

INTRODUCTION TO PLANT SYSTEMATICS

Instructor: **Dr. Ahmed Elkordy**

Email: **Elkordy3000@yahoo.com**

Tel. 2560 or Mobile:

Lecture: Room 5₂

Course overview

- 1. Plant Taxonomy is designed to provide students with a basic understanding of the morphology, distribution, and taxonomy of the flowering plants.**
- 2. The course comprises one-hour lecture and two hours laboratory sessions per week. Lecture and laboratory topics focus on the basic features of represented families of Angiospermae in Egypt.**
- 3. The course includes two field trips for collecting plants. At the end of this course, the experiences gained would enable students to make a key to identify the plant, some 25 Dicots families and 8 monocots**

Course Objectives

By the end of this course, you will be able to know:

- **How systematizes discover, describe, and classify plant diversity.**
- **Understand plant morphology terminology.**
- **The major features and evolutionary origins of vascular plants.**
- **Identifications of plant species (Learn how to identify plants that you've never seen before (key)).**
- **Learn to recognize some important plant families.**
- **Properly prepare a plant collection.**

Introduction

What is the meaning of Botany?

Botany is the scientific study of plants.

Tippo 1942 proposed a system for the classification of the plant kingdom.

- 1. Thallophyta:** plant body is a thallus, no distinct or regular alternation is taking place during the life cycle. Sexual reproduction (if present) is not followed by the formation of an Embryo.
- 2. Embryophyta:** Plant body usually differentiated into different organs, there is a regular alternation of two generations: sporophyte generation with $2n$ and gametophyte generation with n . Each of these two generations give rise to the other. Sexual reproduction usually results in the formation of an Embryo.

Embryophyta is divided into

- **Bryophyta:** gametophyte generation is dominant during the life cycle. Vascular elements are primitive.
- **Tracheophyta:** sporophyte generation is dominant during the life cycle. Vascular elements consists of true xylem and phloem vessels.

Tracheophyta is divided into the following groups :

- **a. Psilopsida**
- b. Lycopsida** all with primitive leaves
- c. Sphenopsida**
- d. Pteropsida** with well developed leaves

Pteropsida includes the most advanced groups of plants which are:

- ❖ **I. Filicinae:** no flowers, no seeds (except an extinct group).
- ❖ **II. Gymnospermae:** no flowers, naked seeds.
- ❖ **III. Angiospermae:** flowers present, seeds covered.

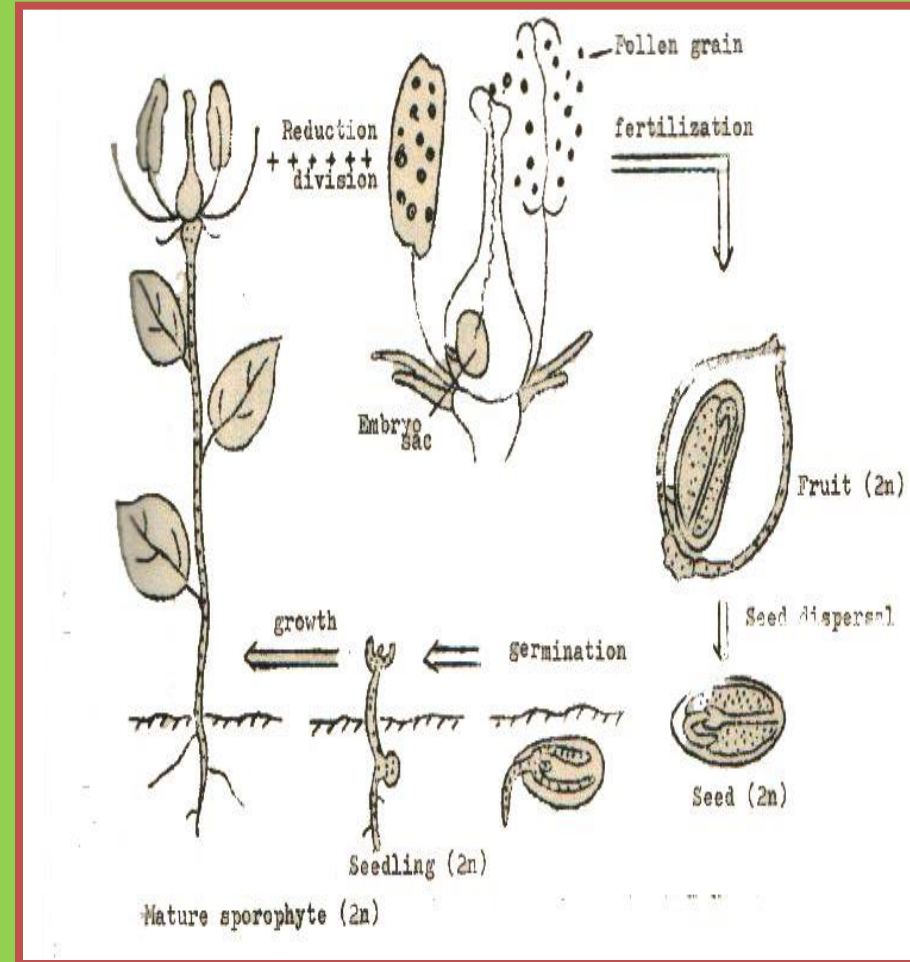
The flowering plants are characterized by the following:

- ⌘ The plant body is represented by a well-organized sporophyte generation, which is self-dependant. Gametophyte generation is a much-reduced phase consisting of few cells or nuclei and completely dependent on the sporophyte.**
- ⌘ The plant body is differentiated morphologically and anatomically into distinct organs (Root, Stem, & Leaf).**
- ⌘ Leaves are distinct, well developed organs, vascular elements of the leaf (leaf trace) results usually in a leaf gap in the vascular cylinder of the stem.**
- ⌘ The sexual fusion of male and female gametes results in the formation of a zygote. The zygote develops into Embryo.**
- ⌘ Seeds are usually enclosed in a special structure, the fruit.**

Features of the flowering plant

It is represented by three phases or forms:

- & Embryo (inside the seed)
- & Seedling
- & Mature sporophyte (2n)



What is Plant Taxonomy?

⌘ Taxonomy is the science of classification, especially the classification of biological organisms. The term is derived from the Greek *taxis* (arrangement) and *nomos* (law).

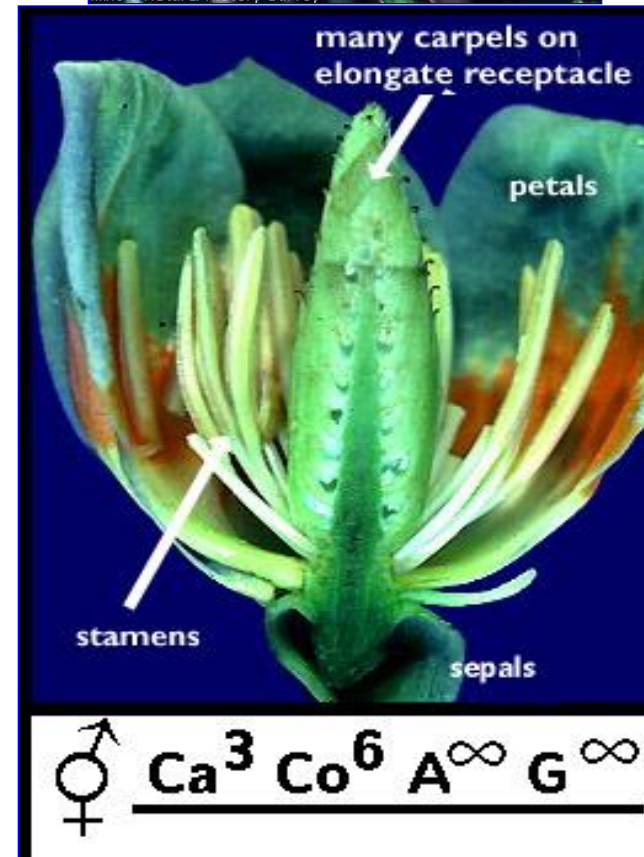
⌘ Taxonomy may be defined as the study and description of the variation of organisms, the investigation of the causes and consequences of this variation, and the manipulation of the data to produce a system of classification, along with a methodology .

The flower

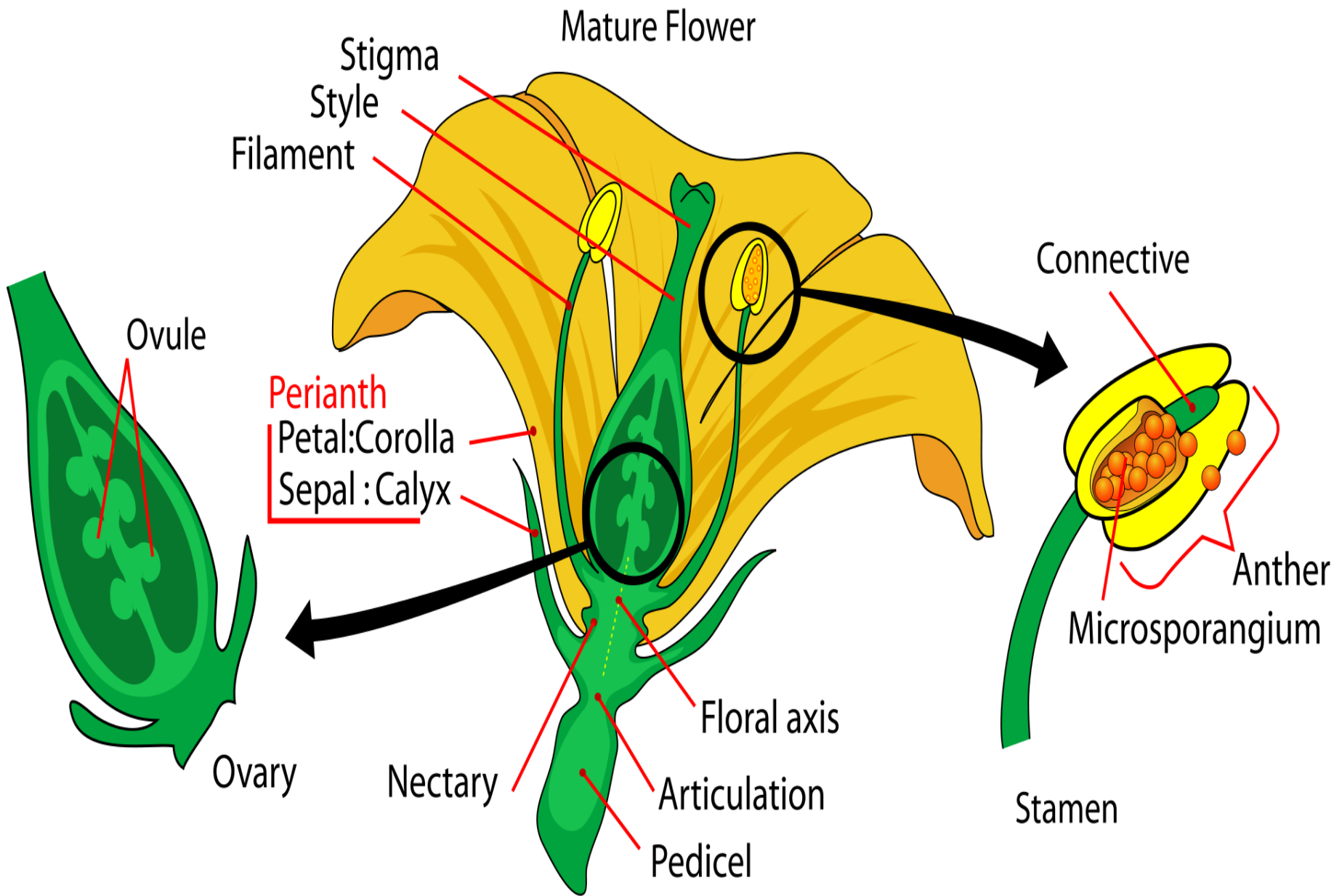


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& Morphologically a flower is a **modified shoot**. The elongated axis (internodes) of a vegetative shoot is reduced into a horizontal disc, the receptacle. Floral leaves are arranged on the receptacle in different whorls. The flower arises in the axil of a leaf known as bract.



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Flower terminology

Ca = Calyx; Co = Corolla

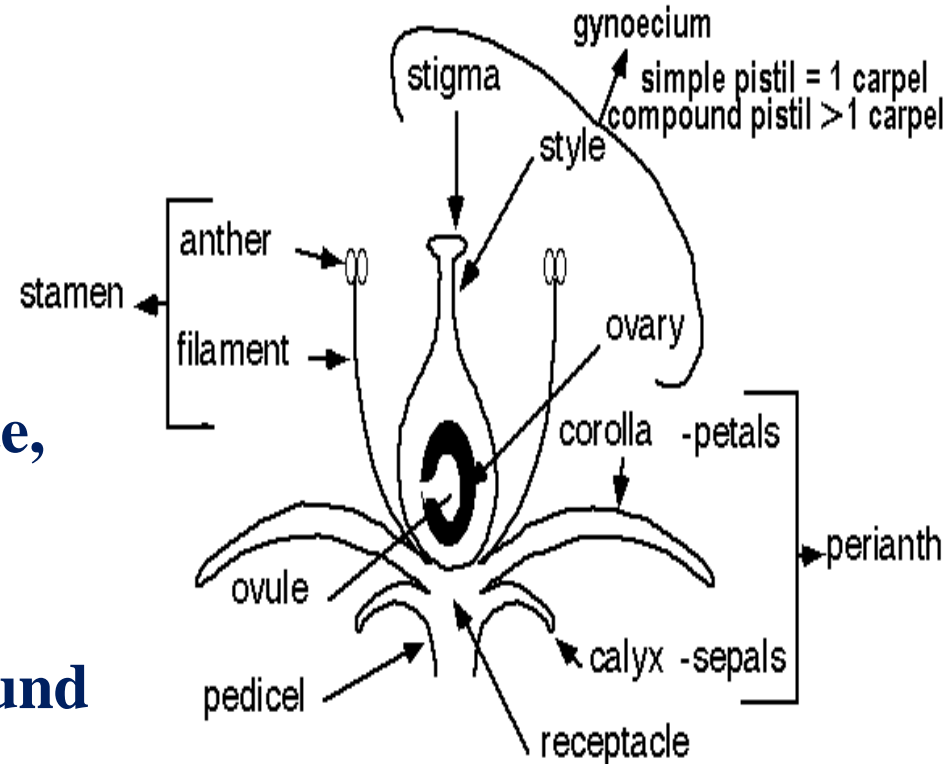
A = Androecium

G = Gynoecium

black bar = Receptacle

**Apocarpous = carpels separate,
not fused**

**Syncarpous = carpels fused to
form a single unit or compound**



The different parts of the flower

↳ Generally the flower consists of

1. Subsidiary or sterile leaves (Perianth): its protect the essential or fertile leaves.

2. Essential or fertile leaves (Sporophylls): these are spore bearing and we have either:

a. **Microsporophylls or male** fertile leaves, also known as stamens.

b. **Megasporophylls or female** fertile leaves, also known as carpels.

↳ Floral leaves are arranged on the receptacle in a special way known as phyllotaxy.

↳ There are two types of phyllotaxy:

1. **Spiral (Acyclic):** characteristic to primitive flowers.

2. **Whorled (Cyclic):** characteristic to advanced flowers, the different types of the leaves are arranged in distinct whorls or cycles.

