CHAPTER 7

Fruits

After pollination and fertilization, the seed develops from the ovule, and the fruit develops from the ovary of a flower. A fruit may be formed from an ovary or any other part of the flower, e.g. receptacle or calyx. A fruit that is formed from an ovary of a flower is known as a **true fruit** (e.g. crotalaria) while a **false fruit** is a fruit that is formed from any other part of the flower other than the ovary, e.g. cashew (*Anacardium occidentalis*)

Characteristics of fruits

1. A fruit usually has two natural scars. One scar represents the point of attachment to the receptacle while the other represents the position of the style or stigma.
2. The fruit is produced from the development of the ovary and its contents.
3. Most fruits contain one or more seeds e.g. mango and orange. Only seedless **(pathenocarpic)** fruits (e.g. bananas and plantains) are different.
4. They have a fruit wall or pericarp which is formed from the ovarian wall.

Characteristics of Seeds

1. They have only one scar (hilum) which is the point of attachment of an ovule stalk to the fruit wall. The hilum in a bean seed is an example.
2. They are usually found inside fruits, e.g. beans and *Crotalaria.*
3. A seed has a seed coat (testa), an outer layer or the integument of the ovule, a tegmen, the inner layer of the ovule and not a pericarp (fruit wall).

Table 7.1 Differences between a fruit and a seed

Fruit	***Seed***

Fruit	***Seed***
1. Formed from a mature ovary	Formed from an ovule
2. Possesses two scars — One scar shows point of attachment to the floral receptacle. The second scar represents the position of the style or stigma.	possesses one scar that represents attachment to the placenta
3. Contains one or more seeds	Contains the embryo
4. The fruit pericarp is formed from the ovarian (ovary) wall.	The testa (seed coat) is formed from the integument

Development of fruits, seeds and ovary wall

After fertilization, the petals, sepals, stamens, stigmas and styles usually droop, wither and drop off from the plant, e.g. mango. In some plants like guava and tomato, the sepals remain as dry structures attached to the fruit. In some others, the floral parts may develop or be modified for the purpose of dispersing the fruits (e.g *Tridax,* see Fig. 7.8).

Inside the fertilized ovule, rapid mitosis (cell-division), accompanied by growth, produce a seed which contains the embryo. This embryo may soon develop into radicle, (future root), plumule (future shoot); cotyledons, food storage organ and endosperm. The protective seed-coats (integument) become thick and hard (impermeable). They develop into seed coats or testa. The ovary and its contents develop into the fruit. The ovary also increases in size, and its wall eventually develops into the fruit wall (pericarp). It may also exhibit a change in colour, e.g. from green to brownish-black as in *Delonix regia* or *Caesalpinia*. Its taste may change as it develops from sour to sweet as in orange or mango. The texture too may change, becoming succulent, as in tomato, or dry, as in legumes, e.g. beans.

Structure of fruits

A typical fruit consists of pericarp, seed or seeds, and placenta. A fleshy fruit (e.g. orange or tomato) will reveal the basic parts of a fruit as shown in Fig. 7.1.

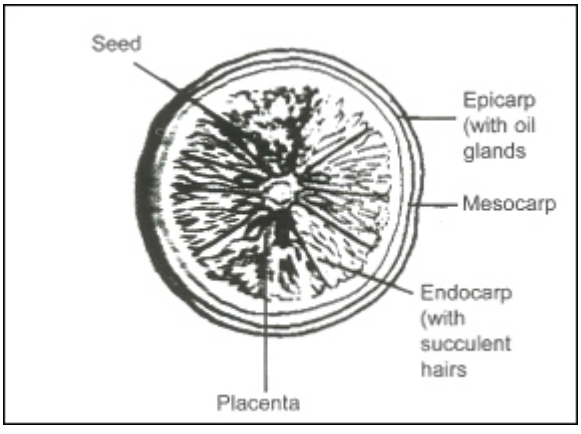

Fig. 7.1 Transverse section of a berry (orange)

In a fleshy or succulent fruit, the pericarp consists of three layers named **epicarp, mesocarp** and **endocarp.** The epicarp is the outermost layer which can be, fleshy or thin, succulent and edible like tomato. The epicarp may also be leathery, e.g. mango. The mesocarp is the middle layer. It is thick and edible in some berries and some drupes. The endocarp is the innermost layer. It is usually hard or stony especially in drapes. It is fleshy in berries. It encloses the seed in drupes. The seed or seeds are attached to the placenta in various ways known as placentation. (See chapter 4 under types of placentation).

