Lakshya KCET 2026

Sexual Reproduction in Flowering Plants

Botany

1. Key Scientist - Panchanan Maheshwari

- Work on embryology, test-tube fertilisation, intra-ovarian pollination, promoted tissue culture, and embryological taxonomy.
- FRS awardee.
- Helped author first NCERT Biology books.

2. Flower Structure

- Flowers are the reproductive organs of angiosperms.
- A typical flower has: calyx, corolla, androecium (male), gynoecium (female).
- Gynoecium may be:
- Apocarpous: multiple free carpels (e.g., Michelia)
- Syncarpous: fused carpels (e.g., Papaver)

3. Pre-Fertilisation Structures and Events

(a) Male Reproductive Part – Stamen

- Stamen = Filament + Anther
- Anther: Bilobed, dithecous, with 4 microsporangia (tetrasporangiate).
- Microsporangium contains:
- Epidermis, Endothecium, Middle layers, Tapetum (nourishes developing pollen)
- Sporogenous tissue forms Microspore Mother Cells (MMCs) → Microspores (via meiosis) → Pollen grains

(b) Pollen Grain

- Male gametophyte
- Size: 25-50 µm, with 2-layered wall: Exine (sporopollenin) + Intine (cellulose & pectin)
- Has germ pores for pollen tube emergence
- Shed at 2- or 3-celled stage (2-celled stage = vegetative cell + generative cell; 3-celled stage = vegetative cell + 2 male gametes)

Parthenium → Causes pollen allergy

- Pollen viability examples:
- Rice, wheat: ~30 min
- Legumes, Solanaceae: Months
- Stored in liquid N2 (-196°C) as pollen banks

(c) Female Reproductive Part – Pistil

- Pistil = Stigma + Style + Ovary
- Ovary contains ovules = megasporangia
- Ovule structure:
- Funicle, Hilum, Integuments (micropyle + chalaza), Nucellus
- MMC → Megaspores (1 functional), monosporic development → Embryo sac

(d) Female Gametophyte (Embryo Sac)

- 7-celled, 8-nucleate:
- 3 cells (micropylar) = Egg + 2 Synergids (with filiform apparatus)

- 3 Antipodals (chalazal end)
- 2 Polar nuclei in central cell

4. Pollination

(a) Types:

- Autogamy – Same flower (e.g., Viola, Oxalis, Commelina)
- Geitonogamy – Same plant, different flower
- Xenogamy – Different plants

(b) Agents:

- Abiotic: Wind (grasses, corn), Water (Vallisneria, Zostera)
- Biotic: Insects (bees, butterflies), birds (sunbird), bats, reptiles

(c) Adaptations:

- Wind: Light, non-sticky pollen; exposed stamen, feathery stigma
- Water: Ribbon-like pollen, mucilage protection
- Animal: Colourful, scented, nectar, edible rewards (e.g., Amorphophallus)

(d) Outbreeding Devices:

- No synchrony in pollen release and stigma receptivity
- Position of stigma and anther incompatible
- Self-incompatibility (genetic)
- Unisexuality (monoecious: maize; dioecious: papaya)

5. Pollen-Pistil Interaction

- Recognition of compatible pollen → Pollen tube → Style → Ovary → Ovule → Embryo sac
- Guided by filiform apparatus

6. Double Fertilisation

- Syngamy: Male gamete + Egg = Zygote (2n)
- Triple fusion: Male gamete + 2 polar nuclei = PEN (3n)

7. Post-Fertilisation Events

(a) Endosperm - Triploid (3n), nourishes embryo

- Types: Free nuclear (e.g. coconut water), Cellular (coconut kernel)

(b) Embryo

- Stages : proembryo → globular embryo → heart-shaped embryo → mature embryo
- Dicot embryo: 2 cotyledons, epicotyl (plumule), hypocotyl (radicle)
- Monocot embryo: 1 cotyledon (scutellum), epicotyl (plumule with coleoptile), hypocotyl (radicle with coleorhiza)

(c) Seed

- Viability:
- Lupinus arcticus: ~10,000 years (Arctic tundra soil)
- Phoenix dactylifera: ~2000 years (Dead Sea excavation)
- Albuminous: wheat, maize, castor, coconut
- Non-albuminous: pea, groundnut
- Perisperm (persistent nucellus) : black pepper, beet

(d) Fruit

- Ovary → Fruit
- True fruit: mango
- False fruit: thalamus also (e.g., apple, strawberry, cashew)
- Parthenocarpy: Banana

8. Apomixis and Polyembryony

- Apomixis: Seed without fertilisation (e.g., Asteraceae, grasses)
- Polyembryony: >1 embryo in a seed (e.g., Citrus, Mango)