(1) **Achenial fruits:** This group includes single-seeded and indehiscent (not splitting open at maturity) fruits, which can be further divided as follows:

(*a*) **Achene:** It is derived from a monocarpellary, unilocular and superior ovary. The pericarp is membranous or leathery and is always free from the testa. These usually occur as aggregate of achenes, as in *Clematis*, rose, strawberry *etc*. The rose hip is a collection of achenes, which are found attached to the inside of a hollow, fleshy, cup shaped receptacle. Here each achene is protected by stiff hairs, so that the birds which eat the fleshy receptacle are unable to swallow the achenes with the seeds inside. The hairs irritate their beaks, and they make an effort to get rid of them.

(*b*) **Caryopsis:** Maize, Wheat, Barley, paddy, *etc*., although commonly sold as grains, are in reality single-seeded complete fruits. Each of them represents the entire ovary consisting of only one carpel. The pericarp and the testa are so fused that the seed cannot in this case be taken out of its fruit. Thus, it can be briefly said that caryopsis is an achene in which the pericarp and testa are fused together.

(*c*) **Cypsella:** It is drived from a bicarpellary, syncarpous, unilocular and inferior ovary which contains only one seed. The pericarp and testa are both free. This kind of fruit is characteristic of Sun-flower, *Dandelion, etc*. In many fruits of this type there is usually a crown of hair-like processes forming a pappus, which is derived from the calyx. The pappus is used as a float and assists in the distribution of the fruit by wind.

Table 10.4: Differences between achene and cypsella.

Achene	Cypsella
1. Develops from multicarpellay, apocarpous, superior ovary.	1. Develops from bicarpellary, syncarpous and inferior ovary.
2. Calyx withers away after formation of fruit.	2. Calyx remains attached with the fruit in the form of pappus.
3. Usually found as aggregate fruit (etaerio).	3. Occur as simple fruits.

(*d*) **Samara:** In this type of fruit, pericarp grows out into a flattened structure of wing, which helps in the dispersal of the fruit by wind. The Indian elm *(Holoptelea integrifolia,* chilbil*)* is a very common example of this type of fruit, found in Uttar Pradesh. Ash is another example. In samaroid fruits it is the persistent lobes of the calyx which develop into winged structures. Thus, in this case the fruit is enclosed by the enlarged calyx tube and is carried bodily by wind. Such fruits are found in *Ulmus, Dipterocarpus, Shorea, etc.*

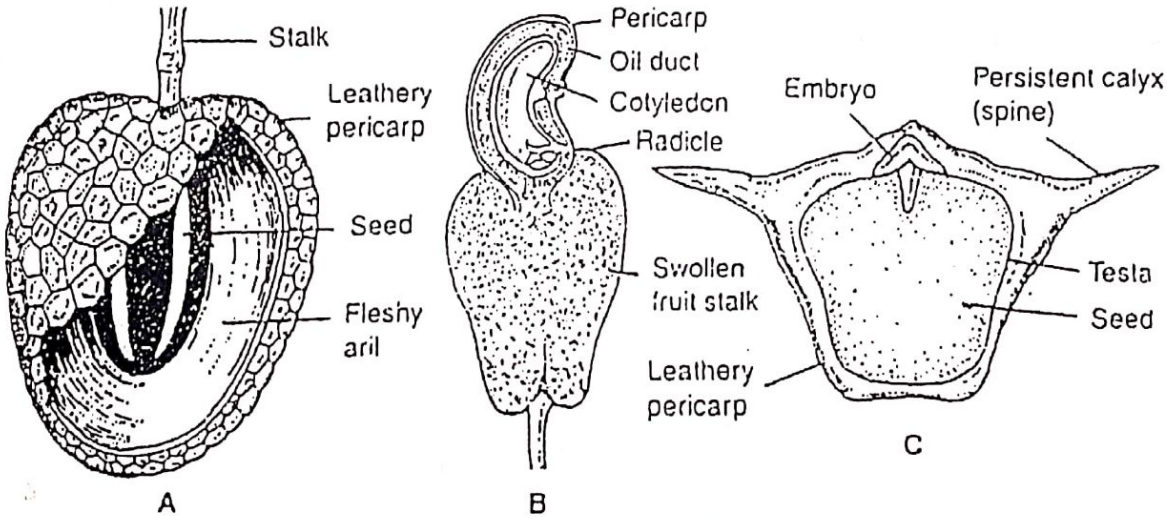

Fig. 10.10. Nuts—A, Litchi; B, *Anacardium* (Cashew nut); C, *Trapa*.

