Flower

- The flower is a **modified shoot.**
- A typical flower has four different kinds of whorls arranged successively on the swollen end of the stalk or pedicel, called **thalamus or receptacle**.

- **Unisexual flower** - with only one reproductive organ either stamens or carpels
- **Bisexual or hermaphrodite flower -** both these organs
- **Monoecious -** both male and female flowers are on same plant - **cucurbits**
- **Dioecious - male and female flowers on different plants as in papaya and mulberry.**

Symmetry :

Actinomorphic (radial symmetry)

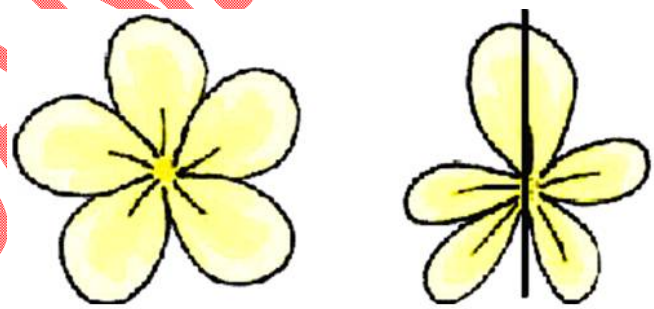
- When a flower can be divided into two equal radial halves in any radial or vertical plane passing through the centre,
- **Mustard Datura Chilli**

Zygomorphic (bilateral)

- When it can be divided into two similar halves only in one particular vertical plane,
- **Pea Gulmohur Bean Cassia**

Asymmetric (irregular):

- A flower asymmetric is if it cannot be divided into two similar halves by any vertical plane passing through the centre
- **Canna**



Actinomorphic Zygomorphic

- A flower is **isomerous,** when each whorl has equal number of parts or its multiple.
- A flower may be **trimerous, tetramerous or pentamerous** when the floral appendages are in multiple of 3, 4 or 5, respectively according to the number of parts in each whorl.
- Opposite to isomerous is **heteromerous.**

Position of ovary :

Based on the position of calyx, corolla and androecium in respect of the ovary on thalamus, the flowers are described as;

Hypogynous :

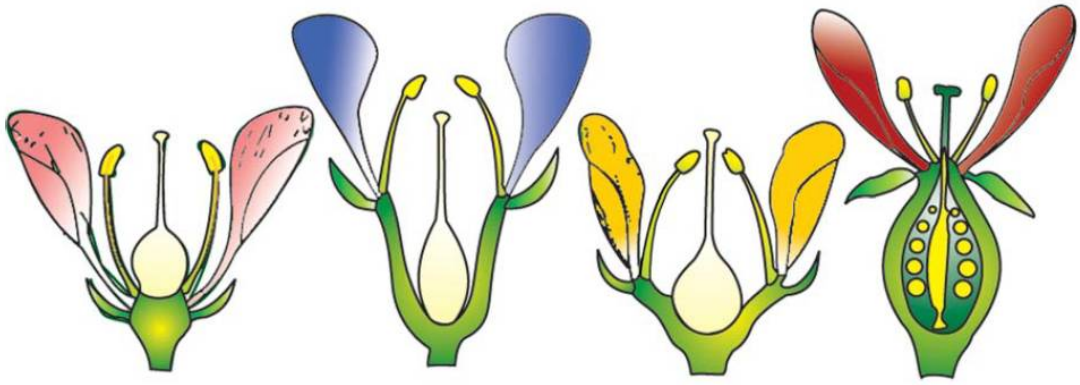
- In the hypogynous flower the thalamus is conical and gynoecium occupies the highest position while the other parts are situated below it.
- The ovary in such flowers is said to be **superior**
- **Mustard China rose Brinjal**

Perigynous :

- In the perigynous flower, the thalamus is disc like on which the carpels are borne in the centre and the rest of the floral whorls are located on the rim of the thalamus.
- The ovary here is said to be **half-inferior**
- **Rose Peach Plum**

Epigynous :

- In epigynous flowers, the margin of thalamus grows upward enclosing the ovary completely and getting fused with it.
- The other parts of flower arise above the ovary.
- The ovary is said to be **inferior**
- **Guava Cucumber Ray florets of sunflower**
- **Coriander**



Bract :

- **Special type of leaf** present **at the base of the flower**
- Specialized leaf from the axil of which flowers arise
- Flowers with bracts are called **bracteate**
- Flowers without bracts **ebracteate -**

