PRACTICAL PLANT TAXONOMY

3rd Chemistry & Botany

Prepared by

Plant Taxonomy & Flora Staff Members

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Course Prof.

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The year 2022/2023

Contents

Flower structure

Remember

- A flower is the complex sexual reproductive structure of Angiosperms, typically consisting of an axis bearing perianth parts, androecium (male) and gynoecium (female) (Fig.1).
- Bisexual flower shows four distinctive parts arranged in rings (i.e. cyclic flower), which are technically modified leaves: Sepal, petal, or tepal, stamen & pistil.
- Sepal: The parts that look like little green leaves that cover the outside of a flower bud (calyx).
- Petal: The colourful, often bright part of the flower (corolla).
- Tepal: Undifferentiated "Perianth segment" that are not clearly distinguished as sepals and petals.
- Stamen: the male Part which is of filament and anther.
- Pistil: the female part (carpel) which is of stigma, style and ovary that contains the ovules. So that a Flower may be considered for the presence of those parts as:

- **Complete** with all four characteristic parts present calyx, corolla, androecium and gynoecium.
- **Incomplete** lacking one or more of the four characteristic parts
- **Perfect:** A flower that has both the male parts and female parts in the same flower. Examples: most cacti.
- **Imperfect:** A flower that has either all male parts or all female parts, but not both in the same flower. (*Plant bearing imperfect flowers may be* ***monoecious*** *(with male and female flowers on the same plant) and* ***dioecious*** *(with male and female flowers on different plants)*.

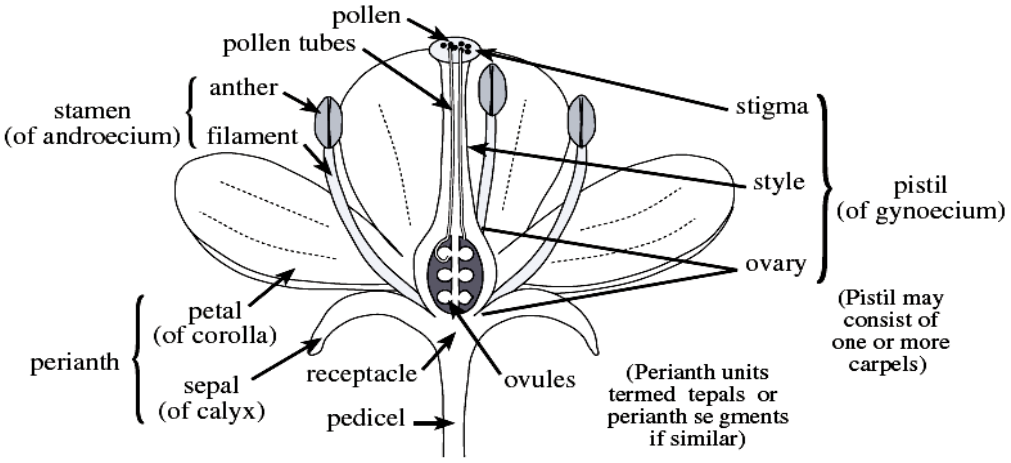


Fig (1): The structure of a typical flower

Flower perianth

(Undifferntiated perianth as taxonomic character)

The perianth is the outer envelope enclosing a flower and is made up of either:

- ✓ An outer calyx and inner corolla.
- ✓ A calyx or corolla; or
- ✓ Calyx and corolla combined and undifferentiated from one another.

The **corolla** of a flower is divided up into **petals** whereas the **calyx** (which usually encloses the corolla at its base) is made up or **sepals**. If the calyx and corolla are combined into one undifferentiated unit, then the individual parts are referred to as **tepals**.

These tepals vary greatly in their type and color between different plants flowers as the tepals may be petalous or apetalous also, they can be free or united to each other and may arranged in 1- or in 2-whorls.

Taxonomic indications of the shape and arranging of the perianth; for examples:

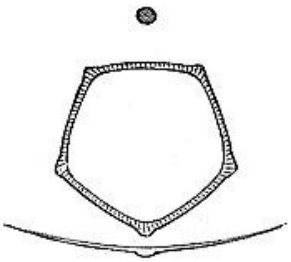
The presence of the undifferentiated perianth is a characteristic feature for the monocot plants and few dicot plants, which are mostly comprises a differentiated perianth to an outer whorl of sepals and the inner petals.

There examples have been shown for the undifferentiated perianth of dicots and monocots:

♣ Noticing that both Chenopodiaceae and Nyctaginaceae [dicots] are related to similar classification groups (sub-class: **Archichlamydeae** (**Monochlamydeae**) and order: **Centrospermae**).

A- Five united tepals arranged in 1-whrol in ***Bougainvillea* (Nyctaginaceae).**

B- (4-5) free or basally united tepals in 1-whrol in ***Chenopodium murale* (Chenopodiaceae).**



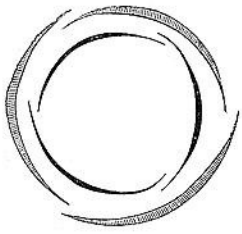
Buginvillea.