(*e*) **Nut:** They are like very large achenes in which pericarp is much harder and woody or leathery. Common examples are Hazal, Oak, (Acorn), Litchi, Cashew (kazu), *Trapa* (Singhara), *etc* (**Fig. 10.10**). In the case of Acorns, the basal part of the fruit is surrounded by a hard cup-shaped structure known as **cupule** (**Fig. 10.11**) which is formed by the fusion of very large number of bracteoles developed beneath the flower.

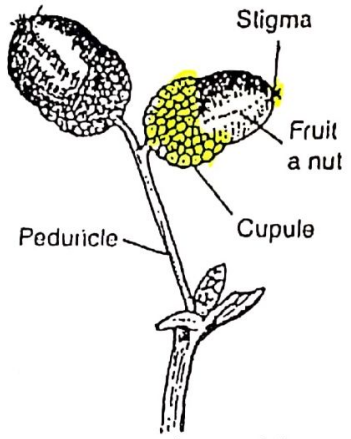

Fig. 10.11. Achenial fruit-Nut of *Quercus*.

In the case of Litchi the aril forms the translucent pulpy portion, which lies between the pericarp and the seed. Many fruits which are ordinarily called nuts are not nuts in strict sense. Thus, the almond is the stone of a drupe; the walnut also is to be considered strictly speaking as a part of a drupe since its shell corresponds to the endocarp, the outer part being fleshy in nature.

(2) **Capsular fruits:** This group includes dry, many-seeded and dehiscent fruits in which the pericarp of a mature fruits splits of its own accord to liberate the seeds. On the basis of the number of carpels forming the ovary and the mode of dehiscence in a mature fruit, the capsular fruits are classified into the following types:

(*a*) **Legume or pod:** It is found in nearly all members of the family Leguminosae (Pea-family). It develops from a monocarpellary and superior pistil and on maturity the dehiscence takes place usually along both dorsal and ventral sutures. This type of dehiscence is known as **sutural dehiscence.** In pea and in other typical legumes the dehiscence or splitting is accompanied by a sudden curling movement which results in the seeds being flung out to a considerable distance. In *Abrus precatorius* (ratti), *Pithecolobium dulce* (janglee jalebee) and ground-nuts unusual types of legumes are found.