Classification of fruits

(a) Fruits may be classified according to the method by which their seeds are released, namely:

(i) Dehiscent fruits: This splits open when dry, e.g. *Crotalaria,* beans and *Delonix regia*

(ii) Indehiscent fruits: do not split open e.g. tomato and mango.

(b) Fruits may also be classified based solely on fertilized ovaries. Those that develop either from the whole inflorescence (e.g. pineapple), or from the other parts of the flower such as the calyx, corolla and receptacle are regarded as false fruits, e.g. cashew nut and apple. Fig. 7.2 shows various classes of fruits and their typical examples.

(c) Fruits may be classified as simple, aggregate or multiple according to the nature of the ovary from which they develop.

(i) *Simple fruits* are the commonest type of fruits. A simple fruit is one which is formed from a single carpel (monocarpous) or one which is formed from a number of ovaries which are fused together (syncarpous). Simple fruits could be dry or succulent. Examples are okra, bean, orange, tomato and banana.

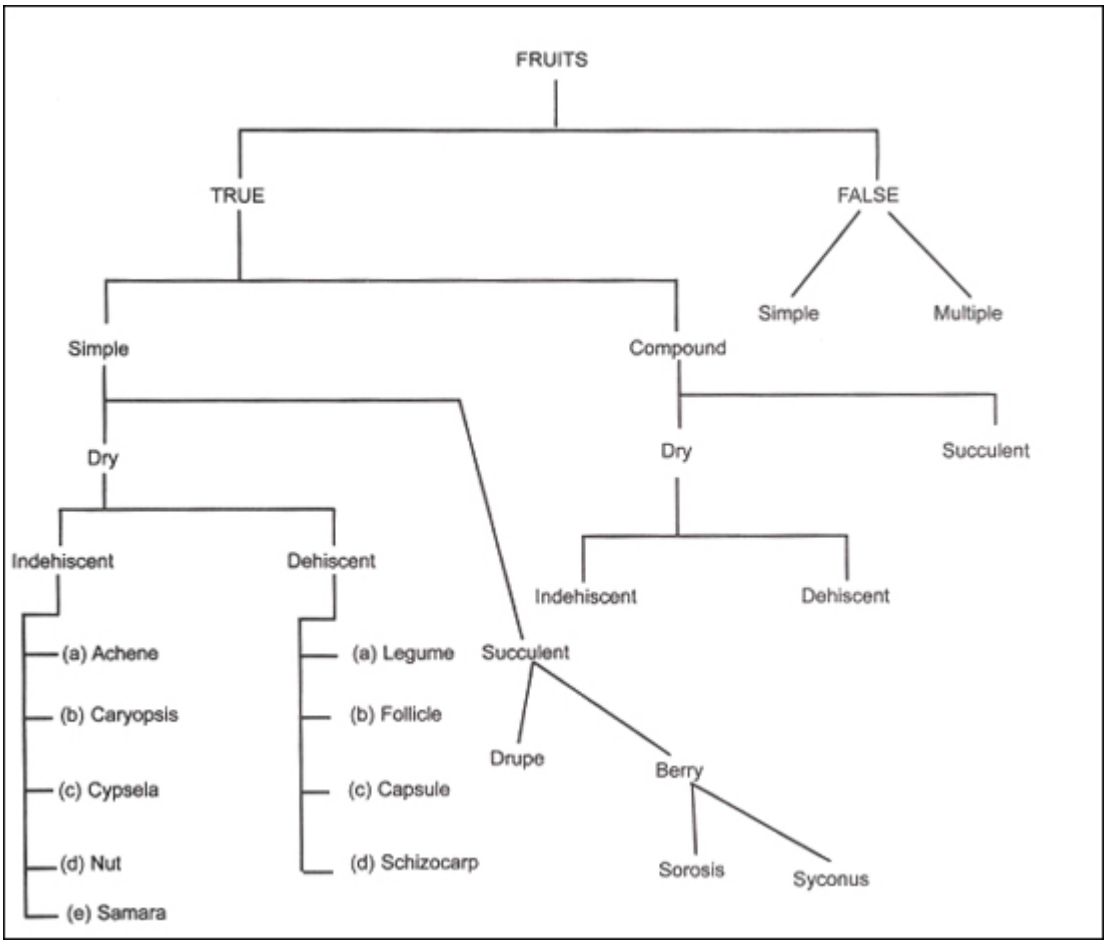

Fig. 7.2 Classification of fruits

(ii) *Aggregate fruits.* An aggregate fruit is one which is formed from a single gynoecium which is apocarpous. Each carpel becomes a fruitlet. It is formed from several free carpels close together (i.e. apocarpous). Each carpel may remain separate as in *kola* which is a collection of follicles. Other examples are Bryophyllum, raspberry, strawberry and sugar apple. Aggregate fruit could be dehiscent or indehiscent.

