Paper - VI : Morphology & Taxonomy of Angiosperms.

Unit - I : MORPHOLOGY OF ANGIOSPERMS

Introduction :⇨

→ Spermatophytes (seed-bearing) plants have two major groups, Gymnosperms and Angiosperms
→ In gymnosperms seeds are naked i.e. seeds are not enclosed within the ovary.
→ In Angiosperms seeds are enclosed within the ovary.
→ Geologically, angiosperms are young group of ~~flowers~~ plants.
→ They have different forms & habitats such as herbs shrubs & trees.
→ Angiosperms are also differ in size.
→ For proper study, angiospermic plants are grouped into different catagories
→ " Study of external features of plants, is called as plant morphology.
→ Typical angiospermic plants consists of a long, cylindrical axis, which is differentiated into underground root system & aerial shoot system.
→ Root system consists of root & its lateral branches.
→ Shoot system consists of stem, branches, leaves.
→ Root, stem & leaves are the vegetative parts.
→ At maturity flowering plant produces flowers, fruits and seeds, These are called reproductive parts

ROOT :⇒

" Root is a non-green underground descending part of the plant axis."

* Characters of root :=

→ Root is non-green & hence non-photosynthetic.
→ It is descending part of plant axis.
→ Root grows towards gravity & hence it is positively geotrophic.
→ It grows away from the sunlight & hence it is negatively phototrophic.
→ It is not divided into nodes & internodes.
→ It bears unicellular hair called root hair, which absorb water & minerals from the soil.

* Types of root system :=

There are two types of root systems in plants, which are as follows:

1] Tap root system
2] Adventitious root system.

1] Tap root system :=

→ This root system is formed from the radicle of embryo.
→ Direct prolongation of radicle forms primary root.
→ It persists and grows downwards.

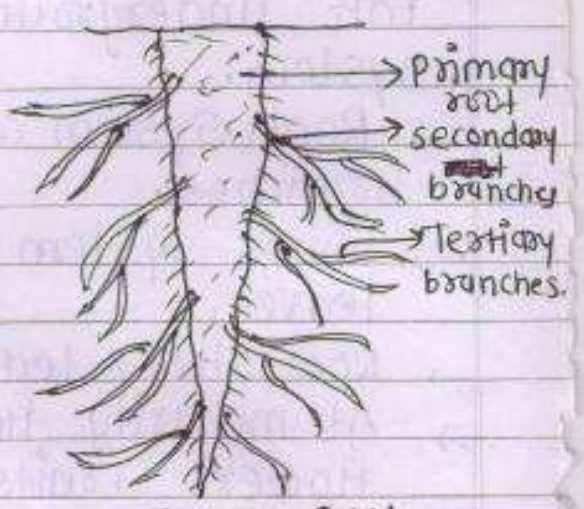


Fig. Taproot System.

→ The branches developed on primary root are called secondary branches.
→ The branches developed on secondary branches are called tertiary branches.
→ Fine branches are called root hair.
→ Presence of tap root system is a ~~me~~ characteristic feature of dicotyledons.
e.g. Pea, Bean, Gram, etc.

2] Adventitious root system :⇒

→ Primary root is short lived. It is replaced by many thin roots developed from the base of stem.
→ These roots are thread like, called fibrous / adventitious roots.

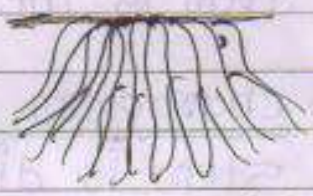


Fig. Adventitious root system.

→ Such types of roots are also developed from nodes of stem. e.g. Maize, Sugercane, etc.
→ Thus roots developing from any other part of plant except radicle are called as adventitious roots.
e.g. Jawar, Maize, etc.
→ Adventitious roots are the characteristic feature of ~~dic~~ monocotyledons.

☆ Function of Root :-

→ Roots absorbs water & minerals from soil.
→ They provide mechanical support to the plant-body.
→ It also conducts water & minerals & provide to the aerial parts of plant.
→ Roots of some plants store food-material. e.g. Carrot.

→ Root nodules of leguminous plants fixes atmospheric nitrogen, with the help of nitrogen fixing bacteria.
e.g. Methi
→ In some plants roots provide mechanical support to the plant which is additional
e.g. Banyan tree, Maize, etc.

Stem :⇒

"Stem is the ascending part of the plant axis."

* characters of stem :⇒

→ Stem is directly developed from plumule.
→ It bears branches, leaves & flowers.
→ It grows towards light hence it is positively ~~photosynthetic~~ phototrophic.
→ It grows away from gravity hence it is negatively geotrophic.
→ It bears nodes & internodes.
→ In young condition, the stem is green in colour.
→ Stem bears different types of buds i.e. Floral bud terminal bud, axillary bud, vegetative bud.
→ Vegetative bud helps in the continuous growth of stem.
→ Floral bud stop the growth of stem.
→ Place of stem from which leaves arises is ~~node~~ known as node while the space between two successive nodes is called internode.
→ Stem may be erect or weak.

→ Habit of plants : on the basis of nature of stem & it's height plants have following habits.

[1] Herbs : These are small plants with soft stem.

According to the duration of their life plants may be classified as annual, biennials & perennials.

ⓐ Annuals :- Plants which completes their whole life cycle within a single year is are called as annual plants.

→ means plant produces flowers, fruits and seeds in a single year.

e.g. Mustard, Bean, Pea, etc.

ⓑ Biennials :- Plants which completes their life cycle in two years.

e.g. Beet, Carrot, etc.

ⓒ Perennials :- These are the plants which requires more than two years to complete their life cycle.

e.g. Canna, Ginger etc.

[2] Shrubs :- These are medium-sized plants, which have hard & woody stem.

→ They are branched & branching is profuse near to the ground.

e.g. China rose.

[3] Trees :- These are the large plants, with a single stout, trunk & hard having woody branches.

e.g. Neem,

Modifications of stem :-

[1] Stem Tendril :-

→ Stem tendrils are highly specialised climbing organs.
→ They are slender, thread-like, wiry structures which can coil around a support & help the plant to climb.
→ It develops from the leaf axil.
e.g. Cucurbita, Luffa, Passion flower.

