AEP STUDY CIRCLE
SINCE 2001...
IIT-NEET-CBSE
ACCENTS EDUCATIONAL PROMOTERS

24 YEARS OF LEGACY

XI NEET

02 MORPHOLOGY OF FLOWERING PLANTS

ONLINE-OFFLINE LEARNING ACADEMY

YOUR GATEWAY TO EXCELLENCE IN IIT-JEE, NEET AND CBSE EXAMS

02

BIOLOGY

IIT-JEE
NEET
CBSE

MORPHOLOGY OF FLOWERING PLANTS

05 IMPORTANT PLANT FAMILIES: BRASSICACEAE, FABACEAE, SOLANACEAE, LILIACEAE

+91-9955930311

www.aepstudycircle.com

aepstudycircle@gmail.com

2ND FLOOR, SATKOUDI COMPLEX, THANA CHOWK, RAMGARH - 829122-JH

04 FRUIT AND ITS CLASSIFICATION, STRUCTURE OF DICOTYLEDONOUS AND MONOCOTYLEDONOUS SEEDS

Key Takeaways

- The fruit
  → Characteristic features
  → Classification
- The seed
  → Structure
  → Characteristic features
  → Classification
- Dicotyledonous seed
- Monocotyledonous seed

Prerequisites

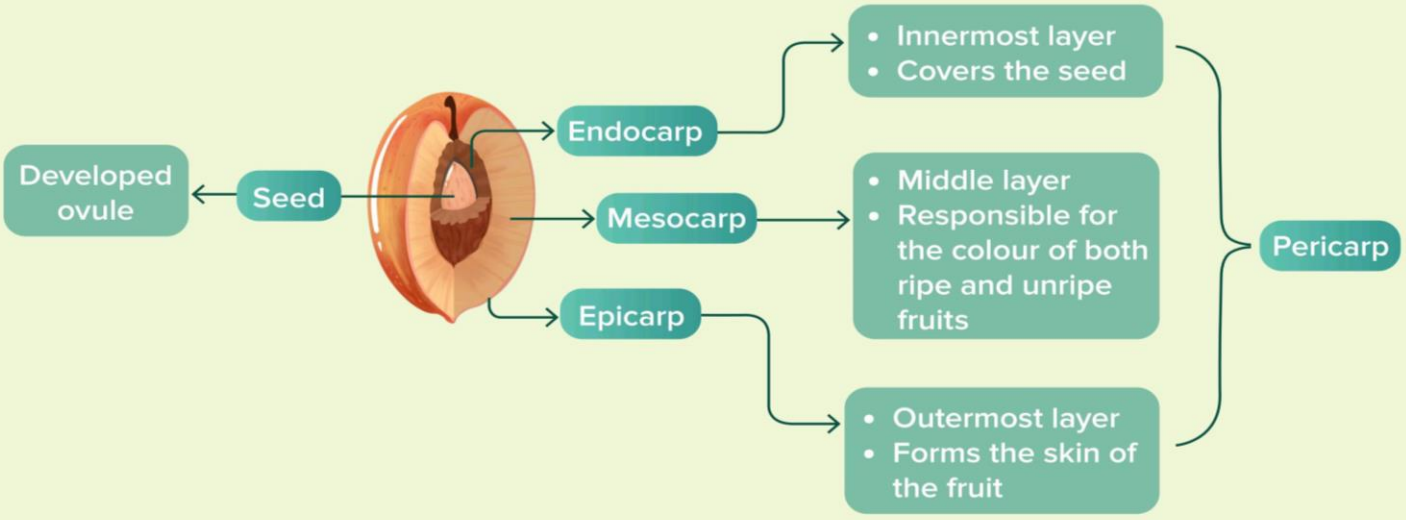
- Parts of a flowering plant
- The flower and its parts

Fruit

- A **ripened ovary** results in the formation of a **fruit**.
- **Ovules** present inside the ovary develop into seeds after the process of **fertilisation**.

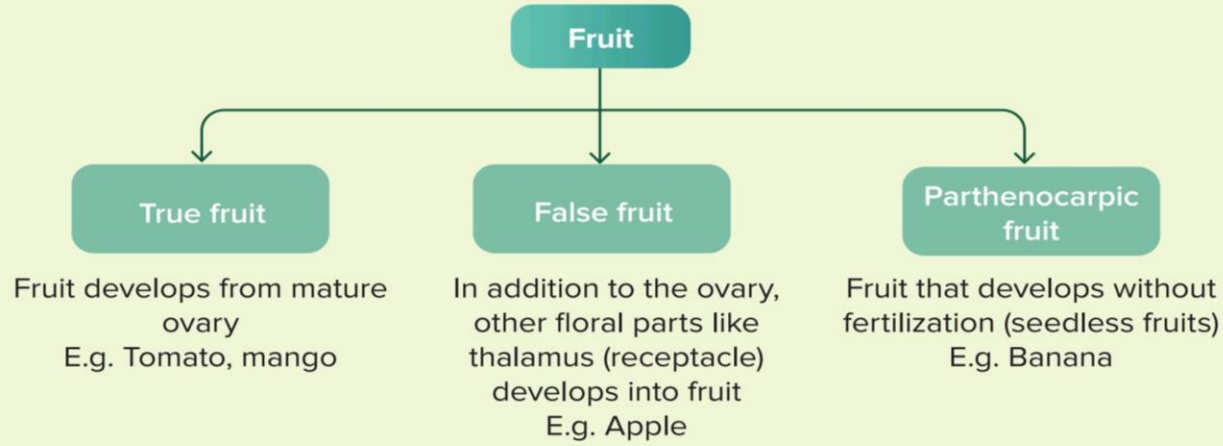
Parts of a fruit

- **Ripened ovary wall** forms the fruit wall known as the **pericarp**.
- **Pericarp** is differentiated into three layers.

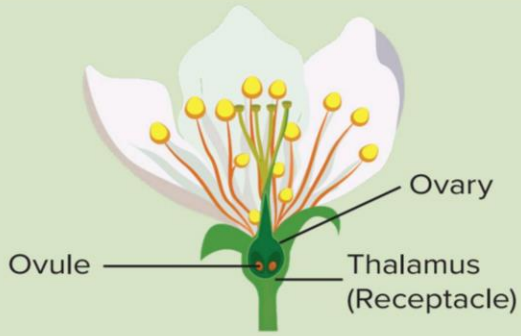


Types of fruits

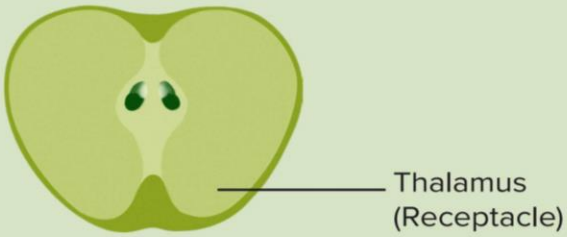
- There are three types of fruits which are as follows:



- **False fruits**
  → They develop from parts of the flower other than the ovary.
  → **Examples**: Apple and pear



Apple flower



Apple

- **In apple and pear,**
  → It is the **thalamus** and not the ovary that develops into the fruit.
  → **Ovary** develops into a **covering** of the seed.
  → **Edible part** is the **thalamus**.

Parthenocarpic fruits

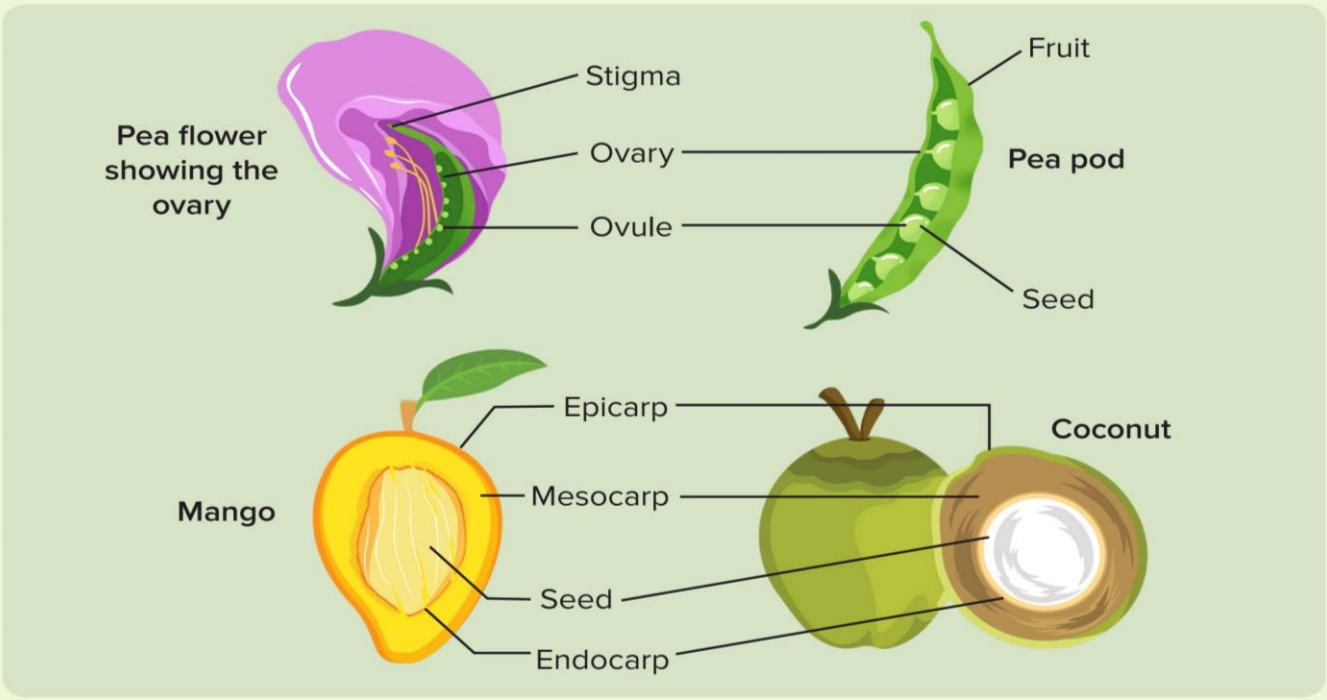
- These are the fruits that develop **without fertilisation**.
- They are either **seedless** or contain **non-viable seeds.**
- They can occur naturally or can be induced.
- **Examples**: Banana, watermelon (seedless), and grapes (seedless)

Watermelon

Note: Parthenocarpic development can also occur in plants when synthetic growth substances are applied to them in paste form, or by injecting or spraying them onto the plants

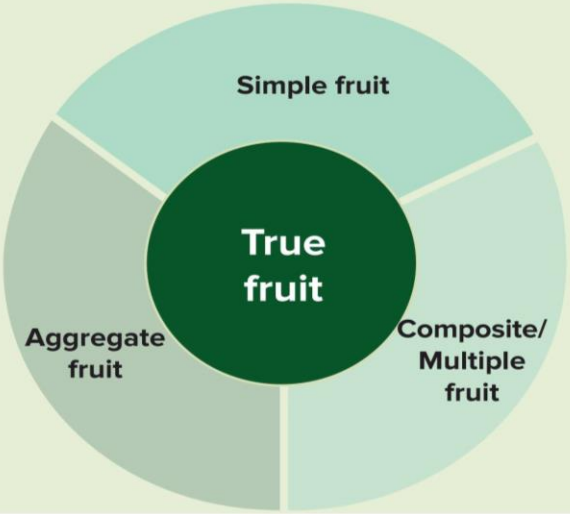
True fruits

- They develop from **mature ovaries**.
- **Examples**: Peas, mango, coconut, and grapes



- **Mango**
  → The edible part of the **mango** is the **mesocarp**.
- **Coconut**
  → In coconut, the **smooth outer layer** forms the **epicarp**.
  → The **fibrous husk** is the **mesocarp**.
  → The **hard woody layer** beneath the fibrous husk is the **endocarp**.
  → **The fleshy edible layer** inside the endocarp is the **solid endosperm**.
  → The **liquid** inside the endocarp is the **liquid endosperm** of coconut.

