



BIOLOGY



GERMINATION

CHAPTER -6

Chapter Outline

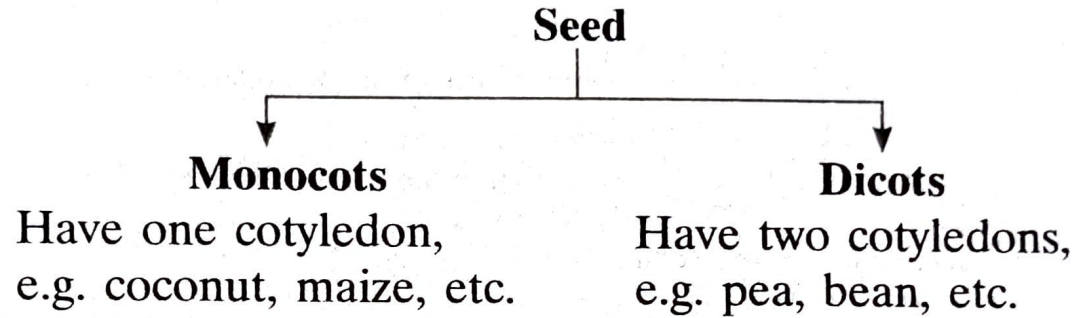
- A Seed
- Structure of a Typical Seed
- Dicot Seed—Bean Seed
- Monocot Seed—Maize Seed
- Germination of Seeds
- Conditions Necessary for Germination of Seeds
- Types of Germination
- Examples of Hypogeal Germination
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A SEED

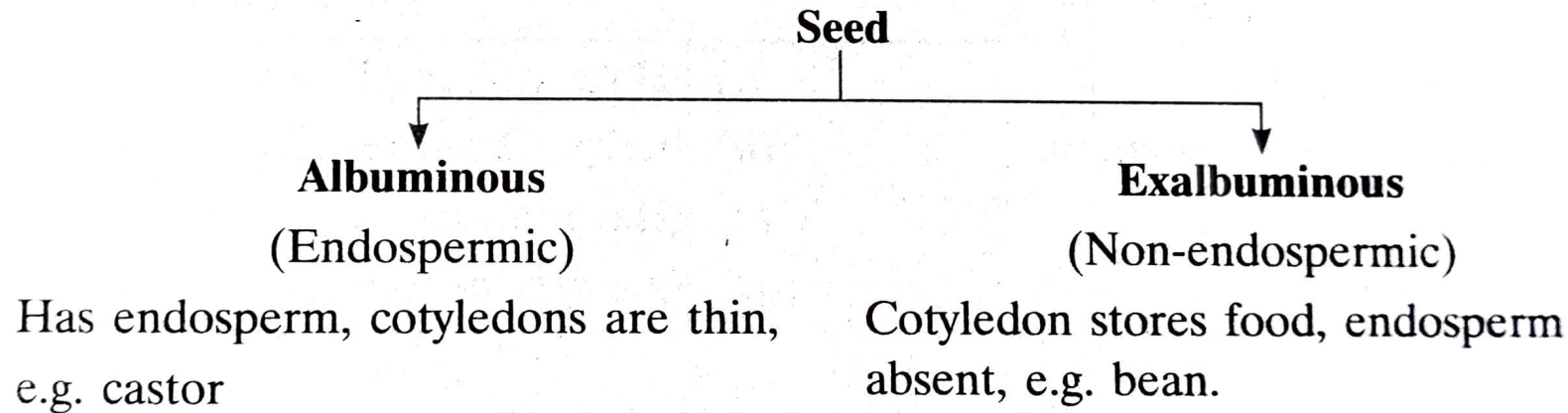
Seed is present in all flowering plants. It is a **mature ovule** and contains a **living embryo** formed by the fertilisation of male and female gametes. The embryo is embedded in a food storage tissue, called **endosperm** which provides nourishment to the embryo for growth. A seed is enclosed by a **series of membranes** or a **hard shell** that protects the embryo from the external environment. The seed contains all the material which helps it to develop into a mature plant.

