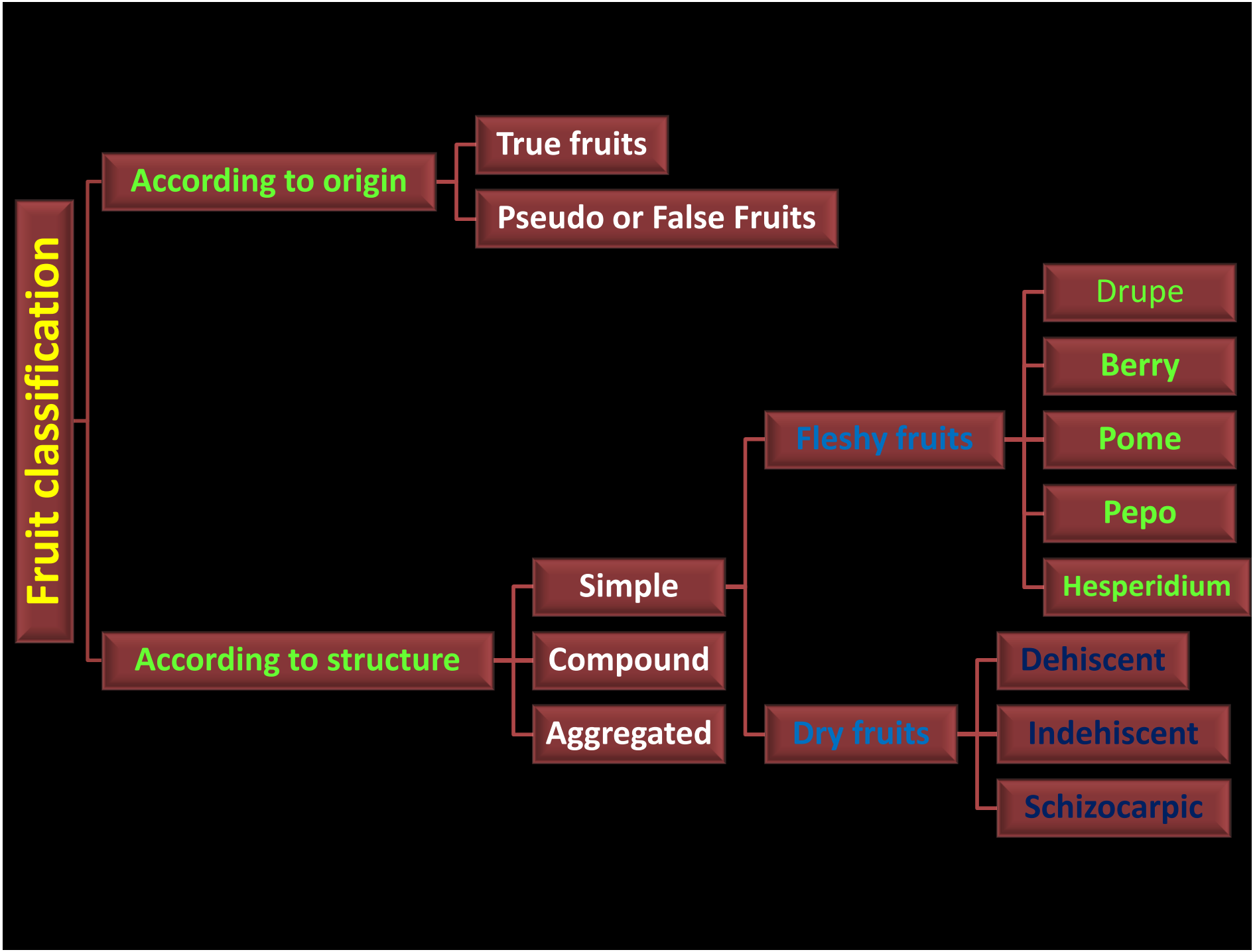
Types of Fruits

What is a fruit?

A mature or ripened ovary formed after fertilization is called fruit.

Ovary wall – Pericarp

Ovule- seed


Fruit classification
According to origin
True fruits
Pseudo or False Fruits
According to structure
Simple
Compound
Aggregated
Fleshy fruits
Drupe
Berry
Pome
Pepo
Hesperidium
Dry fruits
Dehiscent
Indehiscent
Schizocarpic

➢Types of Fruits According to origin

1. True fruits

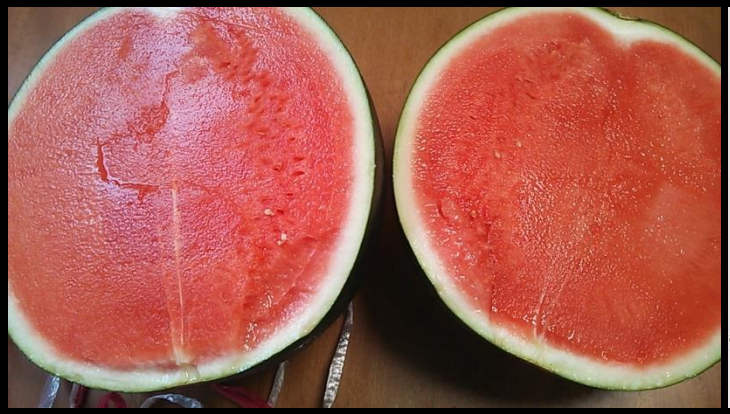
Ovary of the flowers grows into the fruit.

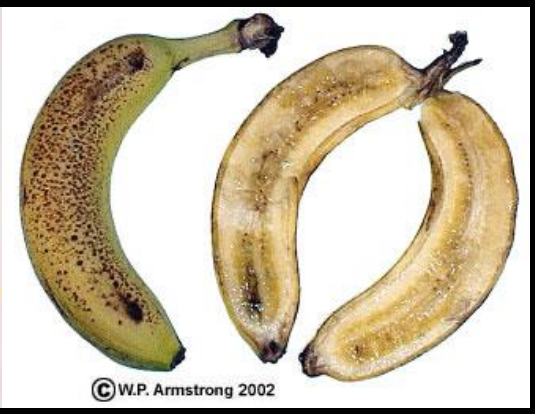
2. Pseudo-fruits/ False fruits

It is often found that other floral parts such as thalamus, receptacle or calyx, may grow and form a part of fruit.

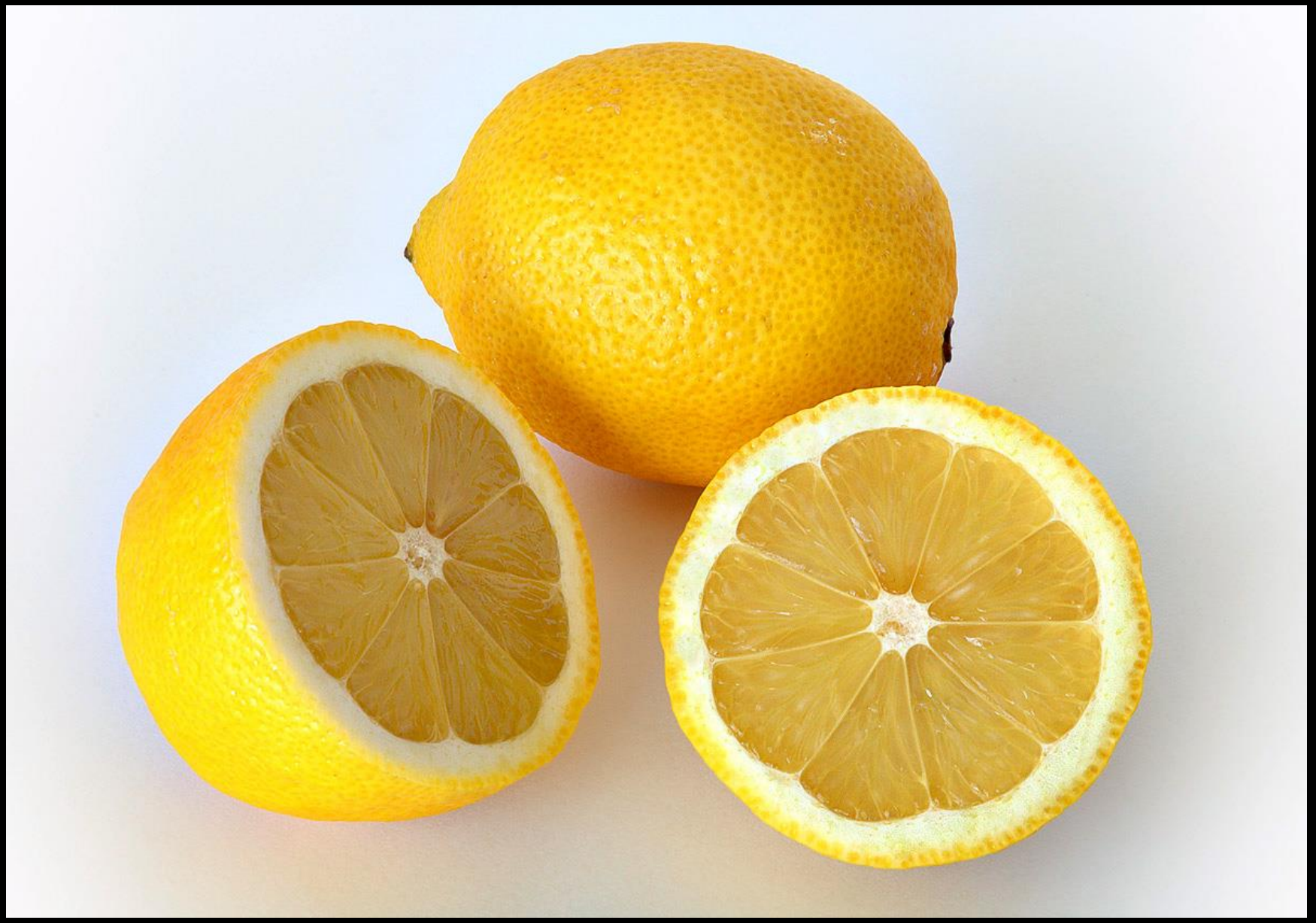
- **Parthenocarpic fruit.**

•They are seedless. E.g. *Musa paradisica* (banana)



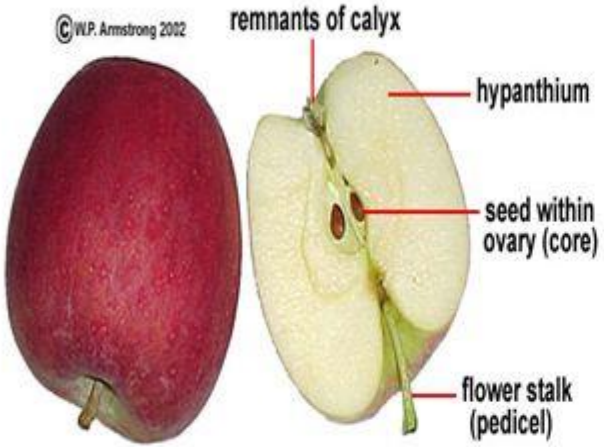


I. True fruits



II- False Fruits (pseudocarps fruit):

- Derived from a mature ovary or ovaries of a single flower together with other parts of the same flower
- The receptacle becomes swollen, fleshy, constituting the main part of the fruit, and enclosing the leathery or hard pericarp.

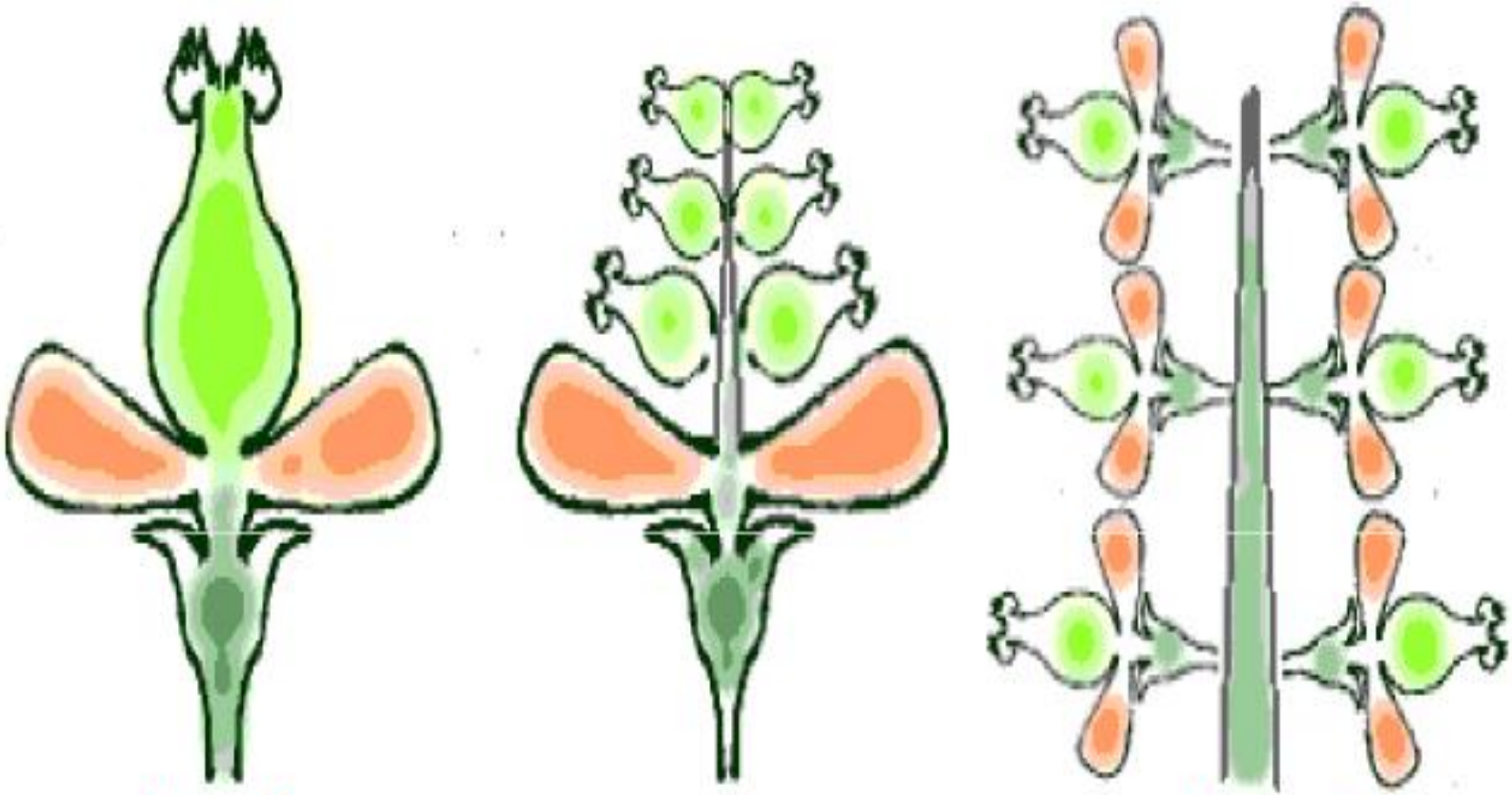


➢ Types of the fruits According to structure

Depending upon the number of fruits developing from a flower (which depends on number of carpels present in the flowers), or from whole inflorescence.

the fruits are classified:

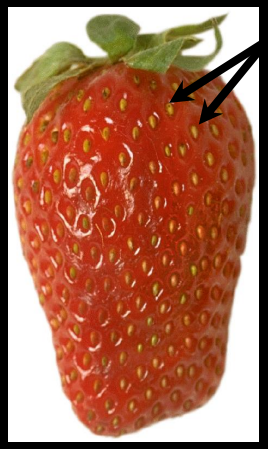
Types of Fruits



simple aggregate multiple

Simple Fruit

Aggregate Fruit



Multiple Fruit

I. **Simple Fruits -** develops from a **single ovary** containing one or more carpels

II. **Aggregate Fruit** - A fruit formed by the development of a number of pistils from the same flower (**apocarpous (free).** The individual units may be berries or other specific types.