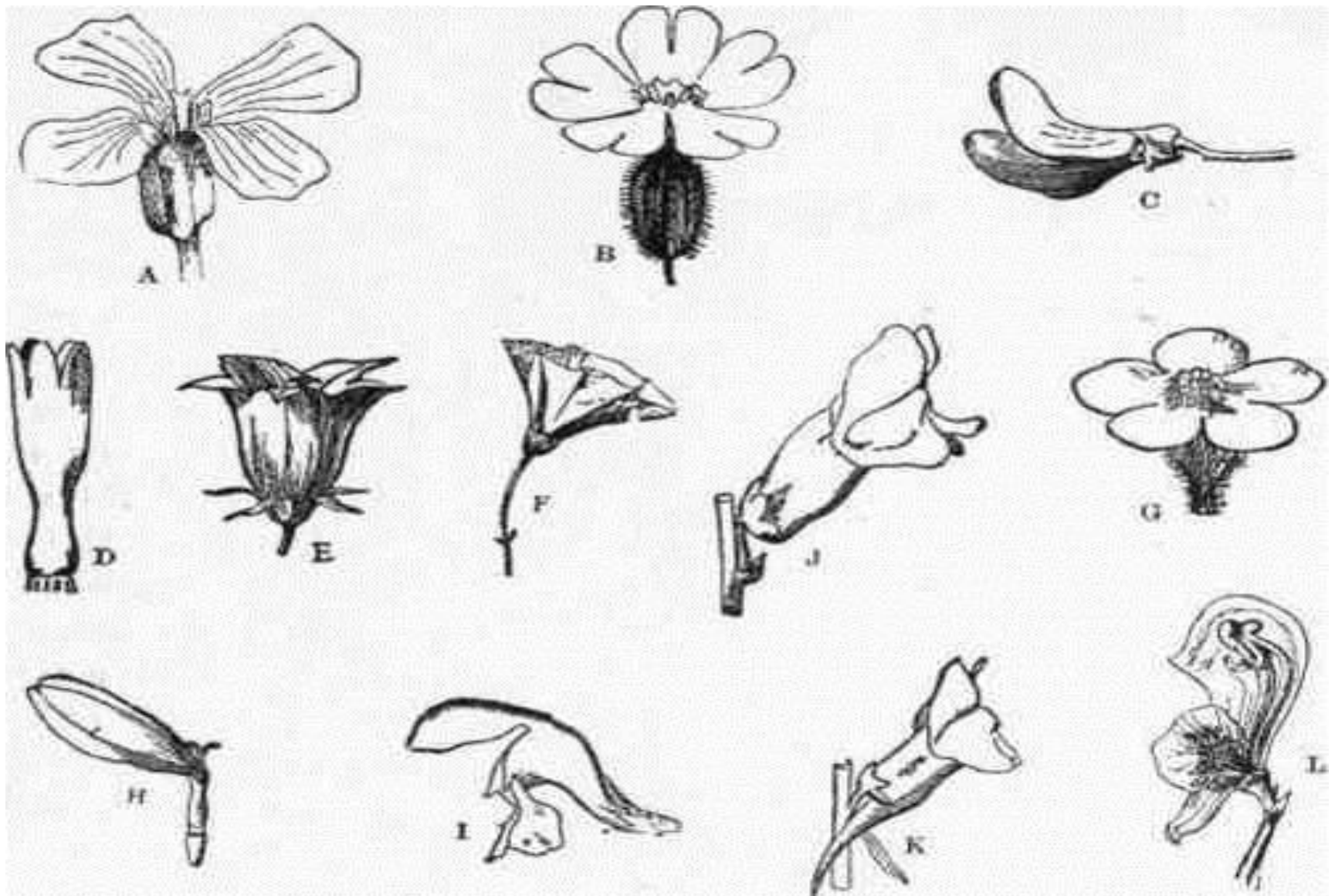
✓ Perianth

- ✓ the perianth segments are usually differentiated into outer whorl (sepals).
- ✓ The inner whorl (petals) of coloured leaves.
- ✓ Perianth segments are either free or united into different patterns (funnel, tubular, salver-shaped, bilabiate, etc..)

the Types of Corolla

- cruciferous corolla
- papilionaceous ~
- labiate ~
- tubular ~
- ligulate ~

- funnel-shaped ~
- Campanulate ~ جرسى الشكل
- urceolate ~ ابريقى الشكل
- salver-shaped ~ طبقى الشكل
- rotate ~



A, Cruciate. B, Caryophyllaceous. C, Papilionaceous. D, Tubular. E, Campanulate. F, Funnel-shaped. G, Rotate. H, Ligulate. I, Labiate. J, Personate. k, Personate and spurred. L, Nectaries.



Infundibuliform



Papilionaceous



Campanulate



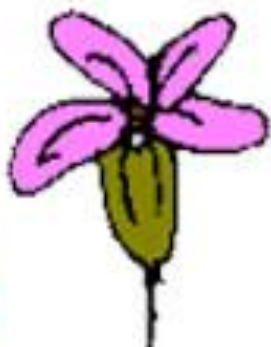
Bilabiate



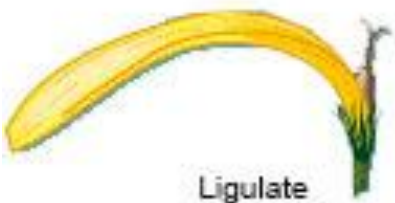
Rotate



Tubular



Cruciform



Ligulate

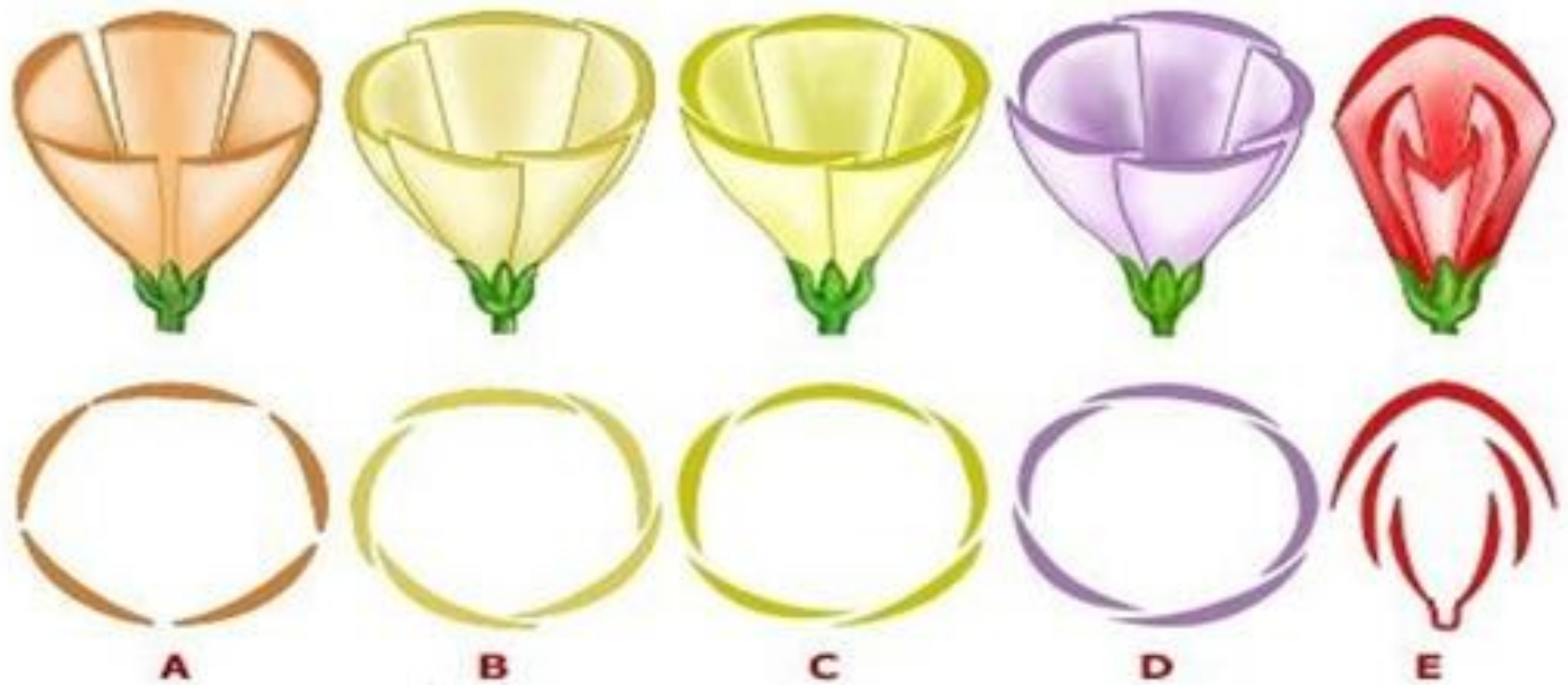


Spurred

Forms of corolla

Aestivation

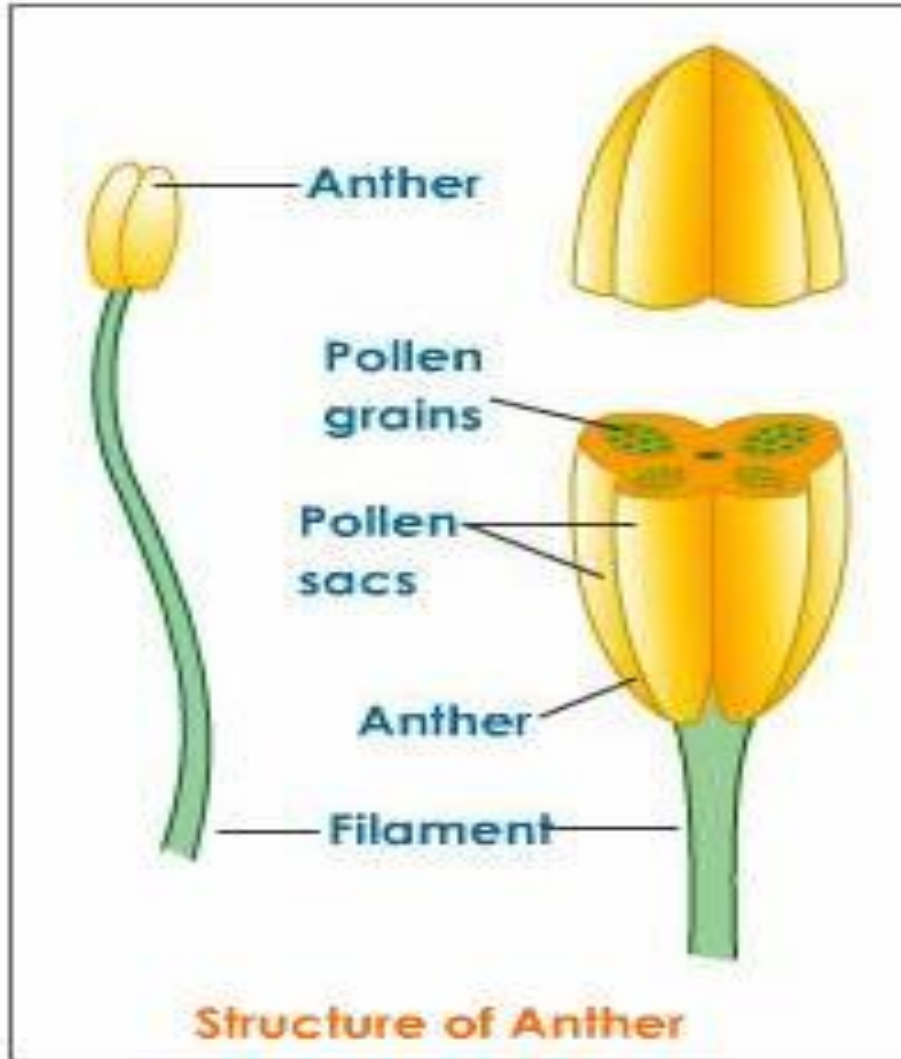
- ⌘ Arrangement of the floral parts in the bud.
- ⌘ **Valvate**: with the parts meeting by their abrupt edges without overlapping or turning.
- ⌘ **Imbricate**: in aestivation of five parts one being exterior, one interior and the rest three having one margin exterior and other interior.
 - ⌘ **A. Descending** imbricate: posterior petal is outer most as in *Pelargonium*.
 - ⌘ **B. Ascending** imbricate, posterior petal is inner most.
- ⌘ **Quincuncial**: in aestivation, partially imbricated of five parts, two being exterior, two interior, and a fifth one having one margin exterior and the other interior.
- ⌘ **Twisted (Convolute)**: with parts rolled up in such a way that the outer part of each covers the inner part of the one in front of it, while in turn its inner part is covered by the one behind it.
- ⌘ **Vexillary**: an aestivation when there are five petals, of which the posterior one is the largest and it almost covers the two lateral petals, and the latter in their turn nearly overlap the two anterior or smallest petals.




Different types of aestivation of calyx and corolla


A. Valvate, B. Twisted, C. Imbricate, D. Quincuncial, E. Vexillary

Androecium: It consists of one or more stamens. The stamen is usually differentiated into a filament and anther.





3. Androecium


 Androecium is the male part of a flower.

 It is the whorl of floral leaves found inside the corolla.

 Androecium consists of stamens.

 A stamen consists of the anther and the filament.

 The function of the androecium is to produce and release pollen grains.

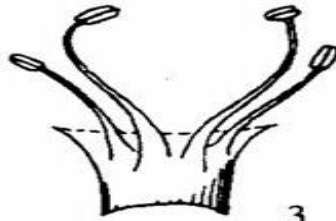
 Stamens of flowers can be independent or connected to the petals.



1



2



3



4

Type of Stamen

1. Monadelphous stamen

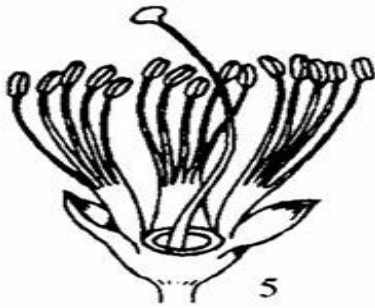
2. Diadelphous stamen

3. Didynamous stamen

4. Tetrastemonous stamen

5. Polyadelphous stamen

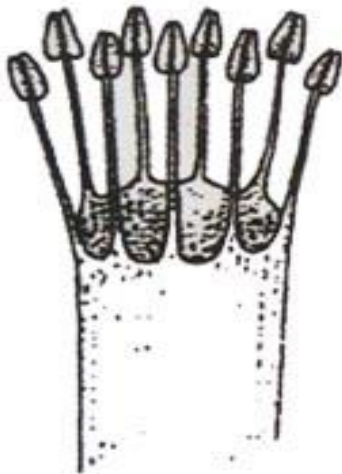
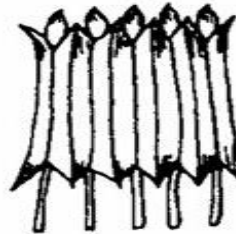
6. Syngenesious stamen



5



6



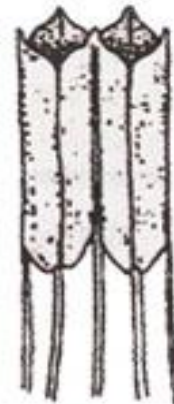
Monadelphous



Diadelphous



Polyadelphous



Syngenesious



Synandrous

- **didymous**: two equal pairs
- **didynamous**: occurring in two pairs, a long pair and a shorter pair
- **tetradynamous**: occurring as a set of six stamens with four long and two shorter ones or respective to the rest of the flower (perianth):
 - **exserted**: extending beyond the corolla
 - **included**: not extending beyond the corolla
- **Synandrous**: Stamens are fused by both their filaments as well as anthers Ex. *Cucurbita* sp. The fused stamens are referred to as a **synandrium**.
- **Syngenesious** : Stamen are fused by anthers only; filaments are free Ex: *Helianthus annuus*.

Gynoecium

It consists of one or more carpels. The ovary is extended upwards into a cylindrical style, which is terminated by a variously –shaped stigma

Placentation

The arrangement of the ovules in the placenta and of the placentas in the ovary.

The placentation are of different types namely

1. **Marginal**
2. **Parietal**
3. **Axile**
4. **central**
5. **Free-central**
6. **Basal**
7. **Apical**



Marginal



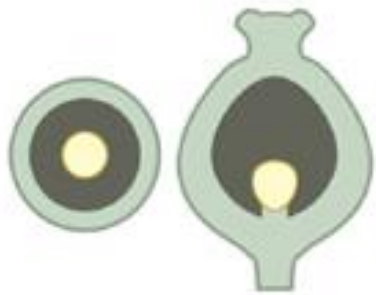
Axile



Parietal



Free-central



Basal



Basal



Apical

The placentation types

1. Marginal

In this type, the gynoecium is monocarpellary and unilocular and placenta are borne on the fused margins of same carpel. This condition is most common in most of the members of the family leguminosae.