In fact, a seed is a miniature plant which encloses a living but inactive (dormant) embryo. The embryo can withstand unfavourable conditions such as drought, and remain in the dormant state for years. When exposed to favourable or suitable conditions, the embryo becomes active, and the seed germinates into a new plant.

Classification of seeds: On the basis of number of cotyledons:



On the basis of endosperm:



An embryo contains radicle and plumule.

Significance of seed and fruit.

Seed:

- (a) A seed contains embryo that develops into a tiny plant after germination.
- (b) It contains the reserve food material. It is used for nourishment by the embryo during germination.

Fruit:

- It protects the seed.
- It also help in the dispersal of seeds.

At A Glance

The seeds are present in two groups of plants:

- **Gymnosperms:** The seeds of these plants are not enclosed in any ovary wall or the fruits and are called **naked seeds**.
- **Angiosperms:** These produce seeds which are enclosed in the fruits.

STRUCTURE OF A TYPICAL SEED

A typical seed has the following parts:

Seed Coat

Seed coat is the outermost covering of a seed. It consists of two layers:

Testa

Testa is the *outer and hard layer* of seed coat. It protects the inner parts of the seed from the external environment, injuries and, attack of bacteria, fungi and insects.

Tegmen

It is the *thin and papery inner layer* of seed coat. A tiny opening called **micropyle** is present at one end of the seed coat. This is the same opening through which pollen tube had entered the ovule during fertilisation. Micropyle is a very important part of seed and performs the following functions:

- Absorption of water for seed germination.
- Gaseous exchange during respiration of embryo.

The seed is attached to the fruit wall by a stalk known as **funiculus**. You may recall from the previous Chapter that this stalk is actually the placenta which attaches ovules to the ovary. When the seed breaks away from the funiculus, a scar called the **hilum**, remains. All parts enclosed by the seed coat are called **kernel**.

Cotyledons

Cotyledons are present *below the seed coat*. These are fleshy structures which generally store food material for the growing embryo and are also called the **first leaves** of the embryo. They remain thin and papery when they do not store food.

The seeds may have one or two **cotyledons**. Based on the number of cotyledons present, the seeds are of two kinds:

Monocotyledonous or Monocot Seeds

These seeds have *only one cotyledon*. A few examples are maize, wheat, grasses and rice.

Dicotyledonous or Dicot Seeds

These seeds have two cotyledons, hinged at a point called **node**. Two cotyledons can open out like a book. Common examples are bean, gram, pea and castor.

The plants which contain monocotyledonous seeds are known as **monocot plants** while those

which form dicotyledonous seeds are named as **dicot plants**.

Embryo

Embryo is the **young plant** attached to one of the cotyledons. It consists of two parts—radicle and plumule.

Radicle

It is the pointed structure which protrudes out of the seed from the *lower end of the axis*. It forms the *root system* of the plant.

Plumule

It is a short stem-like structure which arises from the *upper end of the axis with a pair of small leaves*. It represents the *future shoot system* of the plants.

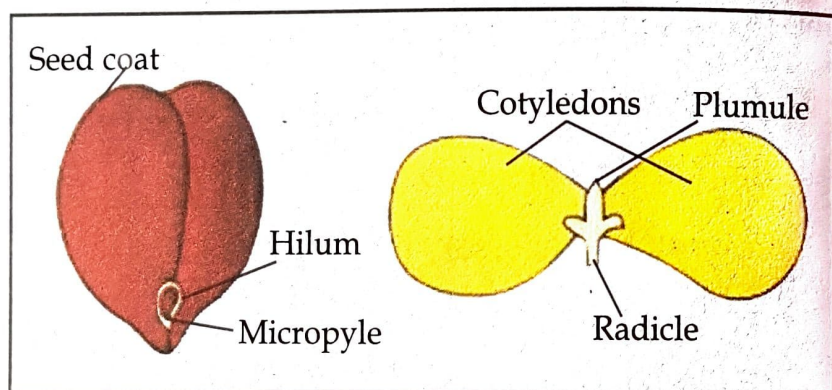


Fig. 6.1: Structure of a typical Seed

Endosperm

Endosperm is the *food storage tissue*. It may be present on one side of the embryo or surround it on all the sides. On the basis of the presence of endosperm, the seeds are of two kinds:

Endospermic Seeds

These seeds have *thin and membranous cotyledons*. The endosperm is present till maturity and stores all the food for the developing embryo. These seeds are also called **albuminous seeds**. A few examples are cereals, poppy and millets.