The bract may be of following types :

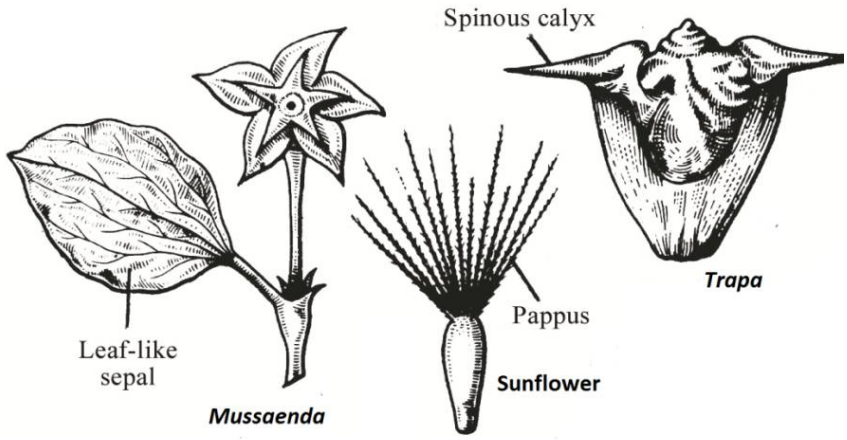
- **Petaloid bract** – **Bougainvillea Euphorbia**
- **Scaly** - **Sunflower** (at base of florets)
- **Involucre bract** - **Sunflower Coriander Umbelliferae**
- **Spathy bract** - **Banana Maize Palms**
- **Glumes** (small dry scales) - **Wheat**
- **Epicalyx** (calyx like green) – **Malvaceae**

Calyx : (Whorl of sepals)

- It is outermost whorl of the flower .
- They are green, leaf like and protect the flower in the bud stage.
- **Gamosepalous** - sepals united
- **Polysepalous** - sepals free

Modification of Sepals :

- **Spines – Trapa**
- **Pappus** (sepals are modified into hairy structure) - **Sunflower**
- **Leafy - Mussaenda**
- **Persistent accrescent – Tomato Brinjal Guava**



Different forms of Calyx

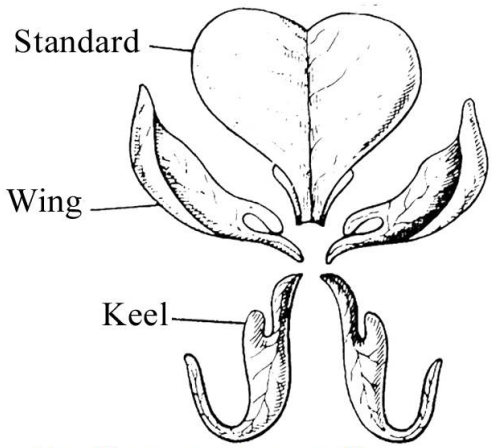
Corolla : (Whorl of petals)

- Petals are the individual units of the corolla and occur inner to sepals.
- Petals are usually brightly coloured to attract insects for pollination.
- **Gamopetalous : Asteraceae Solanaceae**
- **Polypetalous :** : **Mustard**

Types of corolla :

- **Cruciform -** four petals arranged cross wise , each petal is clawed - **Mustard**
- **Infundibuliform / Funnel shaped - Datura**
- **Tubular - Disc florets of sunflower**

- **Bell shaped**
- **Wheel shaped**
- **Papilionaceous or butterfly shaped** -
    - Composed of five petals of which one posterior is largest and is known as **standard or vexillum**
    - Two lateral ones partially covered by standard are known as **wings or alae**
    - Two innermost anterior smaller are united to form a boat shaped structure called **keel or carina**
    - **Pea Gram**



Papilionaceous corolla

Aestivation :

The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation.

