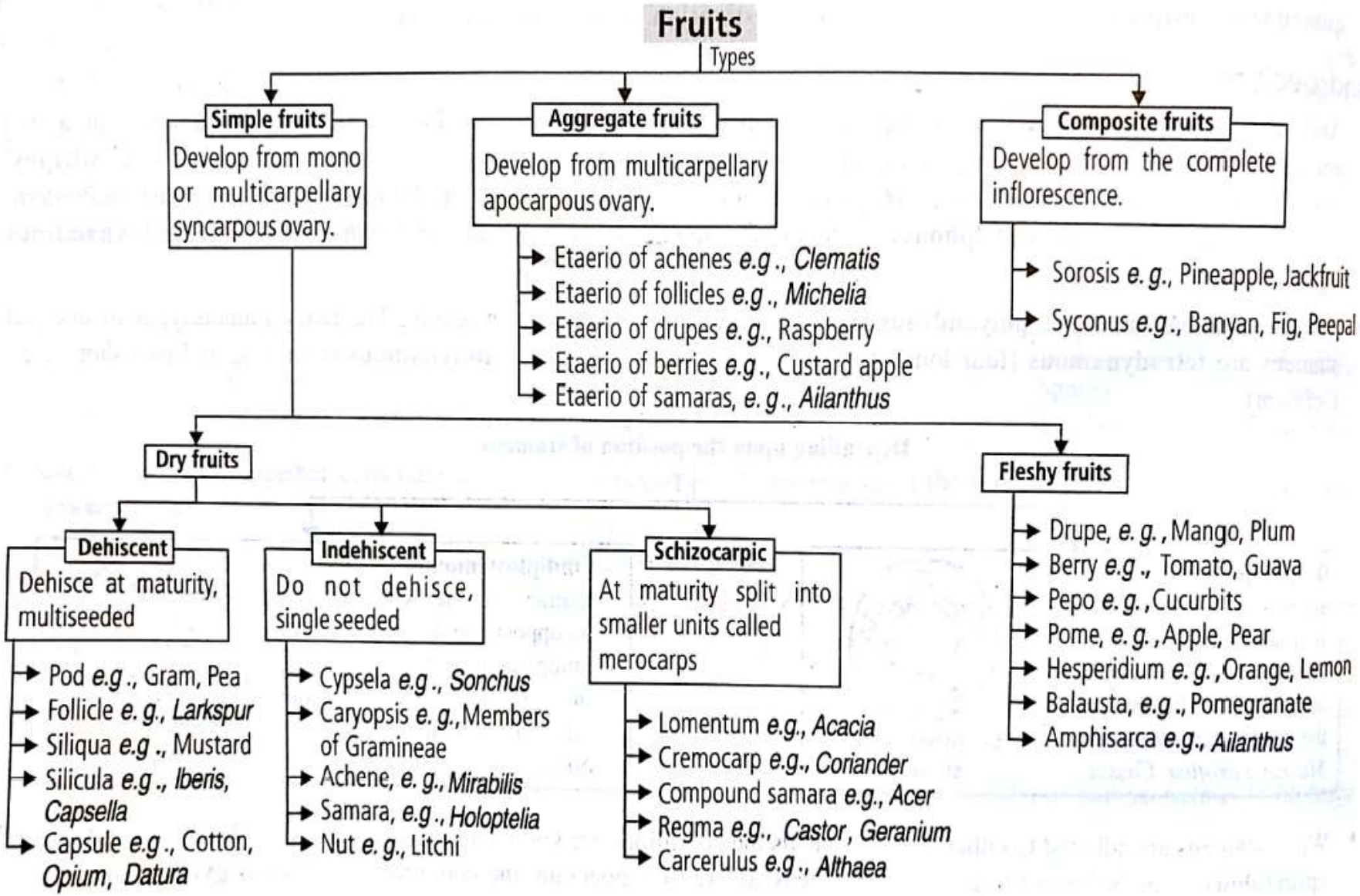
- On the basis of the type of inflorescence, composite fruits are classified into two main types-
- *Sorosis (pineapple, mulberry, jackfruit)*
- *Syconus (fig)*



FRUITS



FRUITS



FRUITS

DRY INDEHISCENT FRUITS

CARYOPSIS : Develops from monocarpellary, unilocular ovary. Fruit wall or pericarp is completely fused with seed coat.

e. g., wheat, maize rice (Graminae).

ACHENE: It develops from monocapellary, unilocular ovary. Fruit wall (pericarp) is not completely attached with seed coat (as that of caryopsis),

e. g., Mirabilis.

CYPSELA : Develops from bicarpellary, unilocular and inferior ovary. Calyx is hair like and called pappus which helps in dispersal of fruits (seeds),

e. g., Sunflower, Sonchus, Zinnia, Taraxacum. It is characteristic fruit of family Compositae (Asteraceae).

NUT: Develops from polycarpellary superior ovary. pericap is hard (stony) and sometimes woody,

e. g., Anacardium (cashew nut), Litchi (marking nut), Triapa (water chestnut) and Quercus (oak)

FRUITS

DRY DEHISCENT

LEGUME OR POD: Dry, one chambered fruit developing from a superior and monocarpellary ovary. Mature fruit dehisces by both sutures or margins,
e. g., Gram, lentil, pea.

