

- Root cap can be regenerated

PAGE NO.  
DATE

# MORPHOLOGY OF FLOWERING PLANTS.

## The ROOT

- Non green - underground
- +vely Geotropic
- +vely Hygroscopic. *→ bends towards source of water*
- +vely phototropic

It can be regenerated

Root cap

no.

One

- multicellular

- parenchymatous

> one

(Screw pine)

Pandanus

Function

Protective covering

Secretory in nature

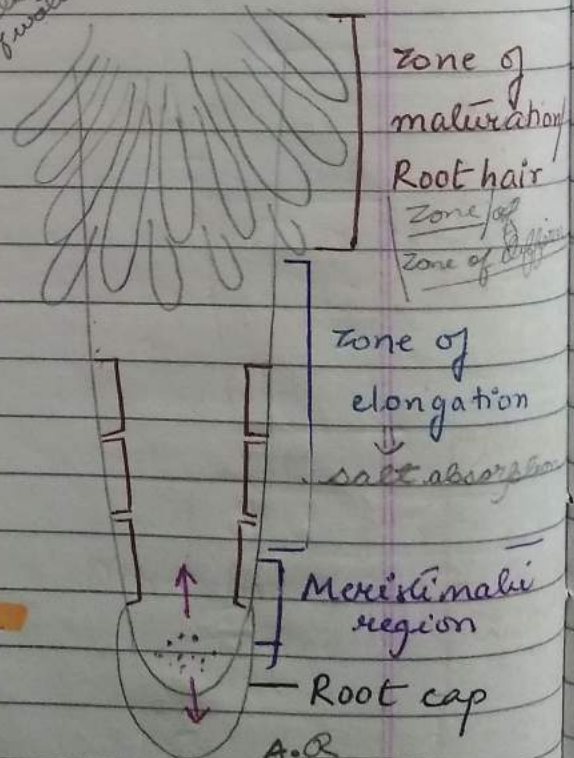
- Mucus

Easy growth of Root.

★ Root cap not universal

- Parasitic roots

- Epiphytic roots.



Epidermis  
Cork  
Quercus  
Cork  
Vascular  
Xylem  
Phloem

# Epiphytes

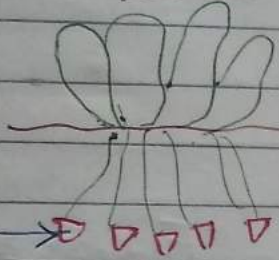
## Epiphytic Roots

- Dependent On the other plant only for attachment.

Space parasites

## Root pocket

e.g. Hydrophytes



Root pocket

→ Balancer - Function.

→ Root pocket regeneration - after injury.

## Meristematic

- position - Subapical
- small, thin cells.
- have dense cytoplasm
- Cell division.
- add cells to both root cap and zone of elongation.

## Zone Of Elongation

- cell grow w.r.t size
- Large vacuole + int

## Functions

- Growth Length.
- Water absp.
- Mineral absp. (Main fun.)

## Maturation Zone

- Differentiation of primary tissue.

- Epidermal (Epidermis)
- Ground tissue
- Cortex
- Pericycle
- Pith

1<sup>o</sup> tissue - young stages of plant.

Differentiation

→ Meristem → Derive

Cell division capacity lost

change / Modify special func.

## Vascular tissue.

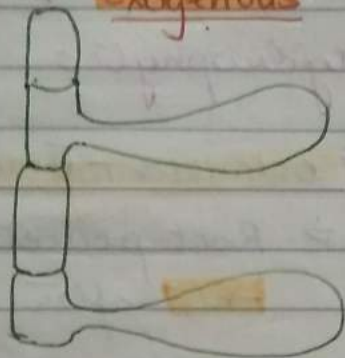
- Xylem
- Phloem.

Maturation zone —

Functions

Epidermis  $\Rightarrow$  Root hairs

Exogenous



Pericycle  $\Rightarrow$  Lateral roots

Endogenous

Smaller cells of epidermis

Trichoblast

$\angle$  Capacity to form  
Root hairs

Surface area  $\uparrow$ ces  
| Water Absp.

ORIGIN OF ROOTS

Epiderm/  
Cortex

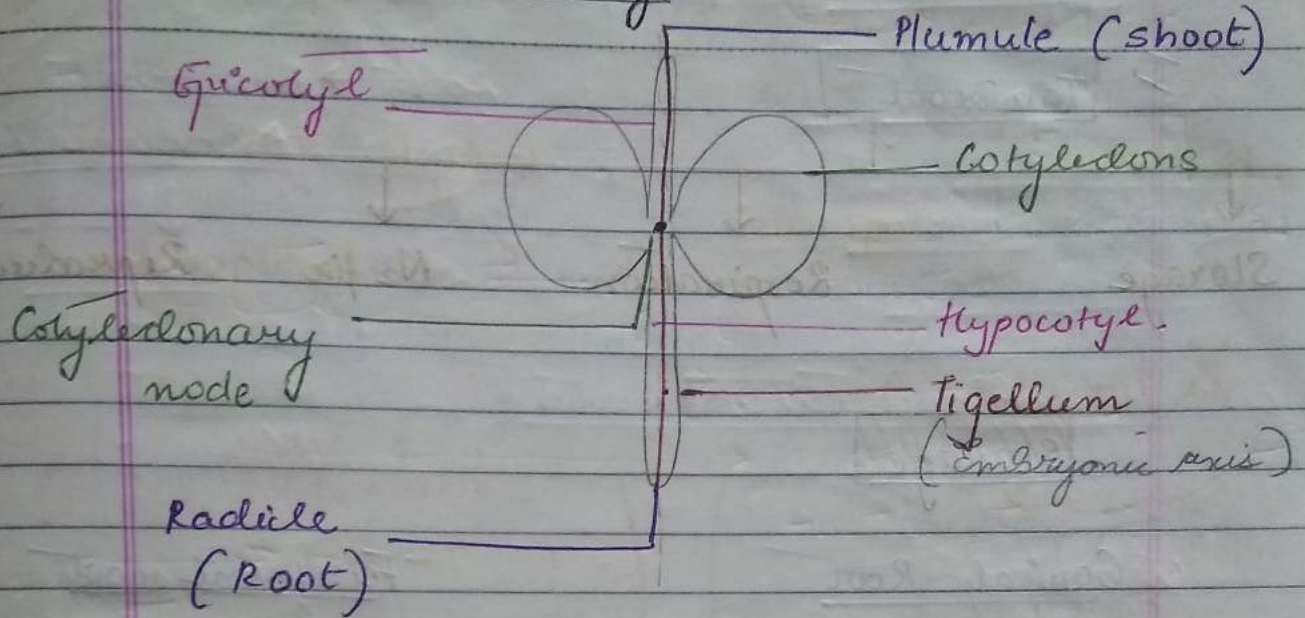
Exogenous origin

Other than Epidermis/  
Cortex

Endogenous origin

- root hairs are present on the rootlets

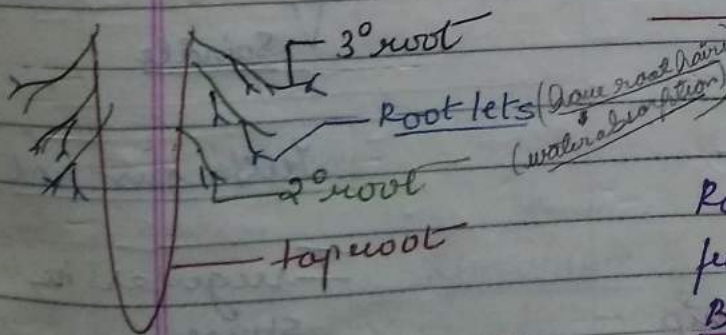
## Parts OF Embryo



## Types - Root Sys.

↓  
Tap root sy.

Origin - Primary root  
↳ elongation of radicle



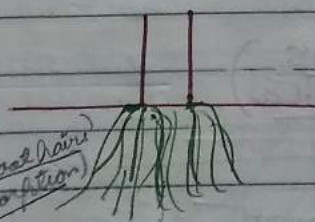
e.g. Dicots, Gymnosperms.

Thickness: Thick.

Position: Underground

↓  
Fibrous root

Primary root degenerates



Roots arise from  
Base of stem

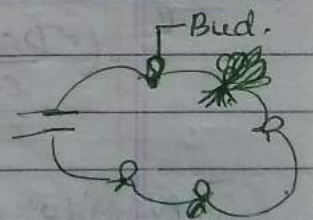
e.g. Monocots

Thin, fibrous

Underground

↓  
Adventitious

Other than the  
Radicle



e.g. Bryophyllum

Dicots,  
Monocots, Pteridophytes

Thin / Thick.

Above / Below

reduced stem = Acaulescent stem

## Modifications.

### I Tap root

Storage

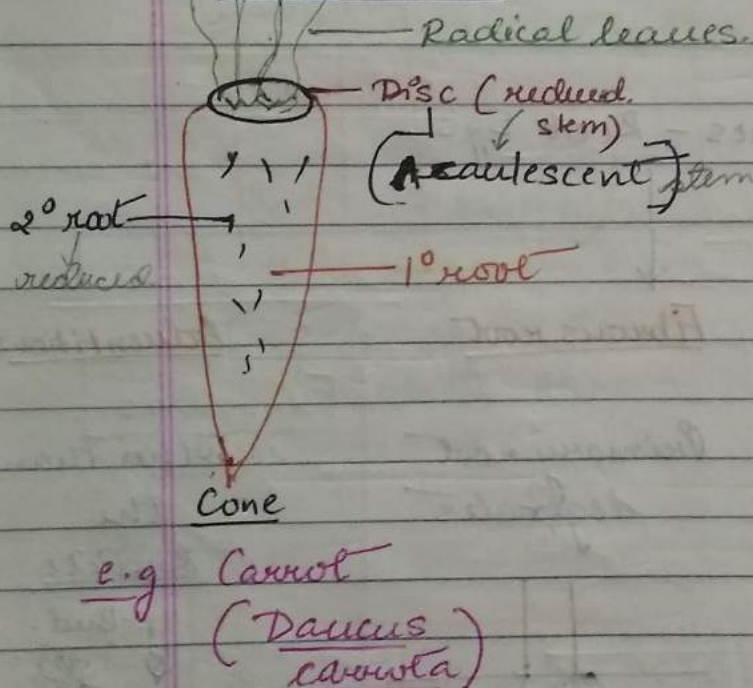
Respiration

N<sub>2</sub> fix

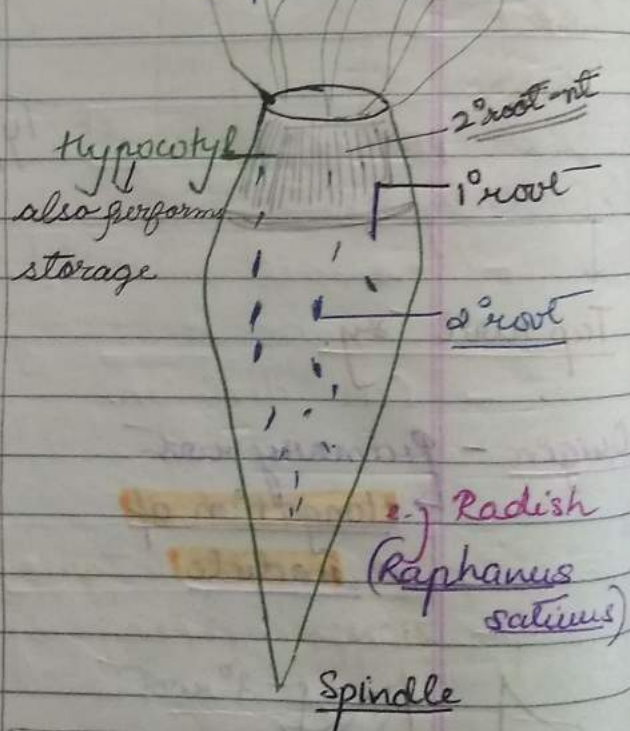
Reproduction

### Storage

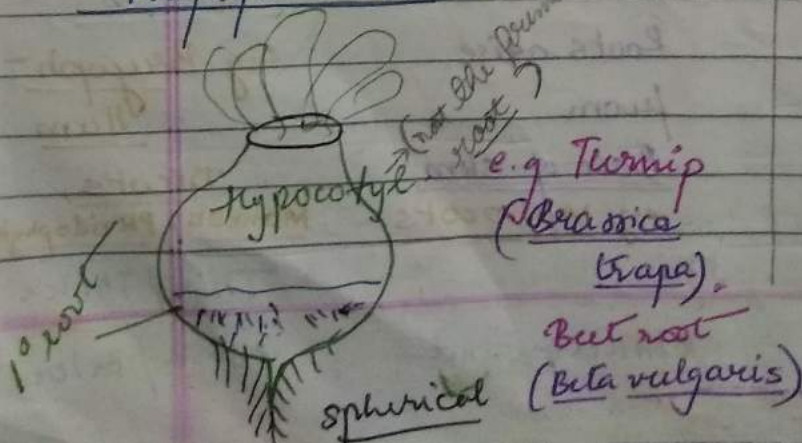
#### Conical Root



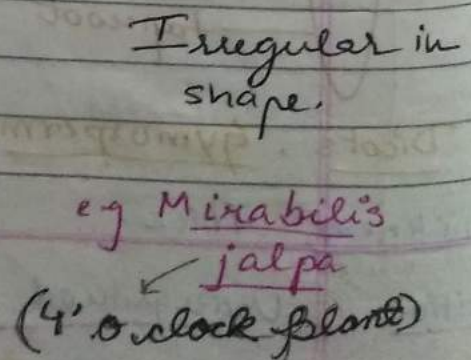
#### Fusiform root



#### Napiform root



#### Tuberous root



# Respiration

Respiratory roots /  
Pneumatophores /  
Aerophores /

(Eg) Avicennia

Sonneratia

Marshy areas.

Mangrove plants.  
-ve geotropic

Rhizophora  
(Mangrove)

H<sub>2</sub>O more in soil

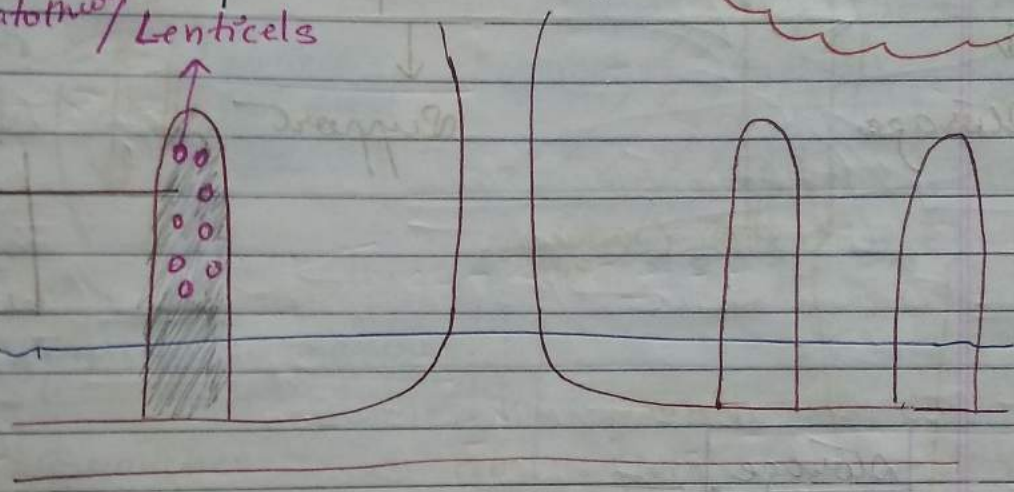
Anaerobic conditions.