(iii) *Multiple or compound fruits. Multiple* fruits are always false fruits. Each fruit is formed from the whole inflorescence or a bunch of flowers which are positioned very close to one another. The ovaries of several flowers are fused together to make multiple fruits. For instance, every hexagonal marking in the pineapple is a flower.

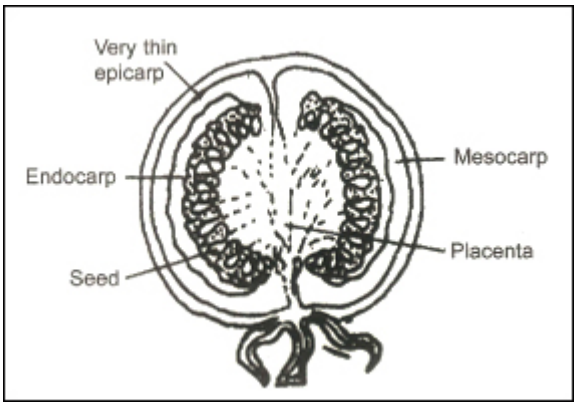

Fig. 7.3 Transverse section of a berry e.g. tomato.

(d) Fruits may also be classified according to the nature of the covering, whether it is hard (e.g. Cassia and beans), or fleshy as in orange and tomato.

Activity 7.1

Arrange the following fruits into either simple or aggregate fruit groups; beans, orange, tomato, kola, strawberry.

Fleshy (succulent) fruits

Many fleshy or succulent fruits are true, simple fruits. They are usually soft, juicy and inde-hiscent. The most popular types of succulent fruits are the berries and drupes. Others are pome, sorosis and syconus.

A berry is a true, simple, wholly succulent and indehiscent fruit. It usually has many seeds. Every part of it is fleshy (see Fig. 7.3). It has a well developed pericarp which has three distinct layers. The epicarp is thin and glandular. The **mesocarp** and **endocarp** within are fleshy and edible. Seeds are attached to the endocarp. Examples include, tomato, orange, cherry, pepper, pawpaw and guava.

A drupe is a true, simple, one-seeded indehiscent fruit. The fruit is developed from a superior ovary of a flower (Fig. 4.10B). It has a distinct pericarp. This consists of a thin epicarp, a mesocarp which may be fleshy as in mango (Fig. 7.4), or fibrous as in coconut. The endocarp is usually hard and stony. It contains the only seed in the fruit. In other words, the drupe is only partly fleshy. Other examples are *Gmelina,* oil palm fruit and plum.

A pome is a false, simple, indehiscent, but succulent fruit. All the fleshy and edible parts are formed from the receptacle. Hence, its false nature. Only the hard core containing the seed is formed from the ovary. Examples are pear and apple.

The sorosis and syconus are two classes of fleshy, multiple, false fruits. They are both formed from a dense inflorescence. Syconus has a hollow, cup-like but fleshy peduncle.

Pineapple and jack fruit are examples of sorosis, while the fig is an example of syconus.

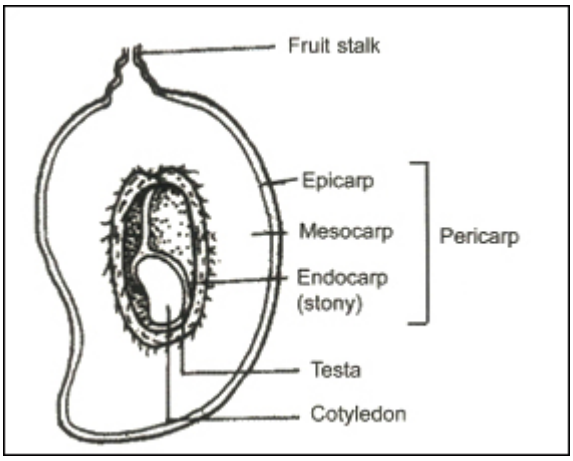

Fig. 7.4 Longitudinal section of a drupe e.g. mango

Dry Fruits

Dry fruits are fruits that have dry and hard pericarp. They may be dehiscent or indehiscent.