SILIQUA: Develops from bicarpellary, unilocular ovary with parietal placentation, dehiscence of fruits occur by both the halves from base to apex,
e. g., Mustard, radish.
This is characteristic fruit of family Crucferae or Brassicaceae.

SILICULA : A short, broad, flat siliqua with few seeds is known as silicula.
e. g., lberis, Capsella

CAPSULE : Develops from multicarpellary, syncarpous ovary. Dehiscence occurs by many ways.
(a) By Pores : Porocidal, e. g., Opium (Poppy), Argemone.
(b) By locules or valves : Loculicidal, e. g., Cotton.
(c) By Septa : Septicidal, e. g., Linseed.
(d) Septa breakdown into fragments : Septifragal, e. g., Datura.

FRUITS

FLESHY OR SUCCULENT FRUITS

DRUPE : Mostly one seeded fruits with pericarp differentiated into epicarp, mesocarp and hard and stony endocarp,

e. g., Mangifera indica (Mango-epicarp forms skin, mesocarp-fleshy, juicy and edible endocarp is hard and stony),

Cocos nucifera (Coconut-Mesocarp is fibrous which is used in making coir so called as fibrous drupe),

Juglans regia (walnut, Edible part are the cotyledons).

BERRY : one to many seeded fruits. Epicarp forms the outer skin. Middle thick and fleshy part is called mesocarp with a membrane like endocarp.

e. g., Tomato, guava, papaya, grapes, banana, brinjal, chillies. **Betel nut is a one seeded berry.**

PEPO (hard walled berry) : Develops from tricarpellary, syncarpous, unilocular and inferior ovary. Epicarp forms skin of fruit. Mesocarp and endocarp are fleshy and edible. Sometimes, fruits are bitter in taste due to **tetracyclic triterpenes**

e. g., Cucumber, gourd, watermelon.

FRUITS

POME: Develops from syncarpous inferior ovary which is surrounded by fleshy thalamus. So, true fruit lies inside the swollen **fleshy and edible thalamus**. It is false fruit or pseudocarp.
e. g., Apple, pear. Edible part is fleshy thalamus

HESPERIDIUM : Develops from multicarpellary, multilocular, syncarpous, superior ovary with axile placentation. The epicarp and mesocarp fused together to form skin or rind of the fruit. Endocarp projects inwards forming a number of distinct chambers. The **juicy unicellular hairs** are present on the inner side of the endocarp.
e. g., Orange and all citrus fruits.

BALAUSTA : Develops from multilocular, syncarpous, inferior ovary. Epicarp is tough and leathery. Endocarp is membranous. Seeds are irregularly distributed inside the fruit. **Juicy testa of the seeds is edible**. The fruit has persistent calyx
e. g., pomegranate.

AMPHISARCA : Develops from multicarpellary, syncarpous, multilocular and superior ovary. The epicarp is hard and woody, mesocarp, endocarp and swollen placenta are fleshy and edible e. g., *Aegle marmelos* (wood apple or bael), *Feronia limonia* (Kaith or elephant apple).

FRUITS

Aggregate Fruits

Aggregate fruits are formed from polycarpellary, apocarpous ovary. Each carpel develops into a fruitlet and all fruitlets together form an aggregate fruit. An aggregate of simple fruits borne by apocarpous ovary of a single flower is otherwise known as 'etaerio'.

(I) An etaerio of achenes e. g., Strawberry
(ii) An etaerio of berries e. g., Artobotrys
(iii) An etaerio of follicles e. g., Delphinium, Michelia
(iv) An etaerio of drupes e. g., Raspberry.

Multiple or Composite Fruits

The multiple fruit develops from the entire inflorescence. These fruits are of two types

(i)Sorosis : These fruits develop from spike, spadix or catkin inflorescence. The flowers fuse together by their sepals or perianth and the whole inflorescence forms a compact mass e. g., Jackfruit, mulberry, pineapple.

(ii)Syconus : This fruit develops from hypanthodium inflorescence
e. g., Ficus sp. (Fig, gular, banyan, peepal).
The fruitlets are achenial in nature.

FRUITS

Pea	*Pisum sativum*	Legume	Seeds
Lady's finger/Okra	*Abelmoschus esculentus*	Capsule	Entire fruit
Wheat	*Triticum aestivum*	**Caryopsis**	Entire fruit
Corn/Maize	*Zea mays*	Caryopsis	Entire fruit
Cashew nut	*Anacardium occidentale*	Nut	Cotyledons and fleshy thalamus
Litchi	*Litchi chinensis*	Nut	**Aril**
Water chestnut	*Trapa bispinosa*	Nut	Seeds
Ground nut	*Arachis hypogea*	**Lomentum**	Seeds
Coriander	*Coriandrum sativum*	Cremocarp	Entire fruit
Mango	*Mangifera indica*	**Drupe**	**Fleshy mesocarp**
Coconut	*Cocos nucifera*	**Drupe**	**Endosperm**
Almond	*Prunus amygdalus*	Drupe	Seeds
Walnut	*Juglans regia*	Drupe	**Cotyledons**
Apple	*Pyrus malus*	**Pome**	**Fleshy thalamus**
Pear	*Pyrus communis*	Pome	Fleshy thalamus