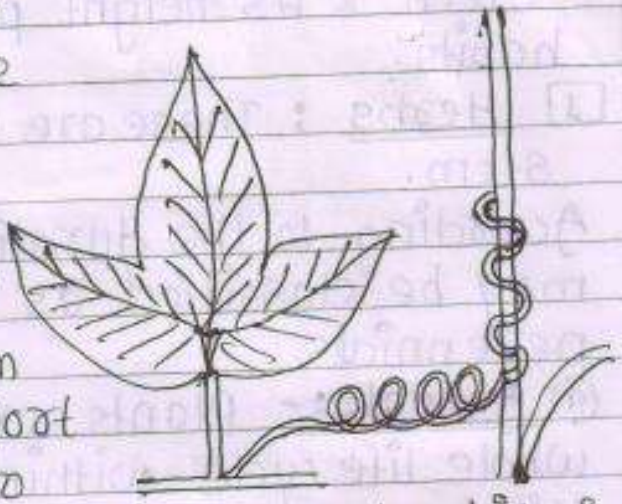


fig. stem tendril of Passion flower.

[2] Phylloclade :-

→ Phylloclade is also called as cladophyll.
→ Phylloclade is found in xerophytic plants.
→ Phylloclade is green flattened, cylindrical stem.
→ It performs the function of photosynthesis.
→ Sometimes phylloclade bears modified leaves in the form of scales or spines.
→ It also functions as storage organ.
→ It stores water.
e.g. Opuntia.

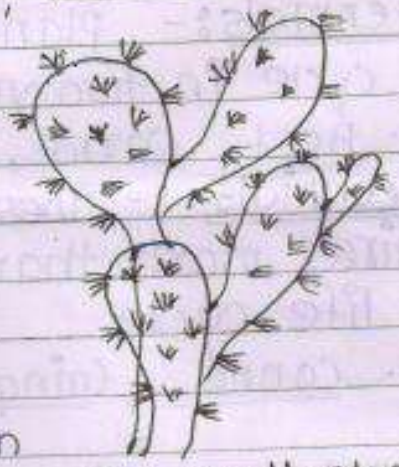


fig. Phylloclade of Opuntia.

[3] Tuber :=

→ Thubers are the swollen ends of special underground stem branch.
→ They store food material & also functions as vegetative propagation.
→ Due to accumulation of food underground branch becomes turgid or it swells at apex & forms spherical structures.
→ These spherical structures are called "tubers".
e.g. Potato.
→ On potato tuber there are no of eye or buds which grows into new plants.

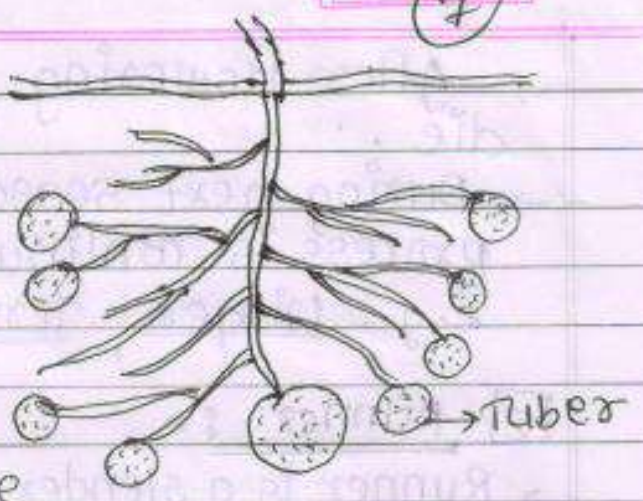


Fig. Tubers of Potato

[4] Rhizome :=

→ Rhizome is a thickned prostrate underground stem.
→ It has nodes and internodes.
→ Scale leaves are present at nodes.
→ The stem has terminal buds and adventitious roots.
→ Rhizome may be branched or unbranched.
→ It remains dormant underground and with the approach of fevourable conditions, terminal buds grows into aerial shoot.

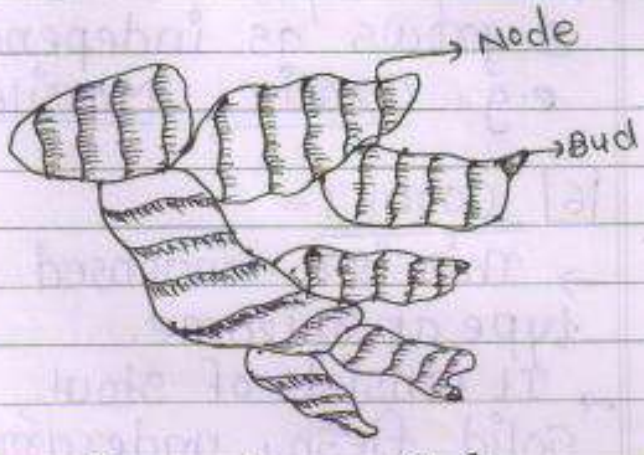


Fig. Rhizome of ginger

→ After flowering, aerial parts ~~may~~ may be die.
→ During next season (year) buds grows & process is continued year after year.
e.g. Ginger, Termeric etc.

[5] Runner :=

→ Runner is a slender, prostrate branch, creeping on the ground.
→ It has roots on nodes.
→ It has nodes and internodes.
→ Runner develops as an axillary bud & creeps sometimes away from mother plant.
→ They may be break off from the mother plant & grows as independent daughter plants.
e.g. Oxalis, Marsilea, etc.

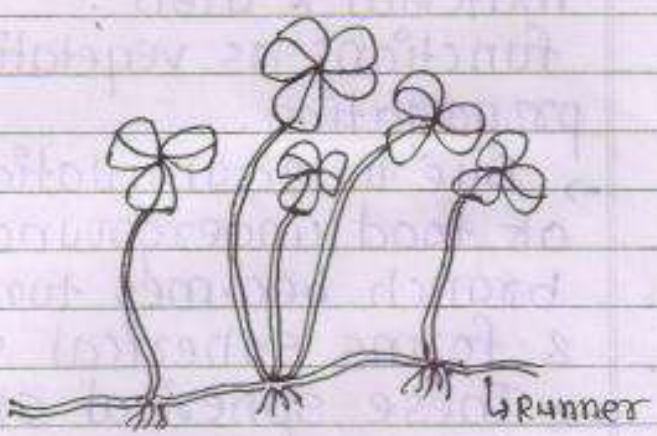


Fig. Runner of Oxalis

[6] Corm :=

→ This is a condensed type of rhizome.
→ It consists of stout, solid, fleshy, underground, stem which grows in vertical direction.
→ It is more or less round in shape or often somewhat flatened from top to bottom.
→ It contains heavy deposition of food material.


Fig. Corm of Gladiolous.

→ It bears one or more buds in the axil of scale leaves, some of these buds develops into daughter corms.
→ Adventitious ~~buds~~ roots develops from the base, sometimes also developed from the sides. e.g. Gladiolous, Amorphophallus, etc.