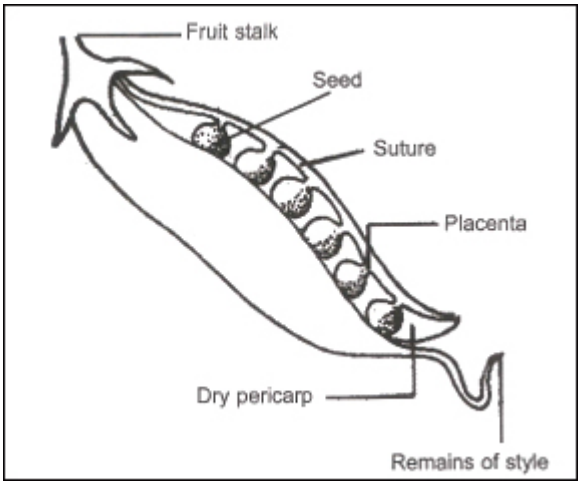

Fig. 7.5 Longitudinal section of a legume (e.g. Crotalaria)

Dehiscent fruits

Dehiscent fruits are fruits that split open their dry pericarp naturally, along one or more sides to release their seeds. Common examples are *Delonix, Caesalpinia,* beans, okra and rubber. Classes of dry dehiscent fruits include, legumes, follicle, capsule and schizocarp.

Follicle: The follicle is a true, simple dehiscent fruit. It is formed from a superior monocarpous gynoecium. It splits open longitudinally, along one side only. Examples are sodom apple, *Cnestis,* rose periwinkle and frangipanii.

Legume: It is a true, simple, dry fruit which is formed from a superior, monocarpous gynoecium. The mature, dry fruit splits open on both sides (see Fig.7.5).

The seeds are attached to the upper edge of the pod. Common examples are *Caesalpinia,* beans, flamboyant, *Crotalaria, cowpea.*

Capsule: It is a true simple, dehiscent fruit. It is formed from two or more carpels with multiple chambers.

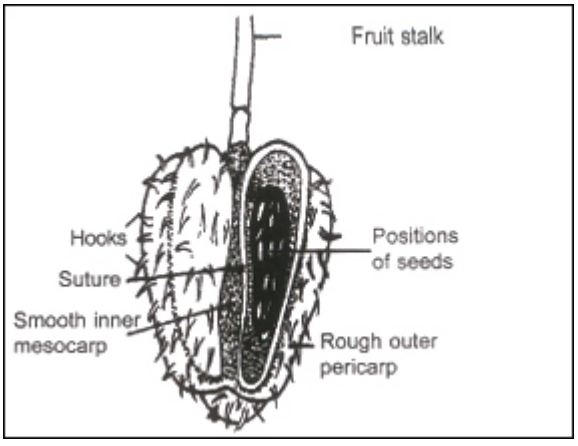

Fig. 7.6 Longitudinal section of a capsule (e.g. castor oil).

Each chamber breaks open and liberates several seeds at the same time in several ways. But characteristically, the capsule splits open along more than two sides. The capsule may split open longitudinally as in okra, cotton or castor oil. It may dehisce through rings of pores close to the tip of a capsule as in poppy or it may dehisce by breaking off a cap as in water leaf.

Schizocarp: A schizocarp is a simple, dry, many-seeded fruit, which is formed from a syncarpous ovary. The ripe or mature fruits split open into several separate, small units, each containing a seed (see Fig. 7.7). Examples are *Cassia* and *Desmodium.*

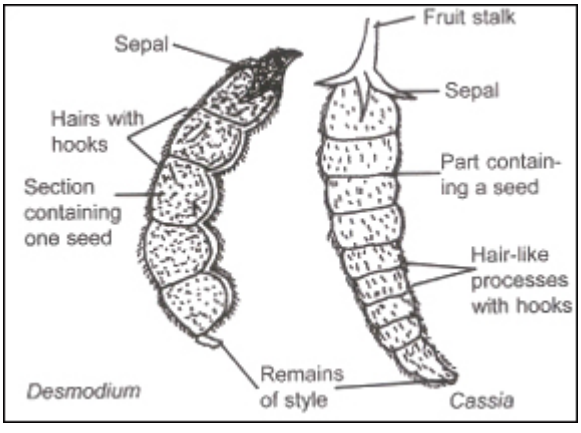

Fig. 7.7 Structure of schizocarp e.g. Cassia and Desmodium

Indehiscent fruits

These are true, simple dry fruits with pericarps which do not split open even at maturity or ripe age. Many of them are tiny but are produced in large quantities. Indehiscent fruits include achene, cypsela, caryopsis, nut and samara.