- Aggregate/ Etaerio of Follicles **(follicetum)**
- Aggregate/ Etaerio of Achenes **(achenecetum)**
- Aggregate/ Etaerio of Drupes **(drupecetum)**
- Aggregate/ Etaerio of Berries **(baccacetum)**
- Aggregate/ Etaerio of Samara **(samaracetum)**
- Aggregate/ Etaerio of Nuts

III- Multiple or compound Fruit - A fruit formed by the development of a number of pistils often with accessory parts, the pistils being from a number of flowers. (mulberry). Or One fruit from an entire inflorescence.

– **Sorosis** – from spadix/spike inflorescences (Jackfruit, Pineapple)
– **Syconus** – from hypanthodium (Eg. Fig)

II. Aggregate fruits:

- ✓ Single flower produces many fruits in clusters. Each tiny fruit is called fruitlet.
- ✓ A bunch of fruitlets is called Etaerio.
- ✓ These fruits are developed from polycarpellary apocarous ovary.

1- Etaerio of drupes:

- It is a cluster of drupe type of fruits.
- E.g. Raspberry (Rubus الشوكى / توت العليق)

Rubus sp

2- Etaerio of follicles:

- **It is a cluster of follicle types of fruits. E.g. Champaka,**

Magnolia champaca الماجنوليا

Brachychiton populneus بودرة العفريت

3- Etaerio of berries:

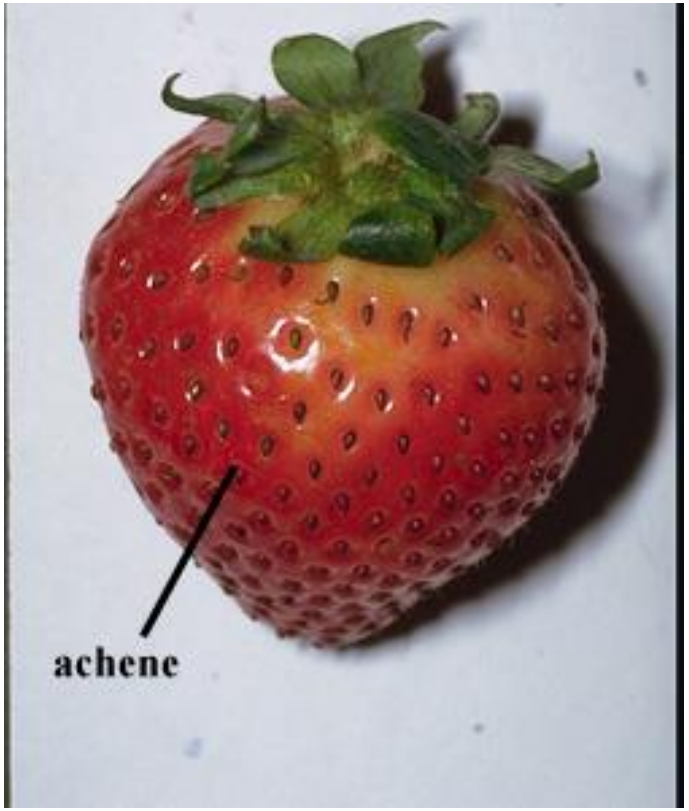
- **Cluster of berry type of fruits E.g. Custard apple القشطة**

Annona sp

4- Etaerio of Achenes

- **Cluster of Achene type of fruits E.g. , Strawberry**

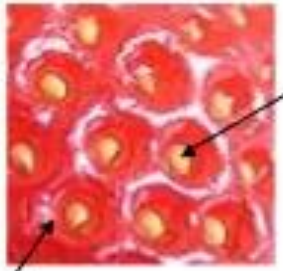
Rosa spp



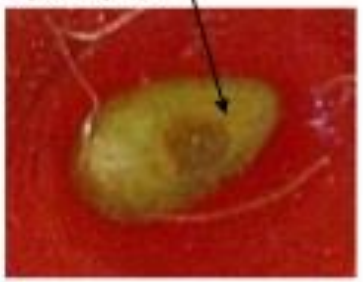
Fragaria ananassa

Strawberry = Aggregate-accessory fruit

This accessory "fruit" is actually an enlarged receptacle.



"seed" is really a simple fruit



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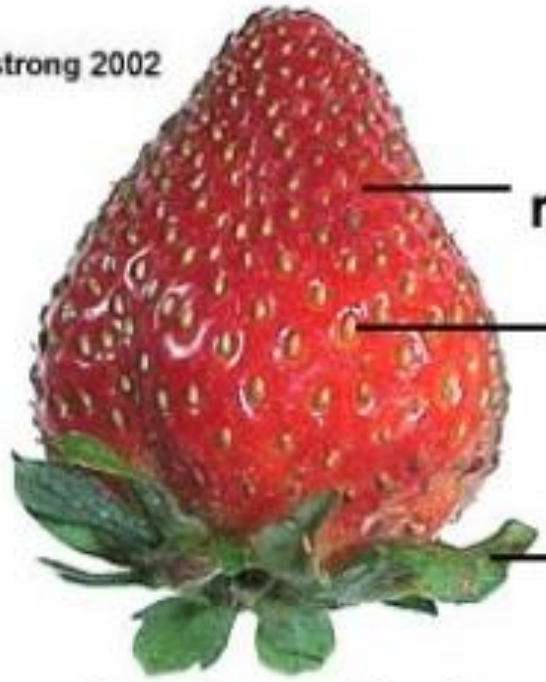
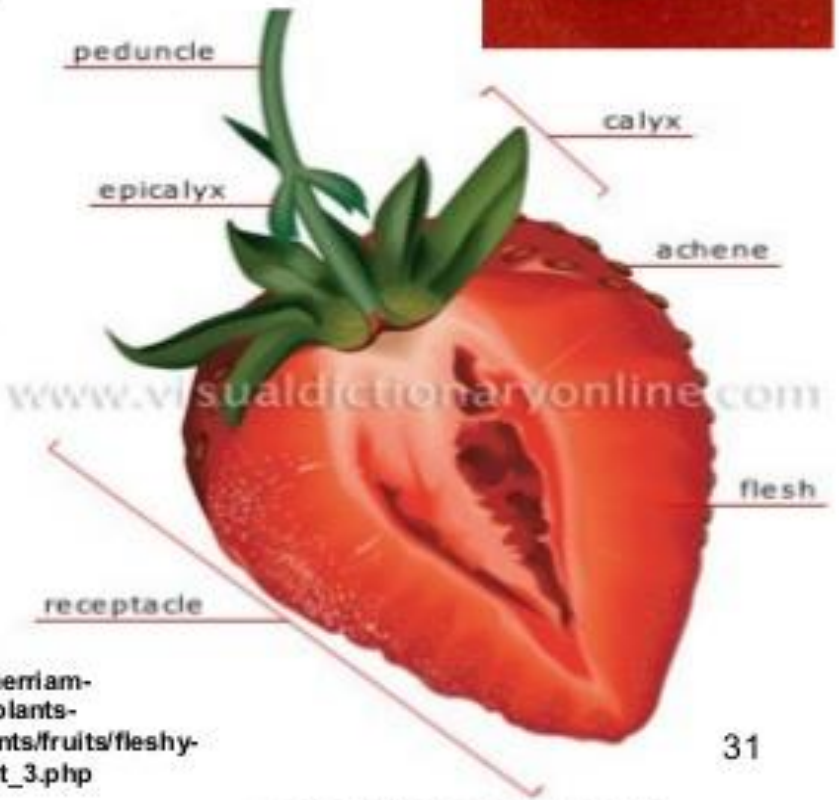


http://waynesword.palomar.edu/termfr4.htm



http://visual.merriam-webster.com/plants-gardening/plants/fruits/fleshy-fruit-berry-fruit_3.php

* section of a strawberry

5- Etaerio of Samara

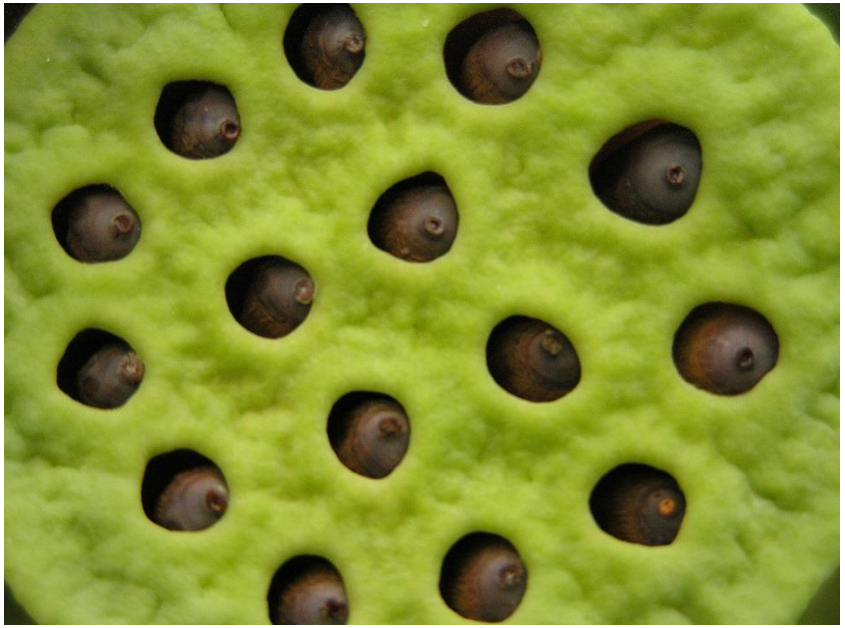
- **Cluster of Samara type of fruits E.g.** tulip tree

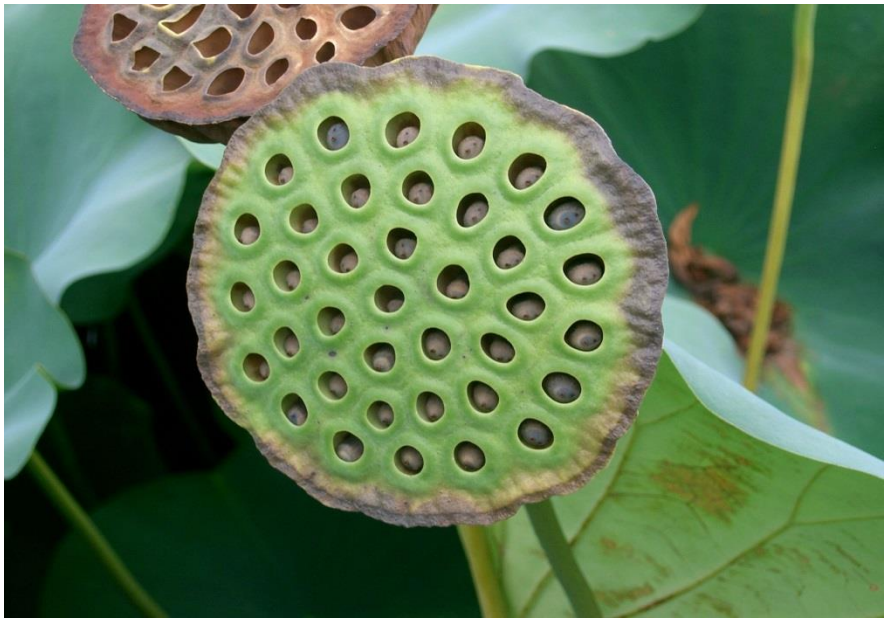
Tipuana speciosa ابو المكارم

Dodonaea viscosa

6- Etaerio of Nuts

- **Cluster of Nut type of fruits.**





Nelumbo nucifera اللوتس

III- Multiple or compound Fruit

A – Sorosis – from spadix/spike inflorescences (Jackfruit,)
B – Syconus – from hypanthodium (Eg. Fig)

Sorosis ثمرة مركبة توتية

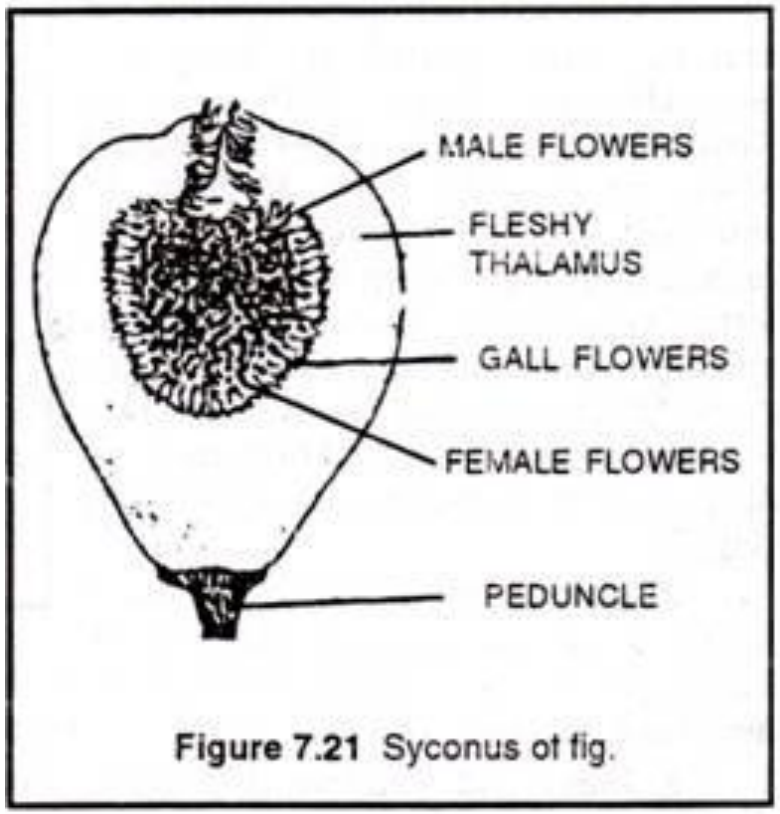


Figure 7.21 Syconus of fig.

