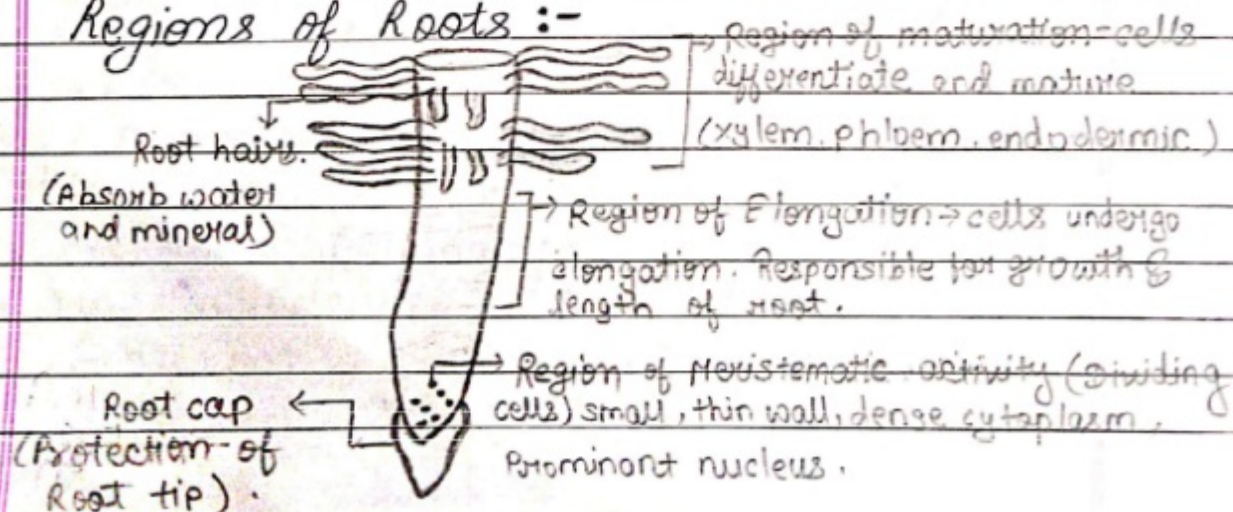


Morphology of Flowering Plants

* Root

1. Tap Root → Root arises from radicle (ex-mustard)
2. Fibrous Roots → Primary root is short line and replaced by large number of roots (ex-wheat)
3. Adventitious Roots - Roots arises from parts of the plants other than radicle (ex-grass, monstera, banyan tree).

* Regions of Roots :-



* Modifications of Roots :-

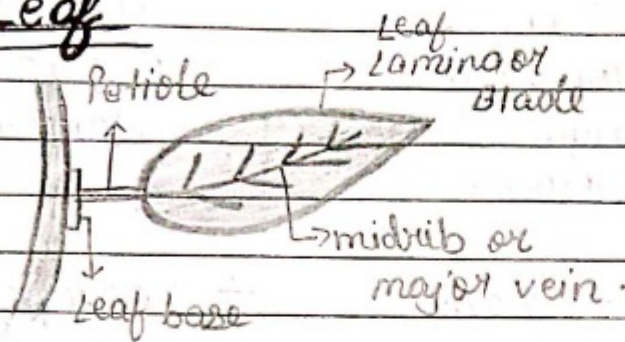
- | | | |
|---|--|---|
| 1) Food Storage
→ Tap roots of carrots and Turnip. | 2) Support
→ prop root or pillar root
Banyan tree. | 3) Respiration.
→ Pneumatophores (Rhizophora)
→ negative geotropic
(जड़ों को नीचे की ओर आकर्षित करता है) |
| → Adventitious roots of sweet potato
Tuberous
Fasciculated e.g. Dahlia,
A. spargangus, Portulaca | → Stilt roots of maize & sugarcane
lower root
→ mangrove plant
→ halophyte. | |

* Stem

/Stem Modification.

- | | | |
|---|--|---|
| <u>Underground stem</u> | <u>Sub-aerial stem</u> | <u>Aerial stem</u> |
| * <u>Tuber</u>
→ Potato
eg. → Colocasia, Solanum tuberosum (chimbing) | * <u>Runner</u>
→ Grass, Strawberry
support | * <u>Tendrils</u>
→ cucumber, pumpkin, watermelon, Grapevines. |
| * <u>Comm</u>
→ Zaminkand | * <u>Stolon</u>
→ Mint, Jasmine | * <u>Thorns</u>
→ Citrus, Bogainvillea. |
| * <u>Rhizome</u> | * <u>Sucker</u>
→ Banana, pineapple, Chrysanthemum. | * <u>Phylloclades</u>
→ opuntia (Flat) |
| * <u>Ginger</u> | * <u>offset</u>
→ Pistia, Eichhornia | * <u>Euphorbia</u>
(Cylindrical) |
| * <u>Bulbil</u>
→ Onion
→ Garlic | | |

* Leaf



* Reduce leaf called stipule

① Leaf Base - attached to stem

② Petiole - Hold the blade.

③ Lamina - Green parts of leaf with veins and venlets.

→ Pulvinus - is a swollen leaf base seen in leguminous plants.

* Leaf:-

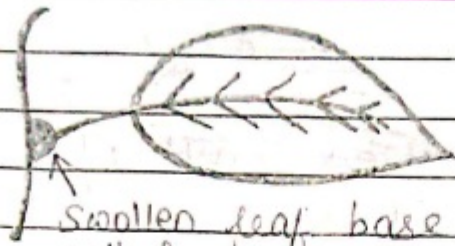
→ leaf is modified shoot apical meristem.

→ arrangement in acropital manner → means older leaf at base & younger leaf at apex.

→ arise from Node.

→ waxy coating of leaf called cuticle

It → mostly acropital manner (not always)



Swollen leaf base
called pulvinus

eg. → pea.



Sheath leaf base

eg - monocot plant.

* Venation → Arrangement of veins and veinlets.

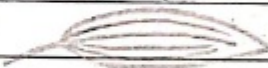
Types

↓
Reticulate



seen in
Dicots

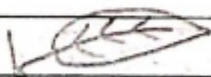
↓
Parallel



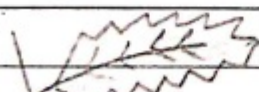
seen in monocots

Types of leaves

↓
Simple



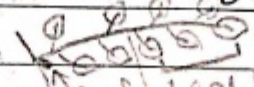
Bud



Bud

↓
Compound

↓
Pinnately



Bud / Leaflet / Rachis

eg - neem

↓
Palmately



Bud

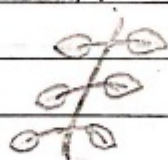
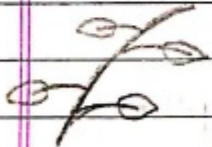
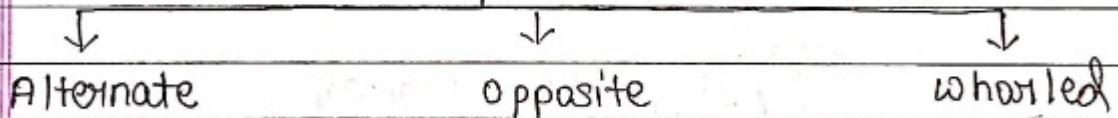
eg - silk cotton

Midrib or major vein or Rachis

- Major vein of leaf extend part of petiole in leaf lamina provide.
- provide rigidity to the lamina of leaf blade
- provide water and mineral to the leaf.
- The arrange of vein & veinlets in the leaf blade & lamina called venation.