T.S



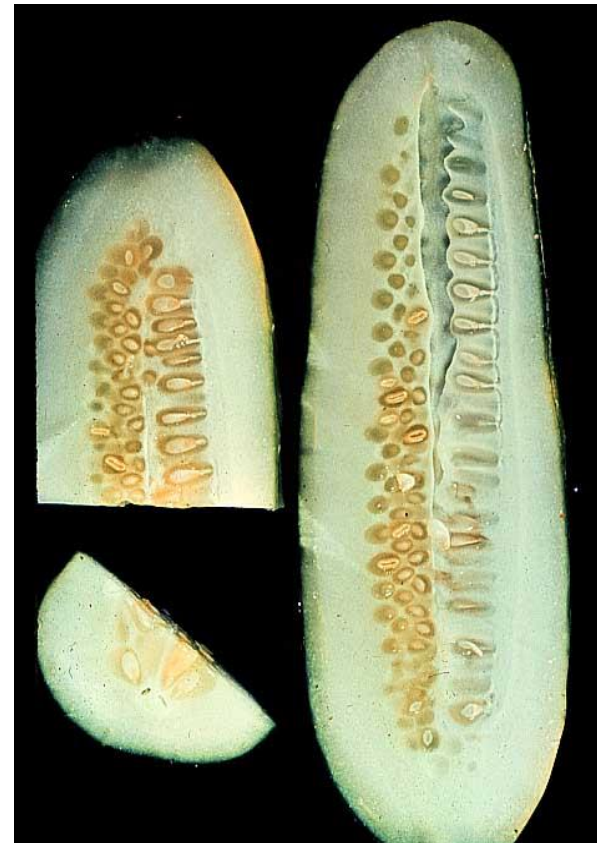
L.S

2. Parietal

In this type the gynoecium is multicarpellary, syncarpous and the ovary is unilocular. The placenta are seen on the inner surface of the ovary, at the junction of the carpels. Sometimes the unilocular ovary is found to be divided by the development of a false septum. Eg. Mustard, Cucurbits



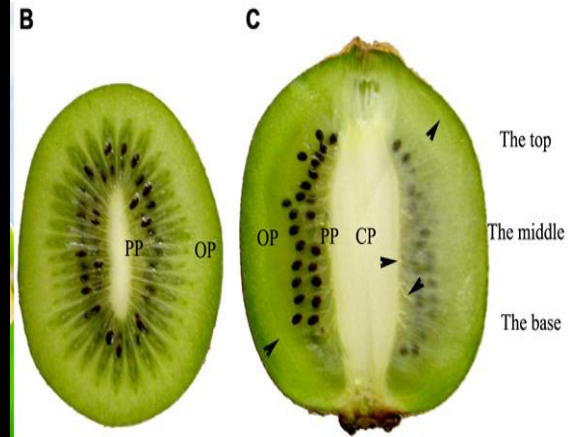
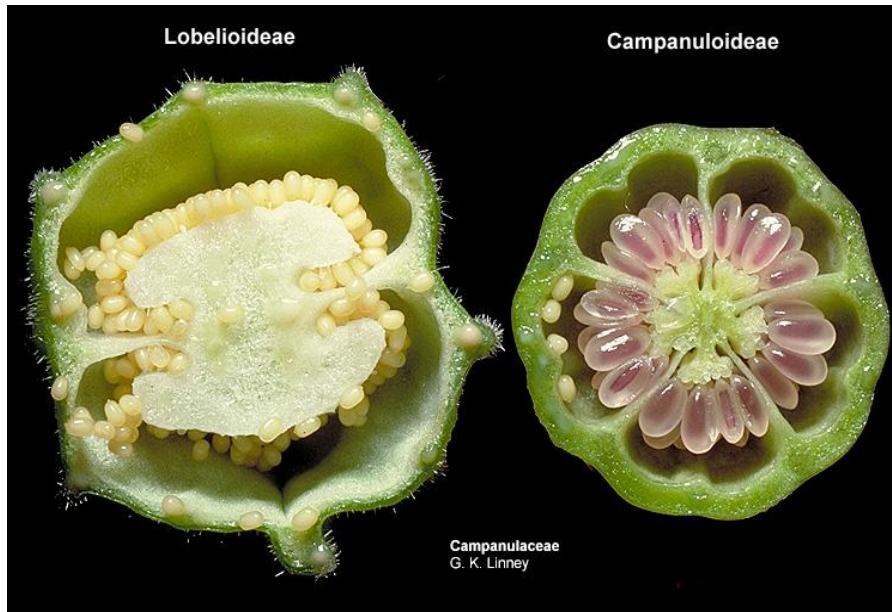
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T.S

3. Axile

In this type, the gynoecium is multicarpellary, syncarpous and multilocular, The wall of the carpels in the centre of the ovary are united to form an axis, which bears the placentae. Eg. China rose (Pentalocular), *Petunia* (Bilocular)



T.S

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4. Central

The ovary is unilocular and the ovules are borne on central axis in the centre of the ovary, axis joint to the top of ovary. Septa are absent. Ex. *Capsicum* spp



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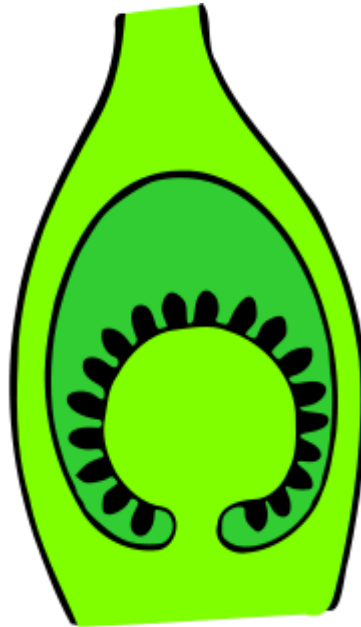
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5. Free central

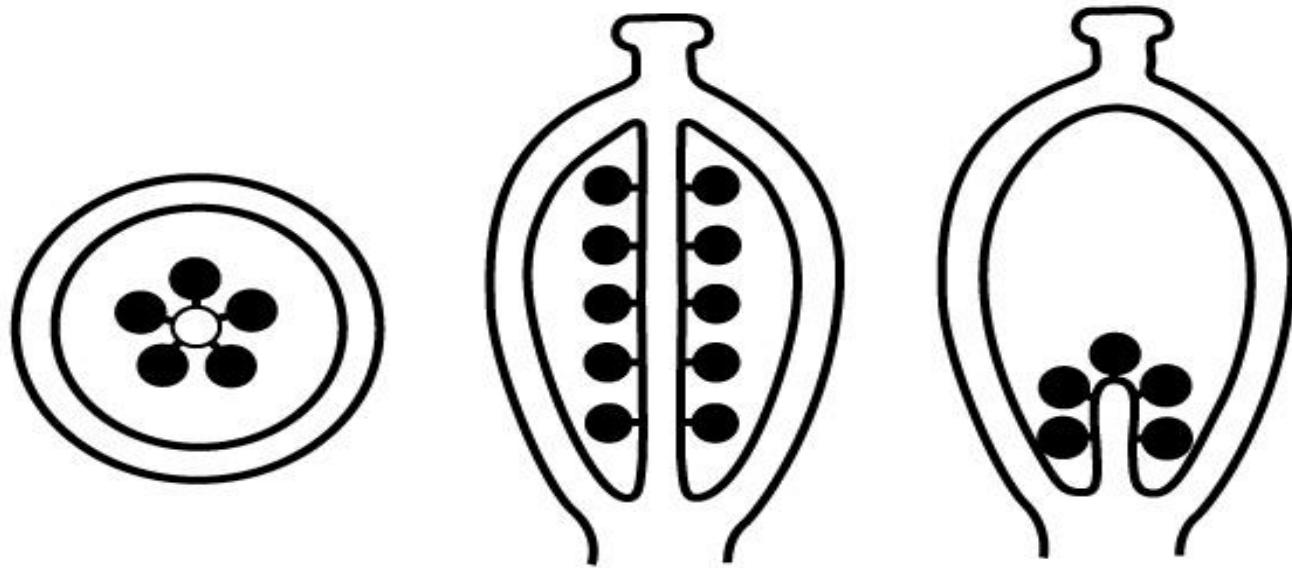
The ovary is unilocular and the ovules are borne on central axis in the centre of the ovary. Septa are absent. Eg. *Dianthus* and Primrose



T.S



L.S



distinguishing between central and free central placentation

6. Basal:

The ovary is unilocular and a single ovule is borne at the base of ovary. Eg. Sunflower



T.S



พลาเซนตาที่ฐาน
(basal
placentation)

L.S

7. Apical:

The ovary is unilocular and a single ovule is borne at the top of ovary. Eg.



T.S



พลาเซนทาที่ยอด

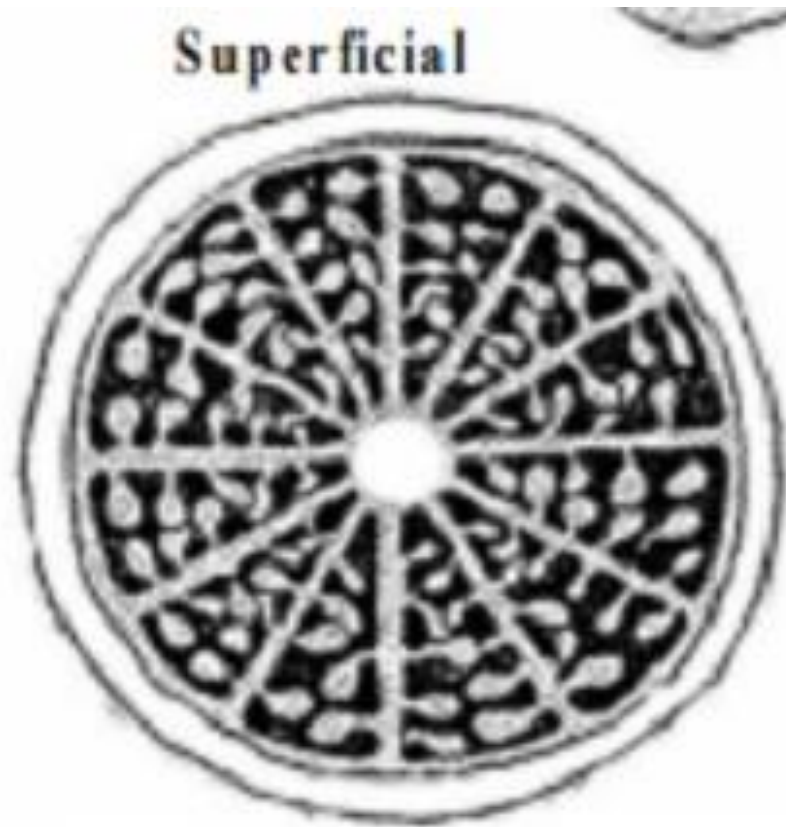
(apical

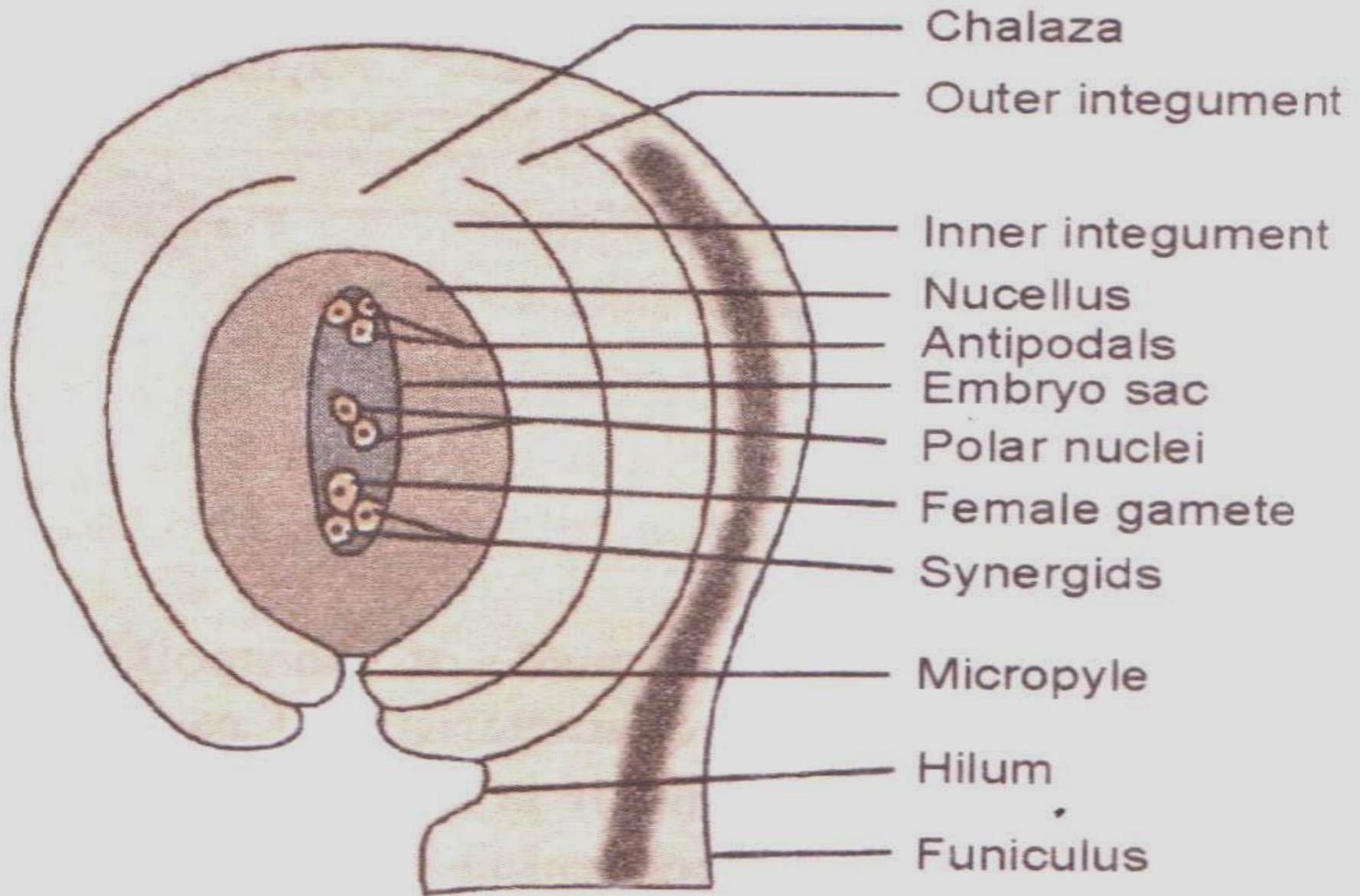
placentation)

L.S

8. Superficial:

The gynoecium is multicarpellary, syncarpous and large number of ovules are borne on the walls of loculi without specific order. Eg. *Nymphaea* (water lily)





**Longitudinal section of an anatropous ovule
with the two integuments and micropyle**

Various types of ovules

1. Orthotropous: البويضة المستقيمة

The ovule is erect. Thus the funicle, chalaza and micropyle all lie in one and the same vertical line. This type of ovule is found in members of family **Polygonaceae**.

2. **Anatropous or Inverted: المنعكسة** The main body of the ovule bends along the funicle. Thus the micropyle lies close to the hilum and the chalaza lies at the other end. The funicle fuses with the main body of the ovule forming a ridge, the raphe. This is the most common type of ovule. It is found in almost all members of **Sympetalae**. It also occurs in other families of both dicots and monocots.

3. **Amphitropous or Transverse or Hemitropous : الأفقية** This is an intermediate type between orthotropous and anatropous. The ovule body is at right angle to its stalk or funicle. The fusion of the integuments with funicle is very slight. Thus the hilum, chalaza and micropyle all lie apart from one another. **This is very rare type. It is found in Primulaceae, Ranunculaceae and some members of Cruciferae**

4. **Campylotropous or Curved: المنحنية** The body of the ovule is bent upon itself like a horse-shoe. Thus the micropyle comes to lie near the funicle. It is also rare. It is found in members of family Leguminosae, Caryophyllaceae, Cruciferae, and Poaceae.

5. Amphidotropous البويضة منحنية الجنين

in these type , nucellus & embryo sac both become curved & converted into horse-shoe shaped

6. Circinotropous المنعكسة على نفسها

The nucellus and the axis remain in the same line in the beginning. But rapid growth occurs on one side. Thus the ovule gets inverted. This curvature continues. Thus the ovule turns completely. So once again the micropyle faces upwards. Circinotropous ovule is found in **Plumbago** and

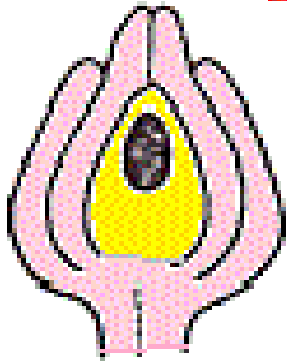
Opuntia.

7. Hemitropous: The body of the ovule is straight. But it is twisted transversely at right angles. Thus the chalaza and micropyle are in the same line. They are at right angles to the funicle. Hemitropous ovule is common in Ranunculus.

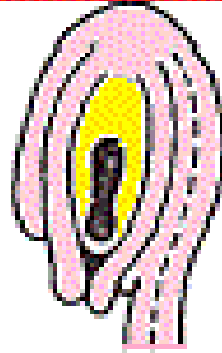


Types Of Ovule

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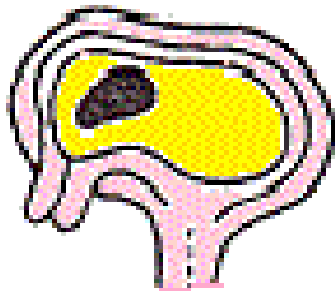
Orthotropous



Anatropous



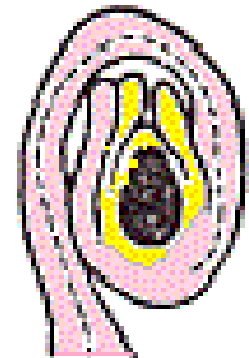
Hemitropous



Campylotropous



Amphitropous



Circinotropous

Types of Ovule positions

Pollination

Pollination is a process in which pollen is transferred to the female reproductive organs of seed plants, thereby enabling fertilization and reproduction through growth of the pollen tube and eventual release of sperm. Both gymnosperms and angiosperms undergo pollination, although the mechanism for angiosperms is much faster and more complex.

Cross-pollination, also called *allogamy*, occurs only when pollen is delivered to a flower from a different plant. Plants adapted to outcross or cross-pollinate often have taller stamens than carpels or use other mechanisms to better ensure the spread of pollen to other plants' flowers.