Classification of true fruits



Simple fruits

- A **simple fruit** is the fruit that develops from a **single ovary** of a single flower containing one or more carpels.

Simple fruit

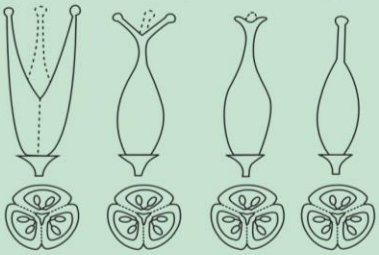
Monocarpellary ovary

A single carpel

Carpel

Multicarpellary syncarpous ovary

Multiple fused carpels of single ovary



Syncarpous (fused carpels)

TYPE 1

Develops from monocarpellary ovary - one carpel with one ovule
E.g. Apricot and mango

TYPE 2

Develops from monocarpellary ovary - one carpel with many ovules
E.g. Pea

TYPE 3

Develops from multicarpellary syncarpous ovary - many carpels fused in one flower
E.g. Orange

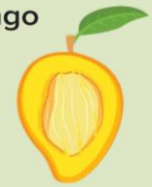
- The fusion of **ovaries** takes place initially, followed by the fusion of **styles and stigma**.

TYPE 1

Apricot

Apricot
(one carpel, one ovule/ seed)

Mango



TYPE 2

Pea

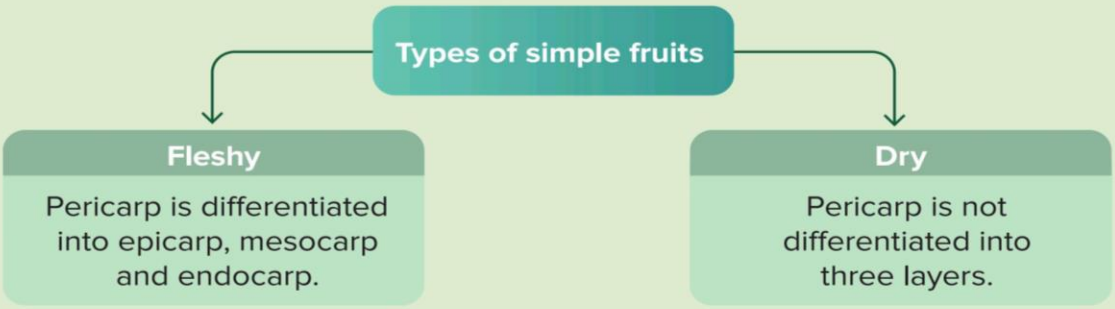
(One carpel, many ovules/seeds)

TYPE 3

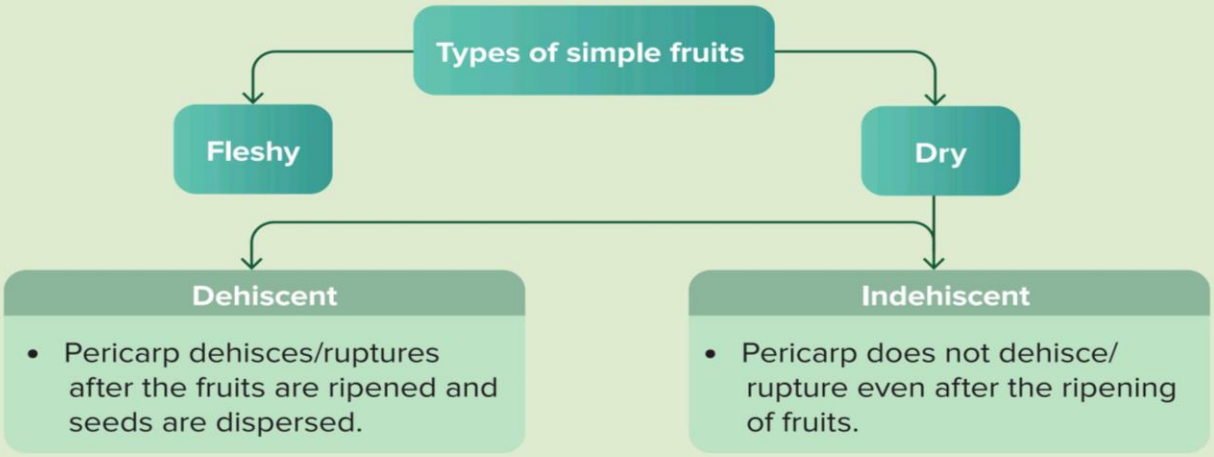
Orange

(Multiple fused carpel, many ovules/ seeds)

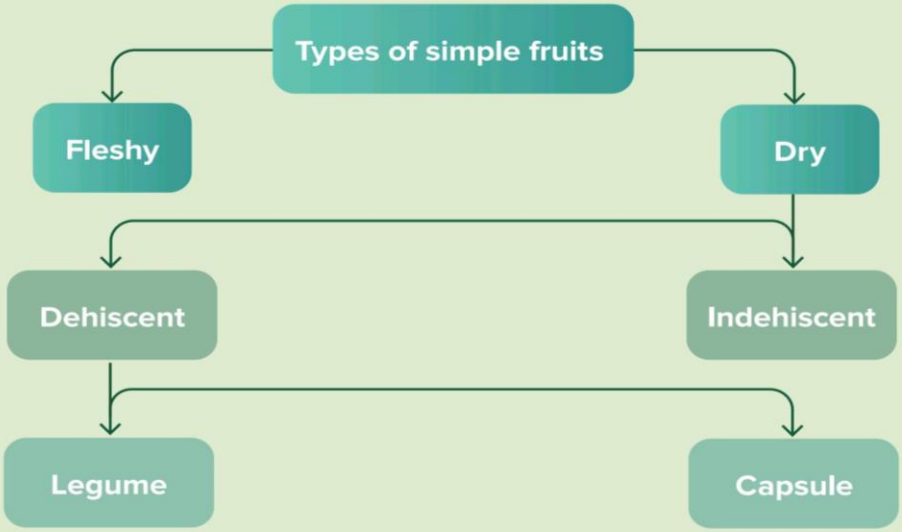
- **Another type of classification of simple fruits.**



- **Dry fruits**
  → **The dry simple fruits** are further classified based on the **dehiscence** of the pericarp and the **dispersal of seeds**.



- Depending on different circumstances (decomposition, predation, etc.) in which the seed dispersal occurs, they either become **dehiscent** or **indehiscent**.
- The dehiscent dry fruits are further classified into **legume and capsule**.



Dry dehiscent fruits

Legume
E.g. Pea

- Develops from monocarpellary superior gynoecium
- Dehiscence starts from apex/tip and reaches to basal part

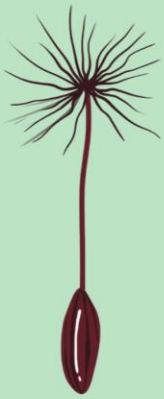
Capsule
E.g. Poppy

- Develops from bi or multicarpellary syncarpous gynoecium
- Dry, multichambered, and multi-seeded fruit which dehisces in several ways

- The **dry indehiscent fruits** are divided into various types as follows:

Dry indehiscent fruits

Cypsela



- Small one-seeded dry fruit
- Develops from bicarpellary, syncarpous, inferior ovary
- Characterised by persistent hair like **pappus calyx**
- E.g. Dandelion