Root cap X  
Root hair X

gaseous exchange.

Pneumatophores / Lenticels

Corky layer -  
(Thick covering)



# N<sub>2</sub> fixation

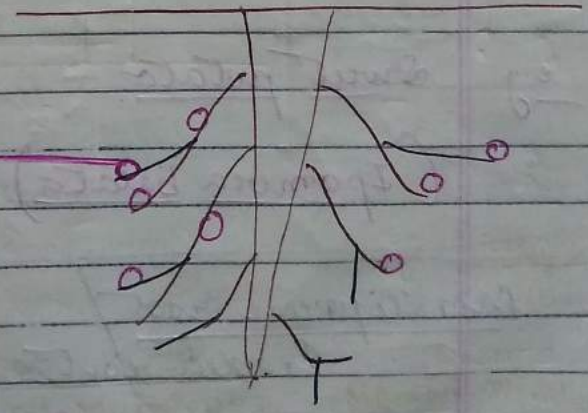
Nodulated roots (Leguminous roots)

Cicer (Black gram)  
Pisum (Pea)

Root nodules

Rhizobium

N<sub>2</sub> fix



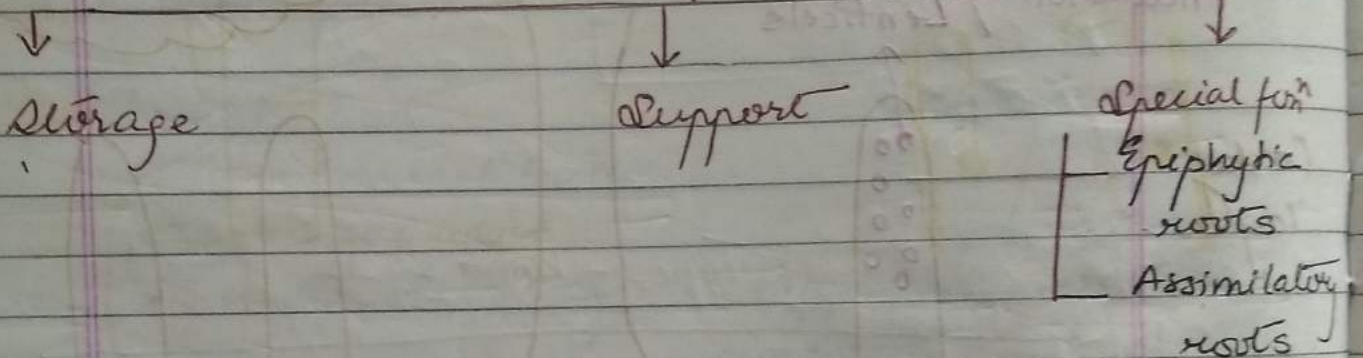
## Reproduction — Reproductive roots

e.g. Dalbergia (

Populus

Root → Bud + nt  
 ↳ Radical bud  
 ↓  
 New plant

## A adventitious roots



## Storage

(i) Tuberous roots

Without definite shape

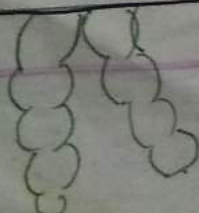
e.g. Sweet potato  
 (*Ipomoea batata*)

(ii) Fasciculated roots

Group of irregular tuberous roots

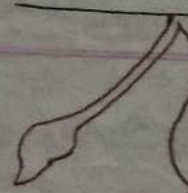
e.g. Asparagus,  
Dahlia

(iii) Moniliform root / Beaded root



e.g. Momordica  
 (Bitter melon)  
 • Portulaca  
 • Vitis (Grapes)

(iv) Nodulose root



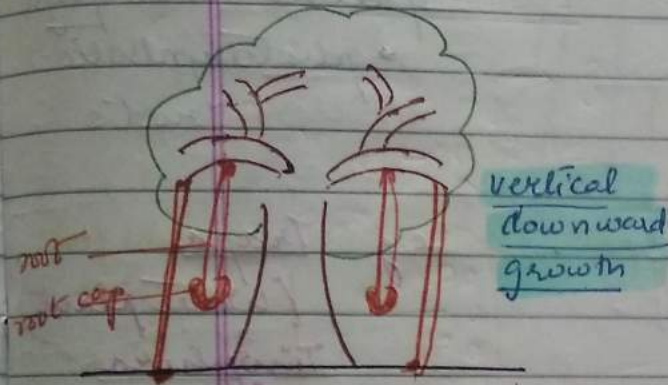
e.g. Curcuma  
Thurmeric

- prop roots, when young are hygroscopic
- Hygroscopic nature → ability to absorb water.

## Support

### Prop roots / Pillar roots

(e.g.) (Banyan tree)  
Ficus benghalensis

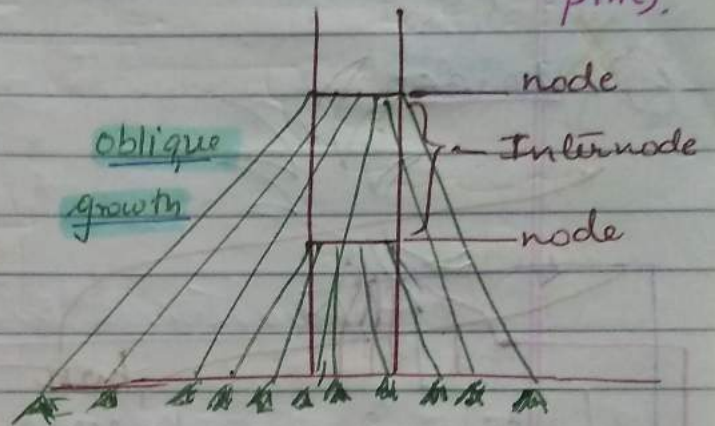


(e.g.) - Hygroscopic nature (Young stages)

Origin - Branches

### Stilt roots / Brace roots

(e.g.) Sugarcane, Maize, Pandanus (Screw pine).



Main stem

### Climbing roots / Climbing

- have weak stems.

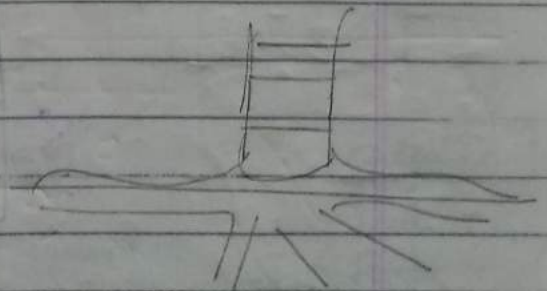
e.g. Money plants,  
(Pothos)

Monstera

Belit (Piper belit)

Black pepper  
(Piper nigrum)

### Buttress roots



Ficus religiosa  
(Peepal)

Terminalia arjuna  
(Arjun tree)

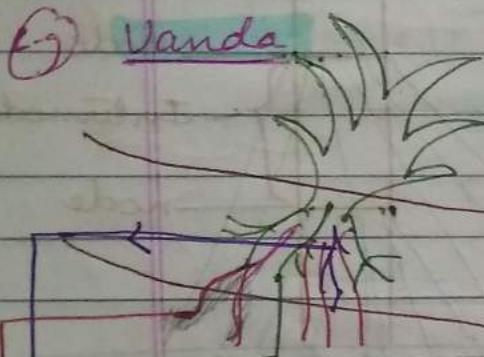
- Epidermis is usually single layered.

PAGE NO.  
DATE

## Special functions

↓  
Epiphytic roots

Space parasites



e.g. Vanda

↓  
Assimilatory roots

- Green - chlorophyll
- photosynthetic roots

e.g. Trapa (Water plant)  
Tinodphora (Woody climber)  
Taenophyllum (Epiphytic plant)

Clinging roots

host

Attachment

Absorbing roots

Minerals absp

Epiphytic roots

Absp.  
H<sub>2</sub>O from

atmosphere

Velamen (special tissue)

modification of  
epidermis

Dead tissue,  
spongy

multilayered  
epidermis

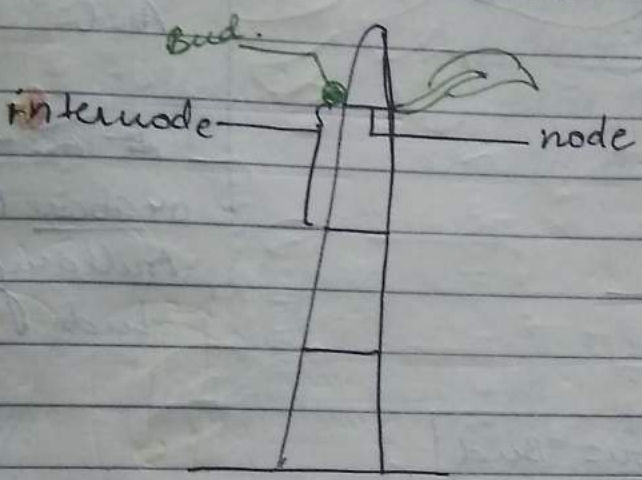
- Kaustorial roots → Luscuta, Viscum, Orobanch  
(Parasitic roots) - root cap - nt



# The Stem

← Plumule : Part of embryo.

- Above ground → ascending part of plant axis
- Nodes & Internodes.



- +vely phototropic
- -vely geotropic
- -ve hygroscopic

## Bud

- compact immature shoot



immature leaves

growing point

Types.

### Nature

- |                |                                    |
|----------------|------------------------------------|
| Vegetative bud | + leafy shoot                      |
| Floral bud     | + flower                           |
| Mixed bud      | + both leafy shoot and floral bud. |

### Position

#### Apical

- Tip / terminal

#### Lateral

any point except tip

#### Nodal

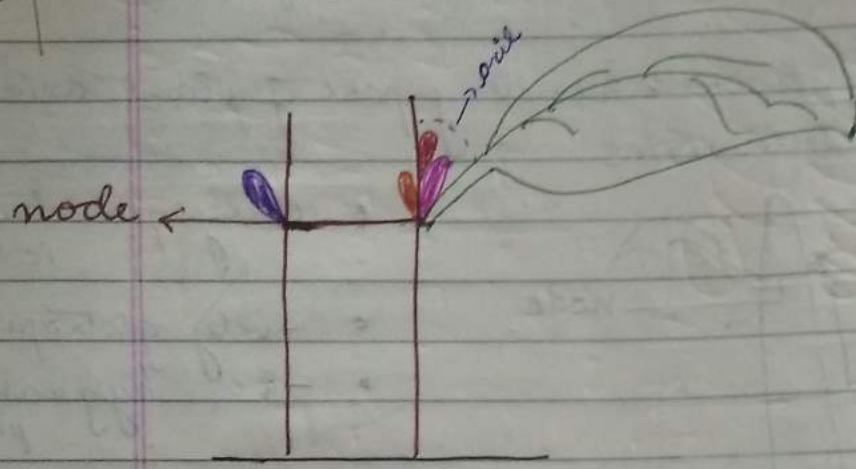
tree on node.

#### Adventitious

+ nt on any part except node.

Axil

Bud — Nodal



Axil - Axillary

Away - Extra Axillary bud

A near - Accessory above the axillary bud

- Adventitious Bud

Root

Radical Bud

Dahlia, Populus, Dalbergia, Ipomoea

Leaf

Foliar Bud

Bryophyllum

Stem

Cauline Bud

• Rose  
• Jack fruit

Special Bud

Budil

Large

fleshy bud

Reproduction - Vegetative

C - Chlorophyllum

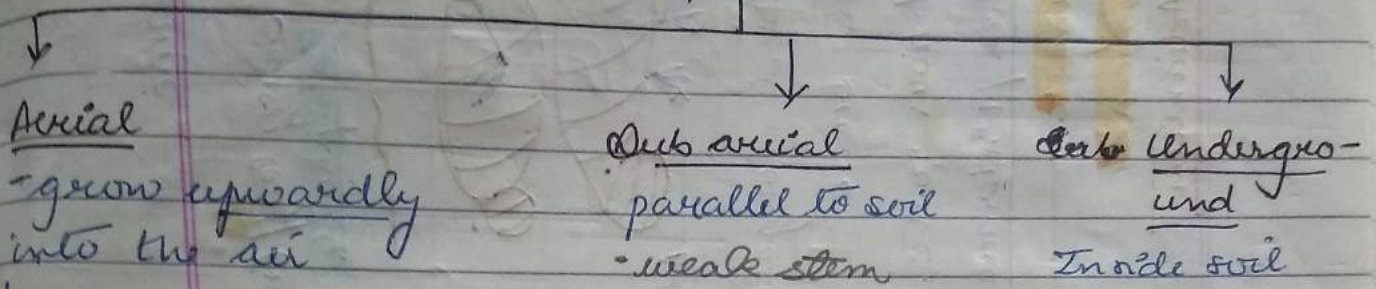
O - Oxalis

L - Lily

A - Agave

TURION : Budil like structure + in water plant  
(e.g.) Polamageton, Utricularia [Bladder plant]

## Types of Stem (spread) Ground



- Erect - upright position
- Weak - support required
- Reduced - internodes reduced.

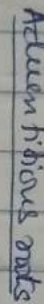


## Modification

- Photosynthesis
- Storage of food
- Reproduction
- Resting/structure
- Perennating

[Bladderwort]  
Jivorous plant.

Scaly leaf (non-green)  
Cacophyllum



- Bring it  
Banana

↓  
Underschied  
Halbtonne

Sub-Aerial - Modification

27. Coleasia (Zanclus)  
Ameghino

node-eyes

- potato (*Solanum tuberosum*)

Diagram of a flower showing its parts:

- Petal
- Stamen
- Pistil
- Ovary
- Style
- Terminal end
- Sessile

- Onion  
 Garlic  
 Terminated

bulb  
naked bulb.  
Lily.

scope = ...  
 ...  
 ...

