XII - Bio

Unit - 1

→ NEET Imp Info

2011

Week 6 Tuesday Day (032-333)

1

Sexual Reproduction in Flowering Plants:

I] Androecium

Androecium → Male necessary whorl

↓

* Attached to thalamus or petals ← Microsporophylls (Stamens)

↓

Microsporangia (Anther lobes)

↓

Microspores (Pollen grains). → Male gametophytes (Microgametophytes)

- **Stamen: Structure**

→ **Filament**:- Stalk-like part, supports anther terminally. Base attached to thalamus

→ **Anther**:- Swollen bilobed, 2 lobes / theca united by a slender connective.

* Each lobe → 2 pollen chambers → demarcated by long. groove called line of dehiscence

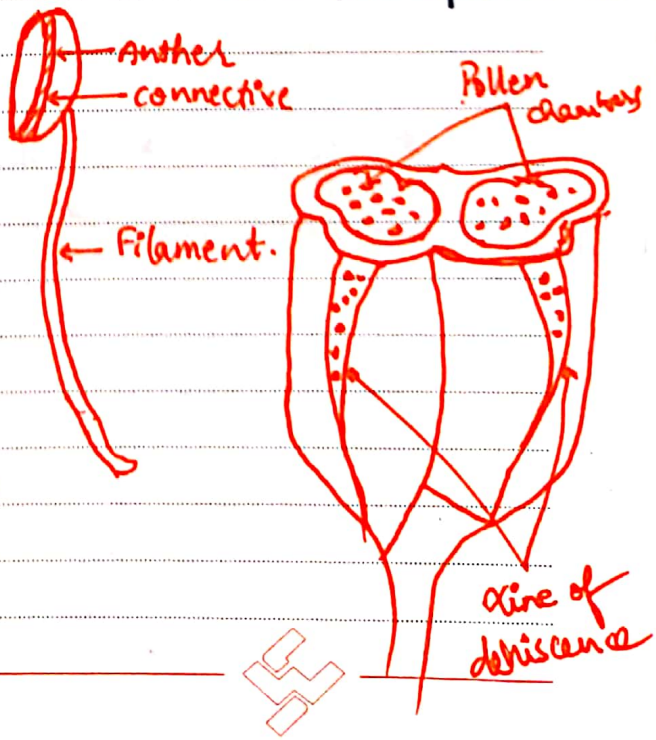
→ **Connective**:- Filament extension b/w two anther lobes.

Dithecous: 2 lobes → majority

Monothecous: 1 lobe → Malvaceae # & Euphorbiaceae

Bisporangiate (2 microsporangia)

tetrasporangiate (4 microsporangia)



Staminodes: Non-functional stamens one or more such as in roses.

2 Wednesday

Day (033-332)

February

Week 6

- **Microsporangia**

⇒ Pollen chambers → two in each lobe
⇒ Covered by anther epidermis

⇒ Young anther → mass of actively dividing parenchymatous cells surrounded by epidermis → 2-lobed → microsporangia initially as rounded masses of archesporial cells → dev. of microsporangia : eusporangiate type

4 microsporangia → 4 pollensacs

Archesporial cells
- Periclinal divisions
- Primary parietal cells
  - Outer sec. parietal → Endothecium (Radially elongated; Fibrous thickenings; Help in dehiscence; Stomium b/w pollen sacs.)
  - Inner sec. parietal → Middle layers, Tapetum (*) (disintegrate in mature anther)
- Primary sporogenous cells → Microspore mother cells → (Meiosis) Microspore tetrads → Pollen grains (Microgametophyte)

↳ initially connected by plasmodesmata, broken by formation of callose layers.

(*) Tapetum → innermost layer of cells with dense cytoplasm; nourish developing p. grains; secretes enzymes & hormones (IAA)

also
- Amoeboid → spore mother cells in Typha (Lily, Tradescantia)
- Glandular → sporogenous cells in Symphoricarpos

#
- Enzyme callase → dissolution of callose
- Ubisch granules → sporopollenin
- Pollenkitt & tryphine on pollen surface
- Proteins for compatibility – incompatibility

(Tapetum functions)

2011

Week 6

Thursday

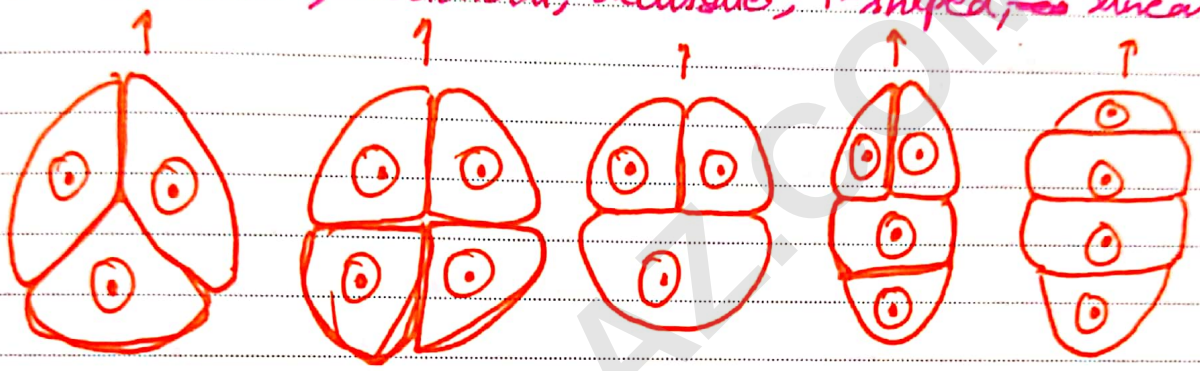
Day (034-331)

3

• Microsporogenesis

⇒ Def^{n} :- Forma^{n} of pollen grains/microspores from microspore mother cells or pollen mother cells (PMCs) inside microsporangia.

