ANGIOSPERMIC SEED

I. STRUCTURE OF SEED

The **whole plant** exists in a **seed.** Plant is the **main base** of whole **living world.** So it can be say that seed is **the most important. In angiosperm, after the fertilization, egg cell changed into embryo, ovary changed into fruit and ovule change into seed.**

Morphologically, **ripened ovule** is known as **seed.** In other words, **seed is a mature, integumented megasporangium.**

Seed are characteristic of **Spermatophytes** (Gymnosperms and Angiosperms). Typical mature seed is having **three main parts:**

1. Seed coat:

Outer, protective covering of the seed is called seed coat, which develops from integuments of ovule . in seeds developing from bitegmic ovules, there are two distinct layers in seed coat. the outer layer is **thick, hard and leathery (developing from outer integument). called testa, whereas inner layer is thin and papery** or **membranous** (developing from inner integument). called **tegmen .**In seeds developing from unitegmic ovules there is single . layered **seed coat.** The seed coat performs usual **protective** function.

The seed is attached to the fruit wall or pericarp by means of a stalk called funicle or funiculus. The point of attachment of funiculus to the body of mature seed is called **hilum.** A small opening or pore called **micropyle** is present just near the hilum, which is the way of **water** into the seed .As most of the ovule in angiosperms are inverted or **anatropous,** so a ridge called **raphe.**

2. Embryo:

Embryo is the most important part of the **seed, which represents miny** or **tiny future plant.** The origin of embryo is from fertilized egg [zygote].

The embryo is having an **embryonal axis** or main axis called **tigellum,** to which one or **two cotyledons** (seed leaves) are attached, depending upon whether the seed is **monocot** or **dicot.** The portion of **embryonal axis** or **tigellum below** the point of attachment of cotyledons is called **hypocotyl,** which bears **radicle** or future root at its tip. Similarly, portion of **embryonal axis** or **tigellum above** the point of attachment of cotyledons is called epicotyl, which bears plumule (future shoot) at its tip.

3. Cotyledons:

In some seeds (e.g. legumes), reserve food is stored in **cotyledons,** whereas in others (e.g. cereals), there is special nutritive tissue called **endosperm .**the seeds having **endosperm** Re called **endospermic** or **albuminous** seed, e.g., **Cereals, Castor,** etc., whereas seeds in which endosperm is fully consumed by embryo and **no endosperm** is left, are called **non- endospermic** or **ex-albuminous** seeds, e.g., **Gram, Pea, Sem, Cucumber, Tamarind,** etc. The reserve food materials in seeds may be **carbohydrate** (e.g. , **Wheat, Rice**) or **proteins**(legumes) or **fats** (**Castor , Peanut, Sunflower**) , etc .

Some time, some part of **nucellus** remains **unused** which is present in the form of thin layer around the endosperm is called **perisperm.** e.g. **Betel nut** and **Black pepper .**

☞ In **Monocot embryo,** there is a **single cotyledon** called **scutellum.** In some **grasses – Wheat.** [On opposite side of scutellum is a ton shaped outgrowth **remains of second cotyledon** is present called **epiblast.**]

☞ In Dicot albuminous seed-**castor** (Ricinus communis), there is a specific outgrowth called **caruncle** or **strophiole,** present over micropyle. It is formed by proliferation of cells of outer integument at tip. Caruncle is somewhat **spongy** and helps in absorption of water during germination of seed.

Endospermic dicot seeds: e.g., Castor, Papaya, Cotton.

Non-endospermic dicot seeds: e.g., Gram, Bean, Pea, cucumber, Tamarind.

Endospermic monocot seed: e.g., **Maize, Rice, Wheat and Coconut.**

Non- endospermic monocot seed: Pothos (money plant), **Vallisneria, Alisma, Amorphophallus.**

☞ On the basis of **cotyledon** in the seed of angiosperm are called **Monocotyledon** [one cotyledon] and **dicotytedons** [Two cotyledon].

The angiospermic seed classified into two categories on the **presence** or **absence of endosperm** in seeds-

1. **Non Endospermic seed or Ex-albuminous** 2. **Endospermic or Albuminous seed.**

1. Non Endospermic or Ex-albuminous seed:

Such type of seed do not have an endosperm at maturity, therefore are called **non endospermic** or **Ex-albuminous** seed. The endospermic tissues are absorbed during the development of embryo. The absorbed food materials from the endosperm is stored in cotyledons, that why they become so large and fleshy e.g. **Capsella** and all dicotytedons. But **Castor** seed is endospermic.