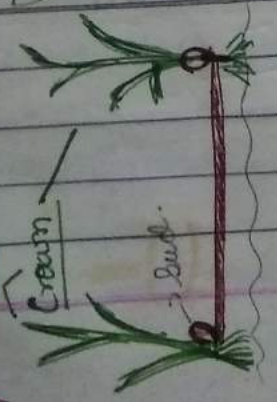
# Modifications of Stem

## Sub-Aerial

## Modification

Runner

Grasses

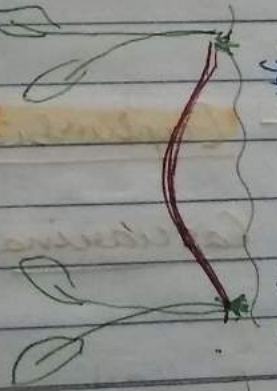


horizontal growth

more than one internode

Stolon

Jasmine



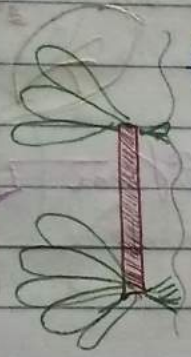
Oblique growth.

> 1

Longest internode

Single internode  
 runner Offset

Pistia, Eichhornia



horizontal growth

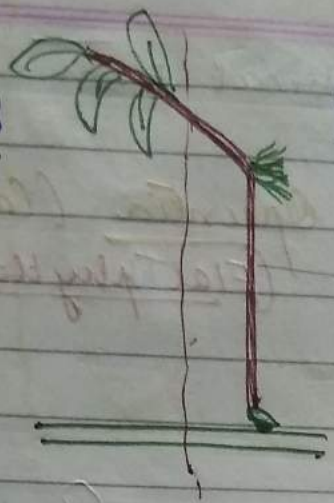
single internode

Shortest internode

Sucker

Pineapple, Banana, Chrysanthemum

→ mint



horizontal → Oblique

> 1 internode

stem is present below the ground

Modification - Aerial stem

Phylloclade - e.g. Opuntia (Cactus)  
(Flat phylloclade)

- Xerophytic plants

To save water

↳ leaves reduced - spines

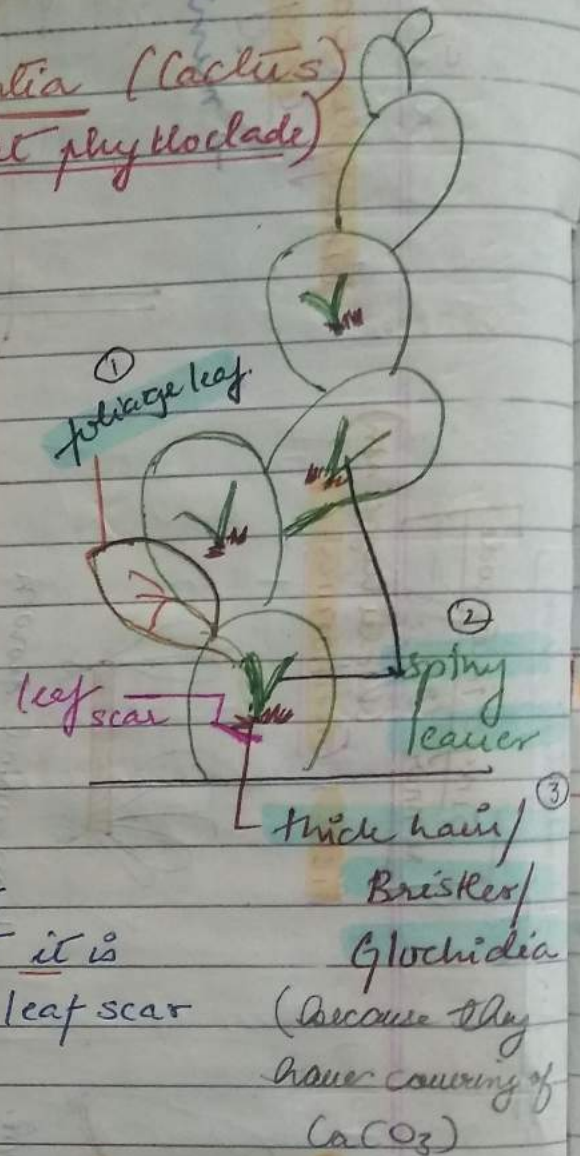
- Function of leaf → Stem  
Green —  
Photosynthesis.

- Whole stem - green

- Unlimited growth.

- Several internodes <sup>might</sup>

- foliage leaf falls after it is  
formed & forms leaf scar  
(Caducous leaf)



Cylindrical phylloclade - Euphorbia

- Casuarina

# Comparatives

## Cladode

## Phyllode

## Tendrils

Branches green

Whole stem green

• formed from various seeds.  
thin, wiry thread like

Limitage growth

Unlimited growth

Coil around the support

one internode

Several internodes

Climbing

X

- Foliage

X

- Spiny leaf

X

- Bristles

Extra  
axillary  
tendrils

Axillary  
tendrils

Asparagus - 1

Ruscus - 2

Internode  
Internode

(e.g)

Pumpkin  
Watermelon  
Cucumber  
Grape Vine

Apical bud  
tendrils

Floral  
bud  
tendrils

## Hard pointed structures



Reduce loss



Protection from  
browsing animals

Thorns, Spines, Prickles, Bristles -



★ In *Bougainvillea*, thorns in the form of hooks are used for climbing.

|          | Origin                                              | Vascular Supply of Xylem, Phloem | Corken cells                          | Examples                                                                                            |
|----------|-----------------------------------------------------|----------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------|
| Thorn    | Stem branched                                       | ✓                                | Thick wall used for climbing can bear | <u>Citrus</u> - Hooks<br><u>Bougainvillea</u><br><u>Duranta</u> - leaves<br><u>Alhagi</u> - Flowers |
| Spines   | Leaves                                              | ✓                                | X                                     | <u>Opuntia</u>                                                                                      |
| Prickles | Superficial structure on<br>- Stem<br>- Leaves      | X                                | Easily removed                        | <u>Rose</u><br><u>Smilax</u>                                                                        |
| Bristles | Have thick<br>- silica/<br>- $CaCO_3$<br>deposition | X                                |                                       | <u>Opuntia</u>                                                                                      |

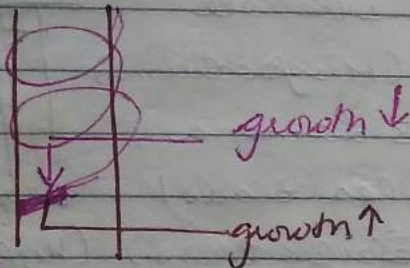


Potatoes: money plant

## Weak - Aerial stem

### Twining

Sensitive to touch



Differential growth  
coiling

Climbing stem X

Convolvulus

### Climbers

Insensitive to touch

No changes in growth

climbing stem ✓

tendrils -

Cucurbits

Roots - Potatoes

Hooker -

Bougainvillea



### Lianas

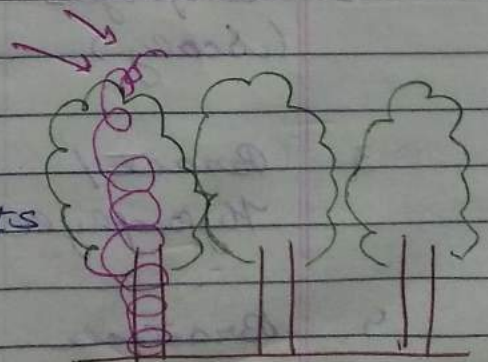
twining, climbers

Woody stems

Perennials

TRF - tropical rain forests

Eg. Hiptage, Tinospora



# The Leaf

- originates from shoot apical meristem (SAM)

- +nt at nodes

- Axil of leaf → Axillary Bud

, Petiole

(Mesopodium)

• Seat of photo-synthesis

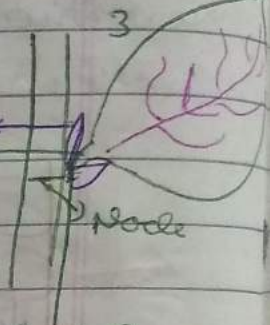
3 Lamina

(leaf blade)

Leaf Base

Epipodium

(Hypopodium)

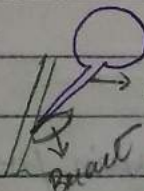


## Veins & Veinlets

- Rigidity

- channels for  $H_2O$ , food transport

## Types of Leaves

|                       |                                                                                                                                          |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Foliage            | Green → Fun - Photosynthesis                                                                                                             |
| 2. Cataphylls (Scaly) | - Dry, non-green → Protection                                                                                                            |
| 3. Bract / Hypophyll  |  <p>Pedicel</p> <p>Bract</p> <p>Involucre (whorl)</p> |
| 4. Bracteole          | <p>+nt on the stalk of flower i.e. pedicel</p> <p>Epicalyx (whorl)</p>                                                                   |

5

Sporophylls

Sporangia  
↓

spores

(I) stamen ^ (II) carpel

6

Prophylls

First few leaves formed are different from the rest.

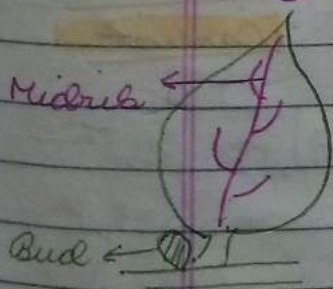
7

Cotyledonary

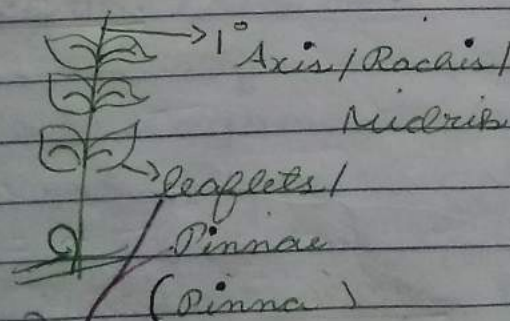
Monocot - 1

Dicot - 2

8

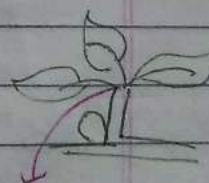
All types of  
leaves present =  
PhyllomeTypes of Leaves - Lamina  
↓Division of lamina - nt  
- simple

Pinnate

Division of lamina - nt  
- compound

Palmsate

Rachis - nt



Tip of Petiole

## Pinnate

• Leaflets

Born on

Rachis

Orientation

2 Row

Architecture

Feather like

## Palmate

Type of Petiole

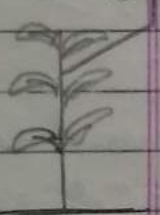
cluster

Fingers of a palm

## Types of Pinnate Leaves

Unipinnate

- Leaflets on  
Primary axis



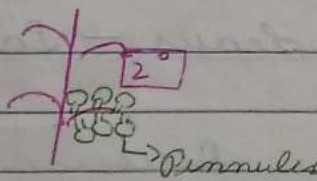
Rose

Neem

Cassia

Bipinnate

Leaflets on  
2° axis

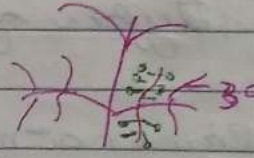


Acacia

Mimosa

Tri-pinnate

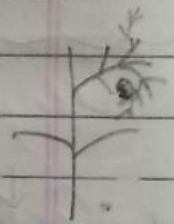
Leaflets on  
3° axis



Moringa

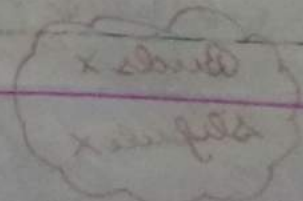
(Drum stick)

Decomposant



Lorander

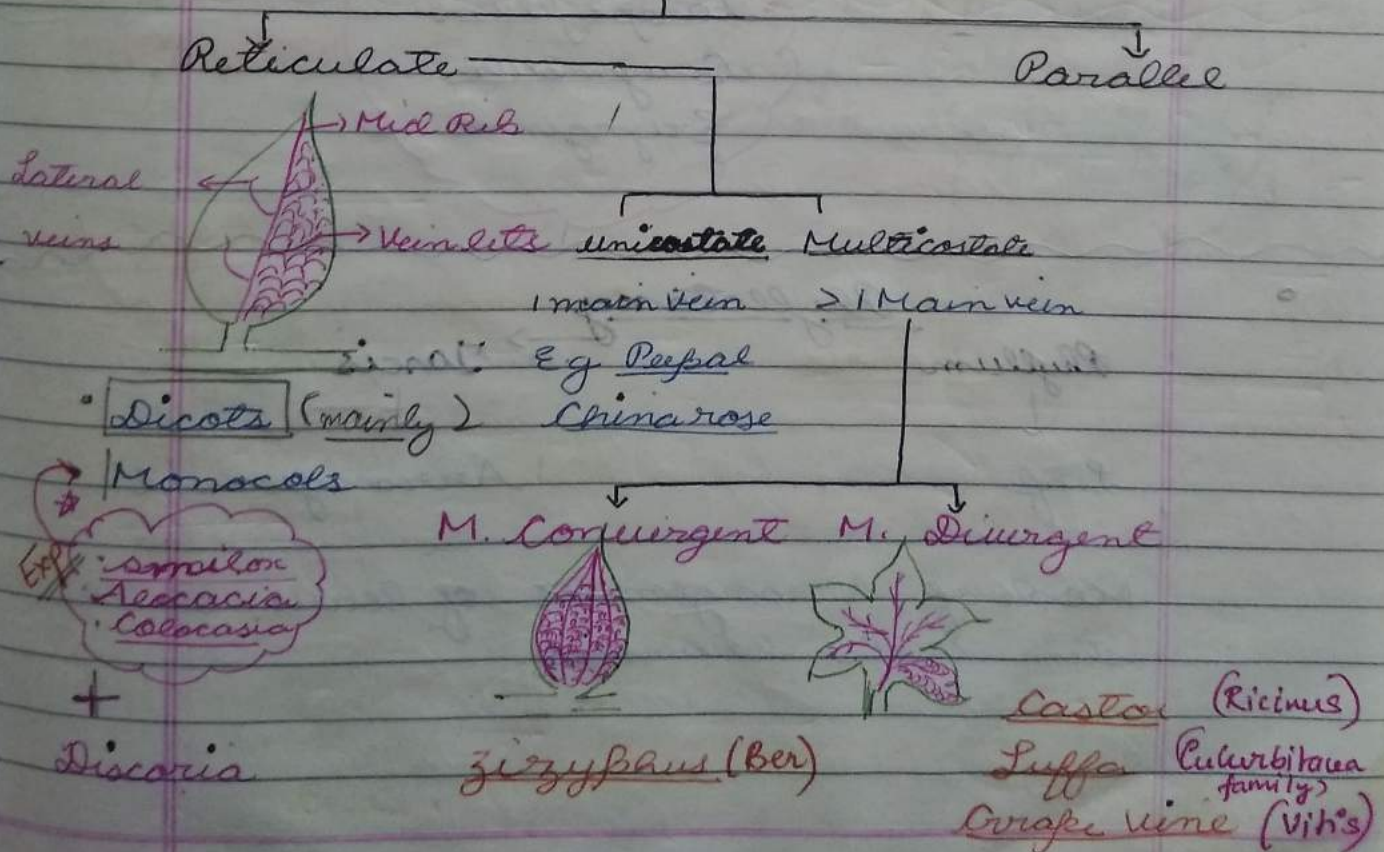
Carrot



## Types of Palmate leaves

|             |                 |                                                     |
|-------------|-----------------|-----------------------------------------------------|
| - 1 leaflet | Unifoliolate    | <u>Citrus</u>                                       |
| - 2 leaflet | Bifoliolate     | <u>Bignonia</u>                                     |
| - 3 leaflet | Trifoliolate    | <u>Trifolium</u> , <u>Dolichosa</u><br><u>Butea</u> |
| - 4 leaflet | Quadrifoliolate | <u>Paris</u> , <u>Crataegus</u>                     |
| > 4         | Multifoliolate  | ★ ★ <u>Bombax</u> (Red silk cotton tree)            |

## Venation

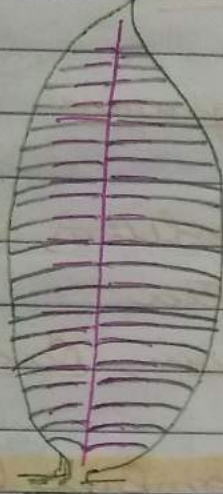


Monocots

Parallel Venation.