✳ Functions of stem :-

→ Main function of stem is to bear leaves, branches flowers & fruits.
→ Main stem is thick & stout, hence it keeps the plant in erect position.
→ It holds the flowers in such a way that they get easily ~~pollinated~~ pollinated.
→ It conducts water & minerals from root to leaves.
→ It also transports food material from leaf to other part of ~~pla~~ plant body.
→ In some cases it stores food-material e.g. Potato, Ginger, etc.
→ The stem is fleshy & store food material. eg. Phylloclade of opuntia.

Leaf :⇨

Defination :- "Leaf is a flattened, lateral outgrowth of the stem or branch."

→ It develops exogenously [i.e. superficial tissues] from node.

→ It is green in colour and hence photosynthetic.

→ It has bud in its axil.

Structure of a typical leaf [Hibiscus] :=

A typical leaf [Hibiscus] consists of following parts :

1] Leaf base
2] Petiole
3] Leaf lamina/leaf blade.

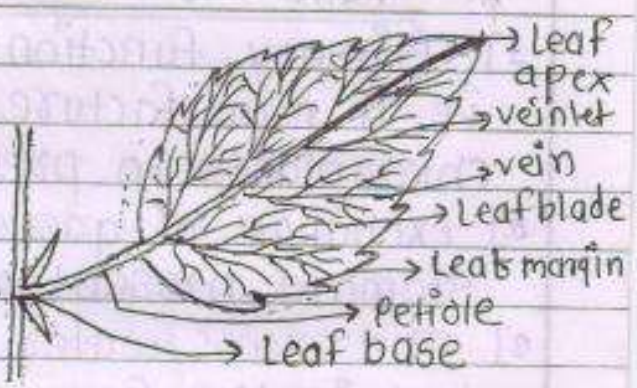


fig. Parts of a leaf [Typical leaf]

1] **Leaf base** := It is the part of leaf which is attached to the stem. In many dicots, leaf bears two lateral outgrowth known as "stipules". They protect young leaves and axillary buds.

→ A leaf with stipule is called "stipulate" leaf, while leaf without stipule is called "exstipulate" leaf.

2] **Petiole** := The stalk of leaf is called as petiole.

→ It joins leaf lamina to the leaf base. It pushes out the leaf blade and thus helps it to secure more sunlight.

→ A leaf with petiole is called "petiolate" leaf while the leaf ~~petiolate~~ without petiole is called "sessile" leaf.

3] Leaf lamina / Leaf blade :- It is the green flat and expanded portion. In the centre a prominent vein called midrib is present. It runs through the leaf lamina from its base to its apex. It produces veins, veins gives rise to veinlets. Leaf lamina is most important part of leaf because it synthesise food material for the entire plant.

Functions of leaf :-

1] Primary function of leaf is photosynthesis. i.e. it manufacture food with the help of Chloroplasts in presence of sunlight.
2] Exchange of gases takes-place through the Stomata present on leaves.
3] The excess water absorbed by root hair is lost in the form of water vapours through Stomata on leaves. It is called transpiration.
4] Fleshy leaves of succulents store water and food material. e.g. Aloe.
5] Some leaves of plant produces buds on them which grows into new plant. e.g. Bryophyllum.

Phyllotaxy :- (Phylla - leaves, taxis - arrengment)

[Phylla → leaves ; taxis → arrengment]

"Phyllotaxy is defined as "the mode of arrengment of leaves on stem or branches".

→ The purpose of this arrengment is to avoid shading one another, so that the leaves may get the maximum amount of sunlight to perform their normal function i.e. photosynthesis.

There are three types of phyllotaxy in plants, which are as follows :
1] Alternate phyllotaxy
2] Opposite phyllotaxy
3] Whorled phyllotaxy

1] Alternate phyllotaxy :=
When a single leaf arises at each node the phyllotaxy is called as alternate phyllotaxy.
e.g. chinarose, mustard, sunflower, Tobacco etc.

2] Opposite phyllotaxy :=
When two leaves arises at each node, standing opposite to each other, such phyllotaxy is called as opposite phyllotaxy.
→ opposite phyllotaxy is again differentiated into (a) opposite decussate phyllotaxy.
(b) opposite superposed phyllotaxy.

(a) Opposite decussate :- In this type one pair of leaves stands right angle to the adjacent pair. e.g. Ocimum, Calatropis, etc.

(b) Opposite superposed phyllotaxy :-
In this type, the pairs of leaves of adjacent nodes lie in same plane.
e.g. Guava, etc.

3] Whorled phyllotaxy :=
When there are more than two leaves at each node & these are arrenged in a circle or whorl, the phyllotaxy is called as whorled phyllotaxy.
e.g. Nerium

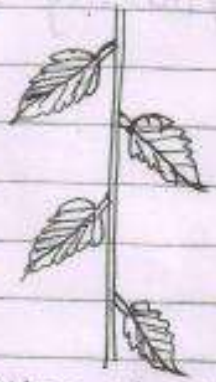


Fig. Alternate phyllotaxy
e.g. ching rose

Fig. opposite decussate Phyllotaxy
e.g. calatropis

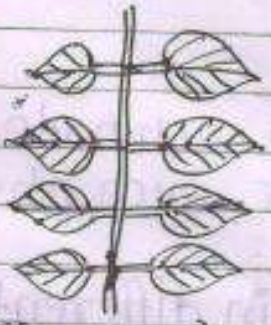


Fig. opposite superposed phyllotaxy
e.g. Guava

Fig. Whorled phyllotaxy
e.g. Nerium.

Venation :⇒

"The arrengment of veins & veinlets in leaf lamina is known as venation".

→ Veins are rigid linear structures which arises from the petiole and the midrib.

→ There are main types of venation :
1. Reticulate venation
2. Parallel venation.

1] Reticulate venation :=

"When veins & veinlets are irregularly distributed in leaf lamina forming a network such type of venation is called as "reticulate venation".

→ Presence of reticulate venation is a characteristic feature of dicotyledons.

Reticulate venation is of again two types :-
(a) Reticulate unicostate venation
(b) Reticulate multicostate venation

(a) Reticulate unicostate venation :→
In this type, there is a single strong midrib, which gives off lateral veins. These veins run towards margin or apex of leaf & produces smaller veins, which connect with each other forming a network.
e.g. Peepal, mango, Guava etc.