Achene: It is a simple dry, indehiscent fruit that is formed from a superior ovary. It is a one chambered and one-seeded fruit. It is also

surrounded by a dry, leathery pericarp with soft portions inside it. Its pericarp is free from the testa.(See Fig. 7.10A). Examples include sunflower *Helianthus and Bougainvillea.* Other forms of achene are, the cypsela and samara.

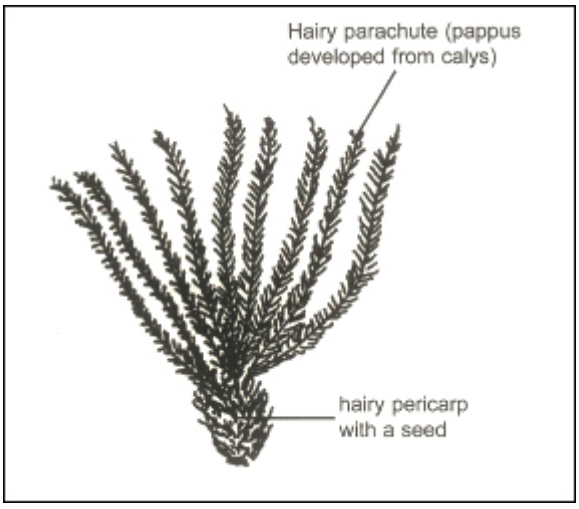

Fig. 7.8 Structure of a cypsela (e.g. Tridax)

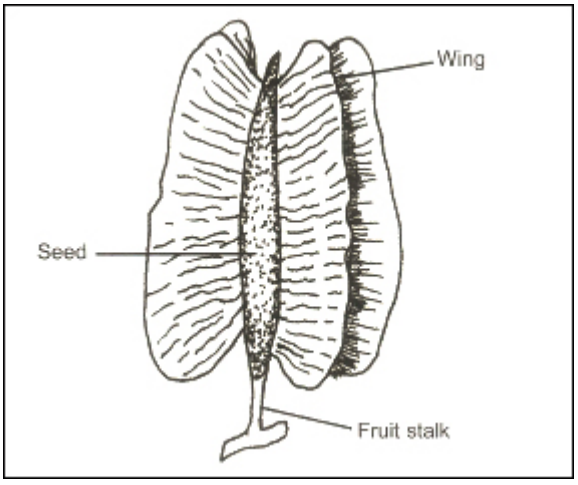

Fig. 7.9 Structure of a samara (e.g.Combretum)