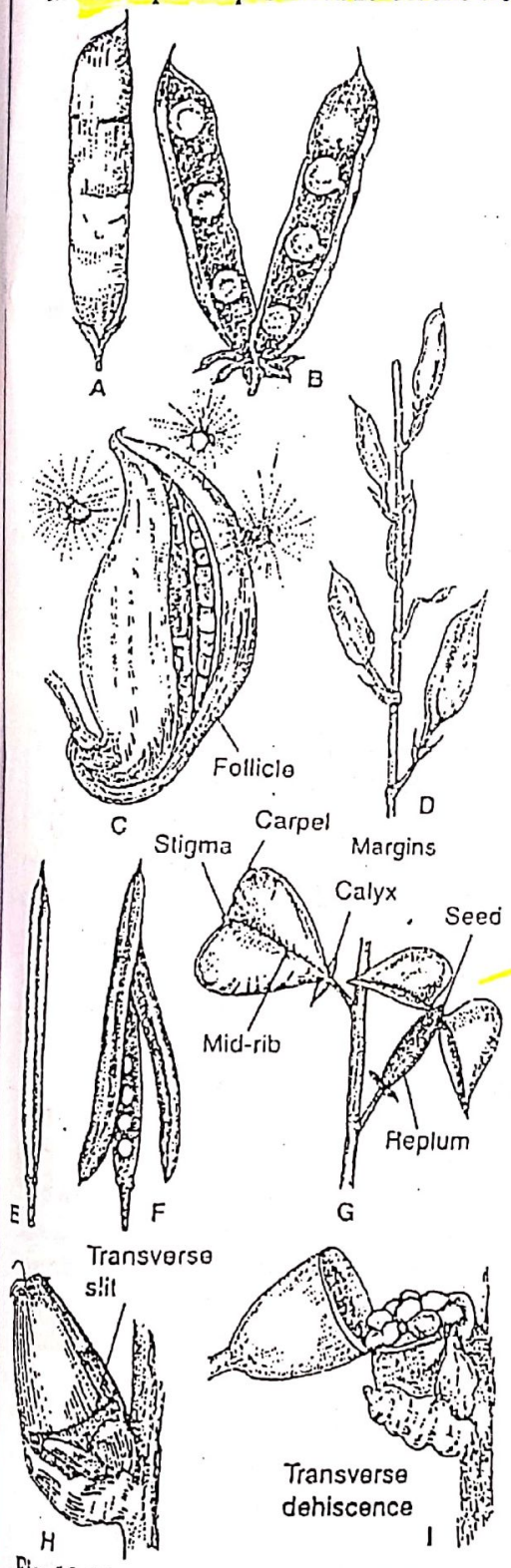

Fig. 10.12. Examples of capsular fruits : A-B, legume of pea; C-D, follicle of *Calotropis* and Larkspur; E-F, siliqua of wall flower; G, silicula of candytuft; H-I, pyxis of pyxidium.

In *Abrus precatorius* (ratti) the seeds are very hard and bright red, each with a black spot at one end. In *Pithecolobium dulce* the red pods are peculiarly curved and the seeds have a fleshy covering and are dispersed by birds. The indehiscent legumes of groundnut are borne in a very unusual manner. Instead of being developed above ground they are buried into the soil. Such fruits are called as **geocarpic**.

(*b*) **Follicle:** The follicle differs from the legume or pod in showing dehiscence only along the ventral suture. The common example of a simple follicle is Larkspur and Milk-weed. In *Calotropis* (Madar) the large follicles are usually found in pairs and are derived from a bicarpellary and apocarpous pistil. As such they are aggregate fruits.

Table 10.5: Differences between legume and follicle.

Legume (Pod)	Follicle
1. Their pericarp splits along two sutures to release the seeds.	1. There is only one suture in the pericarp.
2. Occur singly	2. Found in clusters of two or more fruits.

(*c*) **Siliqua:** It is derived from a bicarpellary, syncarpous and unilocular superior ovary having parietal placentation. The mature fruit is greatly elongated and flattened and is characteristic of the members of the family Cruciferae—Wall flower, Radish, Cabbage, Turnip, Black and White Mustard. The ovary is originally unilocular, but during development it becomes bilocular due to the formation of a false septum. The false septum is formed by outgrowths extending from the edges of the carpels inwards. Finally by the meeting and fusion of these outgrowths a continuous partition results. On maturity the fruit splits lengthwise from the bottom to the top at two places, in order to expose the placental framework and the thin partition, which together form the replum to which many of the seeds remain attached. The seeds are small and flattened and those which do not escape at once are soon helped to do so by the wind.