ثمرة مركبة تينية Syconus

I. SIMPLE FRUIT

1. Fleshy Fruits

- A fruit in which the walls becomes soft and fleshy as it matures.
- It classified into:-

A – Drupes
B – Berry
C – Pepo
D – Pome
E – Hesperidium

structure

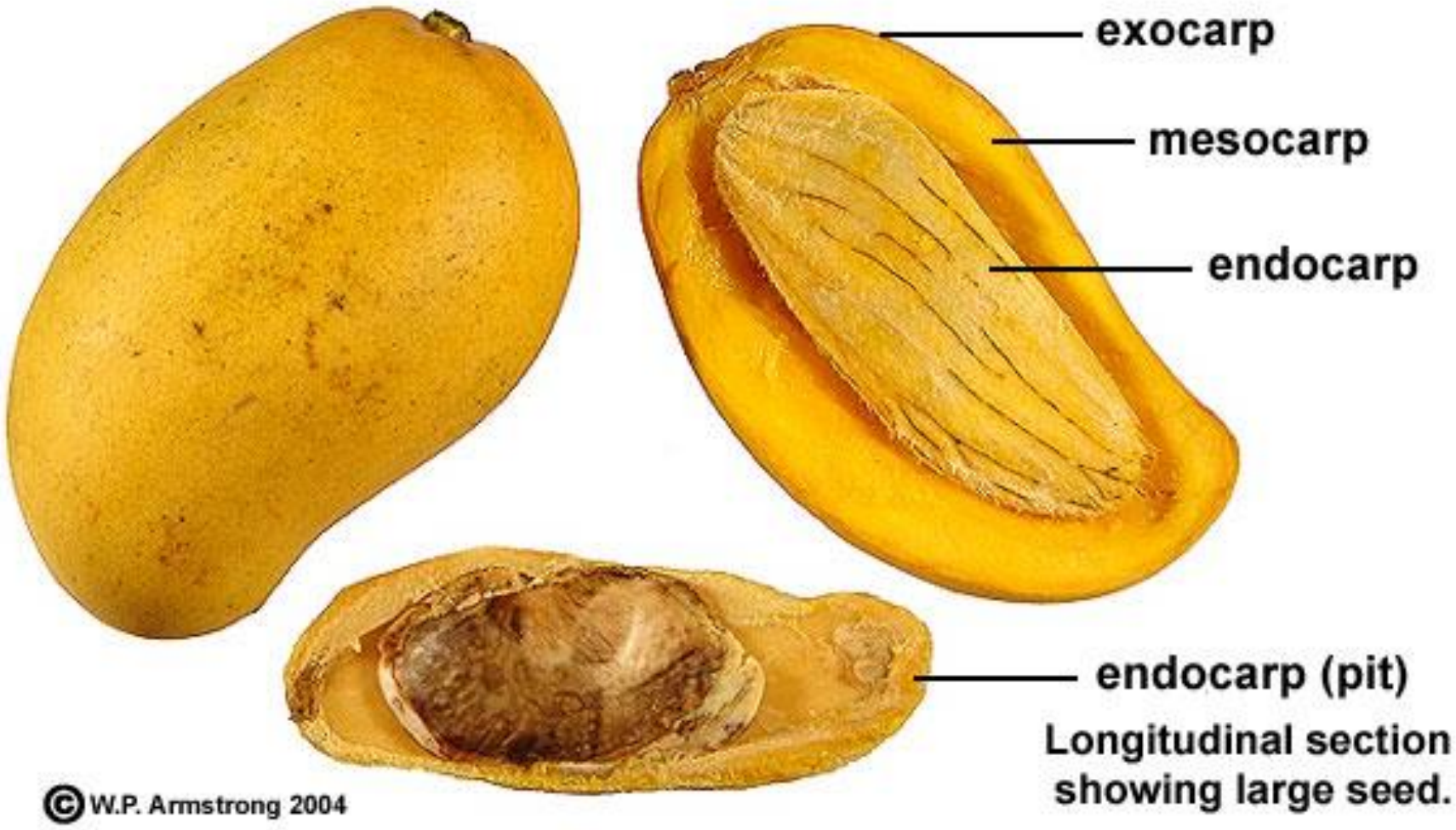
Pericarp is the ovary wall which surrounds the seed (seed container). It has three regions: **exocarp/epicarp**, **mesocarp** **and** **endocarp**.

STRUCTURE

Parts of the Pericarp:

1. **Exocarp/Epicarp** - outer part, skin of the fruit
2. **Mesocarp** - middle part, flesh of the fruit.
3. **Endocarp** - inner part, encloses the seed.

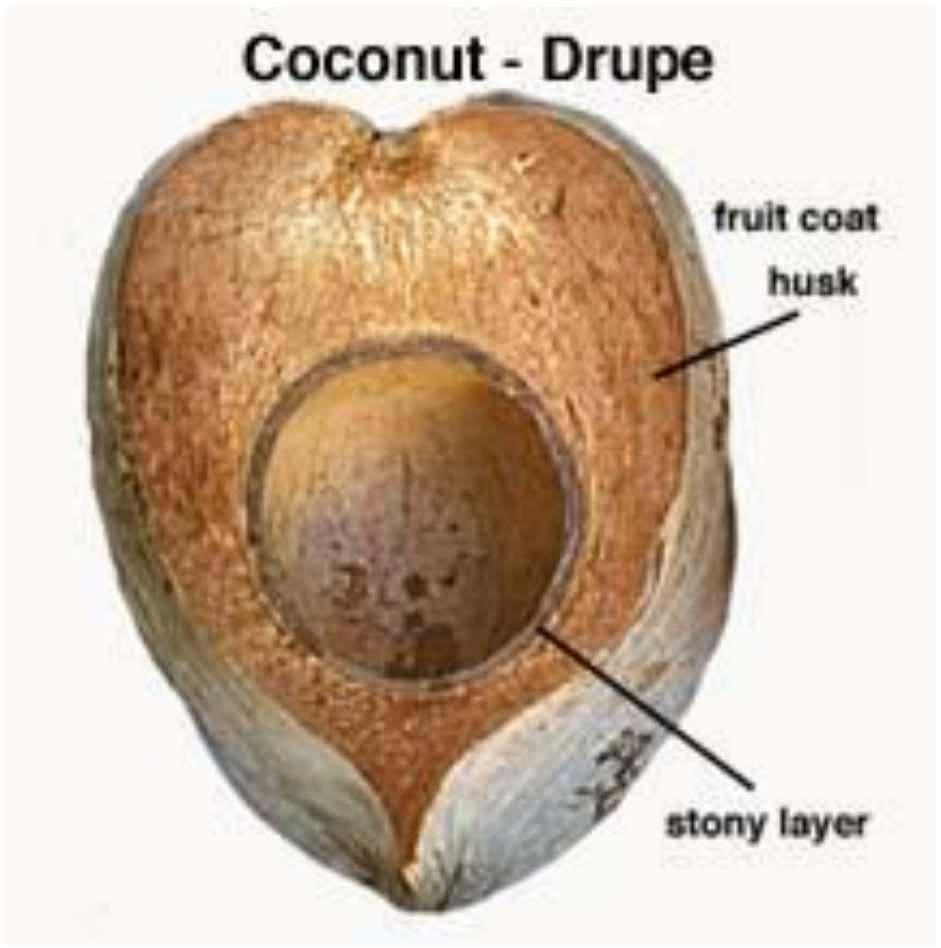
STRUCTURE

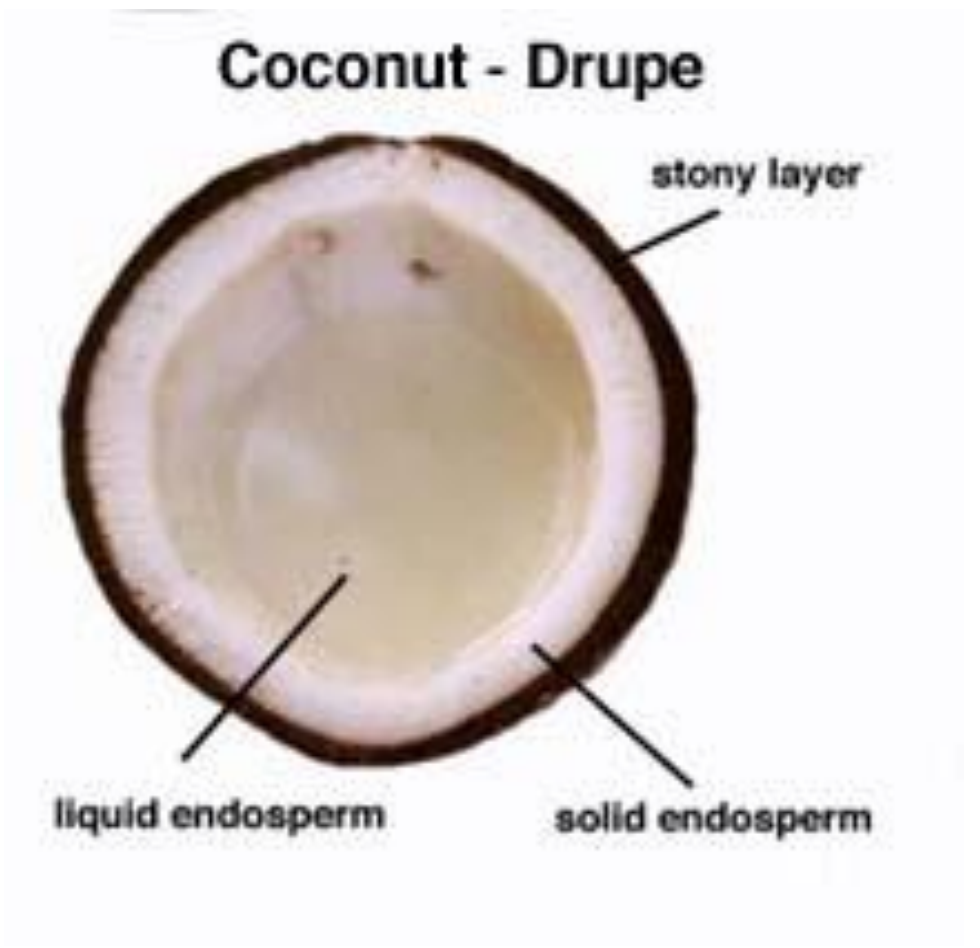

exocarp
mesocarp
endocarp
endocarp (pit)
Longitudinal section showing large seed.
© W.P. Armstrong 2004

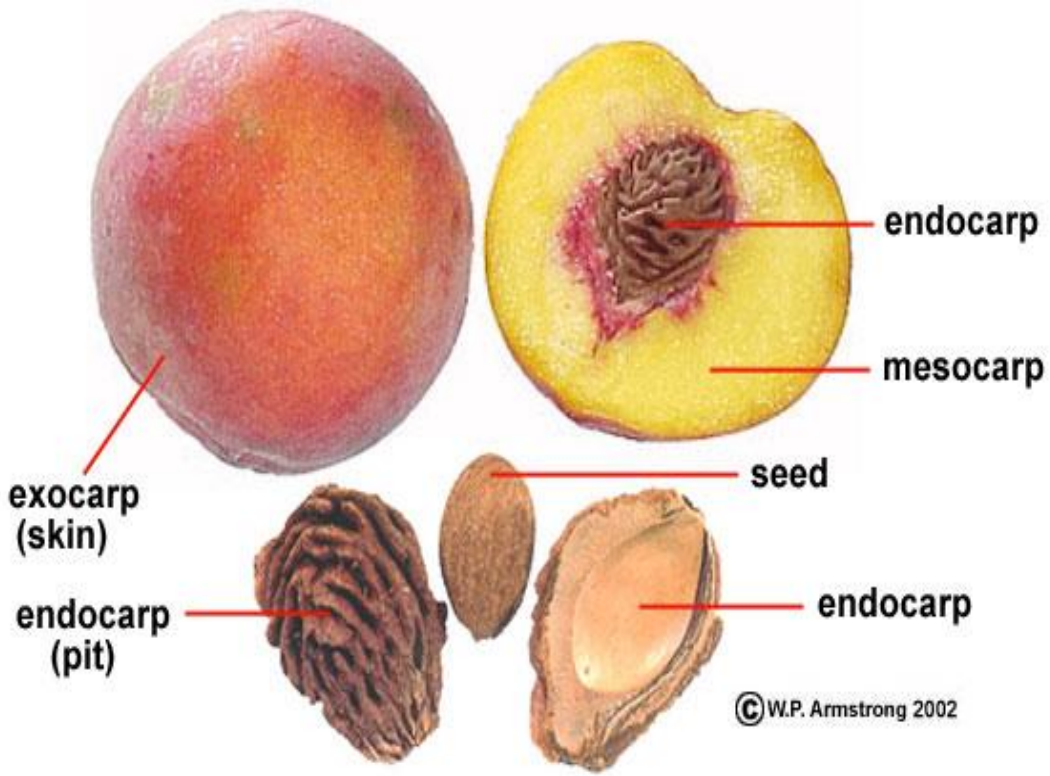
A – Drupes

- A one-seeded simple fruit developed from a superior ovary.
- The innermost portion of the wall (endocarp) becomes hard and stony.
- The outermost part (exocarp) becomes a relatively thin skin.
- The middle portion between the skin and the stone (mesocarp) becomes either fleshy or fibrous. (cherry)

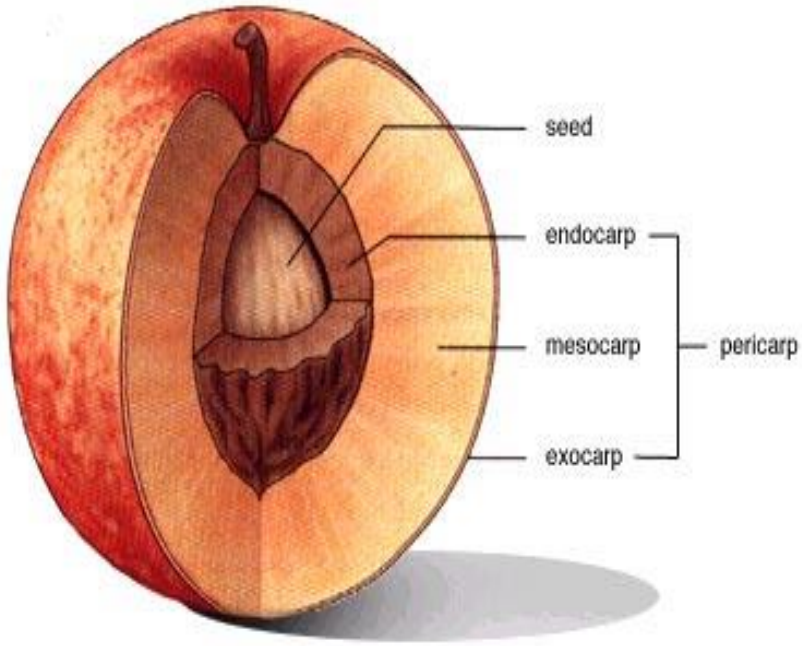
- If a fruit is fleshy and it has a hard stony pit containing a seed it is classified as a **drupe**.
- Drupes are covered by a thin skin derived from the outer tissue layer of the ovary.
- The soft fleshy tissue below the skin is derived from the middle layer of the ovary and the hard stony pit is derived from the inner tissue layer of the ovary.
- Cracking the pit open reveals a single seed formed from an ovule contained within the ovary of the flower.
- Coconuts have fibrous walls instead of the fleshy walls found in most drupes.