FRUITS

Tomato	*Lycopersicon esculentum*	Berry	Pericarp and placentae
Grape	*Vitis vinifera*	Berry	Pericarp and placentae
Date palm	*Phoenix dactylifera*	Berry	Pericarp
Banana	*Musa paradisica* var. *sapientum*	**Berry**	**Mesocarp and endocarp**
Guava	*Psidium guajava*	**Berry**	Pericarp, placenta and thalamus
Betel nut	*Areca catechu*	**Berry**	**Seeds**
Bottle gourd	*Lagenaria siceraria*	Pepo	Mesocarp, endocarp and young seeds
Cucumber	*Cucumis sativus*	**Pepo**	Mesocarp, endocarp and young seeds
Loose skinned orange	*Citrus reticulata*	Hesperidium	Placental glandular hair along with endocarp
Pomegranate	*Punica granatum*	Balausta	**Succulent testa**

FRUITS

II. Aggregate Fruits			
Strawberry	*Fragaria vesica*	Etaerio of achenes	Fleshy thalamus and seeds
Custard apple	*Annona squamosa*	Etaerio of berries	Inner layer of pericarp and thalamus
III. Multiple or Composite Fruits			
Mulberry	*Morus alba* and *M.nigra*	**Sorosis**	Succulent perianth and fleshy axis
Pineapple	*Ananas comosus*	**Sorosis**	Fleshy axis, bracts, fused perianth and pericarp
Jack fruit	*Artocarpus heterophyllus*	Sorosis	Fleshy axis, bracts, perianth and seeds
Fig	*Ficus carica*	**Syconus**	**Fleshy receptacle or thalamus**

SEED

A seed is defined as "a **fertilized** and metamorphosed **ovule** containing an **embryo** enclosed in. resistant protective **coats**."

Seed is also described as the initial, dormant stage of the diploid **sporophytic generation** in the life cycle of **Spermatophytes** or **Phanerogams**

STRUCTURE OF A DICOTYLEDONOUS SEED

- Covering : **outer** thick and resistant layer is called **testa**
  inner thin and membranous layer called **tegmen.**
- A seed is attached to the inner wall of fruit by a small **stalk** called **funicle,** at a **point** called **hilum**
- A small **pore** is present close to the hilum in the testa, called the **micropyle.**
- A **ridge** may be seen in continuation with the hilum on testa, which is called **raphe.**
- Enclosed within the seed coat, there is an embryo consisting of **embryo - axis (tigellum)** and two **cotyledons**
- The contents enclosed within the seed coat are together called **kernel.**
- The **embryo axis** consists of two ends - the **radicle** and the **plumule.**

SEED

STRUCTURE OF A DICOTYLEDONOUS SEED

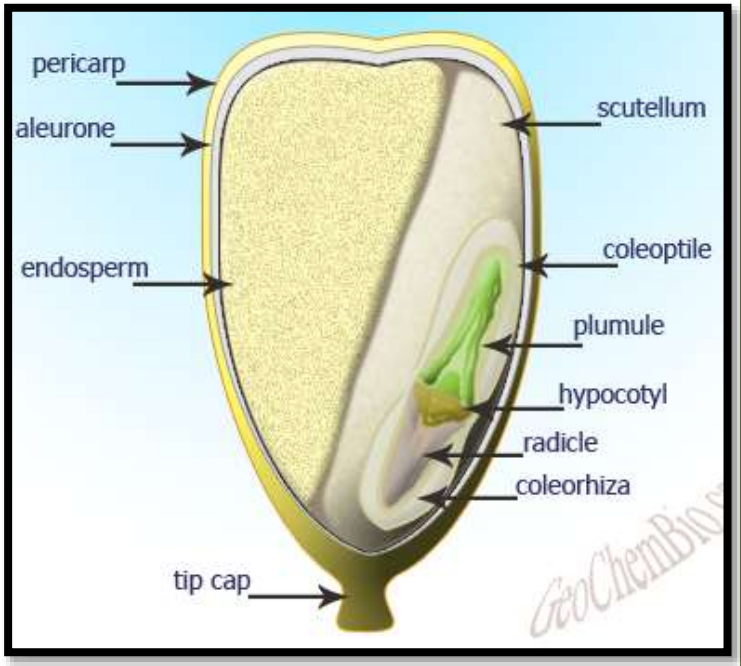
- The cotyledons are attached to the embryo axis at the region, which represents first node of embryo.
- The part of embryo axis between radicle and first node is called **hypocotyl** while the part between plumule and cotyledons is called **epicotyl.**

Most of the dicotyledonous seeds are called **exalbuminous** or **non-endospermic** because they **lack** the **endosperm** at maturity. In such cases, entire endosperm is consumed during its development.
A few dicotyledonous seeds like *castor*, possess endosperm and are called **albuminous** or **endospermic seeds.**
In **albuminous** seeds, cotyledons are thin and **papery** while in ex-albuminous seeds, the cotyledons are thick and **fleshy** as they store necessary reserve food material.

