Seeds - Structure & Germination

Types of Seeds and Their Structures

All of us enjoy eating sweet juicy fruits, don't we? Have you ever pondered while eating them, how are they formed and what are the roles of a fruit and the tiny seeds within them? Let us explore and find out.

Fruits
Fruits are formed from the enlarged ripened ovary of a flower, after fertilisation. The major functions of fruits in a plant's life cycle are to protect the seed and help in its dispersal.

Seeds
A seed is formed from the ripened ovule of a flower, after fertilisation. It contains **embryo** - the propagator of a new plant - and protects its from any kind of physical damage. The seed also stores food material to provide nourishment to the embryo. The embryo remains in an inactive state within the seed. Once it is exposed to favourable conditions, it germinates and forms a new plant.

Let us study in some more detail about seeds, their types and their structures.

Types of Seeds

On the basis of number of cotyledons (embryonic leaves) present, seeds can be classified as:

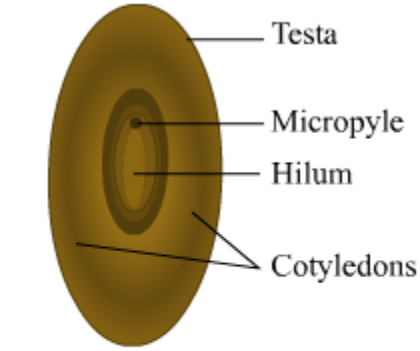
- **Monocotyledonous:** Seeds containing single cotyledon. Example, maize, wheat, rice, etc.
- **Dicotyledonous:** Seeds containing two cotyledons. Example, pea, gram, mango, etc.

On the basis of endosperm, seeds are classified as:

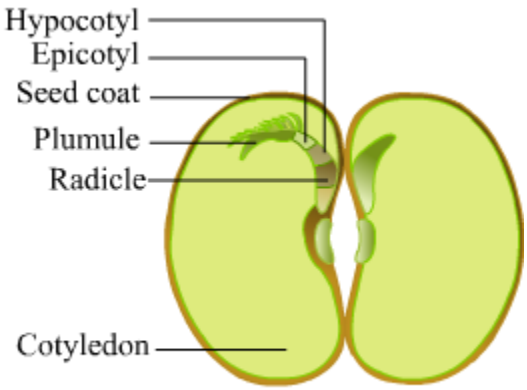
- **Albuminous or endospermic:** Seeds in which endospem persists and cotyledons are thin and membranous. Examples of dicot albuminous seeds: poppy and custard apple. Examples of monocot albuminous seeds: cereals, millets, etc.
- **Exalbuminous or non-endospermic:** Seeds in which cotyledons store reserve food materials and become thick and fleshy. Examples of dicot exalbuminous seeds: gram, pea, and mustard. Examples of monocot exalbuminous seeds: *Vallisnaria,* orchids, etc.

General Structure of A Dicotyledonous Seed

Most dicot seeds are kidney-shaped with a convex and a concave side.



External Structure of Bean Seeds



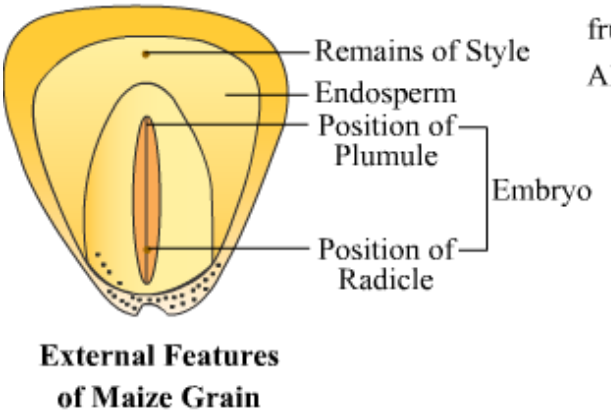
Opened Bean Seed

The structural components of a dicot seed are:

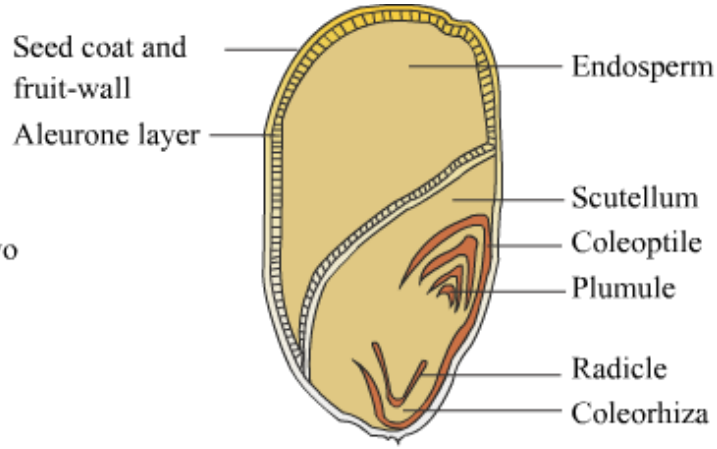
- **Seed coat:** Consists of outermost hard covering, called **testa**, and inner thin layer next to testa, called **tegmen**. Both layers protect the inner delicate parts of a seed from any physical injury or pathogenic attack.
- **Hilum:** Oval, light-shaded scar that represents the spot where the ovule was attached to the ovary through placenta
- **Micropyle:** Tiny pore situated close to hilum that helps in absorbing water for seed germination and also allows diffusion of respiratory gases
- **Cotyledons:** Two thick seed leaves that store reserve food material so as to provide nourishment to the growing embryo
- **Embryo:** Attached to one of the cotyledons. It consists of two parts: **radicle**, which later forms roots, and **plumule**, which later forms shoot.

General Structure of A Monocotyledonous Seed

Let us study the general structure of a monocot seed with the help of maize grain. Maize grain is actually a monocotyledonous, endospermic fruit in which fruit wall and the seed-coat are fused together to form a protective layer. Such a fruit is known as **grain**.



External Features of Maize Grain



Longitudinal Section of Maize Grain

The structural components of a maize grain are as follows:

- Fused fruit wall and seed-coat (testa)
- **Endosperm:** Covers major part of the grain and is rich in starch
- **Aleurone layer:** Outermost, protein-rich layer of endosperm
- **Embryo:** Consists of three major parts: a single cotyledon, called **scutellum**, a radicle, and a plumule
- The radicle is present towards the pointed end of the grain and is enclosed in a protective sheath, called **coleorhiza**.
- The plumule is present towards the upper broad side and is enclosed in a protective sheath, called **coleoptile**.

Differences between Monocot Seed and Dicot Seed

Dicot seed	Monocot seed
It contains two cotyledons.	It contains single cotyledon, called scutellum.
Endosperm is absent.	Endosperm is present.
Embryo is large in size.	Embryo is relatively small in size.
Plumule is large.	Plumule is very small.
Seed is separately contained in a fruit.	Seed wall and fruit wall are fused to form a single grain.
E.g. Bean seed.	E.g. Maize grain

Seed Germination

Germination is the process during which seed reserves present in the seed are broken down and the embryo starts to grow.

During germination, the seed absorbs water. Germination is irreversible i.e. once begun; the seed cannot be brought back to dormant state,

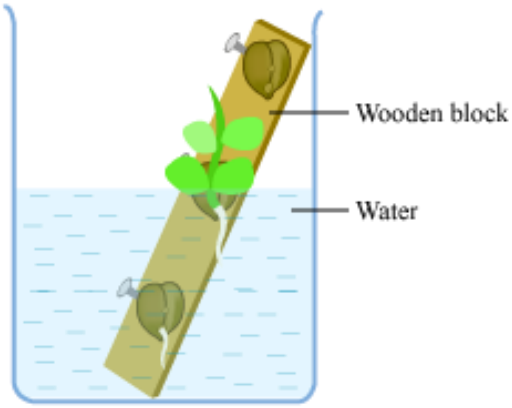
Seeds which do not germinate even after provided with all the conditions necessary for germination are called **dormant seeds** and the phenomenon is termed as **dormancy**.

Let us study what happens during germination

When a seed is germinating, the portion above the cotyledon that forms future shoots is called plumule and the portion below the cotyledon that forms the future roots is called radicle.

Conditions Necessary for Germination

Activity 1



- As shown in the figure, take a beaker with water and place it in, a glass slide with three bean seeds tied to it.
- The slide should be kept in such a way that the upper seed is completely out of water, lower seed is completely submerged in water and the middle seed is half submerged in water.
- The beaker is placed in warm temperature (25° C − 30° C) for few days.

Result

- Seed at top − Does not germinate
- Seed at middle − Germinates

- Seed at bottom − Does not germinates

Inference

- Seed at top gets only oxygen and no water. So it does not germinate.
- Seed at middle receives both oxygen and water. So it germinates.
- Seed at bottom gets only water and no oxygen. So it does not germinate.

Activity 2

- Take two petridishes with moist cotton placed in it.
- Place a few soaked seeds in both petridishes.
- Place the first petridish in refrigerator (4°C) and the second one at room temperature (30°C).
- Leave the petridishes for few days.

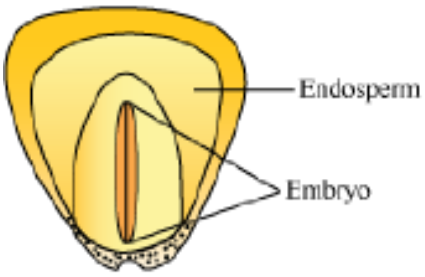
Result

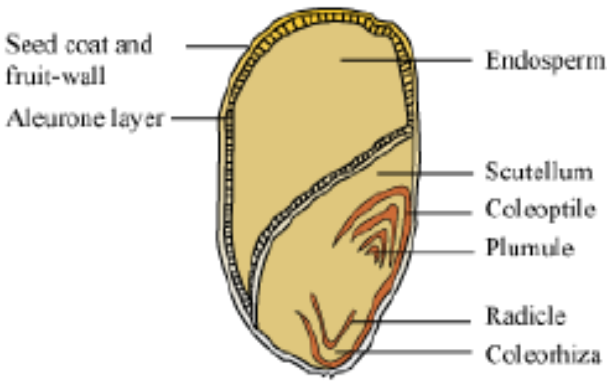
- No germination was seen in the petridish kept in refrigerator while the seed present in the petridish kept at room temperature germinates.

Inference

- Suitable temperature is necessary for germination.

Structure of Monocot Seed





- In seeds of cereals, seed coat is membranous and fused to the fruit wall.

- Generally, monocot seeds are endospermous. Endosperm is bulky and stores food.
- Aleurone layer - proteinous layer that separates embryo from outer covering of endosperm
- Embryo is situated in a groove in endosperm. Embryo consists of
- cotyledon known as scutellum
- embryonal axis (consisting of plumule and radical)
- Plumule is enclosed in a sheath called coleoptile and radical in coleorrhiza.

So what does you concluded about the necessary conditions for seed germination?

Seeds require water, suitable temperature, and oxygen for germination. Let us see how these factors affect germination one by one.

Water

- Helps in rupture of seed coat by swelling the seed, so as to allow the elongated radicle to come out during germination
- Necessary for various biochemical reactions occurring within the seed

Suitable Temperature

- Moderately warm temperature (25ºC - 35°C) is suitable for germination of most of the seeds.
- Very low or high temperature can destroy the delicate tissues of the seed.

Oxygen

- Necessary for providing energy (through respiration) required for rapid cell division and cell growth

Types of Germination

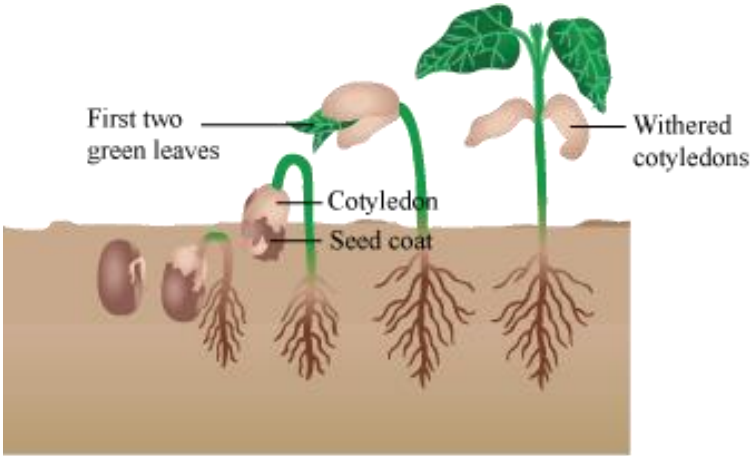
There are two types of germination patterns depending upon the behaviour of cotyledons during germination.

- Epigeal germination

- Hypogeal germination

Epigeal Germination

When the cotyledons are lifted above the ground as a result of rapid elongation of hypocotyls e.g. seeds of bean, castor, cotton, etc germinate in this manner.

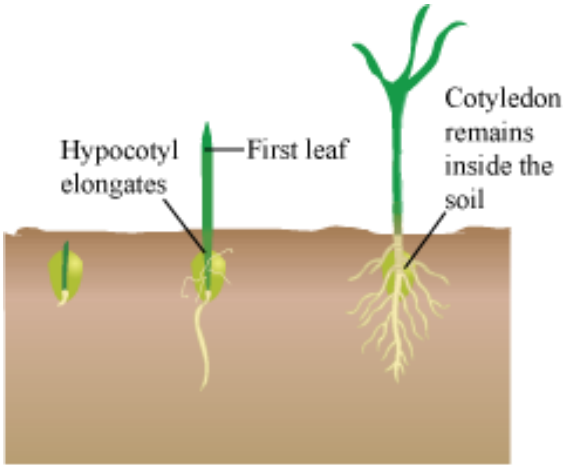


Epigeal germination in a bean seed

Hypogeal Germination

When the epicotyls elongates quickly and pushes the plumule up, and cotyledons are left on the ground only, the germination is hypogeal.

e.g. Gram, pea, maize, etc germinate in this manner.



Hypogeal germination in a maize grain

Viviparous Germination

A special mode of germination in which seed starts germinating inside the fruit while it is

still attached to the parent plant. Once germinated, the seedling is dropped into the soil where it fixes itself by developing roots.

Seedling: A very young plant that grows from a seed after germination. It consists of roots, that fix it in the soil and absorb water and minerals, and small young leaves which manufacture food for it.