

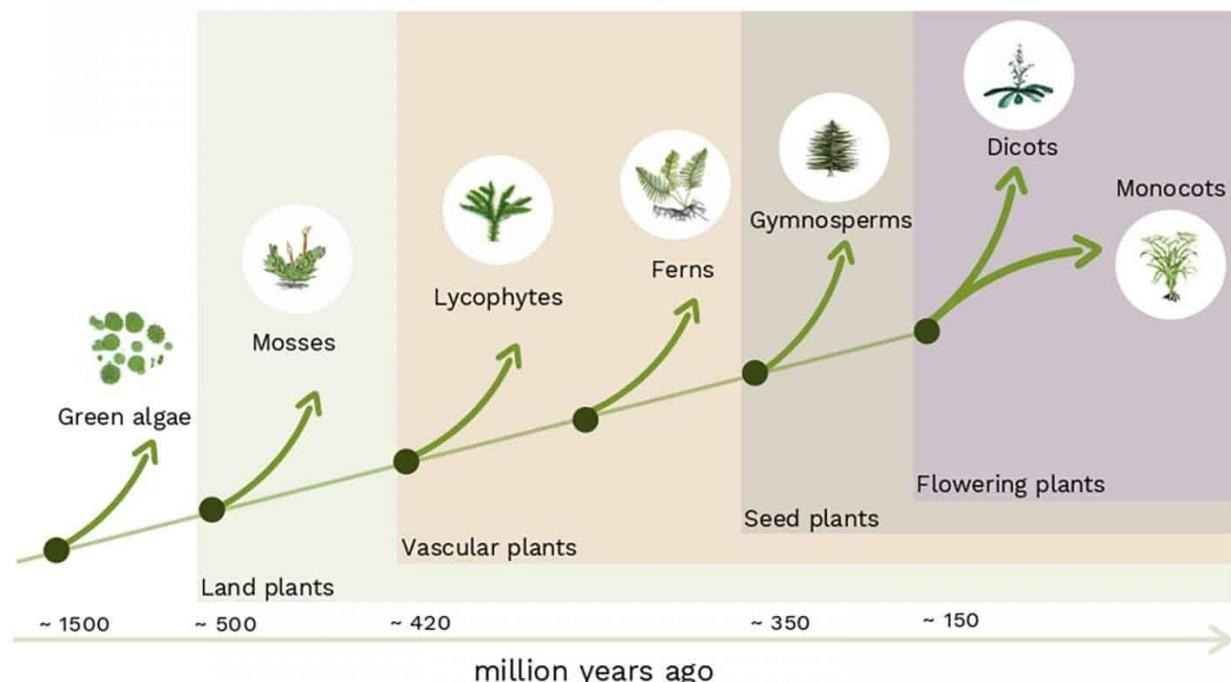
# Detailed Notes on Seeds (with Diagrams)

For SYB.Sc. Botany Students

## 1. Seed: Definition and Importance

- **Definition:** A seed is a mature ovule that develops after fertilization, containing an embryo, food reserves, and a protective coat.
- **Importance:**
  - Ensures **continuity of life** from one generation to the next.
  - Provides **protection and nourishment** to the developing embryo.
  - Acts as a **dormant stage** enabling survival under unfavorable conditions.
  - Enables **dispersal** to new habitats.
  - **Examples:** Lotus seeds remain viable for ~2000 years.

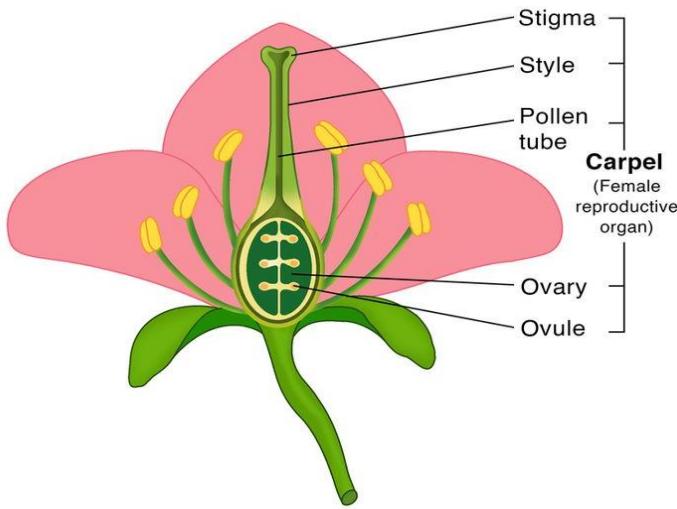
### Evolution of land plants (simplified)



 **Evolutionary Note:** Seed habit evolved around **360 million years ago**, a key innovation in higher plants (Gymnosperms and Angiosperms).