⇒ Each PMC $\xrightarrow{\text{meiosis}}$ four haploid microspores → tetrad → Tetrahedral, isobilateral, decussate, T-shaped, linear.



⇒ Anthers mature → tetrads disintegrate → pollen grains liberated.

• Typha, Drosera, Juncus → tetrads don't seperate → aggregate to form compound pollen grains → 8-64 p. grains together

• Calotropis & orchids → all p. grains of microsporangium → single mass called pollinium → 2 pollinia attached to sticky corpusculum → forms translator.

• Dehiscence of Anther

⇒ Matura^{n} → dries up; line of dehiscence ~~dries~~ disintegrates and single cavity formed

⇒ H_2O loss → dead endothecial cells contract → outer radial walls contract & come near → cells in stomium rupture and wall ruptures → p. grains dispersed

February

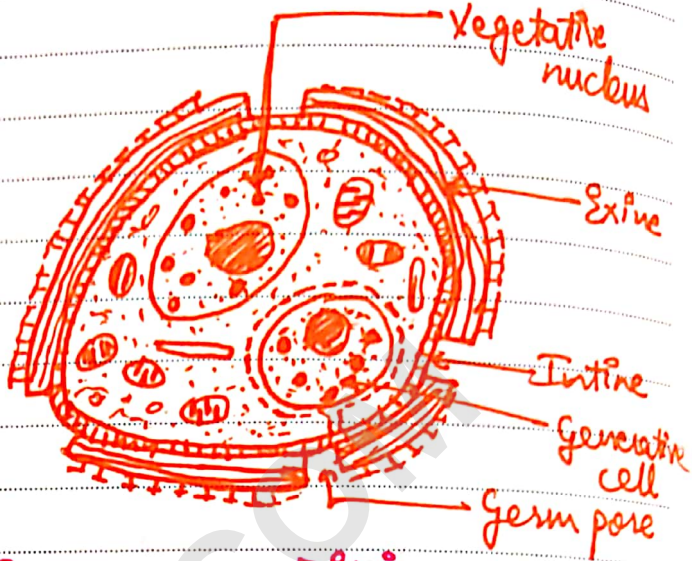
4 Friday

Day (035-330)

Week 6

- Microspores : Structure

⇒ Male gametophytes
⇒ Spherical, 25-50 μm in diameter
⇒ Oval, ellipsoidal, Δular, lobed, C-shaped
⇒ Spines / ridges / furrows



⇒ Wall / Covering → Sporoderm → Exine, Intine.
⇒ Exine → Sporopollenin → most resistant organic material known → withstands ↑ temp, strong acids & alkalis → no acⁿ of enzyme → pollen grains preserved due to sporopollenin. Exine → proteins & enzymes for compatibility.

Exine
- (Sexine) Extexine
- Endexine (Nexine)

Extexine
- Foot layer (inner cont.)
- Baculate layer (middle discont.)
- Tectum (outer discont.) → characteristics sculpting & designs eg. ridges etc. for identifying p. grains.

⇒ Intine → thin, uniform → pecto-cellulose (pectin + cellulose) → intine comes out of germ pore during pollen germinaⁿ in form of p. tube → enzymatic proteins

⇒ At places → exine thin/absent → thickened intine/ deposi^{n} of callose → called germ poses

Types acc. to germ pores

Monocoplate (P. grains with 1 pore)

Tricoplate. (P. grains with 3 pores)

⇒ Pollenkitt

Exine covered by yellowish, sticky, viscous, oily layer → pollenkitt → carotenoids & flavinoids

Importance : a) insect attractant
b) p. grain protec^{n} against UV radia^{n}
c) helps p. grains to stick on insect body.

• Dev. of Male gametophyte

⇒ Pre-polling^{n} :- → precocious germination

a) Starts in pollen grains while still present in pollen sac

b) Nucleus of P. grain grows, moves to one side of wall, divides mitotically to form vegetative & generative cell

Bigger, abundant food reserve, large nucleus

small, spindle-shaped

c) Callose around generative cell → later dissolves → generative cell floats in cytoplasm of veg. cell.

d) P. grains liberated at 2-cell stage → majority. Sometimes → gen. cell mitotically divides into 2 male gametes before p. grains are liberated → 3-celled.

7 Monday

Day (038-327)

February

Week 7

⇒ Post-pollination :-

a) Reach stigma → p·grain absorbs H_2O & nutrients from stigmatic secre^n

b) Veg·cell enlarges → pollentube absorbs nourishment from cells of style

c) Pollen tube → tube nucleus + gen·cell

* → gen·cell divides → 2 male gametes

II] Gynoecium

Gynoecium

↓

Megasporophylls (Pistils) → Mono, bi, tri, ~~tetra~~, or multicarpellary

↓

Megasporangium (Ovule ~~Embryo sac~~)

↓

Megaspore (Embryo sac) → Female gametophyte (Megagametophyte)

Apocarpus (Michelia & Ranunculus) ; or Syncarpous (Papaver & Hibiscus)

- Pistil ← Stigma, Style, Ovary
- Stigma → disc-like ; terminal ; landing platform for p·grains
- Style → Elongated slender part
- Ovary → Basal swollen part ; bears ovules → as many locules in a polycarpellary pistil as there are pistils

2011

Week 7

Tuesday

Day (039-326)

8

- **Megasporangium as Ovule**

⇒ Two parts → Funicle & Body.