Coconut - Drupe
fruit coat
husk
stony layer


Coconut - Drupe
stony layer
liquid endosperm
solid endosperm



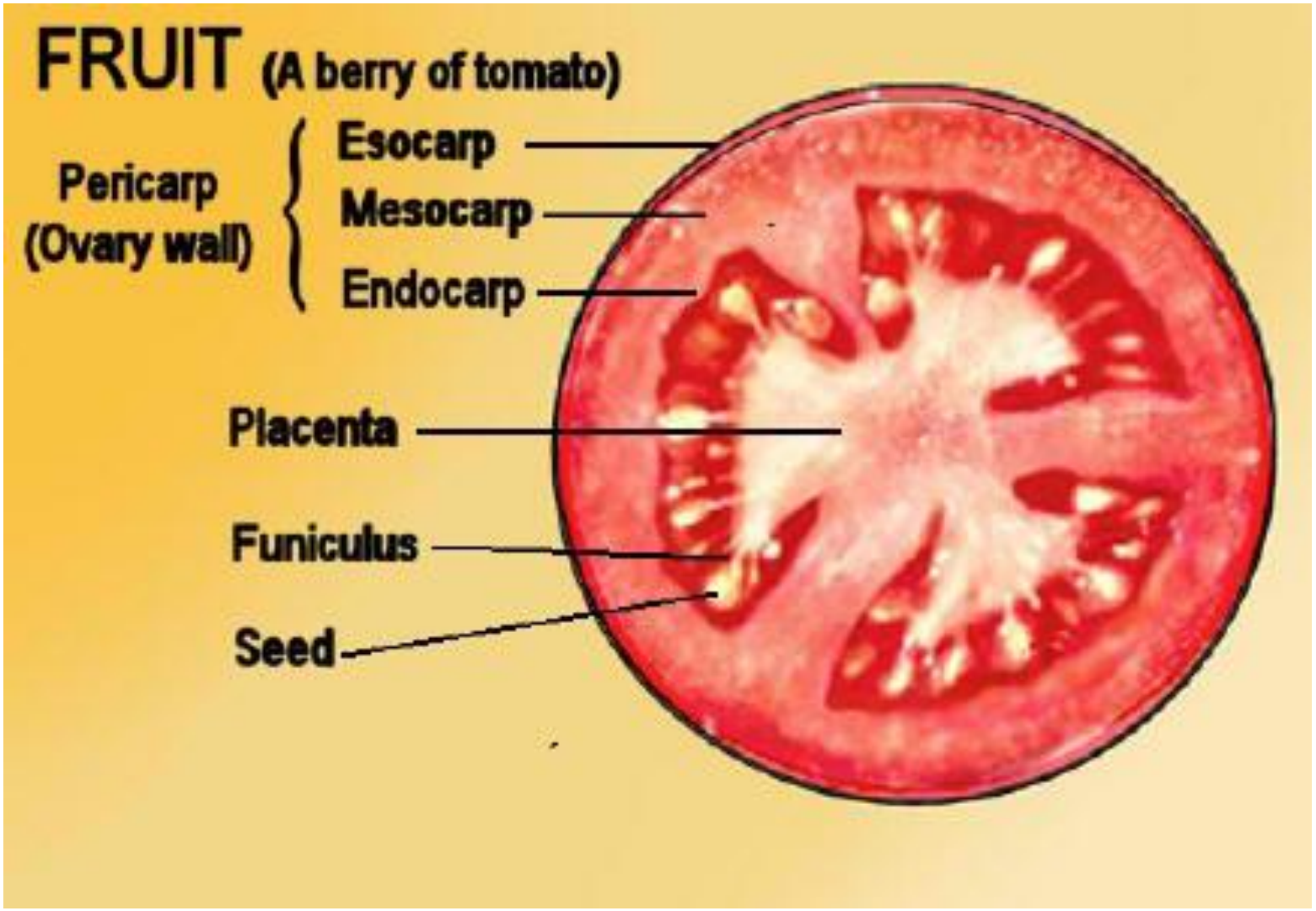
Drupe (fleshy fruit with a stony endocarp)



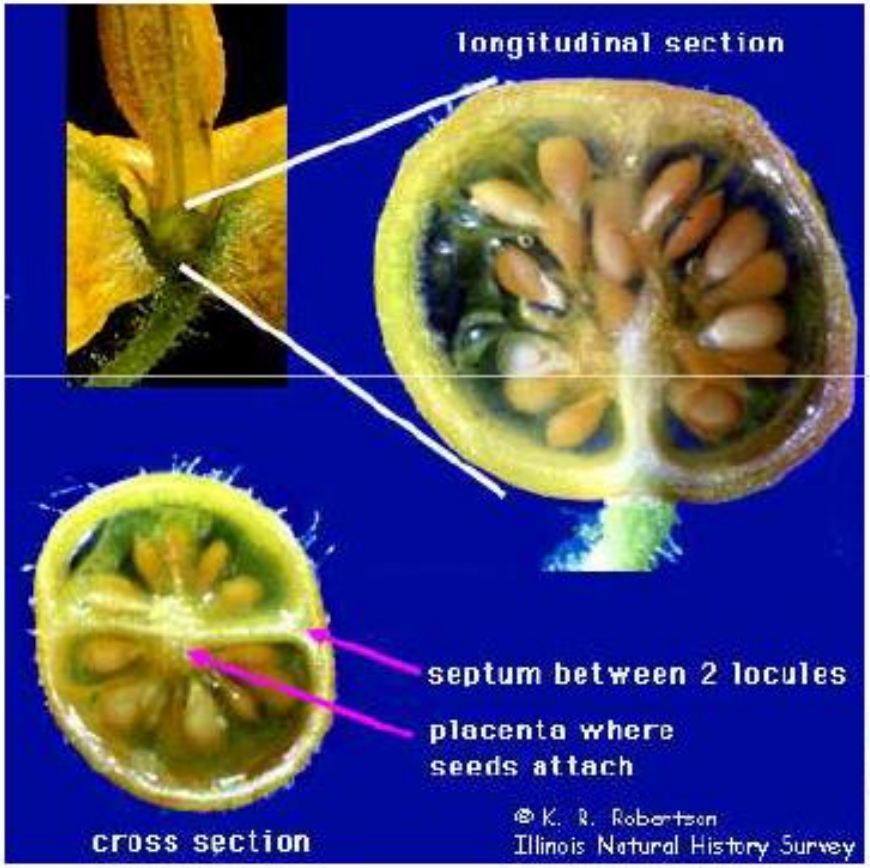
B. The Berry

- ✓ A simple fruit in which the ovary wall or at least its inner portions become enlarged and usually juicy.
- ✓ It is derived from monocarpellary or polycarpellary syncarpous ovary.
- ✓ Have one to many seeds and a pericarp that becomes soft and often sweet and slimy as it matures.
- ✓ Berries have a pericarp divided into three layers but here the endocarp also is fleshy and usually the whole fruit is eaten.
- ✓ Grapes, tomatoes, green peppers, blueberries, guavas, bananas, papaya

STRUCTURE


FRUIT (A berry of tomato)
Pericarp (Ovary wall)
Esocarp
Mesocarp
Endocarp
Placenta
Funiculus
Seed

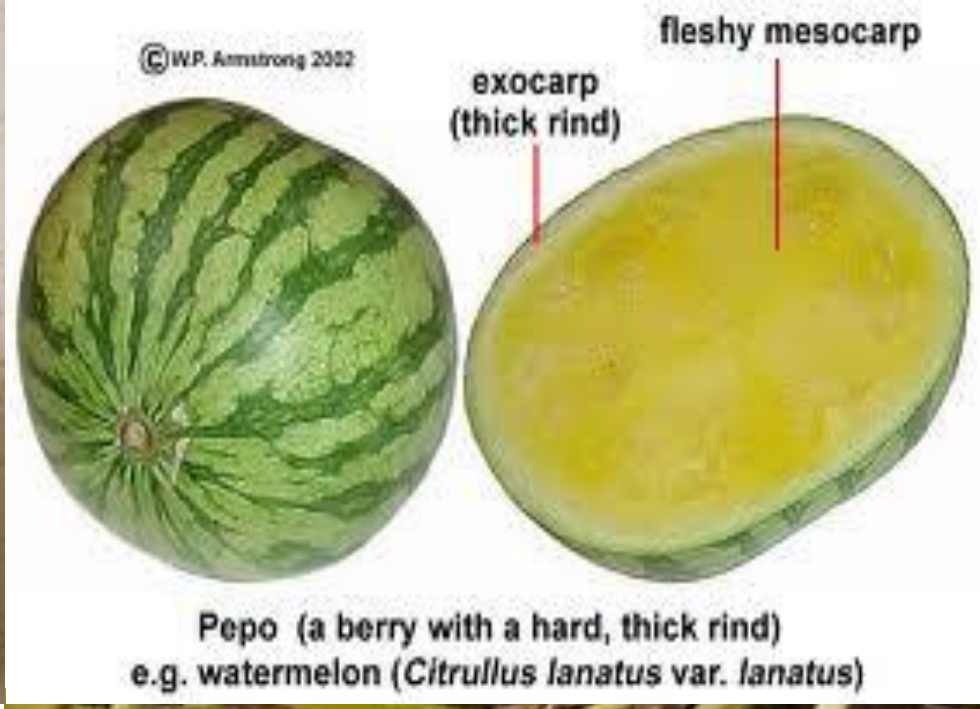
Berry


longitudinal section
septum between 2 locules
placenta where
seeds attach
cross section
© K. R. Robertson
Illinois Natural History Survey

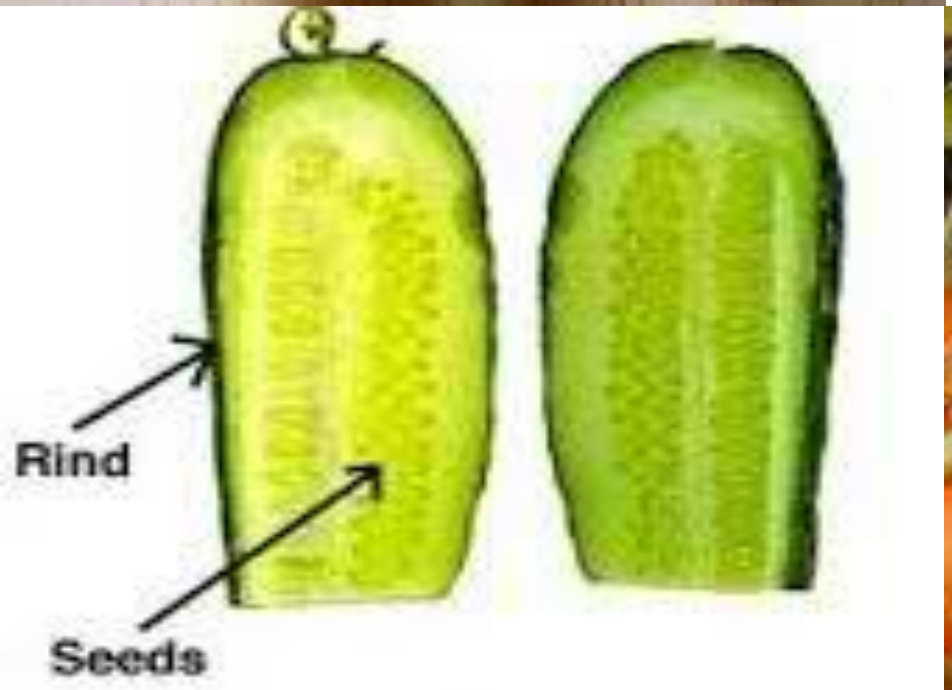

Papaya
Avocado
Eggplant
Pepper

C. Pepos

- Have thick or hard exocarp.
- Have a receptacle that partially or completely encloses the ovary.
- Pumpkins, cucumber, squashes, cantaloupes, watermelons

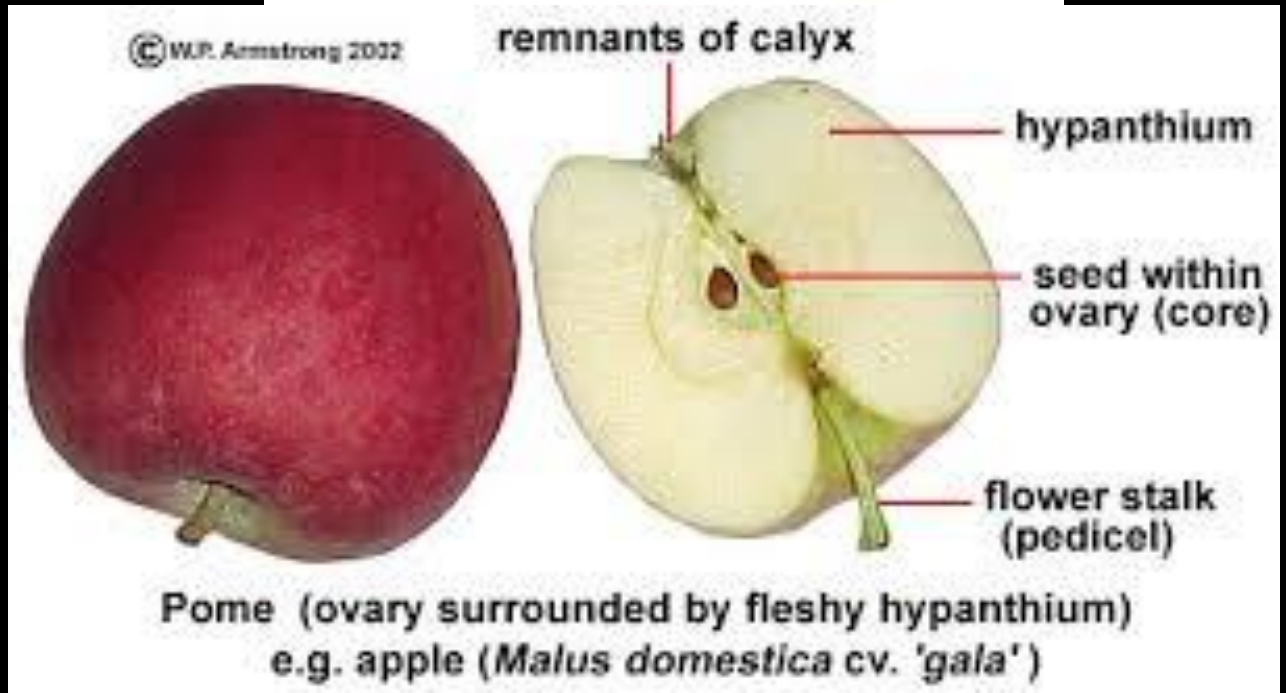


Pepo (a berry with a hard, thick rind)
e.g. watermelon (*Citrullus lanatus* var. *lanatus*)



D. Pomes (Accessory Fruit)

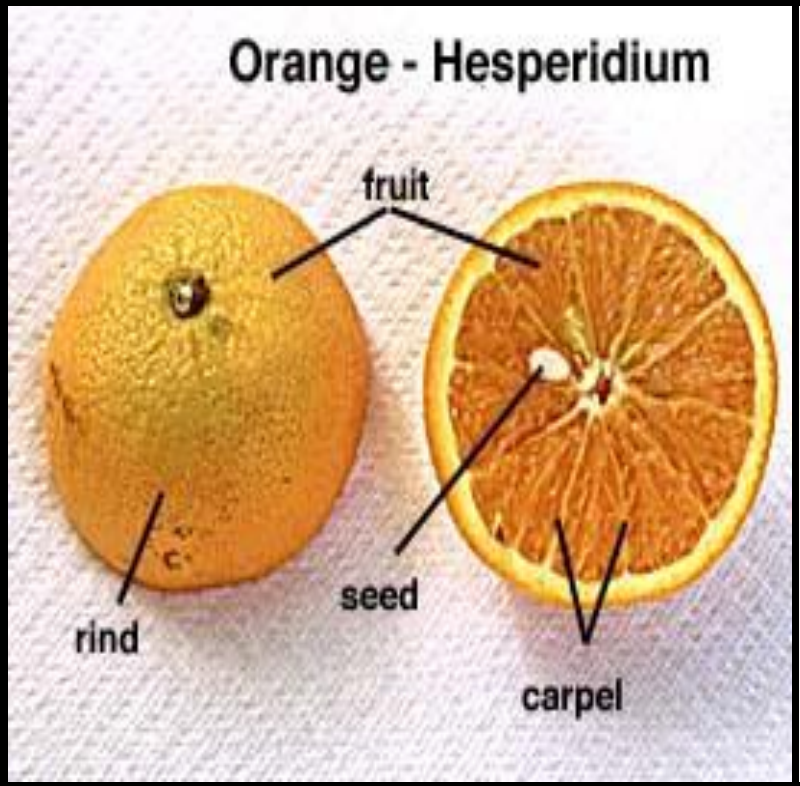
- ✓ A **pome** (after the French name for an apple: *pomme*)
- ✓ An accessory fleshy fruit formed by a group of carpels more or less firmly united with each other and surrounded by and united to the floral tube or receptacle. (apple, pear, mountain ash).
- ✓ Consists of tissue derived from the ovary and from the perianth.
- ✓ Its bulk is formed from a swollen receptacle.
- ✓ Have a thin exocarp and a papery cartilaginous mesocarp.

