SEED GERMINATION TYPES

The following three points will highlight the three main types of seed germination.

The three main types are: (1) Hypogeal Germination (2) Epigeal Germination and (3) Vivipary (Viviparous Germination).

Type # 1. Hypogeal Germination:

In this kind of germination, the cotyledons do not come out of the soil surface. In such seeds the epicotyl (i.e., part of embryonic axis between plumule and cotyledons) elongates pushing the plumule out of the soil. All monocotyledons show hypogeal germination (Fig. 4.3, 4.4, 4.5). Among dicotyledons, gram, pea (Fig. 4.2), groundnut are some common examples of hypogeal germination.

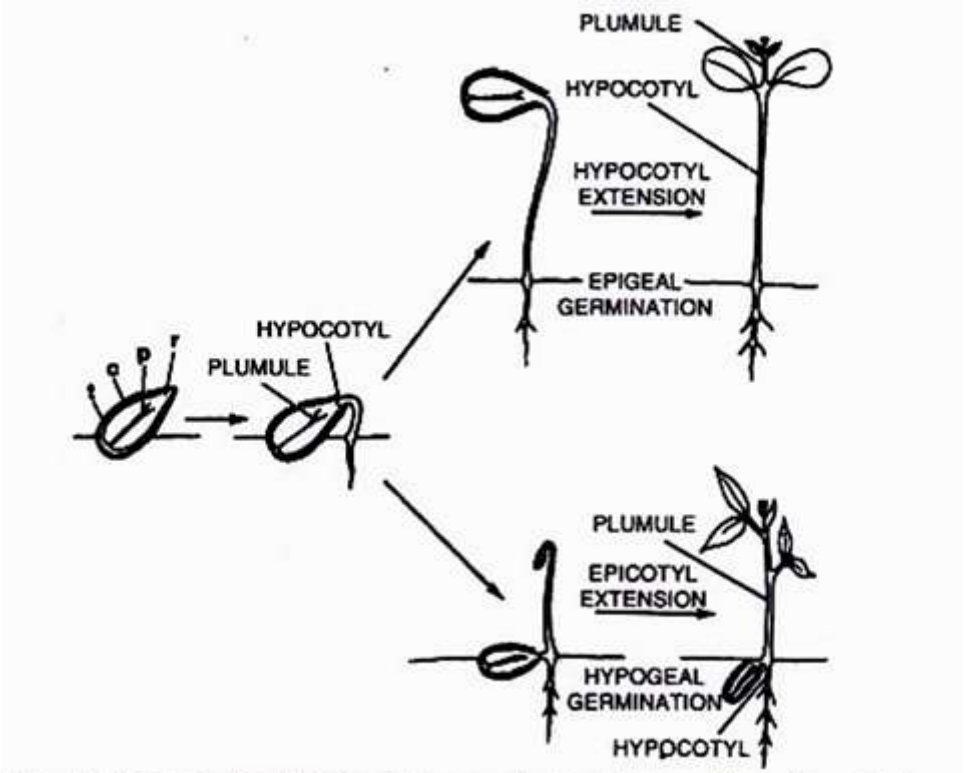

Fig. 4.1. Figure sowing distinction between epigeal and hypogeal type of germination.

In monocotyledons (e.g., wheat, maize, rice, coconut) radicle and plumule come out by piercing the coleorrhiza and coleoptile respectively. The plumule grows upward and the first leaf comes out of the coleoptile. The radicle forms the primary root which is soon replaced by many fibrous roots.

(i) Germination of Pea Seed:

The seed imbibes water and swells. The radicle comes out and first penetrates the soil and forms root system by giving out secondary branches. It is the epicotyls which grows first. It arches out and carries the plumule above ground. The plumule

soon forms the aerial shoot. The cotyledons remain under the soil throughout (Fig. 4.2).