SEED

STRUCTURE OF A MONOCOTYLEDONOUS SEED

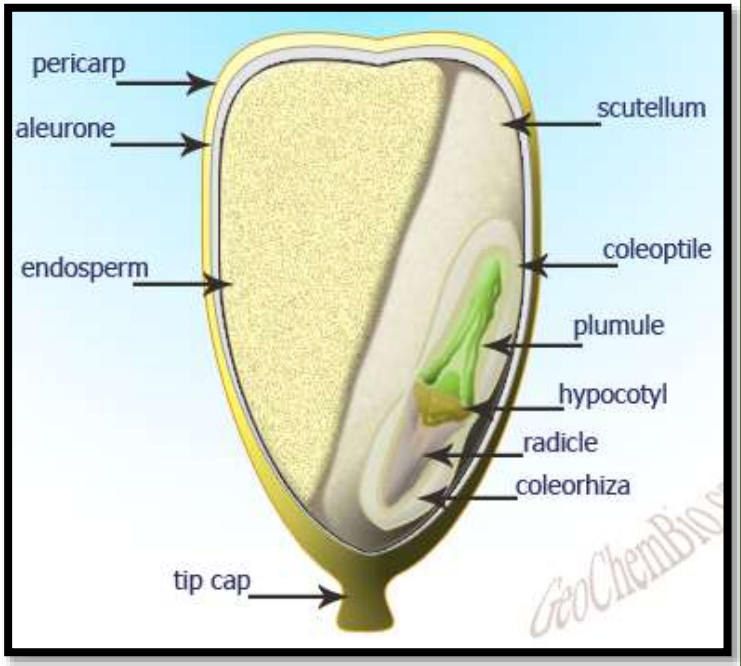
- A *maize* grain represents a single-seeded fruit in which the **seed coat** and the **fruit wall** are **inseparable**.
- On one side of the grain a small, opaque, whitish, area is seen. Embryo lies embedded in this area. A thin layer lying around the grain is formed by **fusion** of seed-coat and the fruit wall which is called **hull**.
- The grain is divided into two **unequal** portions by a definite layer known as the **epithelium**.
- The bigger portion is the **endosperm**, and the smaller portion, the **embryo**.
- The endosperm is **food storage** tissue.



SEED

STRUCTURE OF A MONOCOTYLEDONOUS SEED

- The **embryo** consists of a single shield-shaped **cotyledon** (known as the **scutellum)** and the **axis**.
- The upper portion of the axis is the plumule and the lower portion is the radicle. The plumule is surrounded by a protective sheath called **coleoptile** and the radicle is surrounded by another sheath called **coleorhiza.**



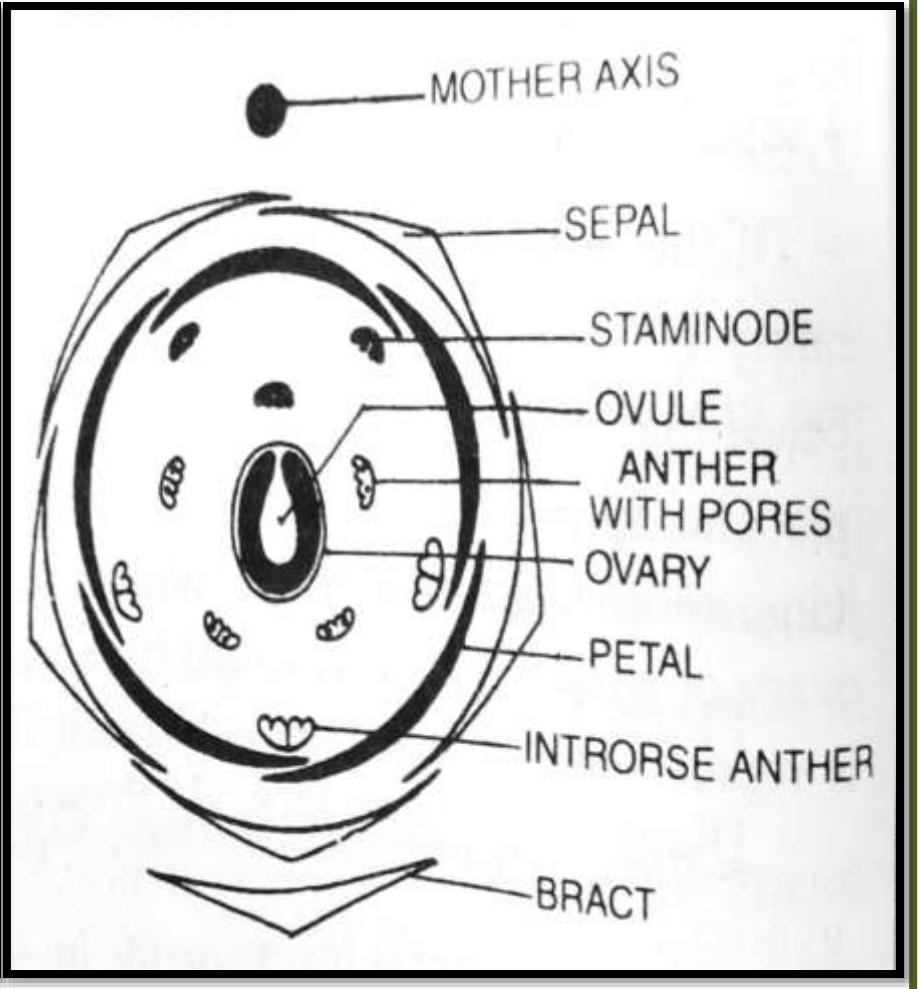
FLORAL FORMULA & FLORAL DIAGRAM

- Various morphological features are used to describe a flowering plant.
- The description has to be brief, in a simple and scientific language and presented in a proper sequence.
- The plant is described beginning with its habit, vegetative characters - roots, stem and leaves and then floral characters inflorescence and flower parts.