* Phyllotaxy - Arrangement of leaves on stem or branch.

Types



eg - Chinrose, ^{family} Malvaceae
mustard, ^{Family} Colotropis

eg - Alstonia

Sunflower. Brassicaceae
↓
Scientific name Cruciferae.

↓
Valvate

Hibiscus Rosa

8:10 PM

family
Compositae
Asteraceae

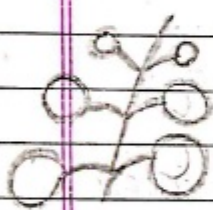
* Leaf Modification

↓	↓	↓	for storage of water
* Climbing	* Defence	* Food storage	* Insectivorous
→ Tendrils	→ Spines	→ Fleshy leaves	→ pitcher plant or Nepenthes.
Eg → Peas	eg - cactus, opuntia	eg - (onion & Garlic)	→ Venus fly trap

→ petiole modified for photosynthesis called phyllode. eg - Australian Acacia

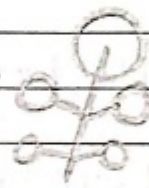
* Inflorescence - Arrangement of flowers on floral axis.

Racemose (Achnopetal order)

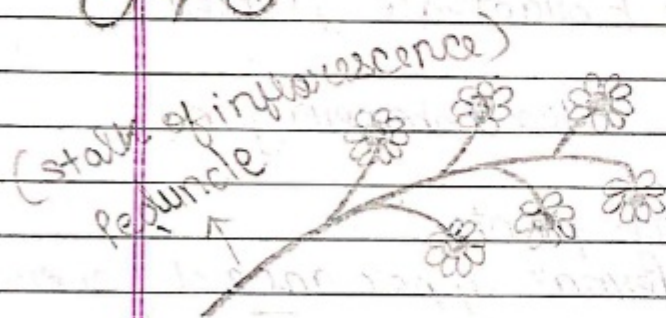


- Indeterminate growth
- young flowers at apex
- ex - cassia, Gulmohar

Cymose (Basipetal order)



- Determinate growth
- young flowers at base
- eg - Jasmine



* Main function of Root system :-

- ① Absorption of water and minerals from the soil.
- ② providing the plant parts with proper anchorage.
- ③ Storing reserve food content.
- ④ Synthesizing plant growth regulators.
- ⑤ Nitrogen fixation.

* Flower

→ Reproductive unit in the angiosperms

→ Has 4 whorls arranged successively on the swollen end of the stalk or pedicel called as Thalamus or receptacle.

→ Bisexual flower - Has both stamens + carpels.

→ Unisexual flower → Having only stamen or carpels.

* Bract - Reduced leaf at the base of pedicel.

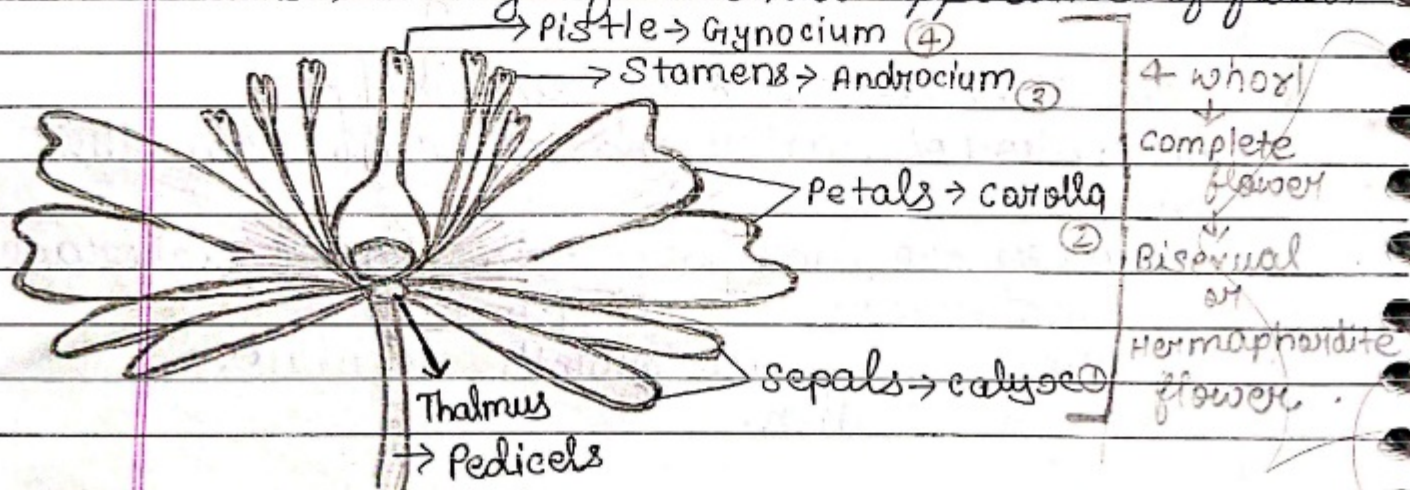
→ Flower with bracts - Bracteate flower.

→ Flower without bracts - Ebracteate flower.

→ Flowering plants also called phanerogams.

Morphology of flowering plants :-

Means → Study of external appearance of flower.



① Calyx, corolla & Androecium - male flower
or Incomplete flower
or unisexual flower.

② Calyx, corolla, Gynoecium - Female flower or
Incomplete flower or
unisexual flower.

* Types of flowers

① Bisexual flower or Hermaphrodite flower.

② Male flower

③ Female flower

* Types of plants on the basis of flower.

→ Monoecious → have bisexual or hermaphrodite flower

→ Dioecious → have unisexual i.e. male or female flower

⇒ If a plant have both type of flower (male flower and female flower) such plant also called as Monoecious plant.

* Types of flower on the basis of no. of floral parts.

→ Trimerous - 3 sepals & 3 petals

→ Tetramerous - 4 sepals & 4 petals

→ Pentamerous - 5 sepals & 5 petals.

* Types of flowers on the basis of symmetry.

① → Radial symmetry or Actinomorphic flower.
(symbol $\oplus$)

When more than one plane or any plane which are passes from centre & body divided or flower divided into two equal parts or halves such symmetry called as radial symmetry or Actinomorphic flower.