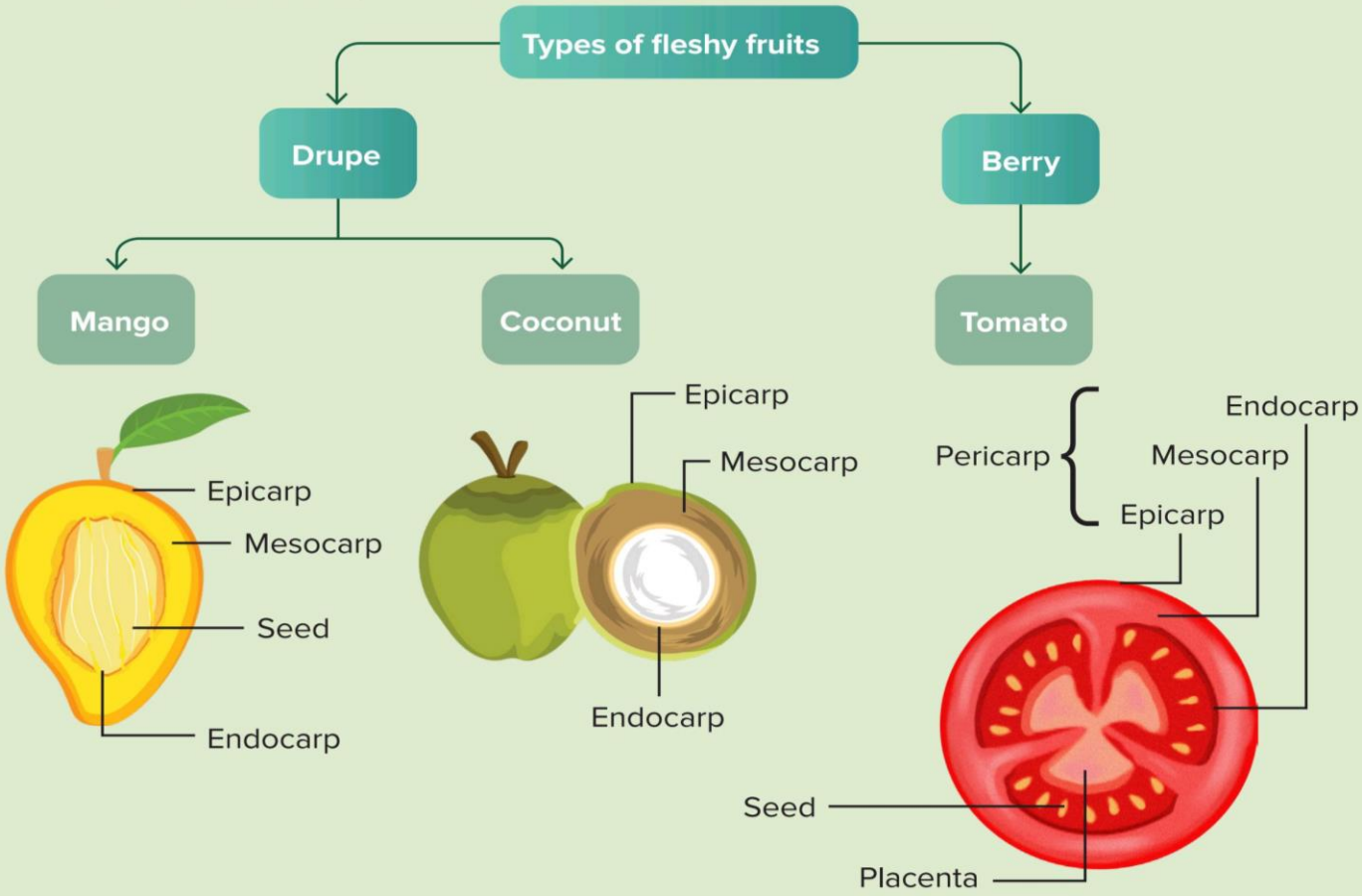
Nut

- Single-seeded fruit
- Develops from bi or multicarpellary, syncarpous, superior ovary
- Pericarp is hard
- E.g. Cashew nut, hazelnut

Caryopsis

- Single-seeded dry fruit
- Develops from monocarpellary, superior ovary
- Pericarp is fused with the seed coat
- E.g. Cereals such as wheat

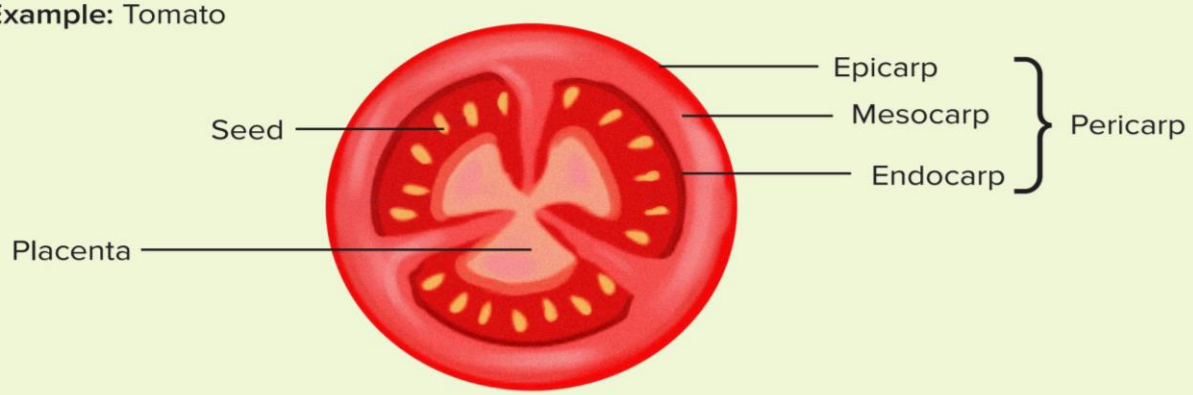
- **Fleshy fruits**
  → These can be broadly classified as follows:



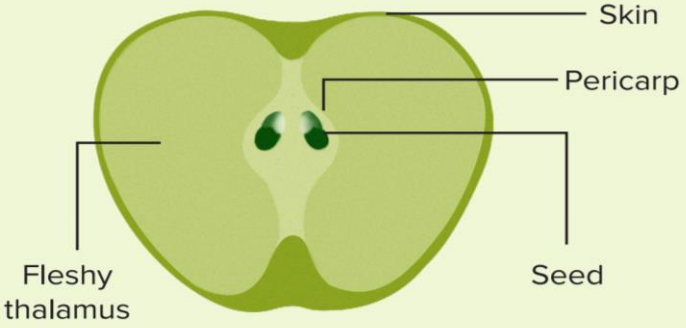
- **Drupe**:
  → **Drupe** is a fruit that develops from **monocarpellary and superior ovary**.

  → They have either **edible fleshy** or **fibrous** mesocarp.
  → They show the presence of characteristic **stony endocarps**.
  → In **mango**, the pericarp is well-differentiated into an outer thin epicarp, a middle fleshy **edible mesocarp**, and an **inner stony hard endocarp**.
  → In **coconut**, which is also a drupe, the mesocarp is **fibrous**.
  → **Drupe** is also known as **stone fruit**.

- **Berry**
  - → These are fruits that develop from **mono or multicarpellary, and syncarpous ovaries.**
  - → In berries, the ovary may be **superior** or **inferior.**
  - → They **do not show** the presence of stony endocarp.
  - → Mesocarp and endocarp are fused to form **pulp** with seeds.
  - → **Example:** Tomato



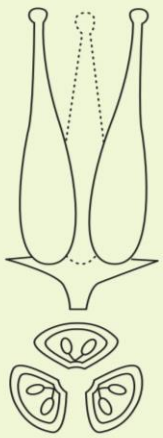
- **Pome**
  - → It is the **characteristic fruit** of the apple family.
  - → It cannot be included in the classification of true fruits. It is a **false fruit** as the **edible part** is the **thalamus** and not the ovary.



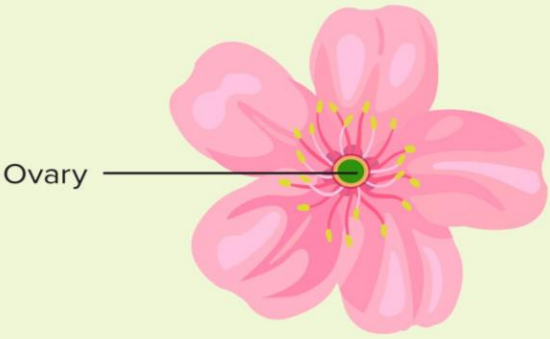
Aggregate fruits

- They develop from **apocarpous** (having distinct carpels) **ovaries**.
- They are formed from multiple **free ovaries** of a **single flower.**
- They show the presence of multiple **unfused carpels**.
- **Example:** Raspberry

Apocarpous



Multiple unfused carpels

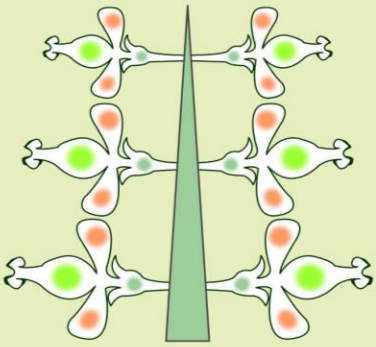


Raspberry flower

Raspberry fruit

Composite/Multiple fruits

- They develop from an entire **inflorescence** (an arrangement of flowers), rather than from a single flower. Here, a cluster of **fruiting flowers** produces a cluster of **fruiting bodies**.
- **Ovaries** of many flowers combine together to form the **fruit**.
- They do **not fuse** with each other.
- **Example**: Pineapple



Multiple fruit

Pineapple inflorescence

Pineapple fruit

Did you know?

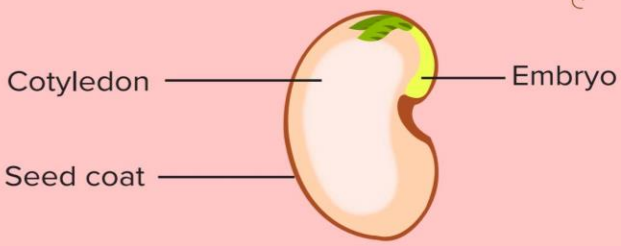
- Fruit salad trees are multi-grafted trees with different fruits from the same family, grafted together on the same tree.
- All the fruits on the tree retain their own characteristics like flavour, appearance, and ripening times.
- They can be grown in a pot or in the ground.
- They are suitable for all climates.

Seeds

- A **seed** develops from a **fertilised ovule**.
- It is found inside the **fruit**.
- It contains the **embryonic plant** that further develops into a **new plant**.

Parts of a seed

- **Seed coat** protects the seed.
- **Cotyledon** stores **food** to nourish the growing embryo.
- The **embryo** grows into a plant.



Cotyledon

- They are the **embryonic seed leaves.**
- The main function of cotyledon can be attributed to **storage of food** for the growing embryo.
- After seed germination, the cotyledons emerge from the seed, expand and become green.

Endosperm

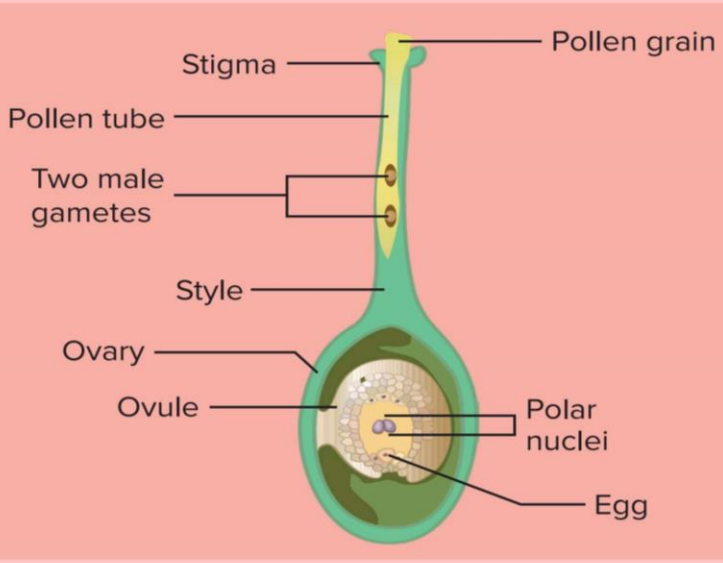
- They are the **nutritive tissues** for the embryo, stored in the seed.
- **Endosperms** are formed by the **fusion** of one **male gamete** with two **polar nuclei.**

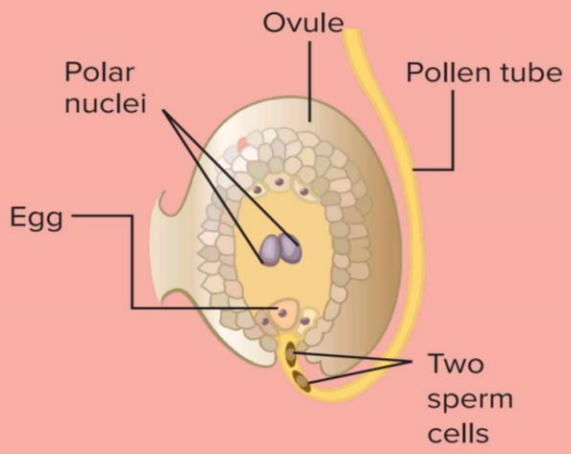
Steps involved in the endosperm formation:

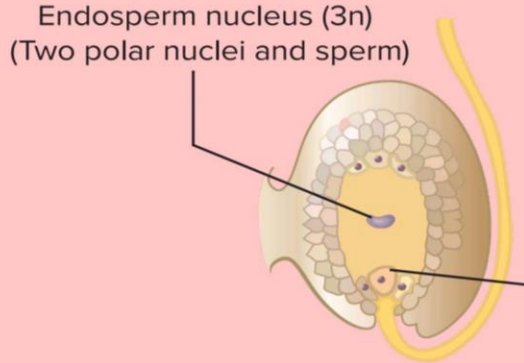
Step 1: During **pollination**, the pollen that is transferred from anther to the stigma, enters the ovary.