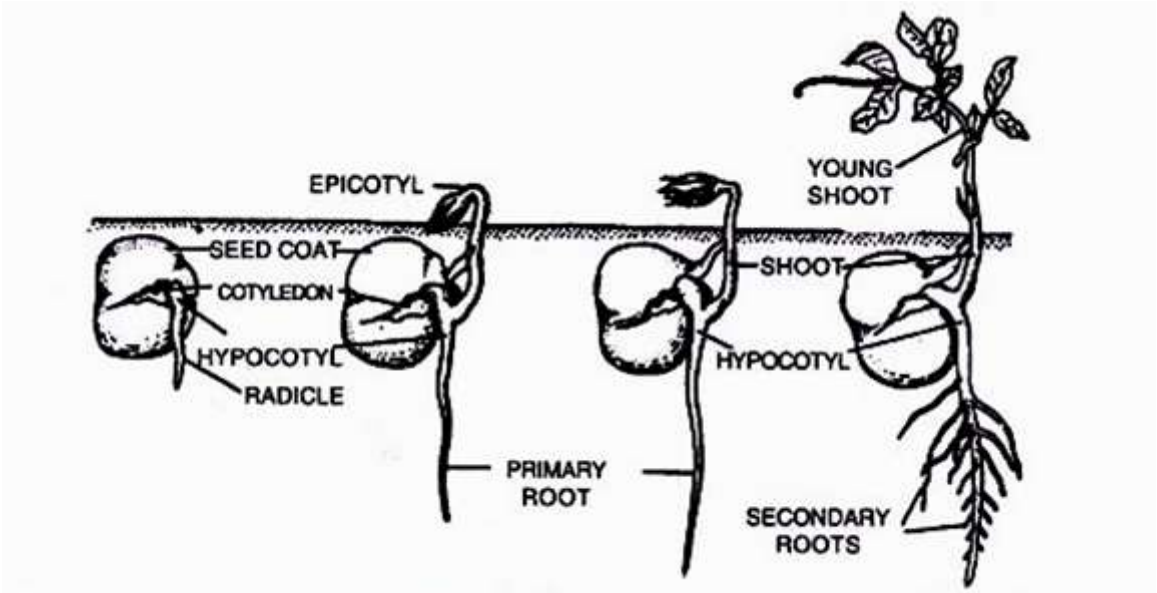

Fig. 4.2. Successive stages of hypogeal germination of dicotyledonous exalbuminous seed of pea.

(ii) Germination of Maize Grain:

The grain imbibes water from moist soil. The coleorhiza pierces the base of caryopsis (fruit) and appears as a shining knob. After sometimes, the coleorhiza gets ruptured due to growth of radicle. After sometime coleoptile comes out.

Three seminal roots develop from above the radicle (but variation in number). The radicle and seminal roots with two branches persist throughout the life of the plant. Adventitious roots are formed from the lowermost nodes above the mesocotyl (Fig. 4.3).