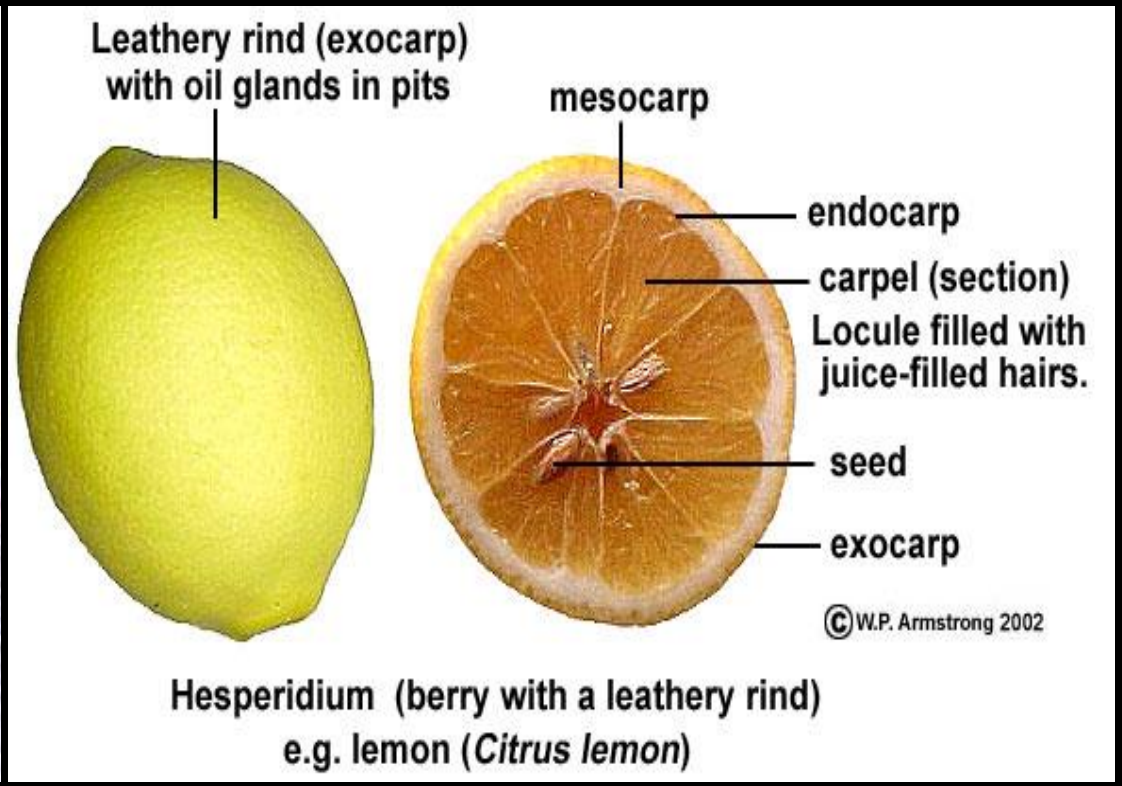


Pome (ovary surrounded by fleshy hypanthium)
e.g. apple (*Malus domestica* cv. *'gala'*)

E. Hesperidium

- ✓ This is a special type of berry in which a leathery rind forms the Exocarp.
- ✓ The interior of the fruit divided by septa, indicating the number of carpels. most of the edible fruit formed by glandular hairs, e.g., citrus fruits: orange, lemon, lime, grapefruit (*Citrus*, Rutaceae).





2. DRY FRUITS

- **Fruits in which the coat becomes dry at maturity.**

Three Major types of Dry Fruits:

A. Dehiscent Fruits - Dry fruits which at maturity open by definite natural beans to shed the contained seeds.

B. Indehiscent fruits - Dry fruits which do not open when mature to shed their seeds. Many of this group are one seeded fruits.

C. Schizocarp - A fruit that develops from a single compound ovary (with 2 or > locules), but dehisces into separate 1-seeded units (mericarps), each of which appears to be a distinct fruit.

A. Dehiscent Fruits

- ✓ Have hard texture and wood-like leathery appearance.
- ✓ Split open at maturity to shed seeds.

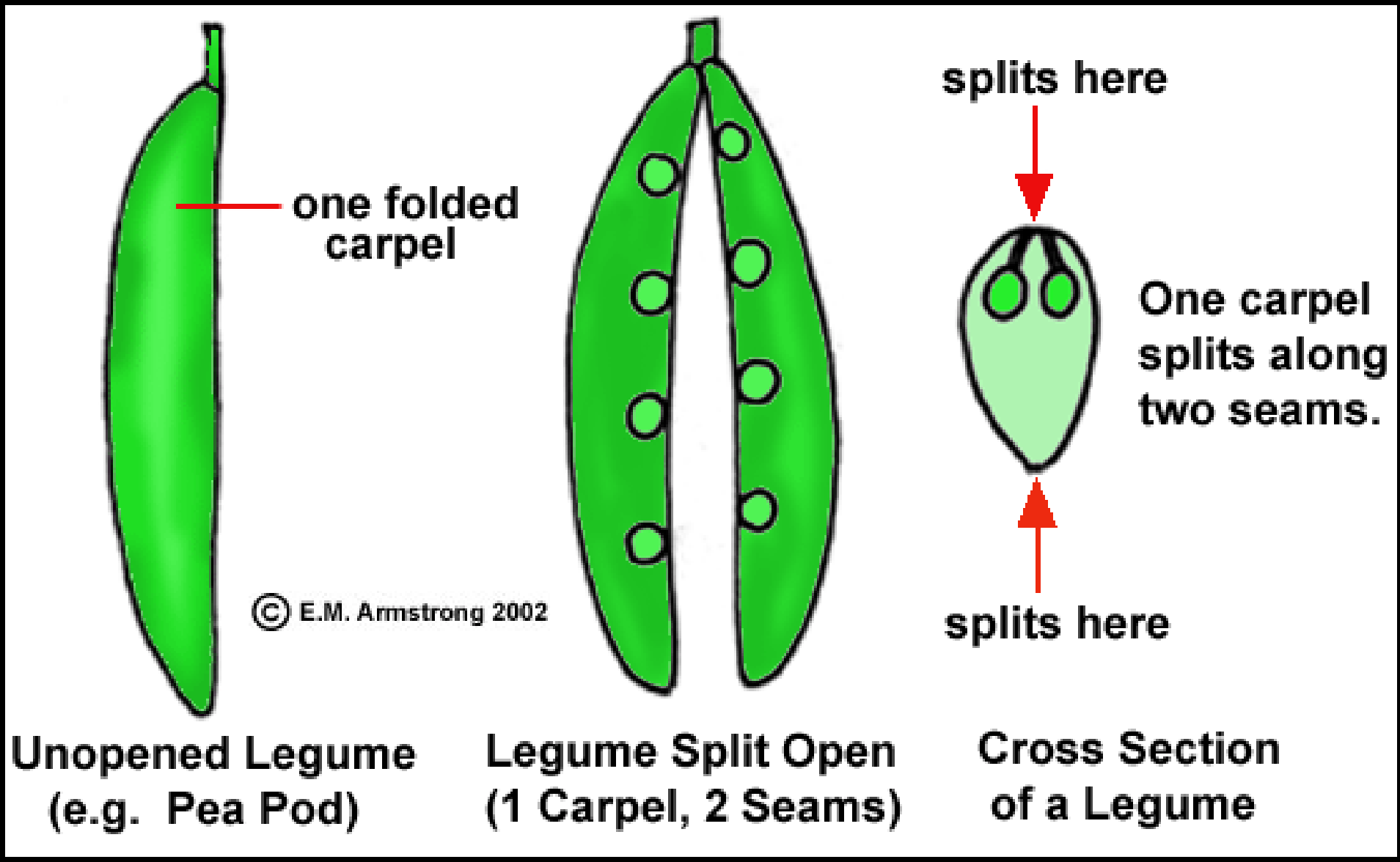
Types of dehiscent fruits

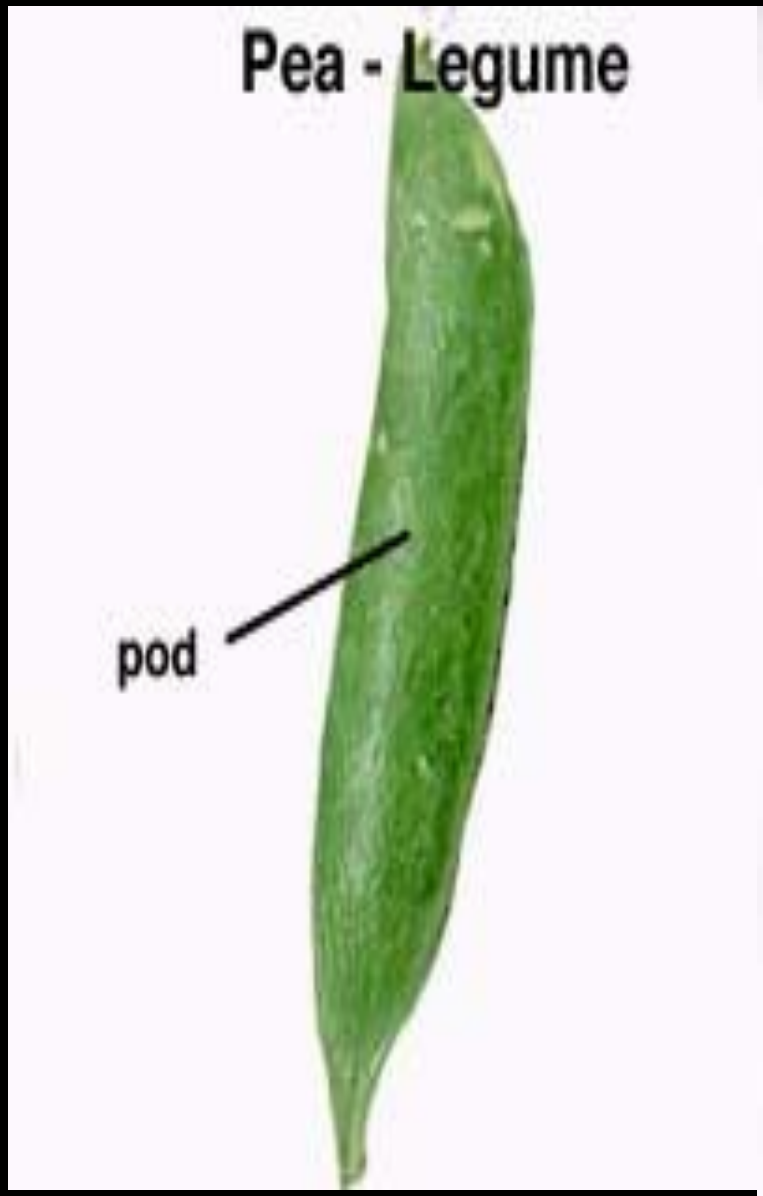
1. Legume
2. Follicle
3. Siliqua
4. Siliqula
5. Capsule

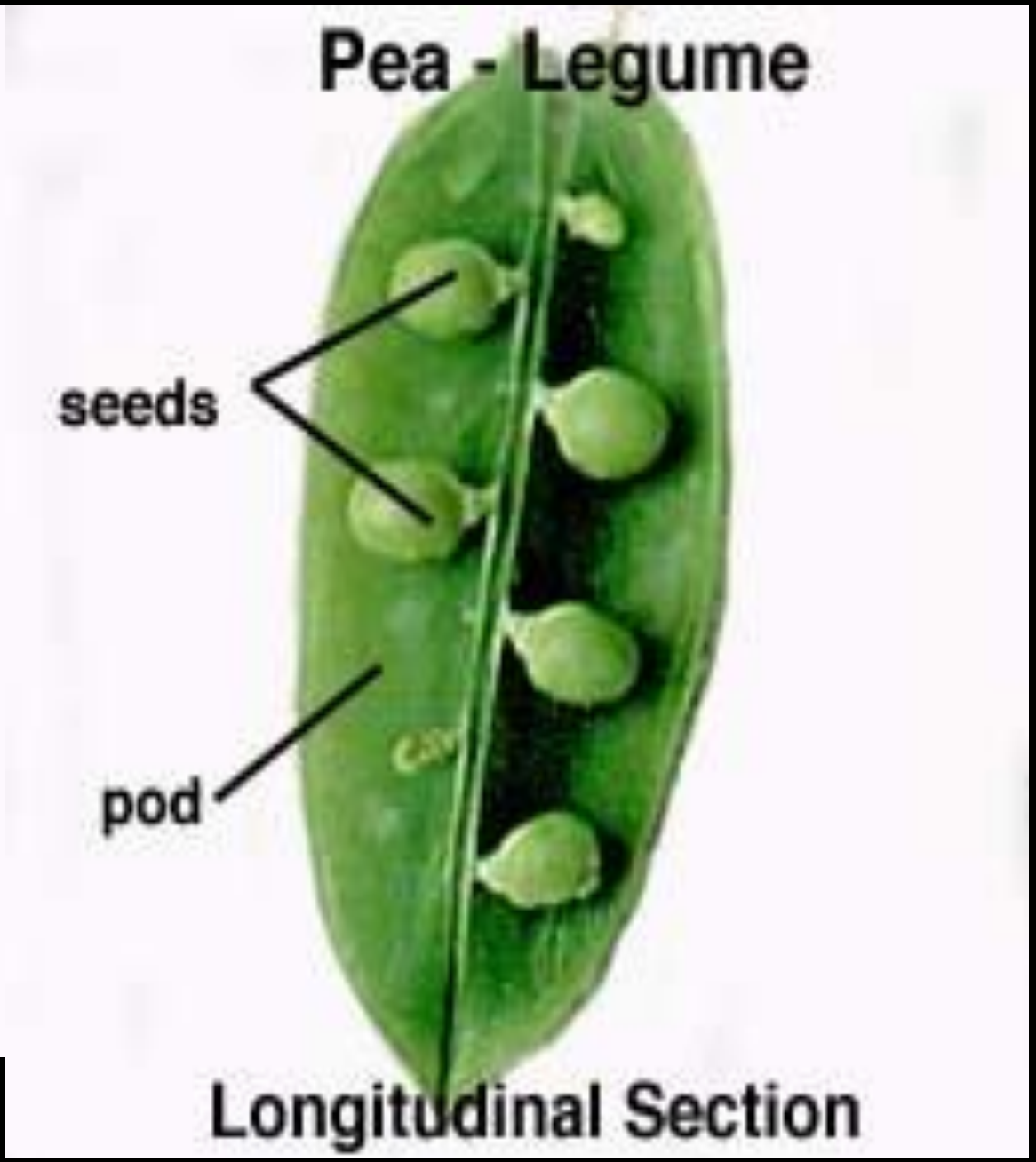
1. LEGUME

A dry dehiscent fruit developed from **1 carpel** and at maturity splitting along both the **dorsal** and **ventral** sutures. (beans, peas).

