Brain Builders Coaching Center

Class 9 ICSE

Seeds: Structure and Germination

1. Seed – Definition & Importance

- A seed is a fertilized and matured ovule.
- Contains an embryo (future plant) and stored food.
- Protected by seed coat.
- Ensures species continuity, dispersal, and survival.

2. Structure of a Seed

(a) Seed Coat

- Testa: Outer hard protective covering.
- Tegmen: Inner thin layer.
- Micropyle: Tiny pore for entry of water and gases.
- Hilum: Scar where seed was attached to fruit/ovary.

(b) Embryo

- Radicle: Future root.
- Plumule: Future shoot.
- Cotyledons: Seed leaves, store food.

(c) Endosperm

- Provides nourishment in some seeds.
- Albuminous (endospermic seeds): Cotyledons small, food in endosperm (e.g. maize, castor).
- Exalbuminous (non-endospermic seeds): Cotyledons large, store food (e.g. pea, gram).

3. Types of Seeds

1. Monocotyledonous seeds (e.g. maize, rice, wheat)
    - One cotyledon (scutellum).
    - Endospermic (food in endosperm).
    - Protective sheath around radicle (coleorhiza) and plumule (coleoptile).
2. Dicotyledonous seeds (e.g. pea, gram, bean)
    - Two cotyledons.
    - Mostly non-endospermic.
    - Radicle, plumule clearly visible.

4. Germination of Seeds

(a) Process by which seed develops into a seedling.

(b) Conditions Necessary

- Water – activates enzymes, softens seed coat.
- Oxygen – required for respiration.
- Suitable temperature – optimum for enzymatic activity.
- Some seeds need light or darkness.

5. Types of Germination

1. Epigeal Germination
    - Cotyledons pushed above soil.
    - Plumule grows upward, hypocotyl elongates.
    - Example: bean, castor.
2. Hypogeal Germination
    - Cotyledons remain below soil.
    - Epicotyl elongates.
    - Example: pea, maize.

6. Viability and Dormancy

- Dormancy: Resting period when seed fails to germinate despite favorable conditions.
- Causes: Hard seed coat, immature embryo, presence of growth inhibitors.
- Viability: Ability of seed to germinate; decreases with age.

Germination in Common Seeds

(A) Bean Seed (Dicot, Exalbuminous)

- Seed type: Dicot, non-endospermic (food stored in cotyledons).
- **Type of germination: Epigeal**
    - **Process**:
        1. Seed absorbs water → seed coat ruptures through micropyle.
        2. Radicle emerges first → forms primary root.
        3. Hypocotyl elongates and arches, pulling cotyledons above soil surface.
        4. Cotyledons provide food to growing embryo.
        5. Plumule develops into shoot and first green leaves.
    - **Result**: Cotyledons appear above soil and eventually shrivel after food is used.

      Key feature: Cotyledons above soil; act as temporary leaves.

(B) Maize Seed (Monocot, Albuminous)

- Seed type: Monocot, endospermic (food in endosperm).
- **Type of germination: Hypogeal**
    - **Process**:
        1. Seed absorbs water → testa and tegmen rupture.
        2. Radicle comes out through coleorhiza (protective sheath).
        3. Plumule emerges later, covered by coleoptile (protective sheath).
        4. Food for germination comes from endosperm, absorbed by scutellum (cotyledon).
        5. Cotyledon remains below soil surface.
    - **Result**: Cotyledon does not emerge; true leaves appear from plumule.

Key feature: Cotyledons remain underground; food from endosperm.

Germination in Bean vs Maize

Feature	Bean (Dicot)	Maize (Monocot)
Seed type	Dicot, non-endospermic	Monocot, endospermic
Food stored in	Cotyledons	Endosperm
Protective sheath	Absent	Coleoptile (plumule), Coleorhiza (radicle)
Type of germination	Epigeal (cotyledons above soil)	Hypogeal (cotyledon remains below soil)
Cotyledons	Two	One (scutellum)

Special Type of Germination – Vivipary

- Germination of seed while still attached to the parent plant.
- **Process**:
    - Seed starts germinating inside fruit, before detachment.
    - Radicle emerges first, protruding from fruit.
    - Once detached, seedling continues to grow directly.
- **Example**: **Mangroves** (e.g. *Rhizophora*, *Sonneratia*, *Avicennia*).
- **Adaptation**:
    - Mangroves grow in saline, swampy areas where soil is waterlogged and deficient in oxygen.
    - Vivipary ensures that the seedling is already developed and can quickly establish roots after falling into muddy soil.
- **Significance**: Increases chance of survival in unfavorable, submerged conditions.

Key feature: Seed germinates while attached to parent plant (seen in mangroves).