⇒ Funicle → short → attaches Ovule body to placenta

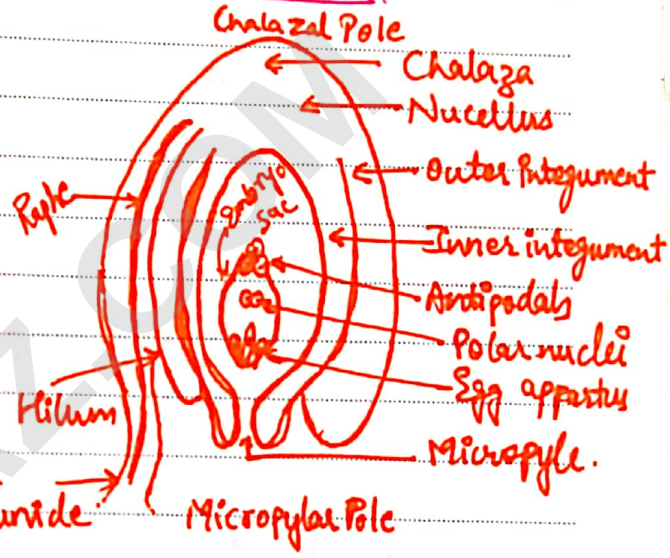
Pt. of attachment of body to funicle → hilum

Fun^{n}: attachment of ovule with placenta

⇒ Main body → oval → composed of parenchymatous cells → nucellus → reserve food material

⇒ Nucellus → surrounded by integuments

Fun^{n}: Forms nourishment tissue for embryo dev.



Unitegmic Ovules with 1 integument)

↓

Gamopetalous flowers

Bitegmic Ovules with 2 integuments)

↓

Polypetalous & monocot flowers

Fun^{n}: Protects inner tissues of ovule

⇒ No integument → ategmic → Santalum & Loranthus

⇒ 3rd integument sometimes → from funiculus → called aril in Litchi & arm in Asphodelus.

⇒ Basal part of nucellus → chalaza → Integuments arise

⇒ Opening at apex of integuments → micropyle

⇒ Embryo sac → embedded in nucellus towards micropylar pole

→ Fun^{n}: Provides entry to pollen tube

→ Fun^{n}: Contain Embryo & Endosperm nucleus → Endosperm for nourishment of embryo later.

Def^{n}: Proces of forma^{n} of megaspore from MMC in ovary of carpel

9 Wednesday

Day (040-325)

February

Week 7

- Megasporogenesis

Archesporial Cells (Micropylar reg. of Nucellus) → sub-epidermal / hypodermal

→ dense cytoplasm & prominent nucleus distinguish

may directly func. as MMC or divide

Periclinal division.

Prim. Parietal cells → Parietal tissue

- One cell → mitosis → 2 nucleate
- one on each end → 2 free mitosis
- mitosis
- differentiation
- Embryo sac

Primary sporogenous cells or Megaspore mother cell (MMC)

Meiosis.

linear row / tetrad of megaspore cells

Two integuments develop from base

other 3 degenerate

One megaspore cell* (Chalazal end of tetrad)

Elaborate process of formation

Cell wall formed after

Mitosis (3 times).

enlarges due to central vacuole

8-nucleate embryo sac [Female gametophyte]

⇒ overlap egg cell
⇒ filiform apparatus → finger like proje^{n} → polysaccharides → guide pollen tube into synergids
⇒ Fun^{n}:
a) Absorb nut. from nucellus
b) Secrete active subs. for p. tube
c) Shock absorber
d) Seat for P. tube discharge

2 Synergids + 1 egg cell (micropylar end)

Diploid central cell (2 nuclei fused)

3 Antipodal cells (Chalazal end)

⇒ oosphere
⇒ polar
⇒ vacuolated → m. end nucleus → C. end
⇒ Main cell for fertilisa^{n}
⇒ gives rise to zygote & embryo

⇒ 2 polar nuclei from div. of *megaspore cell.
⇒ Only diploid structure in Embryo sac
⇒ gives rise to prim. endosperm cell

⇒ Chalazal end of embryo sac
⇒ possess a no. of enzymes, starch, lipids, proteins
⇒ absorbs nutrients from nucellus
⇒ degenerate later.

2011

Week 7

Thursday 10

Day (041-324)

Types of embryo sac :

a) Monosporic - dev. from one funct^{n} megaspore ; most common
b) Bisporic - dev. from one dyad / cell formed after 1st mitosis
c) Tetrasporic - dev. from all 4 cells after complete mitosis

Types of ovules : Refer T.B. → Imp *

- Study of ext-morpho of mature p. grains → palynology
- Monocoplate p. grains → family Liliaceae
- Tricoplate p. grains → true dicots

- Pollen viability → Period of retaining ability to germinate → 30 mins after release in cereals → months in Rosaceae, Leguminoseae, Solanaceae.
- Pollen Banks → P. grains stored for yrs @ in liq. N_2 (-196°C) → crop breeding
- Pollen products → nutrient rich → tablets / syrups to enhance performance of athletes
- Pollen allergy → Severe allergies, asthma, bronchitis, hay fever → cause : tryphine → poisonous [Carrot grass (Parthenium)]

Imp → Differences :-

a) Male v/s female gametophytes (Pg 51)
b) Micro v/s Megasporogenesis (Pg 49)
c) Apocarpous v/s Syncarpous ovaries (Pg 46)

11 Friday

Day (042-323)