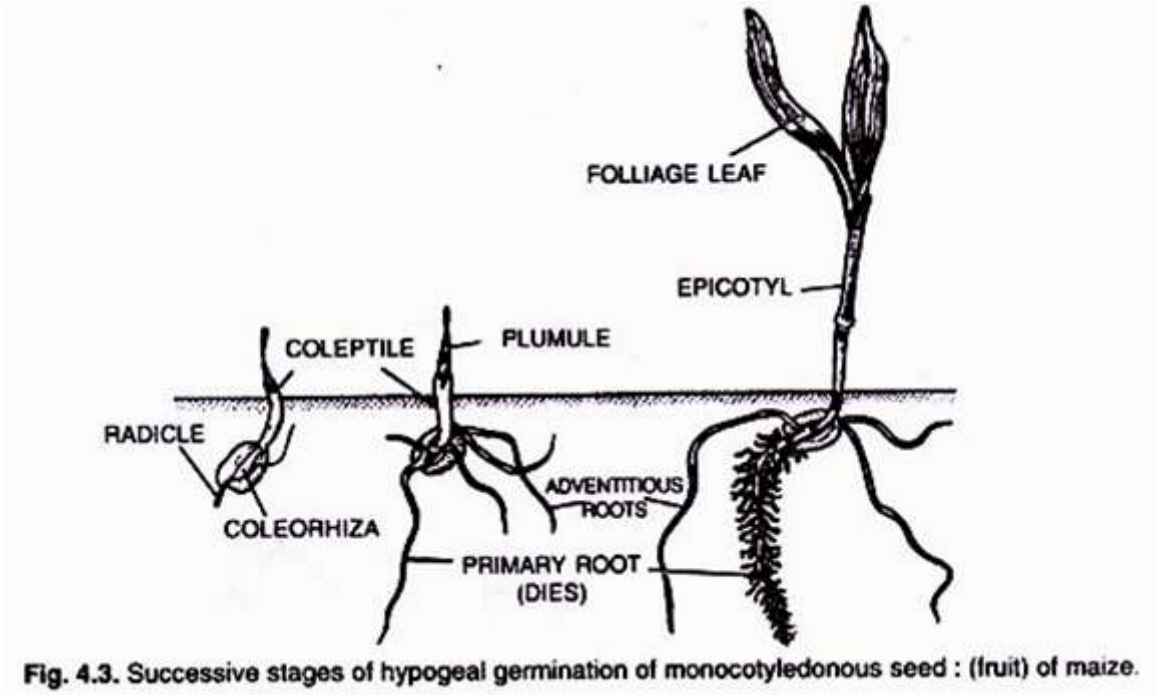

Fig. 4.3. Successive stages of hypogeal germination of monocotyledonous seed : (fruit) of maize.

(iii) Germination of Wheat Grain:

Details of wheat grain germination (Fig. 4.4) are similar to those of maize grain germination. Wheat grain shows hypogeal germination.

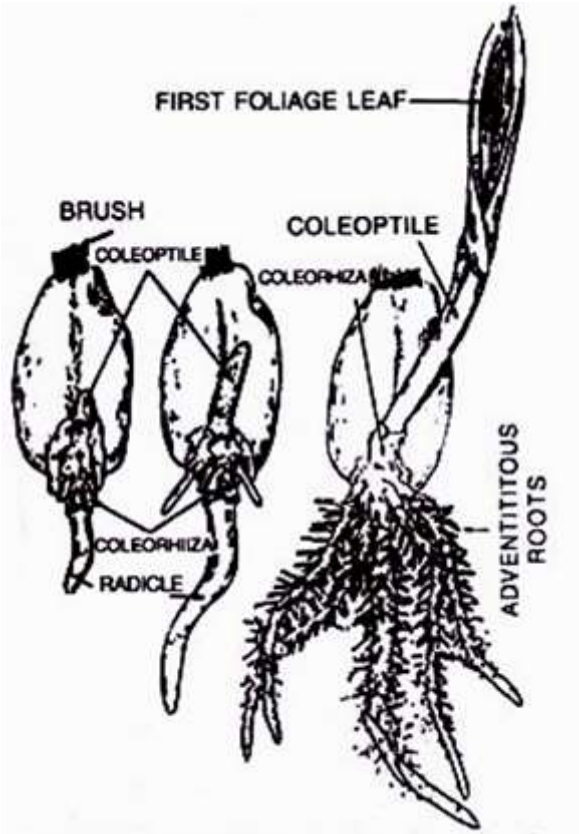

Fig. 4.4. Hypogeal germination of a grain of wheat (*Triticum*).

(iv) Germination of Coconut (Cocos nucifera):

During germination the lower end of the embryo forms the cotyledon which begins to grow as a spongy structure inside the endosperm. This spongy cotyledon increases in size as it absorbs food material stored in the endosperm. The upper end of the embryo develops through the ‘eye’ carrying the radicle and the plumule.

The plumule pierces the fibrous pericarp and emerges like a horn. This develops the aerial shoot even before the roots have come in contact with the soil. The radicle fails to develop any further but several adventitious roots grow from the base of the plumule. The seedling becomes established where the adventitious roots penetrate the soil (Fig. 4.5).