## 2. Flower as the Basis of Seed Formation

A flower is the **reproductive unit** of angiosperms.



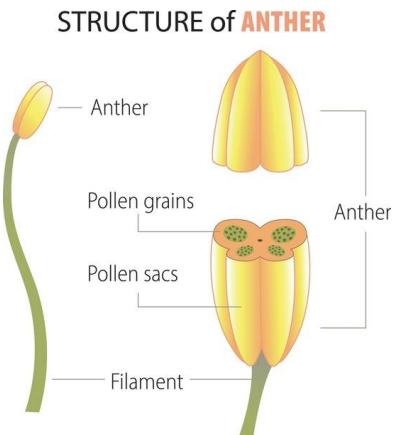
### (a) Accessory (non-essential) organs

- **Sepals (Calyx)** – protect flower bud.
- **Petals (Corolla)** – attract pollinators.

### (b) Essential (necessary) organs

#### 1. Androecium (Male organ)

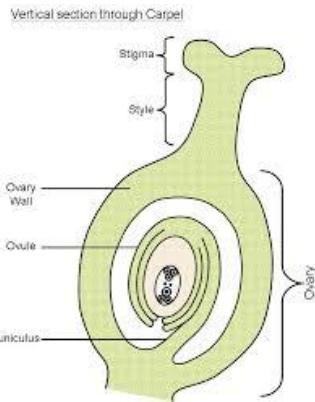
- Composed of **stamens** = filament + anther.
- Anther contains **pollen sacs** → produce pollen grains (male gametes).
- **Function:** Formation and release of pollen.



🔍 *Diagram suggestion: Longitudinal section (L.S.) of stamen showing anther and pollen sacs.*

## 2. Gynoecium (Female organ)

- Made of **carpels** = stigma + style + ovary.
- **Stigma**: Receives pollen.
- **Style**: Passage for pollen tube.
- **Ovary**: Contains ovules → each ovule has embryo sac (egg cell).



🔍 *Diagram suggestion: L.S. of carpel showing stigma, style, ovary with ovules.*

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## 3. From Pollination to Fertilization

### 1. Pollination

- Pollination is the process of transferring pollen grains from the anther (male organ) to the stigma (female organ) of a flower.
- It can occur in two ways:
  - **Self-pollination** – pollen is transferred within the same flower or between flowers of the same plant.
  - **Cross-pollination** – pollen comes from a different plant of the same species, which promotes genetic variation.
- After landing on the stigma, the pollen grain absorbs nutrients and water from the stigma surface and begins germination.

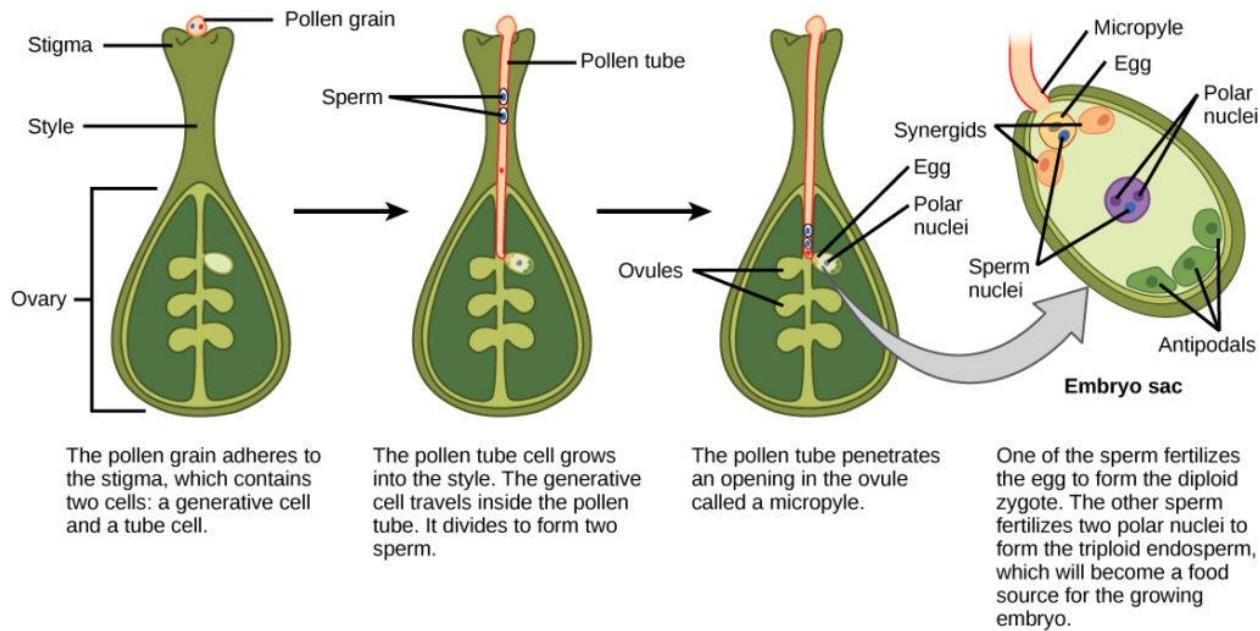
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### 2. Pollen Tube Formation