The main types of aestivation are :

Valvate

- Sepals or petals in a whorl just touch one another at the margin, without overlappings
- **Calotropis Solanaceae Lilaceae**

Twisted

- When one margin of the appendage overlaps that of the next one and so on a
- **China rose Lady's finger Cotton**

Imbricate

- When the margins of sepals or petals overlap one another but not in any particular direction.
- In **Ascending imbricate** the posterior petal is innermost i.e., its both margins are overlapped. - **Cassia Gulmohur Fabaceae**

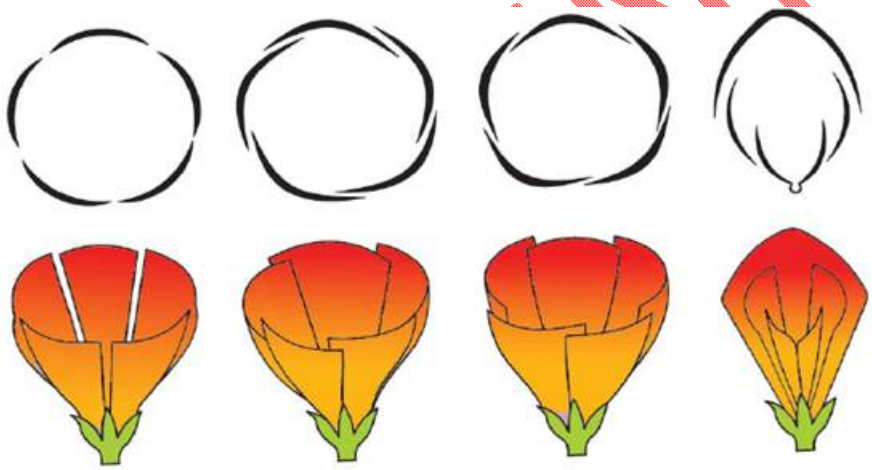
- In **Vexillary (Descending imbricate)** -there are five petals, the largest (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel)

Quincuncial

- It is a modification of imbricate type.
- Out of the five petals, two are completely internal, two completely external and in the remaining petal, one margin is internal and the other margin is external.
- **Cucurbitaceae**

Vexillary / Papilionaceous

Papilionaceae - Pea Bean



Perianth :

- When there is no distinction between calyx and corolla the whorl is described as **perianth.**
- Individual perianth segments are called **tepals.**
- Green tepals are called sepaloid and coloured tepals are called petaloid.
- Tepals are free (polytepalous) or fused (gamotepalous).
- **Lily** (**Liliaceae**)

Androecium :

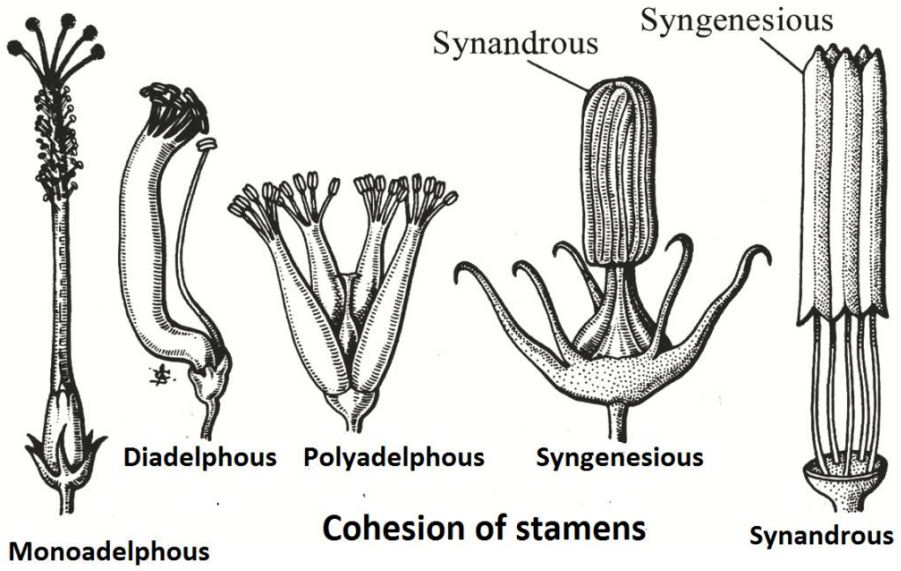
- **Whorl of stamens** or **microsporophylls**
- Androecium is the male reproductive organ and comprises stamens.
- Each stamen consists of three parts, a filament (stalk), connective, and anther.
- In some flowers - **Salvia** some stamens are without pollen grains and remain sterile throughout. These are called **staminodes.**

- The stamens - **free (polyandrous)** – **Mustard Radish.**

Cohesion of Stamens :

When the floral parts of similar whorl are fused, then it is called cohesion.

