SIMPLE DRY-FRUIT

Pericarp of simple dry fruits is hard dry and not differentiated into epicarp, Mesocarp and endocarp. Such fruits are called dry fruit. In some dry fruits, this pericarp is ruptured and seeds are dispersed. These fruits are called dehiscent fruits. In some fruits, pericarp is divided into one or more seeded segments. Such fruits are called Schizocarpic fruits. In some fruits, pericarp does not dehiscence even after maturing/ripening such fruits are called indehiscent fruits.

Simple dry fruits can be divided into following three groups :

(i) Indehiscent (ii) Dehiscent (iii) Schizocarpic

(i) Indehiscent fruits : These simple dry fruits are generally of small size and single seeded.

(1) **Cypsela:** It is a small, one seeded dry fruit which develops from bicarpellary, syncarpous inferior ovary. In it, pericarp and seed coat are free from each other. In these fruits a bunch of hair is attached with the fruit which is known as Pappus. Pappus helps in fruit dispersal. Pappus is modification of calyx. Eg. mainly Compositae family plants. Eg. sunflower, marigold.

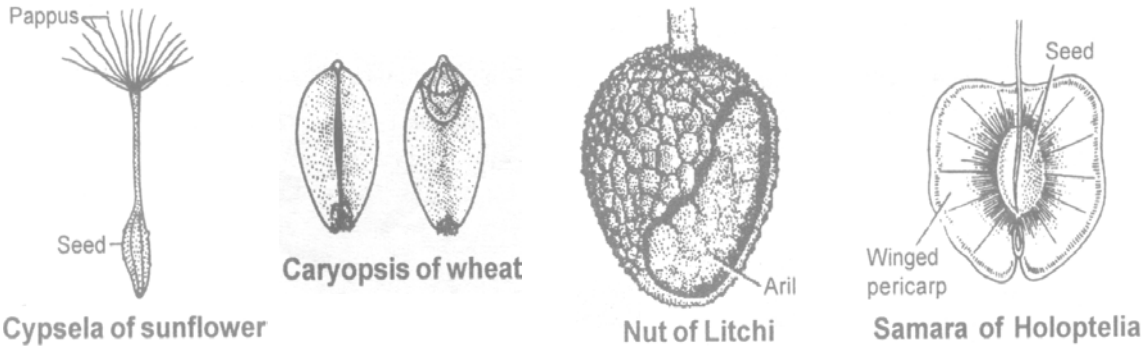
(ii) Caryopsis : These are small, one seeded dry fruits. Which develop from monocarpellary, superior ovary. Pericarp of these fruits is fused with the seed coat and form a joint surface. These fruits are present in family Gramineae. Eg. Wheat, rice, maize etc.

(iii) Achene : These are single seeded fruit Which develops from monocarpellary, superior ovary. Pericarp is free from the seed coat Eg. Clematis, Mirabilis, Boerhaavia are egs. of single seeded fruit.

(iv) Nut : This is a single seeded fruit which develops from bi or multicarpellary syncarpous superior ovary. In it pericarp is hard and unilocular. Eg. Quercus (oak), Anacardium occidentale (Cashewnut) Trapa, (Water chest-nut), Litchi.

In Litchi epicarp and Mesocarp is fused and give leathery appearance. Endocarp is membrane like thin. Outer seed coat grows forms an additional coat around the seed which is called as aril. In mature fruit, this aril is fleshy and is only edible part.

(v) Samara : These are dry indehiscent one seeded feathery fruit. It develops from bi or tri carpellary, syncarpous and superior ovary. The main character of these fruits is that wing like structure develops from its pericarp which helps in dispersal. Eg. Holoptelia.



In Shorea robusta wing develops from calyx instead pericarp and these fruits are called samaroid.

ii. Dehiscent Fruits : After ripening when the pericarp of the fruit become dry and hard than these fruits are called dry fruits when pericarp of such fruits are ruptured and seeds are dispersed outside, then such fruits are called dehiscent fruits. These fruits are mainly of 5 types :

(1) Legume or pods : These fruits develop from monocarpellary, unilocular, superior ovary. It is generally long and multiseeded fruit. Dehiscense of fruit occurs at both sutures i.e. Dorsal and ventral side. Dehiscence start from apex and reaches to basal part. Eg. Pea, Beans.

When only one or two seeds are present in fruit, then it is also called as pod.

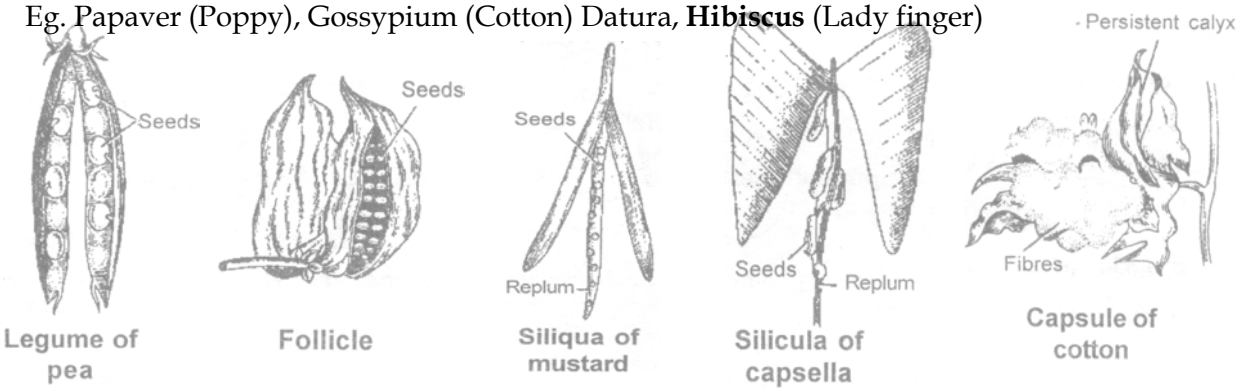
(2) **Follicle :** It is also multiseeded fruit which develops from superior unilocular, monocarpellary ovary but the dehiscence of it occur only at ventral suture. Eg. Asclepias, Rauwolfia Perivmble or Vinca, Michelia (Champa) Delphinium.

(3) **Siliqua :** This fruit develops from bicarpellary, ,syncarpous superior ovary and ovary has parietal placentation. Dehiscence occurs at both dorsal and ventral suture and starts from lower part and proceeds upward. Due to false septum ovary become bilocular. On false septum, seeds are attached. This type of fruit is found in Cruciferae family. Eg. Brassica, Mustard.

(4) **Silicula :** It is reduced form of Siliqua. It's dehiscense is similar to Siliqua. It is also found in Cruciferae family. Eg. Candytuft (Iberis amara)

(5) **Capsule –** This is dry multichambered and multiseeded fruit and develop from multicarpellary ,syncarpous, superior ovary. In it, Axile placentation is found and dehiscence occurs by various methods. Poricidal (Porous), loculicidal, seotifragal, septicidal.

Eg. Papaver (Poppy), Gossypium (Cotton) Datura, **Hibiscus** (Lady finger)



iii. **Schizocarpic fruit :** It is a multiseeded fruit. After ripening , it is devided into mericarp and seeds come out sometimes after destruction of pericarp seed comes out. The fruits develop from mono or bi or multicarpellary superior or inferior ovary. The mericarp, contains one or two seeds.

Schizocarpic fruits are of four types :-

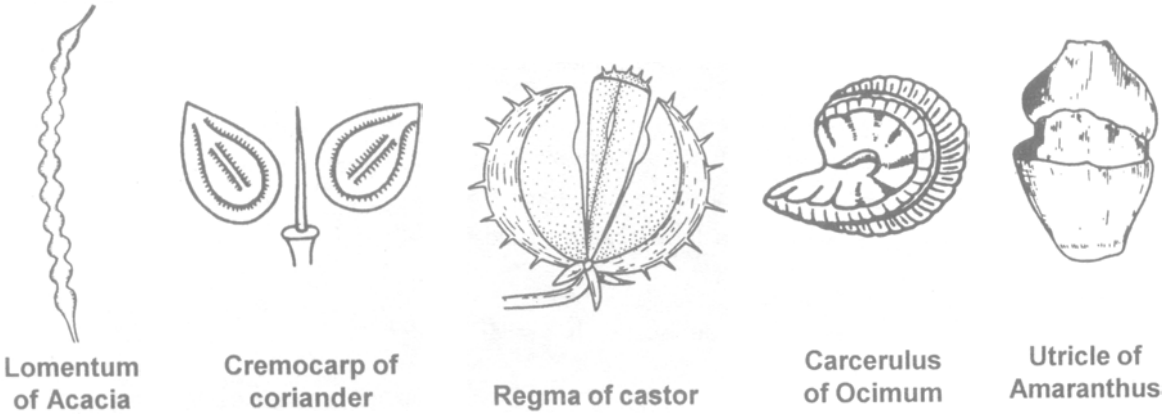
(1) **Lomentum :** It develops like the legume. These are bisutural fruits which are constricted or divided in one seeded mericarp, after maturity these are separated with each other. Eg. Tamarind, **Cassia fistula, Mimosa pudica, Arachis hypogea,** Desmodium.

(2) **Cremocarp :** It is a double seeded fruit and develops from bicarpellary, syncarpous, inferior ovary. It is generally found in umbelliferae family. On maturation, it dehiscence from apex to base in such a way that two mericarp forms and each contain one seed. These mericarp are attached with carpophore. Carpophore is the extended part of receptacle. Eg. Coriander, Daucus, Cuminum, Foeniculum.

(3) **Regma :** This fruit develops from tri to pentacarpellary, ,syncarpous, superior ovary. In it 3 to 5 locules are present and its fruit is breaks into 3 to 5 one seeded part. Each part is knows as coccus. At the outer end of pericarp, spines are found. Eg. Euphorbiaceae family (Castor) has three cocii and Geranium has 5 coccus.

(4) **Carcerulus :** It is a dry fruit which develops from multi carpellary or bicarpellary ,syncarpous, superior ovary. It divides into four one seeded locules. Eg. **Ocimum** (Basil), **Salvia.**
In hollyhock and abutilon (family Malvaceae), the no. of locules is more than four because it develops from multicarpellary ovary.

(5) **Utricle :** It is a single seeded fruit which has thin membrane. It dehiscence generally from cap. It develops from bicarpellary, unilocular, syncarpous, superior ovary. Eg. **Achyranthes, Amaranthus.**



AGGREGATE FRUITS

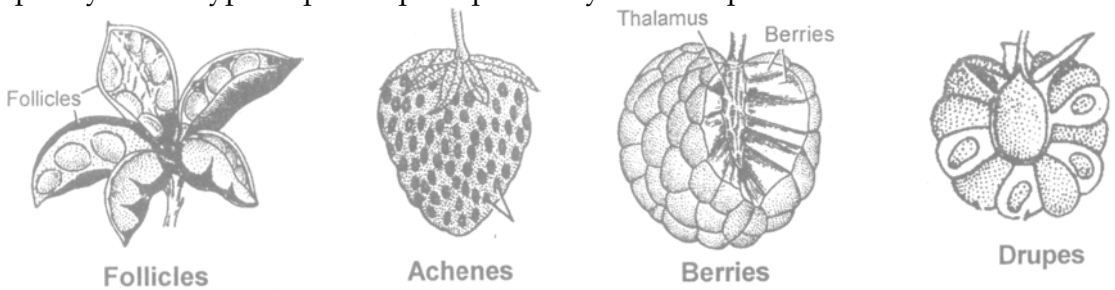
These fruit develop from multicarpellary apocarpous ovary. Because ovary. Because in apocarpous ovary , each carpel is separated from one another ,therefore it forms a fruitlet. These fruits make a bunch of fruitlets which is known as etaerio.

(1) **Etaerio of follicles:** Each fruit of etaerio are follicle. Eg. **Calotropis Catharanthus, Magnolia.** In Calotropis only stigma are fused or jointed in bicarpellary ovary and ovaries of ovoule are separated. It means only two follicles are present in etaerio. In catharanthus and magnolia etaerio develops from many follicles.

(2) **Etaerio of achenes:** In this aggregate fruit, each fruitlet is an achene. Eg. Rananculus, Strawberry, Rose, Lotus
In lotus, thalamus become spongy and some achenes are embedded in it. In strawberry, thalamus is fleshy and small achenes are found on its surface. In rose, many achenes are present on a saucer (Cup) like inner surface of thalamus.

(3) **Etaerio of berries :** It is an aggregate of small berries. Eg. polyalthia, Annona squamosa (Custard-apple). In etaerio of Anona all the berries are arranged densly on thalamus.

(4) **Etaerio of drupes:** In this type of fruit, many small drupes develop from different carpels. Eg. Raspberry In this type carpel of apocarpus ovary form drupe fruit.

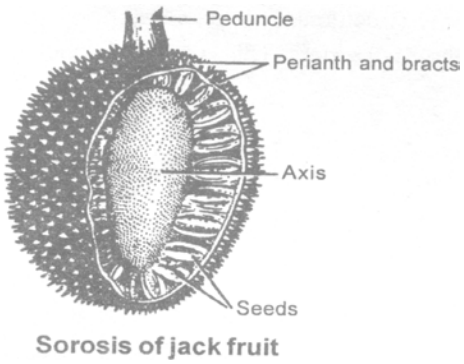


COMPOSITE FRUITS

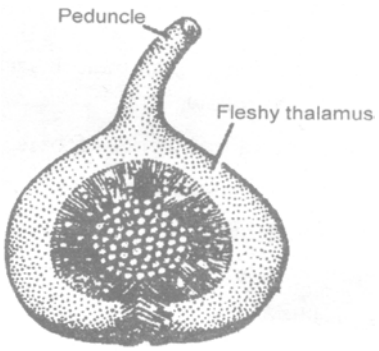
All composite fruits are false fruits.
This type of fruit differ from aggregate fruit that in place of single ovary many ovaries and other floral parts combine together to form fruit. In composite fruits, generally whole inflorescence is modified into fruit. These are of two types:

(1) **Sorosis :** This fruit develops from spike, spadix or catkin inflorescence. Peduncle become thick spongy and woody or spongy sepals of female flower fused with each other resulting a mass is formed by the flowers of a whole inflorescence. eg. : Jack fruit, Kevda (screwpine),
In Jack fruit (Kathal) pistillate flowers are developed around the penducle. In fruit formation pericarp become spongy and fused. Spiny and rough rind is formed by the upper part of ovaries. In Pine apple peduncle bracts and perianth become fleshy. Due to the fusion of perianths of flower a composite fruit is formed. Other growth indicates the flower.
In mulberry perianth becomes fleshy and calyx of every flower becomes thick, sweet and fleshy and are edible.

(2) **Syconus :** This fruit develops from Hypanthodium inflorescence. Receptacle become hollow having a pore surrounded by small scales. Staminate pistillate flowers are present near the pore and normal pistillate as well as pistillate flowers are present on the lower side. Many achenes develop from the pistillate flower. Eg. **Ficus** species like fig, Peepal



Sorosis of jack fruit



Syconus of fig.

Geocarpic fruit: Underground fruits are called geocarpic fruit.
Example: Arachis

Dispersal of fruits and seeds –

We know that most of the plants do not move from one place to another. They grow, produce flower and fruits while remaining fixed at one and the same place. The seeds falling directly under the mother plant have to germinate and develop under limited food supply and space. To overcome this problem, the fruits and seeds have developed several special devices for wide dispersal. The natural agents like wind, water and animals and even mechanism of dehiscence in some fruits, help the seeds and fruits to disperse from one place to another, and to long distances from the parent plant.

Wind-

In the species where the seeds are light in weight or have some accessory part to help dissemination, are dispersed by the air current. The seeds of Drum-stick and Cinchona, and fruits of yam, maple and sal tree, are provided with one or more appendages in the form of thin, flat and membranous wings, which help them to float in the air and be carried away to long distances. In the members of Asteraceae, the calyx is modified into hair- like structures called pappus. They persist in fruit and open out like umbrella, helping the seeds to float in the air. In poppy and prickly poppy (Argemone), the fruit dehisces and seeds are thrown out to a distances away from the parent plant. The seeds of Calotropis, Alstonia and cotton are provided with hair and cover sufficient distances alongwith the wind. The seeds of orchids and some grasses are very small and light in weight and may be easily carried away by wind to far off places.

Water –

The fruits and seeds with specialized devices which may be in the form of spongy and fibrous outer walls as in coconut and spongy thalamus as in lotus, and small seeds with airy aril as in water lily, float very easily in water and are carried away to long distances with the water current.

Animals –

The fruits and seeds with hooks, spines, bristles, stiff hair, etc. , get attached to the body of hairy and woolly animals and are carried away by them to distant places. For instance fruits of Xanthium and Urena bear curved hooks, spear grass has a bunch of stiff hair, Tribulus has sharp and rigid spines **Boerhaavia** has sticky hair, which help their dispersal by animals. The edible fruits like guava, fig and plum are dispersed by birds and even human beings, either by feeding on them and passing out undigested seeds with faces or by carrying them to other places for later feeding.

Defense mechanism in plants –

Nature has provided some specialized structures and organs to plants which save them natural unfavourable factors and from attack of enemies. These specialized structures, organs, substances and adaptations protect the plants from destroying by animals, insects and disease carriers. This is called defence mechanism in plants. Some of these are as follows :

1. Epidermis, Periderm, cork and bark.
2. Trichomes, hairs and spines.
3. Laticiferous glands or ducts.
4. Secretory glands.
5. Taste of different plant aprts.
6. Underground plant parts.
7. Myrmecophily.
8. Colour, shape and structure of plants.