Step 2:
- The pollen grain contains **two sperm cells.**
- The **ovule** contains **one egg cell** and **two polar nuclei**.
- One **sperm cell** fuses with the **egg cell** and the other **sperm cell** fuses with the **polar nuclei** to form the **endosperm.**

Step 3: Based on the presence or absence of endosperm, seeds can be classified into **endospermic** or **non-endospermic seeds**.



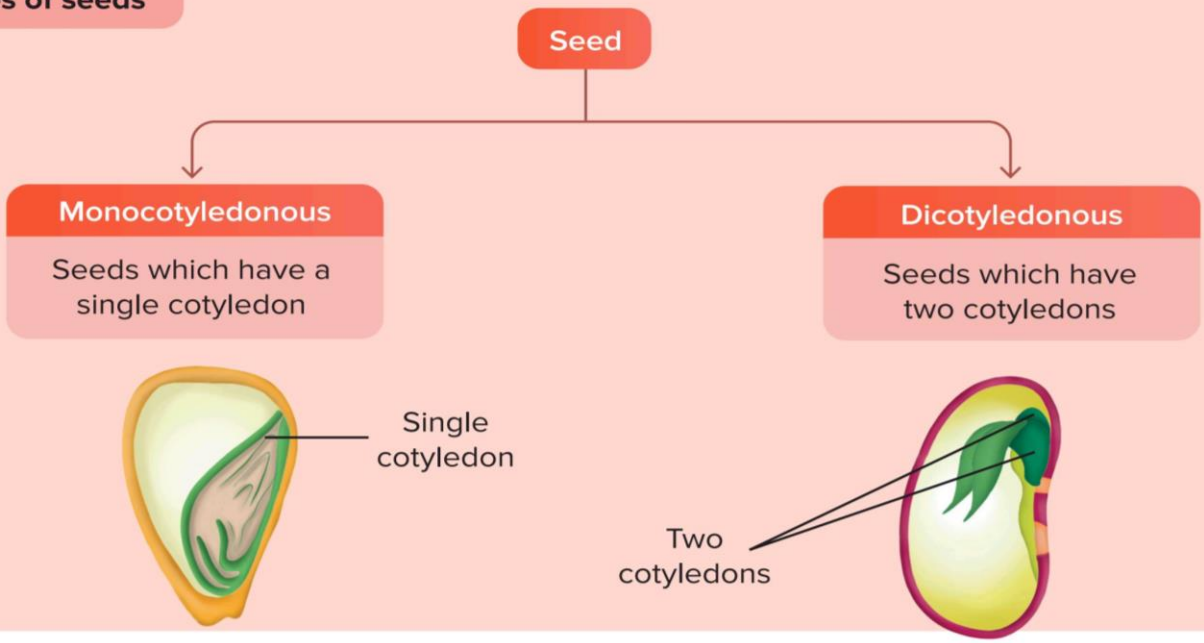




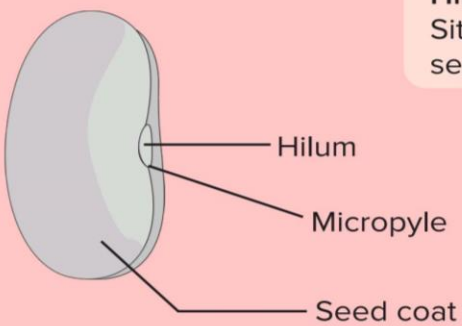
- After the fusion of sperm and the polar nuclei, endosperm is formed with ploidy 3n.

Classification of a seed based on endosperm

Types of seeds



Dicot seed



Hilum
Site of attachment of the seed to the ovary wall

Micropyle
Pore from which water enters the seed

Seed coat
Hard protective covering of the seed

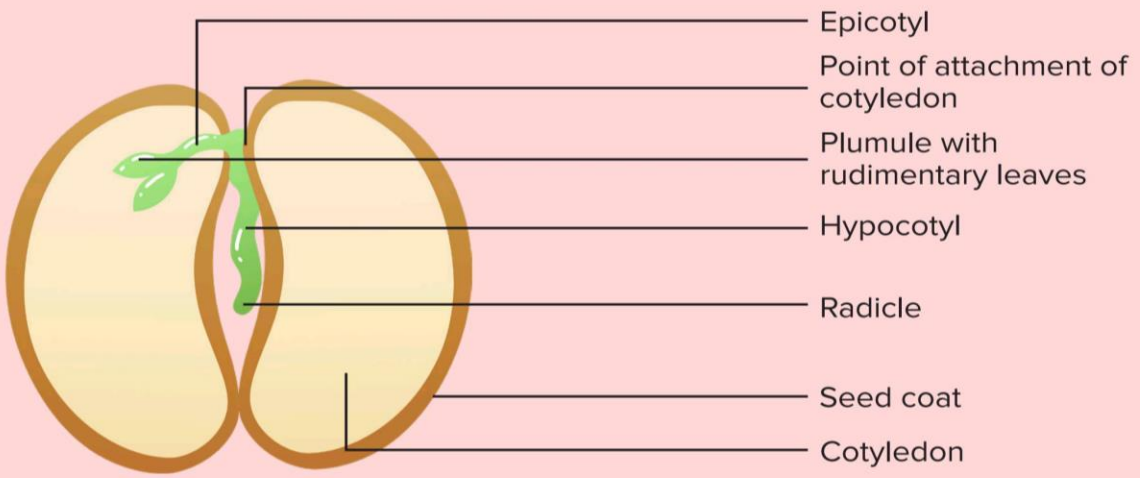
- A **dicot seed** typically contains a **hilum, a micropyle,** and a **seed coat.**

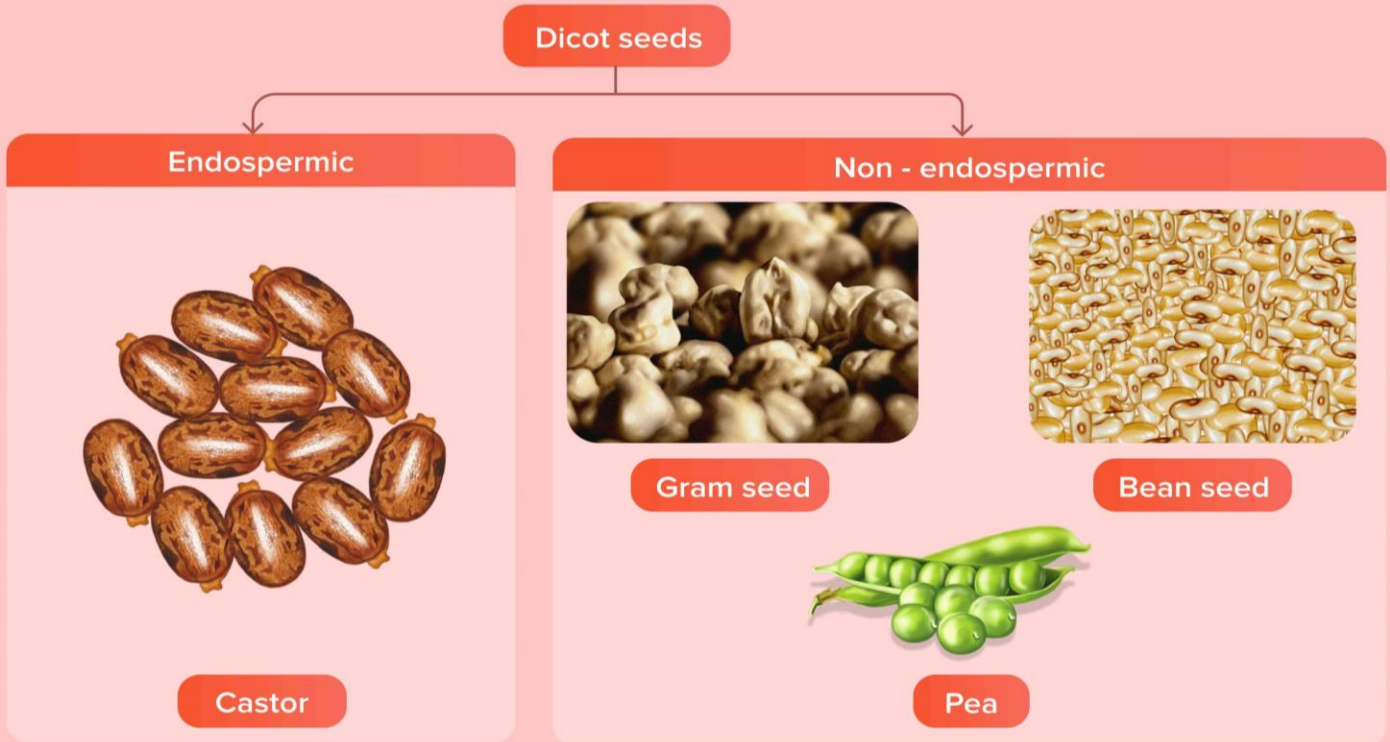
Dicot seed coat

- Seed coat has **two layers**.
- **Testa** forms the **outermost covering.**
- **Tegmen** forms the **inner covering**.
- The **outer testa** is **coloured**, whereas the **inner tegmen** is **colourless**.

Dicot embryo

- The **embryo** contains **two cotyledons** and an **embryonal axis**.
- One end of the embryonal axis consists of the **radicle** and the other end consists of the **plumule**.