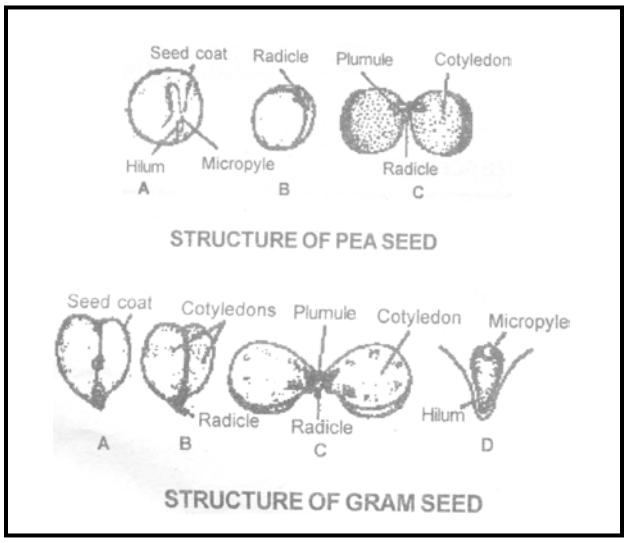
2. Endospermic or Albuminous seed:

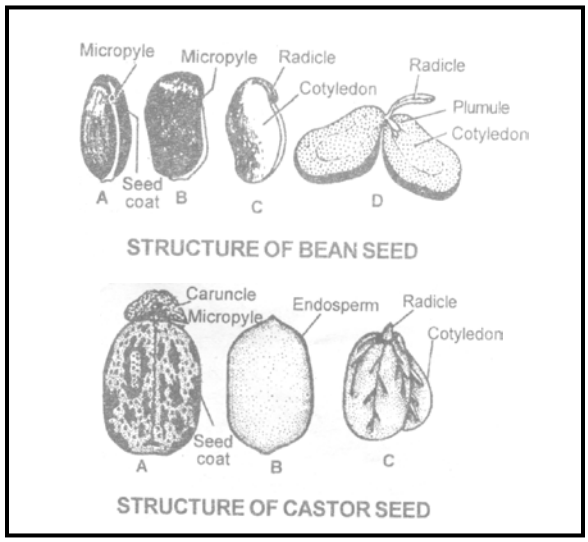
this type of seeds, **food** is stored in **endosperm.** Such seeds are called **endospermic seed** OR **Albuminous seed.** The endospermic tissue in these seeds utilize during the germination of seed and their cotyledons are thin and membranous e.g. All **Monocot seeds** e.g. **Wheat, Rice,** and **Maize** etc. Castor [dicot] is also endospermic seed.

II. STRUCTURE OF BEAN SEED.

Bean seed is kidney having a concave side and a convex side. The concave side is slightly darker and posses a white elongated scar is called **hilum,** which marks the point of attachment of the seed with the funiculus. A small pore lies adjacent to the hilum, called **micropyle,** which performs the function of absorbing water during germination. There is a short ridge on the other side of hilum . It is called **raphe.**

The **Bean** seed has **two seed coats.** The outer seed coat is called **testa.** It is hard, thick, smooth and variously coloured. It develops from outer integument of ovule . The inner coat is white, membranous and thin . It is called **tegmen.** It is difficult to separate tegmen from testa. The seed coats can easily be removed if the seeds a are soaked in water for a few hours.



