

● **10.1 Definition :** A *fruit* may be defined as a seed bearing structure produced usually after fertilization from the ovary of a flower with or without accessory parts, or from an entire inflorescence.

As a result of fertilization the ovary enlarges, the style and other parts of a flower wither away and fall off; the enlarged mature and modified ovary containing the seed or seeds remain—this is the *fruit*. Sometimes the style or some other parts of the flower also remain along with the *fruit*. A fruit may also develop from a number of flowers, i.e. from an inflorescence.

● **10.2 Changes that take place at the time of Fruit formation :** During the maturing of the ovary many important changes take place which consists in addition, alteration or abortion of parts within the ovary, these are :

(a) Formation of false partition walls within the ovary, e.g. in species of *Datura*, *Lycopersicon*, in which the originally two-celled ovary becomes four or more-celled in fruit.

(b) Abortion or obliteration of parts as the ovary ripens, e.g. the young tricarpellary ovary of *Cocos nucifera* becomes one-celled in mature fruit ; the pentacarpellary ovary of *Mangifera indica* also becomes one-celled during ripening of the ovary.

(c) Changes often result in the ovary due to the development of succulent parenchyma (the pulp) filled with sugars, acids, etc.

(d) Sometimes other parts of a flower also take part in the formation of fruit together with the ovary ; in this case true part of the fruit i.e. the mature ovary remains insignificant and tiny, other parts such as the thalamus, receptacle, calyx, etc. entering into its composition form the major part of the fruit. These fruits are known as *false* or *spurious fruit* or *pseudocarp*.

● **10.3 Difference between False and True Fruits :** [Refer also article 10.2(d)]. When no other part of the flower except the ovary only takes part in the formation of the fruit, the fruit is called *true fruit*.

● **10.4 Parts of the Fruit :** A fruit consists of two parts such as (a) the *pericarp* developing from the wall of the ovary and (b) the *seed* or *seeds* developing from the ovule or ovules. The pericarp may be thick or thin. When the pericarp is thick,, it shows three layers, viz. the outer thin layer called *epicarp* which forms the skin of the fruit, the middle layer called *mesocarp* which forms the pulp and the inner layer called *endocarp*. Endocarp may be thin and membranous or it may be hard and stony.

● **10.5 Classification of Fruit :** Fruits, whether false or true, may be classified into three groups viz, (a) *simple*, (b) *aggregate* and (c) *multiple* or *composite*.

I. SIMPLE FRUITS—When the ovary of a single flower with or without accessory parts matures into one fruit, it is called simple fruit.

Simple fruits may be *dry* or *fleshy*. The dry fruit again may be (a) *dehiscent*, (b) *indehiscent* and (c) *schizocarpic*.

(A) **Dehiscent fruits**—These fruits are always dry, the pericarp breaks down, i.e. bursts on ripening and the seeds are liberated. There are different types as follows —

1. **Follicle**—It is a dry *many-seeded* dehiscent fruit which develops from superior monocarpellary ovary. The pericarp dehisces along the *ventral suture only*. Examples—fruit of *Calotropis procera*, *C. gigantea* (Asclepiadaceae), *Alstonia scholaris* (Apocynaceae), etc. (Fig. 10.1,B).

2. **Legume or Pod**—It is a dry *many-seeded* dehiscent fruit which develops from a superior monocarpellary ovary ; here the pericarp dehisces along both *ventral* and *dorsal sutures*. Examples—fruits of the family

Leguminosae e.g. *Pisum sativum*, *Dolichos lablab*, species of *Crotalaria*, *Lathyrus*, *Lens*, *Cicer*, *Phaseolus*, etc. (Fig. 10.1.A).