- **Adelphous -** When stamens are united by their filament only, it is called adelphous. It is of following types:
    - **Monoadelphous -** When all the filaments are united into a single bundle but anthers are free from each other. **China rose**
    - **Diadelphous –** When the filaments are united in two bundles but the anther remains free **Pea**
    - **Polyadelphous –** When filaments are united into more than two bundles **Citrus**
- **Syngenesious –** Only anthers are united in bundle but filaments remain free **Compositae**
- **Synandrous –** When anthers as well as filaments of stamens are united through out their entire length. **Cucurbitaceae**

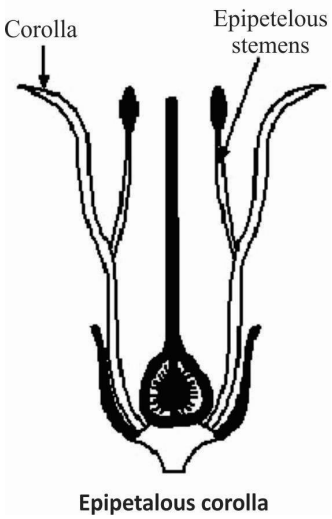


Adhesion of Stamens :

When the stamens are attached to other parts of flower, then it is called adhesion of stamens.

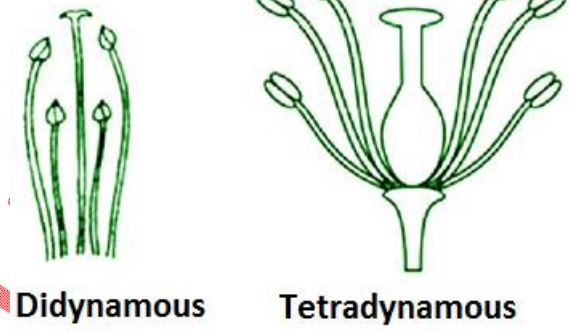
- **Epipetalous -** When stamens are attached to petals. **Brinjal** **Malvaceae**
- **Epiphyllous -** When stamens are attached to tepals. **Lily** **Onion**

- **Gynandrous -** When stamens are attached to gynonecium either throughout their entire length or by their anther. **Form Gynostegium** **Calotropis**



There may be a variation in the length of stamens.

- **Didynamous** - **A 2+2** - Four stamens, two short and two long- **Salvia**
- **Tetradynamous - A 2+4-** Six stamens, inner four long ,outer two short - **Mustard**



Gynoecium :

- Whorl of carpel or pistils or megasporophylls
- Gynoecium is the female reproductive part of the flower
- **Monocarpellary - Pea**
- **Bicarpellary**
- **Tricarpellary-**
- **Tetracarpellary**
- **Pentacarpellary -**
- **Polycarpellary -**

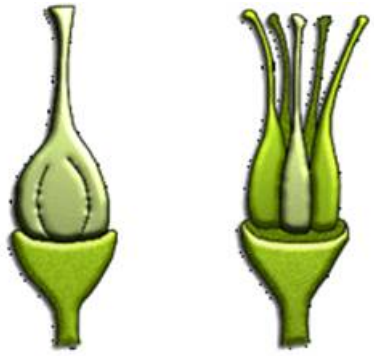
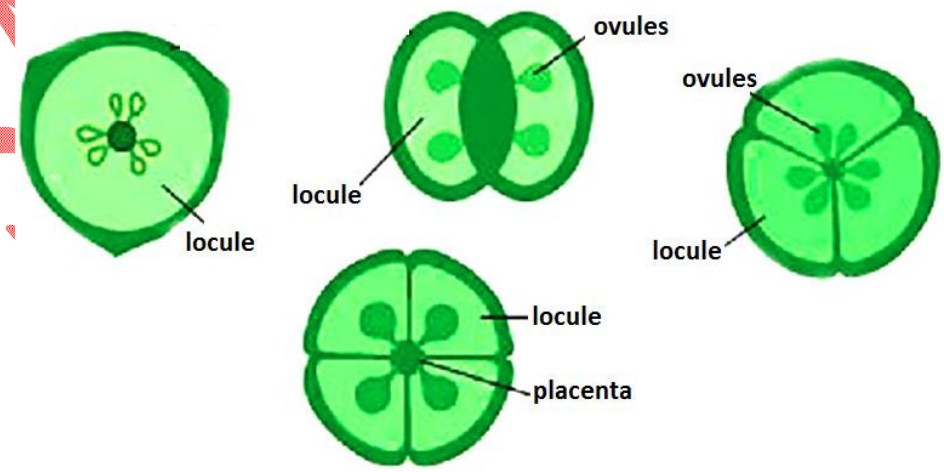


Fig. : Unicarpellary and multicarpellary ovary

Carpel :