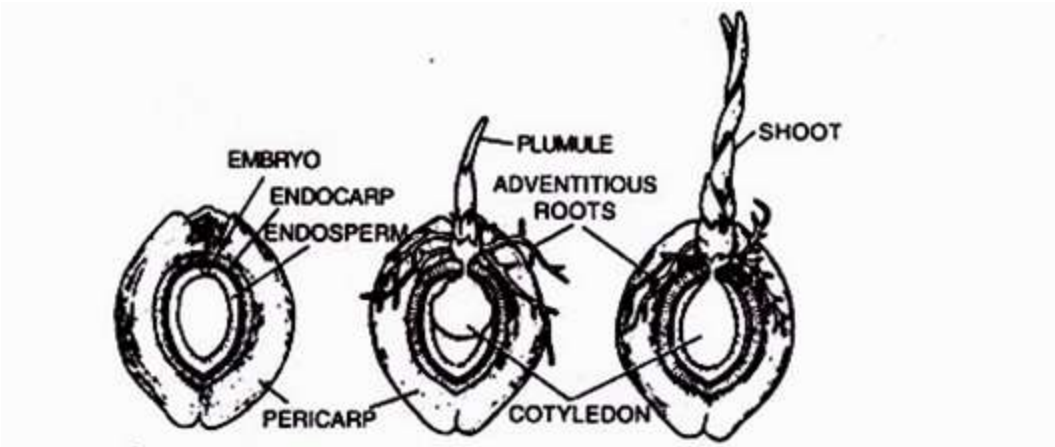

Fig. 4.5. Successive stages of hypogeal germination in monocotyledonous seed of coconut.

Type # 2. Epigeal Germination:

In seeds with epigeal germination, the cotyledons are brought above the soil due to elongation of the hypocotyl. In castor, cotton, papay, onion (Figs. 4.7., 4.8), flat green leaf like cotyledons can be seen in the young seedlings. Here the cotyledons, besides food storage, also perform photosynthesis till the seedling becomes independent. In some other plants like bean, the cotyledons being thick, do not become leaf-like; they shrival and fall off after their food reserves are consumed by the seedling.

(i) Germination of Gourd (Cucurbita maxima):

The straight radicle comes out of the seed and fixes the seed to the soil with the secondary roots developing from the radicle. Next, the hypocotyl grows so quickly that it forms a loop which comes out of the soil and pulls out the rest of the seed. The seed coat is cast off and the cotyledons open out like two leaves, become green, large and thin so that they look and behave like ordinary leaves. The plumule within the cotyledons becomes exposed and soon grows into the aerial shoot (Fig. 4.6).

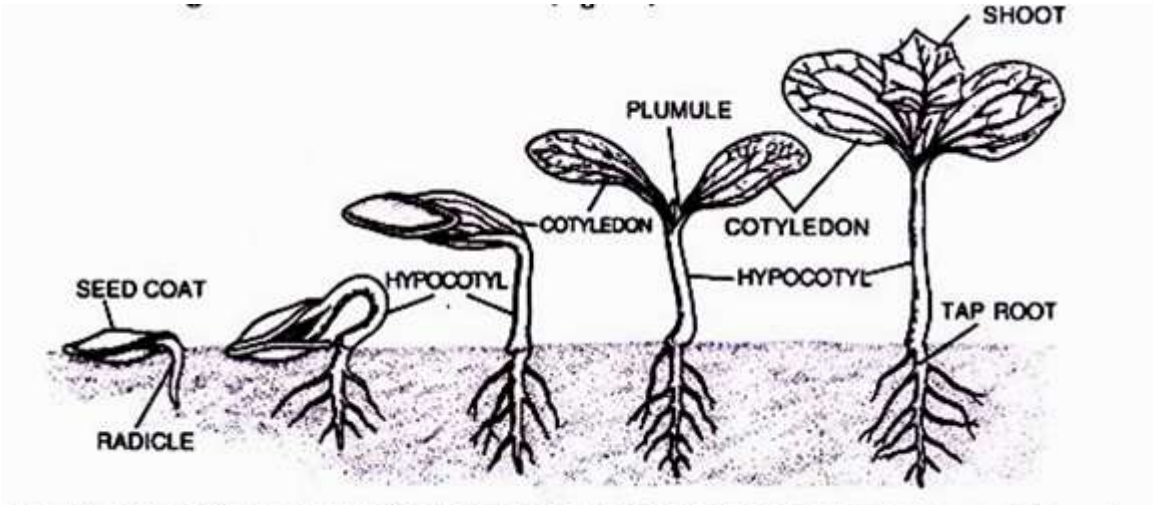

Fig. 4.6. Successive stages of epigeal germination of dicotyledonous exalbuminous seed of gourd.