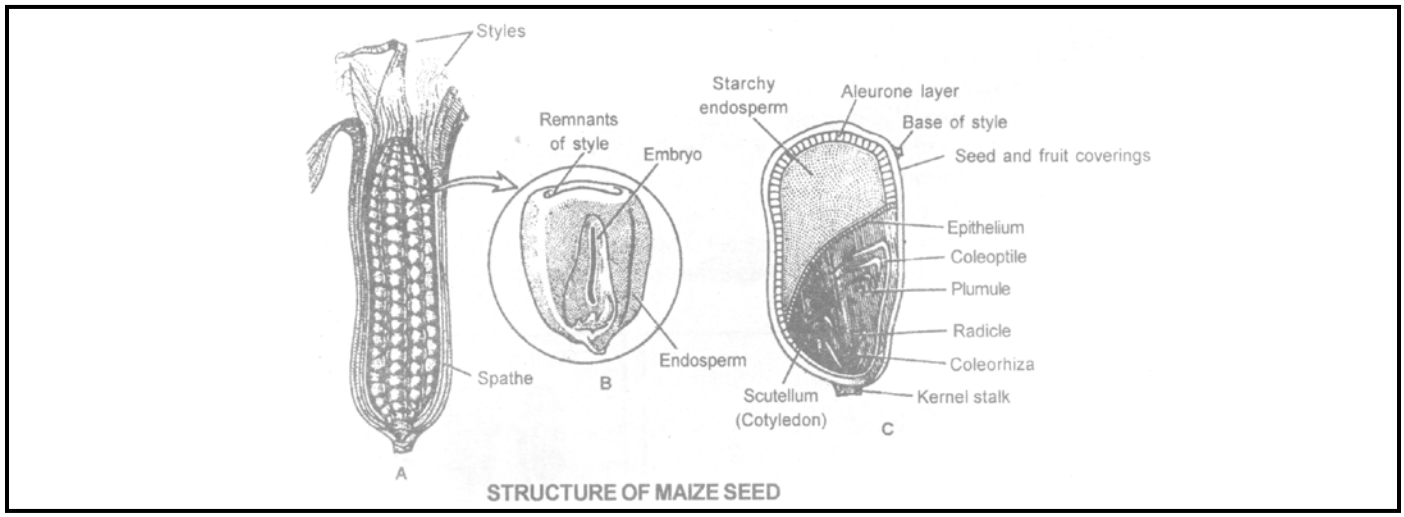


Each seed encloses an **embryo** which can be examined after removing the seed coats. The bulk of embryo consists of two large, white and kidney-shaped **cotyledons** (or seed leaves). They store **reserve food** material in the form of **carbohydrates** and **proteins** to provide nourishment to embryo at the time of **seed germination** and growth of young seedling. The cotyledons are attached laterally to the curved embryonal axis at the **Cotyledonary node.** The micropylar end of embryonal axis rod-shaped and slightly and bulged. It is called **radical** (or the embryonic root). The other side of embryonal axis lies in between the two cotyledons. it is called **plumule** (or the shoot tip). The shoot tip remains protracted two small, folded leaves. The portion of embryo axis between the plumule and Cotyledonary node is called **epicotyl.** The portion of axis between the radicle and Cotyledonary node is called **hypocotyl.**

STRUCTURE OFMAIZE GRAIN [SEED]

A grain of **Maize (Zea mays)** is infect a dry one –seeded indehiscent **fruit** of **caryopsis** type in which **pericarp** (or fruit wall) is fused with the **seed coat.** The covering of grain encloses **two major parts- endosperm** and an embryo. As seen in longitudinal section, the major portion of grain is occupied by a large **starchy endosperm.** It is surrounded by a special one –celled thick layer, called **aleurone layer.** The **cells of aleurone layer** are filled with portentous grains which play an important role at the time of germination.

The embryo consists of an upper shield-shaped **scutellum** which is actually a cotyledon. The scutellum is closely pressed against the endosperm and helps in the translocation of nutrients from endosperm to the growing embryo at the time of germination and seed growth. The epidermal tissue of scutellum lying in direct contact with the endosperm is both secretory and absorptive in function. It secretes certain hormones into the endosperm which synthesize enzymes. These enzymes are responsible for the decomposition of stored nutrients and convert them into soluble state. The soluble nutrients are then absorbed by **epithelial layer** of scutellum and transferred to the **growing embryo.**



STRUCTURE OF MAIZE SEED

The scutellum is attached laterally to the embryonal axis. One end of the embryonal axis points towards the **pointed end** of the grain. It is called **radicle.** The radical is covered by a protective sheath called **coleorhiza.** The other end of embryonal axis, which faces towards the **broader end** of the grain, is called **plumule.** The plumule is surrounded by a conical protective sheath, called **coleoptile.** The coleoptile is capable in growth and covers the growing shoot tip till it passes through the soil during germination.

II. GERMINATION OF SEED :

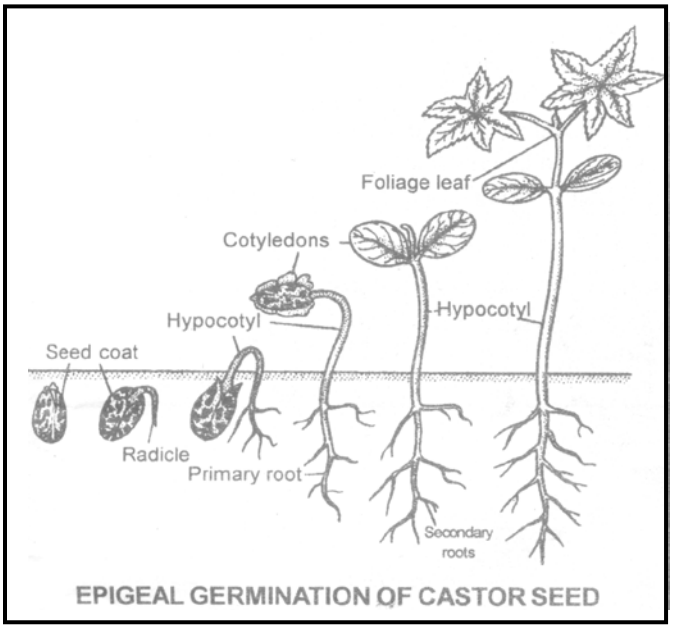
The **embryo** of seed grows in to a **sporophyte plant.** The radicle produces primary root. The plumule develops short and latter on cotyledons degenerates.