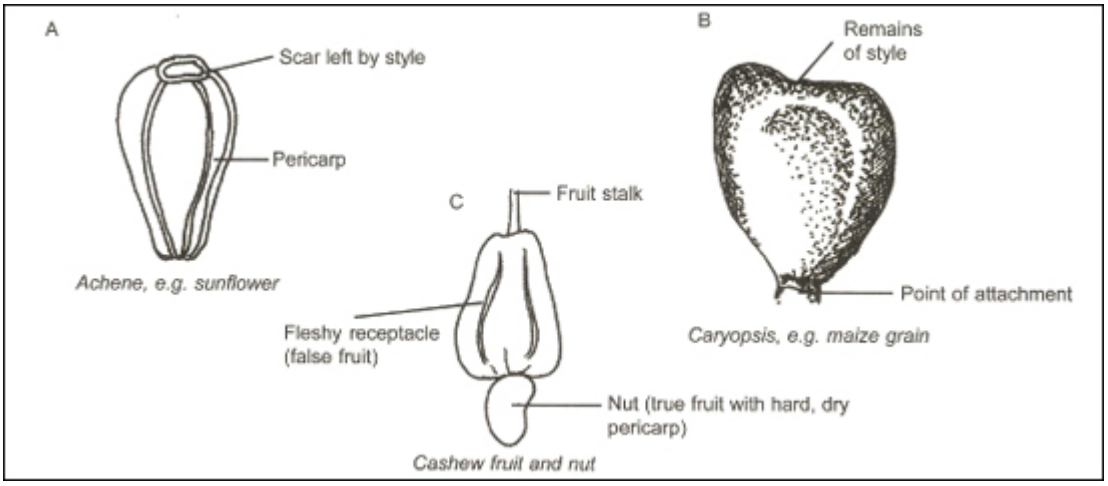

Fig. 7.10 Some dry indehiscent fruits A. An achene B. A caryopsis. C. A nut

Cypsela: It is a one-seeded fruit developed from a bicarpellary inferior ovary. It is common among the compositae family. In some of them, the calyx persists and forms a tuft of hairs â€˜hairy parachuteâ€™ called the **pappus** above the pericarps. Examples include *Tridax* and *Eupatorium.* (Fig. 7.8)

Samara: This is a one-seeded fruit in which the pericarp has been modified at the edges into one or two flat sheets or wings. Examples are, *Combretum (Fig. 7.9),* Obeche tree and African rose wood.

Caryopsis: This is a small, dry, indehiscent fruit which is developed from a single, superior carpel (see Fig. 7.10B). It is an achene-like fruit in which the pericarp and testa are fused together. Typical examples are cereals such as grasses, maize and millet.

Nut: This is a dry fruit which develops from a superior ovary. It is one-seeded and so, it is achene-like. Its pericarp is woody, hard and tough (Fig. 7.10C). Examples include, cashew (a false fruit), almond and walnut.

Dispersal of fruits and seeds

When fruits are ripe and mature, they may drop off from the parent plant or may be plucked by man or other animals. If all the fruits and seeds produced by a plant are to remain around it, there would be problems. The major one is, overcrowding of too many plants in a limited space. In such a situation, there will be competition for space, water, nutrients and even light. To overcome this unfavourable situation, nature has created various adaptive measures for fruits and seeds for dispersal.

Dispersal is the removal, scattering or distribution of fruits and seeds over considerable distances from the parent plants.

Importance of dispersal to plants include the following:

(a) It helps to prevent overcrowding.
(b) It prevents undesirable competition for space, light, water and nutrients.
(c) It results in colonization of new areas or covering of barren lands with new plants
(d) It prevents diseases from spreading among plant species.
(e) Dispersal enhances perpetuation of species.

Modes of dispersal

Most fruits and seeds are variously adapted to dispersal by wind, animal, water, explosive mechanism and man. Dispersal of fruits and seeds by animals occurs in two different groups of fruits:

1. *Dispersal by animals:* The fruits dispersed in this way, when ripe, are often juicy, edible or succulent. They also possess bright colours which are attractive to animals (e.g. monkeys). After eating the fruits, the animals throw away the seeds, as in drupes (e.g. mango, Fig. 7.4, and oil palm).

   In fruits like berries, the seeds often possess slimy or tough woody testa which is resistant to the action of digestive enzymes. The seeds are passed out with faeces undigested and still viable.

   Examples include guava, tomato and pepper seeds. Birds and a good number of mammals are good agents of dispersal in this way.
2. *Posession of hooks or sticky hairs:* Some fruits are not edible but they attach themselves to the fur of mammals such as cats, dogs, rats, cattle, etc. while moving about. For example, *Desmodium* has sticky hairs. *Mimosa, Bidens* and *Triumffeta* (see Fig. 7.11) develop backwardly-directed hooks which fix them to the hairy skin of mammals. The fruits may also attach themselves to the clothes of man. Eventually, these fruits and seeds are shed off far away from the parent plants.
3. *Dispersal by humans:* Humans also disperse several fruits and seeds consciously or unconsciously. During agricultural activities, many seeds are scattered over large distances. Also when one travels from one place to another, one may be involved in the redistribution of various seeds and fruits. Rubber, cassava and guava were all imported into the country many years ago by man.
4. *Wind Dispersal:* Wind also disperses some fruits and seeds (see Fig. 7.11).