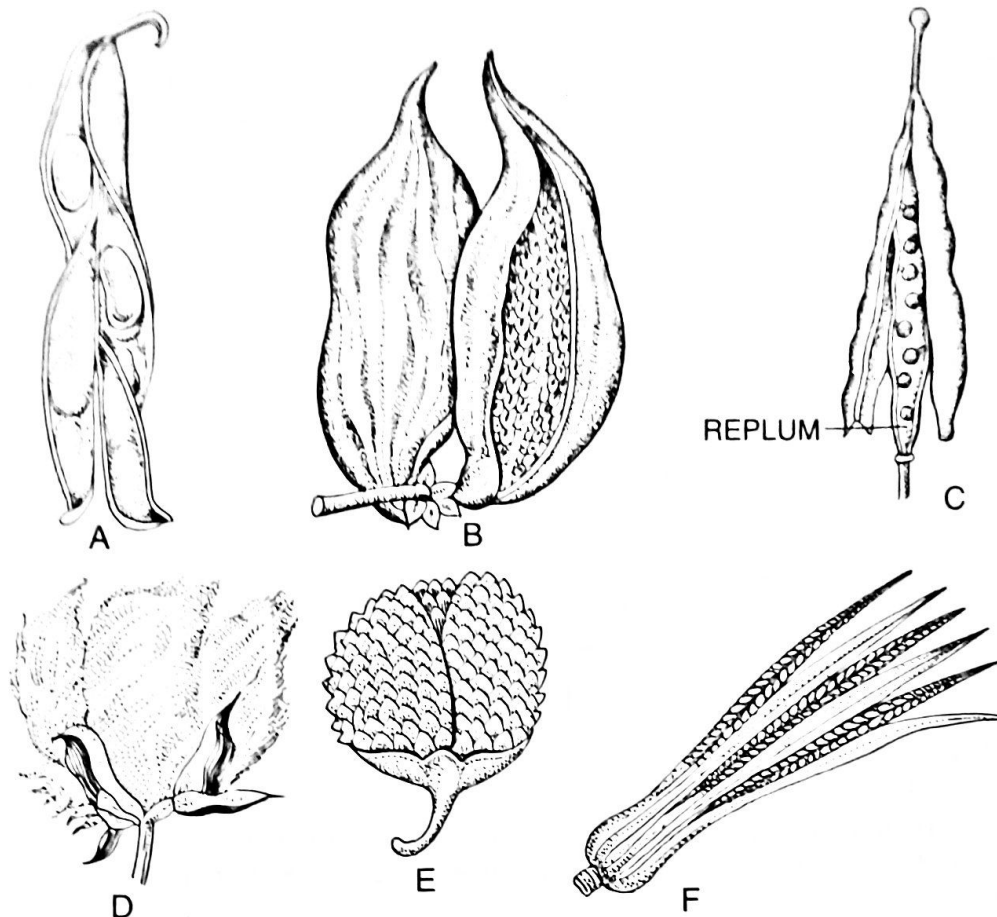


Fig. 10.1 Dehiscent fruits. A—Legume of *Dolichos lablab*; B—Follicle of *Calotropis* sp.; C—Silique of *Brassica* sp.; D—Capsule of *Gossypium* sp.; E—Capsule of *Datura* sp.; F—Capsule of *Hibiscus esculentus*.

3. *Capsule*—It is an one or *more-celled* (Fig. 10.1, D-F) dry dehiscent, many-seeded fruit which develops from a superior or inferior polycarpellary ovary; the dehiscence may take place either by *valves* or *pores*. The

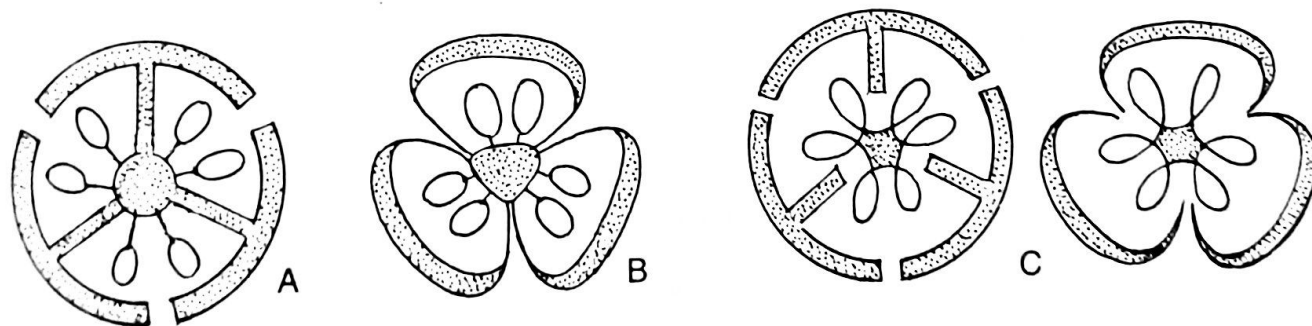


Fig. 10.2 Dehiscence of capsules. A—Loculicidal, B—Septicidal, C—Septifragal with loculicidal (left) and septicidal (right) dehiscence.

mode of dehiscence may be along the septas of the component carpel (*septicidal*) or dorsal sutures of the respective carpels (*loculicidal*) or by both when the seeds are left on the central column after falling of the valves (*septifragal*). Examples of septicidal capsules are *Rhododendron* sp., some fruits of the family Liliaceae; examples of loculicidal capsule are species of *Hibiscus*, *Gossypium*, etc. (Fig. 10.1, D); example of septifragal capsule is *Datura* sp. (Fig. 10.1, E).



4. *Siliqua*—The fruits of the family Cruciferae are usually siliques. This dry dehiscent fruit develops from a superior bicarpellary ovary which is one-chambered, but becomes two chambered by the formation of a false partition wall called *replum*. It dehisces from *base to apex*; the seeds are left on the false partition wall i.e. the *replum* (Fig. 10.1, C).

(B) **Indehiscent fruits**—Indehiscent fruits do not burst or split open at maturity, the seeds are liberated only by the decaying or by accidental destruction of the pericarp. This type of fruit may be again (1) dry and (2) fleshy.

1. **Dry Indehiscent fruits**—These may be of following types :

(a) *Cypsella*—It is dry, one-celled and one-seeded fruit which develops from an inferior bicarpellary ovary. Here the pericarp is free from the seed coat. Example—*Helianthus annuus*, *Cosmos* sp. and other members of the family Compositae (Fig. 10.3, A).

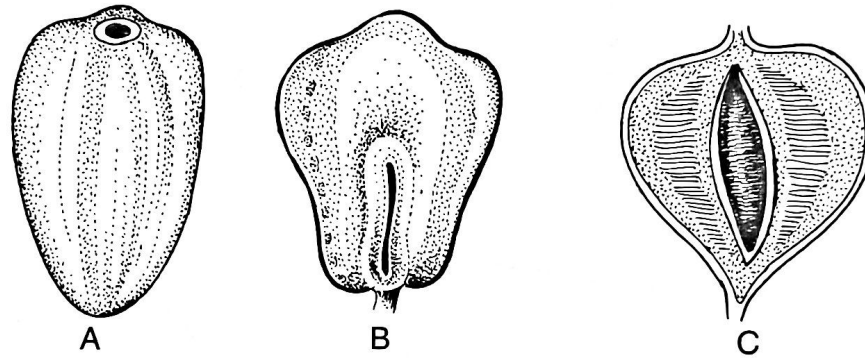


Fig. 10.3 Indehiscent dry fruits. A—Cypsella, B—Caryopsis, C—Achene.