Prick → अजन्ता मोड़स ने आखों में धूल झोंकी मिर्ची लकी
 ↓ ↓ ↓ ↓
 Actinomorphic mustard datura chilli

② → Bilateral symmetry or zygomorphic flower
[$\frac{1}{2}$]

- When single plane which are passes

from the centre & body of flower divided into two equal halves or part such symmetry flower called as zygomorphic flower.

Druck	सुवैनेश्वर कुमार	प्रवीन कुमार	राधे केशव
	↓	↓	↓
	Bean	pea	Gulmohar Cassia

③ → Asymmetrical flower

when flower not divided into two equal parts eg- canna.

* Hypogynous -

→ Gynoecium occupies highest position (superior ovary)
ex - Mustard, Brinjal, China rose.

* Perigynous

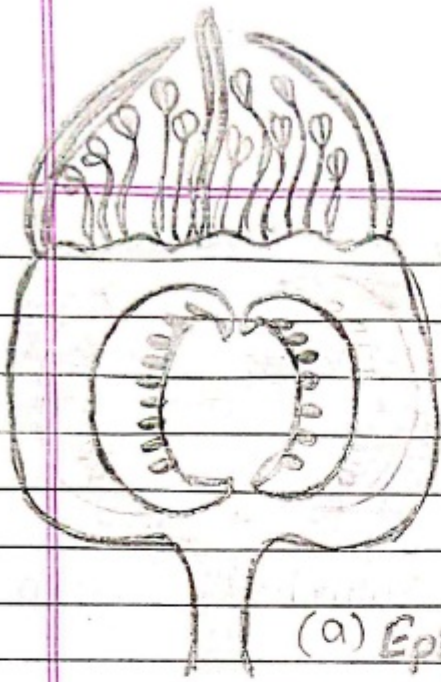
→ Gynoecium & other parts are almost at the same level (Half inferior ^{or half superior} ovary)
ex - Plum, Peach, Rose.

* Epigynous

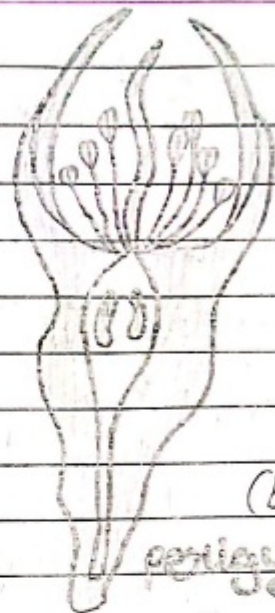
→ other parts are above than ovary.

→ Margin of thalamus enclosing the ovary completely & gets fused [inferior ovary]

→ eg - Guava, Cucumber, Ray florets of sunflower.

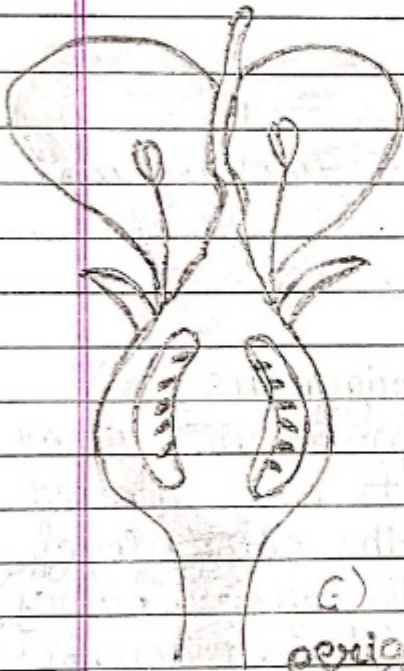


(a) Epigynous



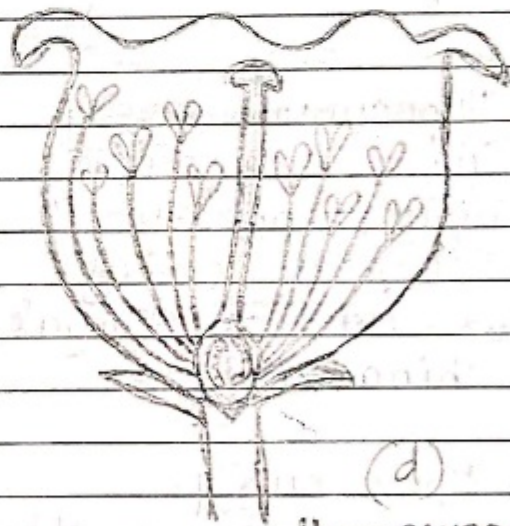
(b)

perigynous



(c)

perigynous



(d)

Hypogynous

* Calyx

- outermost whorl
- unit - sepals
- green colour
- protective
- photosynthesis
- Gamosepalous - sepals fused or unit
- polysepalous - sepals free

Corolla

- 2nd whorl
- unit - petal
- any colour
- attractive
- Gamopetalous - petal fused or united
- polypetalous - petal free.

Shape $\begin{cases} \text{tubular} \\ \text{funnel} \\ \text{bell} \\ \text{wheel} \end{cases}$

Androecium

— 3rd whorl

— male reproductive part

— Anther + Filament = Stamen

* Anther - fertile part produce pollen grain or microspore or male gametophyte.

* Filament - variable length eg- salvinia

* Stamen $\rightarrow$ Androecium
unit $\rightarrow$ stamen

— Staminate - sterile Stamen (means pollen grain ~~are~~ not produce).

— Monodelphous - Stamen are present in a bunch. eg- family Malvaceae, China Rose or show flower.

- **Diadelphous** - two bunch of stamen or
 Hellinthusanus. eg- family
 leguminaceae - pea or
 papilionaceae. (9+1)
 9 bunch of stamen (अलग)

- **polyadelphous** - more than two bunch of
 stamen eg- citrus.

extra - **cruciform** → Anther fuse
 • **cenandrous** → Anther & filament fuse

Gynoecium

Stamen $\xrightarrow[\text{with}]{\text{if unites}}$ → Petals - **Epipetalous** (eg- Brinjal)
 → Perianth - **Epiphyllous** (eg- lily)

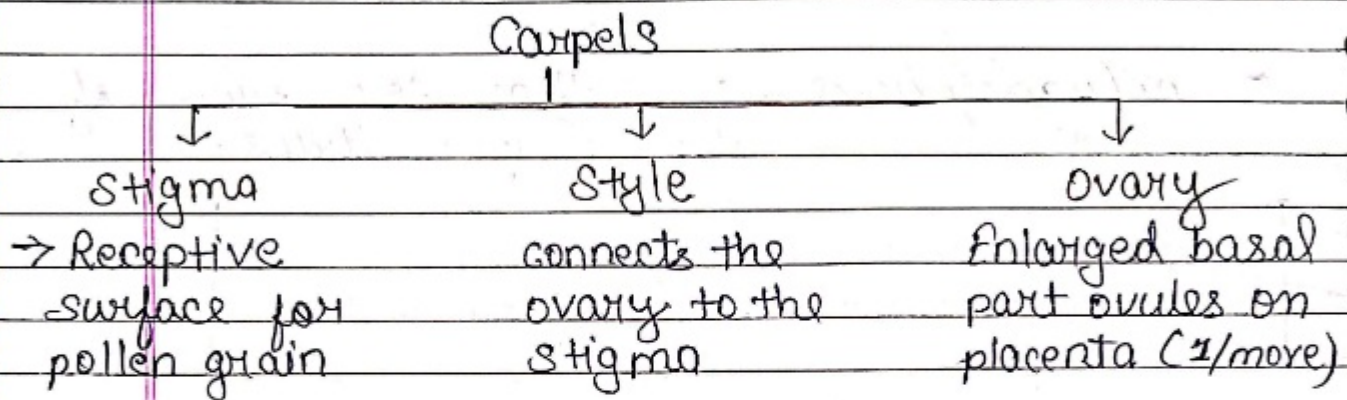
* **Staminode** - Sterile stamen

* **Polyandrous** - Free stamen

→ variation in length of filaments within a
 flower as in salvia & Mustard.