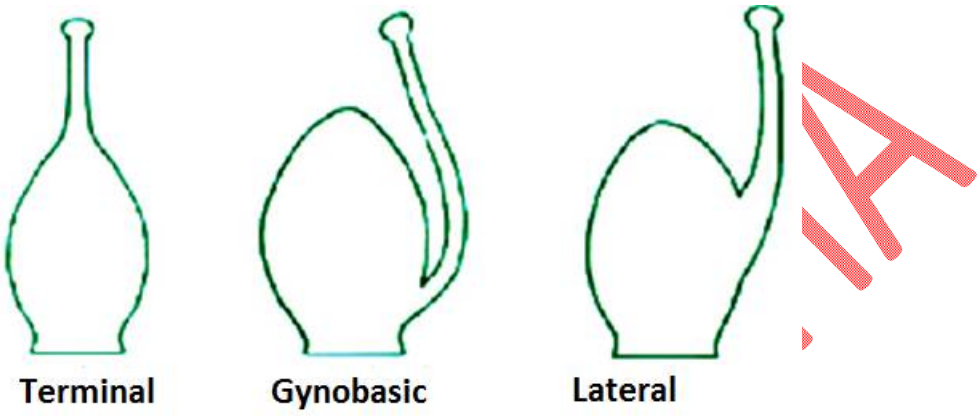
- Each carpel usually consists of an enlarged basal portion, the ovary, which contains one or more ovules and a receptive surface for pollen, the stigma.
- The ovary and stigma are connected by a more or less elongated tube, the style.
- **In polycarpellary condition, carpels may be**
  - **Free (apocarpous) - Lotus Rose**
  - **United (syncarpous) - Mustard Tomato**
- In syncarpous gynoecium,the stigma may have only one flattened disc, divided into a number of lobes.
- Generally, the number of lobes corresponds to the number of carpels in the gynoecium
- Each ovary bears one or more ovules attached to a flattened, **cushion-like placenta.**
- The apocarpous pistils usually have one chamber (locule) containing ovules, while many syncarpous pistils have ovaries partitioned into two or more chambers.
- A sterile pistil is known as **pistillode.**



T. S. of Ovary showing no of locules

The position of style may be :

- **Terminal -** arising from the tip of the ovary
- **Lateral -** arising from the side of the ovary - **Mango Strawberry**
- **Gynobasic -** arising from the depressed centre of the four-lobed ovary, or directly from the thalamus **Ocimum Salvia**



Placentation :

The arrangement of ovules within the ovary is known as placentation.

Marginal :

- Ovules are attached along the junction of two margins of the ovary wall
- Single longitudinal placenta
- The placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows
- In such cases, the ovary is one-chambered (unilocular)
- **Pea**

Axile :

- It is found in multicarpellary syncarpous gynoecium.
- The fusion margin of the carpels grows inward and meet in the centre of the ovary.
- Thus an axis forms in the centre of the ovary and ovary becomes multichambered.
- The ovules are borne at the **central axis**.
- Number of these chambers are equal to the number of carpels.
- **China rose Lemon Tomato Potato**

Parietal :

- This type of placentation is found in unilocular syncarpus ovary.
- In it the ovule develops on the innerwall of the ovary or on peripheral part.

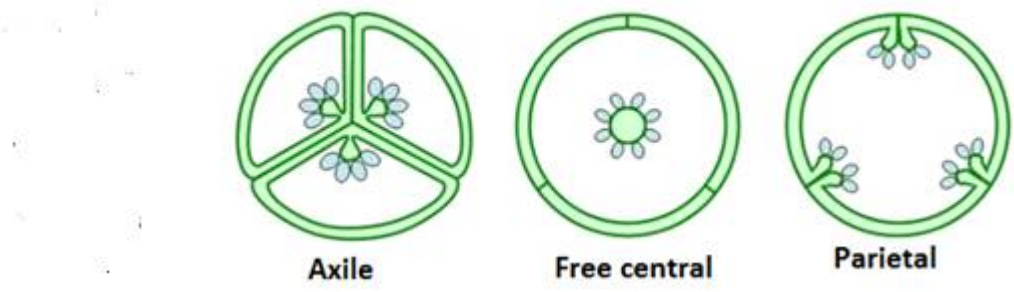
- Placenta on wall from fused margin
- Ovary becomes bi or multilocular due to the formation a false septum called **replum**
- **Argemone Mustard** **Cucurbita**