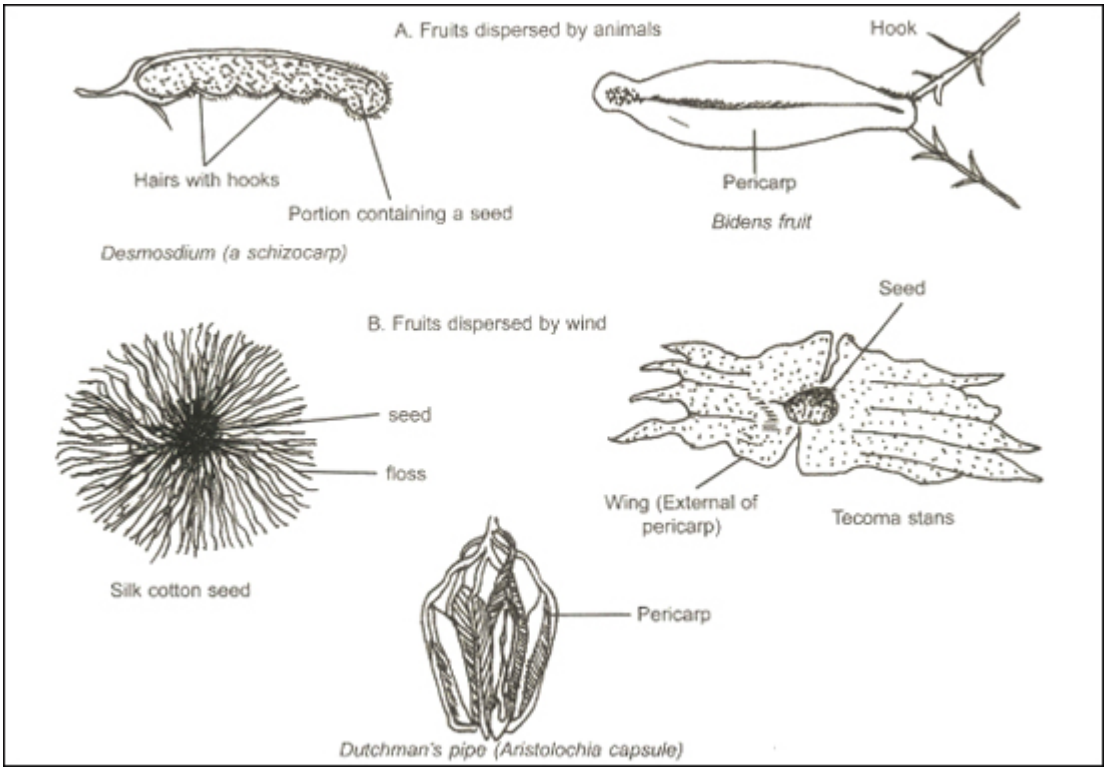

Fig. 7.11 Some fruits dispersed by animal and wind.

(a) Such fruits and seeds are characteristically dry, tiny and light as in grasses.

(b) Some seeds are surrounded by a mass of tiny silky threads (floss) or hairs as in cotton or silk-cotton. They make the fruits float in the air over great distances.

(c) Parachute mechanism is another modification by which light seeds are dispersed. The calyx may be modified in a way that suspends the fruits or seeds in the air like a parachute, and increases their distance before landing. An example of fruits with this type of structure is *Tridax* (see Fig. 7.8)

(d) *Winged fruits and seeds:* Some fruits develop wings. The wings are actually dry, thin, light, transparent, and have flat modifications of the pericarp or testa. The wings enable them spin in the air, that way, they fly a far distance away from their parents.Winged fruits are found in *Combretum* with four wings (see Fig. 7.9). Winged seeds are found in pine and *Tecoma stans.*

5. *Censer mechanism:* This dispersal mechanism occurs in dry fruits, e.g. capsules. The fruit stalk is usually long and pendulous. It therefore sways in the air. When the fruit is mature and dry, the capsule splits open at the top as in poppy and Dutchmanâ€™s pipe (see Fig. 7.11). Afew seeds are released at a time through the pores. These are then blown by the wind some distances away from the parent.

6. *Water Dispersal:* Fruits and seeds which are dispersed by water have waxy, waterproof covering which prevents water from entering the fruits for some time. The method is limited to areas along coasts and rivers. Coconut is one of such fruits and seeds dispersed by water. They also have flotation devices. For instance, coconut may be carried thousands of kilometres on water. This is because it is light and has a fibrous mesocarp which contains plenty of air spaces. These enable it float for a considerable distance. The trapped air gives it buoyancy and prevents it from sinking. Mangrove seedlings with corky internal structures float in water the same way.

   Water lily is also dispersed by water. This plant has seeds which have peculiar air spaces. These assist them in floating (once they are released from the parents) for sometime before they become waterlogged and then sink.