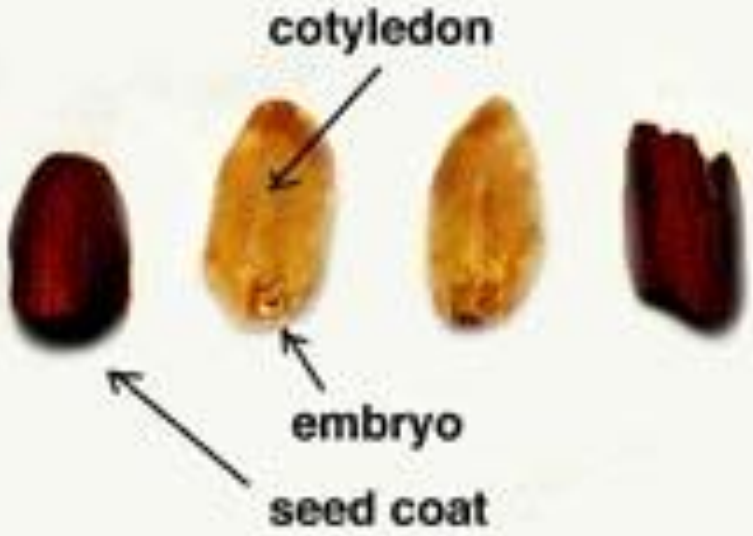
- The legume type fruit is derived from a simple ovary (one carpel) with two rows of ovules.
- The legume splits along two lines of dehiscence following maturation and drying.
- This type of fruit structure is characteristic of peas, beans and peanuts.
- The **peanut** is one of the few legumes that does not split open when ripe. This is probably because the fruit of the peanut develops in the soil rather than in the air.


one folded carpel
© E.M. Armstrong 2002
splits here
One carpel splits along two seams.
splits here
Unopened Legume (e.g. Pea Pod)
Legume Split Open (1 Carpel, 2 Seams)
Cross Section of a Legume


Pea - Legume
pod


Pea - Legume
seeds
pod
Longitudinal Section

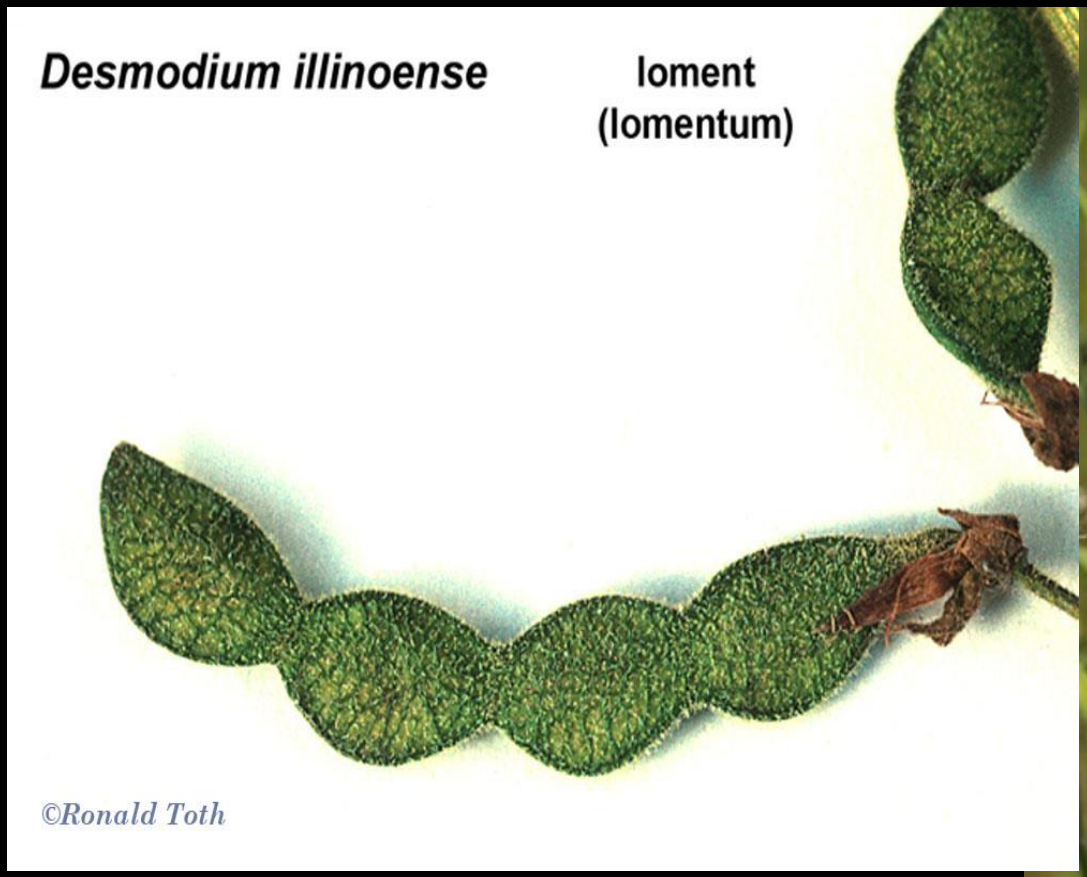
Peanut - Legume



Peanut - Legume

***Loment .

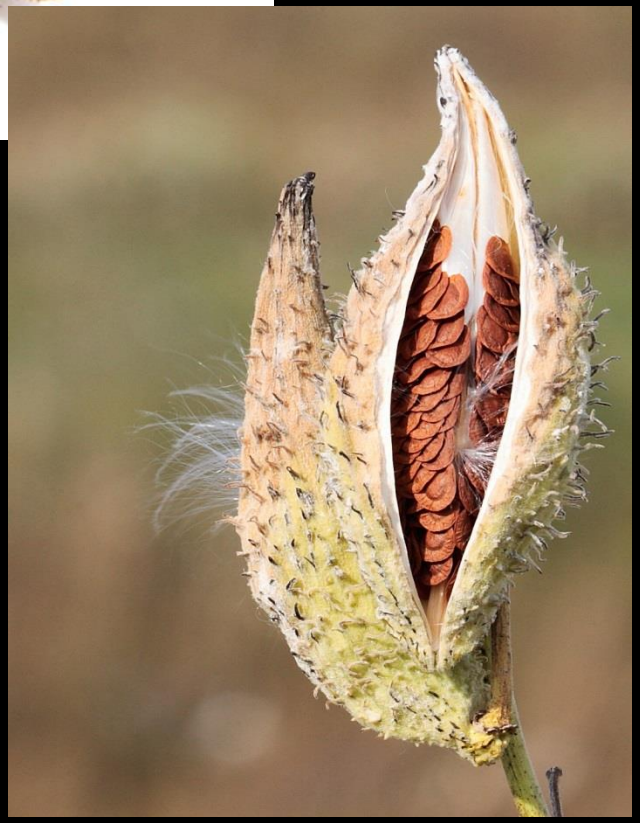
A legume, derived form a 1-carpelled ovary, that is contracted between seeds and which separates transversely into 1-seeded segments (articles) at maturity, e.g., sweet vetch (*Hedysarum*, Fabaceae), tick-clover (*Desmodium*, Fabaceae).



2. Follicle

A dry dehiscent fruit developed from **1 carpel** and at maturity splitting along only **one suture**. (larkspur, columbine, *Delphinium ajacis*)

- ✓ Fruit of the Follicle type develop from a single ripened ovary and split once to release their seeds.
- ✓ The split is always lengthwise, along one edge of the carpel. Legumes you remember split along two edges of the carpel.

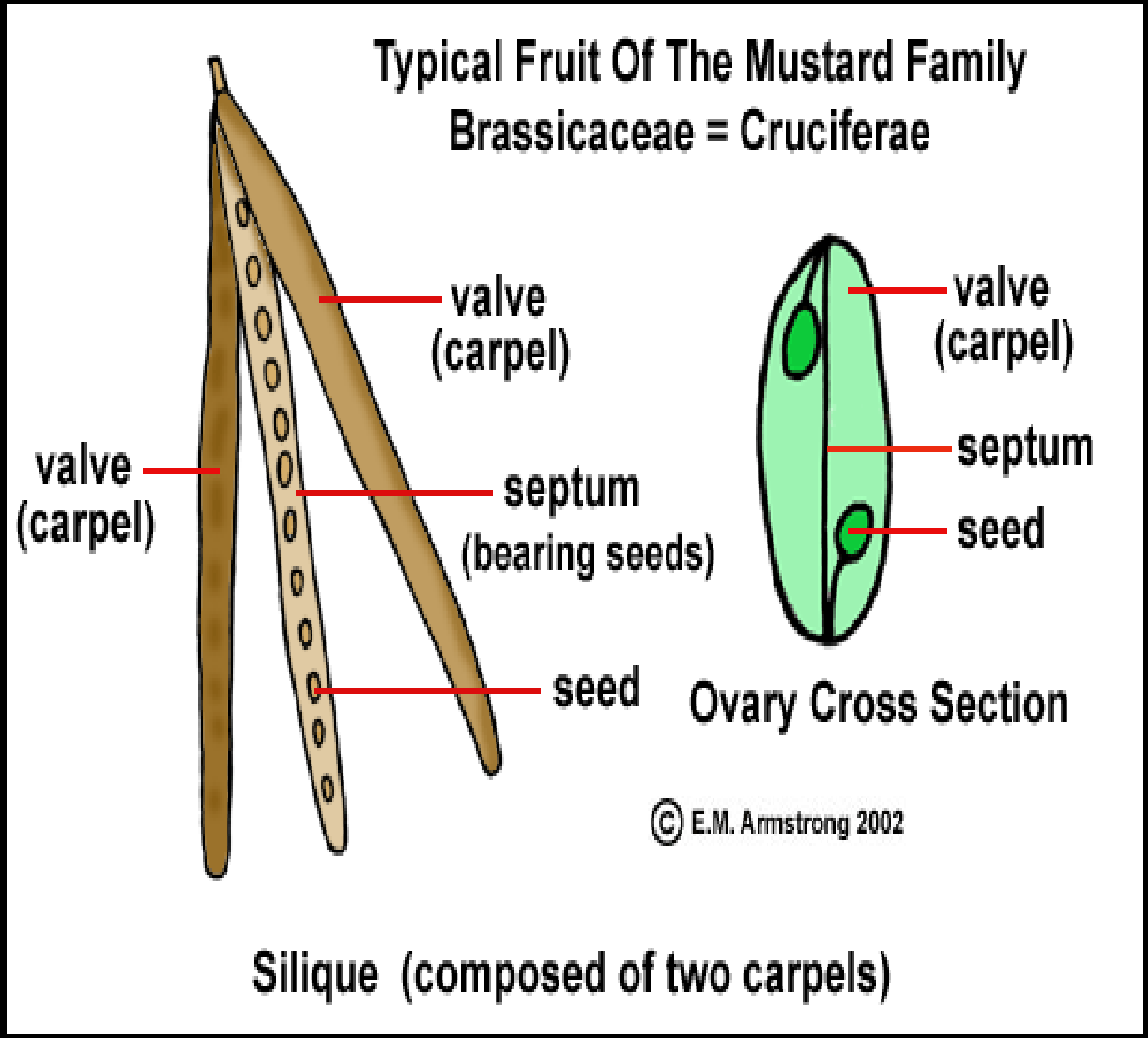


Follicle

3. Silique:

Two carpels separated by a seed-bearing septum.

- ✓ **A dry, dehiscent, elongated fruit, typically more than twice as long as wide, formed from one flower having a single ovary divided into two carpels, separated by a partition (septum) that bears the ovules/seeds; generally, the carpels separate when ripe, although a few separate between seeds along joints**
- ✓ **A silicle is a short silique, no more than twice as long as broad.**
- ✓ **Siliques and silicles have parietal placentation.**
- ✓ **They are the characteristic fruits of the mustard family (Brassicaceae). Some members of the mustard family have siliques that do not split longitudinally into two separate carpels. For example, fruits of the radish (*Raphanus sativus*) split transversely into seed-bearing sections (joints).**


Typical Fruit Of The Mustard Family
Brassicaceae = Cruciferae
valve
(carpel)
valve
(carpel)
septum
(bearing seeds)
seed
valve
(carpel)
septum
seed
Ovary Cross Section
© E.M. Armstrong 2002
Silique (composed of two carpels)

Silique

4. Siliqula

Simillar to siliqua but shorter and broader , It is almost as broad as long.

Examples: *Iberis amara* (Candytuft), *Capsella bursa-pastoris* (Shepherd's purse).

5. Capsule

- ✓ A capsule is a dry, dehiscent fruit containing multiple seeds.
- ✓ Derived from superior multicarpellary , syncarpous ovary.

- ✓ Dehiscence indicates that the capsule opens when mature to release the seeds. Capsules are a common fruit type and there are numerous different forms.

- ✓ Capsules contain several to many seeds and are categorized by the way they split to release the seeds in a variety of ways. The simplest capsule has only two chambers (locules) with two seeds as shown in lilac.

- ✓ There are many different types of capsules, described according to how they dehisce.

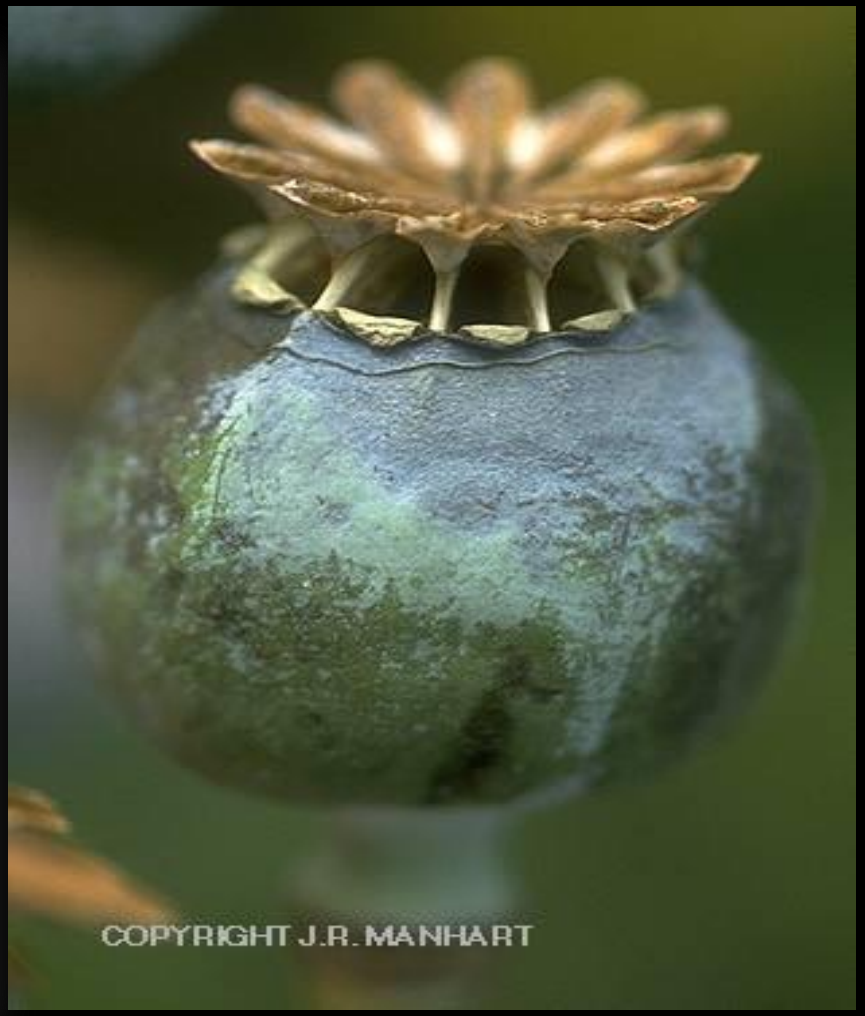
On the basis of dehiscence capsules are of the following types:

i. Opening by **pores** (Porocidal)
ii. Opening by **teeth**. (Denticidal capsule)
iii. Opening by **lid** or (Pyxis)
iv. Opening by **Valves**
    a. **Septicidal** dehiscence
    b. **Loculicidal** dehiscence
    c. **Septifragal** dehiscence

i. Capsule Opening by pores (Porocidal)

Seeds are released through openings or pores that form in the capsule.