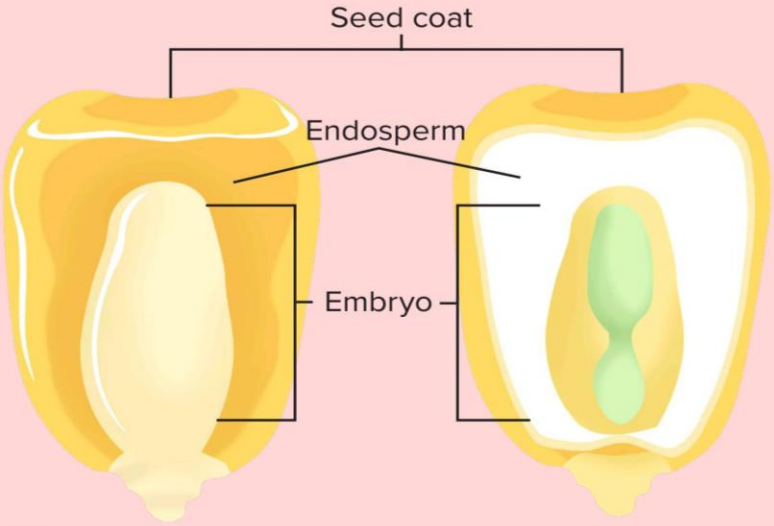


Monocot seed

- **Monocot seed coat**
  → The seed coat is **membranous** and **fused** with the **fruit wall**.

- **Endosperm**
  → It is present in the monocot seed and is **bulky** and **stores food.**

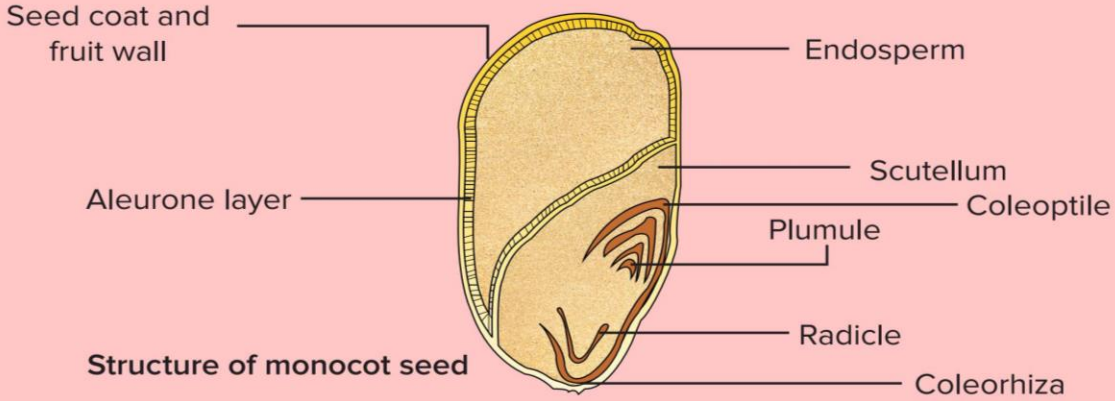
- **Aleurone layer**
  → It is the outer **proteinaceous covering** of the endosperm.
  → The aleurone layer helps to **separate embryos** from the endosperm.



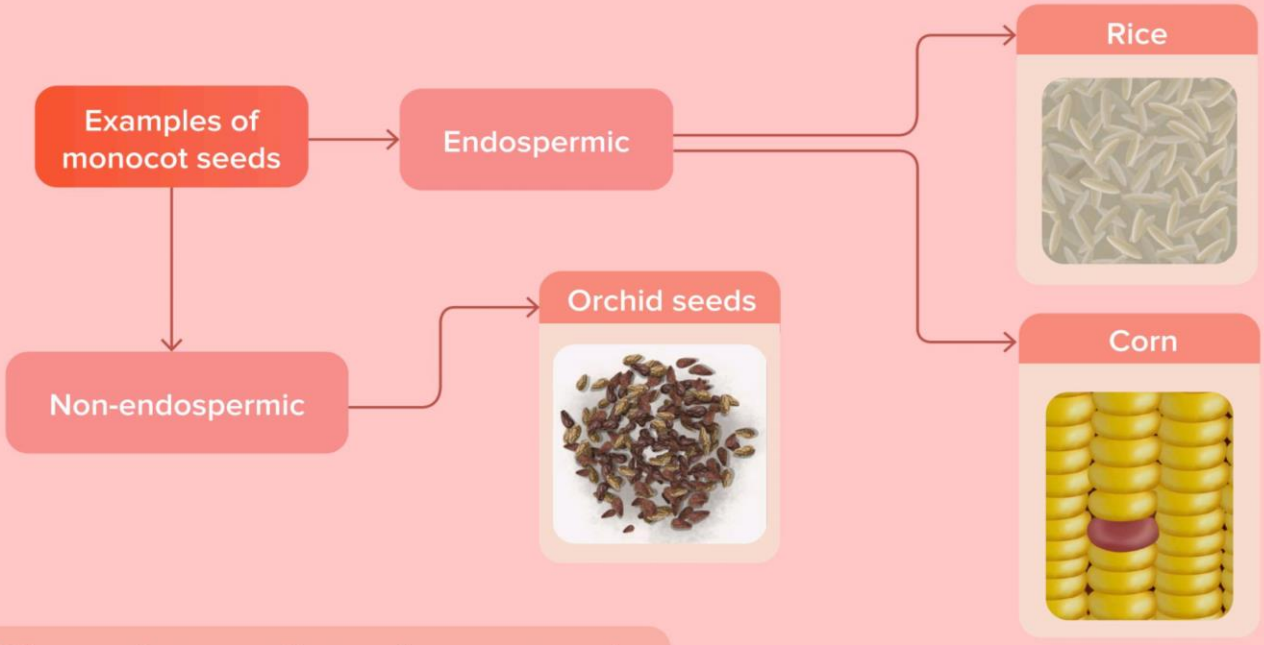
Whole monocot seed Cross section of monocot seed

- **Monocot Embryo**
  → Embryo is **small** and situated in a **groove** at one end of the seed.
  → It has one cotyledon known as s**cutellum and a short embryonal axis.**
  → Short embryonal axis consists of a **plumule** and a **radicle.**

- **Coleoptile and Coleorhiza**
  → **Coleoptile** is a sheath that **encloses the plumule.**
  → **Coleorhiza** is a sheath that **encloses the radicle.**



Structure of monocot seed



Difference between dicot and monocot seeds

Dicot seed	Monocot seed
• The seed coat is distinct from the fruit wall.	• The seed coat is completely fused with the pericarp.
• There are two cotyledons in the seed.	• There is a single cotyledon in the seed.
• Endosperm is absent in most of them but present in a few of them.	• Endosperm is present in most of them but absent in a few of them.
• There is no protective sheath for radicle and plumule.	• The radicle is protected by coleorhiza and the plumule is protected by the coleoptile.

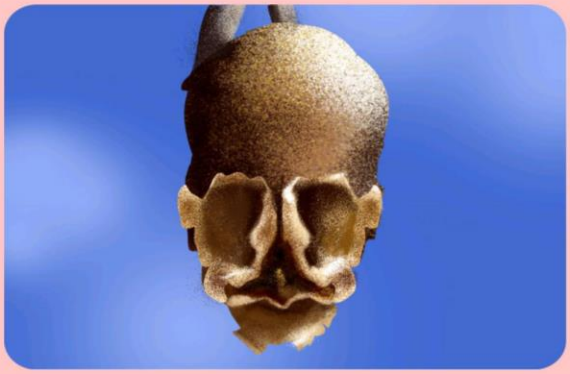
Did you know?

Largest seed: Coco de mer

Smallest seed: *Gomesa crispa*

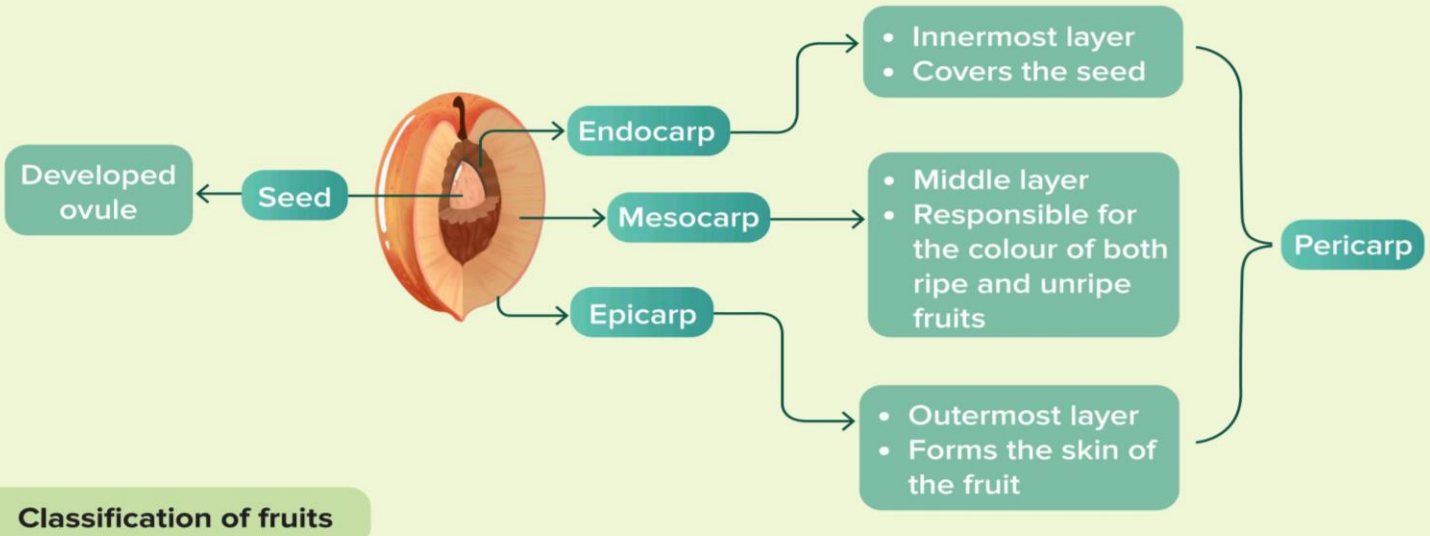
Did you know?