In some of the plants cotyledon comes above the surface of the soil during the germination of seed. Such type of germination is called **Epigeal germination.** e.g. **Capsella.** This is due to higher growth takes place in **hypocotyl region** of embryo in seed so cotyledon pushed above the soil surface [**Capsella, Castor, French bean** etc.]

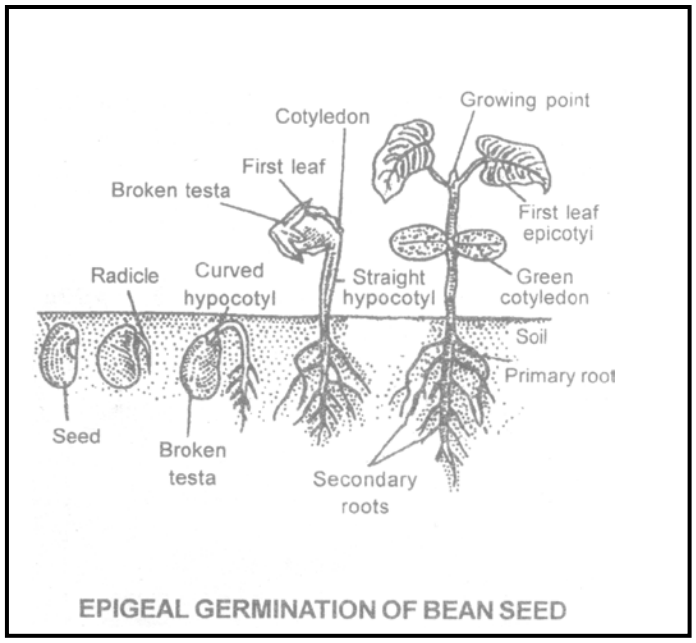
In some of plants the **epicotyl** region grow **faster** during the germination results cotyledon remains under the soil. It is known as **hypogeal germination,** e.g. In most of **Angiosperms** [**Pea, Gram, Rice, Maize** etc]

Type of seed Germination:

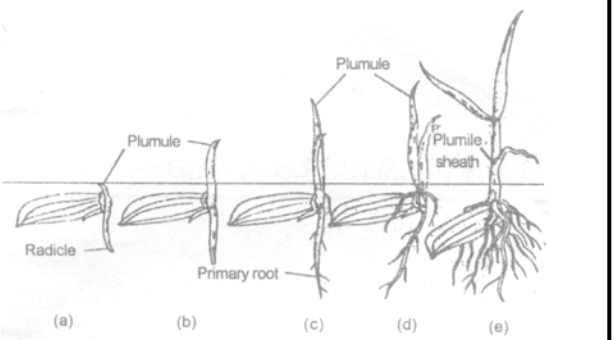
Germination is basically of two types, depending upon behaviour of cotyledons but viviparous germination also found:-