(b) Reticulate multicostate venation :-
In this type of venation number of strong veins arises from the tip of petiole and run towards margin or apex of leaf. These veins connected to veinlets and forms a network.
→ Reticulate multicostate venation is again of two types :
i) Reticulate multicostate convergent type :-
The strong veins converge to the apex of leaf. They run in curved manner from the base of leaf lamina to its apex.
e.g. Zizyphus, cinnamomum etc.
ii) Reticulate multicostate divergent type :-
The strong veins diverge from each other towards the margin of leaf.
e.g. Castor, Cucumber etc.

2] Parallel venation :=
"When the veins runs parallel to each other, such type of venation is called parallel venation."
→ Presence of parallel venation is a charactristic feature of monocots.

Parallel venation is of again two types i.e.
1] Parallel unicostate venation
2] Parallel multicostate venation

1] Parallel unicostate venation :-
In such type of venation there is a single prominant midrib, which gives rise lateral veins. These veins runs parallel to each other towards margin or apex of leaf lamina.
e.g. Canna, Banana, Ginger, Turmeric etc.

2] Parallel multicostate venation :-
In this type of venation, number of prominant [Strong] veins arises from the petiole and runs parallel towards the margin or leaf apex.
→ Parallel multicostate venation is of again two types i.e. (a) Parallel multicostate convergent type &
(b) Parallel multicostate divergent type.

(a) Parallel multicostate convergent type :-
The strong veins converge to the apex of leaf lamina in parallel manner. They runs in curved manner from the base of leaf lamina to its apex.
e.g. Bamboo, Rice etc.

(b) Parallel multicostate divergent type :-
The strong veins diverge from each other towards the ~~leaf lamina~~ margin of leaf blade in parallel manner.
e.g. Fanpalm

Fig. Reticulate unicostate
e.g. Peepul

Fig. Reticulate multicostate convergent
e.g. Cinnamomum

Fig. Reticulate multicostate divergent
e.g. Cucumber

Fig. Parallel unicostate
e.g. Canna

Fig. Parallal multicostate convergent
e.g. Bamboo

Fig. Parallel multicostate divergent
eg. Fanpalm

Types of Leaf :-

There are two types of leaf : (a) simple leaf
(b) compound leaf.

(a) simple leaf :-

When the leaf consists of a single leaf blade which is entire is called as simple leaf.

→ It may be incised but not down to the petiole or midrib.

e.g. Mango, china rose etc.

Fig. Simple leaf of china rose

(b) compound leaf :-

When the leaf consists of incision on leaf blade which goes down to the midrib or petiole, such type of leaf is called as compound leaf.

→ A leaf is broken into number of ~~leaflets~~ called segments called leaflets.

→ Compound leaf is again differentiated into
i) Pinnately compound leaf &
ii) Palmately compound leaf.

i) pinnately compound leaf :-

The leaf in which, midrib bears number of leaflets, arrenged on both sides, is known as pinnately compound leaf.

→ Pinnately compound leaf is of again following types :

(a) **Unipinnate :=**

When the midrib bears leaflets directly, it is called unipinnate.

→ unipinnate leaf having even number of leaflets is called 'paripinnate'.
e.g. Cassia, Ashok, Tamarind etc.

→ unipinnate leaf having odd number of leaflets and an odd terminal leaflet is called "imparipinnate"
e.g. Neem, Murraya, Rose etc.

(b) **Bipinnate :=**

When the compound leaf is twice pinnate, i.e. midrib produces secondary axis which bears leaflets is called as bipinnate
e.g. Sensitive plant [Mimosa], Dwarf gold mohar.

(c) **Tripinnate :=**

When the compound leaf is thrice pinnate i.e. secondary axis produces tertiary axis which bears the leaflets is called tripinnate.
e.g. Moringa.

(d) **Decompound :=**

When the leaf is more than thrice pinnate, it is called "Decompound" leaf.
e.g. Coriander etc.

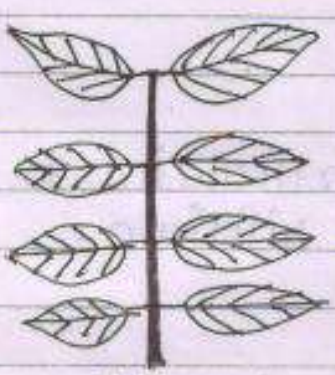


Fig. unipinnate paripinnate
e.g. cassia

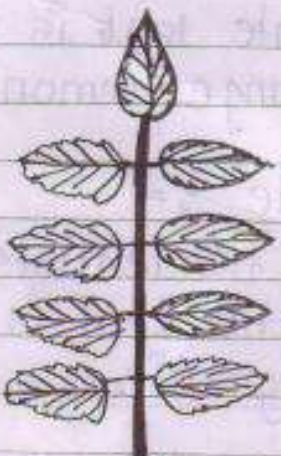


Fig. unipinnate imparipinnate
e.g. Rose

Fig. Bipinnate
e.g. Dwarf gold mohar

Fig. Tripinnate (e.g. moringa)

Fig. Decompound leaf
e.g. Coriander.

→✱← Palmately compound leaf :→

The leaf in which petiole bears terminally articulated to it, a number of leaflets which seem to be radiating from a common point, like fingers from the palm is known as palmately compound leaf.

→ Palmately compound leaf is of following types :

ⓐ Unifoliate :-

When single leaflet is articulated to the petiole the leaf is called unifoliate.

→ Unifoliate leaf is very rare.

e.g. orange, lemon etc.

ⓑ Bifoliate :-

When two leaflets are articulated to the petiole, the leaf is called bifoliate.

e.g. Bignonia

© Trifoliate :=

When three leaflets are articulate to the petiole, the leaf is called trifoliate.
e.g. Oxalis, Aegle, etc.

(d) Quadrifolfate :=

When four leaflets are articulated to the petiole the leaf is called as quadrifoliate.
e.g. Marsilea

(e) Multifolfate :=

When more than four leaflets are articulated to the petiole the leaf is called multifoliate leaf. e.g. Bombax, Cynandropsis, etc.

Fig. Unifoliate
e.g. Citrus

Fig. Bifoliate
e.g. Bignonia

Fig. Trifoliate
e.g. Aegle

Fig. Quadrifoliate
e.g. Marsilea

Fig. Multifoliate
e.g. Cynandropsis

Fig. Palmately compound leaves.

Inflorescence :⇒

"The reproductive shoot bearing commonly a number of flowers or sometimes only a single flower, is called as inflorescence"

→ Inflorescence may be terminal or axillary.
→ The stalk of inflorescence is called as peduncle.
→ Depending upon the mode of branching inflorescence is classified into two groups/types : 1] Recemose &
2] cymose.