- Network - no

↓  
Unicostate



E.g. Banana (Musa)

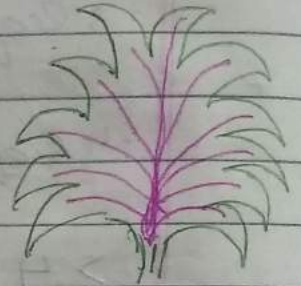
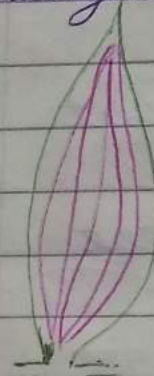
Lanna

↓  
Multicostate

↓  
Convergent

↓  
Divergent

- Bamboo
- Grasses



Fan Palm

Exp

Dicots

Calophyllum

Larignum

Eryngium

Phyllotaxy

Phyllum

Taxis

↓  
Leaf

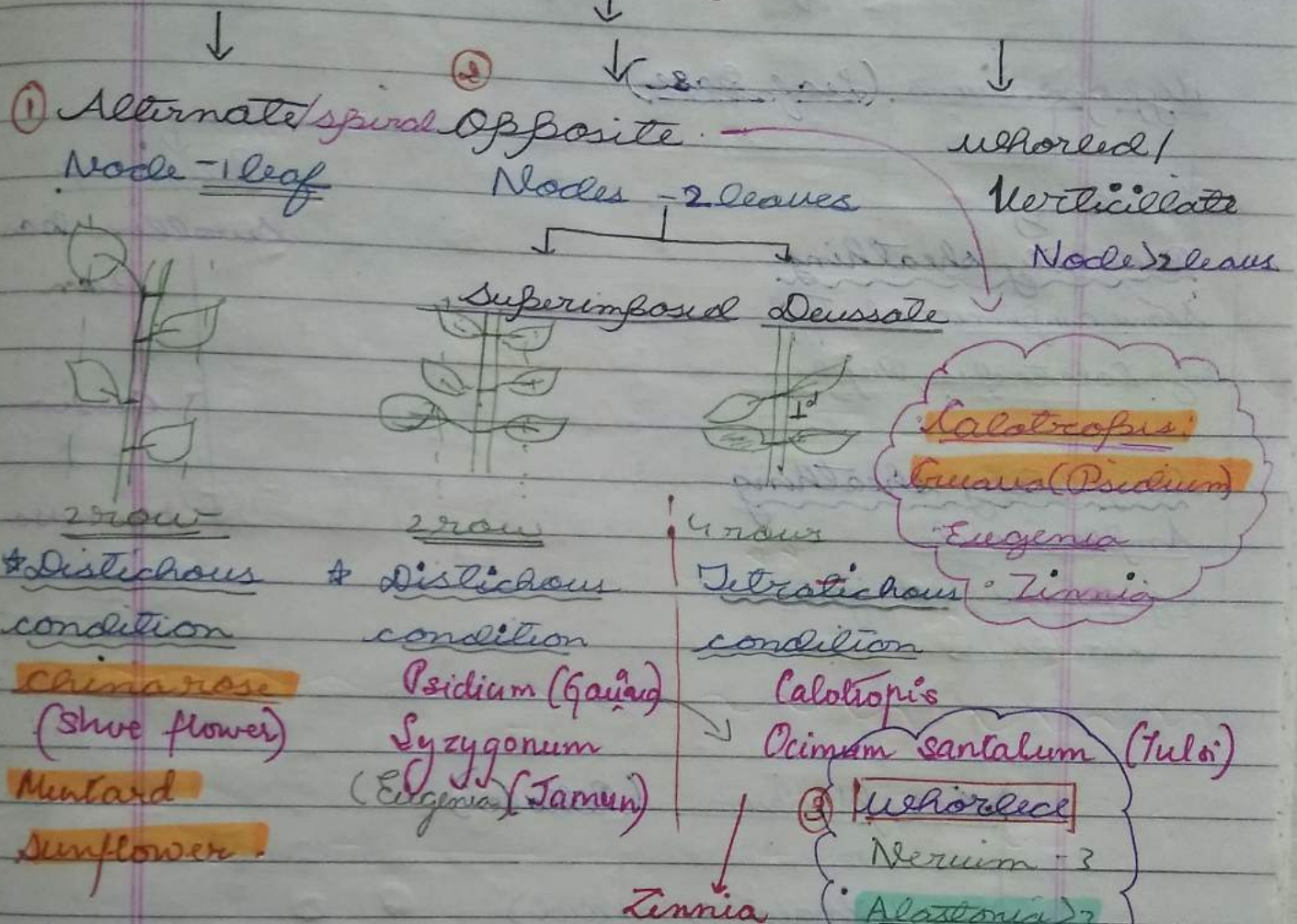
↓  
Arrangement

Mode of Arrangement of leaves on the stem & its branches.

- Alternate type of leaf arrangement also known as spiral phyllotaxy.

DATE

## Phyllotaxy



# Modification of leaves

## Hypophodium (Leaf base)

### Sheathing

Partially sheathing  
Semi amplexicaul type  
e.g. Calotropis, Poppy

Completely sheathing  
Amplexicaul  
e.g. grasses, Polygonum  
Sonchus

### Puttinus

Swollen base

Bean

Cassia

Mimosa

## Mesophodium (Petiole)

Winged (expanded)  
Citrus

Spongy (large amount of aerenchyma)  
Eichornia helps in flotation

### Phylloclade

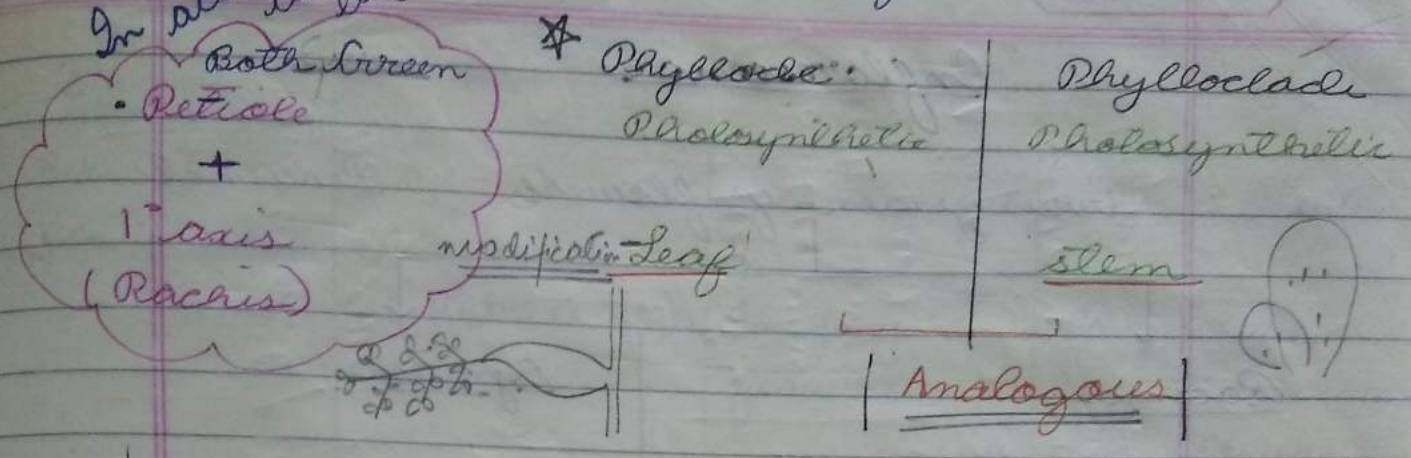
- Xerophytic plants
- Lamina reduction
- Petiole green - Photosynthesis
- Australian Acacia

No of stomata on petiole less as compared to laminae

Hence help prevent water loss.

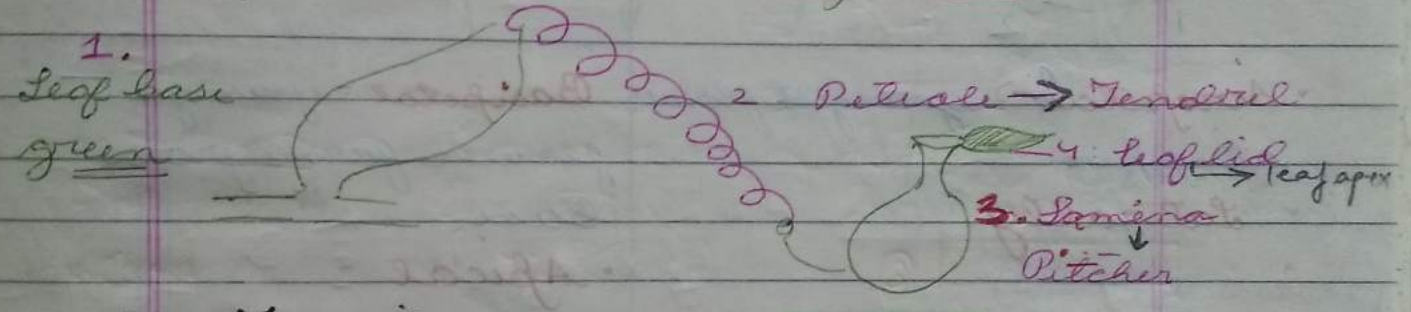
In acacia has compound leaf

Tendrils perform the function of climbing



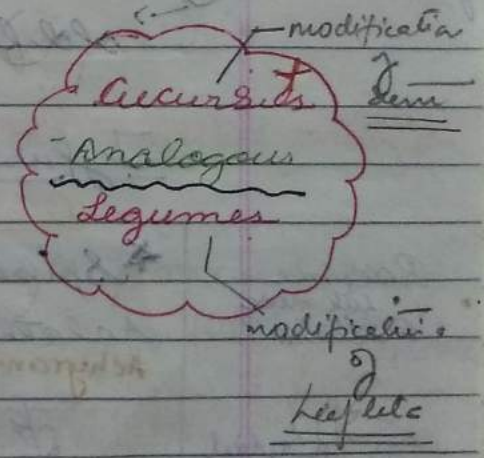
## Whole leaf modification

Nepenthes (Pitcher plant)



→ Tendril

- Whole leaf : Lathyrus sativus
- Leaflets : Pisum
- Leaf apex : Gloriosa
- Petiole :
  - Climatis
  - Nepenthes

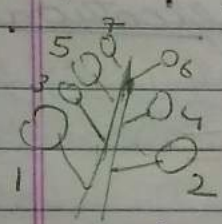


# Inflorescence

Arrangement of flowers → Peduncle <sup>inflorescence axis</sup>

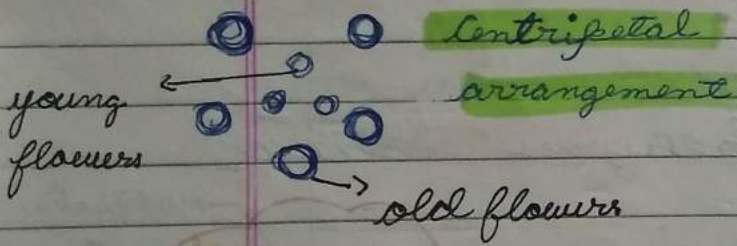
## Racemose

Unlimited growth



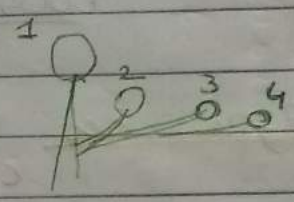
• Acropetal → youngest flower at apex

Flowers form Laterally



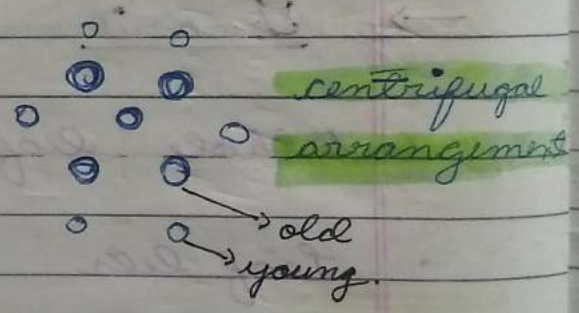
## Cymose

Limited growth



• Basipetal - youngest flower forms from base

• Apical



## Types - Racemose

| <u>Raceme</u><br>• Like spike<br>• Racisima | <u>* Spikes</u><br>Achaetodia<br>Achyranthes | <u>Catkin /</u><br>Amentum<br>Morus (Mulberry)<br>Oak, Birch<br>Acalypha | (Monocots)<br><u>Spadix</u><br>Banana<br>Musa, Alcasia<br>Calocasia, Palm<br>Spathe<br>Appendix flower<br>sterile<br>male<br>female |
|---------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
|                                             |                                              |                                                                          |                                                                                                                                     |

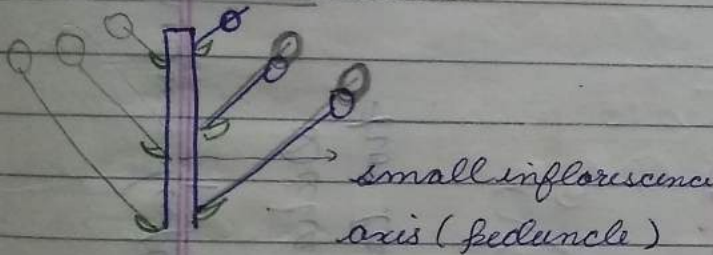
• Capitulum → centrifugal arrangement because it is a type of racemose inflorescence.