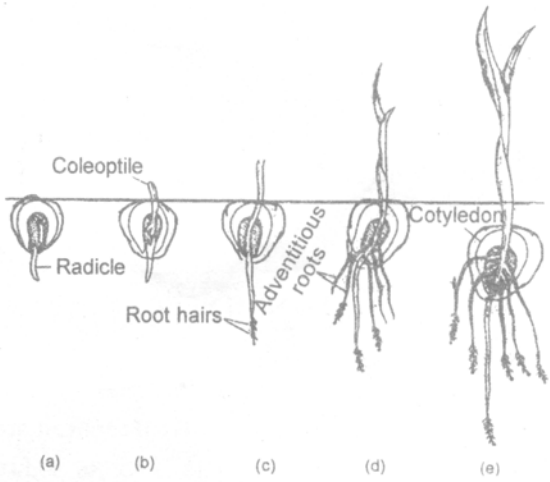
EPIGEAL GERMINATION OF CASTOR SEED



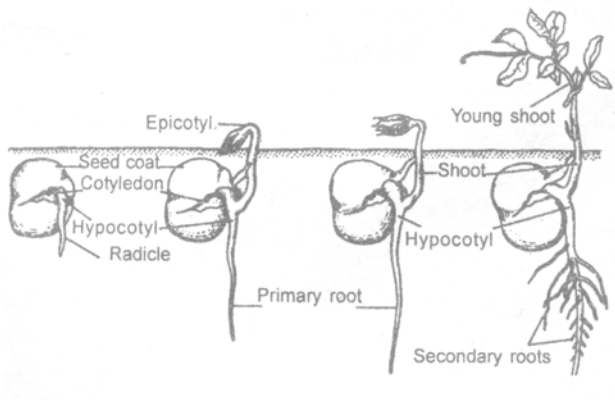
EPIGEAL GERMINATION OF BEAN SEED



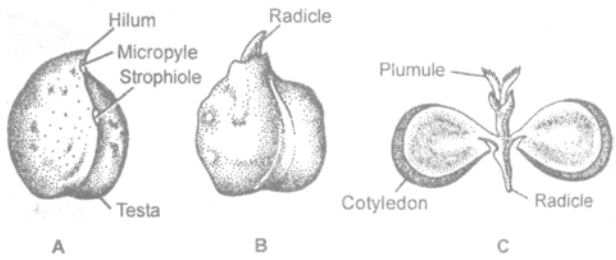
HYPOGEAL GERMINATION OF RICE SEED



HYPOGEAL GERMINATON OF MAIZE SEED



HYPOGEAL GERMINATION OF PEA SEED



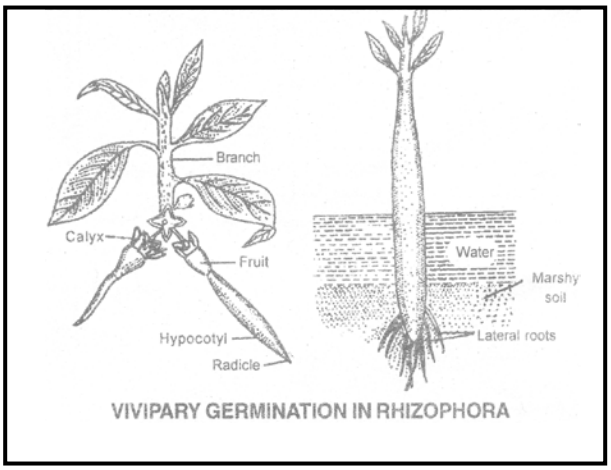
HYPOGEAL GERMINATION OF GRAM SEED

1. Epigeal germination:
Here due to hypocotyl growth or elongation, cotyledons are pushed out of soil. This is called **Epigeal germination.** This type of germination occurs in **Cotton, Papaya, Castor, Onion, Cucurbits, Tamarind, French bean, mustard,** etc. In some cases, these above ground **cotyledons** become **green leaf like** (Cotyledonary leaves) and perform photosynthetic function till the seedling assumes independency (e.g., castor, cotton, onion, papaya, etc.). In other plants cotyledons do not assume leaf like shape and fall off (e.g., **French bean** and **Tamarind**).

2. Hypogeal germination:
Here due first epicotyl an elogation, plumule comes out of the ground and cotyledons remain underground. This is called **hypogeal germination.** This type of germination occurs in most of the monocotyledons and few dicotytedons, e.g., **Maize, Rice, Wheat, Coconut, Gram, Pea, Peanut** and **Mango,** etc.

3. Vivipary:

A **special type of seed germination** is characteristic of **Mangrove vegetation,** found in muddy, saline conditions, e.g., **Rhizophora, Avicennia, Ceriops, Breguira, Sonneratia,** etc. here there is no resting period of embryo and germination occurs inside the fruit, while it is attached to the parent plant, i.e., **"in-situ germination".** The seedling is separated in the mud with the help of lateral roots developing from basal end of radicle. This is called **viviparous germination** or **vivipary.**



VIVIPARY GERMINATION IN RHIZOPHORA

III. FACTORS AFFECTING SEED GERMINATION:

The process by which the dormant embryo wakes up [becomes active] and begins to grow is known as germination of seed. the seed germination takes place in the presence of favourable condition such as **temperature, moisture,** and **air.** This is a very **delicated stage** in the life of the plants. Any minute change in the environment have harmful effect on growing embryo. So **favourable environment** should be essential for germination. The following factors are essential for germination of seed.

1. Moisture:
the **moisture** or **water** is the **most important** factor for germination of seed . Generally, the cells of embryo contain **10-15% water** in the **dormancy period.** The vital activities like growth and development is unable to continue in this less amount of water. For **active life processes**, **water** must be present about **75-90%.** The seed absorbs water and swell up to increase in size before the germination. **Water absorbs** through **seed coat** and **micropyle .** The following effects have been observed in seed due to absorption of water –

I . The seed coat becomes soft and absorbed water reaches to the cells of embryo. When the ratio of water increases in the cells, the protoplasmic contents become more active.

II. The size of embryo increased due to water absorption results, seed coat breaks up and radicle and plumule easily comes out. Seed coat absorbs water, it becomes soft and increase its permeability. Resulting it increases rate of exchange of oxygen and CO_2 . The rate of respiration increases in active cells of embryo .thus it requires more oxygen.