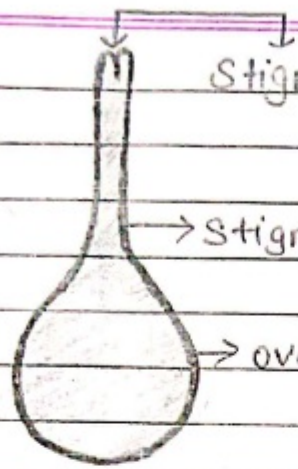
* Gynoecium

- unit of carpels
- Innermost whorl



If more than 1 carpels -
 [Free Apocarpous (eg - Lotus, Rose)
 [Fused Syncarpous (eg - Mustard, Tomato)

- Female reproductive part
- stigma + style + ovary → Pistil
- carpel - ovule bearing structure
- Many time carpel or pistil are same.
- Carpels are found in pistil.



Stigma - platform like structure receive pollen grain or microspore or male gamatophyte.

→ Stigma-provide vascular supply

→ ovary - Basal bulge part
fertile part have locule i.e. ovarian chamber. → locule have ovule.

Aestivation

→ arrangement of sepals or petals or calyx or corolla with respect to other members of a flower called aestivation

① Valvate aestivation - when sepals/petals just touch one another eg - without overlapping
eg - Calotropis flower.



② Twisted aestivation - overlaps sepals or petals but not in continuous manner one to each other.

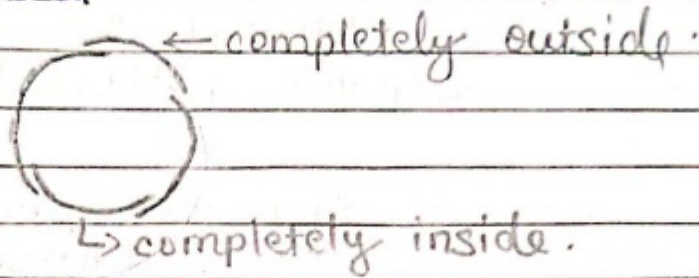
eg → T / C² → china rose / cotton
Twisted / lady finger } malvaceal family



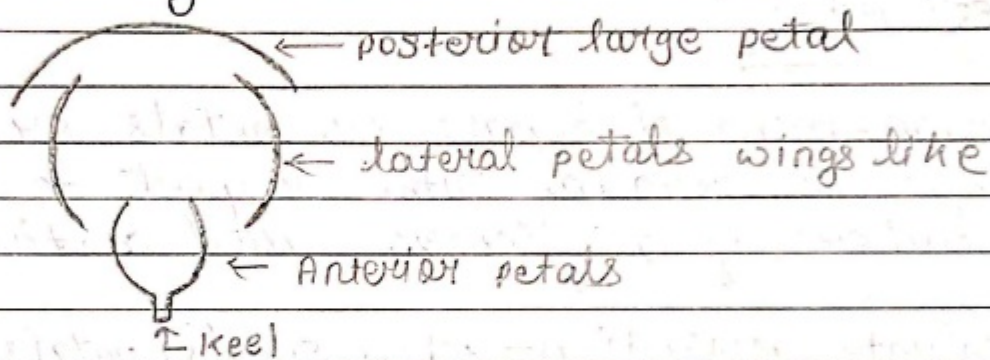
③ Imbricate aestivation

- Sepals or petals overlaps but not in continuous manner one sepal or petal completely outside & other sepals completely inside.

eg - T C G → Gulmohar
Imbricate cassia



(4) vexillary aestivation or papilionaceous



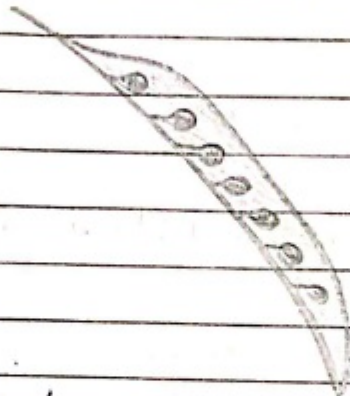
eg - pea & Bean

Pea → family Leguminaceae → subfamily —
papilionaceae

* Placentation → arrangement of ovule within ovary

Types of placentation →

- ① Marginal - Placenta from a ridge along a ventral suture of the ovary and ovules are born on ridge forming two rows ex - Peas

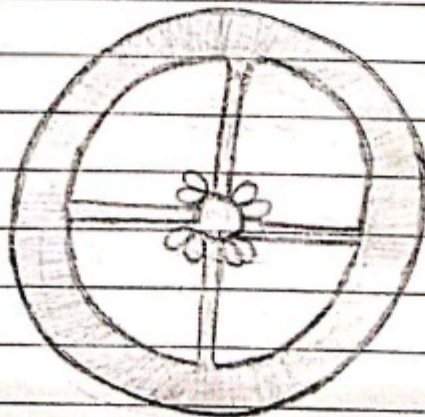


- ② Axile - when placenta is axial and the ovules are attached to it in multicolour ovary.

eg - china rose, Potato Tomato, Lemon.