(ii) Germination of Castor (Ricinus communis):

The seed imbibes water and the testa bursts near the caruncle and the radicle grows out. After this hypocotyl grows due to which two papery cotyledons enclosed by endosperm are pulled out of the soil. Cotyledons come out of the endosperm when it is consumed. The cotyledons become green and leaf-like, while the plumule slowly develops into leafy shoot. The remanents of endosperm withers and drop off (Fig. 4.7).

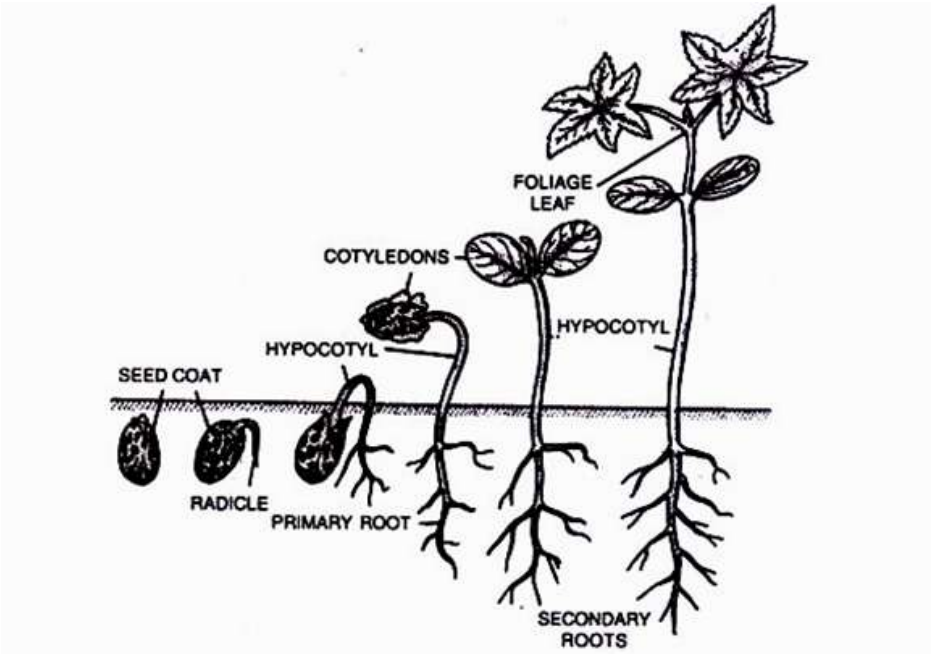

Fig. 4.7. Successive stages of epigeal germination of dicotyledonous and albuminous seed of castor.

(iii) Germination of Onion Seed:

In this case the radicle as well as the base of the scutellum (cotyledon) grow out of the seed. The radicle penetrate the soil, while the other end of the cotyledon remains within the endosperm and sucks the food material. The base of the cotyledon grows further, turns green and pushes the seed out of the soil. The plumule is not visible so long as it is covered by the base of the cotyledon in the form of a sheath just above the radicle.

The plumule now pierces the cotyledonary sheath and forms the first cylindrical foliage leaf. Meanwhile adventitious roots develop from above the radicle and form a fibrous root system (Fig. 4.8) (In this case the seed is pushed out of the soil by growth at the base to cotyledon and not by growth of hypocotyl).