- The image shows the fruit of the snapdragon
- Named after its flower that bears resemblance to a dragons's face that opens and closes when squeezed
- With the seeds gone, the seed pods (shown in the figure) bear a strange resemblance to a human skull

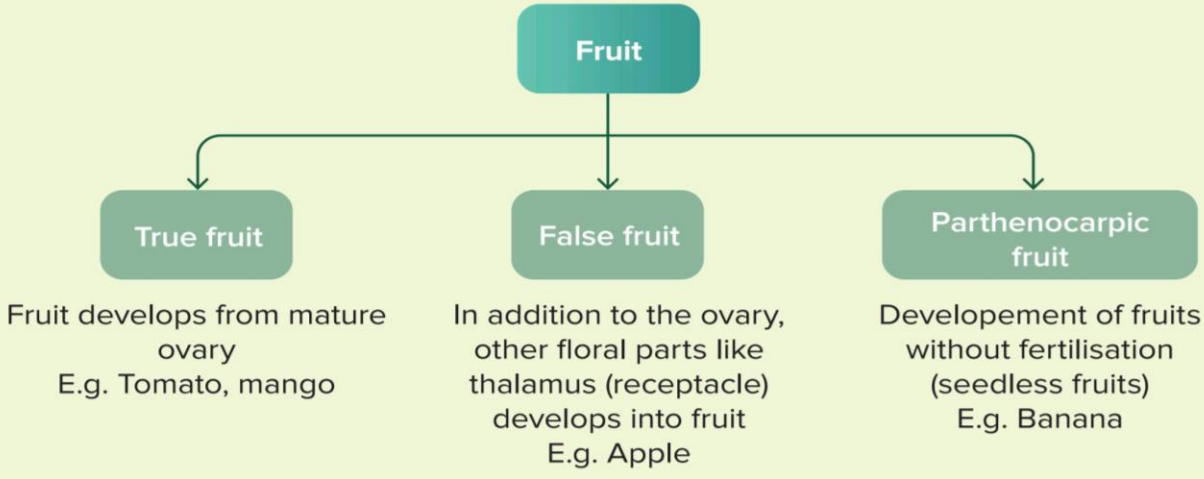


Summary Sheet

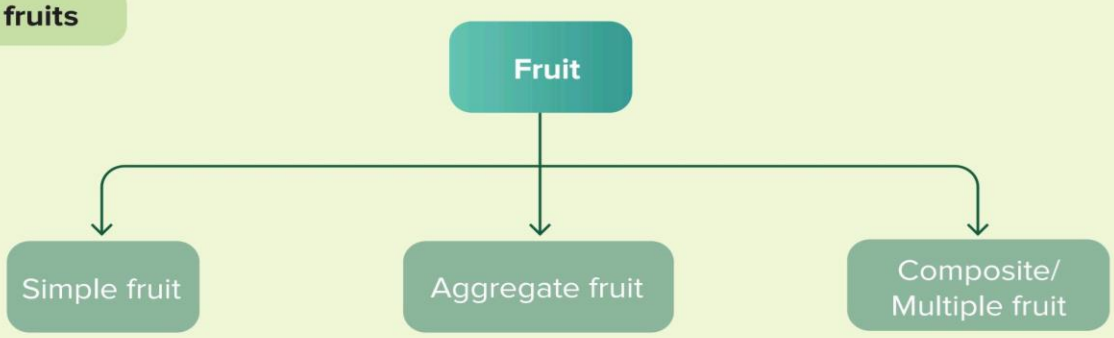
Fruit



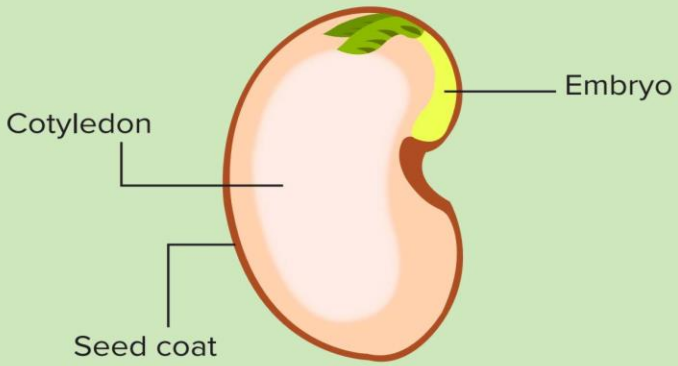
Classification of fruits



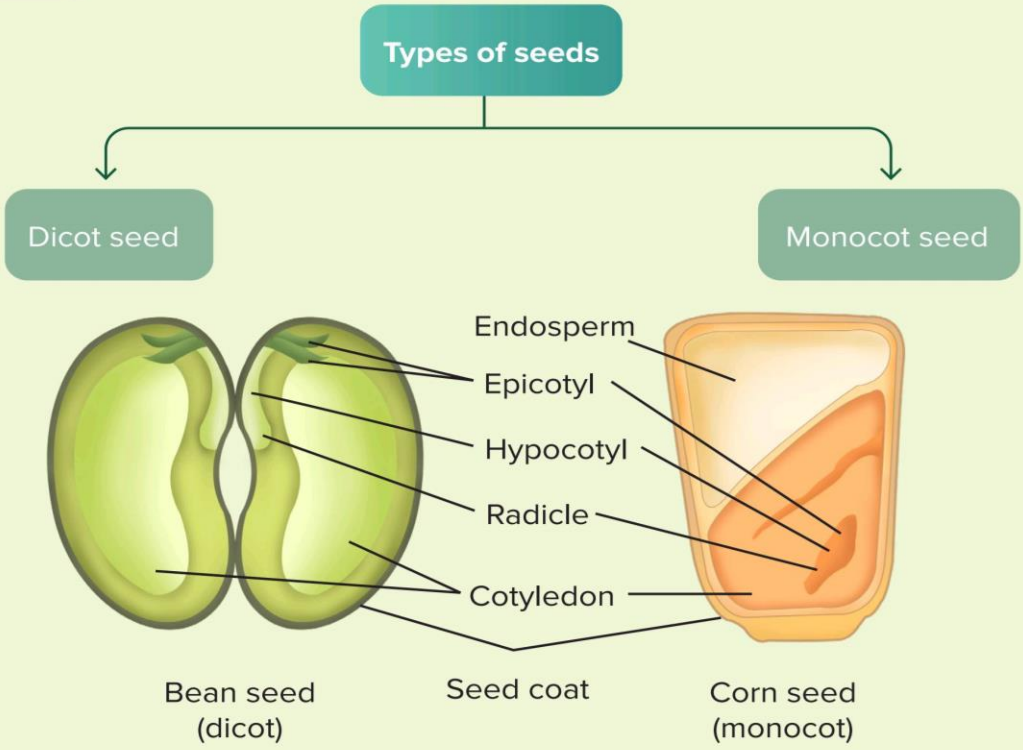
Types of fruits



Parts of a seed



Types of seeds



05 IMPORTANT PLANT FAMILIES: BRASSICACEAE, FABACEAE, SOLANACEAE, LILIACEAE

Key Takeaways

- Floral formula and symbols
- Floral diagram: Graphical representation of a flower
- Floral families
  - Fabaceae
  - Solanaceae
  - Liliaceae
  - Brassicaceae

Prerequisites

- Root, stem, and their modifications
- Leaf venation, types of leaves, and its modifications, Inflorescence
- Flower and its parts
- Fruit, seed and its classification, structure of dicotyledonous and monocotyledonous seeds

Floral Formula

- Representation of the structure of a flower using numbers, letters, and symbols.

Symbol	Description
Br	Bracteate
Ebr	Ebracteate (no bract)
⊕	Actinomorphic flower
%	Zygomorphic flower
♂	Staminate flower (male flower)
♀	Pistillate flower (female flower)
⚥	Bisexual flower

Symbol	Description
K	Calyx
K_n	Polysepalous calyx n = number of sepals
$K_{(n)}$	Gamosepalous calyx (Fusion indicated by brackets) n = number of sepals
C	Corolla
C_n	Polypetalous corolla n = number of petals
$C_{(n)}$	Gamopetalous corolla (Fusion indicated by brackets) n = number of petals
P	Perianth

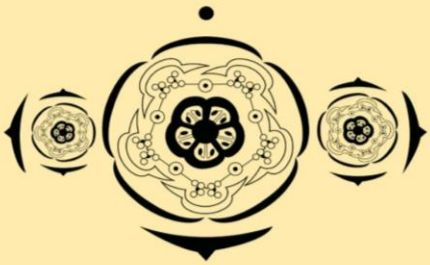
Symbol	Description
A	Androecium
A_n	Stamens free n = number of stamens
$A_{(n)}$	Stamens fused (indicated by brackets) n = number of stamens
C ⌒ A	Epipetalous condition
P ⌒ A	Epiphyllous condition

Symbol	Description
G	Gynoecium
G_n	Carpels free n = number of carpels
$G_{(n)}$	Fused carpels / Syncarpous condition (indicated by brackets) n = number of sepals
$\underline{G}$	Superior ovary
$\overline{G}$	Inferior ovary

Have you seen this?

This is a form of art known as Mandala. In this form, geometric shapes are used to create beautiful works of art.

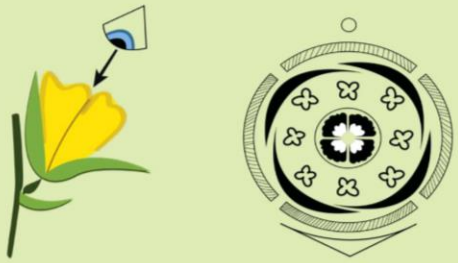
Does this look similar to Mandala?



This is a botanical art known as **floral diagram.**

Floral Diagram

- It was introduced in the 19th century by Eichler.
- The floral diagram is a representation of a flower or a bud.
- It is the graphical representation of the flower when viewed perpendicularly from the top.
- It shows the aestivation of the calyx and the corolla along with the placentation (both of these are not seen in the floral formula).



Looking angle of a floral diagram

Plant families

Taxonomic hierarchy

Rules of botanical nomenclature

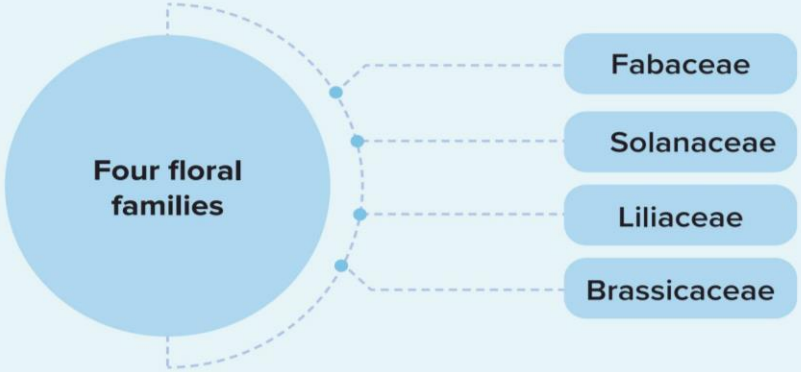
- All family names end with '-aceae'.
- They start with a capital letter but are not italicised.
- If a family has a subfamily, the name of the subfamily will end with '-oideae'.
- The families are grouped together into an order, the name of which ends in '-ales'. Examples: Fabales, Solanales, Liliales, Brassicales!