(b) *Caryopsis*—It is a very small, one-celled, dry and one-seeded fruit developing from a superior monocarpellary ovary. In this type of fruit the *pericarp is closely fused with the seed coat and is therefore inseparable*. Fruits of Gramineae e.g. *Oryza sativa*, *Zea mays*, *Triticum aestivum*, etc. are examples of this type (Fig. 10.3, B).

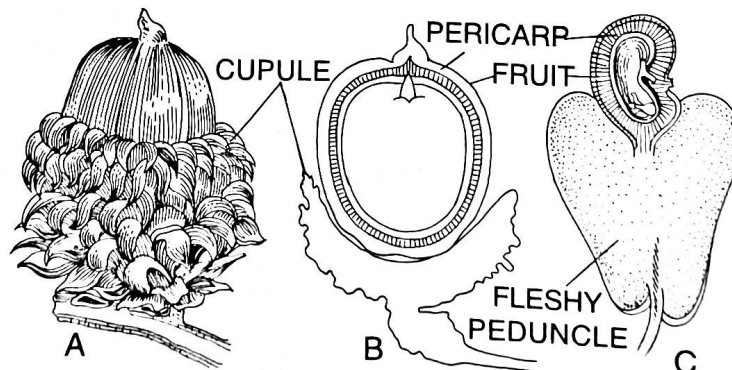


Fig. 10.4 Indehiscent dry fruits. A-B—Nut of *Quercus* sp. (A—entire view, B—sectional view), C—Longitudinal section of *Anacardium occidentale* (cashew-nut) showing fruit (nut) above and the fleshy peduncle below.

(c) *Achene*—It is a small, dry one-celled and one-seeded fruit which develops from a superior or inferior monocarpellary ovary. In this type, the pericarp is very thin and free from the seed coat. Examples—species of *Naravelia*, *Clematis* (Ranunculaceae), *Boerhaavia repens*, *Mirabilis jalapa* (Nyctaginaceae), etc. (Fig. 10.3, C).

(d) *Utricle*—It is a dry, one-celled, *one or few-seeded* fruit developing from a superior monocarpellary ovary. The fruit is provided with a thin membranous loose *pericarp* which is *not attached to the seed coat*. Examples—*Basella* sp., *Chenopodium* sp. (Chenopodiaceae), etc.

(e) *Nut or Glans*—It is a *dry, one-celled and one-seeded* fruit which develops from a superior, bi- or

polycarpellary ovary having a hard and woody pericarp. Sometimes, the fruit is enclosed by cupular persistent bract. Examples—*Anacardium occidentale*, species of *Quercus*, *Trapa*, *Fagus*, *Castanea*, etc. (Fig. 10.4).

2. Fleshy fruits :

(a) *Drupe*—It is a fleshy, one or more-chambered, one or more seeded fruit developing from a superior, monocarpellary or polycarpellary ovary. Here the pericarp is differentiated into *epicarp*, *mesocarp* and *endocarp*. The epicarp forms the skin of the fruit, the mesocarp usually forms the fibrous and juicy pulp, and endocarp forms the hard and stony inner layer. Examples—*Prunus domestica*, *Prunus armeniaca* (Rosaceae), *Mangifera indica* (Fig. 10.5, A ; Anacardiaceae), *Zizyphus mauritiana* (Fig. 10.5, B ; Rhamnaceae), etc. In *Cocos nucifera* (coconut), *Areca catechu* (betel-nut, Palmae) the mesocarp is dry and fibrous—hence coconut, betel-nut, etc.

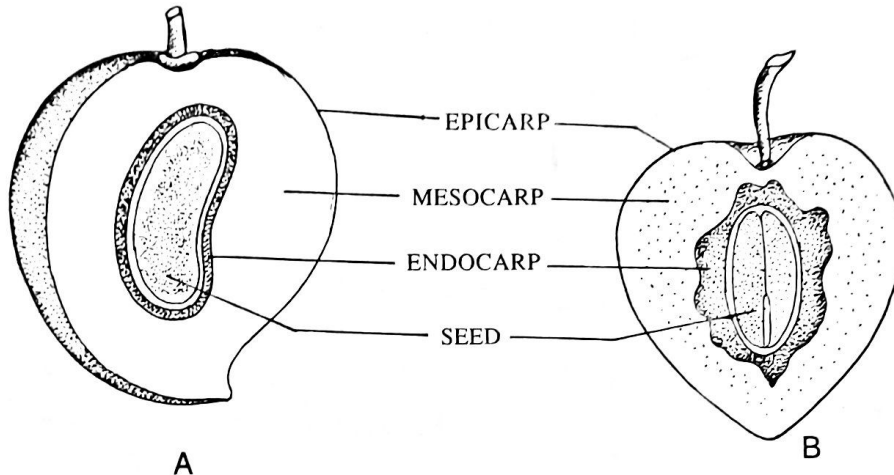


Fig. 10.5 Fleshy fruits. A—Drupe of *Mangifera indica*; B—Drupe of *Zizyphus mauritiana*.

are called fibrous drupe. *Borassus flabellifer* (palmyra palm, Palmae) is the example of more than one-seeded drupe, but in this case each seed is provided with a separate endocarp round it.