- After germination, the pollen grain develops a pollen tube that grows down through the style.
- The **tube cell** forms the pollen tube, while the **generative cell** inside it divides to produce **two male gametes (sperm nuclei)**.
- The pollen tube is guided towards the ovary by chemical signals (chemotropic growth).
- Finally, the tube enters the ovule through a small opening called the **micropyle**.

### 3. Double Fertilization (unique to Angiosperms)

- When the pollen tube reaches the embryo sac inside the ovule, it releases the two male gametes.
- Fertilization occurs in two steps (hence called **double fertilization**):
  - **One male gamete + Egg cell → Zygote (2n)**
    - This forms the diploid zygote, which later develops into the **embryo** of the seed.
  - **Other male gamete + Two polar nuclei → Endosperm (3n)**
    - This forms the triploid primary endosperm nucleus.
    - The endosperm later develops into a nutritive tissue, providing food for the growing embryo.
- The other cells in the embryo sac (synergids, antipodals) degenerate after fertilization.

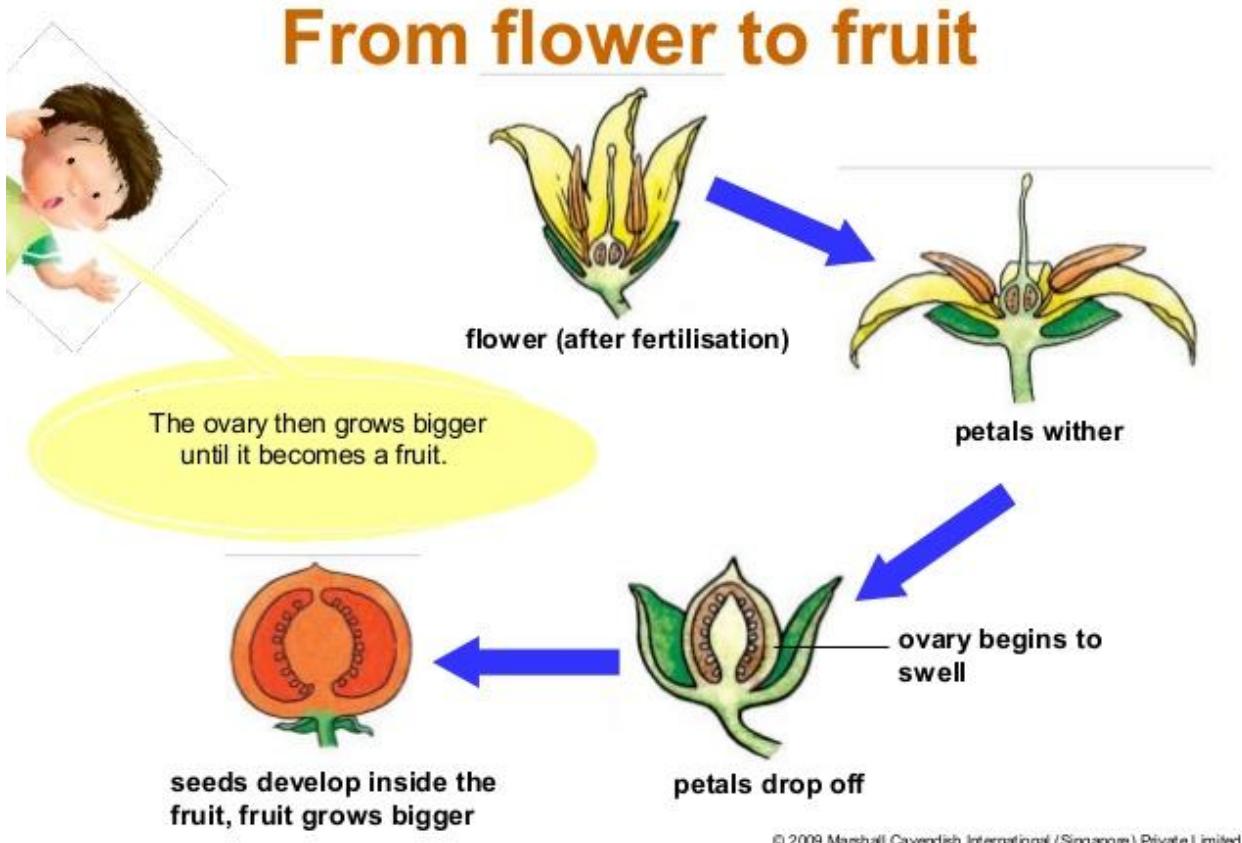


🔍 *Diagram suggestion:* Path of pollen tube from stigma → style → ovule, showing double fertilization.