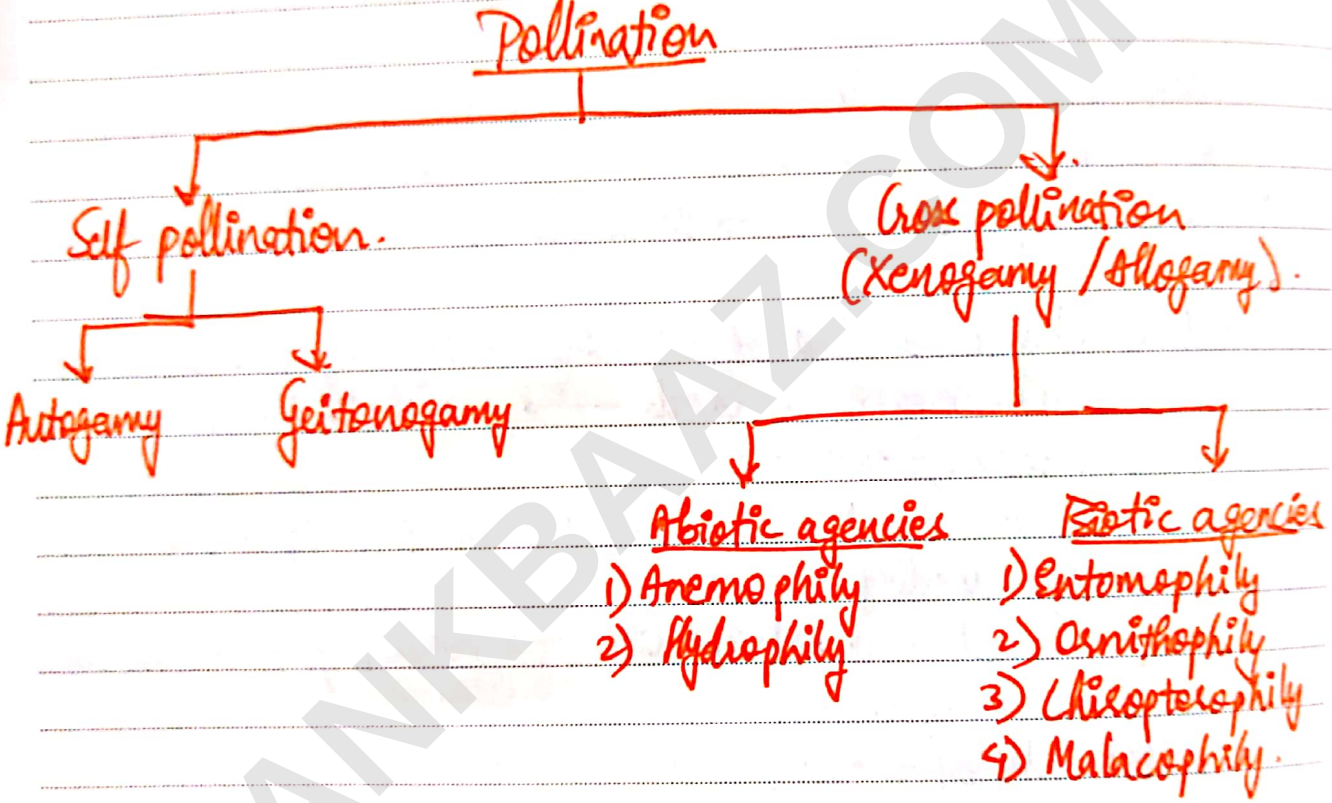
February

Week 7

III] Pollination

Defⁿ :- Transfer of pollen grains from anther to the stigma

- Only in gymno & angiosperms
- Adaptation :-



- Self pollination

⇒ P. grains from anther to stigma of same flower or another flower on same plant. → Autogamy / → Geitonogamy.

⇒ Autogamy acheived by the foll :-

a) Homogamy – Flowers chasmogamous → Stamens & stigma mature at same time → brought closer → Potato, Rice, Wheat, Pea, Mirabilis, Catharanthus etc.

→ Bud pollination

(Anthers stigma mature b/f. flower opening).

2011

Week 7

Saturday 12

Day (043-322)

b) Cleistogamy & Chasmogamy –

Underground flwrs;
closed throughout life;
flowers small, colourless;
inconspicuous, odourless;
Anthers mature & liberate
p. grains in closed flwrs;

Aerial flowers; open like normal ones;
Later become cleisto.
to ensure fruit formⁿ;
larger, brightly coloured, scented → self & cross pollinⁿ

Flowers having both types → chasmo-cleistogamous
Eg. Commelina benghalensis, Viola, Oxalis, Arachis.

⇒ Geitonogamy → p. grains from anther of one to stigma of other on same plant → genetically self pollinᵃ but apparently cross-pollinⁿ → little variations. → homozygous

Sunday 13

Day (044-321)

Or allogamy

⇒ Xenogamy → p. grains from anther of one to stigma of other on diff. plants of same species → ext. agency essential → anther & stigma mature at diff. times → larger variation → heterozygous

Imp → Differences :-
a) Self & Cross pollinⁿ
b) Geitonogamy & Xenogamy.

14 Monday

Day (045-320)

February

Week 8

Self-pollinaⁿ

also a) Advantages : i) No failure chaces of pollinaⁿ
ii) Purity of race maintained
iii) Floweers needn't be attractive
iv) Scent & nectar not produced

b) Disadvantages : i) Continuaⁿ results in weaker progeny
ii) Resistance to diseases ↓ces

Cross-pollinaⁿ

a) Advantages : i) Results in formaⁿ of offspring with new characts
ii) Offsprings → healthier seeds & better yield → hybrid vigour ✗
iii) Disease-resistant & high yielding varieties of economically imp. plants
iv) Adaptaⁿ of plants
v) Used to dev. new kinds of fruits & veges.

b) Disadvantages : i) Uncertain
ii) May lead to addiⁿ of undesirable factors or removal of useful ones
iii) Un-economical → use a lotta energy & food for devices for cross pollinaⁿ

Contrivances for cross pollinaⁿ :-

a) Unisexuality / Dicliny - Flowers → unisexual → self pollinaⁿ not possible
(i) Monoecious : Pumpkin, Maize, Cucumber, Castor
(ii) Dioecious : Papaya, Cannabis, Mulberry, Date palm.

b) Dichogamy – Maturation of anthers & stigma not at same time.