DATE: \_\_\_\_\_

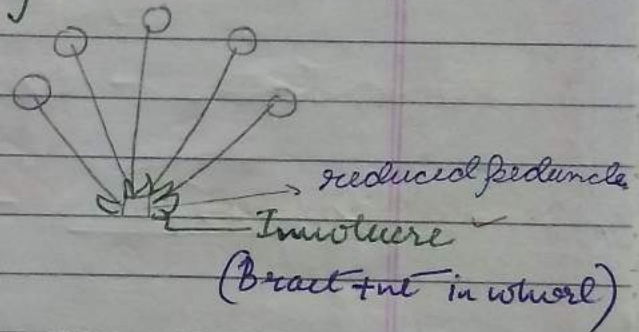
|                    |                                |           |                                                         |
|--------------------|--------------------------------|-----------|---------------------------------------------------------|
| ♀<br>Bisexual      | ♀<br>unisexual                 | unisexual | unisexual                                               |
| Pedicellate flower | Sessile flowers (stalk is not) | sessile   | sterile sessile.                                        |
|                    | hanging flowers                |           | large size bract surrounds flowers called <u>spathe</u> |

Corymb  
Iberis, Capsella

All the flowers are put in the same level.



Umbel (umbrella like appearance)  
Hydrocotyle



• Compound Umbel (branching)  
Coriander

Scapigerous umbel - Onion

• Compound Corymb (branching)  
Cauliflower

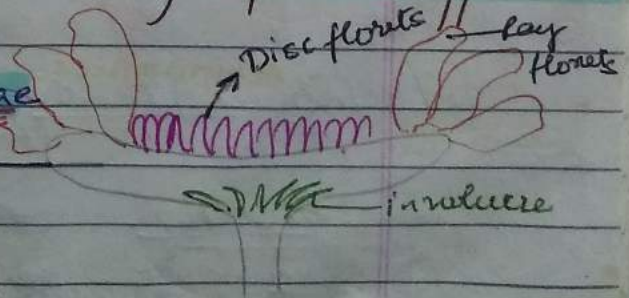
Corymbose raceme - Mustard

• Capitulum - Head inflorescence - "Single flower appearance"  
Zinnia, Cosmos

Daisy flower family - Asteraceae

• Disc shaped inflorescence axis called receptacle

disk / florals



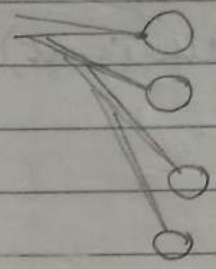
♀  
♂  
Centre  
Tubular / Disc  
- Radial Sym  
- Actinomorphic

♀/neuter  
Outer  
ray / ligulate  
- Bilateral Sym  
- Zygomorphic



o/o

Monochasial / Uniparous.  
One lateral branch



Helicoid  
(Branches arise  
on the same  
side)

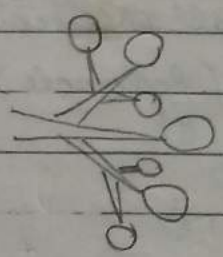
*Atropa*  
*Datura*  
*Begonia*

Scorpioid  
(Helicoid  
branch)

*Ranunculus*.

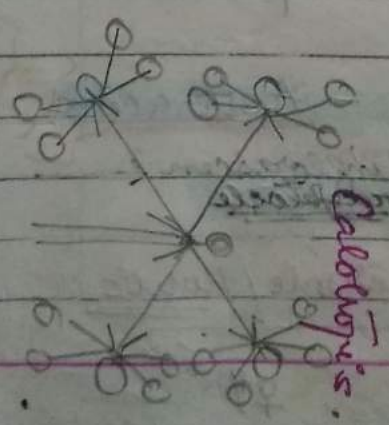
## Cymose Inflorescence

Dichasial / Biparous  
two lateral branch



*Dianthus*.

Polychasial /  
Multiparous.  
> 2 lateral branch



*Calotropis*.

# Special-type Inflorescence

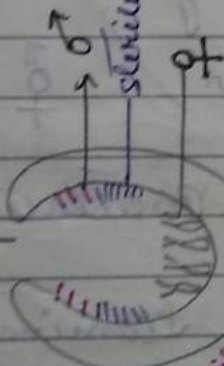
## Hypanthodium

Male

Fig - Ficus carica

pepal - Ficus religiosa

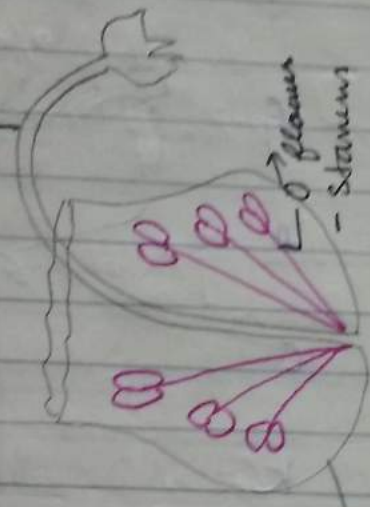
Banyan - Ficus bengalensis



→ Modified Peduncle

## Cyathium

♀ - Carpel flower



Sepals & petals - nt

Bract (cup-shaped)

## Euphorbia

• Single flower appearance

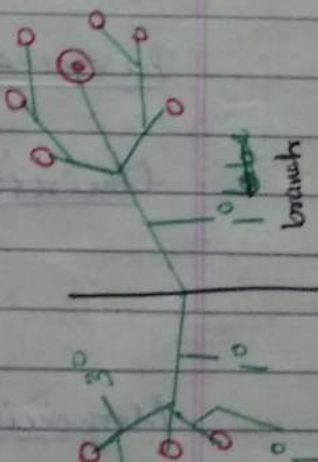
Pedilanthus

## Achlamydeus

Sepals and petals both - nt in male and female flowers

## Verticillaster

•  dichasial cyme with monochasial branches



Decimum (Hulst), Salvia (Lamiaceae)

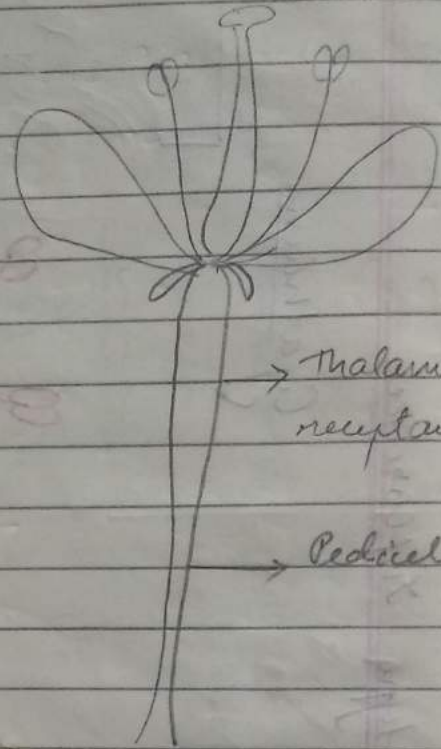
Flower : Defined as highly condensed modified reproductive shoot

- Gynoecium G

- Androecium A

- Corolla C

- Calyx K



Thalamus/  
receptacle

Pedicel

Terms - flower

Complete flower - 4 whorls  
G, A, C, K

Incomplete - missing

Bisexual - G + A, ♀ ♂

Unisexual - G - Pistillate ♀

A - Staminate ♂

Monocious plants - ♀, ♂ same plant

Dioecious

♀, ♂ diff plants

e.g. Coconut  
Cucurbits  
Castor  
Maize  
Acalpha

\* Date palm  
\* Mulberry  
\* Papaya

More common

# Polygamous plants

♂, ♀, ♂, neuter flowers  
Same plant

e.g: Polygonum  
Litchi  
Mango

Dichlamydeous flower

Corolla, calyx + net

Monochalamydeous

Perianth

Siliaceae

Achalamydeous flower

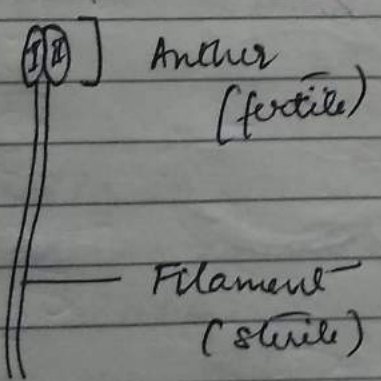
K x Cx

Piperaceae family

Calyx -

Androecium

stamens



[2 lobes  
tetrasporangiate]

T = thalamus G = gynoecium R = rest of floral parts

## Symmetry - Flower

Actinomorphic ⊕  
Many Vertical planes.

Malvaceae - China rose

Brassicaceae - Mustard

\* Solanaceae - Datura  
chilli

Zygomorphic %  
One vertical plane

Pea } Fabaceae  
Bean

Gulmohur  
Camia

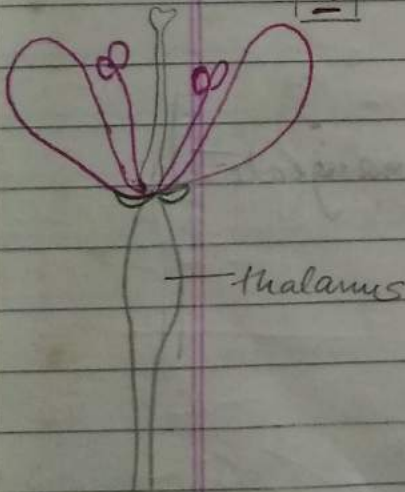
Asymmetrical  
Cannot be divided

Canna

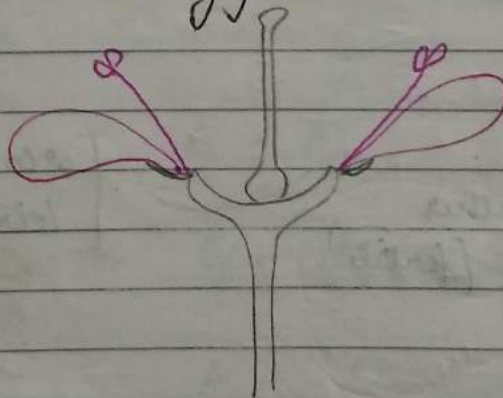
## Position

Hypogynous

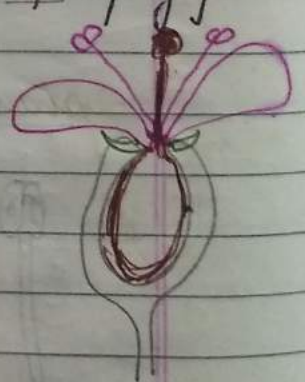
G



Perigynous.



Epigynous.



\* T - conical

G top / Superior

R - Sprouting from lower side

China rose

Mustard ulania

T - Expanded

G - Centre Half inferior / Half superior

R - Rim of thalamus

Peach  
Plum  
Rose

T - Annular

G - Superior

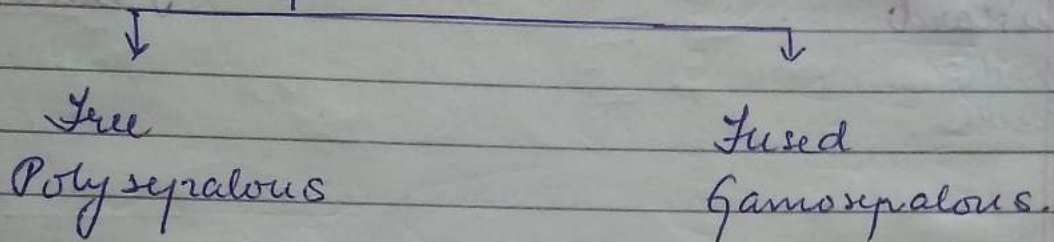
R - Above it

Guava, bilberry  
Cucumber

(Sunflower) Ray flowers

## Calyx

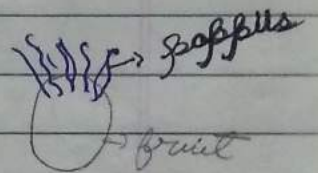
Non-essential whorl  
gamete formation x  
Sepals - Green



## Modification

Helps in  
fruit dispersal

Pappus - Sunflower  
Persistent hairy str.



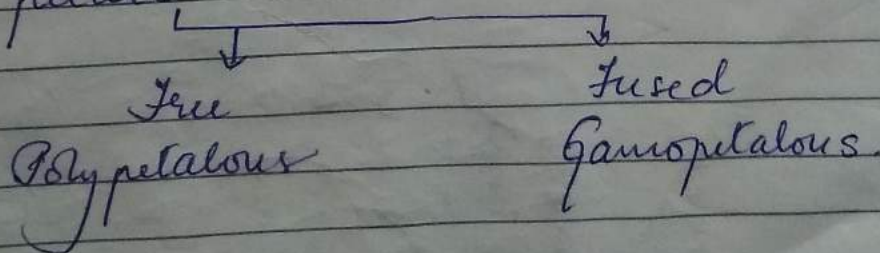
attracts  
insects

Leafy - Mussaenda  
One sepal large - white str.