1] Racemose Inflorescene :=

→ It is the inflorescence of indefinite growth.
→ Main axis does not terminate into a flower & hence grows continuously.
→ Lower flowers are older and open earlier while the upper flowers are younger & open afterwards.
→ Type of arrengment of flower in which older flowers present at base & younger flower towards the apex is called as "acropetal succession".
→ Types of Racemose inflorescence is of following :
ⓐ Raceme
ⓑ Spike
ⓒ Umbel
ⓓ Head/capitulum.

(a) Raceme :-

→ In raceme inflorescence main axis is elongated and bears number of stalked flowers laterally.

→ older flowers have long stalk than younger flowers.

e.g. Dwarf gold mohar, Mustard, Radish, etc.

→ When the main axis is branched & lateral branches bears flowers then the inflorescence is called as "compound raceme" or "Panicle".

e.g. Gold mohar.

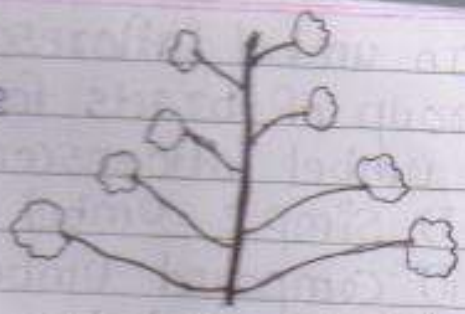


Fig. Raceme of dwarf gold mohar.

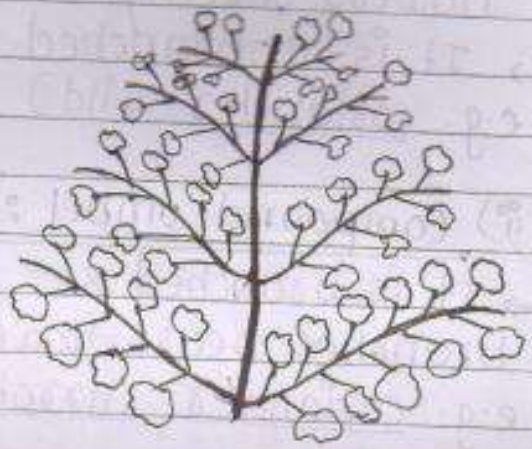


Fig. Panicle of gold mohar.

(b) Spike :-

→ Main axis is elongated, lower flowers are older and opens earlier than upper.

→ Flowers in spike inflorescence are "sessile".

e.g. Adathoda, Amaranthus, Achyranthus, etc.

Fig. spike

(c) Umbel :-

→ In umbel inflorescence main axis is shortened & it bears a group of flower at tip.

→ These flowers bears unequal length of pedicel i.e. some flowers has long stalk (Pedicel) or some has short stalk, so that flowers are seperated from common point.

→ In umbel inflorescence, there is always a group of bracts forming a involucre.
→ umbel inflorescence is of following type :-
i) Simple umbel &
ii) Compound umbel.

i) Simple umbel :-
→ main axis bears flowers directly.
→ It is unbranched
e.g. coriander (wild)

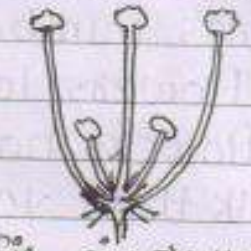


Fig. simple umbel

ii) Compound umbel :-
→ It is branched & branches bears flowers
e.g. coriander, Carrot, etc.

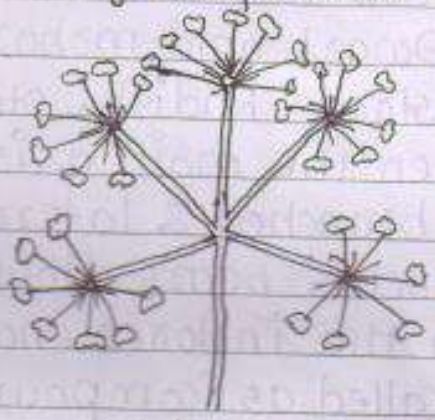


Fig. compound umbel.

→ Presence of umbel inflorescence is a charecteristic feature of family Apiaceae / Umbelliferae.

ⓓ Head / capitulum :-
→ In such type of inflorescence main axis is flat, called receptacle.
→ Receptacle bears small sessile florets. [florets ≠ flowers]
→ outer flowers are older & open earlier than inner flowers.
→ Two types of florets are present in head/ capitulum inflorescence. : ⓐ Ray florets & ⓑ disc florets

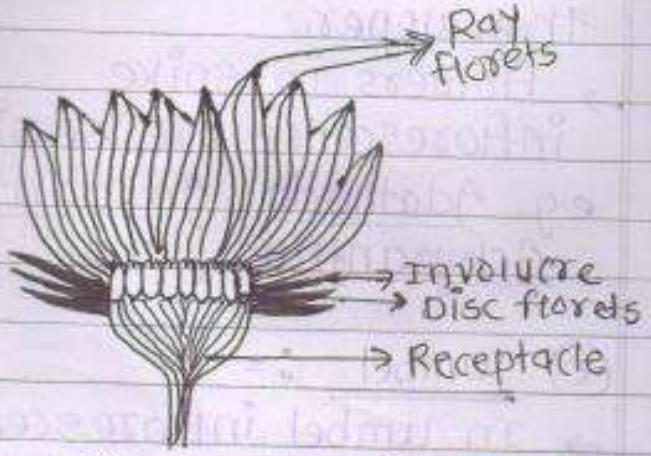


Fig. Head / capitulum of sunflower.

→ Ray florets are marginal & strap-shaped, while disc florets are central & tubular.
→ Although the inflorescence looks similar to the single flower, it consists of ~~small~~ number of sessile flowers.
→ Presence of capitulum / Head inflorescence is a charectristic feature of Asteraceae / Compositeae family.
eg. Tridax, sunflower, Mimosa, etc.

2] cymose inflorescence :⇒

→ It is the inflorescence of definite growth.
→ The growth of main axis is stopped early by the development of a flower at its tip.
→ Lateral axis which is developed below the terminal flowers also ends in flowers therefore it's growth is also stopped.
→ Terminal flowers are older & lateral flowers are younger.
→ The arrengment of flowers in which older flower present at the apex & younger flowers towards the base, is called "basipetal succession".
→ Cymose inflorescence is of following types :
ⓐ uniparous cyme
ⓑ Biparous cyme
ⓒ Multiparous cyme.