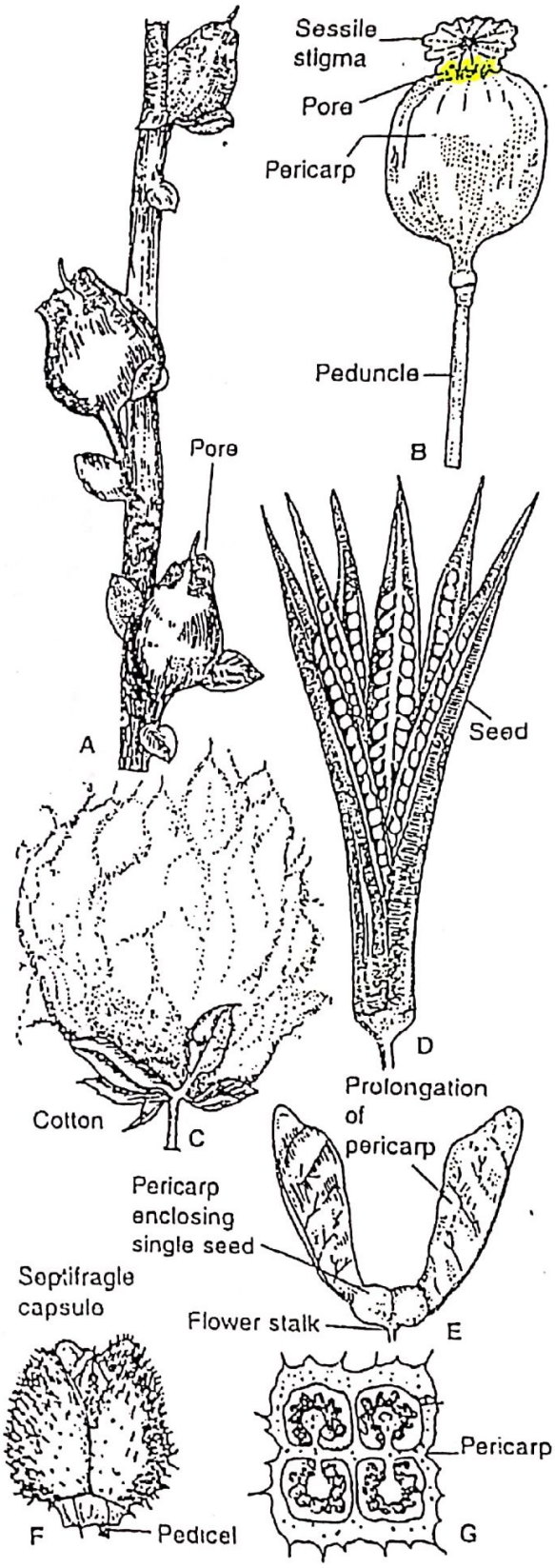

Fig. 10.13. More examples of capsular fruits showing porous, loculicidal and septifragal dehiscence.

(*d*) **Silicula:** It resembles the siliqua in origin and structure but differs only in being much shortened. Thus, the silicula is short and wide and few-seeded. The common example is *Iberis* (candytuft).

Table 10.6: Differences between siliqua and silicula.

Siliqua	Silicula
1. These fruits are elongatedand cylindrical.	1. These are almost squarish and flat.
2. There are many seeds on the replum.	2. The replum bears relatively less seeds.

(*e*) **Capsule:** The capsules are derived from a polycarpellary, syncarpous, uni or multilocular superior ovary. The false septa are never formed. They show different types of dehiscence, and it is the mode of dehiscence which is used in their classification into the following types:

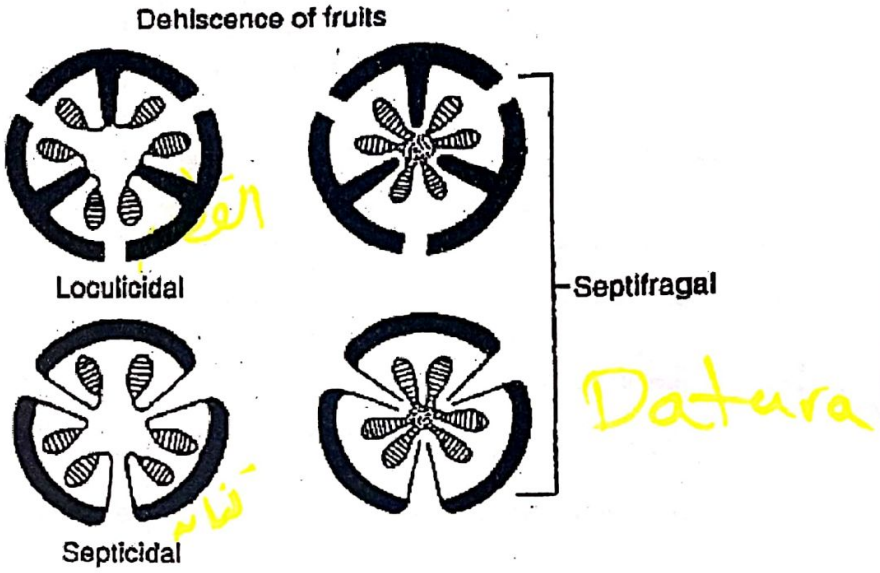

Fig. 10.14. Different types of longitudinal dehiscence in multilocular capsules.

(*i*) **Porous dehiscence:** The commonest porocidal capsule of poppy arises from a polycarpellary, syncarpous and superior pistil. It has very large number of seeds placed on parietal placentas which extend inwards towards the centre. When the fruit is ripe, just beneath the sessile stigma, there appears a circle of pores. Thus, the capsule looks now very much like a *pepper-pot*. Through these small pores the seeds are shaken out by the wind. Other examples of porous capsules are found in *Campañula* and *Snapdragon*.

(*ii*) **Transverse or circumsessile dehiscence:** In some dry capsules, as in *Portulaca* (kulfa) and *Cock's comb* (chaulai) the dehiscence takes place along a circular horizontal line, cracking off a circular lid. The capsule is a little round ball containing seeds on a free central placenta. Such a fruit is usually called **pyxidium**.