### 4. Post-fertilization Changes

- **Zygote → Embryo.**
- **Ovule → Seed.**
- **Ovary → Fruit.**

👉 Hence fruits contain seeds (e.g., Tomato fruit contains many seed).

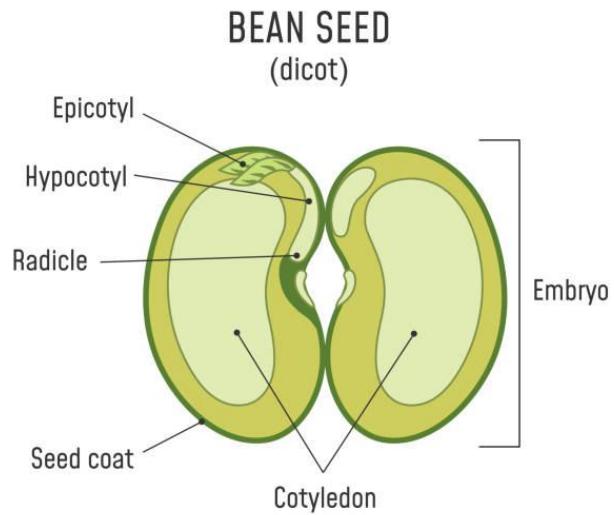


🔍 Diagram suggestion: Sequence – flower → fertilized ovary → fruit with seed inside.

## 5. Structure of a Seed

### A. Typical Dicot Seed (e.g., Bean, Gram)

- **Seed coat:** Testa + Tegmen.
- **Hilum & Micropyle** visible.
- **Embryo:**
  - Two **cotyledons** (food storage).
  - **Radicle** (root tip).
  - **Plumule** (shoot tip).
- **Endosperm:** Absent in most dicots.

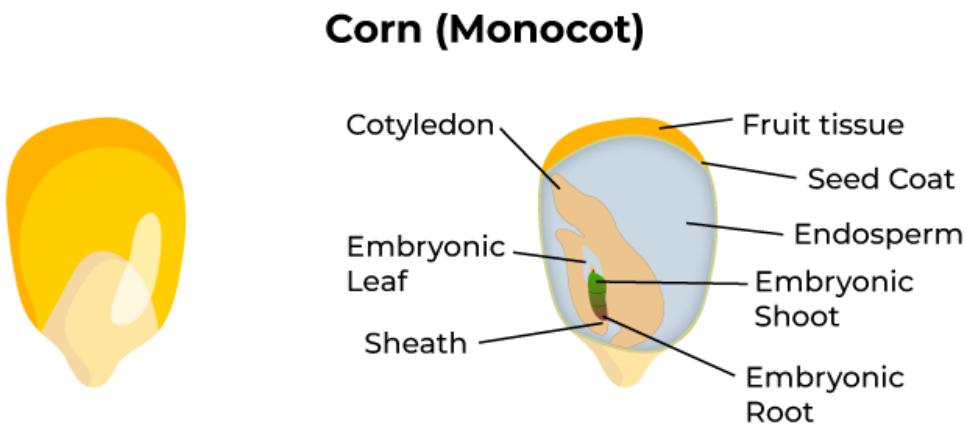


🔍 Diagram: L.S. of dicot seed (Bean).

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## B. Typical Monocot Seed (e.g., Maize, Rice)

- **Seed coat + pericarp** fused.
- **Endosperm**: Large, starchy, surrounded by aleurone layer.
- **Embryo**:
  - One cotyledon = **scutellum**.
  - **Radicle** covered by coleorhiza.
  - **Plumule** covered by coleoptile.



🔍 Diagram: L.S. of monocot seed (Maize).

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## 6. Comparative Table – Dicot vs Monocot Seeds

Character	Dicot (Bean)	Monocot (Maize)
Cotyledons	Two	One (Scutellum)
Endosperm	Absent in mature seed	Present
Seed coat	Free from fruit wall	Fused with fruit wall
Embryo protection	None	Coleoptile & coleorhiza
Example	Bean, Pea, Gram	Maize, Rice, Wheat

## 7. Significance of Seeds

- Survival:** Seeds survive drought, heat, cold.
- Dispersal:** By wind, water, animals.
- Agriculture:** Basis of food crops (cereals, pulses, oilseeds).
- Economy:** Spices, beverages, oil crops.
- Genetic reservoir:** Basis for plant breeding.

## 8. Seed dispersion:

