Morphological study of monocotyledonous and dicotyledonous seed

Mirza Hasanuzzaman, PhD
Professor
Department of Agronomy
Sher-e-Bangla Agricultural University

Introduction

The media used to sustain and multiply plant species are called seeds. Seed is also called propagule. Seed may also be defined as follows:

A. **Botanical Seed:** Fertilized and mature ovule containing an embryo in a dormant stage is known as a botanical seed. It is also called a true seed. e.g. rice seed, wheat seed, maize seed etc.
B. **Agricultural Seed:** Any part of the plant whether vegetative or reproductive having the capability of producing new offspring of its own type under suitable conditions is called an agricultural seed. e.g. stem of sugarcane, the tuber of potato, sucker of banana, pineapple crown etc.

Seeds may be classified in different ways:

A. **Monocotyledonous Seed:** Seeds contain only one cotyledon. e.g. rice seed, wheat seed etc.

B. **Dicotyledonous Seed:** Seeds contain two cotyledons. e.g. gram seed, jute seed, groundnut seed etc.

C. **Polycotyledonous Seed:** Seeds contain more than two cotyledons. e.g. pine seed.

Again, depending on the presence of endosperm, seeds are classified into two groups:

A. Endospermic or Albuminous Seed: Seeds contain endosperm or albumin. e.g. rice seed, wheat, castor etc.

B. Non-endospermic or Ex-albuminous Seed: Endosperm or albumin is absent in these types of seeds. e.g. gram seed, pea seed etc.

Monocotyledonous Seed:

This type of seed bears only one cotyledon. It is also called endospermic or albuminous seed. e.g. rice seed, wheat seed.

Different Parts of Rice Seed:

Entire Seed:

The entire seed is covered with golden or yellowish or reddish or blackish etc. colored husk, consisting of lemma, palea, glume-1, glume-2 and awn in some varieties.

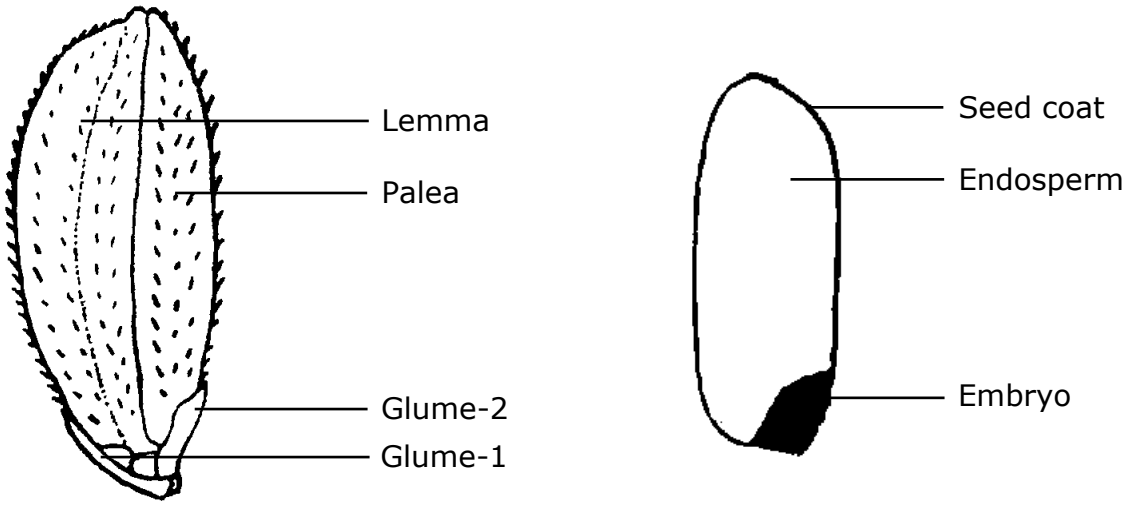

Fig.: Entire rice seed

Lemma: The most outer protective sheath for endosperm and embryo. This is comparatively bigger than palea and envelopes palea.

Palea: The inner and smaller part of the husk is called the palea. This is a protective sheath of the seed which is smaller than the lemma. This is slightly enveloped by a lemma.

Empty Glume: The two glumes (glume-1 and glume-2), the two minute white scales at the base of the grain are called empty glumes because there is no flower at these glumes. Glume-1 is under lemma and glume-2 is under palea.

Rice seed consists of the following parts:

A. Seed Coat:

It is a brownish, membranous layer, adherent to the grain. This layer is made up of the seed coat and the wall of the fruit and fused together.

B. Endosperm:

It forms the main bulk of the grain and is the food storage tissue of it being laden with reserve food material, particularly starch. In a longitudinal section of the grain, it is distinctly separated from the embryo by a definite layer known as the epithelium. Endosperm supplies food to the germinating embryo.

> **Epithelium Layer:** The surface layer of the scutellum lying in contact with the endosperm is called the epithelium. Its function is to digest and absorb food material stored in the endosperm.

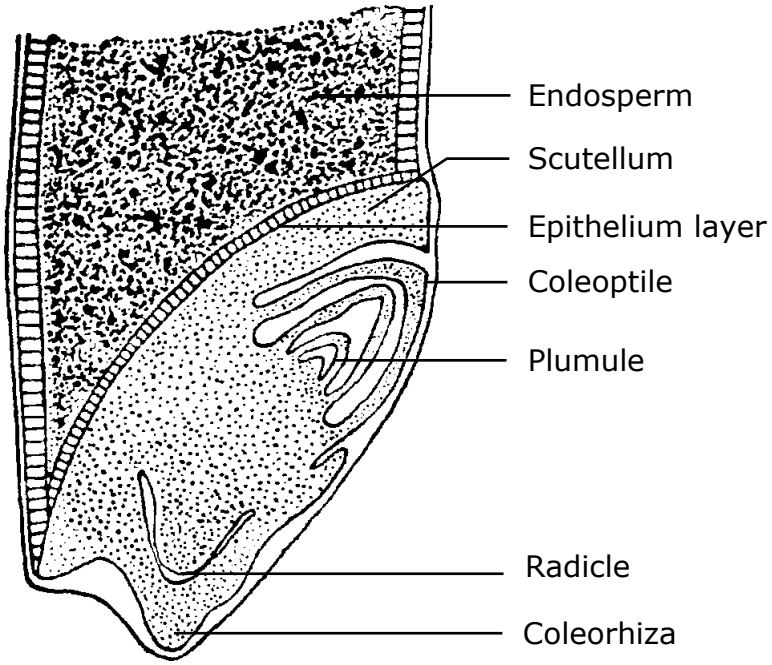

Fig.: Embryo of rice seed

C. Embryo:

It is very small and lies in a grove at one end of the endosperm. It consists of the following parts:

1. **Scutellum:** It is shield-shaped and lies inherent to the epithelium layer. It supplies the growing embryo with food material absorbed from the endosperm with the help of epithelium.

2. **Axis:** A short axis present which has the following portions:

   a) **Plumule:** It is the upper portion of the axis. It is surrounded by minute leaves. The plumule as a whole (growing point and foliage leaves) is surrounded and protected by a sheath called plumule sheath or **coleoptile**. It bears the stem of the next generation.

   b) **Radicle:** It is the lower portion of the axis. The radicle is protected by a cap known as the root-cap. The radicle is surrounded by a root-sheath, called **coleorhiza**.

Dicotyledonous Ex-Albuminous Seed: e.g. gram seed. It is mainly divided into two parts-

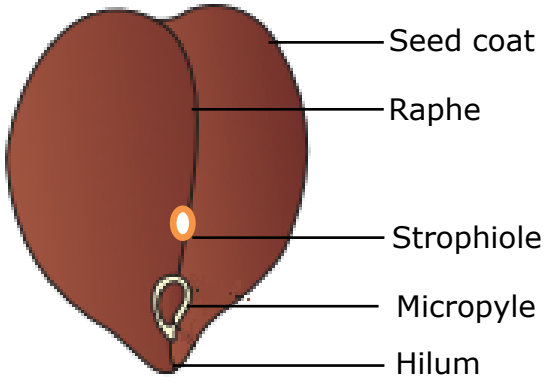

Fig. Entire seed

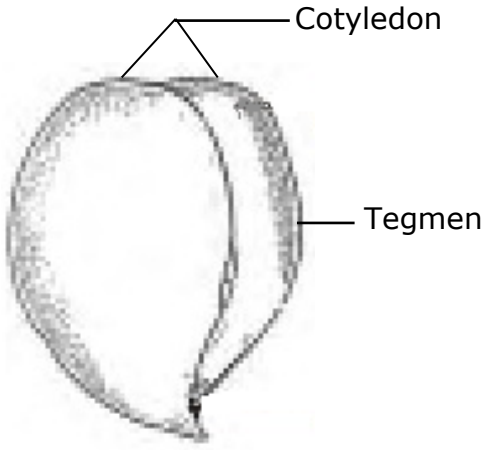

Fig. Kernel

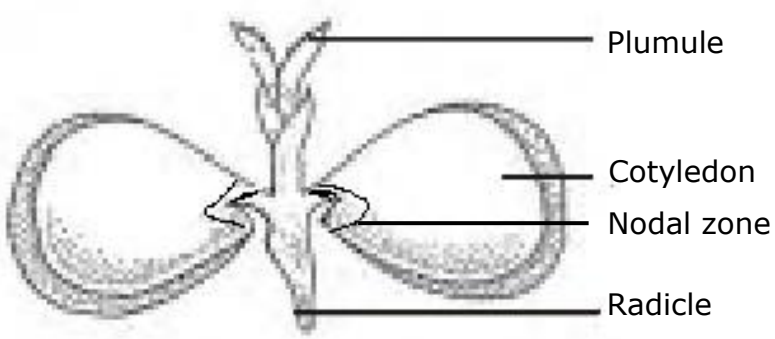

Fig. Unfolded cotyledon with embryo axis

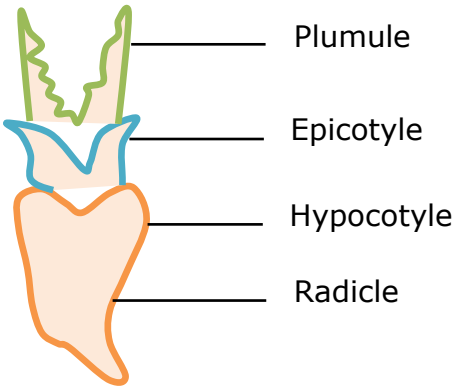

Fig. Axis of embryo

A. Seed Coat:

The seed is covered by a brownish coat known as the seed-coat. It is made up of two layers or integument, they are-

Testa: It is the outer layer of the seed-coat. The testa is brownish in color and is comparatively thick.

Tegmen: It is the inner layer of the seed-coat. The tegmen is whitish, thin and membranous; it is fused with the testa.

The seed-coat affords necessary protection to the embryo which lies within. The seed-coat is provided with the following markings:

1. **Hilum:** On one side of the seed, lying above its projected end, a small oval depression may be seen; this is known as the hilum. It represents the point of attachment of the seed to its stalks.
2. **Micropyle:** Just below the hilum a very minute hole may be seen; this minute slit or opening is known as the micropyle.
3. **Raphe:** When the soaked seed is gently pressed, water and minute air-bubbles are seen to escape trough it. Above the hilum the stalk is continuous with the seed-coat forming a sort of ridge; this ridge which is fused with the testa is called the raphe. Through the raphe food is supplied to the embryo.

4. **Strophiole:** A swollen part in the middle of the outside of the seed-coat is called strophiole.

B. Embryo:

The entire fleshy body, as seen after removing the seed-coat, is the embryo or the baby plant. As the seed germinates it gives rise to a seedling which gradually develops into the gram plant. The embryo consists of two white fleshy bodies as follows-

1. **Cotyledons:** These are two in number, fleshy and flat. Cotyledons store up food material.
2. **Axis:** A short axis is present to which the cotyledons are attached. It consists of the following:
   - **a) Radicle:** The part of the axis lying towards the pointed end of the seed is called the radicle (a little root). As the seed germinates the radicle gives rise to the root.
   - **b) Plumule:** The other end lying in between the two cotyledons is known as the plumule. The plumule is surrounded at the apex by a number of minute leaves and as such it looks more or less like a small feather. As the seed germinates the plumule gives rise to the shoot.
   - **c) Epicotyle:** It is the portion of axis which lies on just above the nodal zone.
   - **d) Nodal Zone:** It is that point of axis in which the two cotyledons are connected with each other.
   - **e) Hypocotyle:** It is the just below portion of the nodal zone.

Dicotyledonous albuminous seed: e.g. castor seed. It consists of the following parts:

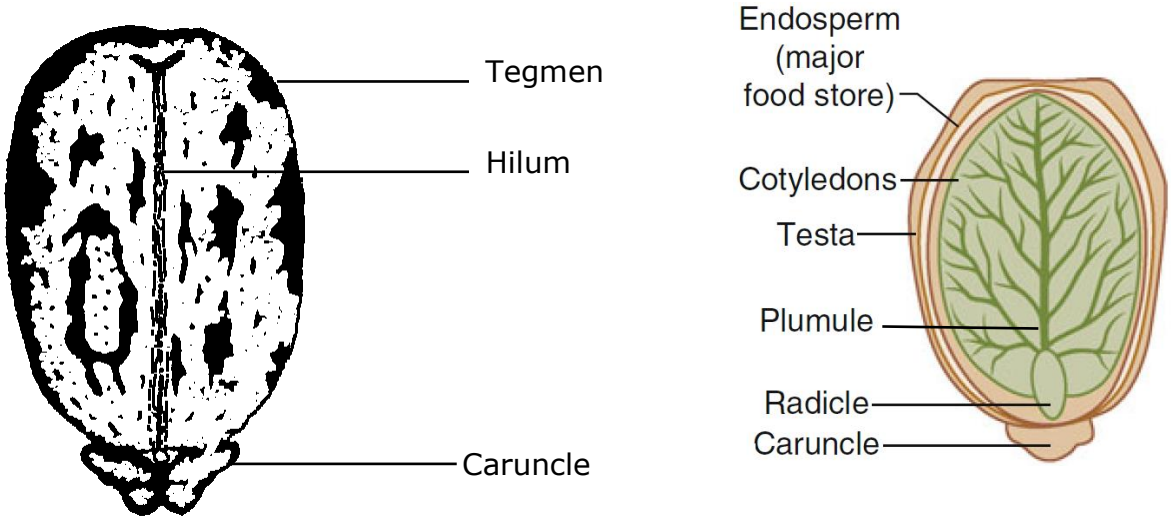

Fig.: Entire castor seed

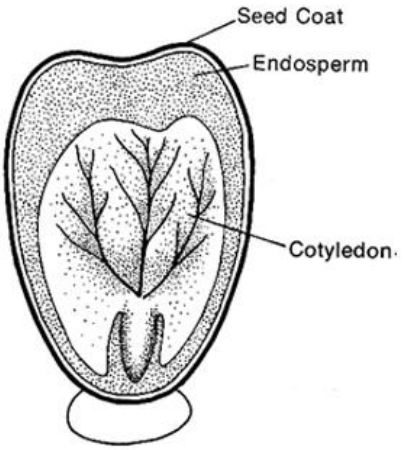

Fig. Lengthwise splitted kerncle

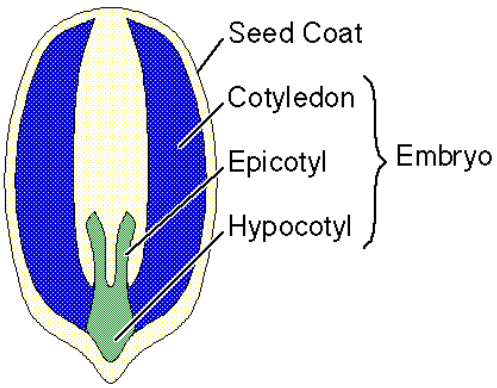

Fig. Embryo

A. Seed-coat:

The hard and blackish shell is the outer seed-coat or testa. It consists of the following parts:

Caruncle: At one end of the seed-coat there is a white body, an outgrowth formed at the micropyle is called the caruncle.

Hilum: Nearly hidden by the caruncle a small scar may be seen on the seed-coat, representing the point of attachment of the seed to its stalk; this is the hilum.

Tegmen: On removing the testa a thin and membranous inner seed-coat may distinctly be seen surrounding the endosperm.

Raphe: Running down the hilum a ridge may be seen on the outer seed-coat or testa; the ridge has been formed by the fusion of the stalk with the testa, and is know as the raphe.

B. Endosperm:

A white fleshy mass lying inside the seed-coat is called as the endosperm. It is the food storage tissue of the seed, particularly rich in oil. It encloses the embryo.

C. Embryo:

This lies embedded in the endosperm. The embryo consists of the following parts:

Cotyledons: Two thin, flat and papery cotyledons or seed-leaves, more or less distinctly marked by veins. Cotyledons lie embedded in the endosperm and their function is to transport the food material from the endosperm to the radicle and to the plumule, and later, on the germination of the seed, they turn green and leafy.

Axis: Plumule and radicle are the two parts of axis. An undifferentiated plumule which is the blunt inner end of the axis lying in between the two cotyledons. The minute leaves of the plumule become apparent only when the seed begins to germinate. The radicle always gives rise to the root and the plumule to the shoot.