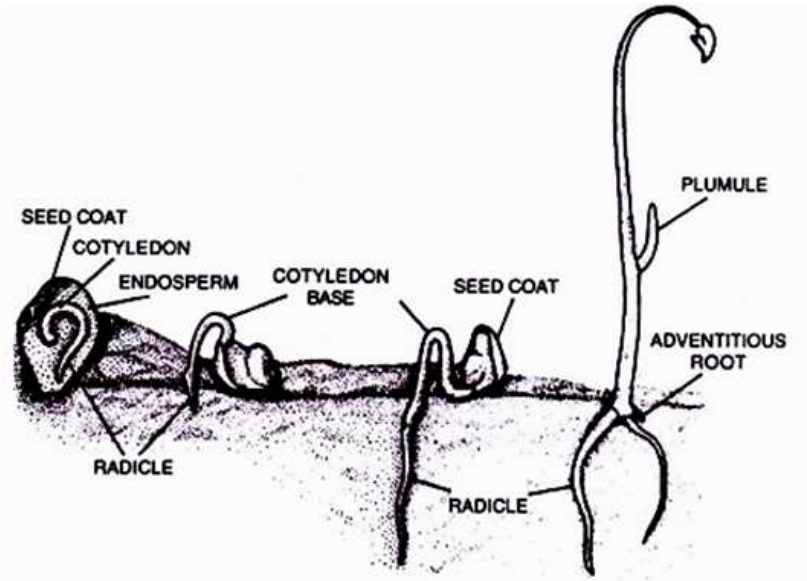

Fig. 4.8. Successive stages in the germination of albuminous seed of onion.

Type # 3. Vivipary (Viviparous Germination):

Vivipary is the phenomenon of giving birth to young ones in advanced stage of development. It occurs in mammals (among animals) and mangrove plants. In mangrove plants (e.g., Rhizophora, Sonneratia, Heritiera) the seeds cannot germinate on the ground because of the excessive salt content and lack of oxygen in marshy habitat. In such plants seed dormancy is absent.

The embryo of the seed (present inside the fruit) continues growth while the latter is attached to the parent plant. Hypocotyl elongates and pushes the radicle out of the seed and the fruit. Growth continues till the hypocotyl and radicle become several centimetres long (more than 70 cm in Rhizophora). The seedling becomes heavy.

As a result it breaks its connection with the fruit and falls down in the salt rich muddy water in such a position that the plumule remains outside the saltish water while the tip of the radicle gets fixed in the mud. This protects the plumule. The radicle quickly forms new roots and establishes the seeding as a new plant (Fig. 4.9).

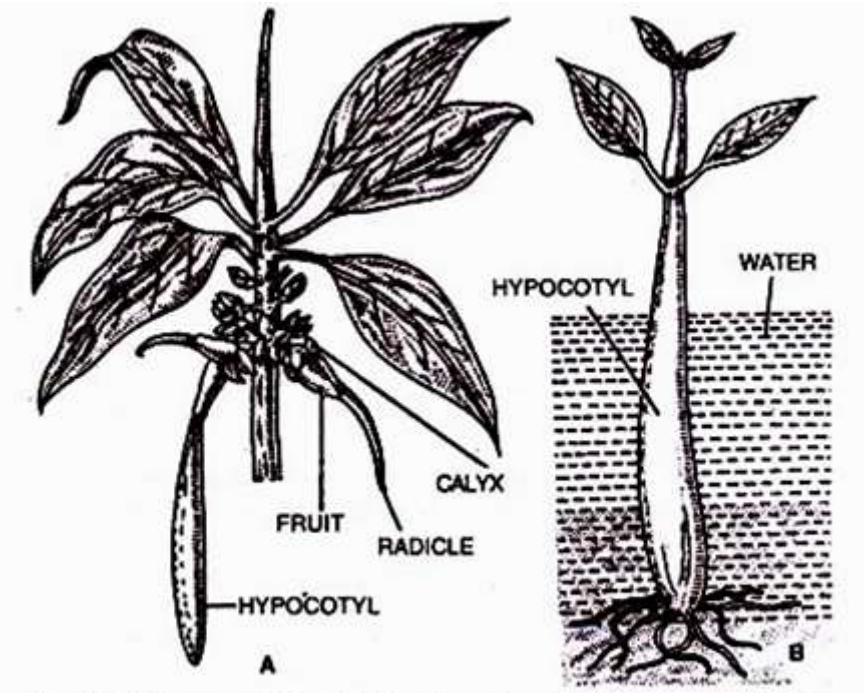

Fig. 4.9. Vivipary. A. twig of *Rhizophora* showing viviparous germination, **B.** A seedling has become established on tidal soil.