Non-endospermic Seeds

These seeds do not have the endosperm at maturity. Instead, they have *large and fleshy cotyledons* which store food for the developing embryo. These are also known as **exalbuminous seeds**. A few examples are gram, pea, mango and mustard.

3. **Hilum:** It is a whitish, oval scar present on the concave side of the seed. It represents the point of attachment of the seed to the fruit wall.
4. **Micropyle:** A small pore called **micropyle** is present on the edge of the hilum.
5. **Cotyledons:** Two thick and fleshy cotyledons are present beneath the seed coat. They store food for the developing embryo. Thus, bean seeds are **exalbuminous** or **non-endospermic seeds**.
6. **Embryo:** A tiny embryo is attached to one of the cotyledons. It contains two parts:
 - (a) One end of the embryo is pointed and protrudes out of the cotyledon. It is the rudimentary root known as **radicle**.
 - (b) The other end of the embryo has the feathery **plumule** with a pair of leaves. It is the rudimentary shoot.

The other dicot seeds, such as gram and pea, have more or less a structure similar to that of beans.

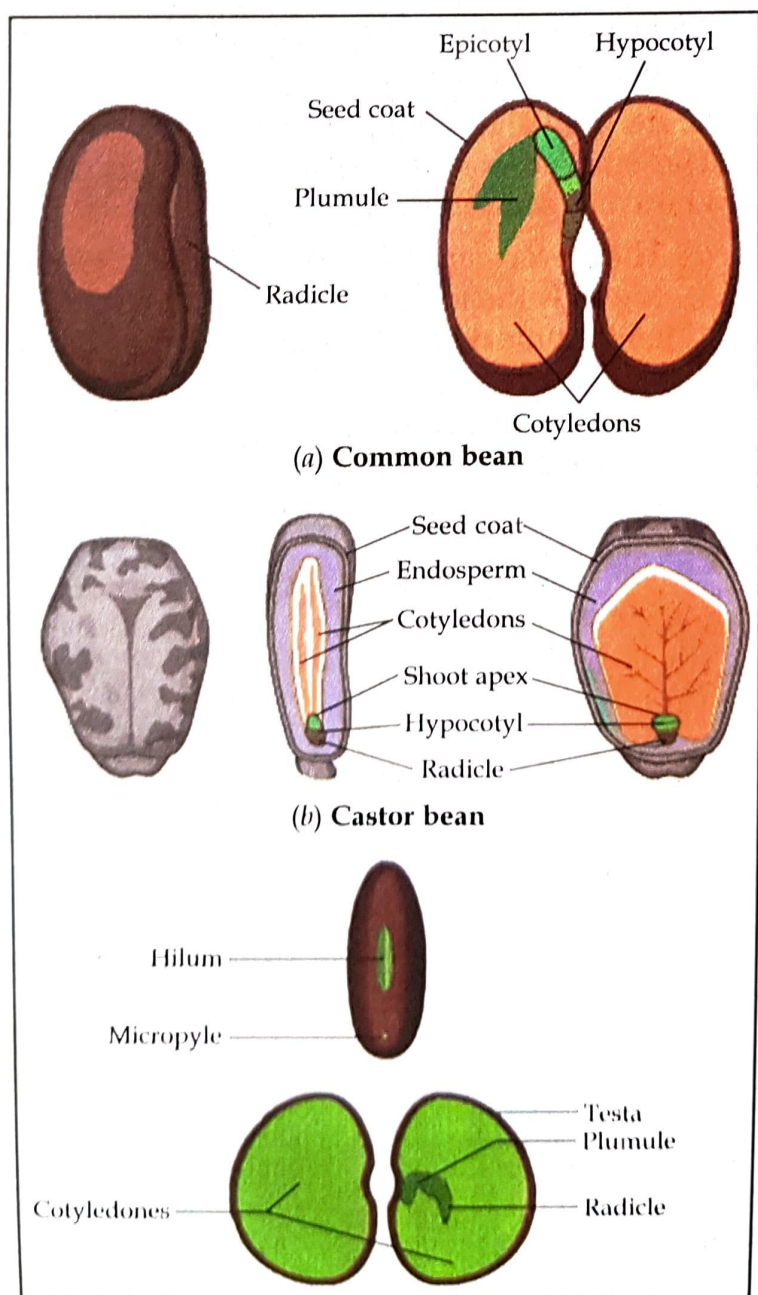


Fig. 6.3: Structure of a bean seed

STRUCTURE OF A MONOCOT SEED – MAIZE SEED/GRAIN

Maize seed is an oblong and flattened endospermic seed. It is also called **grain** because it is actually a fruit in which fruit wall and seed coat are fused together. Maize grain consists of the following parts:

1. **Grain Covering:** In a maize grain, the testa and the pericarp (fruit wall) are fused together to form the yellowish-brown protective covering.
2. **Micropyle and Hilum:** Unlike beans, these are not visible because of the presence of pericarp.