(i) Protandry: Anthers mature earlier → Salvia, Abelmoschus, Sunflower, Cotton, Lady's finger, Jasmine

(ii) Protogyny: Stigma mature (=) earlier → Gloriosa, Mirabilis, Plantago, Peepal, Banyan.

c) Heterostyly – Flowers → diff. heights of stamens & carpels → pollination affected thro stigma & anthers of the same height → 3 diff types :-

(i) Diheterostyly :- Two types of flowers → i) Pin-eyed with long styles short stamens; and ii) Thrum-eyed with short " long " → Jasmine & Primrose.

(ii) Trimorphic heterostyly :- Three types of bisexual flwrs in a plant with diff. hts. of styles & stamens → Lathyrus and Oxalis.

d) Herkogamy – Refer to T.B.

e) Prepotency – P. grains from other flowers grow faster than the ones of own flwrs eg. Apple & Grapes.

f) Self Sterility – In some bisexual flwrs., p. grains of one flwr fail to grow on stigma of same flwr

Highest degree of specialisation to avoid self pollination → Potato, Tobacco, Cruciferes.

• Pollinating agents •

⇒ Abiotic (wind & water) → Anemo → Hydro
⇒ Biotic (birds, insects, bats, snails).
→ Ornitho → Entomo → Chiroptero → Malaco.

⇒ Anemophily :-

a) Pollination of flwrs by wind
b) [anemos = wind + phílein = to love]
c) Characteristics of flwrs :-
(i) Colourless, inconspicuous, small, odourless, nectarless
(ii) P. grains → large no. (Cannabis → 5,00,000 ; tassels of Maize → 25 million)
(iii) P. grains → light, dry, non-sticky, sometimes winged (carried till 1200 km)
(iv) Stigmas → branched, broad, large, well-exposed, feathery
(v) Flwrs. produced bfr leaves to increase chances of p. grains reaching stigma.
(vi) Calyx & corolla → reduced / absent ; Anthers → exserted & versatile
(vii) Utrica → gunpowder mechanism
d) Examples :- Grasses, Sugarcane, Maize, Bamboo, Coconut Palm, Date Palm, Cannabis, Amaranthus etc.

⇒ Hydrophily :-

a) Pollination by water
b) [Hydro = water + phílein = to love]

2011

Week 8

Thursday 17

Day (048-317)

c) Characteristics of flwrs :-
(i) Small & inconspicous
(ii) W/out bright colour, nectar & odour
(iii) Unwettable perianth, whorls & p. grains
(iv) due to mucilagenous covering
(v) Long & sticky stigma.

d) Doesn't occur in all aquatic plants.

with emergent flwrs → anemophily or entomophily

Vallisneria, Zostera, Hydrilla → hydrophily

e) Hydrophily

Epihydrophily

- Occurs in plants where flwrs remain at H_2O surface
- Vallisneria → dioecious; Male flwrs → small, short-stalked, large nos.; Female → solitary, born on long stalks
- Mechanism → (TB) (*)

Hypohydrophily

- Occurs in completely submerged plants
- Zostera (marine) → marine angiosperm; p. grains → long, ribbon like, w/out exine → float below H_2O surface → coil around stigma & germinate
- Ceratophyllum demersum → fresh water; Monoecious; Male flwr → 30-45 stamens, anthers detach at base, float to H_2O surface, dehisce, liberate p. grain. Germinate & sink → come in contact with long stigma of female flwrs.

18 Friday
Day (049-316)

February
Week 8

⇒ Entomophily :-

a) Pollinⁿ brought abt. by agency of insects
b) Bees → most common
c) Insects → nectar / edible p. grains / shelter from flwr → pollinate meanwhile
d) Characteristics of flwrs :-
(i) Large, conspicuous, brightly coloured (Rose, Sunflower)
(ii) P. grains → pollenkitt for sticking to insect body
(iii) Sepals & Petals → showy & attractive
(iv) Most nocturnal flowers → entomophilous → sweet-smell to attract insects (Jasmine, Rose)
(v) Nectar secreted by nectar glands
(vi) If flwrs small & inconspicuous, other parts become large & coloured :-
• Bougainvillea → bracts
• Euphorbia splenedus → bracts of each cyathium
• Poinsettia → leaves in floral reg.
Other characteristics → (TB) → ★
e) Few adaptations :-
1) Salvia : Calyx & Corolla → bilabiate ; Corolla divided into 2 lips (upper part) → lower lip as platform, upper lip → hood-like structure for protecⁿ ; two epipetalous stamens → short filament & long curved connective with 2 ≠ arms → long arm fertile lobe, short arm sterile lobe ; Mechanism → (TB) ★
2) Calotropis : All anthers fuse with stigma → gynostegium ; p. grains in a lobe → pollinium with translator → lifted with translator & p. grains dusted on insect body.

3) Yucca: Yucca & Pronuba moth → obligate symbiotic relationship; female moth → night → collects pollen in form of balls → pushes into style on climbing the stigma → also deposits its eggs into ovary for larvae to feed on seeds.

4) Ficus: Hypanthodium inflorescence → narrow opening for insect entry; 3 types of flwrs → male, female, gall → Pollinated by gall wasp Blastophaga.

⇒ Ornithophily:-

a) Pollinⁿ by birds
b) Birds pollinating → small but with a long beak (Sunbirds, Hummingbirds, Honeyeaters).
c) Large birds → Myna, Parrot, Bulbul → also pollinate.
d) Characteristics of flwrs:-
(i) Large-sized, odourless
(ii) Brightly coloured
(iii) Corolla → funnel shaped
(iv) Floral parts → strong & leathery
(v) Secrete lot of nectar with plenty of sugars & H_2O.
e) Examples:- Bignonia, Tecomaria, Butea monosperma, Bottle brush, Agave, Bombax

Sunday 20
Day (051-314)

⇒ Chiropterophily:-

a) Pollinⁿ by bats
b) Bats visited nocturnally for ~~plants~~ nectar
c) Carry pollen for about 30 km.
d) Characteristics of flowers:-
(i) Stout & large sized

(ii) Dull colour ; Fruity odour
(iii) Abundant p. grains ; Stamens numerous (Adansonia → 1500 - 2000 stamens / flower).
d) Examples :- Kadamb, Bauhinia megalandra, Sausage tree, Adansonia)

⇒ Malacophily :-

a) By snails
b) Examples :- Cobra plant, Arum lillies, aroids (Philodendron, Peace lily etc.)

⇒ Anthropophily :-

a) Controlled / artificial pollinⁿ by humans
b) Breeding experiments.
c) P. grains collected from selected plants, dusted over stigma of other plants
d) Date palm

• Significance

⇒ Prerequisite for fertilisaⁿ
⇒ Helps in produⁿ of seeds & fruits → continuity of species
⇒ Seeds & fruits → source of nutrition
⇒ New combinaⁿ of genes
⇒ Hybrid seed development.

• Pollen - Pistil Interaction

⇒ A no. of p. grains land on stigma ; pistil recognises the right (compatible) or wrong (incompatible) type.

⇒ Pistil accepts compatible ⟶ fertilisation ; rejects incompatible ⟶ no germination

⇒ Def^{n} : Events from pollen deposition on stigma, pollen germination and entry of pollen tube into ovule are referred as pollen - pistil interaction

⇒ Compatibility / Incompatibility ⟶ special proteins ⟶ compatible pollen absorbs H_2O & nutrients ⟶ germinate ⟶ p. tube ⟶ grows in style ⟶ determined by specific chemicals (Chemotrophy).

• Artificial Hybridisation

⇒ Def^{n} : Technique of crossing diff. species & genera to combine desirable characters to produce commercially superior varieties.

⇒ Crop improvement ⟶ p. grains of desirable characters used ⟶ achieved by emasculation & Bagging

⇒ Emasculation : Practice of removing stamens / anthers of bisexual flwr wlout affecting pistil bfr. anther dehisces.

⇒ Bagging : Emasculated flwrs covered with butter ppr. bag to prevent contamination of stigma by unwanted p. grains

⇒ Bagged stigma ⟶ maturation ⟶ Emasculation ⟶ Dusting ⟶ Re-bagging

[V] Fertilisation

- Defⁿ: Fusion of the nuclei of compatible male and female gametes.
- Siphonogamy → fertilisaⁿ brought about by p. tube
- 1st studied by Strasburger

(A) Germinaⁿ of p. grain :-

P. grains → absorb H_2O & nutrients → swell up → tube cell grows out through germ pore → p. tube → surrounded by intine.

(B) Passage of p. tube :-

P. tube → generative nucl., tube nucl., cytoplasm → secretes pectinases & hydrolases to create passage. (passage created chemotropically → conc. of sugar complex (α–β–inositol))

→ gen. nucl. divides mitotically in 2 male gamets (if 2-celled) → ∴ male gametophyte : highly vacuolated p. grain body, p. tube, tube nucl., 2 male gametes.

↳ obturator tissue guides p. tube to embryo sac → entry thru synergids

Male gamete → large nucl. + thin cytoplasm sheath → tube nucl. degenerates → ∴ tip of tube has dense cytoplasm + 2 gametes + degenerated tube nucl.

(C) Entry of p. tube in ovule :-

1) Porogamy - entry thru micropyle → usual mode
2) Chalazogamy - entry thru chalazal end → Betula, Casuarina, Juglans regia
3) Mesogamy - entry thru integuments → Cucurbita, Pistacia, Populus, etc

(D) Entry of male gametes :-

Enter into embryo sac (p. tube) guided by filiform apparatus → tip of tube disintegrates → gametes set free in embryo sac → tube nucl. & 1 or both synergids disintegrate

(E) Fusion & Double fertilisation :-

Syngamy : 1 male gamete (n) + Egg cell (n) → Zygote (2n) (diploid)

Triple fu^{n} : 1 male gamete (n) + Polar nuclei (2n) → Primary endosperm (3n). (triploid)

Double fertilisa^{n} → discovered by Nawaschin in Fritillaria & Lilium → characteristic of angiosperms.

- **Significance of double fertilisa^{n}**

⇒ Provides characteristics of male plant to offsprings
⇒ Ensures endosperm forma^{n} only when egg is fertilised
⇒ Triple fusion (vegetative fertilisa^{n}) provides growth stimulus & endosperm forma^{n} by withdrawal of nourishment from nucellus.
⇒ Ensures forma^{n} of nutritive tissue only when embryo forma^{n} has taken place.

V] Formation of Endosperm

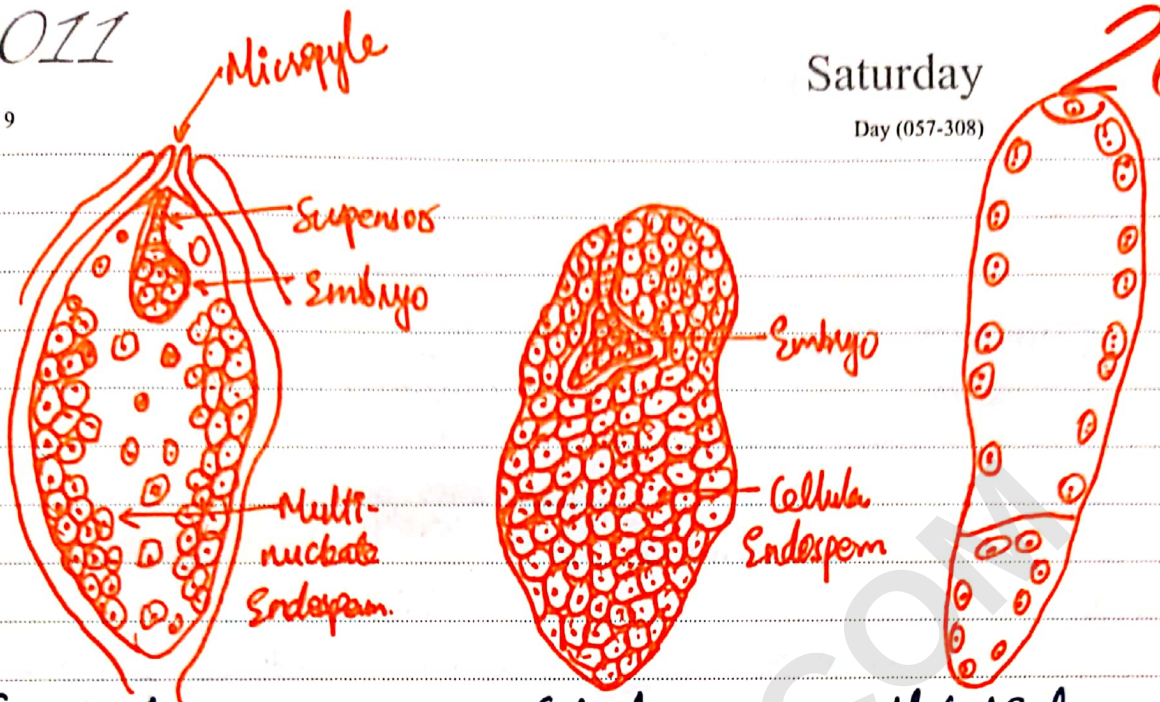
(A) Formation of PEN (Primary Endosperm nucleus):-
2 polar nuclei (2n) + 1 male gamete (n) = PEN (3n).
Divides repeatedly → Triploid Endo. tissue → reserve food for growing embryo.
Receives food supply from nucellus → perishes & remains in form of a thin layer outside endosperm → Perisperm

(B) Development of Endosperm:-
Three ways -

(i) Free-nuclear: Most common; PEN gives rise to a no. of free nuclei → remain in peripheral layer; then cell wall formed → cellular endosperm. Coconut HD → eg. White kernel → cellular endosperm.

(ii) Cellular: Peperomia, Villarsia, Drimys → div. of PEN immediately foll. by wall formation → endosperm cellular from beginning.

(iii) Helobial: Vallisneria, Eremurus, Limnophyton; intermediate b/w above two → partition wall dev. b/w 2 nuclei resulting in 1st div. of endosperm; large no. of free nuclei → upper chamber; lower chamber nucleus → few nuclei or no nuclei (no div.)



Free Nuclear | Cellular | Helobial

(c) Fate of Endosperm :-
Some plants → nourishment to embryo during germinat°.
Some others → consumed by cotyledons " embryo development

(i) Endospermic / Albuminous seeds : Castor, Cocconut, Wheat, Maize and other cereals → endosperm persists → permanent part of seed → food stored utilised by embryo during germinat°.

(ii) Nonendospermic / Exalbuminous seeds : Gram, Bean, Almond → (dicots) → cotyledons fleshy by absorbing food from nucellus & endosperm → endo. disappears.

VI] Formaⁿ of Embryo (Embryogenesis)

Embryogeny → formaⁿ of zygote from embryo ; Micropylar end of embryo sac ; Mesoblastic → dev. from part of zygote ; endoscopic → dev. tow. interior due to suspensor ; Early embryos → globular → proembryo.

28 Monday
Day (059-306)

February
Week 10

→ Diagram 2.32

(A) Dicot Embryogeny

Zygote → elongates
- → 2 unequal cells
- → divides by a transverse wall (1)

Suspensor cell (Basal cell)
- → larger comparatively
- Divides transversely to form a row of 7-8 cells (suspensor) (2)
- → Haustorium (4)
  - swollen; 1st cell of suspensor; absorbs food mat. for embryo
  - Towards micropylar end
- → Suspensor (3)
  - pushes dev. embryo deep into endosperm (developing stage)
- → Hypophysis (6)
  - last cell over embryonal cell
  - → radicle + root cap

Embryonal cell
- smaller comparatively
- Divides 3 ices; (6) 1st 2 → vertical, 3rd → transverse
- (7) Eight celled → octant.
- → Embryonal mass
  - (8) Arranged in 2 tiers:-
    - i) Epibasal (terminal) → 2 coty. + plumule
    - ii) Hypobasal → hypocotyl
  - periclinal div:- outer dermatogen; inner 6 cells → (9)
    - anticlinal div. → procambium + ground meristem.
      - procambium → stele / vasc. strand
      - ground meristem. → pith + cortex
    - Epidermis

Globular embryo / Proembryo (radial symmetry)
- Dev. of radicle, plumule & coty. (11)
- Differentiation of 2 coty. → ♡ shaped (12)

Embryo
- Group of cells in groove of 2 coty. (13) → Plumule
- Suspensor disintegrates (14)

Basic flowchart:-

Zygote → embryonal cell → Proembryo → Embryo → 2 cotyledons, Embryonal axis
Embryonal axis → Plumule, Radicle

(B) Monocot Embryogeny

(1) Zygote → elongates

micropylar end ↖ — Transverse Division

Basal cell (2) → large, swollen, vesicular (3) → **Suspensor**

four cells added later ↓ serves as (4)

Haustorium (5)

(Func^{n} same)

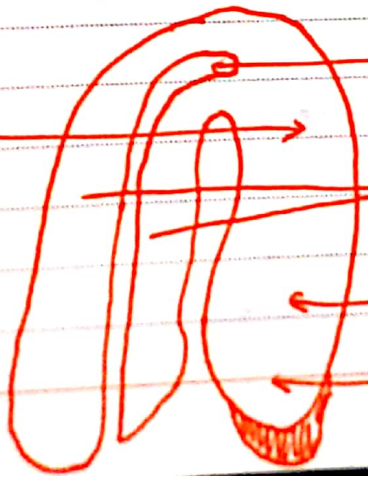
(6) **Terminal cell** — Transverse wall

Top cell (7) → Repeated divisions → **Plumule** + **Single coty. or Scutellum**

- Comes to lie in a depression (8)
- Single coty. or Scutellum → In grass families
- Single coty. or Scutellum → grows rapidly; pushes embryonal axis to one side (9)
- covered by coleoptile
- covered by coleorhiza → in cereals → Dev. from scutellum (12)

Middle cell (10) → Many divisions → **Hypocotyl** (11) + **Radicle**

(C) Structure of Dicot Embryo



- Plumule : future shoot. ← step tip at apical end
- Epicotyl ← b/w plumule & radicle above coty. level
- Cotyledons : Stores food. ← at the embryonal axis
- Hypocotyl → cylin. portion b/w embryonal axis & radicle below coty. ← plumule.
- Radicle / root tip : future root

VII] Development of Seed

1) Zygote → embryo
2) Triploid PEN → nutritive endosperm → nourishment to
3) Nucellus → used up by → may persist as perisperm
4) Integuments → dry up → testa (outer) & tegmen (inner)
5) Micropyle → remains as a fine hole → entry for O_2 & H_2O
6) Hilum → pt. of attachment of ovule to stalk
7) Funicle → stalk of seed

⊛ Dormancy: The phase in life cycle of seed, when it fails to germinate even though the environmental conditions which are normally considered favourable are present.

Imp → Differences b/w:-

also
a) Dicot v/s Monocot embryo (Pg. 68).
b) Epi v/s Hypocotyl (Pg. 68)
c) Coleorhiza v/s Coleoptile (Pg. 68)
d) Dicot v/s Monocot seed (Pg. 69)

only
1) Structure of monocot seeds → Onion & Maize
2) Structure of dicot seeds → Bean & Castor.

TB → Imp

Diff. b/w: 1) Perisperm v/s Pericarp. 2) Integument v/s testa.

⊛ Seed viability:-
Few species → few months.
large no. of seeds → several years
Eg. Lupine (Lupinus arcticus) → dormancy of 10,000 yrs
Date palm (Phoenix dactylifera) → 2000 yrs.

⊗ ⇒ p → pollination
f → fertilisation

VIII] Parthenocarpy & Parthenocarpic fruits.

- Fruits formed w/out fertilisⁿ ⟶ parthenocarpic fruits
- Phenomenon of formⁿ of parthenocarpic fruits ⟶ parthenocarpy.
- Causes / Reasons :-

Nop., no f. ← a) Absence of pollinⁿ – Banana, Pineapple, Citrus etc.
only p., no f. ← b) Failure of fertilisⁿ – certain Orchids
Both, abortⁿ of embryos. ← c) Zygotic Sterility – Peaches, Cherries, Grapes

- Natural parthenocarpy ⟶ seedless Oranges, Grapes, Pineapples.
- Common varieties of Banana & Pineapple ⟶ parthenocarpic.
- In seeds varieties ⟶ parthenocarpy by low conc. applicaⁿ of auxins & gibberellins.
- Prac. applicaⁿ :-
  a) Best varieties of Ban., Pinea., Grapes are parthenocarpic; Seedless Tomatoes
  b) Higher propoⁿ of edible part in par. fruits ⟶ prepareⁿ of jams & juices on commercial scale.

IX] Apomixis

Defⁿ :- Formaⁿ of new individuals / seeds with embryo growing directly from diploid cells of nucellus / integument (Mango, Orange), diploid egg or other gametophytic cell (Apple, Rubus, etc.)

- Form of asexual repro. that mimics sexual repro.
- Coined by Winkler ⊗
- Two types:

1) Vegetative Propagaⁿ :-
New plants develop from roots, stem, buds, leaves. No seed formed, formaⁿ of flwr. not req.

2) Agamospermy :-
Haploid gametes not formed ; seed & embryo formed w/out meiosis & fertilisation. Foll. types :-
a) Adventive Embryony : Embryo from diploid cell of nucellus or integument eg. Citrus, Opuntia, Mango etc.
b) Recussent Apomixis : Diploid embryo sac from formed with diploid egg → grows parthenogenetically → dip. embryo
c) Non-secussent agamospermy : Embryo from haploid female gametes (haploid parthenogenesis)
d) Apospory : Dev. of dip. gametophyte on sporophyte w/out meiosis. Embryo sac from sporphytic cell (2n) of ovule → egg also diploid → dip. embryo (dip. parthenogenesis)
e) Apogamy : Embryo from any cell of embryo sac except egg w/out fertilisation → Orchidaceae (Orchids family)
f) Diplospory : Dip. Embryo from MMC.

Imp → Importance of Apomixis. (Pg. 76).

I] Polyembryony (other things from FB) → Imp

- Phenomenon of dev. of more than 1 embryo in a seed.
- Discovered by Leeuwenhoek in ~~Orange~~ Orange (*)

- False Polyembryony :
1) Cleavage polyembryony – more than 1 embryo by cleavage of zygote → gymnosperm

2) Embryo from synergids – Sagittaria
3) " " antipodals – Ulmus Americana
4) " " endosperm – Balanophora
5) Adventive embryony – refer apomixis.
6) Citrus → extra embryos from other embryo sacs in ovule