ⓐ Uniparous cyme :=

→ It is also called as monochasial cyme.
→ In uniparous cyme main axis ends in flowers & it produces only one lateral branch at the time of ending of flowers. later & ~~successiding~~ succeeding branches again produce only one branch at a time.

→ Uniparous cyme has following types:
i) Helicoid cyme &
ii) Scorpioid cyme.

i) Helicoid cyme :-
In this type lateral axis develops successively on the same side, forming a sort of helix.
e.g. Begnonia, Drosera, etc.

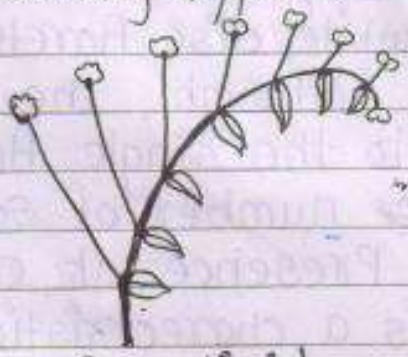


Fig. Helicoid cyme.

ii) Scorpoid cyme :-
→ In this type lateral axis develop on the alternate sides, forming a zig-zag pattern.
e.g. Geranium, Crassula etc.

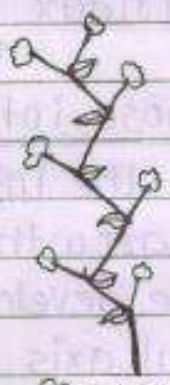


Fig. Scorpoid cyme.

(b) Biparous cyme :-
→ It is also known as dichasial cyme.
→ In this type main axis ends in flowers & at the same time it produces two lateral branches which bears flowers at it's tip.
e.g. Teak, Ixora, Jasmine, etc.

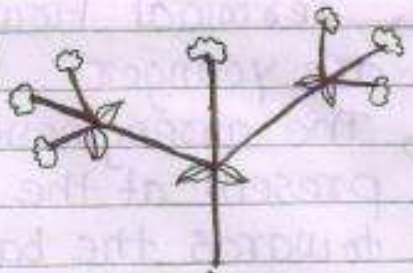


Fig. Biparous cyme.

(c) Multiparous cyme :-
→ It is also called as polychasial cyme.
→ main axis ends in flower & at the same time it produces no of lateral branches which bears flowers at its apex.
→ e.g. Calotropis, Asclepids, etc.

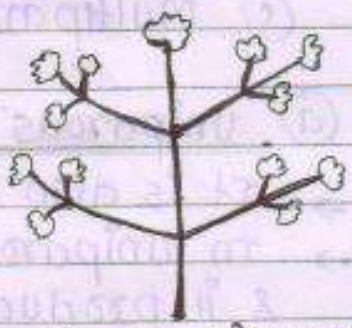


Fig. Multiparous cyme.

Special types of inflorescence :⇒

[1] Cyathium :-

→ This is a special type of inflorescence.
→ In cyathium there is a cup-shaped involucre provided with nector-secreting glands.

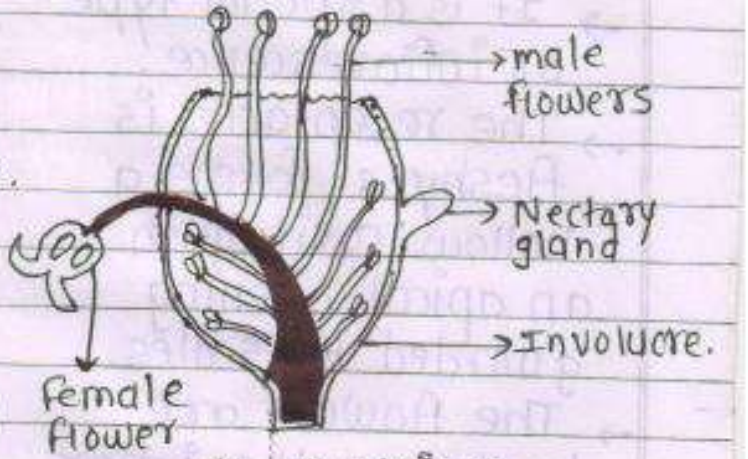


fig. Cyathium.

→ Involucre encloses a single female flower [reduced to pistil] in the centre & a number of male flowers [reduced to stamens] around it.
→ Female flower has long stalk than male flowers.
→ Each male flower has a scaly bract at base.
→ Female flower mature first than the male flower.
e.g. Euphorbia.

[2] Verticillaster :-

→ It is a special type of inflorescence.
→ There is a cluster of flowers in the axil of leaf, forming a false whorl at each node.
→ The first axis ends in a flower & bears two lateral branches which also ends in a flower.

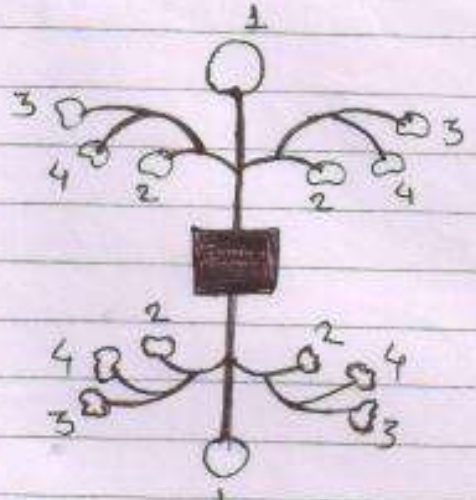


fig. Verticillaster inflorescence

→ Verticillaster inflorescence is a charactristic feature of Lamiaceae / Labiatae family.
e.g. Ocimum sanctum.

3 Hypanthodium :-

→ It is a special type of inflorescence.
→ The receptacle is fleshy & forms a hollow cavity with an apical opening guarded by scales.
→ The flowers are borne on the inner wall of cavity.
→ The female flowers are developed at the base of the cavity, while male flowers towards the apical opening.
→ e.g Fig, Peepul, Banyan tree, etc.

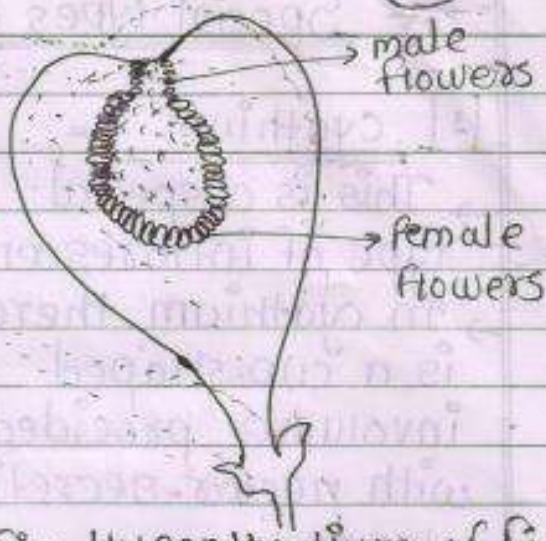


Fig. Hypanthodium of fig.