(*iii*) **Loculicidal dehiscence:** It is a kind of longitudinal dehiscence. In this type, the multilocular capsules with axile placentation shows splitting along the midribs of the carpels (that is, along the dorsal sutures) and the longitudinal slits thus formed always open directly into the loculi and the placenta and the septa break away down the centre of the capsule. The common examples are Cotton, Lady's finger.

(*iv*) **Septicidal dehiscence:** It is longitudinal dehiscence, which is shown by capsules arising from multilocular pistils with axile placentation. Here the longitudinal slits appear along the middle of the septa and the placenta separate along their line of junction. The common example is Linseed (alsi).

(*v*) **Septifragal dehiscence:** In this case the dehiscence of the capsule takes place either in a loculicidal or septicidal manner and the septa or partition walls break up but the seeds remain attached to the large and massive axile placenta. The best example is Thorn-apple (Dhatoora).

(3) **Schizocarpic fruits:** These are dry many-seeded fruits, which, as they ripen, split into a number of one-seeded parts. If these single-seeded parts are indehiscent, they are known as **mericarps,** but when they are dehiscent they are often called **cocci.** The best known types of schizocarpic fruits are:

(*a*) **Lomentum:** The lomentum develops from a monocarpellary pistil and is found in some of the members of family Leguminosae (Mimosoidae). On maturity it splits transversely into many separate single-seeded or indehiscent pieces or mericarps. Typical examples of lomentum are found in sensitive plant and *Desmodium gangeticum*. The fruits of *Acacia* (babool) and Radish (*Raphanus*) are really legume (pod) and siliqua respectively but they are constricted between the seeds and are, therefore, described as lomentaceous pods or siliquas.

Table 10.7 Differences between legume and lomentum.

Legume (Pod)	Lomentum
1. It is a dehiscent fruit. 2. In a mature fruit, the peripcarp splits to release the fruits.	1. It is a schizocarpic fruit. 2. After ripening, the fruit breaks into one seeded mericarps from where seed is released after decay of the pericarp.

Table 10.8 Differences between lomentum and caryopsis.

Lomentum	Caryopsis
1. It is an indehiscent fruit.	1. It is a schizocarpic fruit.
2. Pericarp is separate from the seeds.	2. Pericarp and the seed coat are fused.
3. They develop from the ovary having marginal placentation.	3. Ovary has basal placentation.
4. Characteristic of the family Leguminosae (sub-family Mimosoidae).	4. Characteristic of the family Graminae.

(*b*) **Cremocarp:** This is a characteristic fruit of family Umbelliferae. It arises from a bicarpellary, syncarpous inferior ovary. On attaining maturity the fruit splits up from above below into two single-seeded indehiscent mericarps, which remains attached for some time to the top of a central axis, known as **Carpophore**. Such fruits are found in *Coriander* (dhania), *Fennel* (sonf), *Caraway* (ajwain) and *Carum* (zeera).

(*c*) **Carcerulus:** This kind of fruit is derived from a bicarpellary or pentacarpellary, syncarpous and polylocular superior ovary. Each loculous contains many seeds but on maturity many false-septa arise and thus each loculus is divided into many single-seeded compartments or mericarps. The fruit of hollyock is partially enclosed in a persistent calyx. Eventually each mericarp breaks away from its neighbours as a small flat piece. Familiar example is (kanghi) *Abutilon indicum.*

(*d*) **Regma:** Typical examples are found in *Geranium* and castor seed. In *Geranium*, the superior ovary consists of five fused carpels which are surmounted by a long beak representing the fused styles. When dry, one-seeded dehiscent carpels or **cocci** tear away from the persistent central column or **Carpophore** and remain for a long time suspended from the stigmatic end by a strip of stylar tissue. This strip of stylar tissue of each coccus coils spirally on drying, and its subsequent hygroscopic curling and uncurling plays some part in forcing out the single seed of each carpel.

(*e*) **Double samara:** It arises from a bicarpellary and syncarpous pistil and on maturity it splits in the middle into two single-seeded portions, each provided with a wing-like expansion of the pericarp which assists in wind dispersal. Mapple and Scyamore are common examples. In some cases it may even consist of three or four samaras.