III. The enzymes are present in the cells of endosperm or cotyledons which are only active in the presence of water. The **stored food** changed in to **dissolved form** by the activity of **enzymes** and it reaches to the active embryo.

2. Oxygen [O_2]

The process like **cell division cell elongation** etc. of the embryo require **energy.** This energy is released by the oxidation of carbonic substances. oxygen is essential for oxidation process. The upper surface of soil contains sufficient amount of O_2. the health germination does not lake place in the absence or scarcity of oxygen in deep soil so crop seed sown in the soil by the farmers upto 5-7 c.m. deep.

3. Temperature:

The **suitable temperature** is essenyial for germination of seed. the protoplasm of the cell remains active at certain range of temperature .most of seed **do not germinate** in between the range of **00C to 50C** and above the 450C.the **favourable range** of temperature is **20-25oC** for germination of seed in the majority of seeds.

4. Food or Nutrition:

The growing embryo requires [needs] nutrition during germination. The embryo depends upon stored food materials in **cotyledons** or **endosperm** in the germination period upto the formation of primary root from the radicle and first leaf from the plumule.

5. Light:

Light produces different effect in different variety of seeds. The **most of the plants** do not require light up to the formation of first leaf. Adversely, the rate of germination very fast in the absence of light .but for some plants light is very essential for germination.

They will not germinate in the dark. For example seed of **Orchids, Tobacco, Mistletoe** etc. after the development of newly leaves on shoot light becomes plant [juvenile] will die in the absence of photosynthesis and deficiency of food.

IV. SPECIAL POINT

1. Highest amount of **fat** is found in endosperm of **Coconut.**
2. Embryonic development of **Capsella** is **endoscopic** because it is developed towards chalazal region of the zygote.
3. **Single celled suspensor** is found in **Triticum** [wheat] and **Catyophyllum.** Their seed are **caryopsis** fruit.
4. Suspensor is absent in **Sunflower** and **Marigold.**
5. **125 meiotic** division are essential for development of **100 grains of Wheat.**
6. **two generation** and **three genotypic** cells are present in **Angiospermic seed.**
7. Heaviest seed (6 k.g.) is found in **Lodoshia.** Its fruit is **1 meter** in length and wt. of fruit is **18k.g.**
8. **Edible** part of **Betelnut is endosperm.**
9. **abscisic acid** is the **natural** germination inhibitor of seed.
10. Light induces germination in **Lettuce/Lactuca sativa**
11. Anatomical transition from root to stem occurs in hypocotyl region.
12. Seed of the **Ruella** dispersed by **jaculator technique.**
13. **Smallest** or **minute seeds** are found in **Orchids** which are lightest in plant kingdom and are called **"Dust seeds"** [wt. 20. 33 µg.].
14. **Longest** leaf Angiosperm is **Raphia vinifera** [10-15m] and **broadest** in diameter in **Victoria regia** -1- 1.5m.
15. **Xenia** (by Focke) – Effect of pollens inside Embryosac on Endosperm (except Embryo) → Maize.
16. **Metaxenia** –Effect of pollen out side the Embryosac on seed coat or pericarp **Datepalm —**maturity time as well as size of fruits can be changed by using different pollens.