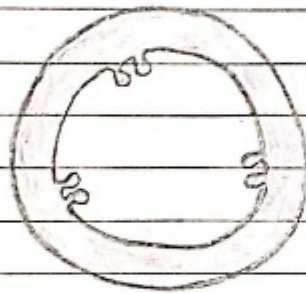
(ACTL)

↓
Axil → china rose

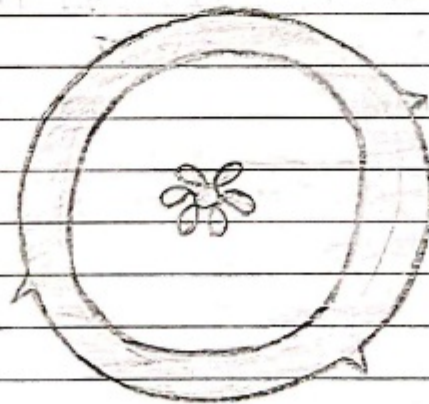


3. Parietal - ovules develop on the inner wall of the ovary or on peripheral part. ovary is one chambered but it becomes two chambered due to the formation of false septum.

eg - P M A $\rightarrow$ Argemone
 Parietal Mustard $\rightarrow$ family
 Brassicaceae
 or
 Cruciferae



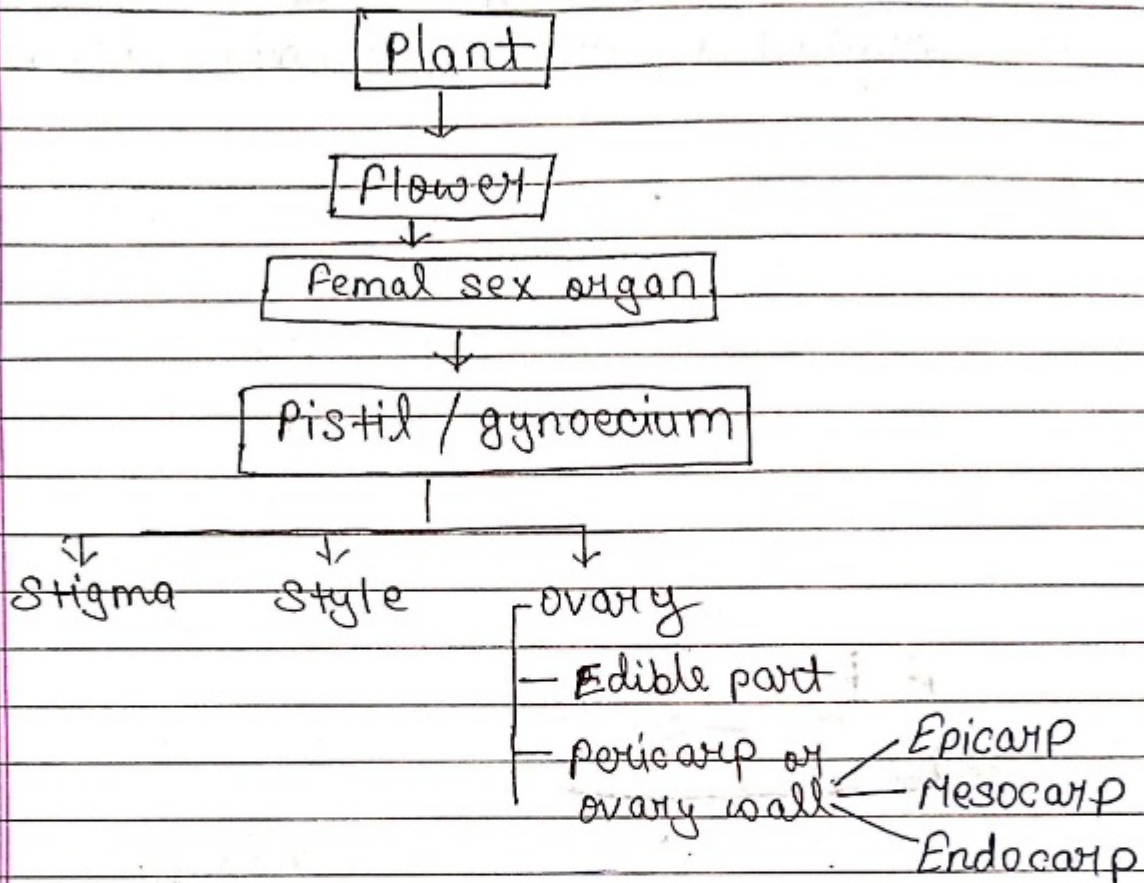
Free central - when the ovules are born on central axis and septa are absent
 ex - Dianthus, Primrose



- ⑤ Basal placentation - Placenta develops at the base of ovary and a single ovule is attached to it eg - sunflower, marigold.