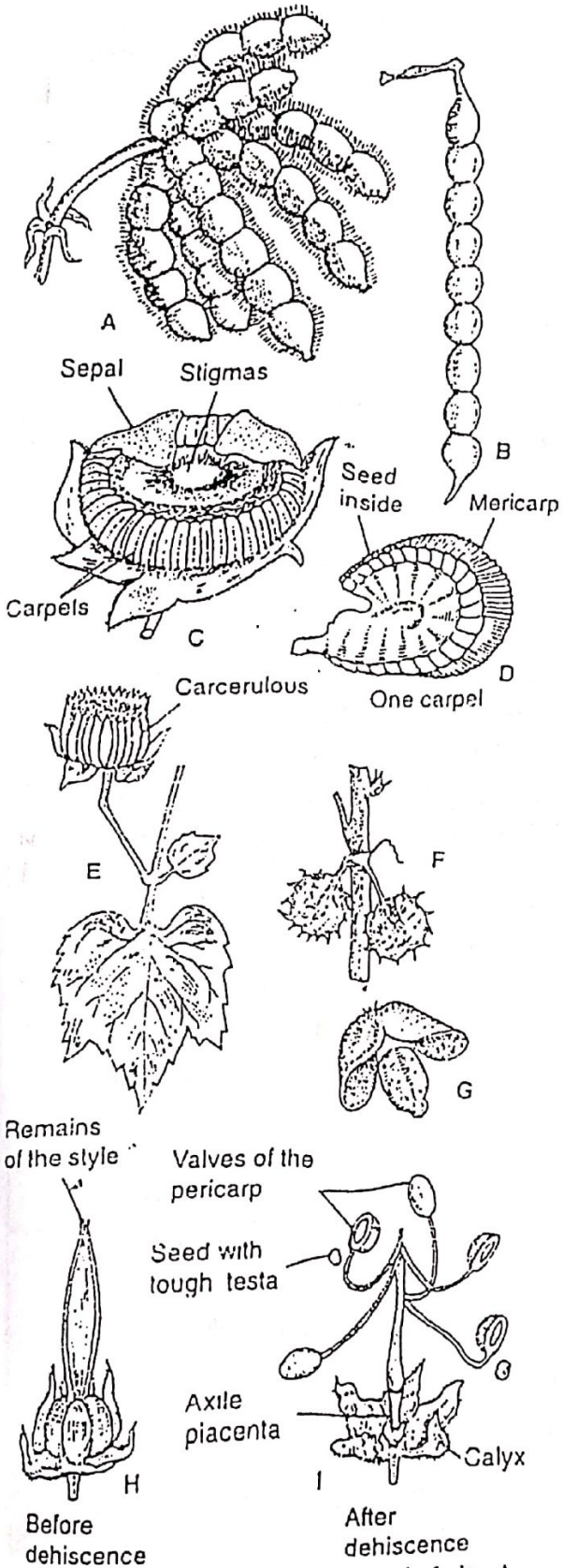

Fig. 10.15. Examples of schizocarpic fruits; A, lomentum of *Mimosa;* B, lomenteceous pod of Acacia; C-E, carcerulus of holiyhock and kanghi; F-G, regma of castor; H-I, regma of *Geranium*.