TYPES of corolla :⇨

On the basis of symmetry, corolla is differentiated in different types, which are as follows.

1. cruciform corolla
2. Tubular corolla
3. Infundibuliform corolla
4. Papilionacious corolla
5. Bilabiate corolla.

① cruciform corolla :=

→ cruciform corolla consists of four free petals.

→ Each petal is differentiated into claw & limb.

→ Petals are arrenged in the form of cross, hence corolla is known as "cruciform corolla".

e.g, Mustard Radish

Fig. cruciform corolla
e.g. Mustard.

② Tubular corolla :=

→ When corolla is tube-like or cylindrical it is said to be tubular corolla.

e.g. Sunflower (central florets)

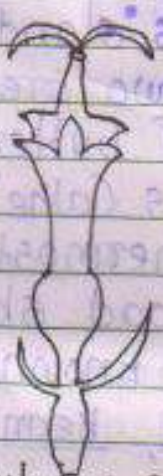


Fig. tubular corolla
e.g. Sunflower

③ Infundibuliform corolla :✧

→ Infundibuliform corolla is also known as "funnel shaped" corolla.

→ In this type of corolla, petals are arrenged in the form of funnel.

Fig. Infundibuliform corolla e.g. Datura

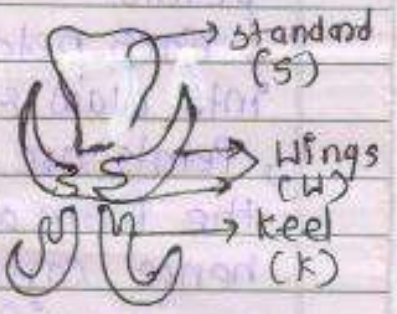
→ All petals are fused with each other and looks like a funnel.

④ Papilionaceous corolla :✧

→ Papilionaceous corolla is also known as "butter-fly like" corolla because it looks like a butterfly.

→ It consists of five petals.

→ Outermost petal is largest, known as standard.
Lateral two are somewhat wings of butterfly, known as wings (alae).
Two innermost united and form boad shaped cavity, together known as keel.
e.g. Pea, Bean, Clitoria etc.



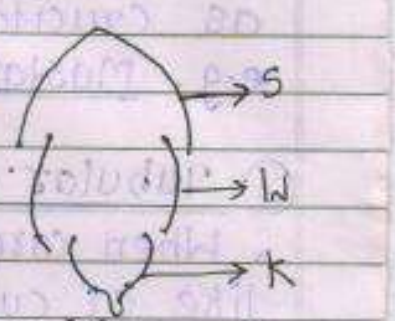


Fig. Papilionaceous corolla (flower) of Pea.

⑤ Bilabiate / Two-lipped corolla :=

In this type of corolla, the limb of corolla is divided into two portions i.e. upper & lower having open gap in between limbs.
e.g. Ocimum Adathoda

Fig. Bilabiate corolla

Fruit :⇒

"Fruit is a mature or ripened ovary".

→ After fertilization ovules are developed into seeds and ovary gets converted into fruit.

→ Fruit consists of two parts i.e. ① Pericarp & ② Seed.

① **Pericarp** :- [Peri = around ; karpos = fruit]

→ Pericarp is developed from the wall of ovary.

→ Pericarp may be thick or thin.

→ If pericarp is thick, it consists of 3 parts:
ⓐ Epicarp ⓑ Mesocarp ⓒ Endocarp.

ⓐ **Epicarp** :- It is outermost part & forms skin of the fruit.

ⓑ **Mesocarp** :- It is middle part of the fruit.
→ sometimes it is pulpy. e.g. Mango

ⓒ **Endocarp** :- It is inner part of the fruit.
→ It may be thin & membranous e.g. Orange.
→ It may be hard & stony e.g. Mango

In some cases, Pericarp is not differentiated into these three parts.

② **Seed** :-

→ Seeds are developed from the ~~ovary~~ ovules.

* **True fruit** :- only ovary grows into fruit, such type of fruit is called true fruit.
e.g. Maize, Grapes, Mango, etc.

* **False fruit** :- Fruit is developed from other floral parts, like thalamus, receptacle such fruit is called as false fruit.
eg. Apple, Cashew nut, etc.

✳ Forms of Fruit or Classification of fruits :⇒

→ Fruits are classified into following three types.
① Simple fruit
② Aggregate fruit
③ Composite/Multiple fruit

① Simple fruit :-

"When only one fruit is developed from ovary. is called as simple fruit."
→ Simple fruit is developed from either single ovary or syncarpous ovary.
e.g. Pea, Gram, Groundnut, mango, etc.

② Aggregate fruit :-

"An aggregate fruit is a collection of simple fruits, developing from the apocarpous ovary."
→ An aggregate of simple fruits, borne by a single flower is also known as "etario".
e.g. Etario of berries in custard apple.

③ Composite/multiple fruit :-

→ Fruit which is developed from the inflorescence, called as composite/multiple fruit.
→ Flowers in inflorescence are crowded together & often fused with each other.
e.g. Pineapple, fig, etc.

[1] Simple fruit :-

→ Simple fruit may be dry or fleshy.
→ Dry fruits may be again dehiscent, indehiscent or schizocarpic. [in schizocarpic, carpel or carpels split into one-seeded parts].

A Dehiscent fruits :-

(a) Legume :-

→ Legume is also called as pod.
→ This is a simple, dry & dehiscent fruit.
→ It is developed from one-chambered, superior ovary.

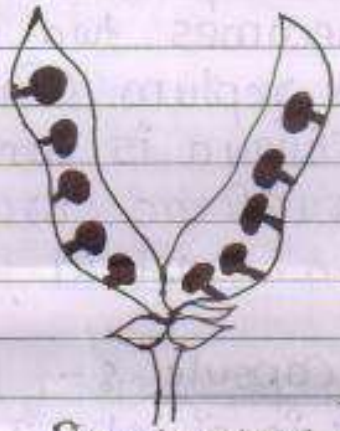


Fig. Legume of Pea.

→ It dehisces by both sutures.
→ It is a characteristic feature of papilionaceae family.
e.g. Pea, Gram, etc.