(b) *Berry or Bacca*—It is usually a many-seeded fleshy fruit which develops from monocarpellary or polycarpellary superior or inferior ovary. The seeds after separation from the placenta lie embedded freely in

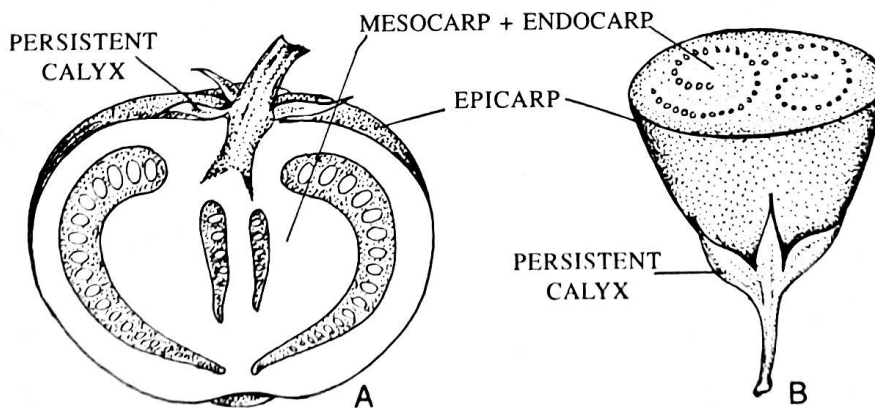


Fig. 10.6 Fleshy fruits. A—Berry of *Lycopersicon esculentum* ; B—Berry of *Solanum melongena*.

the massive pulp formed from the mesocarp and the endocarp of the pericarp, the epicarp remains as the skin of the fruit. Examples—*Musa paradisiaca* (Banana, Musaceae), *Lycopersicon esculentum* (tomato), *Solanum melongena* (Brinjal), etc. of Solanaceae (Fig. 10.6, A-B). *Phoenix sylvestris* (date palm, Palmae) is the example of one-seeded berry, here the endocarp is thin and papery. Sometimes the pericarp may not be differentiated into epi-, meso- and endocarps.

The berry may be modified into the following types :

(i) *Balausta*—It is an *inferior*, many-celled and many-seeded fruit with leathery or tough pericarp ; the carpels are placed in two rows, one above the other with thin yellow papery partition walls. The seeds have succulent seed coat (testa) which forms the edible part. Example—*Punica granatum* (Pomegranate, Rosaceae), (Fig. 10.7, C).

(ii) *Amphisarca*—It is a superior, many-celled, many-seeded fruit with woody pericarp. The placenta and the inner layer of the pericarp form the pulpy edible part. The seeds are provided with mucilaginous seed-coat (testa). Example—*Aegle marmelos* (wood-apple), *Feronia limonia* (wood-apple, katbel) of the family Rutaceae (Fig. 10.7, D)