1. Epidermis, Periderm, Cork and Bark:

The epidermis is formed by division in the protoderm. Usaully it is single layered but in **Vanda** (orchid), **Nerium, Peperomia** etc. it is multilayred. In **Peperomia,** it consists of 14 to 15 layers of cells. All parts of a plant except root, have a layer of wax-like substance or cutin on the outer face of the epidermis. This layer is known as the cuticle. In **Cycas** and **Pinus** the cuticle is lignified. In some plants it has rod shaped structured and granules. On aerial parts of **Equisetum** and members of grass family silica or silicon oxide is found. Similarly on epidermis of some plants wax, oil resin crystallized salts, silica, lignified substances etc. are deposited. Epidermis acts as a protective layer which saves internal tissues from being damaged by high temperature, microbes, acidic rain and high wind velocity etc.

In woody plants Periderm is present which is a secondary epidermal tissue and is formed by activity of the phellogen. Here the cork is a protective layer consisting of prism like tubular cells. Bark is the tertiary epidermal tissue found in woody plants. This layer consists of dead and dried tissues. Its main function is to protect the internal tissues from mechanical injury.

2. Trichomes, Hairs and spines:

Trichomes may be present on vegetative and reproductive parts of plants. These are dead or living and persistent and may show veriable structures and functions. Leafy epidermal hairs regulate atmospheric humidity, covering hairs protect plants from disease causing insects, glandular epidermal hairs secrete some chemical substances and stinging hairs pierce the skin if animals and secrete poisonous substances which cause irritation and protect

the plants from animals. Uni-or multicellular sticky glandular hairs secrete some sticky substances. The stinging hairs of **Urtica diocia** Consist of a calcified basal part and a narrow siliceous elongated upper part. The lower part is surrounded by collar – like structure formed by outgrowths of the epidermal cells. On contact with an animal the upper part pierces into its skin and secretes histamine and acetylcholine which cause irritation and itching.

Spiny stipules and spines found in xerophytes protect these plants from grazing animals. Spiny stipules of **Zizyphus, Acacia, Prosopis juliflora, Balanites, Tribulus** etc. and spines of **Euphorbia** act as defensive devices against grazing animals. Prickles of **Capparis, Bombax** and rose and needle like hairs of cacti save these plants from animals.

3. Laticiferous glands or Ducts:

Woody plants of torrid and other xeric areas secrete a white milky fluid which is called latex. This substance is secreted by the Laticiferous ducts or glands. Mostly it is white. It is a viscous fluid which contains various substances like water, hydrocarbons, resins, oils, proteins, acids, salts, sugars and rubber in suspended from. It is found in members of family Moraceae, Euphoriaceae, Apocyanaceae etc. Latex helps in protection of these plants from animals. The latex secreted by plants of **Calotropis** is poisonous.

4. Secretory glands or cells:

These are specialized cells found in ground tissue. These cells are different from other cells in their structure and shape and are called idioblast. They are filled with difference types of excretory of secretory substances such as oils, tannins, gums, mucilage and different types of crustals. Smell of oily substances secreted by oil glands present in the leaves and dark of **Eucalyptus** and pericarp of lemon fruit protect these plants from animals. Other such examples are **Tamarix, Plumbago, Thyus capitatus** etc.

5. Taste of difference plant parts :

Aerial parts like fruits, seeds, leaves, branches and bark of some plants contain different types of alkaloids or excretory substances which are repulsive or bitter to taste and are disliked by animals e.g. **Azadirachta indica, Momordica charantia, Trigonella, Ocimum sanctum, Datura stramonium, Papaver somniferum, Mentha arvensis, Nicotiana tabacum, Carcia papaya, Cinchona officinalis** etc.

6. Underground plants: In some plants remain under the soil i.e. out reach of grazing e.g. underground modified roots of radish **(Raphanus sativus),** carrot **(Daucus carota), turnip (Brassica rapa), Sugarbeet (Ipomea batata), chukandar (Beta vulgaris), heeng (Ferula asafoetida)** etc. underground modified stems of potato **(Solanum tubersum),** arbi **(Colocasia antiquorum),** onion **(Allium cepa),** garlic **(Allium sativum)**, ginger **(Zingiber officinale)**, turmeric **(Curcuma domestica)** etc. and undrground fruits of ground nut **(Arachis hypogea).**

7. Myrmecophily :

Gauva **(Psidium guajava)**, mango **(Mangifera indica),** litchi (**Litchi chinensis),** shahtoot **(Morus alba)** etc. secrete some substances which attracts some ants. These ants take their abode on these plants and etc. as bodyguards against any marauding animal. This relationship is called Myrmecophily.

8. Colour, shape and structure of plants :

Certain plants strikingly resemble some dreaded animals so that they are carefully avoided by other animals. This is known as minicry or copying other animals e.g. plants of **Caladium** and **Sensviria** resemble spotted serpents.

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