7. *Explosive mechanism:* Some dry, dehiscent fruits are dispersed by explosion or explosive mechanism. This results from the unequal drying of the pericarp due to tensions set up in the ovary. It leads to the splitting and twisting of the fruit walls. The seeds and fruits are forcibly thrown several metres away. The seeds are usually self-dispersed that way. Usually, when a fruit splits open, it is accompanied by a pop noise, hence, the term explosion or explosive mechanism. Examples may be found in:

(a) legumes, e.g. beans, *Crotalaria* and *Delonix regia.*

(b) capsules, e.g. okra, rubber and balsam;

(c) schizocarp, e.g. *Cassia*

Suggested Practicals

1. *Fruits and seeds*

   Using an orange or mango and bean as starting points,

   (a) distinguish between a fruit and a seed.

   (b) examine their internal structure and identify parts of the given fruits, e.g. orange or tomato

   (c) Draw and label your specimen.

2. *Classification of fruits*

   From a collection of fruits such as orange, mango, Pride of Barbados, cashew, apple, pineapple, okra, cotton seed, identify and classify them as follows:

   (a) Fleshy fruits

   (b) Hard and dry (dehiscent) fruits

   (c) Hard and dry (indehiscent) fruits

   (d) True fruits

   (e) False fruits

   (f) Multiple fruits

Draw and label the internal structure of a berry and a drupe and note their basic differences and similarities.

3. *Fruit structure and dispersal*

   You would be provided with *Combretum,* sunflower, coconut, ripe oil palm fruit, cotton, bean, *Desmodium, Crotalaria* and *Cassia.*

   (a) Draw the fruits and label their parts.

   (b) Pour water over the coconut fruit and observe

   (c) What is the advantage of this act?

   (d) Tabulate the fruits and seeds according to how they are dispersed.

   (e) What are the adaptive features of these fruits for dispersal?

   (f) Note the ways the fruits split. Draw two of them.

Summary

1. Fruits are formed after pollination and fertilization have occurred.
2. A fruit is a fertilized ovary. It has two natural scars.
3. Fruits may be classified into two:

   (i) succulent or fleshy e.g. berry and drupes.

(ii) hard and dry e.g. legumes such as *Delonix.*

4. Succulent fruits usually have pericarp whose layers (epicarp, mesocarp and endocarp) are not fused and can be identified.
5. Dry fruits may be sub-divided into dehiscent or indehiscent. Dehiscent fruits are those which split open naturally, while indehiscent fruits do not split open naturally.
6. False fruits are fruits which are developed from the other floral structures besides the ovary.
7. Dry dehiscent fruits may be classified into follicle, legumes, capsules and schizocarp.
8. Indehiscent fruits may be classified as achene, cypsela, samara and caryopsis.
9. Fruits are dispersed in various ways. The agents include, humans, other animals, wind, water, and explosive mechanism. Each fruit or seed is adapted for a particular method of dispersal.

Objective Questions

1. The maize grain is regarded *not* as a seed but a fruit because
   A. it has the remains of a style.
   B. of the relatively small scutellum.
   C. it has a coleoptile.
   D. it has a coleorhiza.
   E. of its relatively large endosperm.
2. The following statements are correct except
   A. Seeds have two natural scars.
   B. A fruit consists of a pericarp and seeds.
   C. Most fruits have seeds.
   D. Fruits develop from fertilized ovaries
   E. The pericarps of berries and drupes are structurally the same.
3. Which of the following statements is false?
   A. Multiple fruits are always false fruits.
   B. Aggregate fruits are formed from free and close carpels.
   C. True fruits are formed from either the whole inflorescence or other parts of the flower.
   D. Drupes have hard and stony endocarp.
   E. Only dry fruits may dehisce.
4. Which of the following statements is **true?**
   A. Follicles split along one side.
   B. Legumes split along one side.
   C. Coconut is dry and indehiscent.
   D. Capsules split into several, separate small units.

E. Flamboyant is dispersed by explosive mechanism.

5. Which of the following features is **not** correct?
   A. Dispersal prevents overcrowding.
   B. Dispersal encourages colonization of other areas.
   C. Lightness in weight aids wind dispersal of fruits.
   D. The water-proof nature of some fruits ensures wind dispersal.
   E. Beautiful colours of fruits attract animal agents of dispersal.

Essay Questions

1. (a) Tabulate the major differences between a berry and a drupe.
   (b) Draw and label parts of a named drupe.
   (c) Mention the importance of each part.
2. (a) Describe the dispersal of seeds and fruits by
      (i) animals.
      (ii) wind or water.
      (iii) explosive mechanism.

(b) Give two examples of each.