- After describing various parts of plant, a floral diagram and a floral formula are presented.
- The **floral formula** is represented by some symbols.
- A **floral diagram** provides information about the number of parts of a flower, their arrangement and the relation they have with one another

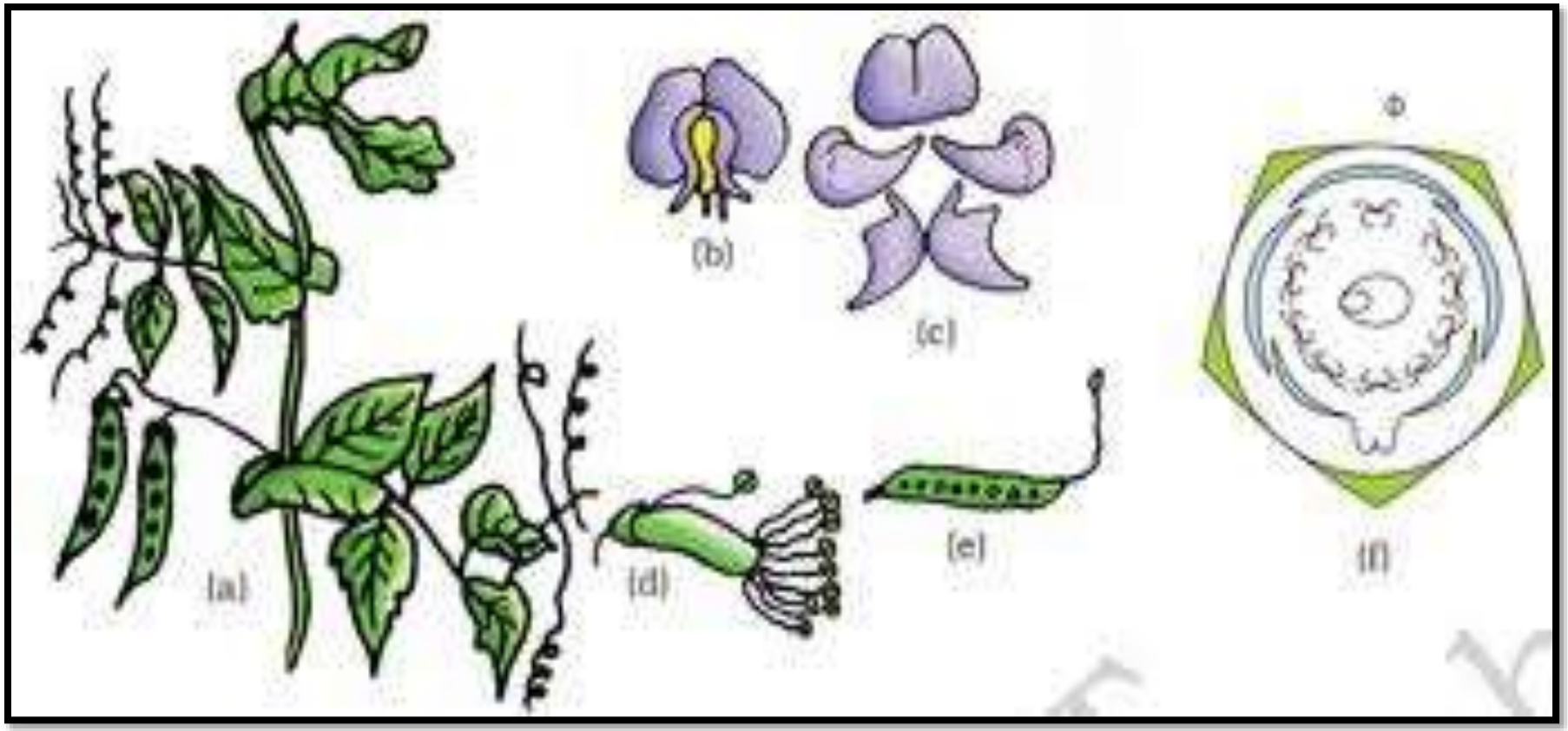
FLORAL FORMULA & FLORAL DIAGRAM

Br	Bracteate
K	Calyx
C	Corolla
P	Perianth
A	Androecium
G	Gynoecium
$\underline{G}$	Superior ovary
$\overline{G}$	Inferior ovary
♂	Male
♀	Female
☿	Bisexual
⊕	Actinomorphic
%	Zygomorphic
Enclosing figure within brackets	Fusion
Line drawn over symbols of floral parts	Adhesion



FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : FABACEAE



FLORAL FORMULA & FLORAL DIAGRAM

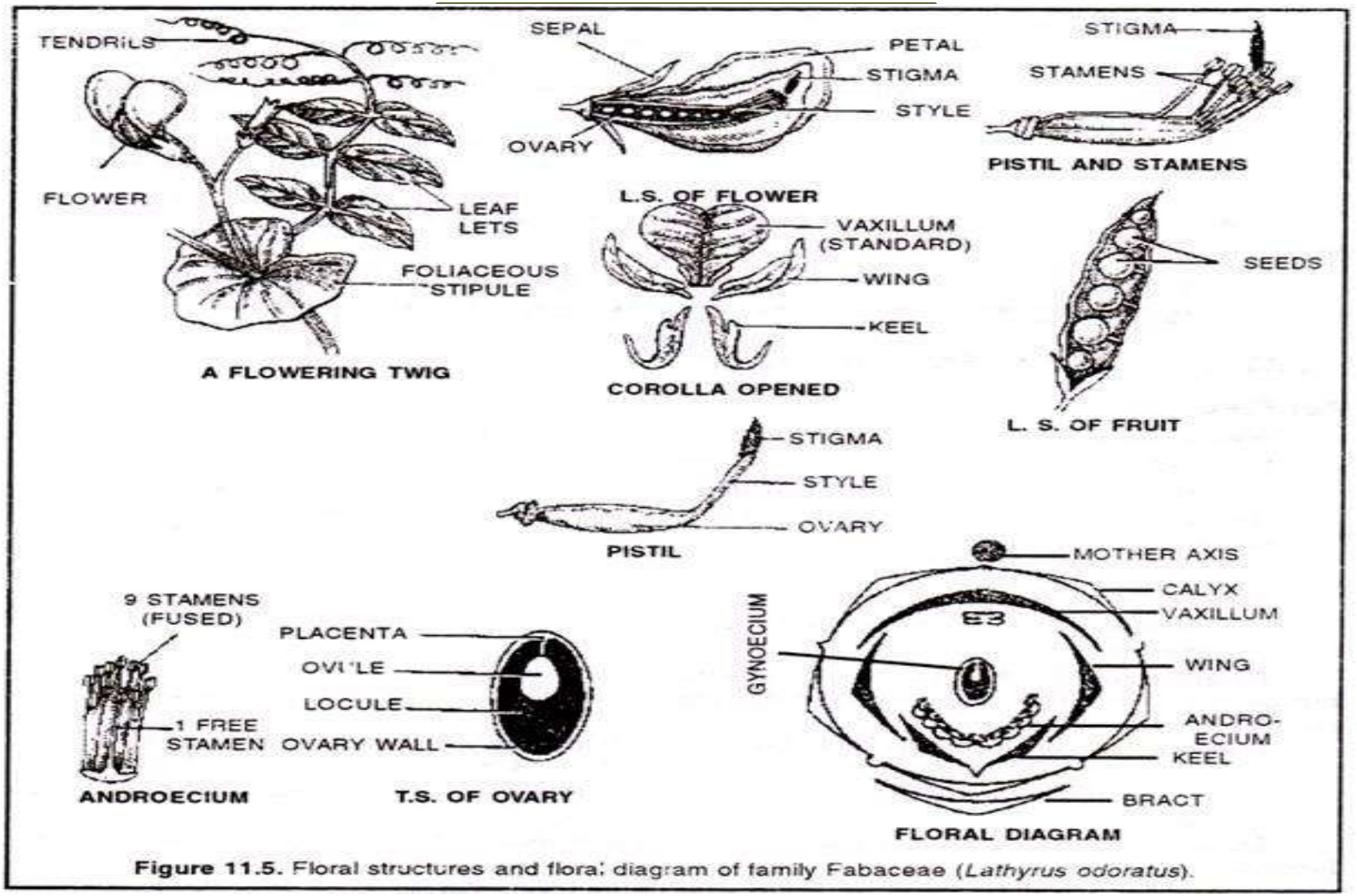


Figure 11.5. Floral structures and floral diagram of family Fabaceae (*Lathyrus odoratus*).

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : FABACEAE

Vegetative Characters :

Trees, shrubs, herbs; root with root nodules

Stem : erect or climber

Leaves : alternate, pinnately compound or simple; leaf base, pulvinate; stipulate; reticulate venation

Floral characters :

Inflorescence: racemose

$\%\ ♀^{♂}\ K_{(5)}C_{1+2+(2)},\ A_{(9)+1}\ \underline{G}_1$

Flower : bisexual, zygomorphic

Calyx : sepals five, gamosepalous; imbricate aestivation

Corolla : petals five, polypetalous, papilionaceous, consisting of a posterior standard, two lateral wings, two anterior ones forming a keel (enclosing stamens and pistil), vexillary aestivation

Androecium : ten, diadelphous, anther dithecous

Gynoecium : ovary superior, mono carpellary, unilocular with many ovules, style single