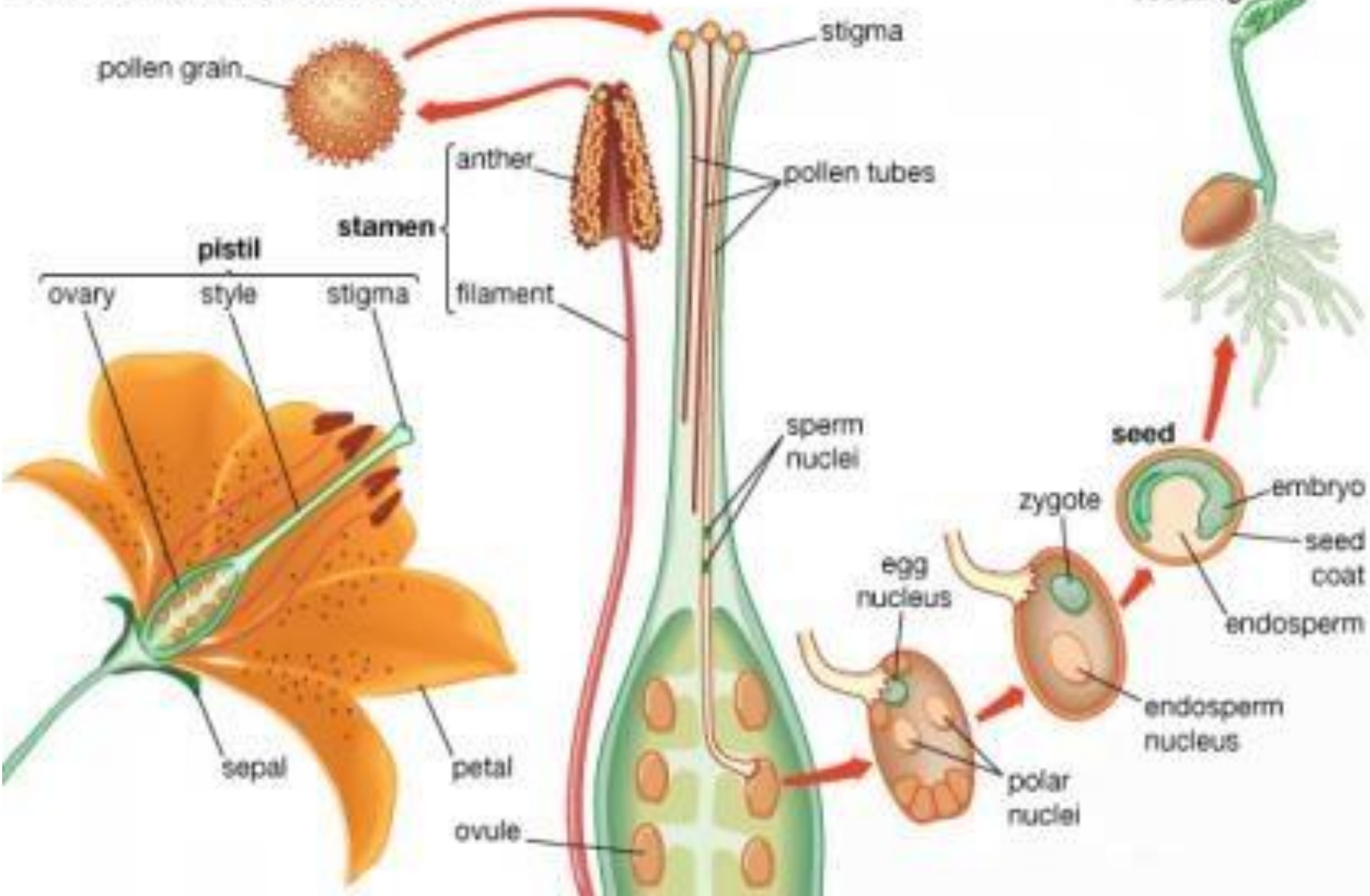
Self-pollination occurs when pollen from one flower pollinates the same flower or other flowers of the same individual. It is thought to have evolved under conditions when pollinators were not reliable vectors for pollen transport, and is most often seen in short-lived annual species and plants that colonize new locations. Self-pollination may include *autogamy*, where pollen moves to the female part of the same flower; or *geitonogamy*, when pollen is transferred to another flower on the same plant.

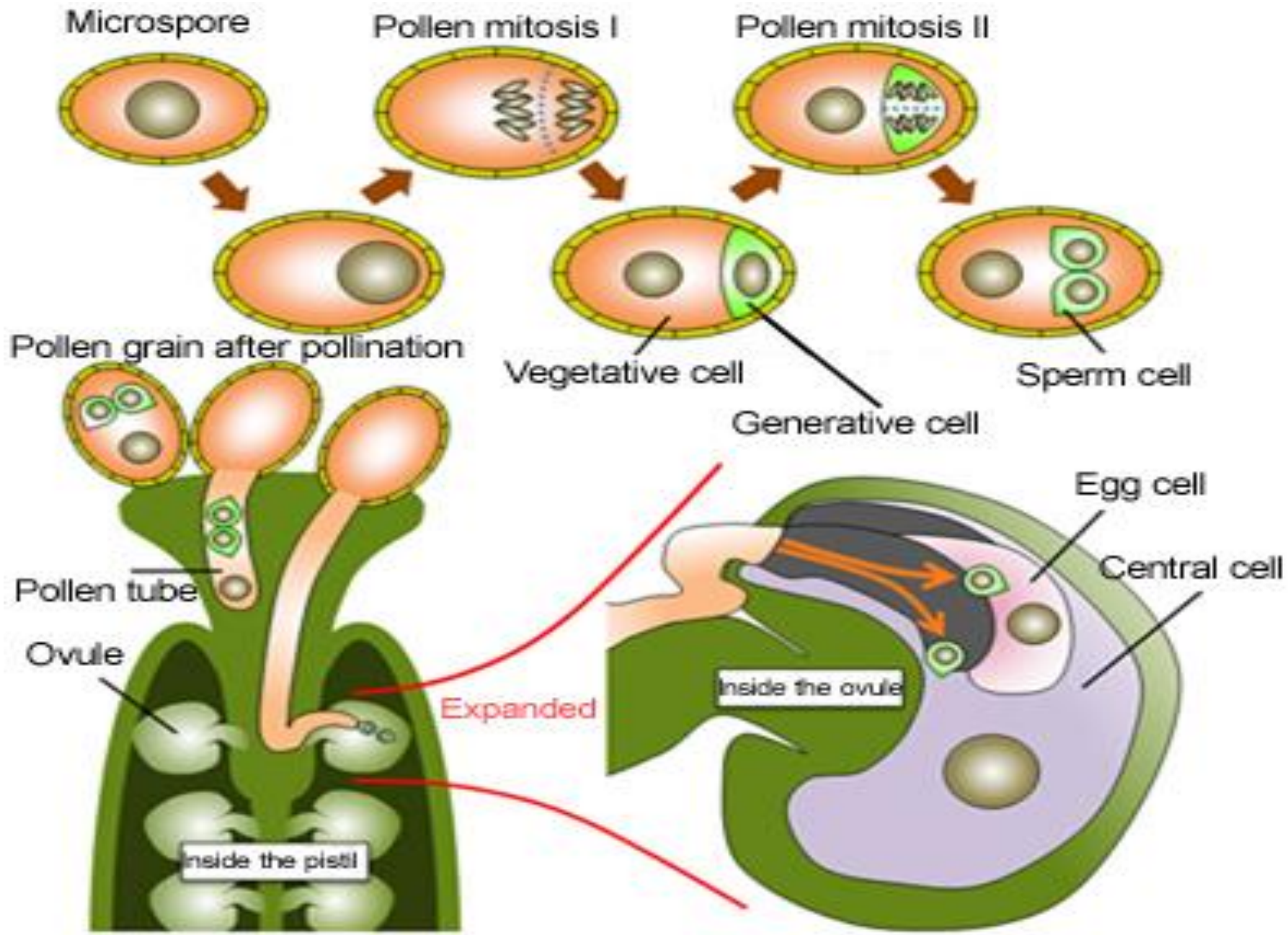
:*Cleistogamy* is self-pollination that occurs before the flower opens.

Fertilization

- ✎ This process starts when pollen grains come in contact with the stigma
- ✎ A pollen tube comes out from the pollen grain, the male gametes move penetrates gradually the tissues of the stigma and style and continues within the ovary to the ovule.
- ✎ The pollen tube releases the two male gametes inside the embryo sac. One of these gametes succeeds to fertilize the egg and a diploid ($2n$) nucleus is formed which is known as the zygote. The other male gamete fuse with the primary endosperm nucleus ($2n$) and a triploid nucleus ($3n$) is formed.

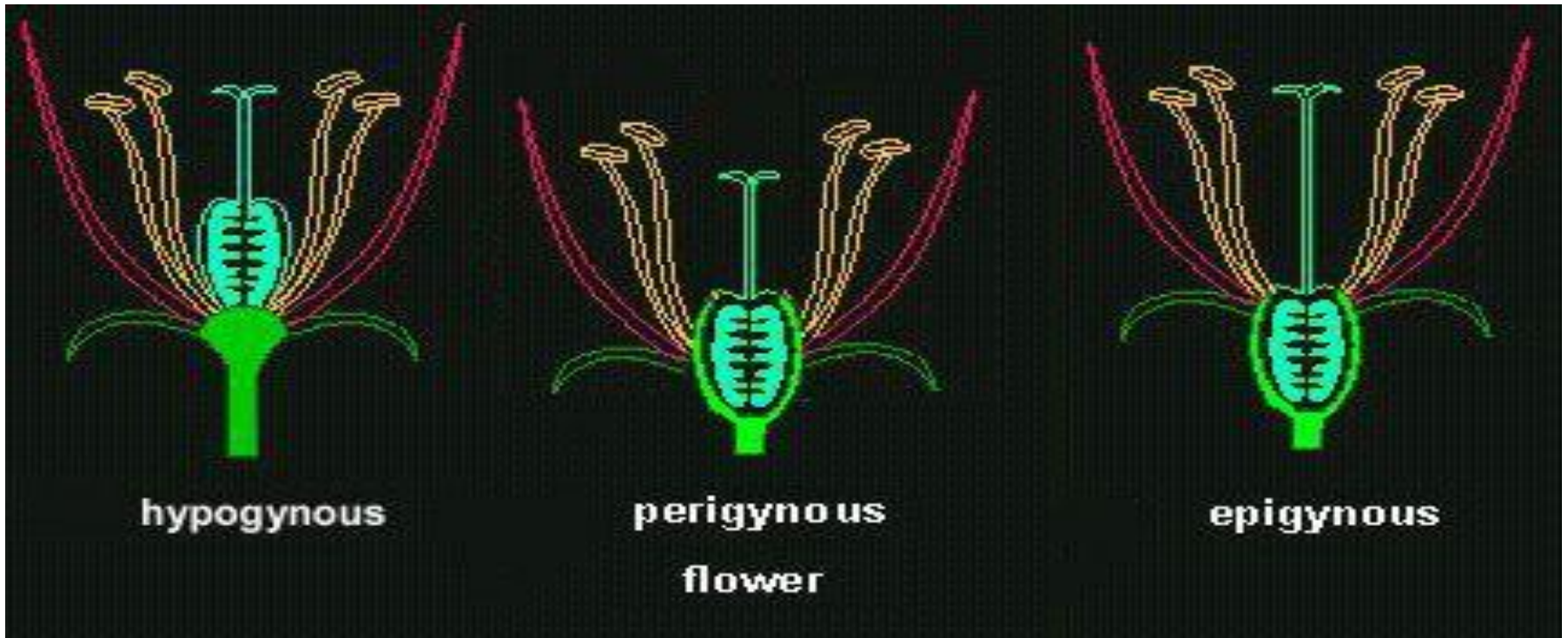
How flowering plants reproduce





The position of the ovary

The position of the ovary in relation to the other structures of a flower is an important taxonomical feature. It has to be distinguished between a **hypogynous** (the perianth is attached to the receptacle below the pistil) **perigynous** (perianth and stamens are borne on the rim of a concave structure in the depression of which the pistil is borne) **epigynous** ovary (blossom seems to arise upon or above the ovary).



Sex of the flower

1. Bisexual (hermaphrodite). Each flower of each individual has both male and female structures, i.e. it combines both sexes in one structure.

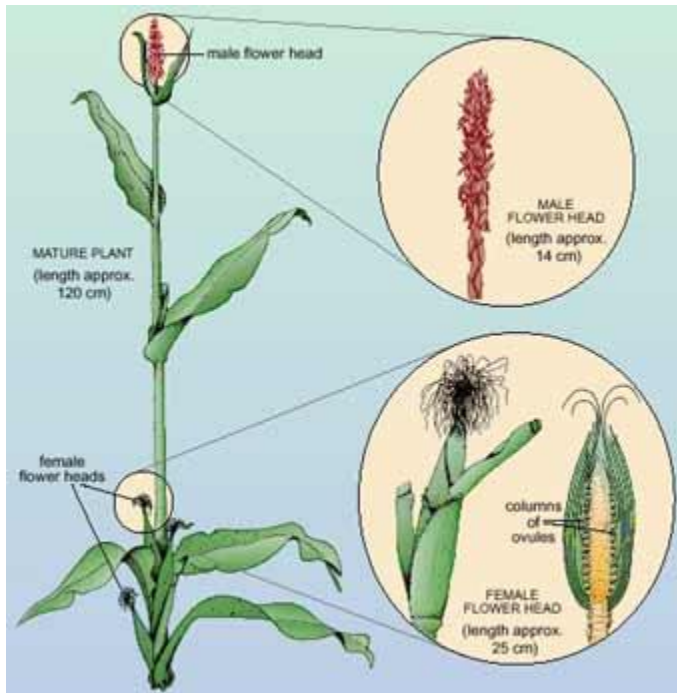
2. Unisexual.

having either functionally male or functionally female flowers. This condition is also called **diclinous**, **incomplete** or **imperfect**.

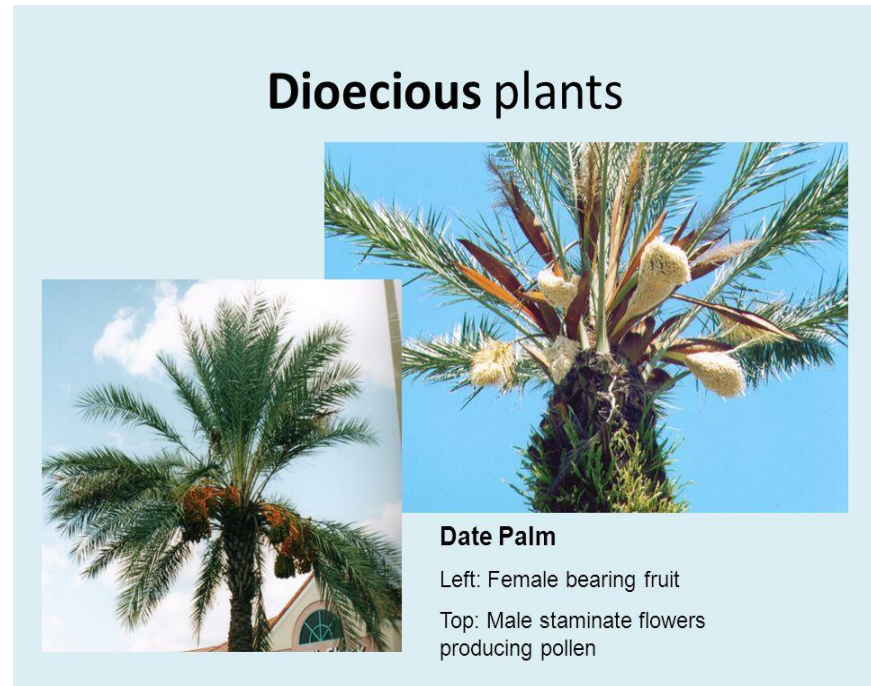


What is the difference between Monoecious plant and Dioecious plant?

- **Monoecious plants** have separate male and female flowers on the same plant.
- **Dioecious plants** have male (staminate) flowers on one plant, and female (pistillate) flowers on another plant.



Monoecious



Dioecious plants

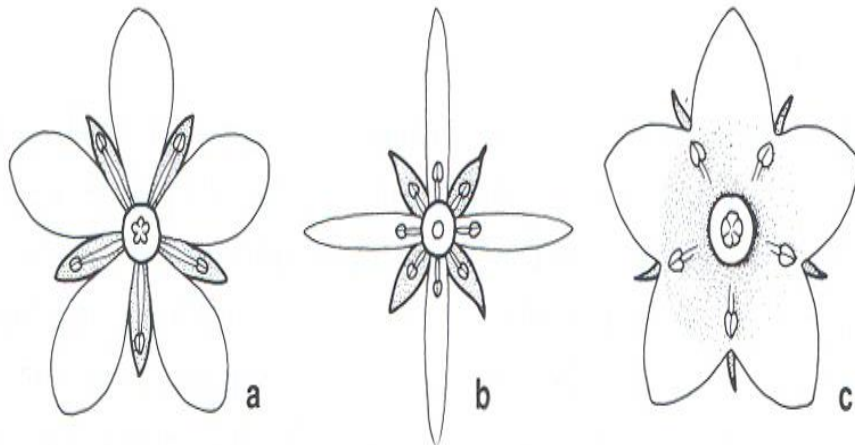
Floral symmetry

Floral symmetry describes whether, and how, a flower, in particular its perianth, can be divided into two or more identical or mirror-image parts.

Uncommonly, flowers may have no axis of symmetry at all, typically because their parts are spirally arranged.

1- Actinomorphic or radial (or regular) - also known as polysymmetric.

Divisible through the centre of the flower in several or many longitudinal planes, the halves of the flower being mirror images in every case.