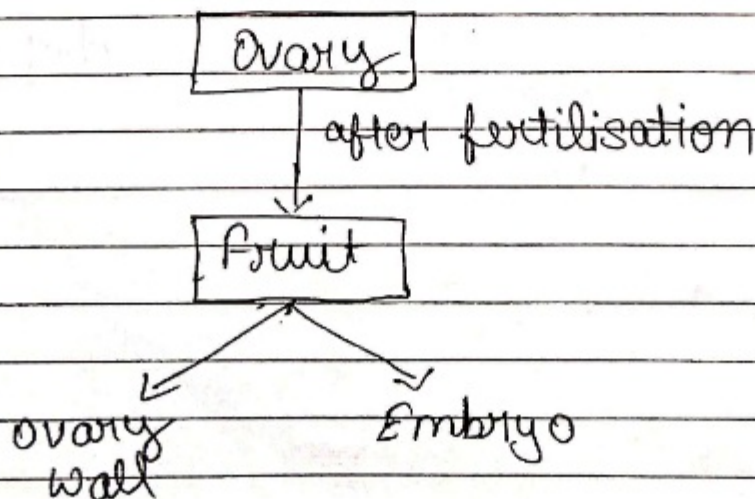


* Fruit



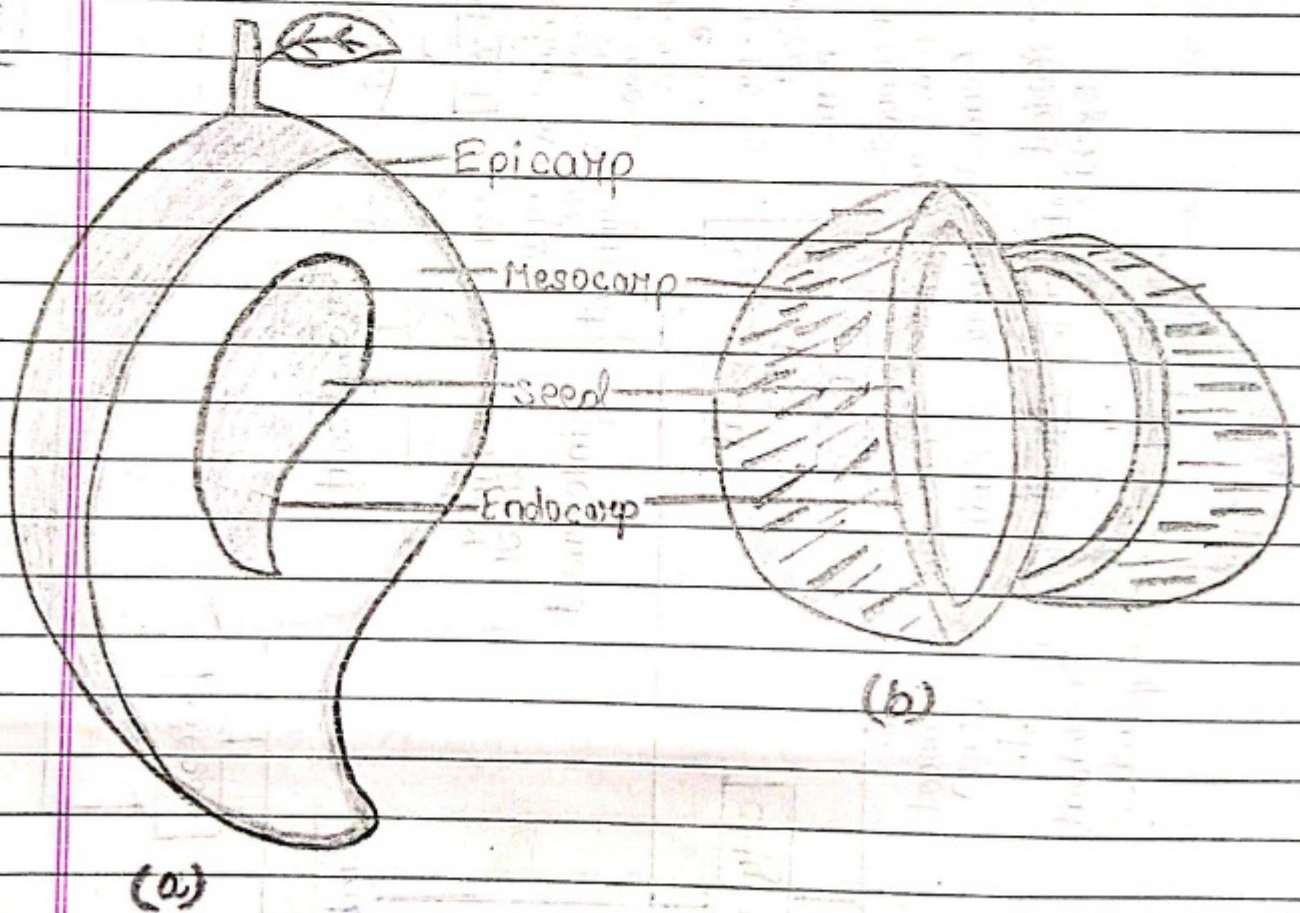
* Fruit

- fertilised ovary
- If fruit is formed without fertilization of ovary called as parthenocarpic fruit.



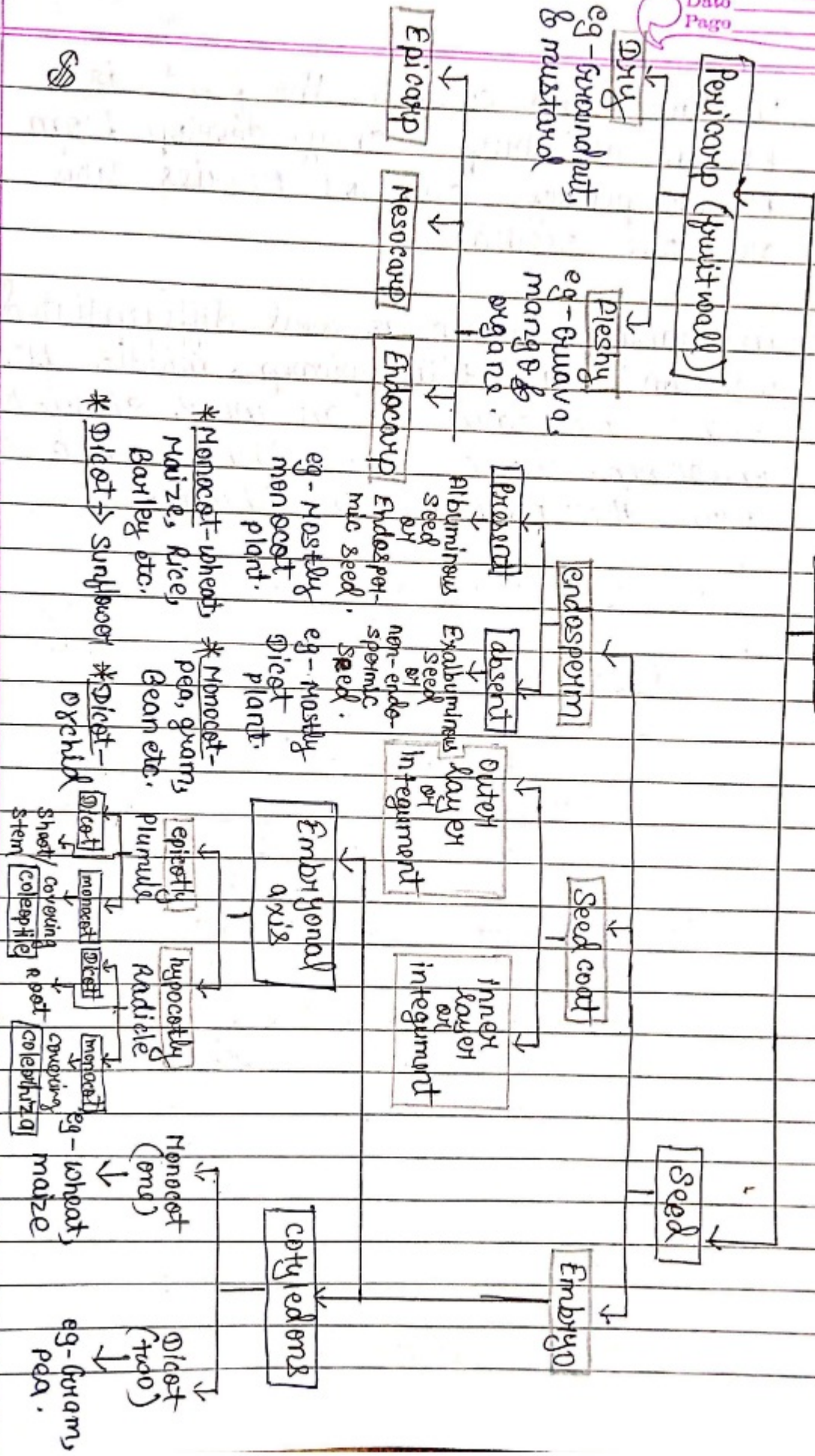
→ In Mango and coconut, the fruit is known as drupe. They develop from Monocarpellary superior ovaries and are one seeded.