3. **Endosperm:** The bulk of the grain is filled with a large food storage tissue—endosperm.
4. **Embryo:** On one side of the grain, there is a small, light-coloured oval area, where the embryo lies. If we cut the grain vertically, the endosperm and embryo become distinctly visible. These are separated from each other by a thin epithelial layer.
5. **Aleurone Layer:** A protein-rich aleurone layer covers the endosperm.
6. **Scutellum:** The maize grain is a monocot seed. The embryo consists of a single cotyledon known as **scutellum**. It consists of two parts:
 - (a) The lower part, **radicle**, is always present towards the lower and pointed end of the embryonic region. It is covered by a sheath called **coleorhiza**.
 - (b) The upper part, **plumule**, is present towards the upper and broader end which is ensheathed by **coleoptile**.

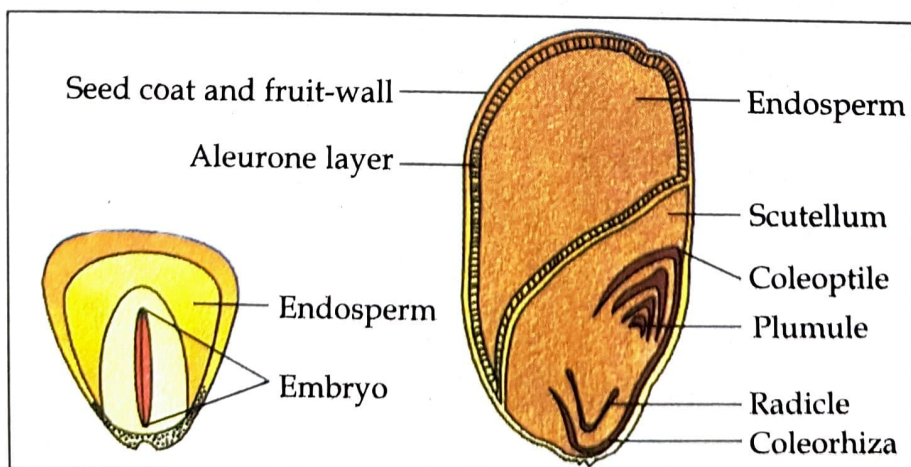


Fig. 6.4: Structure of a maize grain

Name the following:

- (a) Part of the plant from which seeds develop.
- (b) Part of the embryo that forms the root system.
- (c) Part of the embryo that forms the shoot system.

Why is the seed considered a miniature plant?

Differentiate between:

- (a) Two layers of the seed coat
- (b) A monocot seed and a dicot seed
- (c) Albuminous seeds and exalbuminous seeds.

What is micropyle? Write its functions.

Why are cotyledons known as the first leaves of the embryo?

What is hilum?

Tick (✓) the correct pairs:

- (a) Bean seed—Dicot, endospermic.
- (b) Maize grain—Monocot, non-endospermic.
- (c) Bean seed—Dicot, non-endospermic.
- (d) Maize grain—Monocot, endospermic.

Why are the seeds of maize called grains?

Write three differences between bean seeds and maize seeds.

Name the sheaths which cover the embryo of the maize grain.