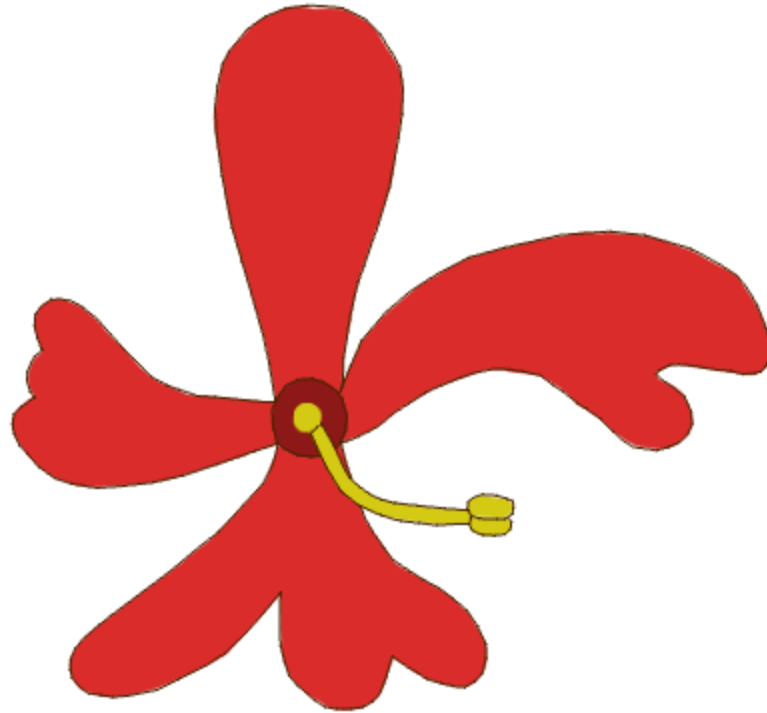
2- Zygomorphic or bilateral (or irregular) - also known as monosymmetric.

divided into equal halves along one (longitudinal) plane only, or in other words, divisible through the centre of the flower in only one longitudinal plane for the halves of the flower to be mirror images.



3- Asymmetric

The flowers of a few species have no plane of symmetry and are **asymmetrical** (a term that is applied by some authors to zygomorphic flowers). The flowers of some cannas and some gingers are classified in this manner.



floral formula

A floral formula is a convenient way to store and retrieve information about plants. There is no one correct method for writing a floral formula.

[I]	Bracts (Br) Br	Bracteate	Ebr	Ebracteate
[II]	Bracteoles (Brl) Brl	Bracteolate	Ebrl	Ebracteolate
[III]	Symmetry of the flower \oplus	Actinomorphic	\ominus or \dagger	Zygomorphic
[IV]	Sex ♂ ♀	Staminate (male) Hermaphrodite (Bisexual)	♀	Pistillate (female)
[V]	Calyx (K) K_4 K_{2+2}	4 sepals, polysepalous 4 sepals in 2 whorls of 2 each	$K_{(4)}$	4 sepals, gamosepalous
[VI]	Corolla (C) C_4 C_{2+2}	4 petals, polypetalous 4 petals in 2 whorls of, 2 each	$C_{(4)}$	4 petals, gamopetalous
[VII]	Perianth (P) P_6 P_{3+3} $P_{(3)+(3)}$	6 tepals, polytepalous/polyphyllous 6 tepals, in 2 whorls of 3 each 6 tepals, gamotepalous/gamophyllous		
[VIII]	Androecium (A) A_6 A_{2+4} A_0 $A_{(\alpha)}$ $A_{(5)}$ $\overset{\curvearrowright}{C} A$	6 stamens, polyandrous 6 stamens in 2 whorls of 2 and 4 each, Tetradynamous stamens absent monadelphous syngenesious epipetalous	A_{α} $A_{1+(9)}$ $A_{(5)}$ PA	stamens indefinite diadelphous synandrous epitepalous/Epiphyllous

[IX] **Gynoecium (G)**

G_0 Gynoecium absent
 $G_{(2)}$ 2 carpels, syncarpous

G_2 2 carpels, apocarpous
 $G_{(2)}$ bicarpellary, syncarpous, superior
 G_1 Monocarpellary, semi-inferior G_2 bicarpellary, apocarpous

\overline{G} - Ovary inferior
 \underline{G} - Ovary superior

∞ - Many
 $()$ - Sometimes

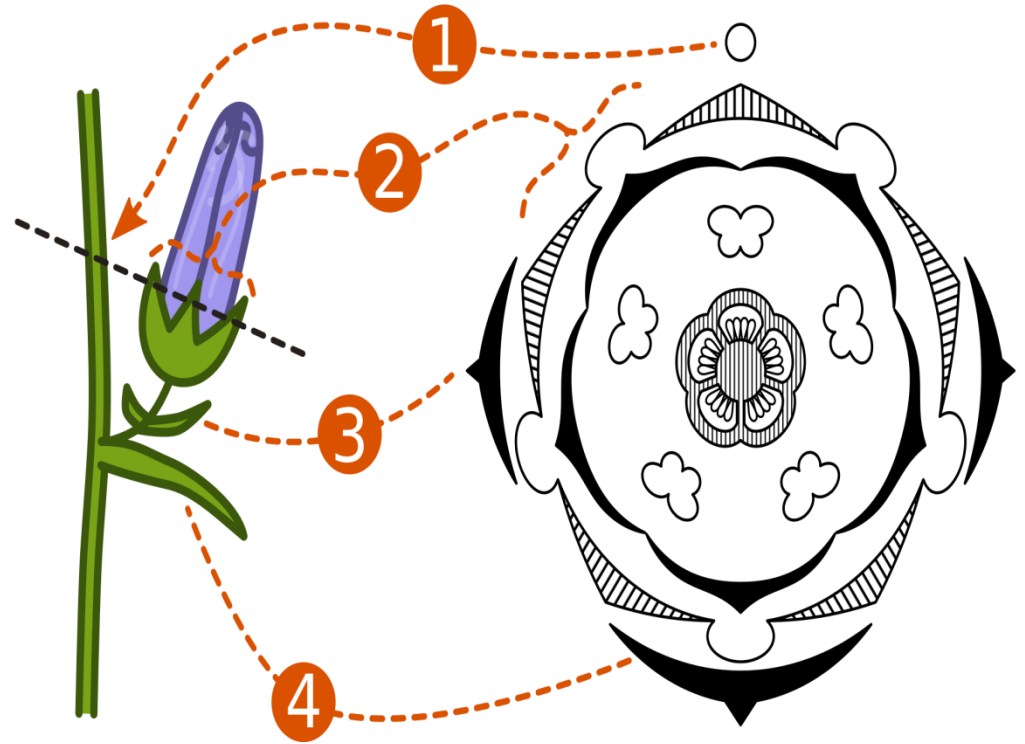
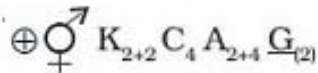
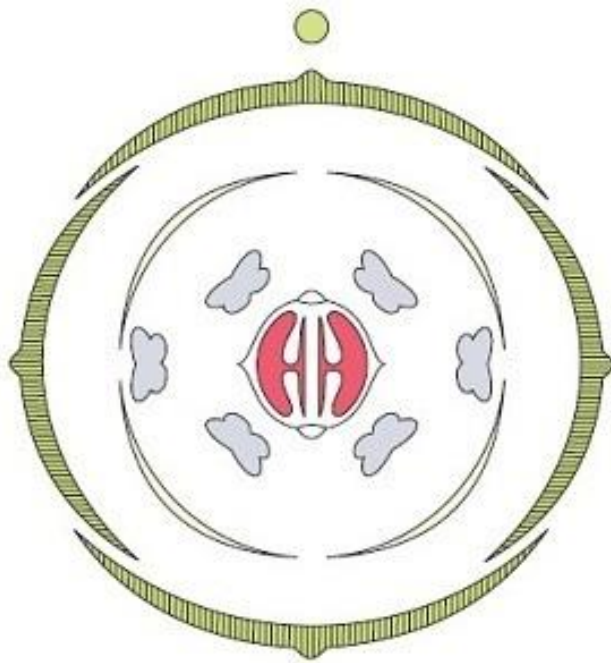


Figure 20. Floral diagram with floral formula

Inflorescence

- ✓ Flower it could be born solitary or in a group
- ✓ **Inflorescence**, in a flowering plant, a cluster of flowers on a branch or a system of branches. An inflorescence is categorized on the basis of the arrangement of flowers on a main axis (peduncle) and by the timing of its flowering (determinate and indeterminate).
- ✓ Inflorescences are described by many different characteristics including **how the flowers are arranged on the peduncle?**, **the blooming order of the flowers** and how different clusters of flowers are grouped within it?.

Plant organs can grow according to two different schemes, namely monopodial or racemose and sympodial or **cymose**. In inflorescences these two different growth patterns are called indeterminate and determinate respectively, and indicate whether a terminal flower is formed and where flowering starts within the inflorescence.

Indeterminate inflorescence: Monopodial (racemose) growth.

The terminal bud keeps growing and forming lateral flowers. A terminal flower is never formed.

Determinate inflorescence: Sympodial (cymose) growth.

The terminal bud forms a terminal flower and then dies out. Other flowers then grow from lateral buds.

Indeterminate and determinate inflorescences are sometimes referred to as **open** and **closed** inflorescences respectively.



Solitary flower

Inflorescence

Racemose

Raceme

Spike

Corymb

Umbel

Capitulum

Spadix

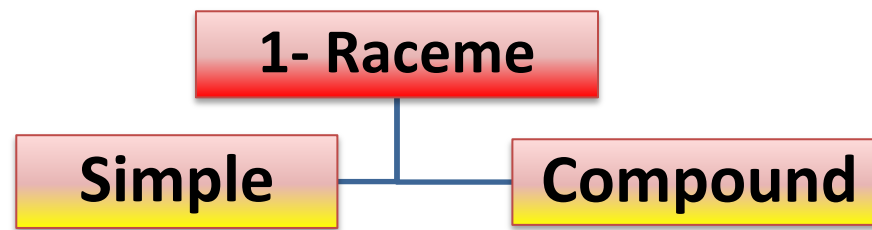
Catkin

Cymose

Monochasium

Dichasium

Polychasium



An inflorescence consisting of a main axis, bearing single flowers alternately or spirally on stalks (pedicels) of approximately equal length. The apical growing point continues to be active so there is usually no terminal flower and the youngest branches or flowers are nearest the apex. This mode of growth is known as monopodial

Simple Raceme

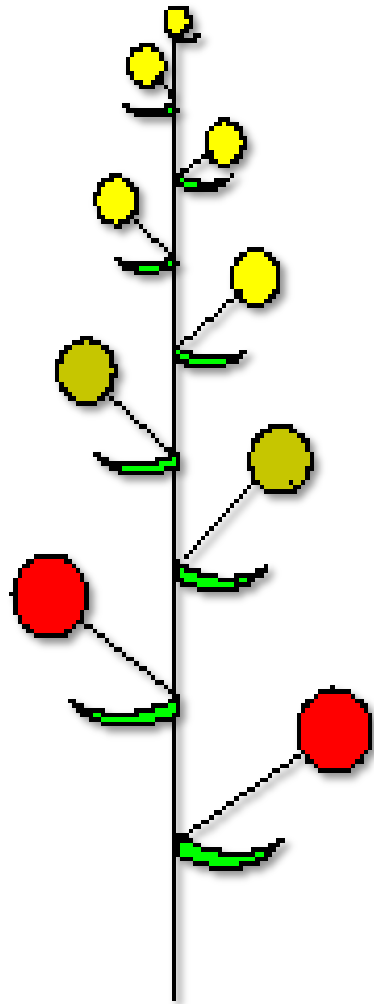
Simple raceme has long peduncle and bears on a number of pedicellate flowers in acropetal succession.

Example: Crotalaria, Erythrina.

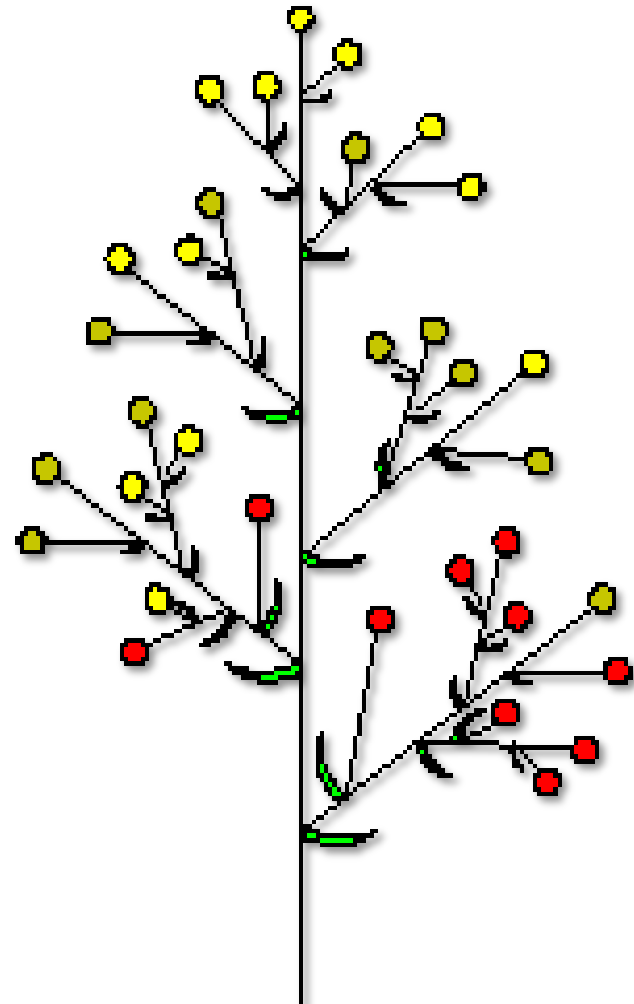
Compound or Panicle

Panicle is a branched raceme. The peduncle produces a number of branches in acropetal succession. On these branches pedicellate flowers are produced in acropetal succession.

Example: Mango.



Raceme



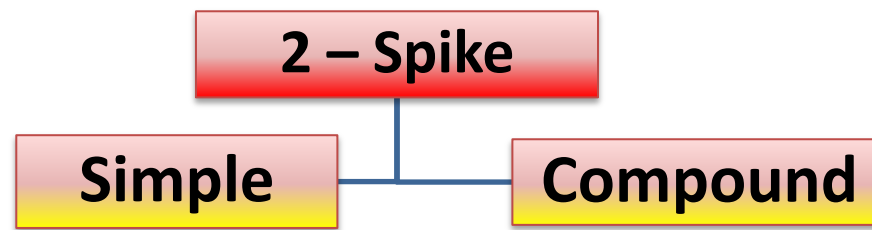
Panicle



Simple Raceme



Panicle



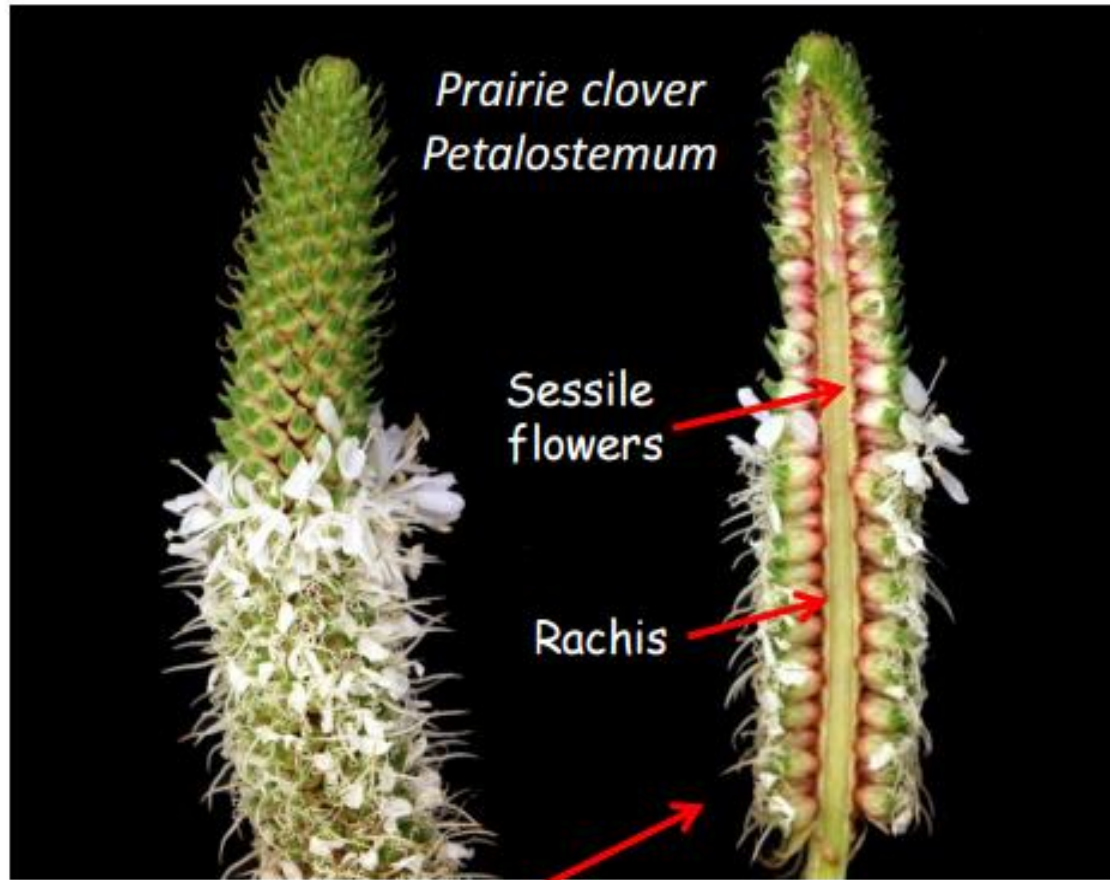
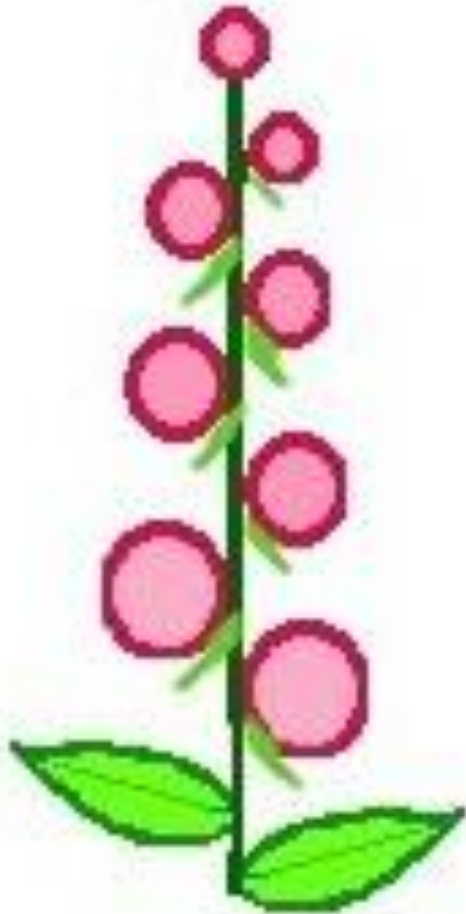
A spike is a raceme, but the flowers develop directly from the stem and are not borne on pedicels, as in *Plantago* spp.