Fruit : legume; seed: one to many, non-endospermic

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : FABACEAE

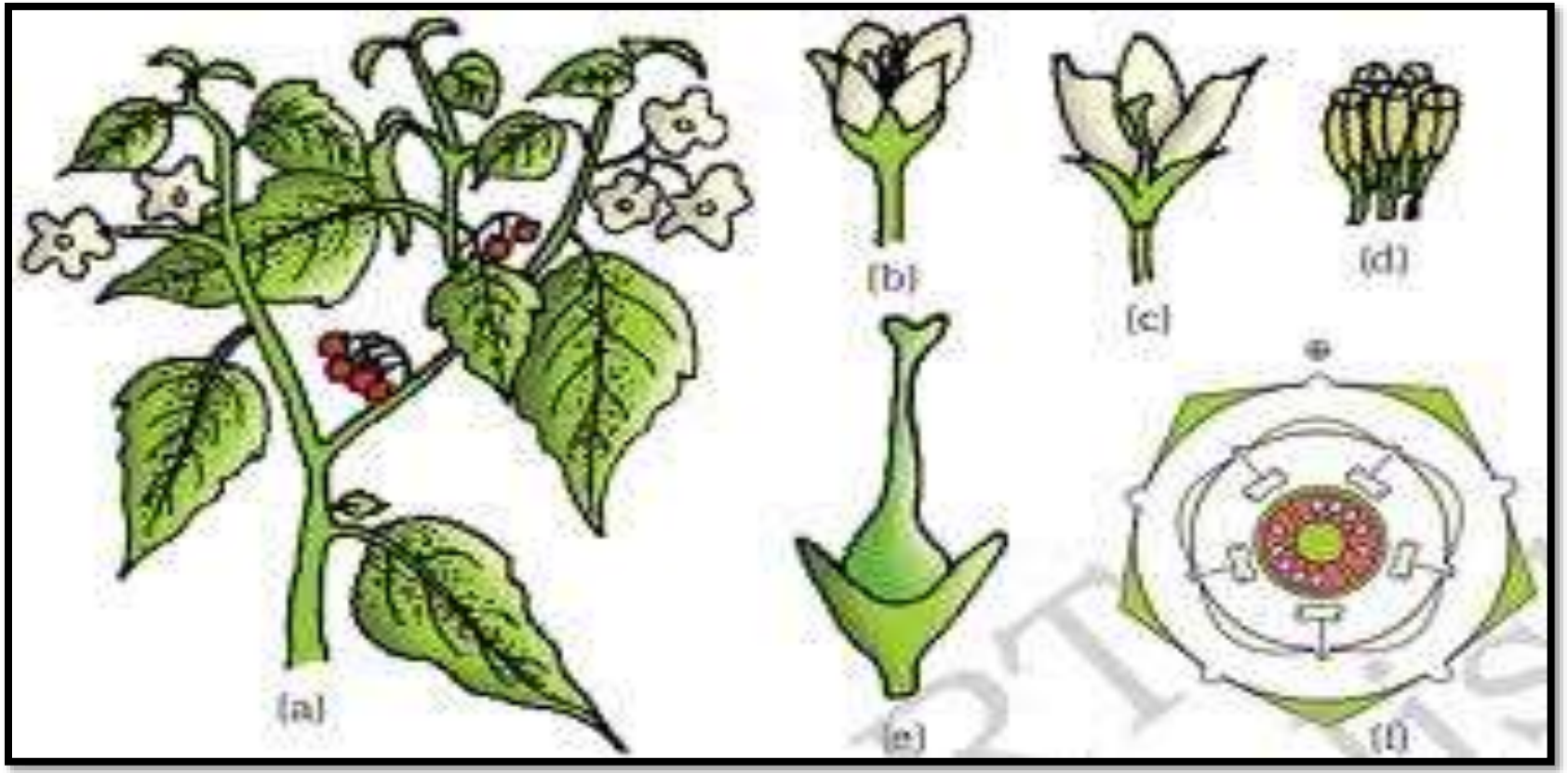
Economic importance :

Many plants belonging to the family are

- sources of pulses (gram, *arhar,* sem, *moong,* soyabean)
- edible oil (soyabean, groundnut);
- dye (Indigofera);
- fibres (sunhemp);
- fodder *(Sesbania, Trifolium)*
- ornamentals (lupin, sweet pea)
- medicine *[muliathi).*

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : SOLANACEAE



FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : SOLANACEAE

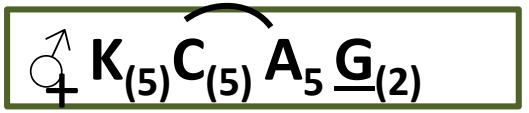
Vegetative Characters :

Plants mostly herbs, shrubs and rarely small trees

Stem : herbaceous rarely woody, aerial; erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato *(Solanum tuberosum)*

Leaves: alternate, simple, rarely pinnately compound, exstipulate; venation reticulate

Floral Characters :



Inflorescence : Solitary, axillary or cymose as in *Solarium*

Flower : bisexual, actinomorphic

Calyx : sepals five, united, persistent, valvate aestivation.

Corolla : petals five, united; valvate aestivation

Androecium : stamens five, epipetalous

Gynoecium : bicarpellary, syncarpous; ovary superior, bilocular, placenta swollen with many ovules

Fruits : berry or capsule

Seeds : many, endospermous

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : SOLANACEAE

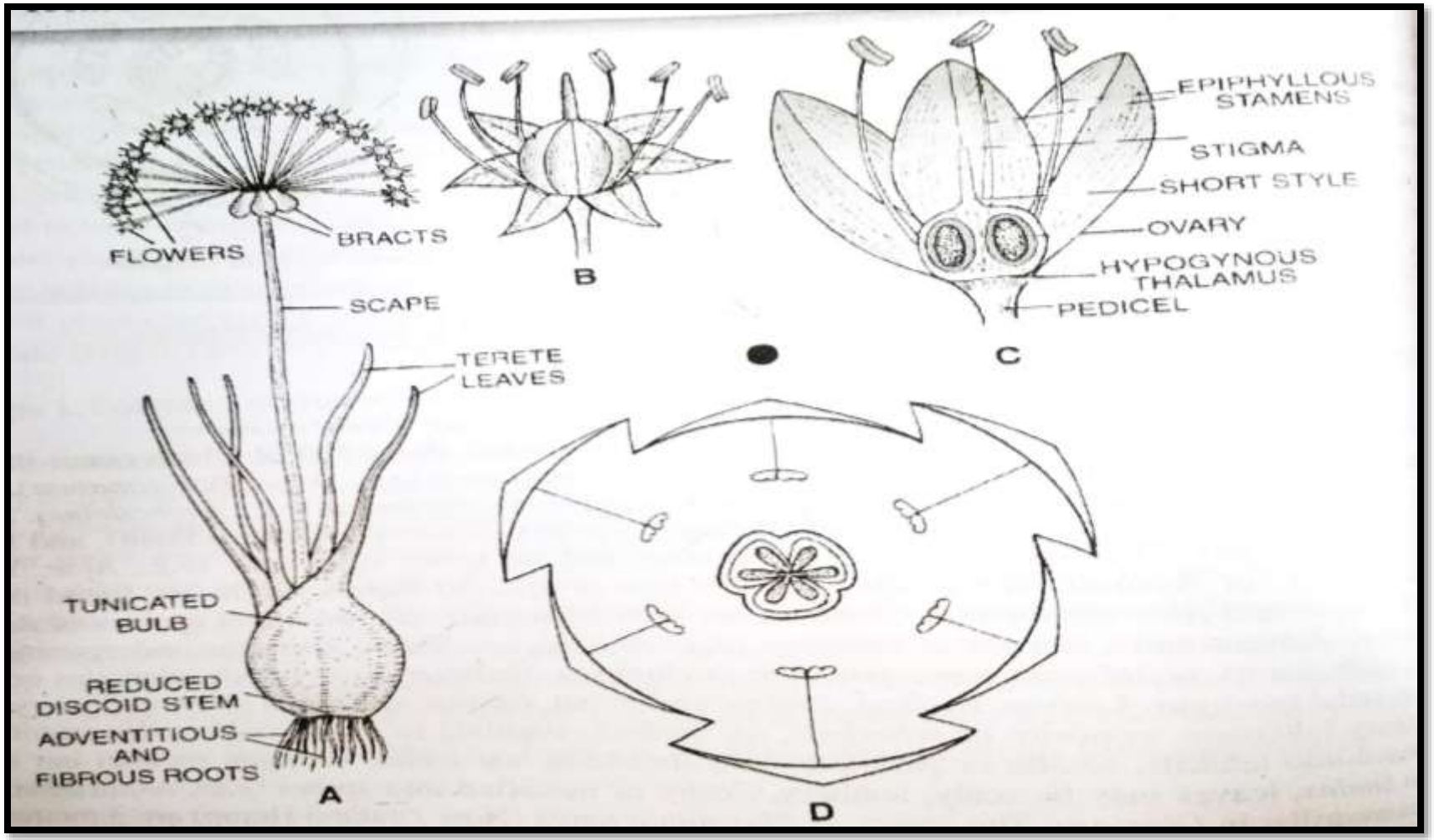
Economic importance :

Many plants belonging to this family are

- source of food (tomato, brinjal, potato),
- spice (chilli);
- medicine (belladonna, *ashwagandha)*
- fumigatory (tobacco);
- ornamentals (petunia)

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : LILIACEAE



FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : LILIACEAE

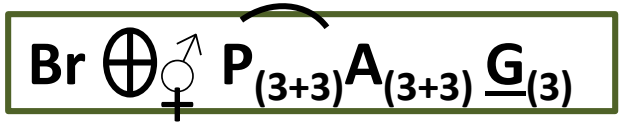
Vegetative Characters :

Perennial herbs with

Stem : underground bulbs/corms/ rhizomes

Leaves: mostly basal, alternate, linear, exstipulate with parallel venation

Floral Characters :



Inflorescence : solitary /cymose; often umbellate clusters

Flower : bisexual, actinomorphic

Perianth : tepal six (3+3), often united into tube; valvate aestivation

Androecium : stamen six, (3+3)

Gynoecium : tricarpellary, syncarpous, ovary superior, trilocular with many ovules; axile placentation

Fruits : capsule rarely berry

Seeds : endospermous

FLORAL FORMULA & FLORAL DIAGRAM

FAMILY : LILIACEAE

Economic importance :

Many plants belonging to this family are

- good ornamentals (tulip, *Gloriosa),*
- source of medicine *(Aloe),*
- vegetables *[Asparagus],* and
- colchicine *[Colchicum autumnale].(medicine that treats Gout)*