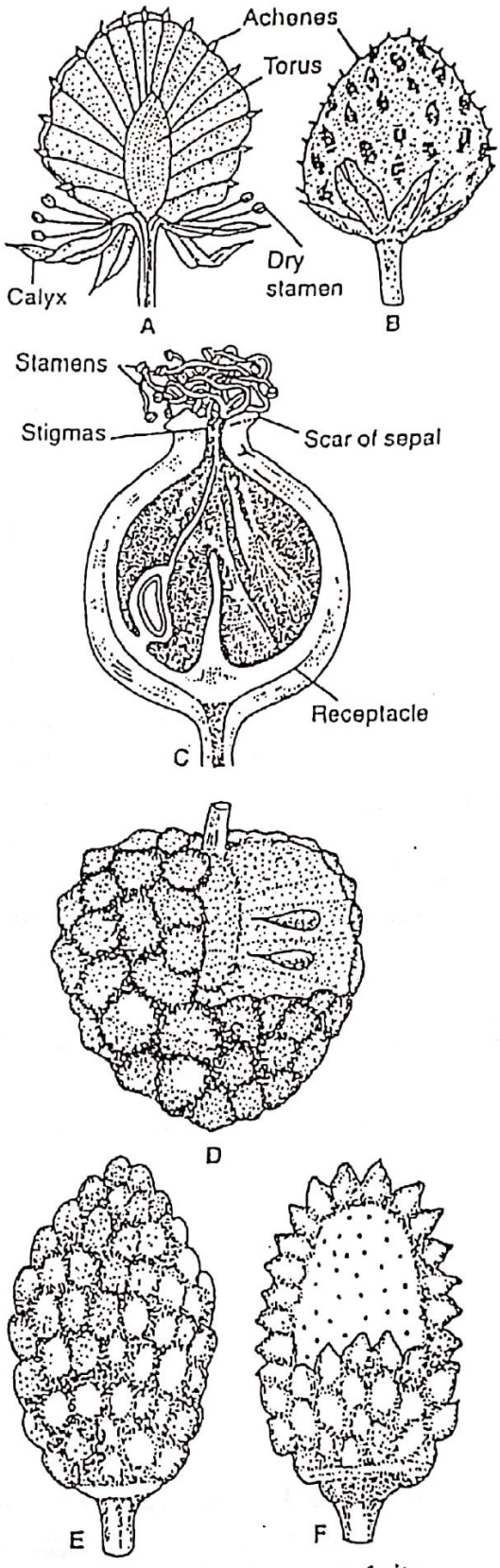

Fig. 10.16. Examples of aggregate fruits : Etaerio of Achenes of A-B— strawberry, and C—rose; Etaerio of berry of D—Custard apple (Sarifa) and E-F—*Artabotrys*.

Aggregate fruits

These fruits are sometimes termed **Etaerios** and are, as we have seen, formed from a single flower having polycarpellary but apocarpous pistil. The common types of etaerios are the following:

(*a*) **Etaerio of achenes:** It is commonly found in Rose, Strawberry, Buttercup, Clematis, Lotus, *etc*. The hip of the rose is deeply cup-shaped and it is this receptacle which becomes coloured and fleshy and surrounds the true fruits, which are dry achenes each representing a long hairy style, which protrudes through the mouth of the hollow receptacle, where also the persistent sepals are present.

The strawberry contains a group of achenes which are little yellow pips and are attached to a red massive and fleshy edible receptacle. In *Clematis* the achenes have feathery persistent styles. In the case of lotus the single-seeded achenes lie in depressions on the flat top of an enlarged receptacle. Since the receptacle contains large number of air spaces, the entire fruit (etaerio) can float on the surface of water.

(*b*) **Etaerio of follicles:** It is found in *Calotropis*, *Michelia* (Champa), etc. In the case of *Michelia* large number of follicles are borne on an elongated receptacle.

(*c*) **Etaerio of berries:** Examples are seen in Custard-apple (sarifa), *Artabotrys etc*. The Custard-apple is widely cultivated in tropical countries. It develops from a polycarpellary apocarpous pistil but each carpel does not give rise to a separate fruitlet but the apices of the ripe carpels fuse together forming the outermost rind of a single fruit, with large number of hexagonal facets. The fleshy portion is the mesocarp of the numerous fruitlets borne on a long conical receptacle.

(*d*) **Etaerio of drupels:** Examples are seen in raspberry and blackberry. In the case of blackberry the gynoecium of the flower consists of a number of separate carpels, closely aggregated on a common receptacle. On maturity each carpel gives rise to a small drupe or drupel. Thus, a collection of drupels arises from a single flower. Below the enlarged receptacle, the persistent sepals and stamens can often be seen.

Multiple or composite fruits

Such fruits always develop from an inflorescence in which the female flowers are rather compactly arranged around the peduncle.

Table 10.9: Differences between aggregate and multiple fruits.

Aggregate fruits (Etaerio)	Multiple (composite) fruits
1. Develop from multicarpellary apocarpous ovary	1. Develop from entire inflorescence.
2. Only one flower gives rise to a complete fruit.	2. The complete fruit develops from several florets of one inflorescence.

They may be of the following two types:

(*i*) **Sorosis:** Common examples are Mulberry, Pine-apple (ananas), Jack fruit (Kathal) *etc*. (**Fig. 10.17**). Such fruits develop from a compact female **Catkin** in which sessile flowers are borne by the peduncle or axis of the inflorescence. The individual flowers are joined together from the time that they are first formed. In the case of the pineapple each of the so-called hexagonal areas or 'eyes' on the surface represents a single flower. The flowers open few at a time from the base to the apex and in each flower three inconspicuous petals can be seen. Each flower is subtended by a bract. In the mature fruit the perianths and bracts become fleshy.