(b) Follicle :-

→ This is a simple, dry, dehiscent, fruit.
→ It is developed from a monocarpellary, syncarpous ovary, like legume but it dehisces by only one suture.

Fig. Follicle

→ simple follicles are rare & sometimes seen in Calatropis.
e.g. Calatropis, Rauwolfia, etc.

(c) Siliqua :-

→ It is a simple, dry, and dehiscent fruit.
→ It is long, narrow & many-seeded fruit.
→ It is developed from a superior, bicarpellary ovary with parietal placentation.

Fig. Siliqua of Mustard.

→ It dehisces from bottom to apex, along with two sutures into two valves, leaving wiry framework, called replum to which seeds are attached.

→ ovary is one-chambered at first but becomes two-chambered due to development of replum (false septum)
→ Siliqua is commonly found in family Cruciferae / Brassicaceae.
e.g. Mustard, Radish, etc.

(d) Capsule :-
→ It is simple, dry, dehiscent fruit
→ It is many seeded fruit.
→ It is developed from superior, bicarpellary or polycarpellary ovary.
→ It dehisces in various ways.
→ All dehiscent fruits developed from syncarpous ovary are called capsules.
e.g. Datura, Cotton, etc.


Fig. Capsule of Datura

[B] Indehiscent fruit :-

(a) Caryopsis :-
→ It is a simple dry & indehiscent fruit.
→ It is small one-seeded fruit.
→ It is developed from superior, monocarpellary ovary having pericarp fused with seed-coat.
→ It is found in the members of Poaceae or Graminae family.
e.g. Rice, Wheat, maize, etc.


Fig. Caryopsis of maize.

(b) Cypsela :-

→ It is simple, dry, indehiscent fruit.
→ It is one seeded fruit.
→ It developes from an inferior bicarpellary ovary.
→ cypsela is mostly present in Asteraceae family.
e.g. Sunflower, marigold, etc.

Fig. cypsela of Sunflower

[c] Schizocarpic fruits :⇒

→ Schizocarpic fruits are also called as splitting fruits.
→ These fruits may be considered as intermediate between dehiscent & indehiscent fruits.
→ This fruit breaks into number of pieces called mericarps, which consists of one or more seeds.
→ Schizocarpic/splitting fruit is of following types :
① Lomentum
② Cremocarp
③ Regma

(1) Lomentum :-

→ This is a simple, dry & splitting fruit.
→ It is constricted between seeds into a number of compartments.
→ The fruit splits along the constrictions into one seeded pieces.
e.g. Acacia (Gumtree), mimosa (sensitive plant) Arachis hypogea (Groundnut) etc.

Fig. Lomentum of Acacia

② Cremocarp :-

→ This is a simple, dry & splitting fruit.
→ It is two chambered & developed from an inferior ovary (bicarpellary).
→ Fruit splits up into one seeded pieces called mericarps.
e.g. Coriander.
→ Cremocarp fruit is a charecteristic feature of Apiaceae / Umbelliferae family.

Fig. Cremocarp of coriander.

③ Regma :-

→ This is a simple dry & splitting fruit.
→ It is developed from syncarpous ovary.
→ It is three to many chambered fruit & splits away from the central axis into many parts, each containing one to two seeds.
e.g. Castor, euphorbia, Jatropha, etc.

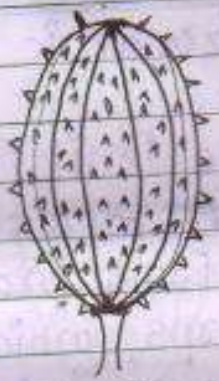


Fig. Regma of Castor.

D Fleshy fruits :-

④ Drupe :-

→ This is simple & fleshy fruit.
→ It is one seeded fruit.
→ It is developed from a monocarpellary or syncarpous gynoecium.

Fig. Drupe
e.g. Mango

→ Pericarp of drupe is differentiated into epicarp, mesocarp & endocarp.
→ Epicarp is outermost covering, mesocarp is middle layer which is fleshy & endocarp is innermost which is stony & hard. Hence, drupe is also called as "stone fruit". e.g. Mango

② Berry / Bacca :-
→ This is simple fleshy fruit.
→ It is many-seeded fruit.
→ It is developed from a single carpel or syncarpous ovary.
→ At first seeds remains attached to placenta, but later on seeds are seperated from placenta and lie free in pulpy region.
e.g. Tomato, Brinjal

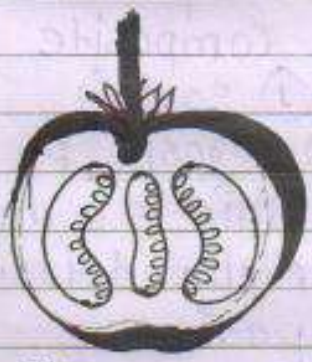


Fig. Berry
e.g. Tomato

[1] Aggregate fruits :⇒
An aggregate fruit is a collection of simple fruits developing from apocarpous ovary of a flower.
An aggregate of simple fruits developed from a single flower is called "etario".
Etario of berries :-
→ This is an aggregate fruit, common in Annonaceae family.
e.g. Custard apple

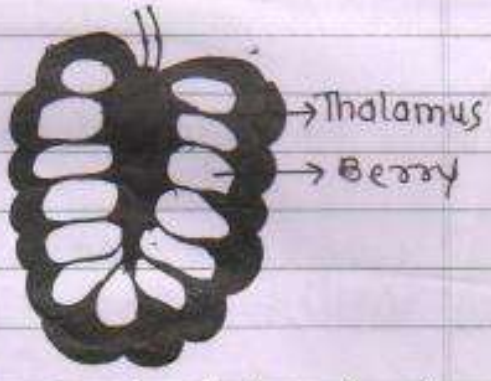


Fig. Etario of berries in custard apple.

In custard apple, the berries become very fleshy & embeded in thick & fleshy thalamus. The ~~apx~~ apices of berries fuse together & form a common rind. [बाहेरील कवच/साल].

[3] Composite / Multiple Fruits :⇨

Composite / multiple fruit is the fruit which is developed from an inflorescence.

→ Composite fruit is of sorosis types :⇨

① Sorosis

① Sorosis :-

→ This is a multiple fruit developed from spike or spadix.

→ Flowers fuse together by their succulent sepals & at that time axis bearing them grows & become fleshy or woody.

→ As a result, whole inflorescence forms a compact mass.

e.g. Pineapple, Jack-fruit, etc.

Fig. sorosis of Pine apple.