→ In mango pericarp is well differentiated into an outer thin epicarp, middle fleshy edible mesocarp and an inner stony hard endocarp. In coconut which is also a drupe, the mesocarp is fibrous.



a) Mango b) Coconut

Fruit



* Seed

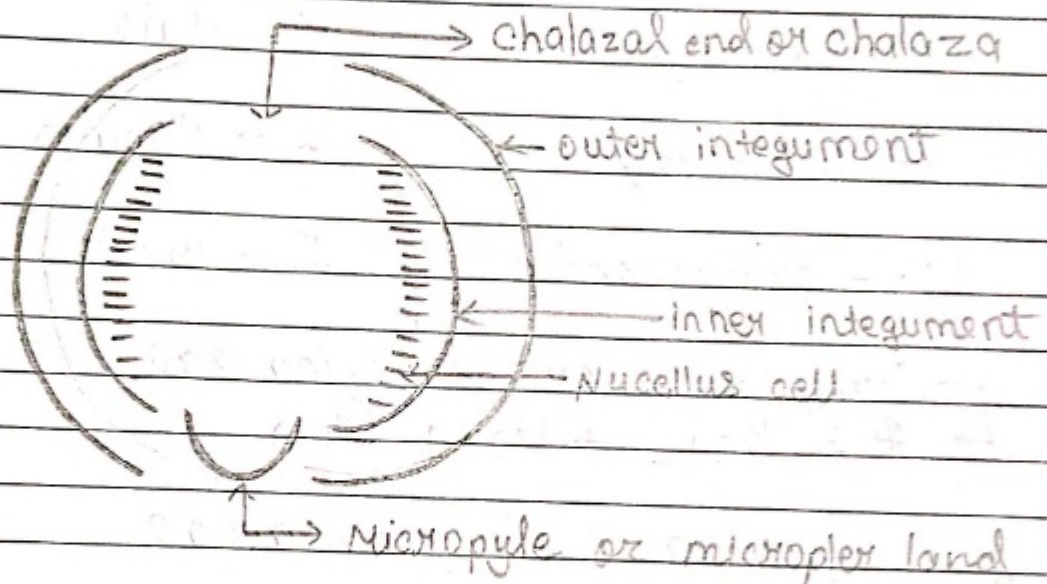
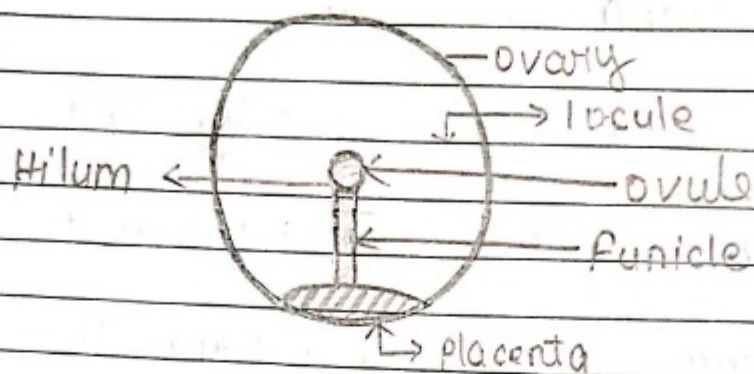
- Develops after fertilisation of ovules.
- seed contains seed coat and Embryo
- Embryo is made up of radicle / Plumule or embryonal axis, cotyledon.

* Dicot seed

- 2 cotyledon present
- outermost covering of a seed is seed coat.
- Seed coat has 2 layers [outer Testa & inner Tegmen]
- Hilum is a scar on the seed coat through which the developing seeds were attached to fruit.
- Above the hilum is a small pore called micropyle.
- Embryo - Embryonal axis + 2 cotyledon.

Monocot seed

- one cotyledon
- In the seeds of cereals such as maize the seed coat is membranous and generally fused with fruit wall.
- Endosperm is bulky and stores food.
- Outer covering of endosperm separates the embryo by a proteinous layer called Aleurone layer.
- Embryo consist of shield shaped cotyledon called Scutellum and short axis with plumule and radicle.
- Embryo is small and situated in a groove at one end of endosperm.
- Plumule enclosed in coleoptile & radicle in coleorhiza.



Outer integument - Testa

inner integument - Tegmen

Nucellus cell - act as megaspore mother cell (MMC) produce female gametophyte or embryonic sac have female gamete called egg cell.

* Floral Formula

K - Calyx / sepals

G - Superior

C - Corolla / petals

G - Inferior

A - Androecium / stamen

P - Perianth

G - Gynoecium / Pistle

♂ - Male

⊕ - Antinomorphic

♀ - Female

∴ - zygomorphic

♀ - Bisexual

Cruciferae or Brassicaceae
 ⊕ ♀ K₂₊₂ C₄ A₂₊₄ G₍₂₎

Leguminosae or Leguminaceae
 (a) Fabaceae
 ∴ ♀ K₍₅₎ C₁₊₂₊₍₂₎ A₍₉₎₊₁ G₁

Malvaceae
 Br. ⊕ ♀ Epik₃₋₇ K₍₅₎ C₅ A_∞ G_(5-∞)

Compositae (Asteraceae)
 ⊕ ♀ K_{proppus} C₍₅₎ A₅ G₍₂₎ → Disc. florets.
 Br. ∴ K_{proppus} C₍₅₎ A₀ G₍₂₎ → Ray florets.

Graminal (Poaceae)
 Br. ∴ ♀ P₂ A₃ G₁

for own knowing

1. Cruciferae or Brassicaceae

$$\oplus \quad \text{♂} \quad K_{2+2} \quad C_4 \quad A_{2+4} \quad \underline{G}_{(2)}$$

$\oplus$ - Actinomorphic

♂ - bisexual or Hermaphrodite

K_{2+2} - 4 sepals arrange in 2+2, condition -
 C_4 - Corolla 4 polypetalous polysepalous

A_{2+4} - Stamen 6

$\underline{G}_{(2)}$ - 2 $\rightarrow$ bicarpellary, () $\rightarrow$ Syncarpous,
superior ovary. (apocarpous)
bracket nahi hai

2. Leguminosae or Leguminaceae

a) Fabaceae

$$\hookrightarrow \text{Y. } \text{♀} \quad K_{(5)} \quad C_{1+2+(2)} \quad A_{(9)+1} \quad \underline{G}_{(1)}$$

Y. - Zygomorphic

♀ - bisexual

$K_{(5)}$ - 5 sepals Gymosepalous

$C_{1+2+(2)}$ - 5 petals

$A_{(9)+1}$ = 10 stamens, diadelphous

$\underline{G}_1$ - Monocarpellary, ^{apocarpous} superior ovary.

3. Malvaceae

Br. $\oplus$ Epik 3-7 $K(5)$ C_5 A_∞ $G(5-\infty)$

Br. - Bracteate

$\oplus$ - Actinomorphic

Epik - Bisexual

Epik 3-7 - Epicalyx

$K(5)$ - 5 sepals. Gymosepalous

$C(5)$ - 5 petals, epipetalous condition [petals fused with stamens]

A_∞ - Many stamens.

$C_5 A_\infty$ - epipetalous condition

$G(5-\infty)$ - Gynoecium, pentacarpellary or multicarpellary [syncarpellary].

4. Compositae (Asteraceae)

Ray floret - Br. γ . $Kpappus$ (5) A_0 $G(2)$

Br - Bracteate [unisexual female flower]

γ - Zygomorphic

$Kpappus$ - sepals are hair like

$C(5)$ - 5 petals, gampetalous

A_0 - stamen absent

$G(2)$ - bicarpellary, syncarpous, inferior ovary

Disc florets

⊕ ♂ Krappus $C(5) A_5 G(2)$

⊕ - Actinomorphic

♂ - bisexual

Krappus - Sepals are hair like (calyx papuse me hai)

$C(5)$ - 5 petals, gamopetalous

A_5 - 5 stamens polysepalous

$G(5)$ $C(5) A_5$ - Epipetalous

$G(2)$ - bicarpellary, syncarpous, inferior ovary.