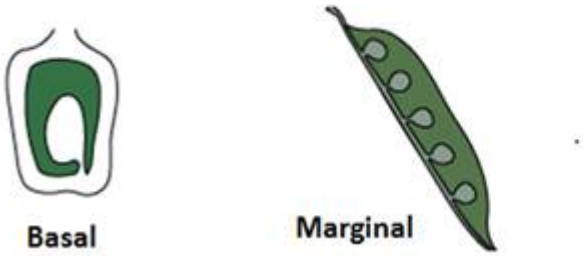
Free-central :

- This type of placentation is found in syncarpous gynoecium.
- Ovary is unilocular and the ovules are borne on the axis in the centre of the ovary.
- Septum are absent in ovary and placentation is axile in beginning.
- After sometime walls of chamber destroy and only ovulated central axis is left.
- **Primrose** **Dianthus**

Basal :

- Placenta develops at the base of the ovary and bears a single ovule
- It is most advanced type of placentation.
- **Asteraceae** (**sunflower, marigold)**





- A sterile pistil is known as **pistillode**

Inflorescence / Anthotaxy

The arrangement of flowers on the floral axis is termed as inflorescence.
The stalk bearing an inflorescence is called

- **peduncle**
- **mother axis**
- **inflorescence axis**
- **Receptacle** (flat)

The inflorescences are of various types depending on the type of branching of the peduncle.
There are two major types :

Racemose :

- The main axis does not terminate into a flower, but continues to produce flowers laterally in an acropetal order.
- Indefinite / Indeterminate growth of main axis
- Opening centripetal if flat
- **Mustard Mulberry Palms Maize Carrot wheat Sunflower**

Cymose :

- Growth of main axis is checked by a flower at the apex.
- Determinate
- Peduncle ends in flower
- Few flowers - Terminal flowers
- Basipetal manner
- Opening centrifugal if flat
- Flowers open at long intervals
- More common
- **Datura Dianthus Bougainvillea Calotropis**

Fruit

The fruit is a **mature or ripened ovary**

True fruits :

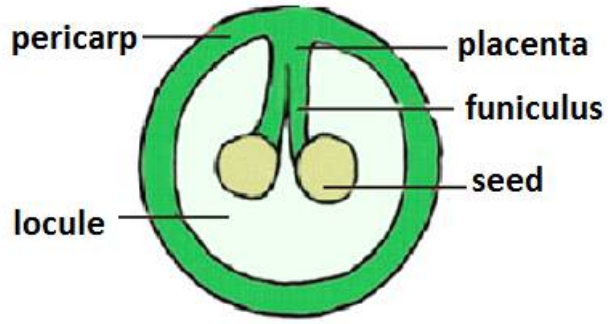
- In most of the fruits **only the ovary** takes part in the formation of fruit; such fruits are known as true fruits or **eucarp**

False fruits :

- Sometimes **along with the ovary other floral parts** form a major part of the fruit; such fruits are described as false fruits, accessory fruits , spurious fruits or pseudocarp **Apple Cashewnut Strawberry**

Parthenocarpic fruits :

- Fruit formed without fertilization is called parthenocarpic
- Such fruits are seedless.
- **Banana Orange Grapes Pineapple**



Parts of Fruits :

A fruit has two main parts, seeds and pericarp (fruit wall). Pericarp develops from the wall of the ovary.
Depending upon nature of pericarp the fruit is

Dry :

- Pericarp is dry and thin and not differentiated

Succulent :

- Pericarp is thick and fleshy and clearly differentiated into three layers- the outer **epicarp**, the middle **mesocarp** and the inner **endocarp**.

Types of Fruits :

Simple Fruits :

- A fruit that develops from a **single ovary** (either monocarpellary or polycarpellary and syncarpous) of a flower .
- **Pea Mustard Cotton wheat rice sunflower Litchi Mango Coconut Grapes Banana Papaya Apple Water melon Cucumber Lemon**

-

Aggregate fruits / etario :

- Fruits developed from a flower having a number of free (**apocarpous) carpels**, all of which ripe together and are aggregated as a unit on a common receptacle.
- Thus, each fruitlet of an aggregate fruit represents a single ovary of an apocarpous pistil.
- **Rose Lotus Raspberry Custard apple**

Multiple Or Composite Fruits :

- These fruits being complex fruits develop from the **whole inflorescence**.
- **Mulberry Jackfruit Pineapple Ficus**