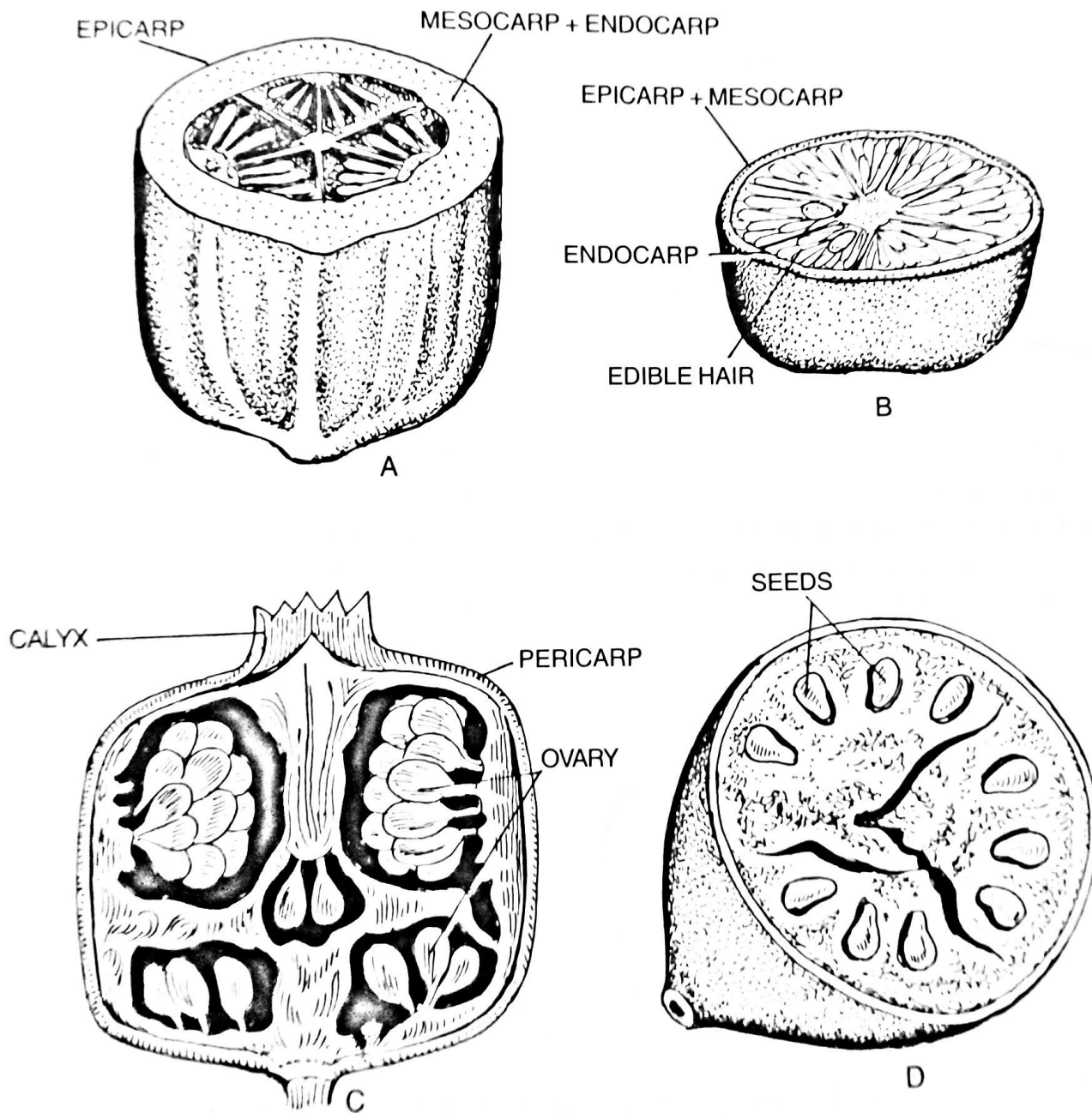


Fig. 10.7 Fleshy fruits. A—Pepo of *Cucumis sativus* ; B—Hesperidium of *Citrus sp* ;
C—Balausta of *Punica granatum* ; D—Amphisarca of *Aegle marmelos*.

(c) *Hesperidium*—It is a many-celled fleshy fruit which develops from a polycarpellary superior ovary with axile placentation. Here the epicarp and mesocarp are fused together forming the skin (rind) of the fruit.

the endocarp remains thin papery forming the outer covering of compartments ; the edible part is the inner juicy succulent hairs of the endocarp. Examples—*Citrus aurantium* (lemon, Rutaceae). (Fig. 10.7. B).

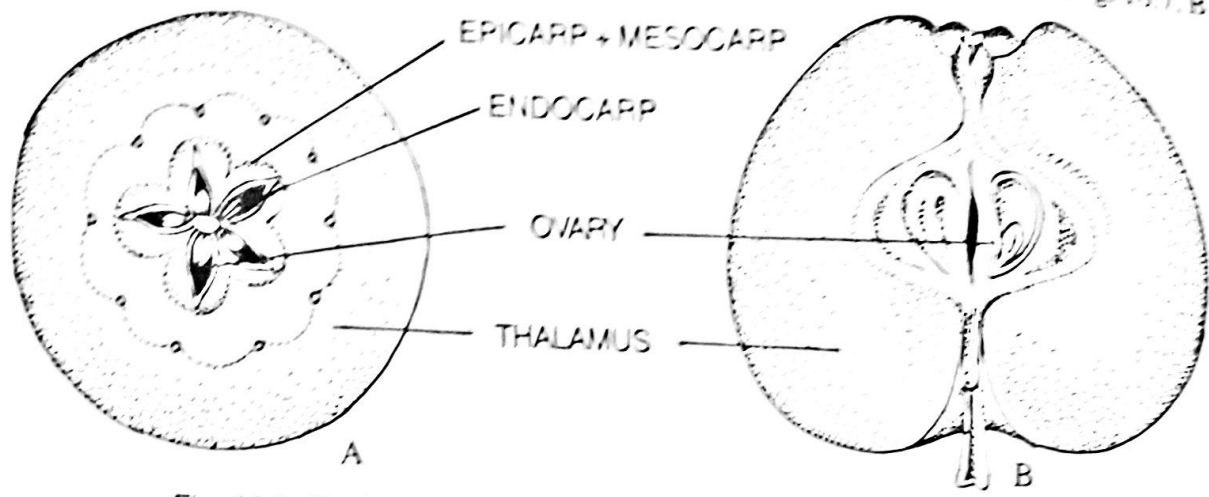


Fig. 10.8 Fleshy fruit ; Pome of *Malus sylvestris*. A—In t.s. ; B—In l.s.

(d) *Pepo*—It is also a fleshy, many-seeded fruit which develops from the inferior, one-celled or falsely 3-celled polycarpellary ovary with parietal placentation. Here the epicarp is leathery or more or less hard, the seeds remain attached to the placenta not like typical berry but loosely embedded in the pulp. Examples—fruits of *Lagenaria siceraria*, *Cucurbita* sp., etc. (Cucurbitaceae) (Fig. 10.7 A).

(e) *Pome*—This is a two to many-celled inferior, fleshy syncarpous fruit. Here the thalamus becomes enlarged, fleshy and succulent forming the edible part, it covers the ovary which is more or less bony containing seeds—this type of false fruit is known as *pome*. e.g. ; *Malus sylvestris* (apple, Rosaceae). (Fig. 10.8, A-B).

(C) **Schizocarpic or Splitting fruits.**—The term schizocarp is applied to the fruits which break up into a number of indehiscent bits, generally equal to the number of component carpels. Each indehiscent bit, called *mericarp*, contains one or more seeds. Here the pericarp does not burst or break down but seeds are liberated only by the decomposition of the pericarp or by its splitting.