17. The pollen grains of **insect pollinated flower** bears oily is called **pollen-kitt.** it is made up of lipid and carotenoids.
18. The **longest pollen tube** is found in **Maize.**
19. The **highest viability** is found in the seed of **Lotus [Nelumbo nucifera]**
20. The **enosi**s formed after the fertilization in **Angiosperms.** it is **triploid** while in **Gymnosperm,** endosperm is formed before the fertilization and **haploid in nature.**
21. Normally, **Dicotyledon** embryonic development is **Crucifer-type** which is also known as **onagred-types.**
22. The ovules of some parasitic plants do not have integument e.g. **Sandal [Santalum]** and **viscum.**
23. The polysiphonous condition is found in families of **Malvaceae** and **Cucurbitaceae.**
24. Those plants which live immortal through the seed are known as **therophytes.**
25. The synergids are absent in the embryosac of **Plumbago.**
26. The **pollination** takes place at **two celled** structure of pollen grains.
27. **Monosporic embryosac** extensively found in Angiosperm. it is discovered by **Strasburger** in **Polygonum divarictum.** it develops only from a functional megaspore.
28. The seed of **Cuscuta** and **Santalum** lacks of cotyledon
29. The **endosperm** of **Monocotyledons** such as **Zea mays, wheat, and Grasses** bear **aleurons granules .**
30. The middle layer is absent in **Wolffia**
31. **Costum** and **Nicodia** plants have **multilayered tapetum.**
32. The dormancy is absent in the seed of most of **Crop plants** and **Mangrove** plants like **Rhizophora.**
33. The fruit formed the ovary without fertilization is called **"Parthenocarpic fruits".**
34. **Lotus, Nymphaea** and **Alisma like aquatic** plants are **entomophilous.**
35. All the microspores of anther of **Calotropis** are joined together to form a special , structure called **Pollinium .**these staminal structure are called **translator apparatus.**
36. In some plants like **Typha, Drosera, Cryptostegia** all four microspores joined together and they are called **Compound pollen.**
37. for the formation of mature pollen grain. One meiotic and one mitotic division required. For the formulation mature male gametophyte, one meiotic and two mitotic division required .
38. **In orchis maculate** and **Rumex —T-shaped tetrad** of megaspore is formed (In most angiosperms generally **linear letrads** are formed. isobilateral, tetrahedral and decussate type tetrad of megaspores are absent).
39. **Balanophora** and **Oenothera** plants one **micropylar** megaspore of tetrad becomes functional rest of three which are present towards the chalaza degenerate.
40. When entry of male gametes into the embryosac are not participate in fusion is called **Semigamy.**
41. When two pollen tube enter into an ovule and release their contents. it is possible to that the one male gamete of one pollen tube fertilize with egg cell and one male gamete of another pollen tube participate in triple fusion (with secondary nucleus) is called **hater fertilization.** because of this xenia effect in **Zea mays.**
42. The white fluid is found in green coconut is **nuclear endosperm** which is known as **"liquid syncytium".**
43. In **Cereals** [Monocots] outer layer of endosperm is thick walled dense cytoplasm, which is mainly filled **aleurone grains** [highly protein rich] and hence called **Aleurone Layer.** this layer secrete some hydrolytic enzymes like **proteases** and **amylases.**

SEED - DORMANCY

I. DEFINITION OF DORMANCY OF SEED

The presence of **dormancy** in a seed is the **most important** characteristic feature. Because of this character, **seeds** remain **viable** for many years. The seeds are dispersed very far places through water, air or insects. Most of the seeds are unable to germinate just afterdispersal. They germinate after sometime. The time between the maturation and germination of seed is known as **"Dormancy period".** The state of inhibited germination as a result of internal causes is usually called **'dormancy'**. This seed dormancy is of considerable advantage to the plant which helps in adverse environmental conditions. The **embryo** remains **inactive** in this period and all the growth processes suspended temporarily. There are **three** main basic reasons of dormancy ofseed:-

II. REASONS OF SEEDDORMANCY

1. Impermeability of seed coat

The **seed coats** of many species of **Leguminosae** and **Convolulaceae** families are completely **impermeable** to moisture [water] and oxygen at the time of their maturity.**Seed coats,** in these are **thick** and **hard.** Their cell wall is covered by a **layer of lignin** which is water proof coating. Such seeds take more time for germination. The dormancy of seeds breaks by different artificial methods

(i) By making minute hole / pores with help of pointed sharp apparatus on the seedcoat.
(ii) The seeds are rubbed on hard object so that seed coat become thin.
(iii) The partial degeneration of seed coat is carried by the action of Sulphuric acid.

Under nature conditions seed coat is carried by the action of **microbes** [bacteria] in soil, in the alimentary canal of **fruit eater birds** and due to the presence of high cold or high temperature.

2. Dormant Embryo

In many species, although, the **embryo completely not matured** when the seed is ripe, even then it fails to germinate when ever the **environmental conditions are favourable are favourable** or even seed coat is removed. This is known as **"Embryo" dormancy".** Normally embryo dormancy occurs in many **fruits yielding plants of forest.** This condition is achieved due to physiological action of seed. Such type of seed must complete their **enzymatic** and **chemical reaction** before the germination of seed. In the lack of these reactions, seeds are unable to germinate. Such seed are kept in **low temperature** and in **desirable moisture.** Due to this seed dormancy can be broken. The **low temperature** is the main reason for germination of seeds of **Apple, Peaches, Pears, Mapple and Pine** etc.

3. Germination Inhibitors

Germination of some seeds is sometimes **checked** or **prevented** by the presence of some chemical compounds are called **"Germination Inhibitors"** such as **Ferulic acid** present in **Tomato juice, Caumarin, Abscisic Acid, Dormin** and **Para ascorbic acid** etc. this condition is generally found in **Xerophytic plants . These germination inhibitors washed away with water is known as "Leaching".**

III. METHODS OF BREAKING OF SEED DORMANCY

(i) **Scarification: -** the **hard seed coat** is **broken** in this method so that water andoxygen ether into the seed coat.