Taxonomic hierarchy of mango (*Mangifera indica*)

Kingdom	Plantae
Division	Embroyophyta (Angiospermae)
Class	Dicotyledonae
Order	Sapindales
Family	Anacardiaceae
Genus	*Mangifiera*
Species	*indica*

Floral Families

Several floral families have been identified all around the globe. In this lesson, we will learn the features of the four of the more common floral families—Fabaceae, Solanaceae, Liliaceae, and Brassicaceae.



Fabaceae

- Third-largest family of angiosperms, after Orchidaceae and Asteraceae
- Also known as the legume or the bean family
- Distributed all over the world
- Earlier known as subfamily Papilionoideae because of the presence of **papilionaceous corolla**
- Five petals: one large, standard petal, two wing petals, and two small, keel petals that are fused
- The keel petals enclose the stamens and pistil
- Later it was recognised as a complete family and was given the new name Fabaceae

Standard petal or **Banner**
Outermost and the largest part of the flower

Wings or **Alae**
Two lateral petals

Keels or **Carinae**
Two innermost and smallest petals

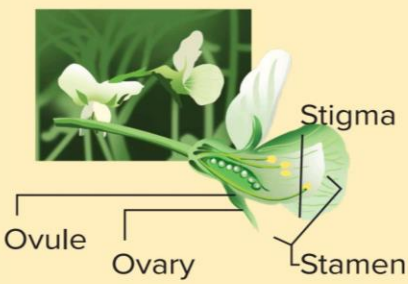
Papilionaceous corolla

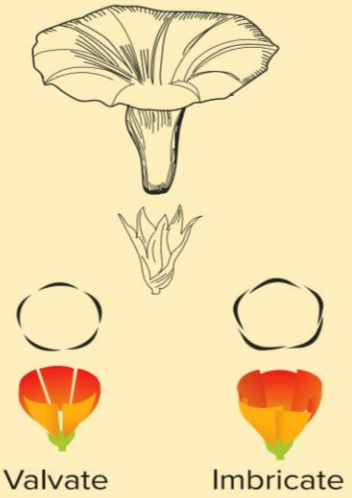
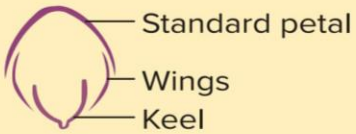
Vegetative characteristics

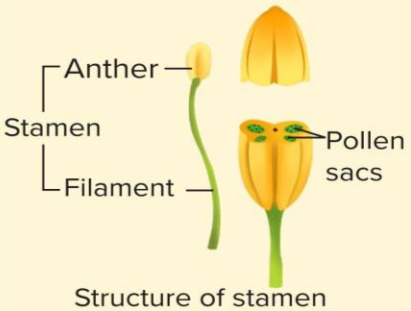
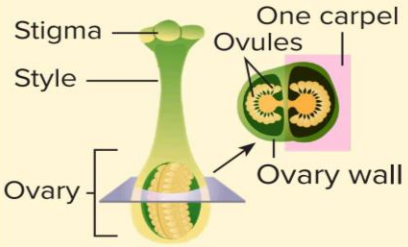
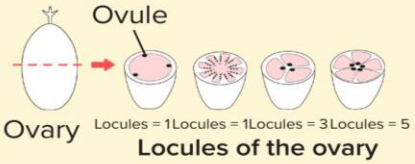
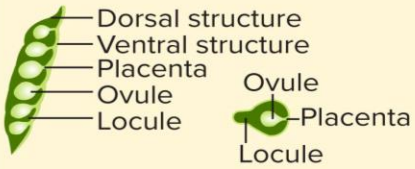
Habit	• Herbs, shrubs, trees, vines	 Licorice (Mulethi)
Root system	Tap root system • Leguminous - Root nodules present • Nodules have nitrogen fixers such as *Rhizobium* • Association of the nitrogen-fixing bacteria with the roots is an example of symbiosis/ mutualism	 Tap root system with root nodules

Shoot system	• **Stem** ◦ Erect or climber • **Leaves** ◦ Leaf arrangement (phyllotaxy)- Alternate ◦ Simple or pinnately compound leaves ◦ Stipulate - have stipules ◦ Pulvinate - swollen leaf base (pulvinus) ◦ Reticulate venation	 Alternate, simple, and pinnately compound leaves  Pulvinus leaf  Reticulate venation

Floral characteristics

Inflorescence	• Racemose acropetal arrangement (Older flowers at base and younger flowers at apex) • Indefinite growth of floral axis	 *Caesalpinia*
Sexuality	• Bisexual or hermaphrodite (⚥)	

Symmetry	• Zygomorphic: Bilaterally symmetrical (%)	
Calyx (K)	• Pentamerous (Five sepals - K_5) • Gamosepalous (Fused sepals - $K_{(5)}$) • Exhibit either valvate or imbricate aestivation • When the margins of sepals touch each other without overlapping, it is known as valvate aestivation. When the sepals overlap but not in any particular direction, then it is known as imbricate aestivation.	
Corolla	• Pentamerous: Five petals - C_5 • Polypetalous: Free petals - C_5 • Vexillary aestivation • Papilionaceous corolla: The corolla has five petals. One large standard petal, and two wing petals and two small keel petals that are fused. The keel petals enclose the stamens and the pistil.	   

Androecium (A)	• There are 10 stamens. The filaments of nine stamens are united to form one bundle and the 10th stamen is free. This type of arrangement of stamens into two bundles is known as the diadelphous condition. Diadelphous condition is a characteristic feature of this family. • 10 stamens present in diadelphous arrangement $A_{(9)+1}$ • Each stamen has a dithecous anther with two lobes	 **Diadelphous arrangement**  Structure of stamen **Dithecous anther**
Gynoecium (G)	• Monocarpellary, i.e. only a single carpel is present. • Ovary superior • Multiple ovules in an ovary • Unilocular ovary • **Marginal placentation**: Characteristic feature of the family Fabaceae. ◦ Placenta develops along the ventral suture ◦ Ovules are arranged on the placenta in two rows.	 Monocarpellary ovary  **Multiple ovules**  **Locules of the ovary** 
Fruit	• The ovary transforms into fruit after fertilisation and ovules into seeds. • The plants of this family produce a characteristic legume fruit. Hence, these are also known as leguminous plants. • The legume fruit develops from a mono carpellary unilocular ovary. • The fruit dehisces and liberates seeds at maturity.	

Common Characteristics of Fabaceae

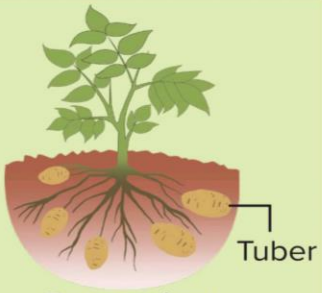
- All the plants classified into Fabaceae show the following common characters:

Fabaceae
Root nodules
Pulvinus leaf basse
Papilionaceous corolla
Diadelphous condition
Marginal placentation
Legume fruit

Solanaceae

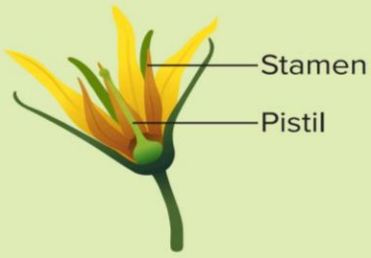
- The potato family
- Widely found in tropics, subtropics, and temperate regions

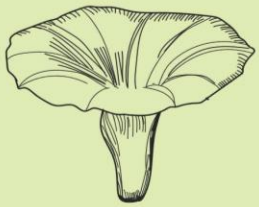
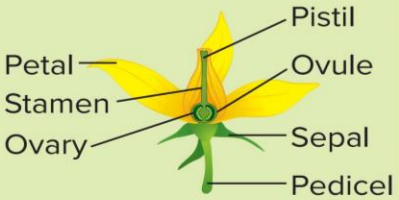
Vegetative characteristics

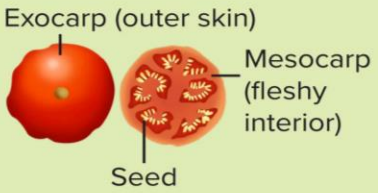
Habit	• Herbs, shrubs, trees (rare)	 *Datura*
Root system	Tap root system	
Shoot system	• **Stem** ◦ Aerial ◦ Erect stem ◦ Herbaceous and rarely woody ◦ Underground storage stem (tuber)	 Potato plant

	◦ Branched ◦ Hairy/non-hairy (glabrous) • **Leaves** ◦ Arrangement (phyllotaxy) - Alternate ◦ Simple and rarely pinnately compound ◦ Exstipulate - No stipules ◦ Reticulate venation	 Hairy stem  Glabrous (non-hairy) stem  Stipule **Stipulate** **Exstipulate**

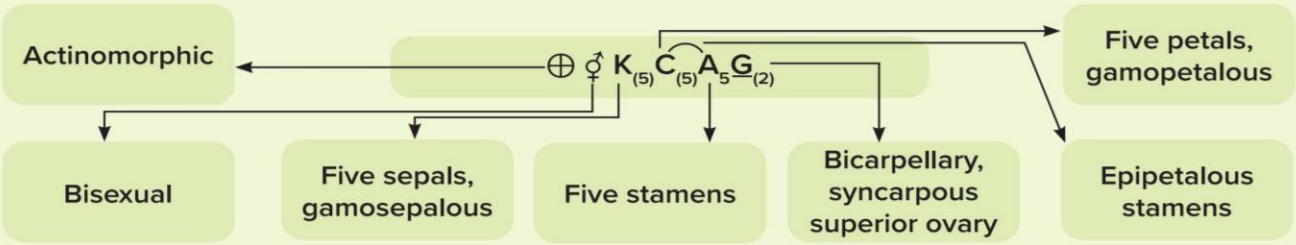
Floral characteristics

Inflorescence	• Solitary, axillary • Cymose - flowers arranged in basipetal order	  *Physalis* *Solanum tuberosum* (potato)
Sexuality	Bisexual (⚥)	 Stamen Pistil
Symmetry	Actinomorphic (⊕) - Radially symmetrical	