Simple

An unbranched, indeterminate inflorescence in which the flowers are without pedicels, that is the flowers are sessile.

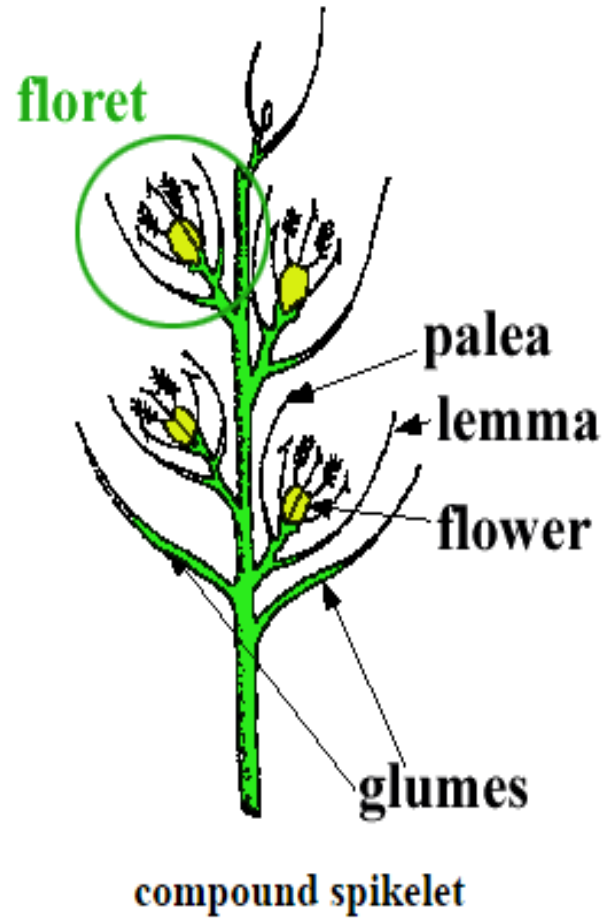
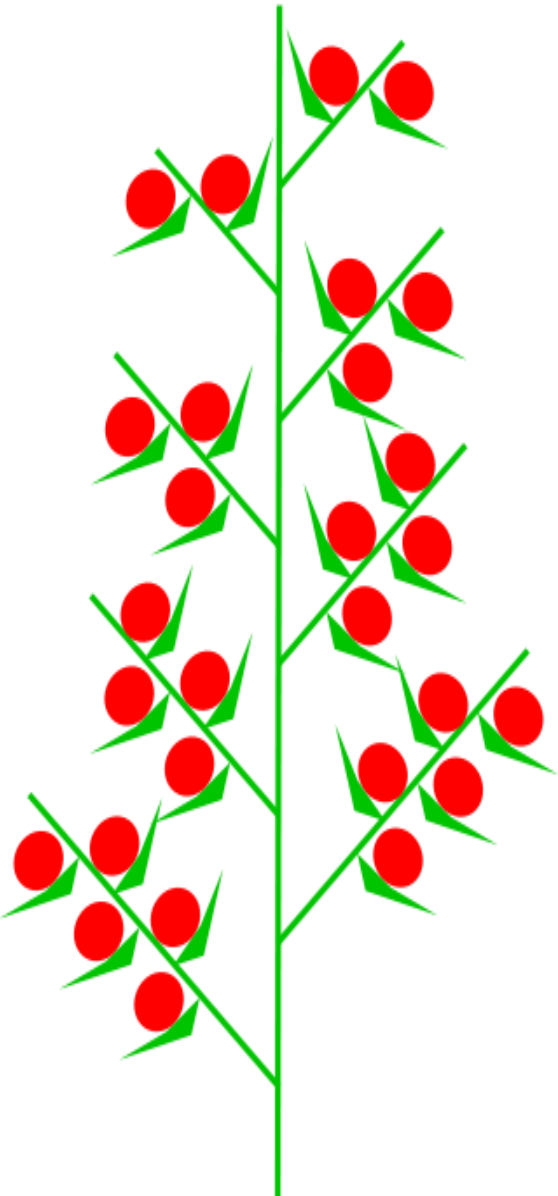
Compound

It is a replicates of the simple spike inflorescence on the same Axis, as in Family Poaceae.



Inflorescence split to expose sessile flowers on the rachis.

Simple spike



Compound spike

splikelet

florets

1st glume

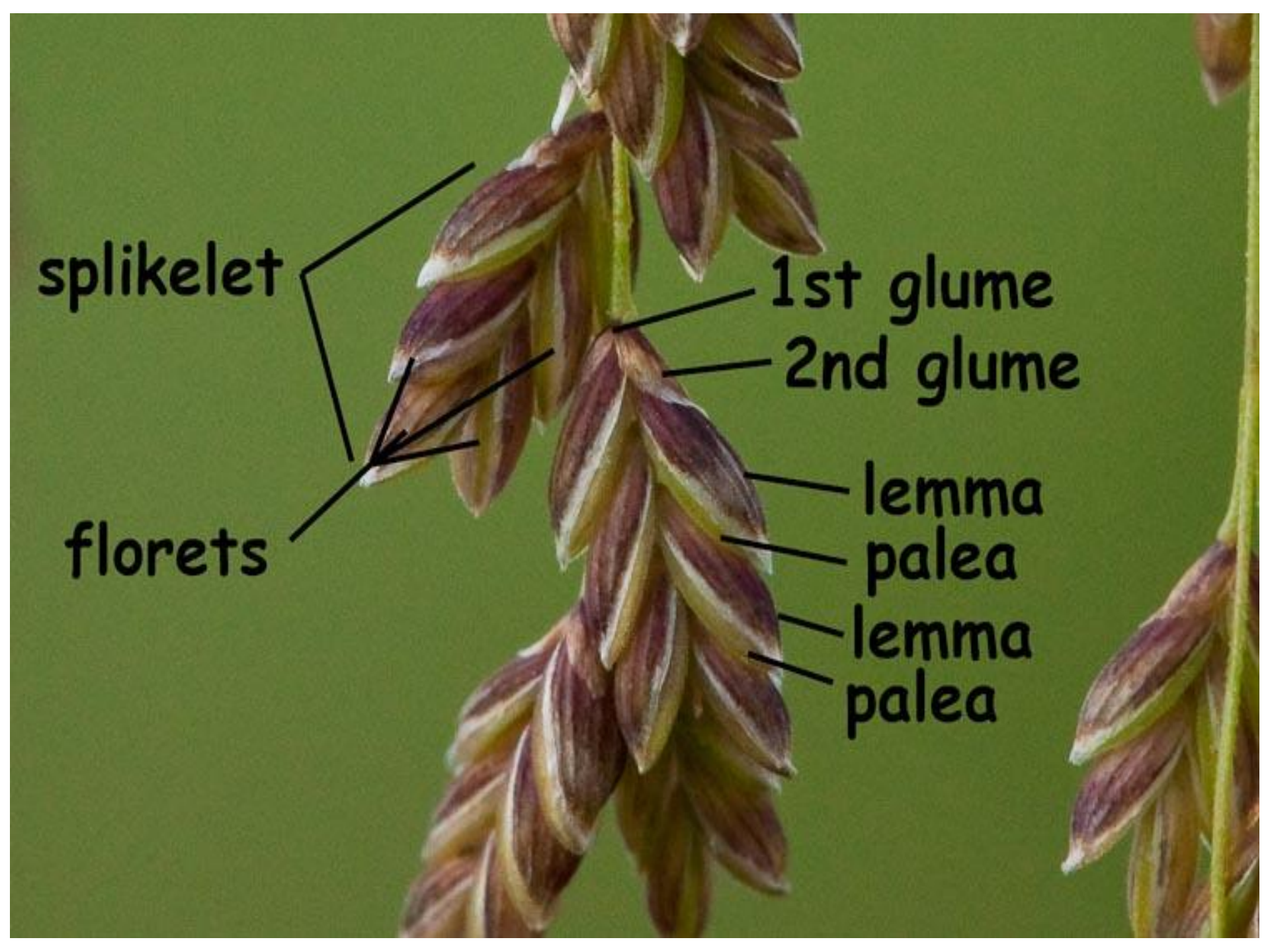
2nd glume

lemma

palea

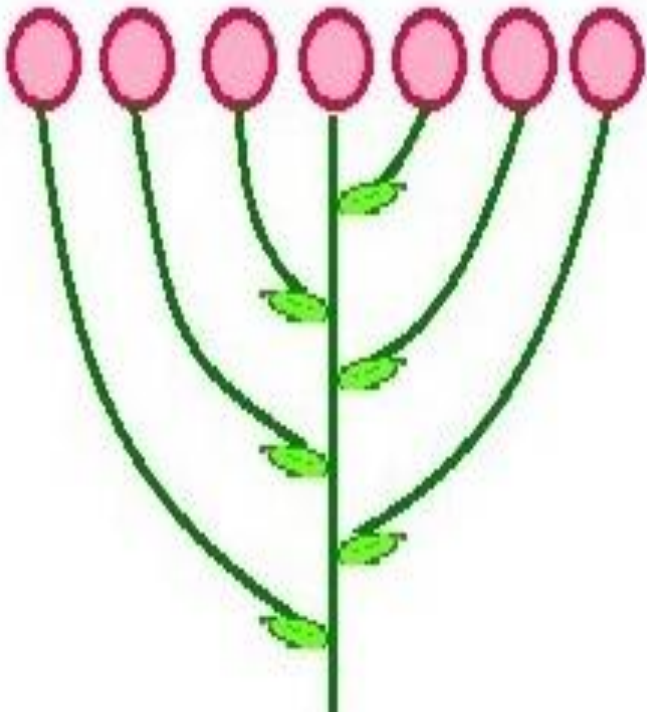
lemma

palea



3- Corymb

Corymb is a racemose inflorescence with a slightly shortened axis. The older flowers have the longer and the younger flowers have the shorter pedicels. As a result of this, flowers of the corymb inflorescence are found more or less at the same level of arrangement.



4- Umbel

Umbel is also a type of racemose inflorescence whose main axis is shortened and at the tip bears a whorl of bracts. All the flowers are at the same level and they show centripetal arrangement.

Simple

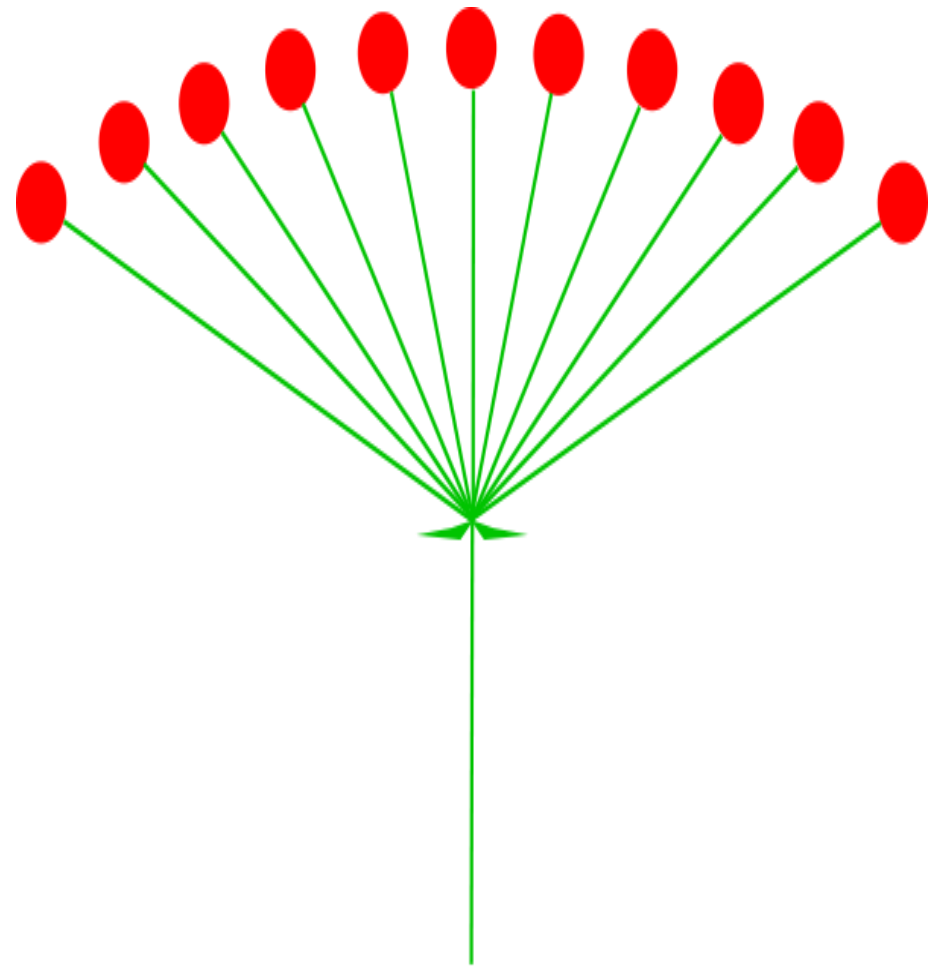
When the peduncle of this type of inflorescence is unbranched and bears a cluster of flowers showing centripetal arrangement, this kind of inflorescence is called simple umbel.

Example: Ammi spp.

Compound

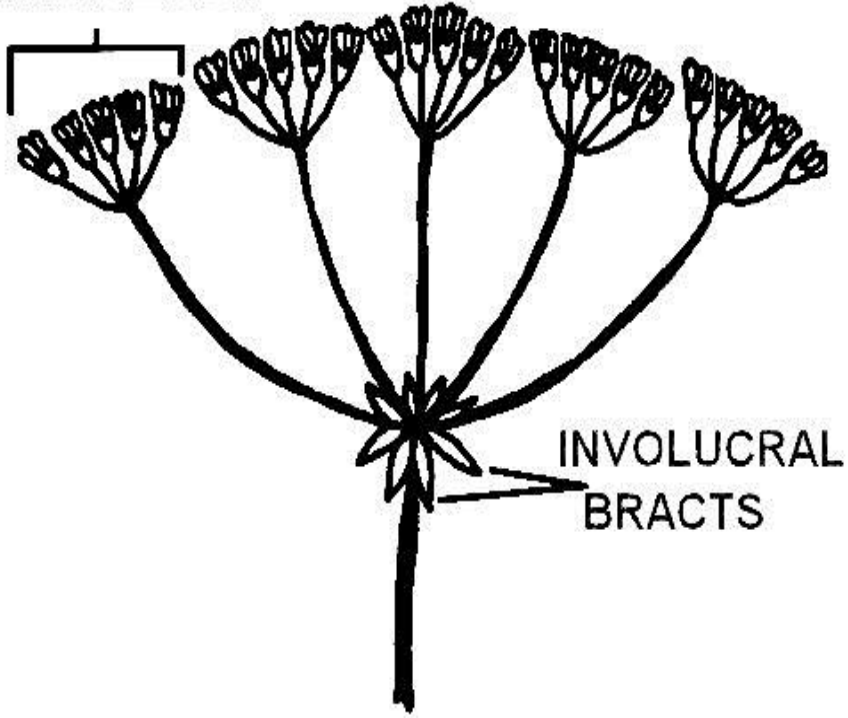
Compound umbel is where the peduncle is branched from the tip of each branch, a cluster of flowers is produced in an umbellate manner called a compound umbel.