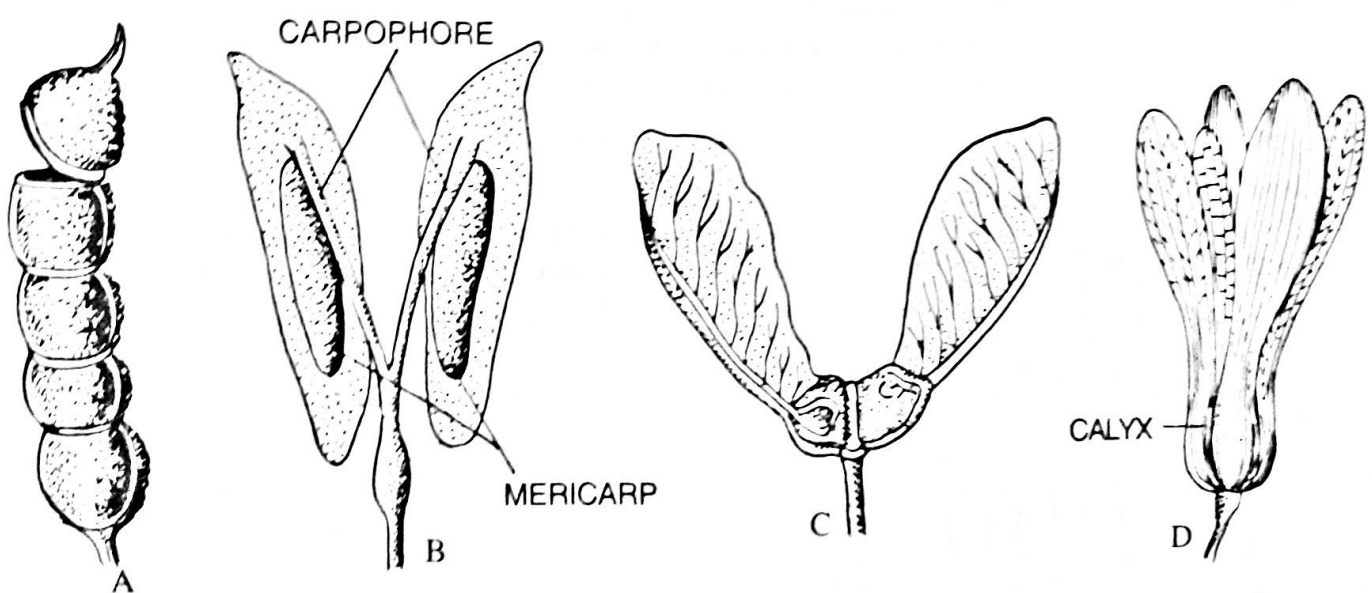


Fig. 10.9 Schizocarpic (splitting) fruits. A—Lomentum ; B—Cremocarp ; C—Samara of maple; D—Samaroid of *Shorea* sp.

There are usually five types of schizocarpic fruits as follows :

1. *Cremocarp*—It is a dry and two-seeded fruit which develops from the inferior bicarpellary ovary. The two halves i.e. two mericarps of this fruit are attached on a common axis—the *carpopore* ; on maturity they

separate but remain attached pendulously by a slender chord. Examples—*Coriandrum sativum*, *Foeniculum vulgare* and many other species belonging to the family Umbelliferae (Fig. 10.9, B).

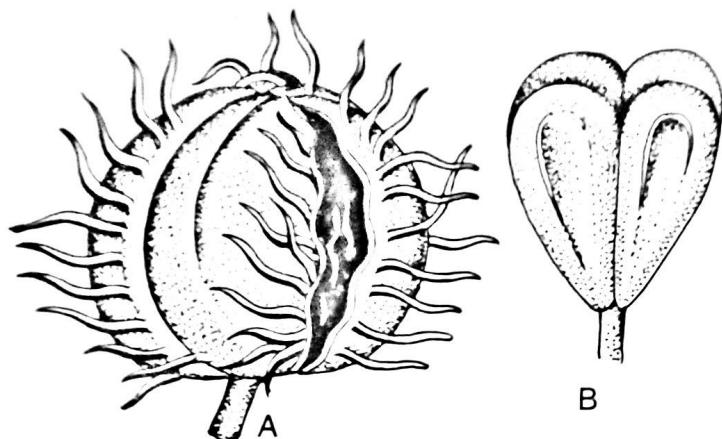


Fig. 10.10 Schizocarpic fruits. A—Regma of *Ricinus communis*; B—Carcerule of *Leucas* sp.

2. *Samara*—It is a dry, two or more-celled and winged fruit which develops from a superior bi- or tricarpellary ovary (Fig. 10.9, C). The wings are formed from the pericarp. The fruit breaks up into component parts and each part contains a seed but does not split further to liberate the seed. Examples—*Hiptage madhoblata* (Malpighiaceae), *Dioscorea* sp. (Dioscoreaceae), etc. Fruits of *Shorea robusta* (Dipterocarpaceae) and some other species are also winged but the wings are not formed from the pericarp, rather wings are the persistent sepals of the calyx whorl—such a fruit is called *samaroid* (Fig. 10.9, D).

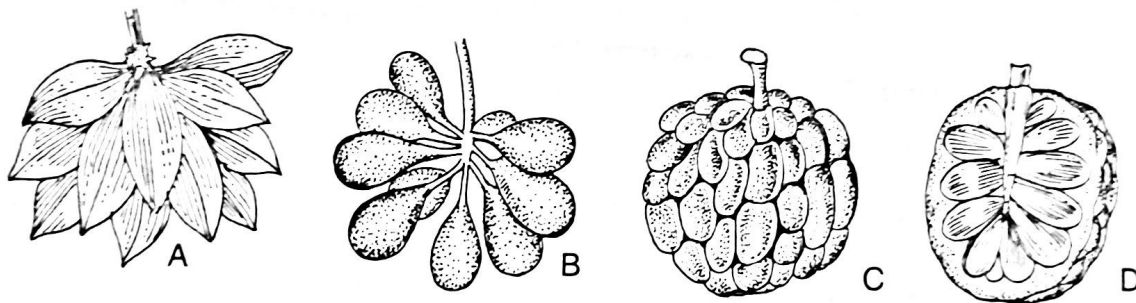


Fig. 10.11 Aggregate fruits. Etaerio of berries of *Artabotrys odoratissima* (A) *Polyalthia longifolia* (B) and *Anona squamosa* (C). L.S. of the fruit of Custard apple (*Anona squamosa*).