Ex. ***Papaver*** **spp**



ii. Capsule opening by teeth. (Denticidal capsule)

A capsule that dehisces apically, forming 5-10 teeth, small teeth at the top of the fruit split open to release the seeds, as in *Silene* spp

iii. Opening by lid or (Pyxis)

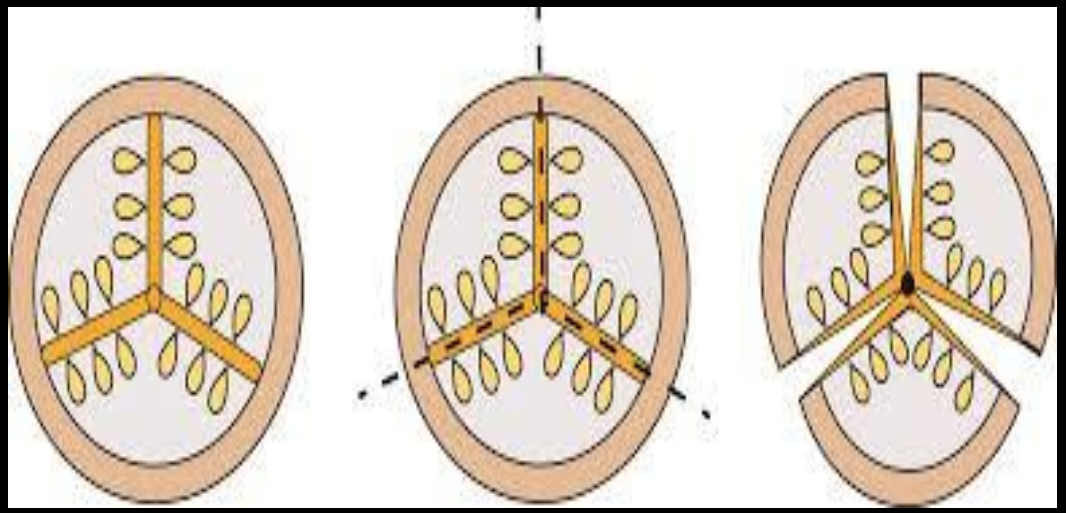
These types of capsules separate into two pieces along a horizontal circular line across the fruit This produces a lid that pops off to release the seeds.

Ex. *anagallis arvensis* نبات عين القط

iv. Opening by Valves

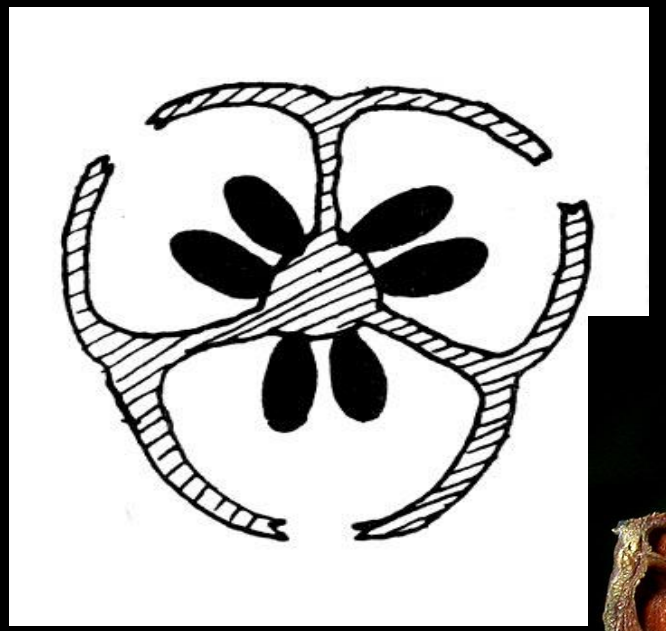
a.Septicidal dehiscence.

A capsule that dehisces longitudinally through the fused sides (septa) of the carpels, e.g., lily (*Lilium*, Liliaceae), willow (*Salix*, Salicaceae), .



b. Loculicidal dehiscence capsule.

A capsule that dehisces longitudinally through the cavity of the locules, e.g., evening primrose (*Epilobium*, Onagraceae), most orchids (Orchidaceae), horse chestnut (*Aesculus*, Sapindaceae), crepe myrtle (*Lagerstroemia*, Lythraceae), and cotton (*Gossypium barbadense*)

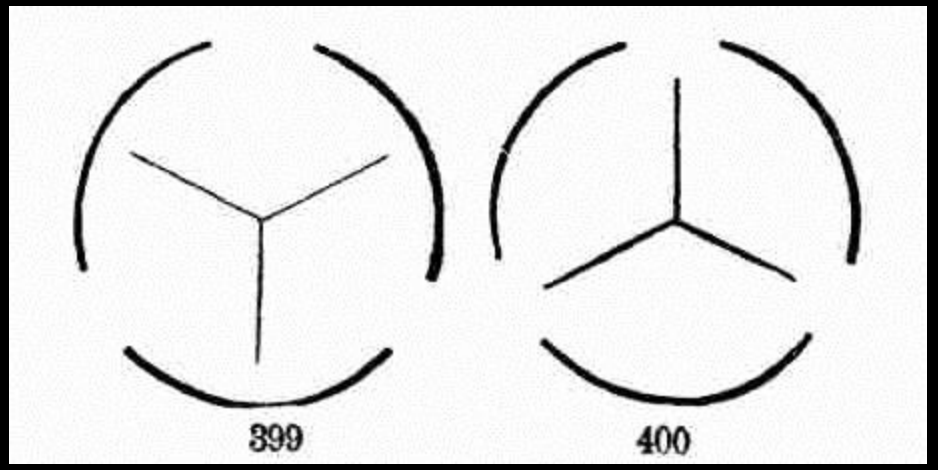


Gossypium

c. Septifragal

Here, the pericarp breaks away completely from the septa and further the dehiscence may be of septicidal or loculicidal type.
e.g. *Datura* spp.

399. Diagram of septifragal dehiscence of the loculicidal type. Same of the septicidal or *marginicidal* type.



B. Indehiscent fruits

- Dry fruits which do not open when mature to shed their seeds. Many of this group are one seeded fruits.
- These fruits do not dehisce but the seeds are released only after the decay of the pericarp.

a: with a thin, papery, fibrous, or leathery pericarp

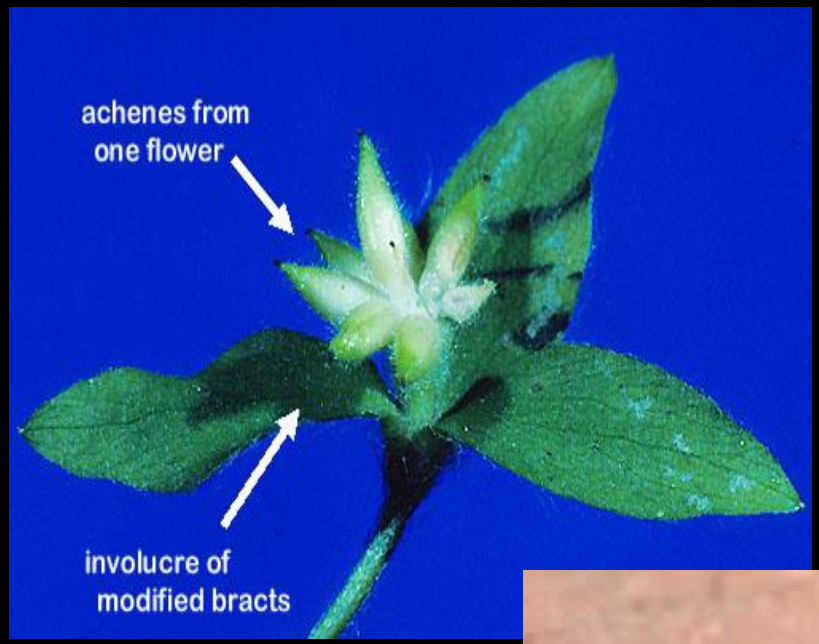
-1- Achene
-2- Cypsela
-3- Caryopsis
-4- Samara
-5- Utricle
-6- Balausta

b: with a hard pericarp:

-7- Nut
-8- Nutlet
-9- Calybium

1- Achene

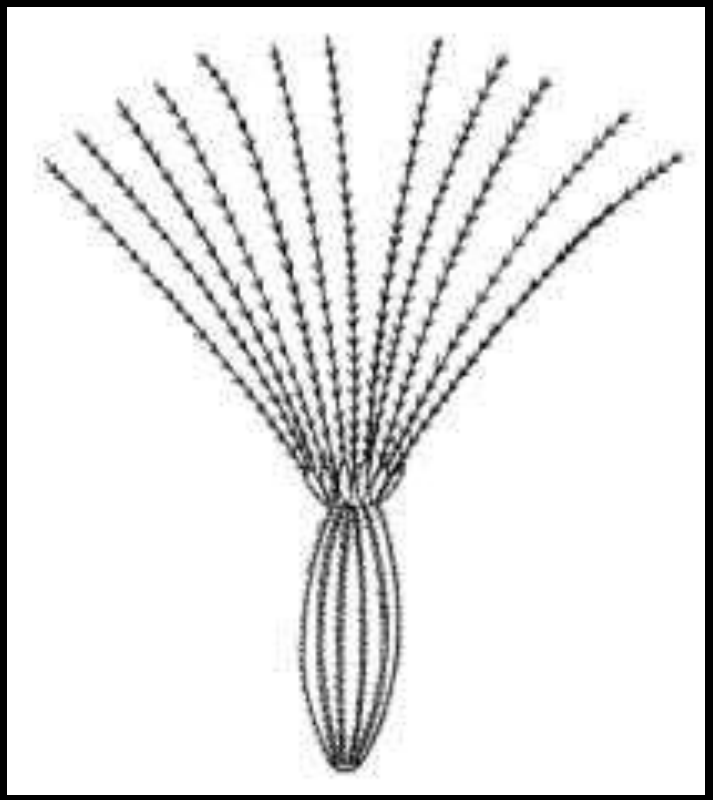
A simple, dry, indehiscent, 1-seeded fruit with the seed attached to the fruit wall at only one point; derived from a **superior ovary with 1 locule and 1 ovule, leathery pericarp Ex. *Rosa***



**A Hep or Hip is a fleshy fruit containing achenes, as in the Rose (*Rosa*);

2- Cypsela

It is a simple, dry, indehiscent fruit developing from **inferior**, **bicarpellary**, **syncarpous**, **monolocular** ovary with a single ovule. The pericarp is thin and free from the seed coat, e.g. *Helianthus*, dandelion (*Taraxacum*, Asteraceae), characteristic of many spp. of the Asteraceae.



Cypsela or Achene?

An achene is a dry, one-chambered, single-seeded fruit, formed from a single carpel, with the seed attached to the membranous outer layer (wall) only by the seed stalk; the wall, formed entirely from the wall of the superior ovary, does not split open at maturity, but relies on decay or predation to release the contents.

A cypsela is a dry, one-chambered, single-seeded fruit, formed from a single carpel, with the seed attached to the membranous outer layer (wall) only by the seed stalk; the wall, formed from the wall of the inferior ovary and also from other tissues derived from the receptacle or hypanthium, does not split open at maturity, but relies on decay or predation to release the contents.

The difference between a cypsela and an achene is the fruit's origin. **A cypsela** is formed from an **inferior ovary** and may have **a pappus**, the modified calyx composed of awns, scales, bristles, or feather-like hairs, attached to one end. An achene is formed from an superior ovary and does not have a pappus attached.

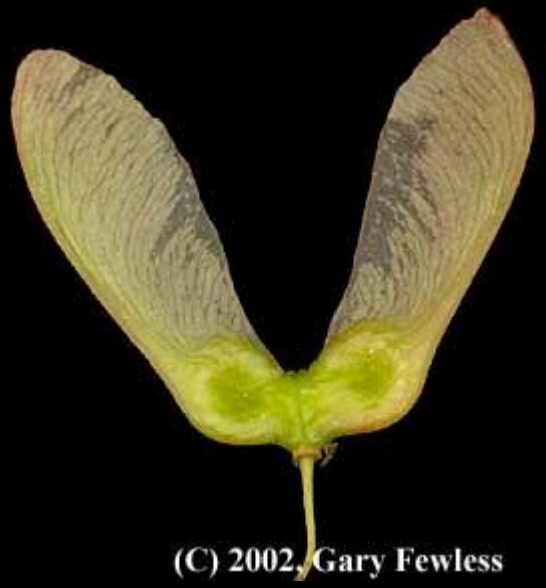
Sunflowers *(Helianthus* spp.*)* are in the family Asteraceae. All plants in that family have inferior ovaries. The fruit of a sunflower is a cypsela.!!!!

3- Caryopsis (or grain)

A dry, indehiscent, 1- seeded fruit with the seed coat **fused** to the fruit wall, derived from a **superior** ovary with 1 locule and one ovule, characteristic of the ***Poaceae***, e.g., corn (*Zea*), wheat (*Triticum*), rice (*Oryza*).

4- Samara

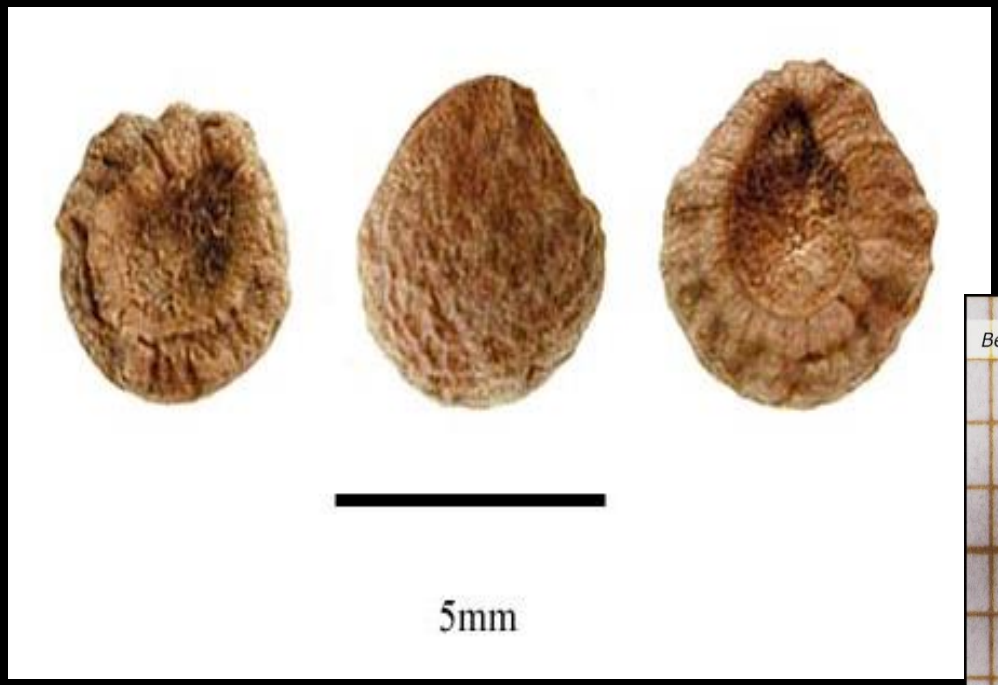
A dry, indehiscent ,1-seeded, winged achene, e.g., ash (*Fraxinus*, Oleaceae), birch (*Betula*, Betulaceae), elm (*Ulmus*, Ulmaceae), hop-tree (*Ptelea*, Rutaceae), maple (*Acer*, Sapindaceae).