⑤ Guimarae (Poaceae)

Br. 1. ♂ $P_2 A_3 G_1$

Br - Bracteat

1. - Zygomorphic

♂ - bisexual

P_2 - 2 perianth $\Rightarrow$ sepal + petal = Perianth [unit of perianth = Papal]

A_3 - 3 stamens, polysepalous

G_1 - Superior ovary, monocarpellary.

Important families

① - Cruciferae or Brassicaceae

Habit - Annual, biennial or perennial herbs.

Root - Tap root Pleshy in Radish (*Raphanus sativus*) and Turnip ~~tea~~ (*Brassica napus*).

Stem - herbaceous or rarely woody.

Leaves - leaf base, sessile simple or rarely compound.

Inflorescence - Usually raceme.

Fruit - Silique or silicula

Seed - Non-endospermic.

NS* Economic importance

1. Food yielding plants:

- i) Yellow mustard (*Brassica campestris*)
- ii) White mustard (*Brassica alba*)
- iii) Black mustard (*Brassica nigra*)
- iv) Indian mustard or Rye (*Brassica juncea*)
- v) Radish (*Raphanus sativus*)

- vi) Turnip or shalgam (*Brassica rapa*)
- vii) Cabbage or Pattagobhi (*Brassica oleracea* var *capitata*)
- viii) Cauliflower or phoolgobhi (*Brassica oleracea* var *botrytis*)

2) Ornamental plants:

- i) Candytuft (*Iberis amara*)

Note:- Pungent smell of mustard oil is due to a presence of S-containing glycoside called *singrine*.

~~Leguminosae or Leguminaceae~~

* Systematic Position

Domain : Eukarya

Kingdom : Plantae

Division : Angiospermae

Class : Dicotyledonae

Order : Parietales

Family : Cruciferae (*Brassicaceae*)

- Commonly know as mustard family.
- It is a dicot family.

② - Leguminosae or Leguminaceae

* Systematic position

Domain : Eukarya

Kingdom : Plantae

Division : Angiospermae

Class : Dicotyledonae

Order : Rosales

Family : Leguminosae

Habit - Herb, shrub.

Root - Root nodules.

Leaf - pulvinate, stipulate, simple or pinnately compound, reticulate venation.

a) Fabaceae

- Vegetative characters

Habit - Trees,

Leaves - pulvinate, stipulate, simple or pinnately compound, reticulate venation.

Inflorescence :- Racemose

Fruit - Legume

Seed - One to many, non-endospermic.

* Economic importance

1. Many plants belonging to the family are sources of pulses.

- i) Gram (*Cicer arietinum*)
- ii) Arhar or Pigeon pea (*Cajanus Cajan*)
- iii) Sem
- iv) Moong
- v) Soyabean

2. Edible oil:

- i) Soyabean (*Glycine max*)
- ii) Groundnut or Peanut (*Arachis hypogea*)

3. Dye:

- i) Indigofera (Neel)

4. Fibres:

- i) Sunhemp (*Crotalaria juncea*)

5. Fodder:

- i) Sesbania
- ii) Trifolium

6. Ornamentals:

- i) Lupin
- ii) Sweet pea (*Lathyrus odoratus*)

7. Medicine:

i) Muliathi

Note:

- a) Green Gram (mung bean); *Vigna radiata*.
b) Pea or Garden pea; *Pisum sativum*.

③ Malvaceae

Systematic position

Domain : Eukarya

Kingdom : plantae

Division : Angiospermae

Class : Dicotyledonae

Order : Malvales

Family : Malvaceae

Vegetative characters

Habit - Herbs, shrubs (eg, *Hibiscus rosa-sinensis*) or rarely trees.

Floral characters

Inflorescence - Usually the flowers are solitary axillary

Flower - Actinomorphic, bisexual, pentamerous.

Fruit - Fruit is capsule or berry.

Seed - Endospermic

Economic importance

1. Bhindi or Okra or Lady's finger (*Abelmoschus esculentus*).
2. Cotton or Kapas (*Gossypium* sp.) - Source of oil and fibre.
 - Cotton fibre is obtained from seed coat of *Gossypium*.
3. Madras Hemp (*Hibiscus cannabinus*): Also called raton & used in rope industry.
4. Guirhal or china rose (*Hibiscus rosa sinensis*): Ornamental.

Note: Most of the economically important fibre yielding plants belong to family malvaceae.

④ Compositae (Asteraceae)

Systematic position

Domain : Eukarya

Kingdom : Plantae

Division : Angiospermae

Class : Dicotyledonae

Order : Asterales

Family : Compositae (Asteraceae)

> Asteraceae is also called Sunflower family.

> Asteraceae is the largest family of angiosperms having largest number of genera and species of plants.

- Date _____
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- Asteraceae family is most advanced among angiosperm.

Vegetative characters

Habit: Herbs, shrubs or rarely trees.

Floral characters

Inflorescence: Capitulum or head

Fruit: Cypsella

Seed: Non-endospermic

Economic importance

1. Sunflower (*Helianthus annuus*): Ornamental & source of unsaturated edible oil.
2. Marigold: (*Tagetes erectus*)
3. Carpet grass or Congress grass (*Pennisetum*)
 - *Pennisetum* is a weed growing in all parts of India.
4. Chrysanthemum: A commercial insecticide is got from inflorescence of this plant named pyrethrum.
5. *Carthamus tinctorius*: Red dye is obtained for dyeing silk from the petals and edible oil obtained from seeds.

6. *Artemesia annua* : Santemini drug is prepared from the flower of *Artemesia* which is used in removing the worms from the body.

(5) Graminae (Poaceae)

Systematic position

Domain : Eukarya
Kingdom : Plantae
Division : Angiospermae
Class : Monocotyledonae
Order : Poales
Family : Poaceae

- Poaceae or Gramineae is a large family of Monocotyledonous flowering plants commonly known as grasses.

Vegetative Characters

Habit:- Herbs, shrubs and trees.
Root - Fibrous root
Leaves - Sheathing leaf base, sessile

Floral characters

Perianth - The perianth is reduced to two scales, called lodicules.

Fruit - Caryopsis (one seeded)

Economic importance

1. Cereals:

- i) Wheat (*Triticum aestivum*)
- ii) Rice (*Oryza sativa*)
- iii) Maize (*Zea mays*)

2. Millets

- i) Jowar (*Sorghum vulgare*)

- Rice, wheat and maize contribute maximum to global food production.
- Major crop of Asia is rice.
- Doob grass (*Cynodon dactylon*)
- Sugarcane (*Saccharum officinarum*): Sugarcane is the major source of sugar production.
- Lemon grass is a grass used as a culinary herb for its citrus-like flavor and scent.