Spinous - Trapa  
Persistent - 2 spines  
calyx in the form of

## Corolla

Non-essential whorl.  
petals



# Polypetalous (free)



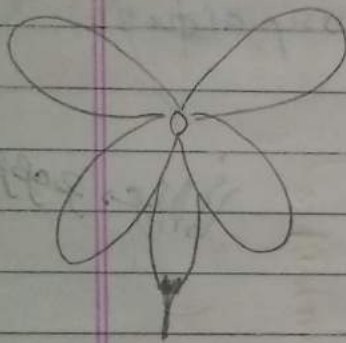
Cruciform

Brassicaceae

— Mustard

Radish

Turnip



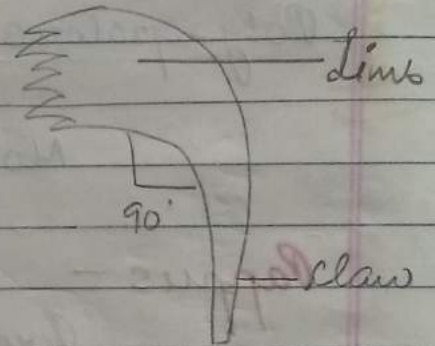
C<sub>x4</sub>



Caryophyllaceae

Caryophyllaceae

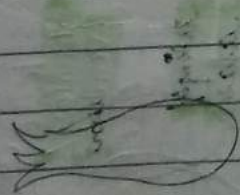
✓ Dianthus



C<sub>5</sub>

## Gamopetalous (fused)

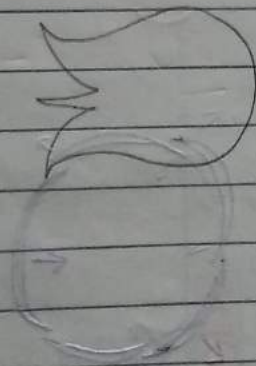
Tubular



Disc flower of  
Sunflower

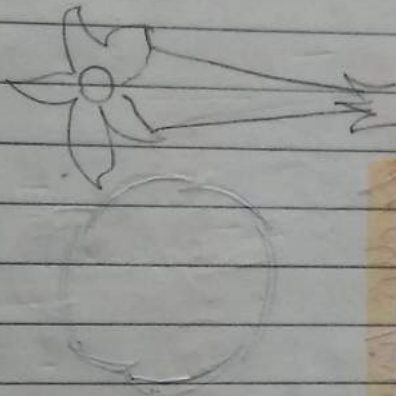
Companulate

Bell



Physalis

Infundibuliform



Datura

Bilabiate

2 Lips  
mouth open

Ocimum, Salvia

(Lamiaceae)

Personate

2 lips - very close  
mouth close

Dog flower

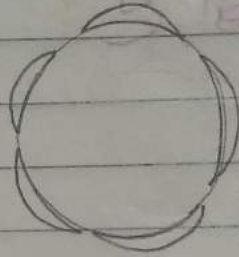
Ligulate

strap

Ray florets

# Aestivation (Arrangement of sepals & petals)

Valvate

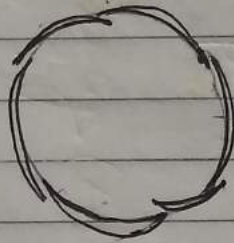


Overlapping x

Calotropis

Mustard

Twisted



Lady's finger

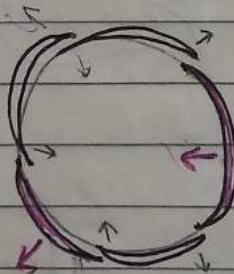
Cotton

China rose

Melanoschus esculentus

Imbricate

Imbricate



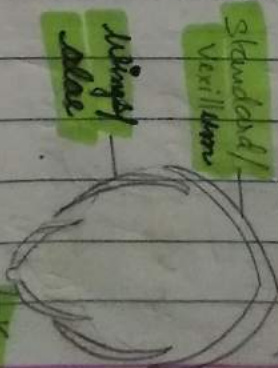
Cassia

Gulmohur

(Butterfly corolla)

Papilionaceous

(Fabaceae)



Standard/Vexillum

Wing

Keel

$(1+2+(2))$

# Androecium.

## Cohesion - Stamens.

among themselves

### Syngenesious

F - Free  
A - fused  
A(5)



Asteraceae

Sunflower

\* Sunflower shows both cohesion and cohesion.

### Adelphous

F - free  
A - free

A - free

Monoadelphous.

A(∞)

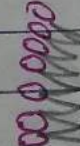


Malvaceae

- Chinarpal

Diadelphous

A(9)+1



Fabaceae

Pea

Polyadelphous.

Scrophulariaceae

(Petunias)

Rutaceae

### Synandrous.

F - A - Fusion

Culicis

Cucurbitaceae

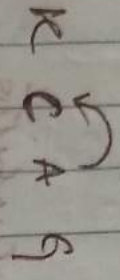
family

Cucurbitaceae

family

Epipetalous

Petals



Chinase rose

Monophloer

Doctanum

↓  
Burijal

Adhesion - Stamen

Epiphyllous / Epipetalous

Petal (Sepals)



Lily (Liliaceae)

Gynandrous

Gynoeceum



Calotropis

Fusion of A & G

[Gynostegium]

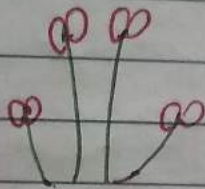
is called.

## Length And Arrangement - Stamen

### Didynamous

4 stamens

- 2 short - outer
- 2 long - inner

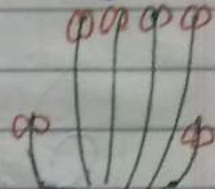


$A_{2+2}$

### Tetradynamous

6 stamens

- 2 short - outer
- 4 long - inner



$A_{2+4}$

### Lamiaceae

Ocimum

Salvia

### Brassicaceae

Mustard

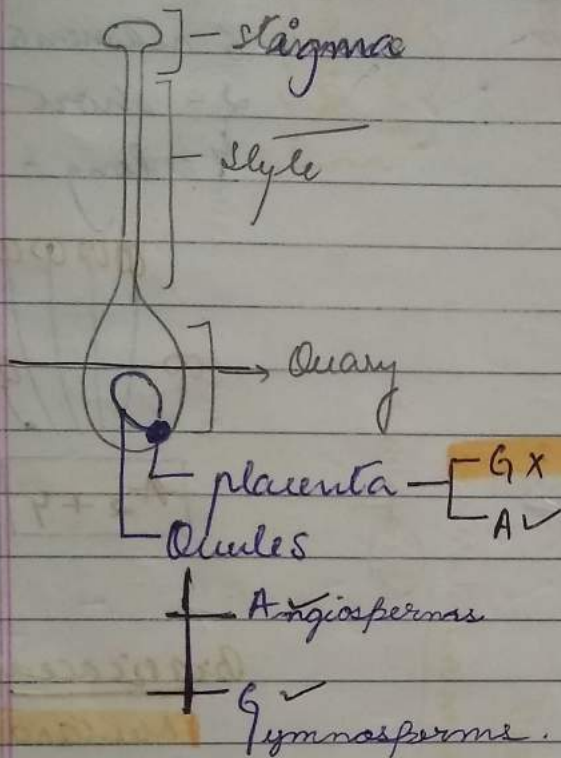
Terms : • Polyandrous  
stamen - free

• Staminode  
sterile - stamen

Mustard

# Gynoecium

## Carpel



## Gynoecium

Monocarpellary

Many  
Polycarpellary

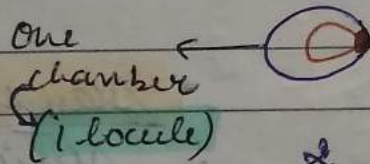
free  
Apocarpous

• Ranunculus  
• Rose  
• Lotus

fixed  
Syncarpous

More  
common  
in  
Angiosperms

## TS of Ovary



2

3

4

5

> 5

Unilocular Pea

Bilocular Solanum

Trilocular Amaranthus

Tetralocular

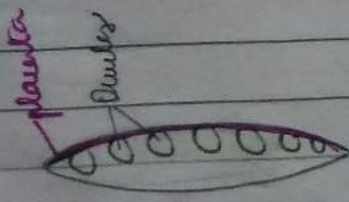
Pentalocular Ocimum  
Chinarose

Multilocular

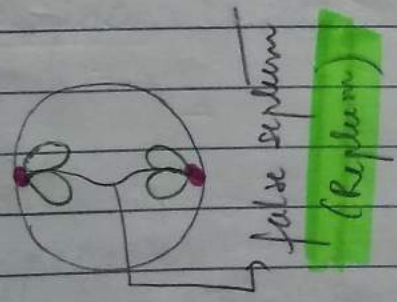
lady's fingers.

# Placentation - Arrangement of ovule in ovary

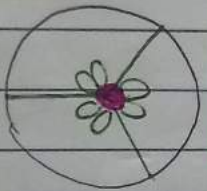
Marginal  
Unilocular  
Pea, Bean



Parietal  
Uni → Bi  
Mustard, Argemone

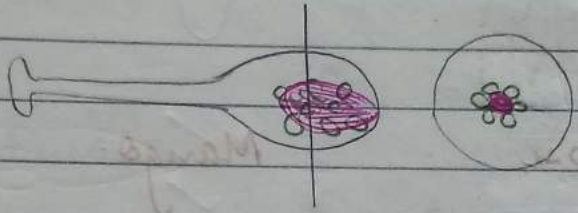


Axile  
Bi to Multi  
Lemon, Lily, Tomato, Primrose



Most Common  
seen in angiosperms

Free Central  
Uni  
Dianthus, Primrose (Primula), Stelaria



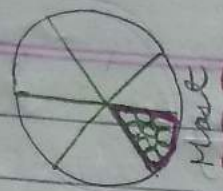
Basal  
Mori, Monarda, Sunflower, Wheat, Poaceae



Most Advance

Ex -  
- Poaceae  
- Asteraceae  
- Single ovule

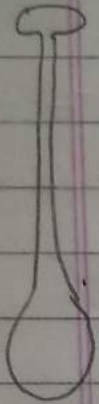
Superficial  
Multi  
Waterlily



Most Primitive  
Large no. of ovules

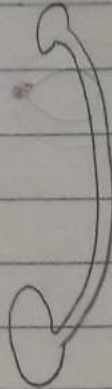
## Position Of style

Terminal



China rose  
(Most common  
in angiosperms)

Lateral style



Mango

Gynobasic  
from base of ovary



Ocimum  
(Tulsi)



# Symbols - floral formula

1. Br - Bracteate flower

$\overset{\curvearrowright}{C \ A}$  Epipetalous

2. EBr - EBracteate flower (bract - not)

$\overset{\curvearrowright}{G \ A}$  Gynandrous

3.  $\oplus$  - Actinomorphic

$\overset{\curvearrowright}{P \ A}$  Epiphyllous/  
Epitopalous.

4.  $\%$  - Zygomorphic

$G$  - Gynoecium

5.  $\text{♂} \text{♀}$  Bisexual

$G(n)$  = Syncarpous.

6.  $\text{♀}$  Unisexual female

$G_n$  = Apocarpous.

7.  $\text{♂}$  Unisexual male

$G_n$  - Superior Ovary

8. K - Calyx

$\bar{G}_n$  - Inferior Ovary

9.  $K_n$  - polysepalous (free)

Epi - Epicalyx (below sepals)

10.  $K(n)$  - Gamosepalous (fused)

● - Posterior side of flower

C - Corolla

Mother axis

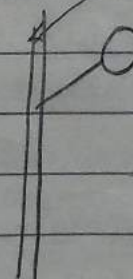
$C_n$  - polypetalous

$C(n)$  - Gamopetalous

P - Perianth

A - Androecium

$A_\infty$  - infinite stamens.



Fabaceae

Solanaceae

Liliaceae

Pea family

Potato family

Lily family

See family

Herbaceous

Dicot

Dicot

Monocot

H, S, T

H, S, T

Perennial

Herbs, Shrub, Trees

Herbs

Herbaceous / Woody  
Solid / Hollow

✓

Tuber (Underground stem)  
(Potato)

Underground stem

Bulb - Onion

Corm - Colchicum

Rhizome - Polygonatum

Reticulate venation

✓

Simple / Compound

✓

Phyllotaxy - Alternate

✓

Parallel

Leaf

Simple

Alternate / Basal

• Pulvines (swollen leaf base)  
• Stipules

x

x

x

x

Racemose

Solitary / Cymose

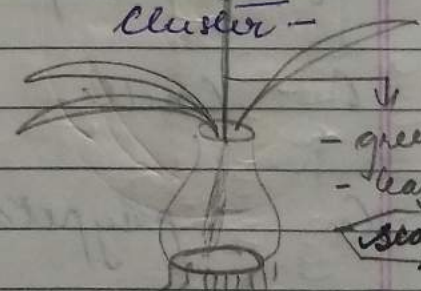
Solitary / cymose

- Umbellate cluster -

Potato family

Solanaceae

Inflorescence



- green leaves  
- scape

♂ ♀

♂ ♀

♂ ♀

Scapiflorous

Umbel

Scapiflorous  
Umbel  
Flower

## Fabaceae

## Solanaceae

## Liliaceae

Calyx

K(5)

K(5)

P 3+3 / (3+3)

↓  
tube.

Corolla

Vexillary

C<sub>1+2+(2)</sub>

Valvate

C(5)

Androecium

Diadelphous.

A(9)+1

Epipetalous

↙ ↘  
C(5) A<sub>5</sub>

Epitropalous

↙ ↘  
P<sub>3+3</sub> A<sub>3+3</sub>

Gynoecium

3G

Monocarpellary

Unilocular

3G

Bi, Syn.

Bitrilocular  
Obliquely

3G

Tri Syn.

Trilocular

Locusta

Marginal

Axile, Swollen

Axile

Fruit

Legume / Pod

Berry / Capsule

Capsule / Berry  
(rare)

Uses - Arhar, sem,  
Gram, soyabean

Food - tomato, potato  
Brinjal

Vegetable -  
Asparagus  
Onion (Allium lilia)

Medicine - Glycyrrhiza  
(Mulathi)

Spices - Chillier

Medicine -  
Aloe vera

Oil - Groundnut,  
Soyabean,

Medicine - Atropa  
belladonna

Ornamental

Dye - Indigofera

Asparagus → Withania  
Somnifera

Tulip,  
Gloriosa

Ornamental - Lupin, Sweet pea

Fumigatory -  
Tobacco

Chemical -  
Colchicum,

Fibres - sun hemp

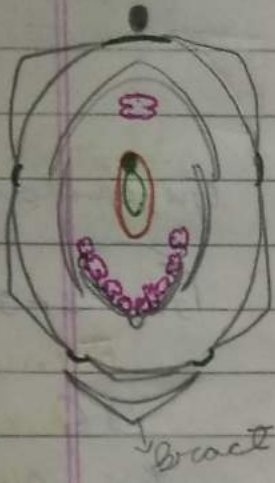
Ornamental  
↳ petunia

Antitumoural  
↓  
colchicine

Fodder - Sarbania  
trifolium - N<sub>2</sub> fixing

## Labaceae

Br ♀ K(5) C<sub>1+2+(2)</sub> A(9)+1 G<sub>1</sub>



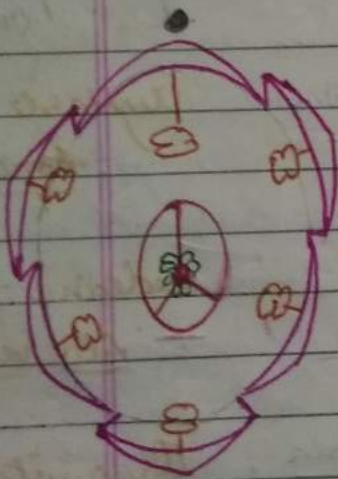
## Solanaceae

⊕ ♂ K(5) C<sub>5</sub> A<sub>5</sub>  
G<sub>(2)</sub>



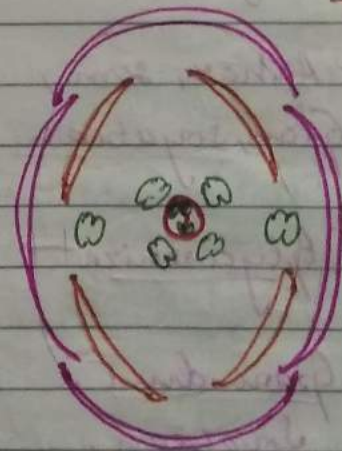
## Liliaceae

⊕ ♀ P<sub>3+3</sub> A<sub>3+3</sub> G<sub>(3)</sub>



## Brassicaceae

⊕ ♀ K<sub>2+2</sub> C<sub>x4</sub> A<sub>2+4</sub>  
G<sub>(2)</sub>



Floral diagrams do not provide information about position of ovary.