(ii) **Stratification:** - The seed kept at **low temperature** and in the presence of **oxygen** and **water** for some time, so that embryo can complete its germination period.

(iii) **Light Requirement: -** The plants w3hich are affected by the **light** are known as **"Photoblastic seeds".** The seeds which germinate in the presence of light are called **"positive Photoblastic seeds",** such as

Lettuce, Capsella, Lepidium and **Tobacco** etc. The seeds in which germination take place in the absence of light are called **"negative photoblastic seeds",** Such as **Nigella** and **Silene** etc. Some seeds are **not affected by light** are called **"nonphotoblastic seeds".**

The dormancy of **photoblastic seeds** can be broken by the treatment of **red light.** The **phytochrome red,** absords red light and convert into **phytochrome far red** which increase the germination of seed.

Seed + R [red light] → Germination
Seed + R + FR → No germination
Seed + R + FR+ R → Germination
Seed + R + FR + R +FR→ No germination

(iv) **Alternative Temperature** :- Seeds are treated with **high** and **low temperature** alternatively at high pressure to increase the germination of seed . e.g. The seed of **Malilotus** (Sweet clover) and **Alfa – alfa** are treated at **2000 atmospheric pressure** and **18⁰ C temperature.**

(v) **Viablity :-** This is called **existence of life in a seed.** The viability of seed can be found out by **2, 3, 5, triphenyl tetrazolium chloride.** The **embryonal axis** of living seed becomes pink in colour in the solution of **T.T.C.**

(vi) **Seed dormancy** also broken by the treatment of **G.A.**

IV. SPECIAL POINTS

(1) **Hard** and **impermeable seed coat** is found in most of **legume plants** which is the main reason of seed dormancy.
(2) Growth inhibitor is present in the **endosperm of Iris.**
(3) If a fleshy sweet part of fruit is present in one seed and a fleshy bitter part of fruit is present with another seed then both seeds are unable to germinate due to presence of germination inhibitors in flesh.
(4) The seed dormancy in **Eranthis heemalis** and **Ginkgo** is present due to **immature embryo.**
(5) A **hard lignin** water resistant layer [seed coat] is present on seed of some **Leguminoseae** plants.
(6) **Growth inhibitors** are present in **seed coat** of **Cucurbita** and in the embryo of **Xanthium.**
(7) **Strong mineral acids** have been used successfully to interrupt seed dormancy caused by resistant or hard impermeable seed coat. Such as **potassium nitrate, Ethylene, Chlorohydrine** and **Thiourea** etc.
(8) Atriplex seed contains high concentration of salt of the time of dispersal, which do not allow germination.

BUD DORMANCY

I. REASONS OF BUD DORMANCY

The buds are of two types-

(1) **Vegetative** (2) **Floral bud**

Before showing their respective growth, the bud of many plants undergoes a dormant phase. This period starts in **late summer** and terminate in the **spring season.**

Causes of Bud Dormancy –

According to **Hamburg** in **woody plant,** the bud dormancy is caused by **Abscisic acid.** The level of **endogenous ABA** increases with the onset of dormant period and decreases when it is broken. In **non woody plant** like **Potato,** the bud dormancy is again due to the presence of an inhibitor. **Bannet Clark** and **Kefford** (1953) identified this substance as **Inhibitor-β.** It present in the **peel** of dormant **Potato tuber.** The inhibitor-β is responsible for checking the **sprouting of buds** located in the **'eyes'** of **Potato tuber.**

Perception of Dormancy by Buds –

According to **Wareing.** The bud dormancy, at least in woody plant, is caused by **short day length,** while it is broken by long day.

II. BREAKING OF BUD DORMANCY

(i) **Chilling :** The **bud dormancy** of some plant can be broken, if they are given **cold temperature treatment** for specific duration.]

(ii) **Alternating temperature treatment :** The dormancy of buds of some plants can be broken, if they are subjected to **low temperature** (0^{o} – 10^{o} C) for a brief duration and then given **warm treatment.**

(iii) **High temperature treatment :** If **dry Potato tubers** are stored at **35^{o}C** or moist at 20^{o} C, the dormancy of tubers buds is broken.

(iv) **Chemicals :** Some chemicals like **2-chloro ethanol, Gibberellin** and **Thiourea** are capable of **breaking** of **dormancy of buds.** of these **2-chloro ethanol** is very effective in breaking the dormancy of **Potato tuber's buds. Endogenous Gibberellin** plays a very significant role in controlling the dormancy of **Potato tubers.**

(v) **Gene De-repression :** The genome of the dormant potato bud lacks the ability of **DNA dependent RNA synthesis.** By treating the bud with **Ethyl chlorohydrin** or **Gibberellin,** the ability of RNA synthesis is achieved, Thus causing derepression of a repressed gene.