Example: Coriander, carrot.

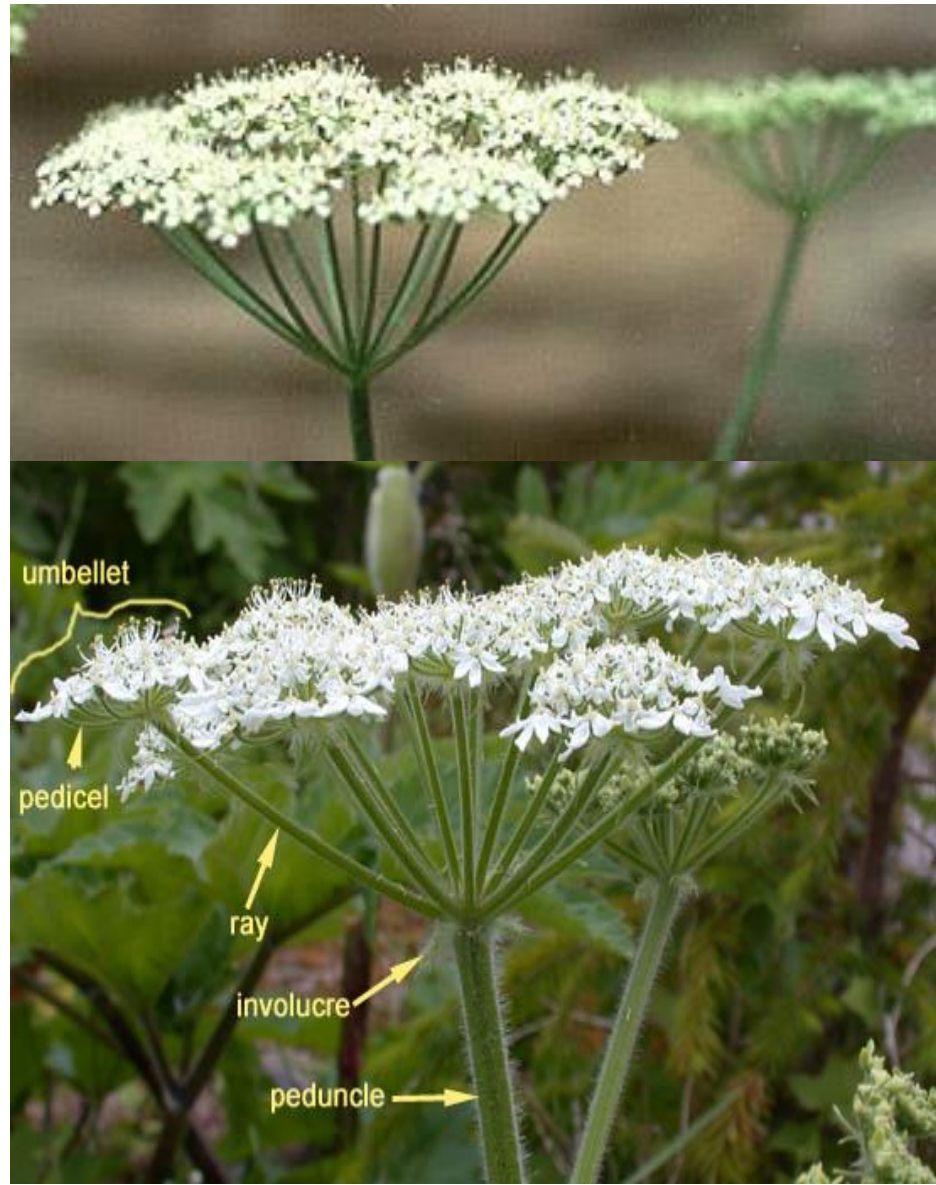


Simple Umbel

UMBELLET



COMPOUND UMBEL

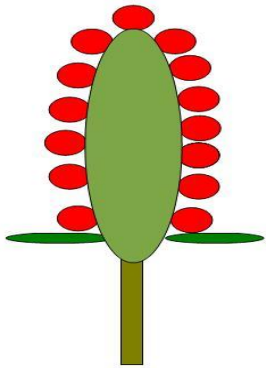


Compound umbel

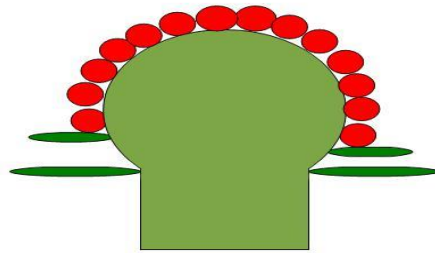
5- Capitulum (head)

A head (Capitulum) is a short dense spike in which the flowers are borne directly on a broad (Sessile flowers), flat peduncle, (Sessile flowers) giving the inflorescence the appearance of a single flower

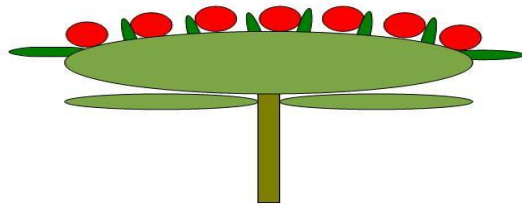
Forms of Inflorescences Part 4



g) spadix



h) head 1



h) head 2

© by FerroMetall



Ray florets

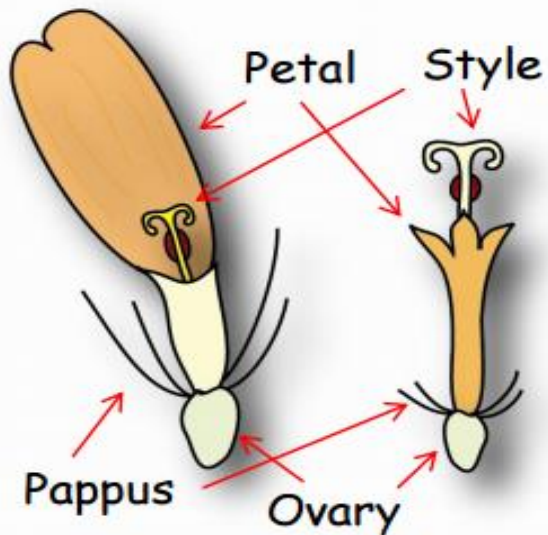
Disk florets



Stokes' aster *Stokesia laevis*

Ray floret

Disk floret



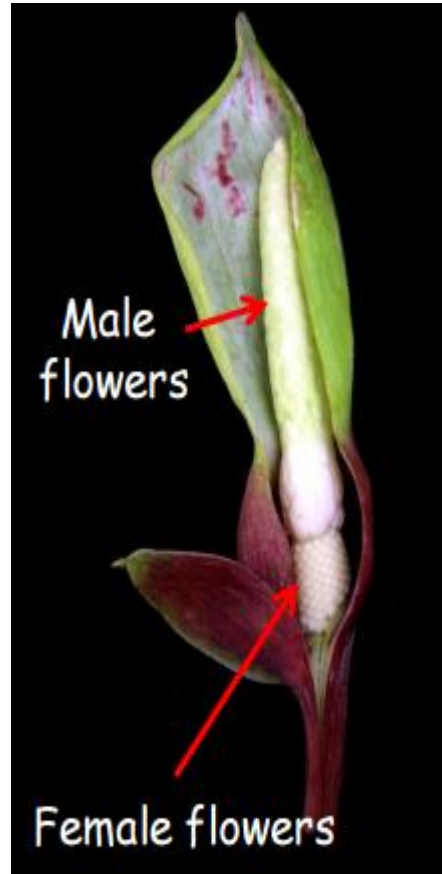
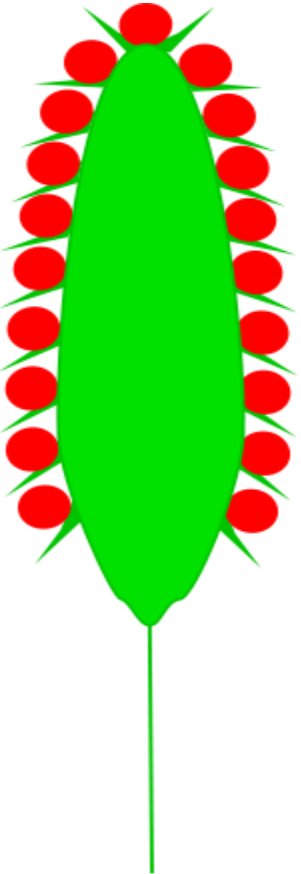
Ray florets

Disk florets



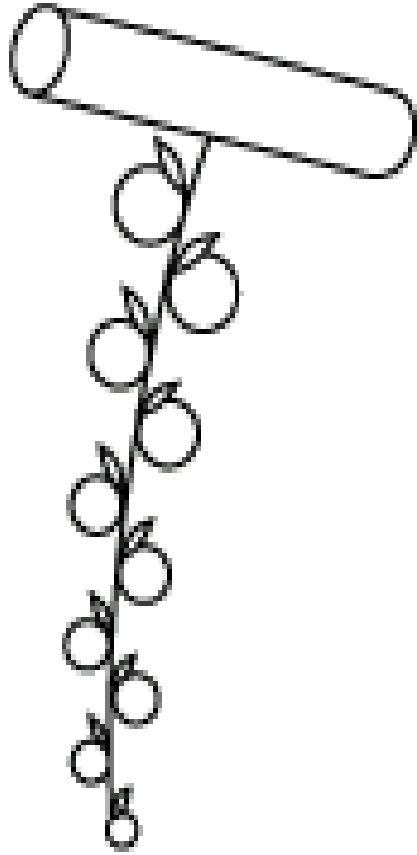
Zinnia

6- Spadix Inflorescence composed of flowers with no pedicel, all embedded in an elongated thick or fleshy ovoid receptacle surrounded by a spathe. The flowers may be unisexual or bisexual. Spadix with unisexual flowers usually have male flowers produced on the upper end of the spadix with females produced at the base.



7- Catkin

Catkin is a type of spike inflorescence with a pendulous peduncle. The flowers in this type of inflorescence are generally unisexual. Ex. *Salix* spp



catkin



Chinese chestnut
Castanea mollissima

Male and female catkins in river birch (*Betula nigra*).





©W.P. Armstrong 2002



male catkin
White Mulberry (*Morus alba*)



individual pistils (female flowers)
each with a stigma, style & ovary

female catkin
Black Mulberry (*Morus nigra*)

©W.P. Armstrong 2002

II. Cymose

```
graph TD; A[II. Cymose] --> B[Monochasium]; A --> C[Dichasium]; A --> D[Polychasium]; B --> E[Scorboid (Cincinnus)]; B --> F[Hilicoide];
```

Monochasium

Dichasium

Polychasium

Scorboid (Cincinnus)

Hilicoide

II. Cymose

A cyme is a determinate inflorescence where each pedicle ends in a **terminal flower**. Flowering is centrifugal where the innermost flower opens first followed by the next outer flower. Cymes can have single (Monochasia) pedicels, double (Dichasia) or multiple (Polychasia) branched pedicels.

Monochasium

1- Scorpioid cyme - a zig-zagging, determinate cyme with alternate branches due to abortion of opposing paired buds at each rachis node.

2- Helicoid cyme, a.k.a. **bostryx** - a determinate cyme in which the branches develop only on one side due to abortion of opposing paired bud

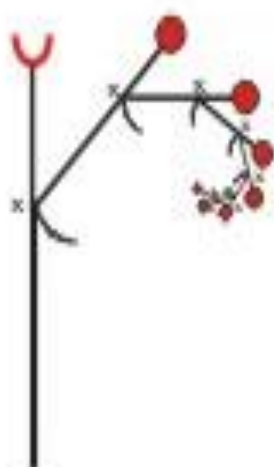
Determinate inflorescences: (first flower to open is at the top or middle)



simple cyme or dichasium
(a simple cyme with
2 lateral branches)



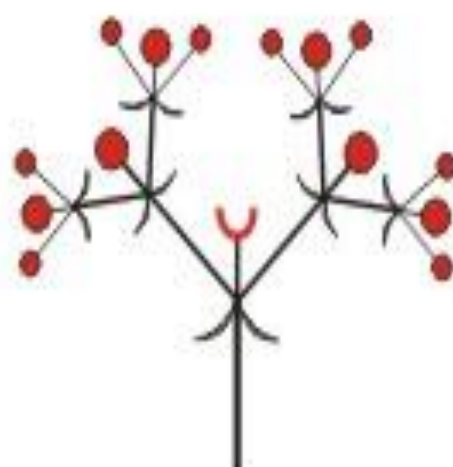
scorpioid
cyme



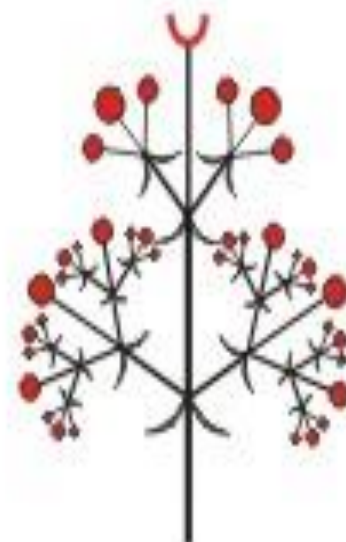
helicoid
cyme



cincinnus



compound
dichasium



compound cyme
(determinate thyrses)



Heliotropium amplexicaule
Boraginaceae
© G. D. Carr

Helicoid cyme

Dichasium An inflorescence having a central older flowers and a pair of lateral bearing younger flowers.

1- **Simple cyme, dichasium** - two dichotomous lateral branches and pedicels of equal length.

2- **Compound dichasium** - a branched dichasium



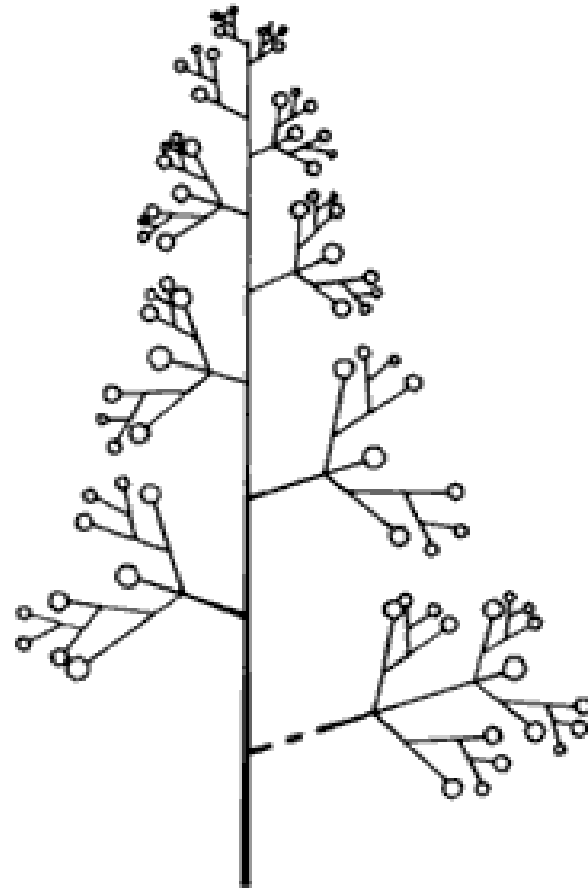
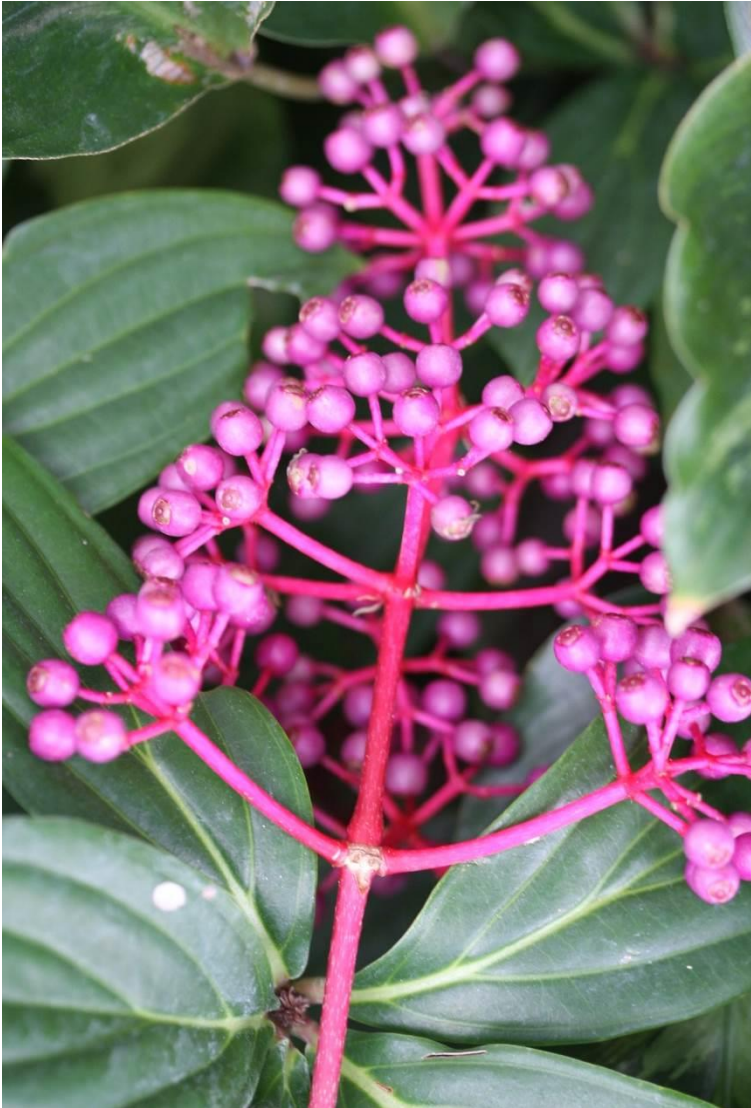
3. Polychasium An inflorescence in which each flower, in turn, is formed at the tip of a growing axis and further flowers are formed on branches arising below it. The largest and oldest flower (the one in longitudinal section) is in the center, with younger flowers on either side and below.