Tipuana tipu

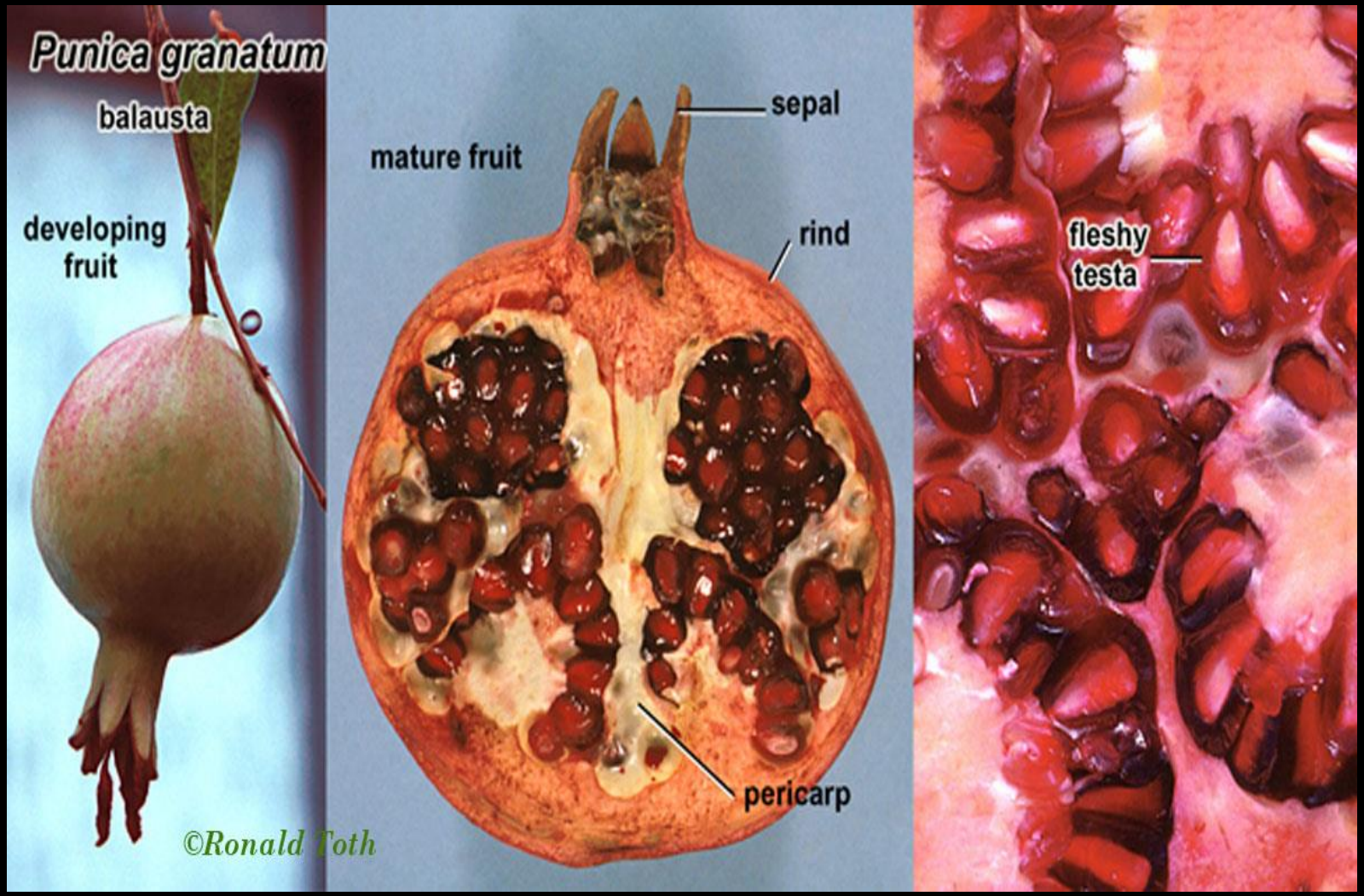
5- Utricle

A small, dry, indehiscent, 1-seeded fruit with a thin, bladdery or inflated pericarp, e.g., beet (*Beta*, Amaranthaceae), spinach (*Spinacia*, Amaranthaceae).



6- Balausta

An indehiscent, many-seeded, having **a swollen testa**, fruit with a tough, leathery pericarp, derived from an **inferior** ovary with many locules. e.g., pomegranate (*Punica*, Lythraceae).



a: with a hard pericarp:

7- Nut

A hard, indehiscent, 1-seeded fruit with a bony pericarp, derived from a superior ovary with 1 locule; sometimes surrounded by a papery or spiny involucre, or embedded within a spongy receptacle, e.g., hazelnut (*Corylus*, Betulaceae), beech (*Fagus*, Fagaceae), chestnut (*Castanea*, Fagaceae), lotus (*Nelumbo*, Nelumbonaceae).

8- Nutlet

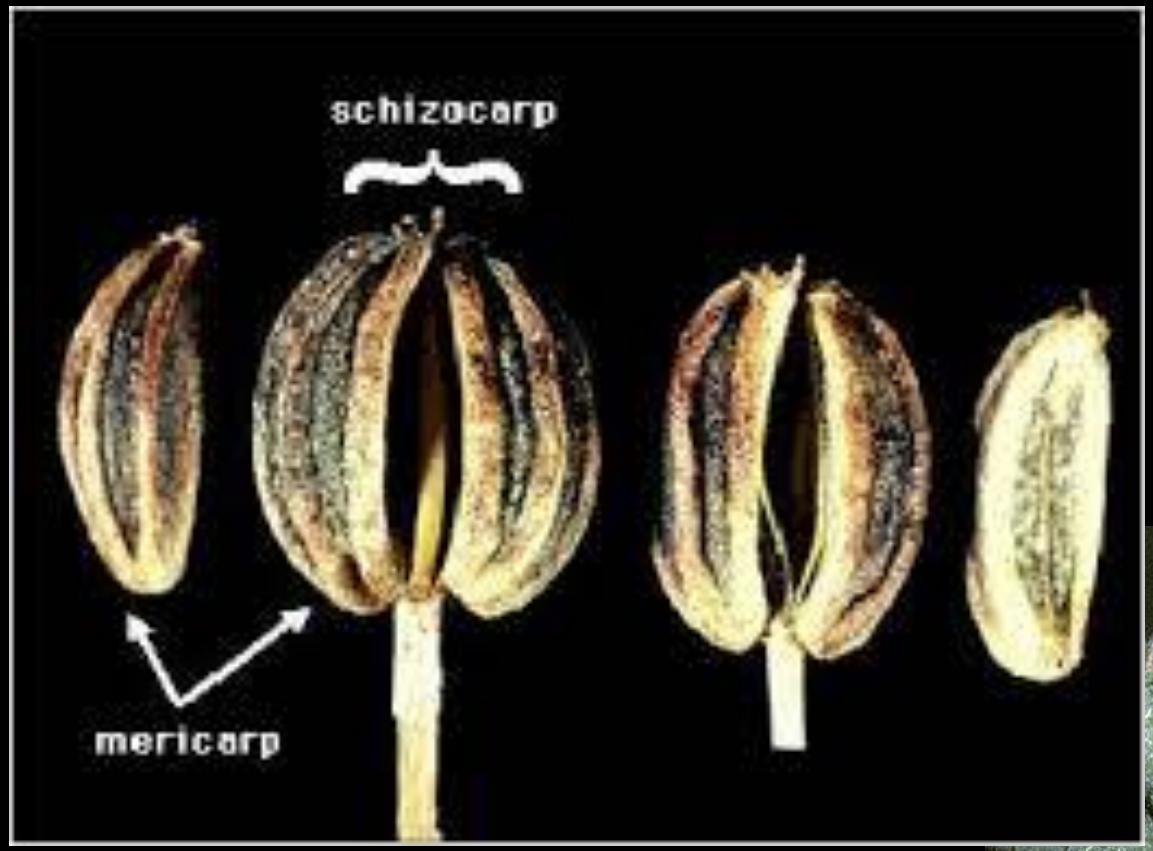
A small nut, sometimes enclosed within a papery bract or attached to a wing-like bract; e.g., mints (*Mentha*, Lamiaceae), ironwood (*Ostrya*, Betulaceae), and hornbeam (*Carpinus*, Betulaceae).

9- Calybium

A nut derived from an **inferior** ovary with 1 locule, e.g., the nut part of an oak acorn (*Quercus,* Fagaceae).

C: Schizocarp

- A fruit that develops from a single compound ovary (with 2 or > locules), but dehisces into separate 1-seeded units (mericarps), each of which appears to be a distinct fruit, e.g., mallow (*Malva*, Malvaceae), hogweed (*Heracleum*, Apiaceae).
- Schizocarps can be fleshy or dry; subcategories of schizocarps are named for the individual fruit type.
- **Mericarp** - each unit of a schizocarp, each of which looks like a distinct fruit. A schizocarp of 2 mericarps is typical of the carrot family (Apiaceae), e.g. carrot (*Daucus*, Apiaceae).
- A characteristic of schizocarps of the Apiaceae is the carpophore, a thin, forked extension of the floral axis between adjacent mericarps, visible in this picture of the mericarps of sweet cicely (*Osmorhiza*, Apiaceae).
- The persistent style of the fruit, called the beak or rostellum, is also visible on this image.

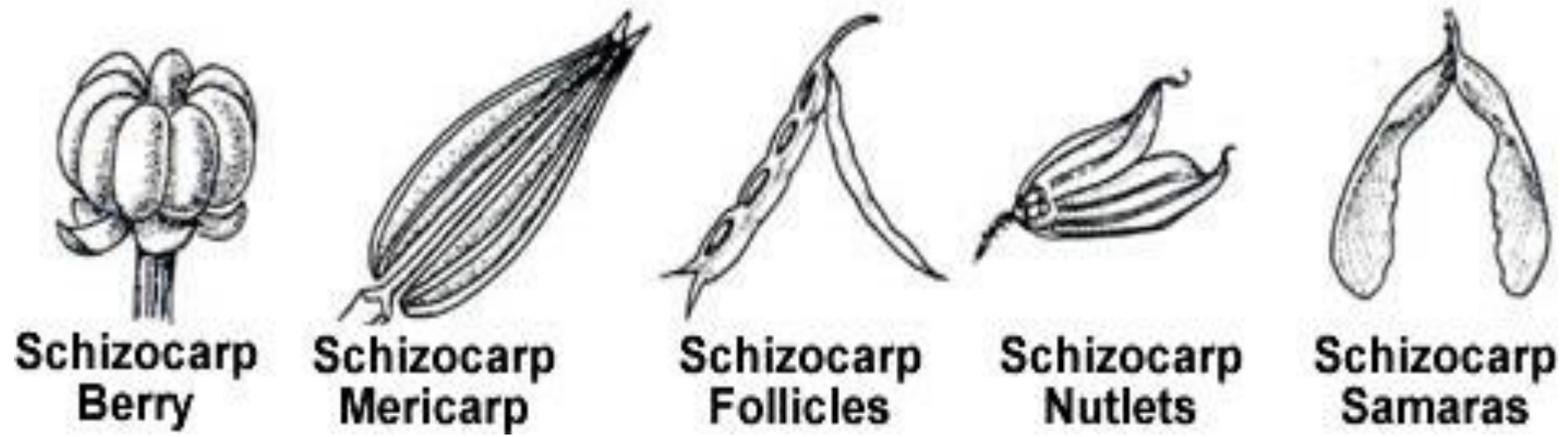


Malva parviflora
Malvaceae
© G. D. Carr

fruit type schizocazrp: twin fruits of the parsely family

sweet-cicely *Osmorhiza* sp. (Apiaceae)

Different Schizocarpic Fruit Types



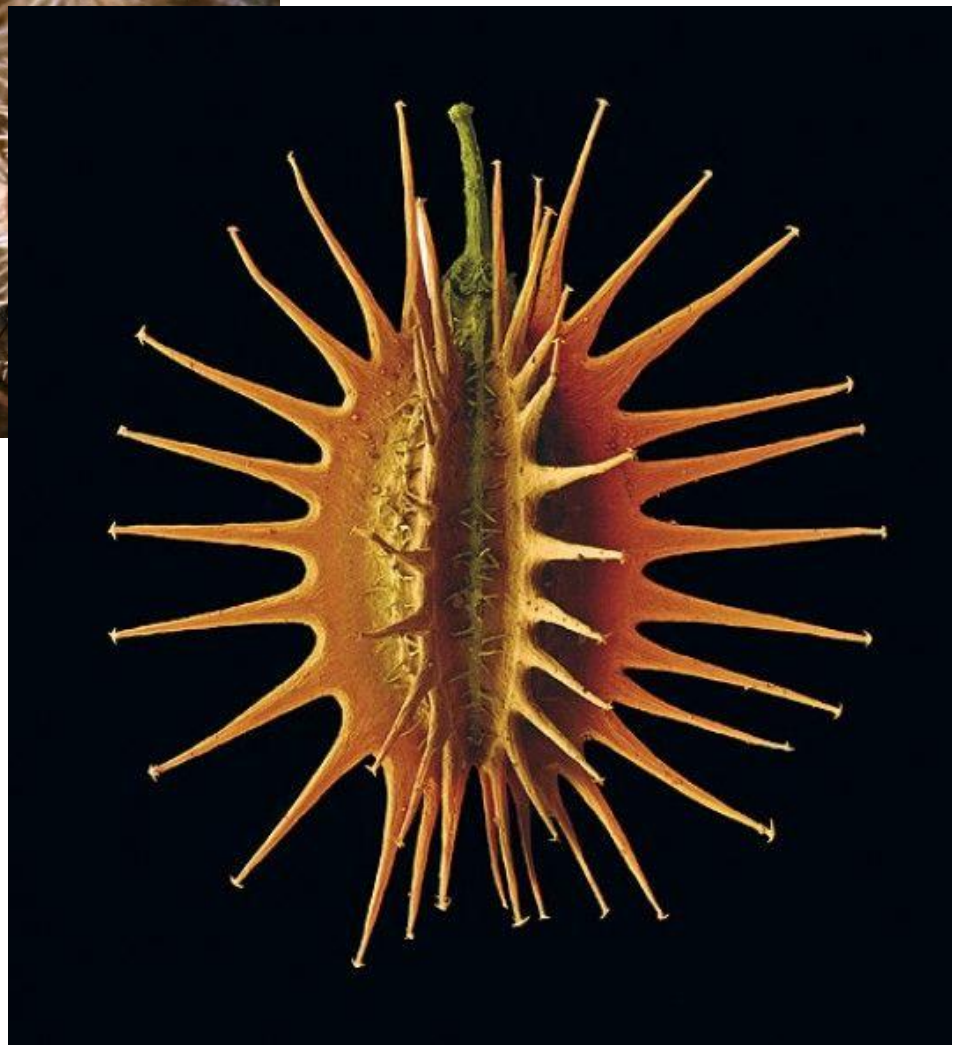
Schizocarp Berry

Schizocarp Mericarp

Schizocarp Follicles

Schizocarp Nutlets

Schizocarp Samaras



Cremocarp:

- It is a Schizoczrpic fruit.
- At maturity it splits into two one seeded indehiscent mericarp.