# Fruit

True

False

Parthenocarpic

Superior Ovary

Inferior Ovary

Fertilisation ✓

✓

x

Seeds ✓

✓

x

Eucarp

Pseudocarp

Chemicals

- Mango

\* Pedicel - Chashwonet

Auxin

Coconut

\* Thalamus - Apple

Gibberlin

\* Perianth - Mulberry  
(Morus alba)

- Banana  
(Natural)



→ Fruit (Ripened ovary)

→ Fruit wall / Pericarp

→ seed

- O Epicarp

- M Mesocarp

- I Endocarp

# Type of fruit

Simple

Aggregate

Composite  
Multiple  
in fruits

Single flower

Single flower

Entire inflorescence

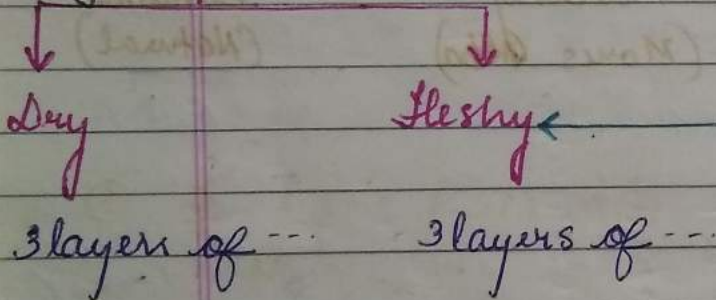
Gynoecium

Monotocarpellary

Apocarpous

(1) Syconus  
Hypanthodium  
influence

Syncarpous

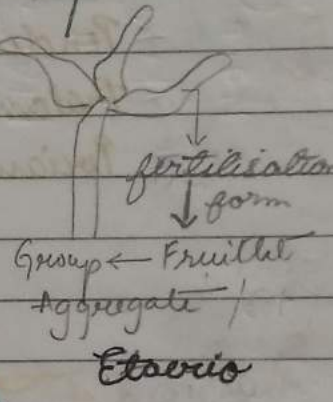


Pericarp - nt      -- Pericarp + nt

→ Indehiscent - split X

→ Dehiscent - " ✓

→ Schizocarpic - In b/w



(2) Sorori's  
Spice  
Catkin  
Spadix

1. Drupe
2. Berry
3. Pepo
4. Pome
5. Hesperidium
6. Ballanista
7. Anphisarca

**DRY**

Pericarp and seed coat completely fused.

Caryopsis

Superior Gynoecium

Monocarpellary

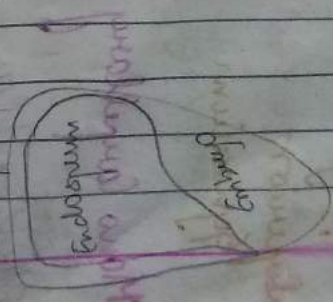
Poaceae family

Maize

Wheat

Rice

Pericarp



**Edible**

Entire fruit

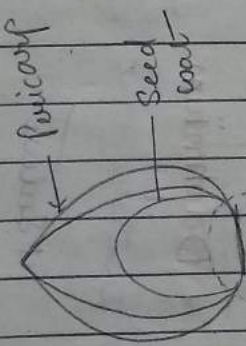
**(1) INDEHISCENT**

Achene

Superior Gynoecium

Monocarpellary

Mirabilis



Fusion of

Pericarp &

Seed Coat

restricted to lower zone.

Lysela

Superior Gynoecium

Bicarpellary

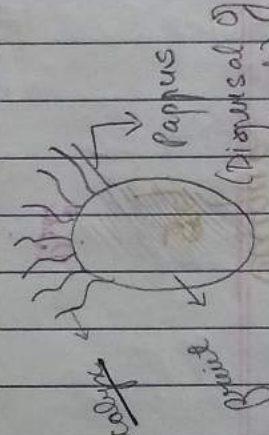
Asteraceae family

Sunflower

Sonchus

Lactuca

Zinnia



Parachute Mechanism

Samaras

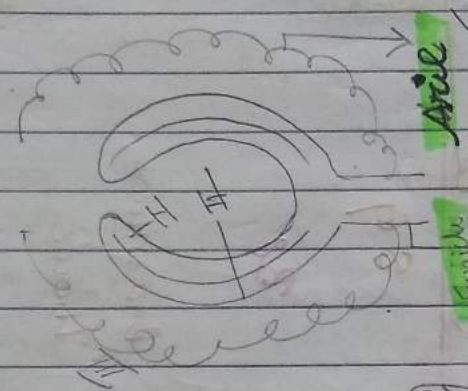
Superior Gynoecium

Winged fruit

from pericarp

Hiptage

Dioscorea



Integument

Nut (True)

Superior/Inferior Gynoecium

Mono-poly

**Pericarp**

Hard (stony)

woody

**Cashewnut (Anacardium)**

**Edible**

Thalamus & Cotyledons

Oak (Quercus)

Litchi (Marking nut)

**Aril / Edible**

3rd integument

arises from funicle

## (ii) DEHISCENT.

→ Simple - dry.

Pod / legume

Superior  
Gynoecium

Mono Carpellary

Fabaceae / Pea  
Family

• Silicle

Sg

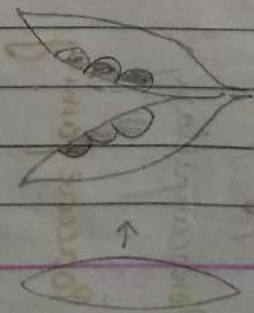
Mono

Delphinium

2 sutures + not

1 Suture  
involved  
in splitting

• Etaria  
of  
Fallicides



• 2 Sutures  
and both  
involved in  
splitting

Siliqua

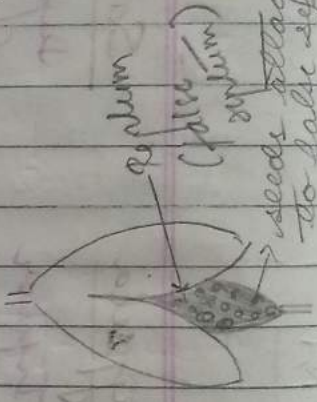
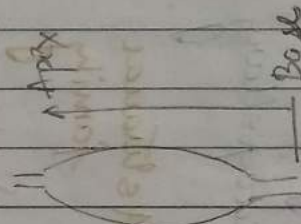
Sg

Bi

Brassicaceae

Mustard

Radish



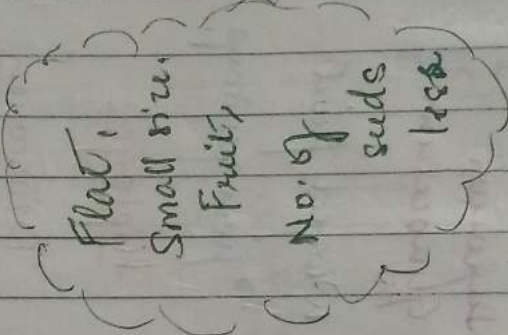
Silicle

Sg

Bi

Brassicaceae

Theris



• Anemochory: seed dispersal due to air current

Capsule

Sg.

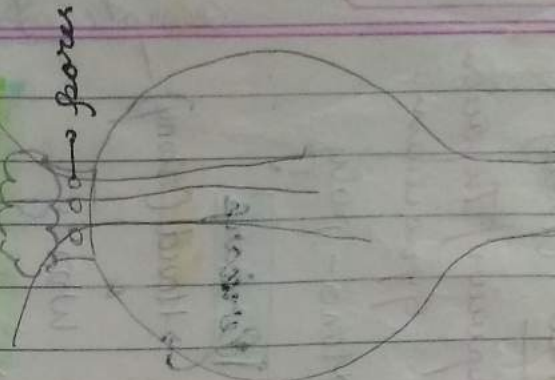
Bi - Poly

multiple floration

• Poppy

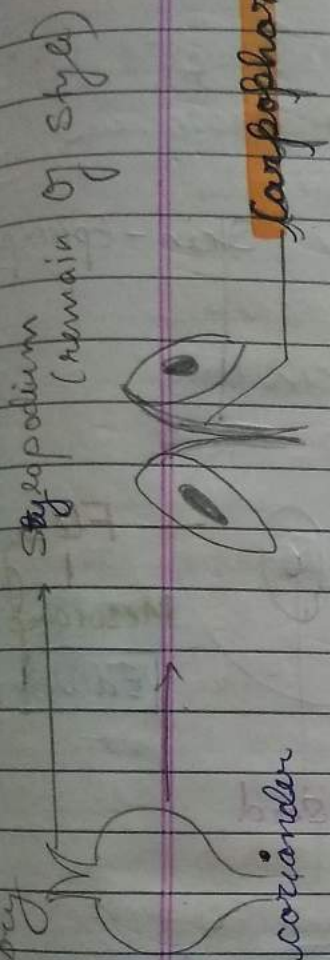
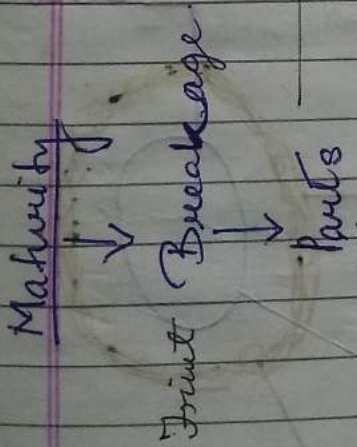
(Opium)

• → Datura



Anemochory  
Cinger Mem.

(11) Schizocarpic -



→ Dehiscent fruits known

as Cocci

More

33

## Regma

### Example

Ricinus  
(Castor)

### Example

Curcinder

Answer

famouairnd

Tulsi (Ocimum)

Indehiscent part is known

as Meicarp  
(Coriander)

Murica

၁

## Summary

$$\frac{2}{4}$$

Frail

• Cremona

## Impulse G

## Double Samana

55

Lomentum

*Coryxillus* 86

Almond and walnut are fleshy fruit and not dry fruit.

Fleshy / Succulent

Drupe

• 3 layer of Pericarp

★ Endocarp - stony

Mango

Coconut

★ Walnut - Cotyledons  
Edible

Peach

Pear

Plum

Lizyphus

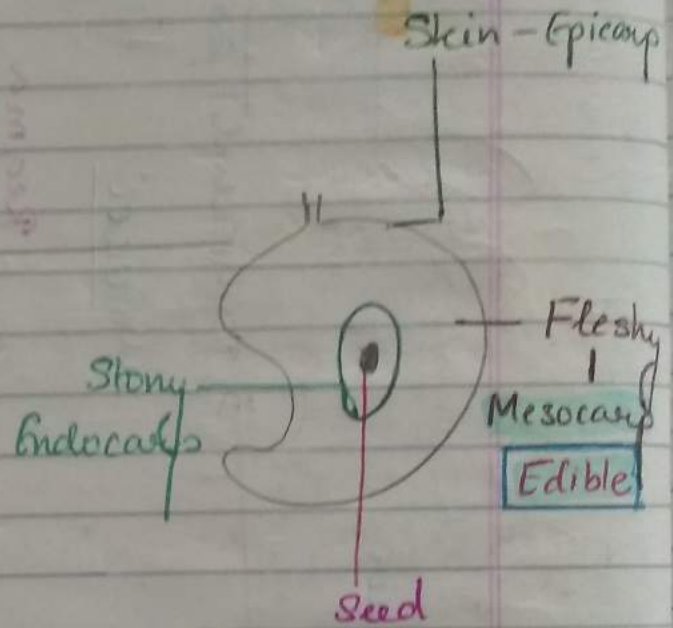
★ Almond

Epi - Velvety

Meso - Hard

Endo - Stony

Seeds - Edible



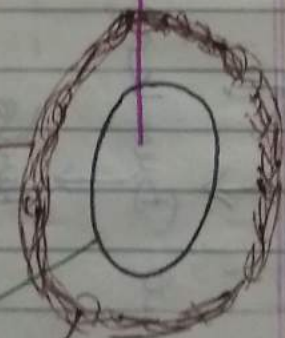
Edible - Endosperm  
Seed

Papery  
Epicarp

Stony  
Endocarp

Fibrous - Mesocarp  
Cow

★ Fibrous Drupe



## Berry

Superior Gynoecium

True Berry

Grapes

Tomato

Chillies

Beanjal.

Inferior Gynoecium

False Berry

Guava

Banana

Edible - All parts are edible except Seeds

• Usually multiseeded

exception

- Betel nut  
Date palm

} Single Seeded.