In Mulberry the fruits develops from a female Catkin. On maturity the perianth of the individual flowers become fleshy and thus form a compact fleshy fruit.

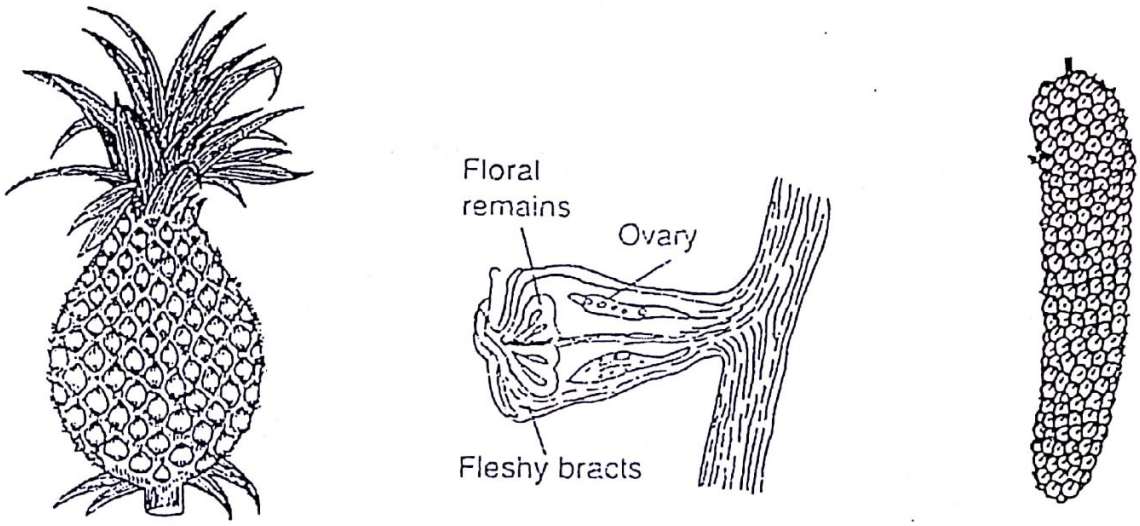

Fig. 10.17. A, sorosis of pineapple; B, fleshy bracts of pineapple; C, sorosis of mulberry.

In the jack-fruit (Kathal) the apical parts of the mature carpels fuse together to form a thick leathery rind with numerous spiny processes. The individual flowers arise in the axils of fleshy bracts. The perianth of the individual flowers becomes fleshy and encloses a single seed which has a cartilaginous testa.

(*ii*) Syconus: It is derived from a type of inflorescence known as hypanthodium, which has a hollow fleshy receptacle. It encloses large number of very minute unisexual flowers. The staminate flowers are situated below the small opening, guarded by a few scales. The pistillate flowers are situated below the staminate flowers. On ripening, the receptacle becomes fleshy and juicy and forms the edible portion. Examples of this type of fruit are found in *Ficus* like Banyan, Peepal, anjeer (Fig. 10.18), *Ficus glomerata* (goolar), *etc.*

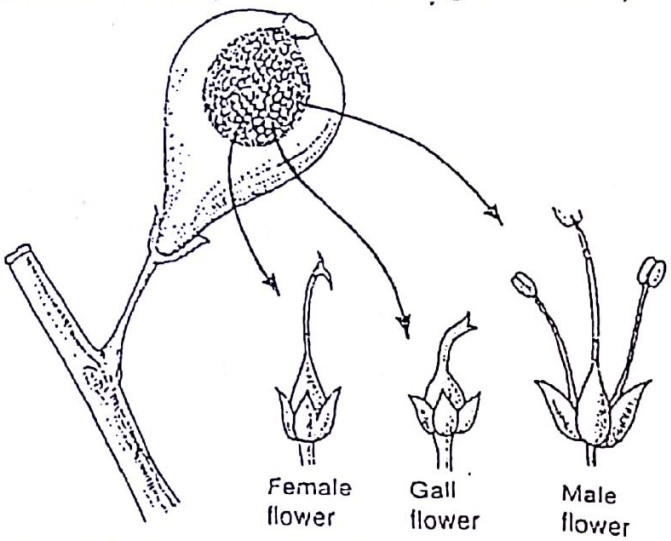

Fig. 10.18. Syconus of Fig. L.S. of fruit and three types of flowers.