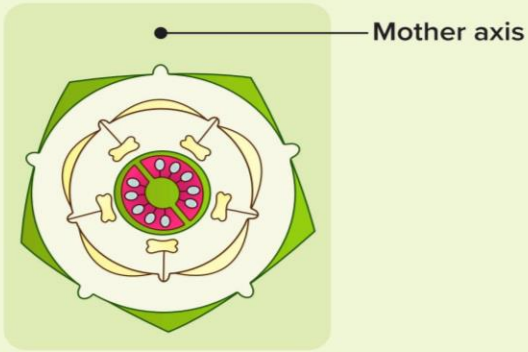
Calyx (K)	• Pentamerous: Five sepals • Gamosepalous: Fused sepals - $K_{(5)}$ • Exhibit valvate aestivation (the margins of sepals touch each other without overlapping) • Persistent calyx (Generally sepals wither away after fertilisation. But in the family of Solanaceae, the calyx is persistent even after fruit formation)	  Persistent Calyx 
Corolla (C)	• Pentamerous: Five petals • Gamopetalous: United petals - $C_{(5)}$ • Exhibit valvate aestivation	 Chilli flower
Androecium (A)	• Five stamens - A_5 • Epipetalous - Filaments of stamen attached to petals	 Brinjal flower
Gynoecium (G)	• Bicarpellary - Presence of two carpels • Syncarpous - Carpels united - $G_{(2)}$ • Bilocular ovary • Swollen placenta with multiple ovules • Axile placentation • Hypogynous flower - Superior ovary - $\underline{G}$	 Ovary wall Ovules Placenta Locule **Obliquely placed bicarpellary ovary**   Pistil Petal Ovule Stamen Ovary Sepal Pedicel

Fruits	• Berry (A fleshy fruit that develops from the ovary of a single flower. The mesocarp and endocarp are fused to form pulp). Example: Tomato • Capsule (A dry, dehiscent fruit that liberates seeds at maturity). Example: *Datura*	 Berry (All or most of pericarp is fleshy)  Dehiscent capsule
Seeds	• Multiple seeds present • Dicotyledonous • Endospermic	

Floral formula and floral diagram of Solanaceae



- In the **outermost whorl**, the calyx has five sepals fused and **valvate aestivation**.
- In the **second whorl**, the corolla has five petals fused and **valvate aestivation**.
- In the **third whorl**, the androecium has five stamens that are attached to petals. This is known as **epipetalous condition**.
- The **ovary is bicarpellary bilocular** and the placenta is swollen with **axile placentation**



Economic importance

- **Source of food**
  - Vegetables: Tomato, potato, and brinjal
  - Spices: Green chilli

- **Medicine**: *Atropa belladonna*, ashwagandha
- **Fumigatory**: Tobacco plant
- **Ornamentals**: *Petunia*

Common characteristics of Solanaceae

- All the plants classified into Solanaceae show these common characters:

Solanaceae
Persistent calyx
Epipetalous condition
Swollen placenta

Liliaceae

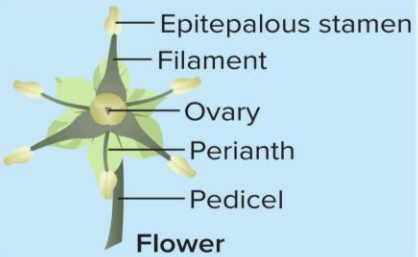
- The lily family
- Consists of monocots
- Tulips, onions, lilies, etc. belong to this family

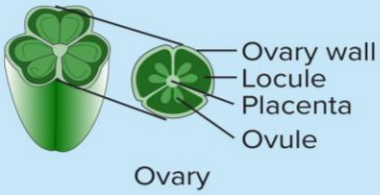
Vegetative characteristics

Habit	• Perennial herbs	
Root system	• Fibrous roots (Monocot characteristic)	
Shoot system	• **Stem** ◦ Underground stem present, which helps in vegetative propagation ◦ Corm: *Colchicum autumnale* ◦ Bulb: Onion ◦ Rhizome: *Gloriosa*	 *Colchicum autumnale*  Onion

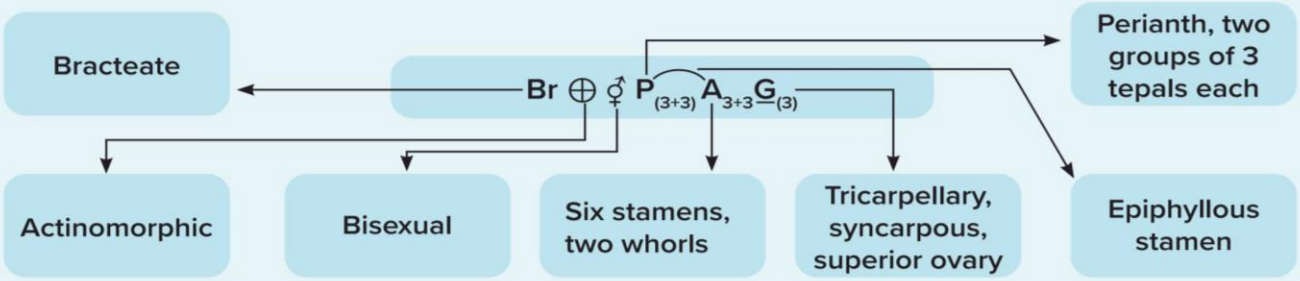
	• **Leaf** ◦ Basal leaf - Arise from the base of the stem ◦ Leaf arrangement (phyllotaxy) - Alternate ◦ Exstipulate - No stipules ◦ Parallel venation (characteristic of monocots)	 *Gloriosa*  Parallel venation

Floral characteristics

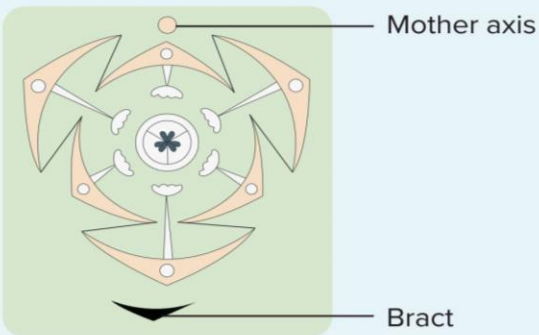
Inflorescence	• Solitary, axillary • Cymose, umbellate clusters	 
Sexuality	• Bisexual (⚥)	 **Flower**
Symmetry	• Actinomorphic (⊕) ◦ Radial symmetry	
Perianth (P)	• Sepals and petals cannot be differentiated • Tepals are the individual units of perianth • Six tepals arranged in two groups - $P_{(3+3)}$ • Tepals united into tubes • Valvate aestivation	   

Androecium (A)	• Six stamens • Six stamens arranged in two groups of three each - A_{3+3} • Epiphyllous - Stamens attached to the tepals	
Gynoecium (G)	• Tricarpellary - three carpels present • Syncarpous - United carpels - $G_{(3)}$ • Trilocular ovary with multiple ovules • Axile placentation	 Ovary
Fruits	• Capsule (A dry dehiscent fruit that liberates seeds at maturity) • Rarely berry	 
Seeds	• Multiple seeds present • Monocotyledonous • Endospermic	

Floral formula and floral diagram of family Liliaceae



- In the **outermost whorl**, the perianth has six tepals arranged in two whorls.
- Six stamens are arranged in two whorls. The stamens are attached with tepals. This is known as the **epiphyllous condition**.
- The flower shows **tricarpellary condition**, the ovary is **trilocular** with ovules on **axile placentation**.



Economic importance

- **Ornamentals**: Tulip, *Gloriosa*
- **Medicine**: *Aloe*, *Colchicum autumnale*
- **Vegetables**: Asparagus, onion

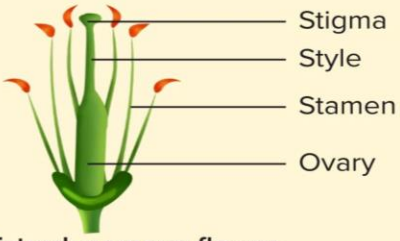
Common characteristics of Liliaceae

- All the plants classified into Liliaceae show these common characters:

Liliaceae
Fibrous root system
Parallel venation
Single cotyledon in the seed
Underground stem

Brassicaceae

- The mustard family
- Tetradynamous condition is its unique feature.
- In the tetradynamous condition, the flower has six stamens that are arranged into two groups—one group has two short stamens and the other group has four long stamens.



Tetradynamous flower

Summary Sheet

Floral families

Fabaceae	Solanaceae	Liliaceae	Brassicaceae
Legume or bean family	Potato family	Lily family	Mustard family
Vegetative characters **Root**: Taproot system, leguminous plants with root nodules containing N_2 fixing bacteria. **Leaf**: Simple or pinately compound leaves, stipulate, pulvinate, reticulate venation.	**Vegetative characters** **Root**: Taproot system **Stem**: Hairy, or non-hairy stem, underground storage **Leaf:** Alternate, simple, rarely pinnately compound, exstipulate, reticulate venation	**Vegetative characters** **Habitat**: Perennial herbs **Root**: Fibrous roots **Stem**: Underground stem **Leaf**: Alternate, exstipulate, parallel venation	**Vegetative characters** **Tetradynamous condition:** The flower has 6 stamens arranged into two groups - one group has two short stamens and the other group has four long stamens

Fabaceae
Floral characters

Inflorescence: Racemose

Sexuality: Bisexual

Symmetry: Bilaterally symmetrical

Calyx: Pentamerous, gamosepalous, exhibit either valvate or imbricate aestivation

Corolla: Pentamerous, polypetalous, vexillary aestivation, papilionaceous corolla

Androecium: 10 stamens present in diadelphous arrangement. Each stamen has a dithecous anther with 2 lobes

Gynoecium: Monocarpellary, unilocular ovary with multiple ovules, marginal placentation

Seeds: Dicotyledonous, lacks endosperm

Economic Importance

- Pulses
- Edible cooking oils
- *Sesbania* and *Trifolium*: fodder for animals
- Natural dye from *Indigofera* plant
- Lupin and sweet pea: Ornamentals
- Liquorice: Medicinal properties

Solanaceae
Floral characters

Inflorescence: Solitary, axillary, cymose

Sexuality: Bisexual

Symmetry: Radially symmetrical

Calyx: Pentamerous, gamosepalous, exhibit valvate aestivation

Corolla: Pentamerous, gamosepalous, valvate aestivation

Androecium: 5 stamens present, epipetalous

Gynoecium: Bicarpellary, syncarpous, bilocular ovary, swollen placenta with multiple ovules, axile placentation, hypogynous flower

Seeds: Multiple, dicotyledonous endospermic

Economic importance

- Vegetables and spices
- *Atropa belladonna*, Ashwa gandha - medicinal
- Tobacco plant - fumigatory
- *Petunia* - ornamental

Liliaceae
Floral characters

Inflorescence: Solitary, axillary, cymose, umbellate clusters

Sexuality: Bisexual

Symmetry: Radially symmetrical

Perianth: Tepals are united into tubes, valvate aestivation

Androecium: 6 stamens arranged in 2 groups of 3 each, epiphyllous stamens

Gynoecium: Tricarpellary, syncarpous, trilocular ovary with multiple ovules, axile placentation

Seeds: Multiple, monocotyledonous, endospermic

Economic importance

- Vegetables
- Tulip, *Gloriosa* - ornamentals
- Aloe, *Colchicum autumnale* medicinal