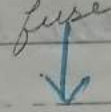
## • Pepo

(Hard Walled Berries)

Inferior Gynoecium

Cucurbitaceae

Epicarp + Thalamus



- Exocarp form the

- Skin of the fruit

and is Non edible

Cucumber - Edible - Mesocarp + Endo + Young Seeds

Botlegourd - Edible - Mesocarp + Endo + Young Seeds

Watermelon - E - Endo + Placenta + ~~Meso~~  
non edible

Melon - E - Meso + Endo + ~~Placenta~~  
non edible

## • Pome

Inferior Gynoecium  
False / Pseudocarpic

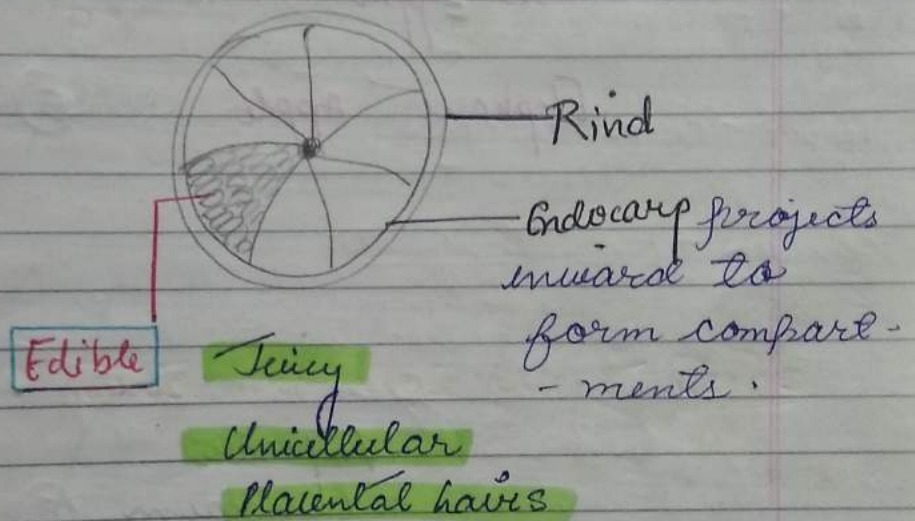
Apple } - Edible - Thalamus  
Pear }

• Hesperidium - Superior Gynoecium

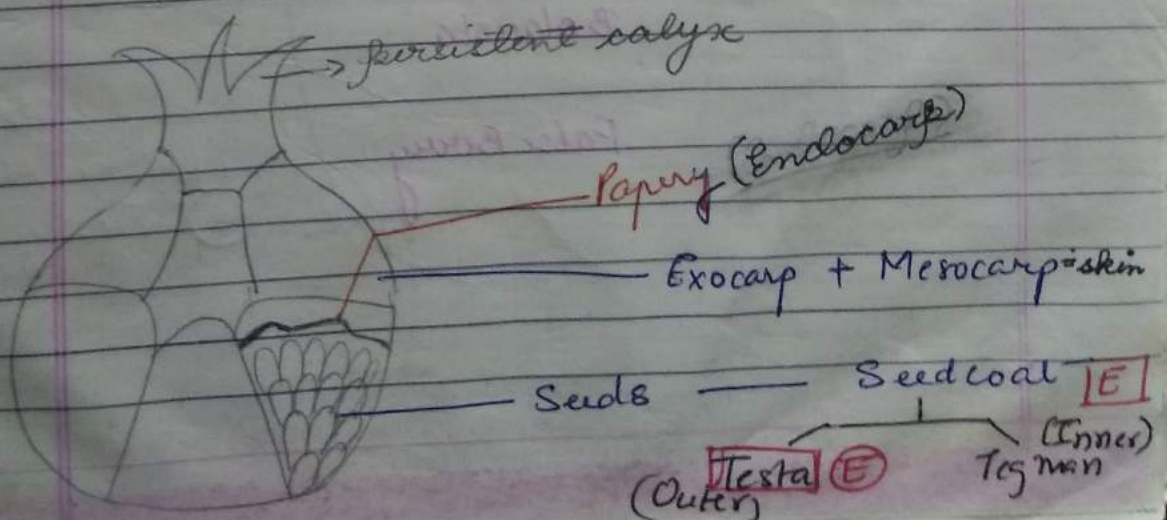
Epi + Mesocarp  
fuses

↓  
Skin / Rind

Citrus



Balausta - Inferior Gynoecium  
Pomegranate

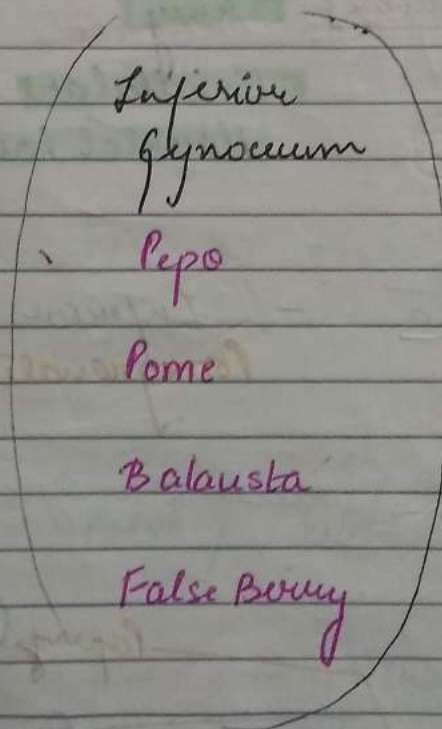


- Amphisarca - Superior Gynoecium

→ Epicarp - Stony

(E) - Mesocarp  
Endocarp  
Placenta

- Wood Apple
- Elephant Apple



## Aggregate fruit

\* Example of Achenes - Strawberry  
(E) - thalamus

\* Example of berries - Custard Apple  
(E) inner layer of pericarp  
+ thalamus

Example of follicles - Delphinium

\* Example of Drupe - Raspberry



\* after fertilisation female flower forms achene type of fruit.

## Composite / Multiple Fruit

↓  
Entire Inflorescence

### • Syconus

Hypanthodium

Fig - Ficus carica (E) - fleshy receptacle

Peepal - Ficus religiosa

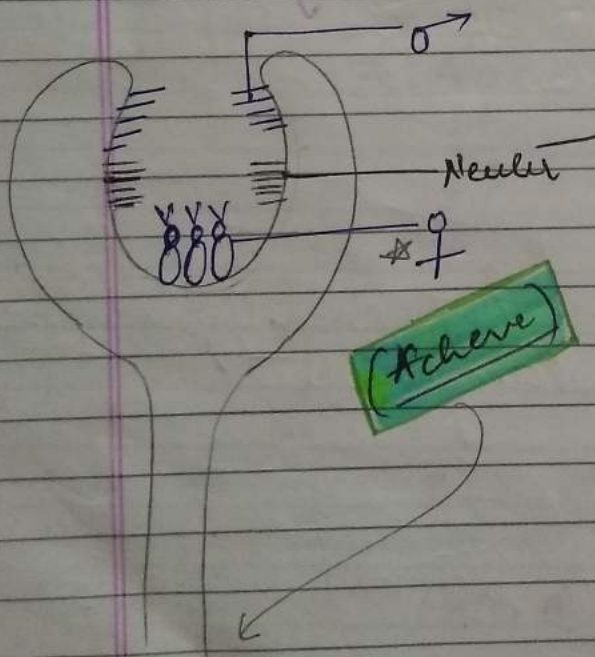
Banyan - Ficus Bengalenis

### • Sorron's

Spike, Catkin,  
Spadix

Pineapple

(E) - Fleshy axis +  
Bract +  
Perianth +  
pericarp



### Jackfruit

(E) Fleshy axis +  
Bract +  
Perianth +  
pericarp +  
Seeds

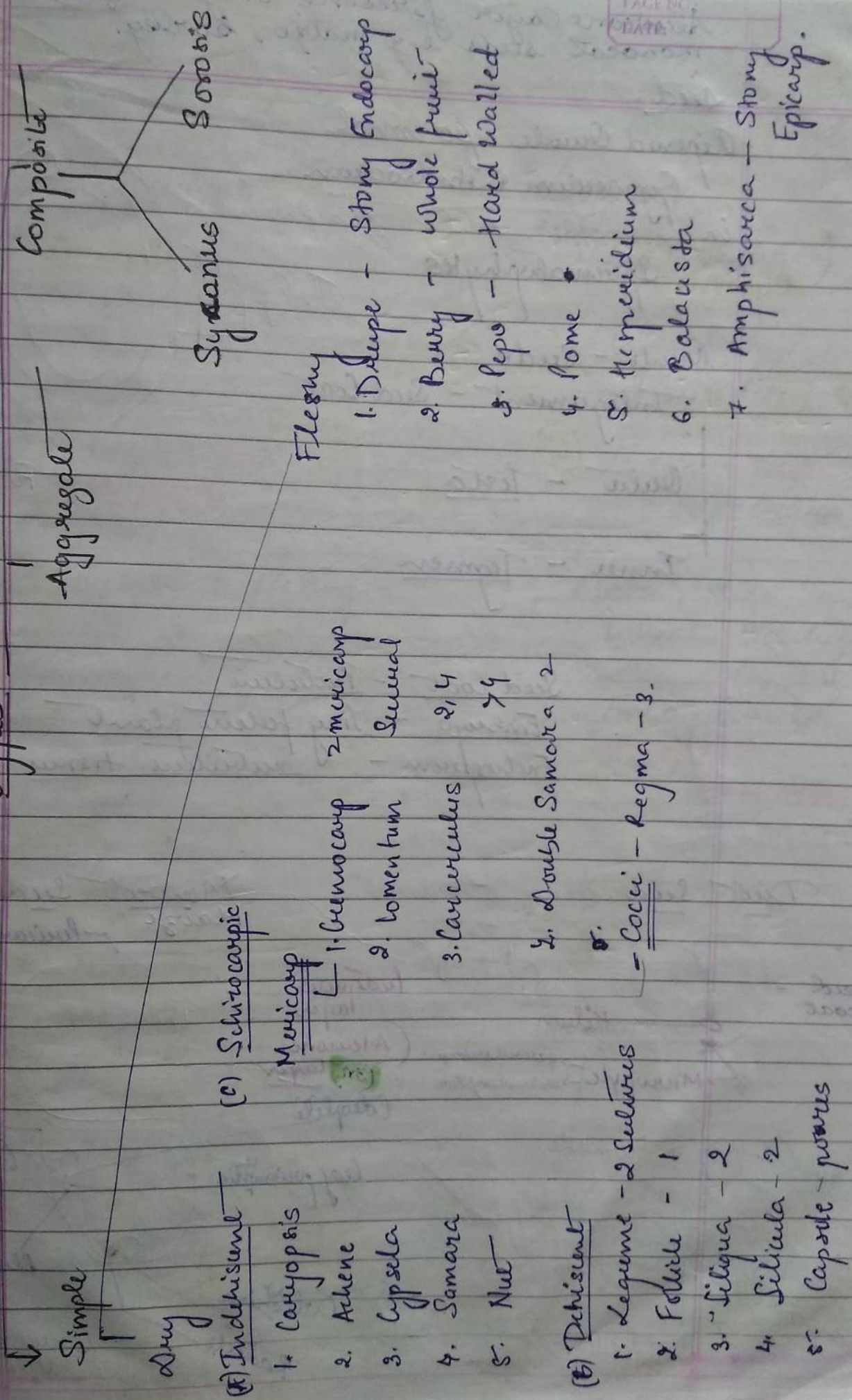
### Mulberry

(Morus Alba)

(E) Fleshy axis +  
Perianth

In syconous fruit  
the female flowers  
form achene type  
of fruit.

# Types



Aleurone layer present only in few monocot seeds e.g. maize, barley.

## Seed

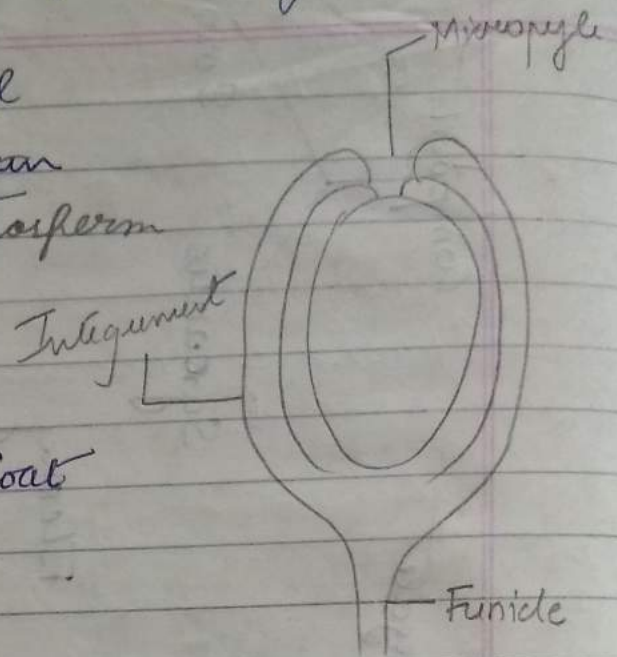
Ripened Ovule formed  
Gynoecium + Androecium  
in Gymnosperm and Angiosperm  
Spermatophytes

Ovule - Seeds

Integument - Seed Coat

Ovule - Testa

Inner - Tegmen

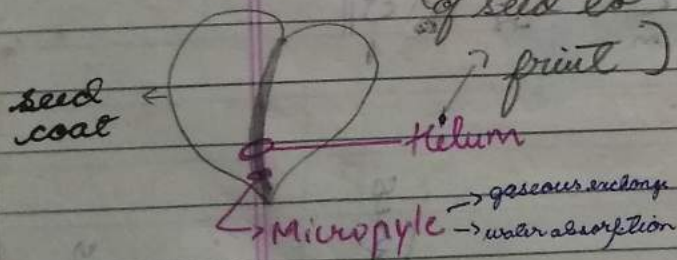


Seed Coat - Protective

Embryo - tiny future plant

Endosperm - nutritive tissue

Dicot Seed (pt. of attachment  
of seed to  
fruit)



Monocot Seed

Maize - Pericarp +

Seed Coat

Protective layer

(Aleurone  
3n layer)

Coleoptile

Leaf primordia

Coleoptile

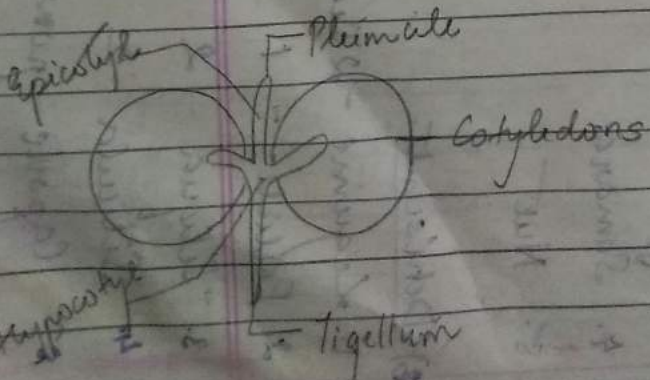
Radicle

Endosperm

Scutellum  
(Shield shape)

Plumule

Caryopsis fruit



Coleoptile

Radicle

Caryopsis fruit

Castor has : - Endosperm  
- perisperm  
- caruncle.

Lyonsium

Dicot Seed

Monocot Seed.

2 Cotyledons

Scutellum  
(1 cotyledon)

X

Coleoptile  
Coleorrhiza

Ex albuminous

Endosperm X

Exception: Castor

Albuminous

Endosperm ✓ seeds

exp - Orchids

Cotyledons fleshy

e.g. Maize, Rice,  
Wheat, Barley

e.g. Gram, Pea, Bean  
Groundnut

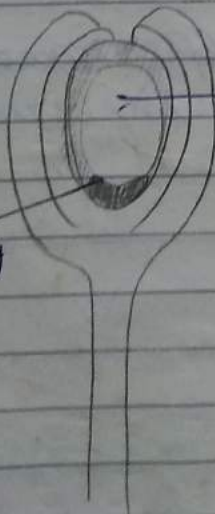
Endosperm ✓

Exception :

Orchids

Perisperm

Modification  
of style.



Nucellus

Seed (-)

Seed (+)  
remains

Perisperm

(1) Gymnosperm  
Pinus

(2) Angiosperm  
Piper nigrum  
Castor

e.g. x → Gynostemium

- Tendril in Antigonon is modification of inflorescence.
- Cytoplasmic male sterility gene affects staminode, sterile stamen which is characteristic feature of caesalpinaceae.
- Important chemicals and families
  - Singrin — Brassicaceae
  - Carthamin — Asteraceae
  - Atropine — Solanaceae
  - Alain — Liliaceae
- Primitive family (dicot) — Ranunculaceae
- Advanced family (dicot) — Asteraceae.
- Anthesis → opening of flower bud.
- Geocarpic fruit → ground nut
- Single flower appearance in cyathium and capitulum inflorescence.