3. *Regma*—This is a dry fruit which develops from a superior tri- or polycarpellary ovary. The fruit splits up into as many parts, called cocci, as there are carpels. Each part contains one or two seeds which are liberated on the decaying of the dry pericarp. Examples—*Ricinus communis* (Euphorbiaceae), *Hura crepitans*,

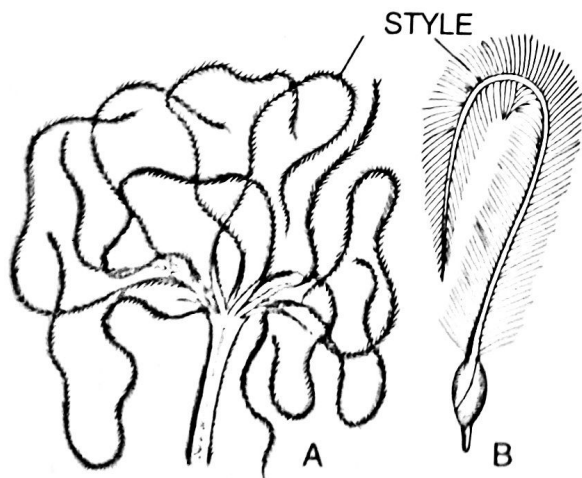


Fig. 10.12 Aggregate fruit. Etaerio of achenes of *Naravelia zeylanica* (A); One achene-fruitlet is shown separately (B).

Geranium sp. (Geraniaceae), etc. (Fig. 10.10, A).

4. *Lomentum*—This is a dry legume-like fruit developing from a superior monocarpellary ovary. Here the fruit is transversely constricted between the seeds and on maturity the fruit breaks up into bits containing one or more seeds. Examples—species of *Acacia*, *Mimosa*, *Entada gigas* (Mimosae), etc. (Fig. 10.9, A).

5. *Carcerule*—This is small, dry fruit which develops from a superior bicarpellary ovary. The fruit later on splits into four chambers enclosing one seed in each. Carcerule is the characteristic fruit of the members of the family Labiatae (Fig. 10.10, B).

II. AGGREGATE FRUITS—In flowers having apocarpous pistil (free carpels), the ovaries of respective carpels mature up into fruitlets clustered together

on a pedicel or stalk of the flower, such fruits are known as aggregate fruits—in other words these fruits are the products of a single flower having apocarpous pistil.

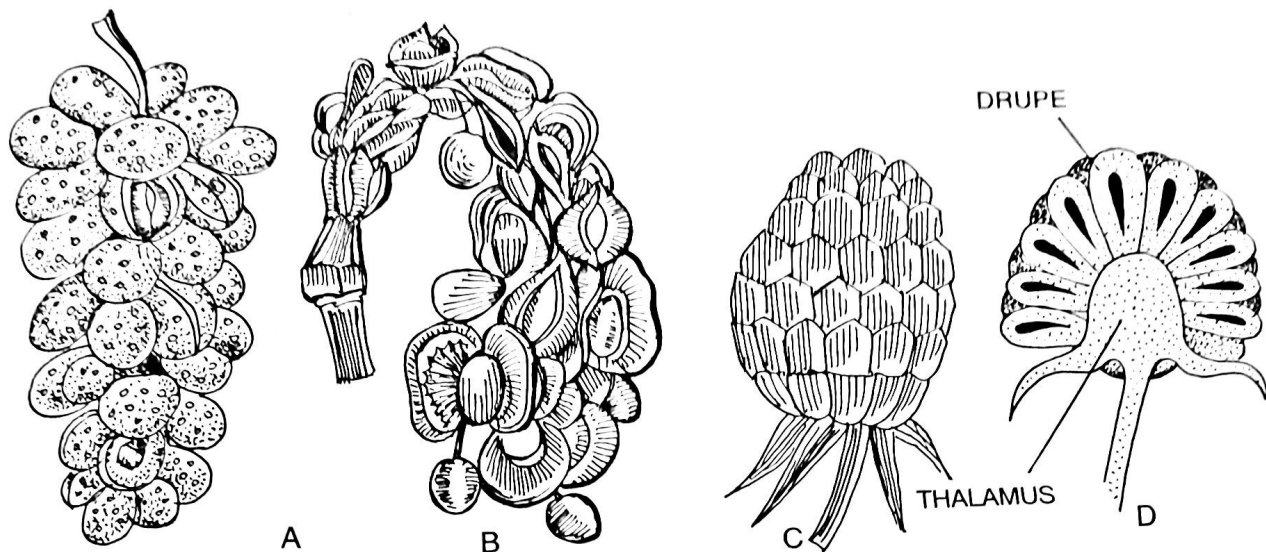


Fig. 10.13 Aggregate fruits. Etaerio of follicles of *Michelia champaca* (A) and *Magnolia grandiflora* (B). Aggregate fruit. Etaerio of drupes of *Rubus idaeus*; C—entire, D—in 1.s.