Special Types of Inflorescence

1- Thyse Inflorescence

A thyse resembles a panicle, but the side-branches are cymes, not racemes.



thyse

2- Verticillaster:

This type of inflorescence is a condensed form of dichasial (biparous) cyme with a cluster of sessile or sub-sessile flowers in the axil of a leaf, forming a false whorl of flowers at the node. The first of main floral axis gives rise to two lateral branches and these branches and the succeeding branches bear only one branch each on alternate sides.

The type of inflorescence is characteristic of Lamiaceae (Labiatae) family. Typical examples, are—Ocimum, Mentha.

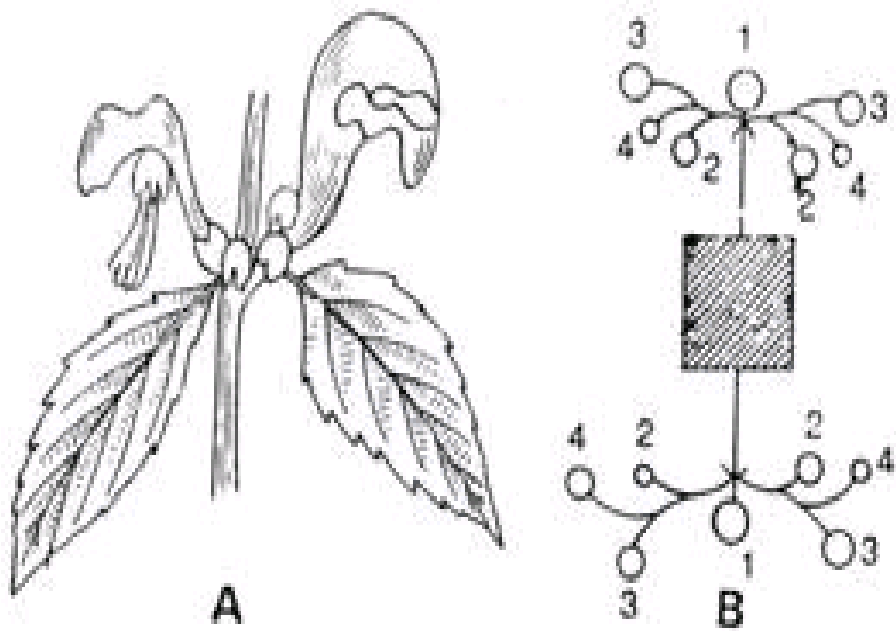
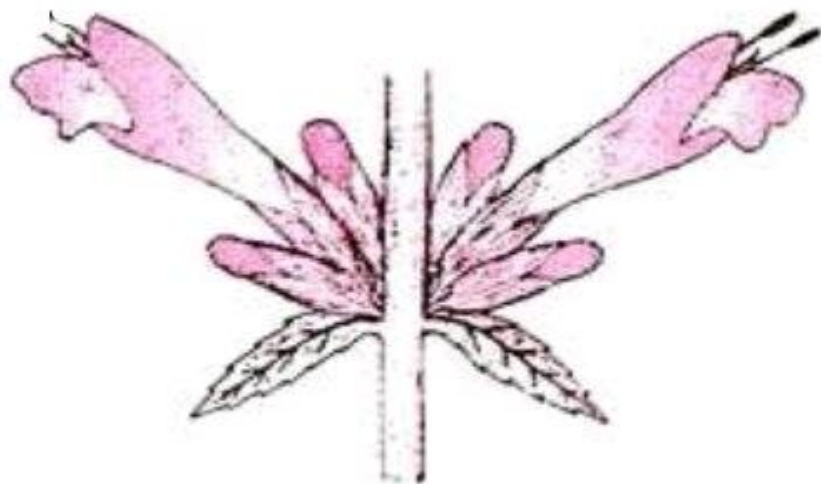


Fig. 34.56. Inflorescence—special verticillaster—A verticillaster of Labiatae; B, diagram of same.

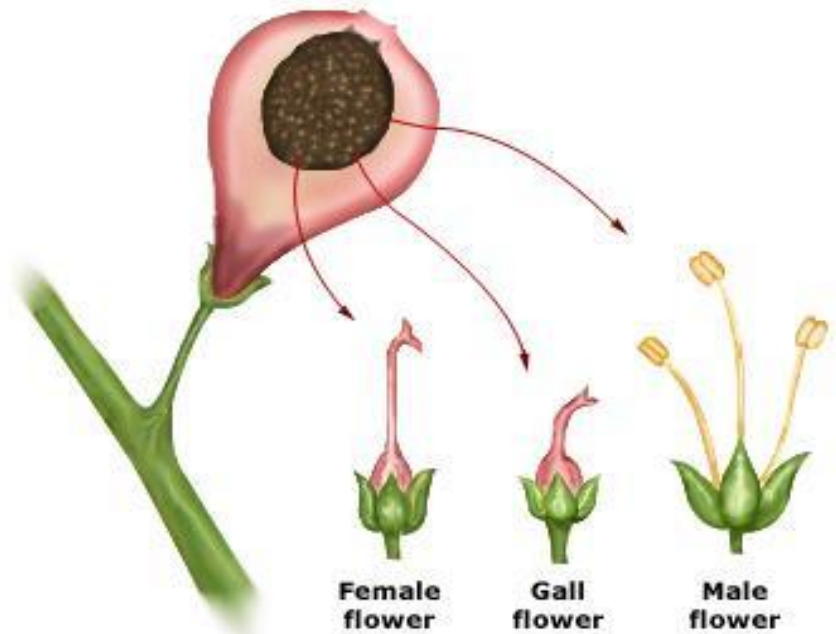
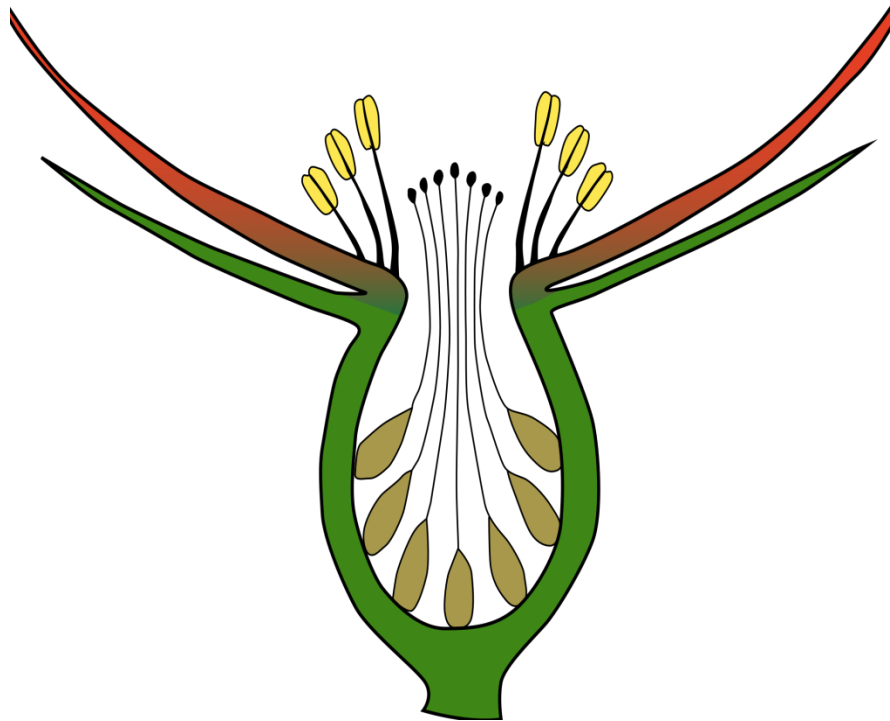


Verticillaster of *Salvia*.

3- Hypanthodium inflorescence

In this type of inflorescence the receptacle becomes spherical with a cavity inside. It opens to the outside with a small opening. Numerous small sessile flowers are produced from the inner surface of the receptacle.

These flowers are of three types: male flowers, female flowers and sterile female flowers (gall flowers) e.g., Ficus.

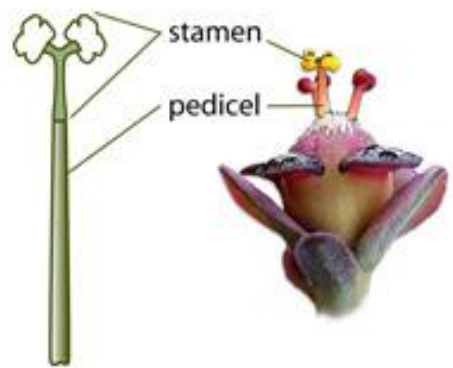


Hypanthodium inflorescence (ficus)

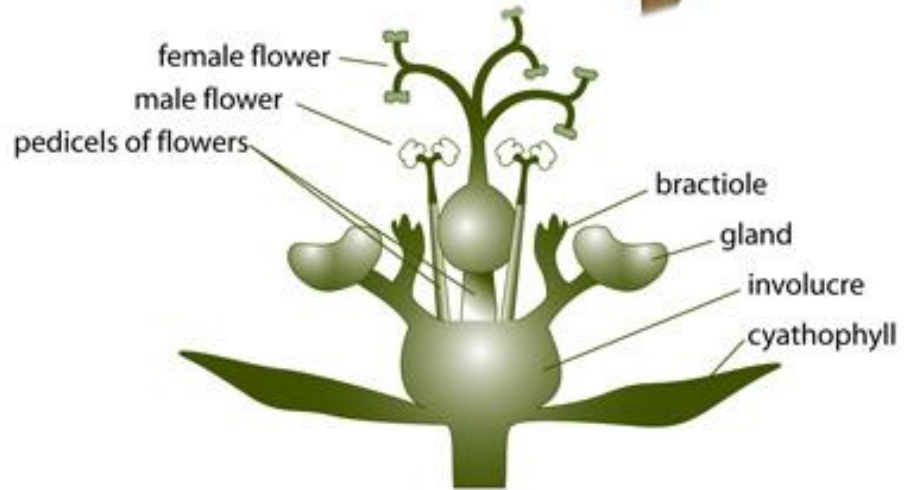
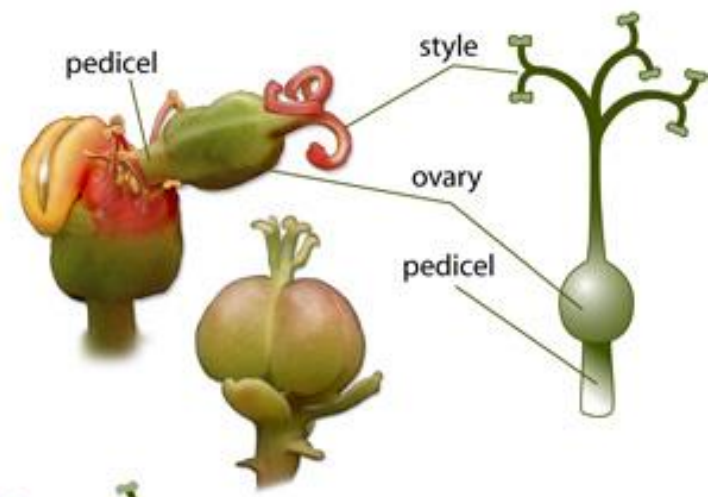
4- Cyathium

Here, the inflorescence is highly reduced. It has a cup shaped receptacle formed by the fusion of five bracts. On the surface of this cup, generally a yellow coloured nectar secreting gland is present. A single female flower arises from the centre of the cup. It is highly reduced and is borne on a long stalk. The male flowers are highly reduced and are produced in a scorpioid manner from the axil of each bract e.g. *Euphorbia pulcherrima*.

Male flower

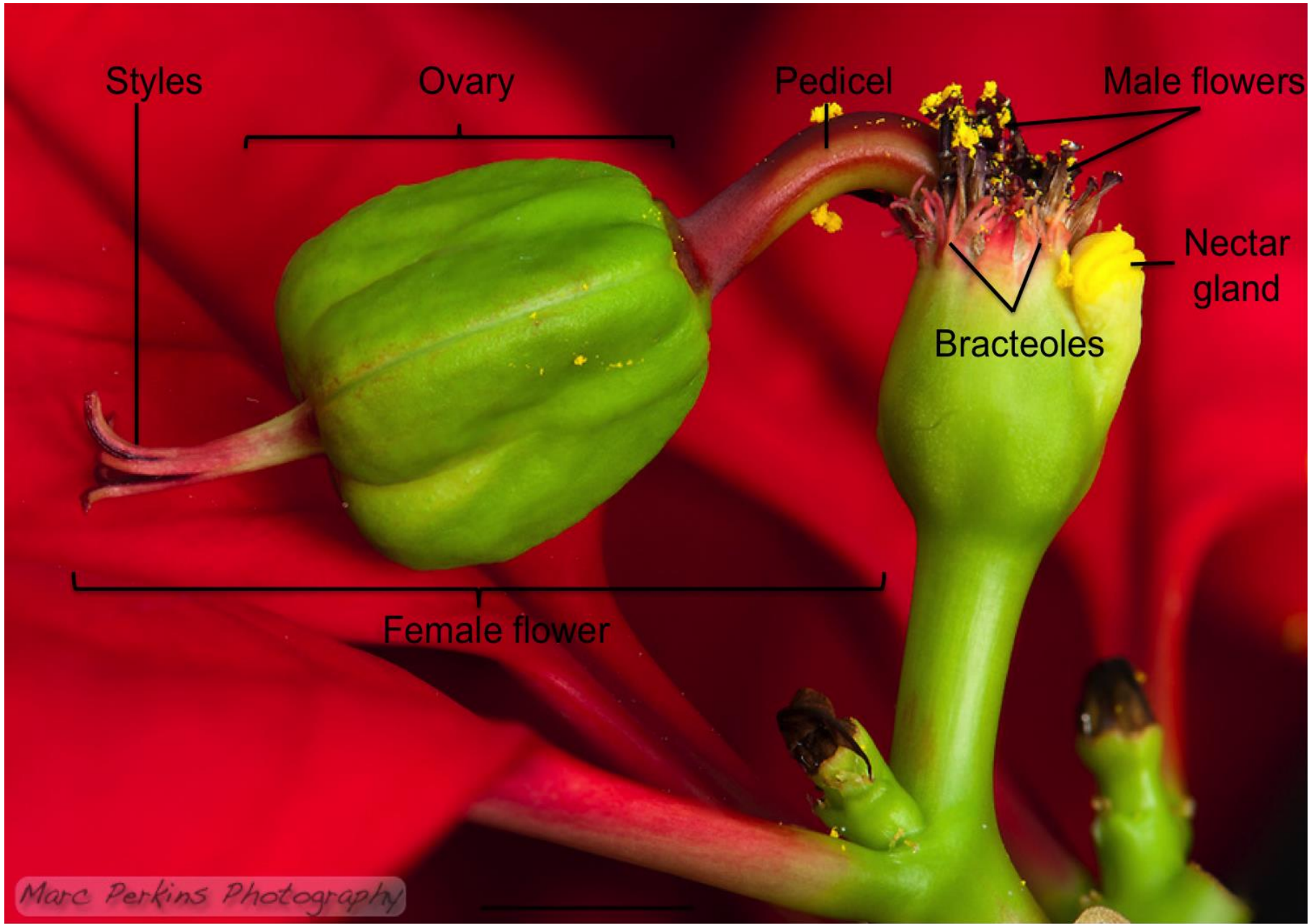


Female flower



Parts of a stylized *Euphorbia* cyathium





Cyathium

DIFFERENCES BETWEEN CYATHIUM AND HYPANTHODIUM

CYATHIUM	HYPANTHODIUM
1.It is a single flower like special inflorescence	It is a fruit like special inflorescence
2.Involucre of bracts forms a cup like structure	Inflorescence axis forms a cup like structure
3.It has external nectaries	It does not possess external nectaries
4.It consists of a single female flower and many male flower	It consists of female flowers, male flowers and sterile flowers calld 'gall flowerers'.
5.Flowers are achlamydeous. (Perianth absent)	Flowers are chlamydeous (Perianth present)
6.Flowers arranged in centrifugal manner eg: Euphorbia and Poinsettia	The arrangement of flowers is not in a definite order. e.g: Ficus.