In aggregate fruits, the fruitlets derived from the ovaries of free carpels may be—

- (i) *Berries*—called *etaerio of berries*; examples—*Polyalthia longifolia*, *Artabotrys odoratissima*, *Anona squamosa* (Annonaceae), etc. (Fig. 10.11 A-C).
- (ii) *Achenes*—called *etaerio of achenes*; examples—*Clematis* sp., *Naravelia* sp. of the family Ranunculaceae (Fig. 10.12).
- (iii) *Follicles*—called *etaerio of follicles*: examples—*Magnolia grandiflora*, *Michelia champaca* (Magnoliaceae), etc. (Fig. 10.13, A-B).
- (iv) *Drupes*—called *etaerio of drupes*; examples—*Rubus idaeus*, *Fragaria vesca* (Rosaceae), etc. (Fig. 10.13, B).

III. MULTIPLE OR COMPOSITE FRUITS—These fruits are the products of whole inflorescence together with its component parts.

There are two types as follows:

- (i) *Sorosis*— Examples are the fruits of *Ananas comosus* (Pine apple, Bromeliaceae). *Artocarpus heterophyllus* (Jack fruit, Moraceae), *Morus indica* (Moraceae), etc.

In *Ananas comosus* (Fig. 10.14, A) there is a crown of sterile leafy bracts at the apex of the fruit; the surface of the fruit is represented by polygonal areas, each of which is the united ovary of the component flower of the inflorescence spike. The rachis, perianth and bracts become fleshy and succulent forming the edible parts of the fruit.

In *Artocarpus heterophyllus* (Fig. 10.14, B) the rachis is club-shaped, not fleshy; the edible juicy ovaries of fertile flowers and bracts become succulent—at the axils of bracts there are fleshy perianth (calyx) which also forms the edible part.

- (ii) *Syconus*—It develops from the hypanthodium inflorescence. The fleshy rachis of the inflorescence

(Fig. 10.13) becomes succulent enclosing the minute achenes, each of which is developed from female flowers of the hypanthodium — so it is a multiple or composite fruit.

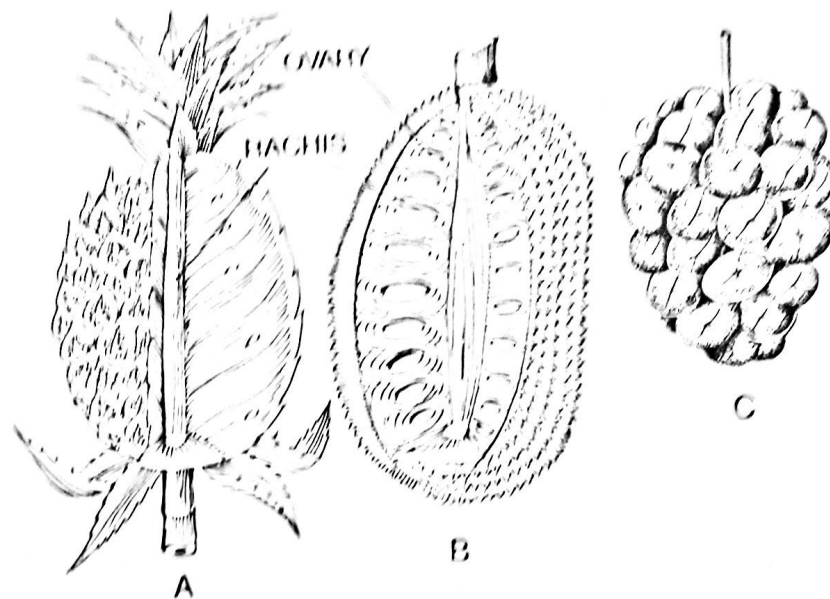


Fig. 10.14 Multiple fruits. A—Sorus of *Ananas comosus*, B—Sorus of *Artocarpus heterophyllus*, C—Sorus of *Morus indica*.

In *Ficus benghalensis* and other *Ficus* sp. (Fig. 10.15, A), the hollow pear-shaped receptacle becomes fleshy which encloses a number of fruits or achenes developing from female flowers closed within the

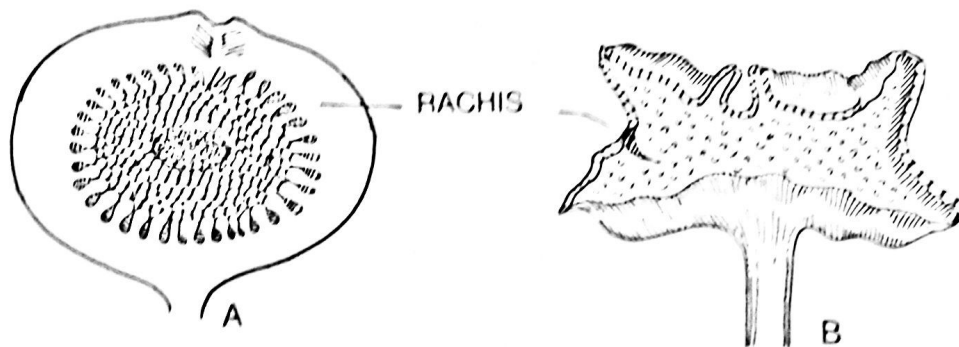


Fig. 10.15 Multiple fruits. A—Syconus of *Ficus* sp. B—Syconus of *Dorstenia* sp.

receptacle. In *Dorstenia* (Fig. 10.15, B) the coenanthium develops achenes on the open receptacle forming syconus type of multiple fruit.