Chenopodium

♣ Moreover the Iridaceae and Liliaceae [monocots] are related to the same order: **Liliflorae.**

C- In **Liliaceae** the perianth is of six free tepals in 2-whorls e.g. in ***Frilillaria sp***.

D- In **Iridaceae** the perianth of six joined tepals in 2-whorls.e.g. ***Iris sp***.



Fritillaria

Iris

Practical

►Examine some different flower samples of various plant groups either from the same family or differently; report and draw your observation for the appearance of their perianth and may you find a relationship between each of them?

Androecium

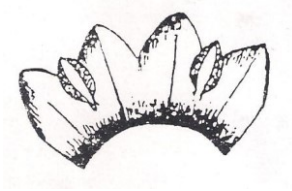
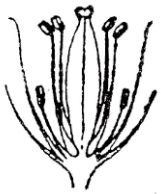
It is the male part organ of the flower; its units os stamens.

Stamen structure

A stamen is two parts of filament attached to flower receptacle and the anther at its tip containing pollen grains. Stamens may be free or united in different form, also the anther takes different posisions where attached to the filament tip, these various forms allows studying the variation between flowers of different plants.

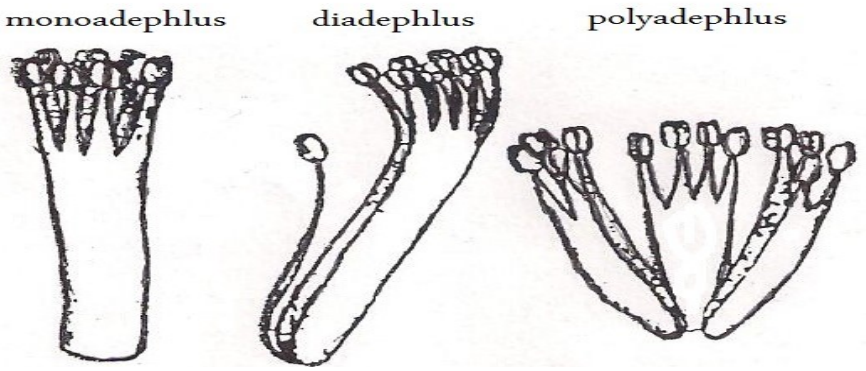
Stamens appearance

Stamens appear in different cases; illustrated as the following:

Case	Illustration	Description
Epiprtalous stamens		Stamens fused with corolla
Didynamous stamens		4 stamens in 2 outer are longer than 2 inner
Tetradynamous stamens		6 stamens, 4 inner stamens longer than 2 outer e.g. Cruciferae
Reduced stamens		Stamens may be sterile e.g. *Tecoma stans*

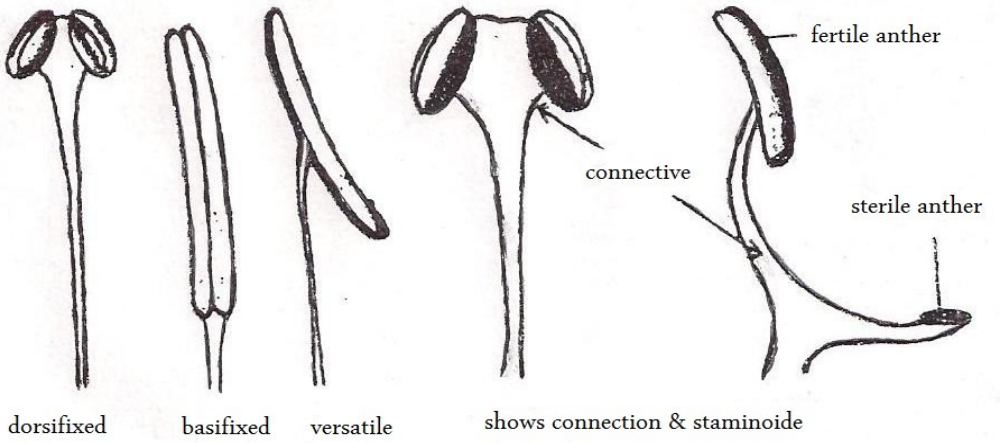
Stamen connation

Stamens appear as fused or connate in different manners as illustrated.

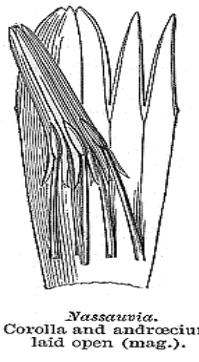


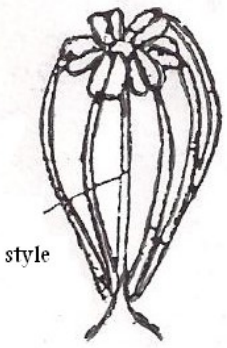
Adhering of filaments with anthers

There are different types of attaching the filament by an anther; shown as:



Stamens connation at anthers forming an anther tube (syngensious):


Nassauvia.
Corolla and androecium laid open (mag.).



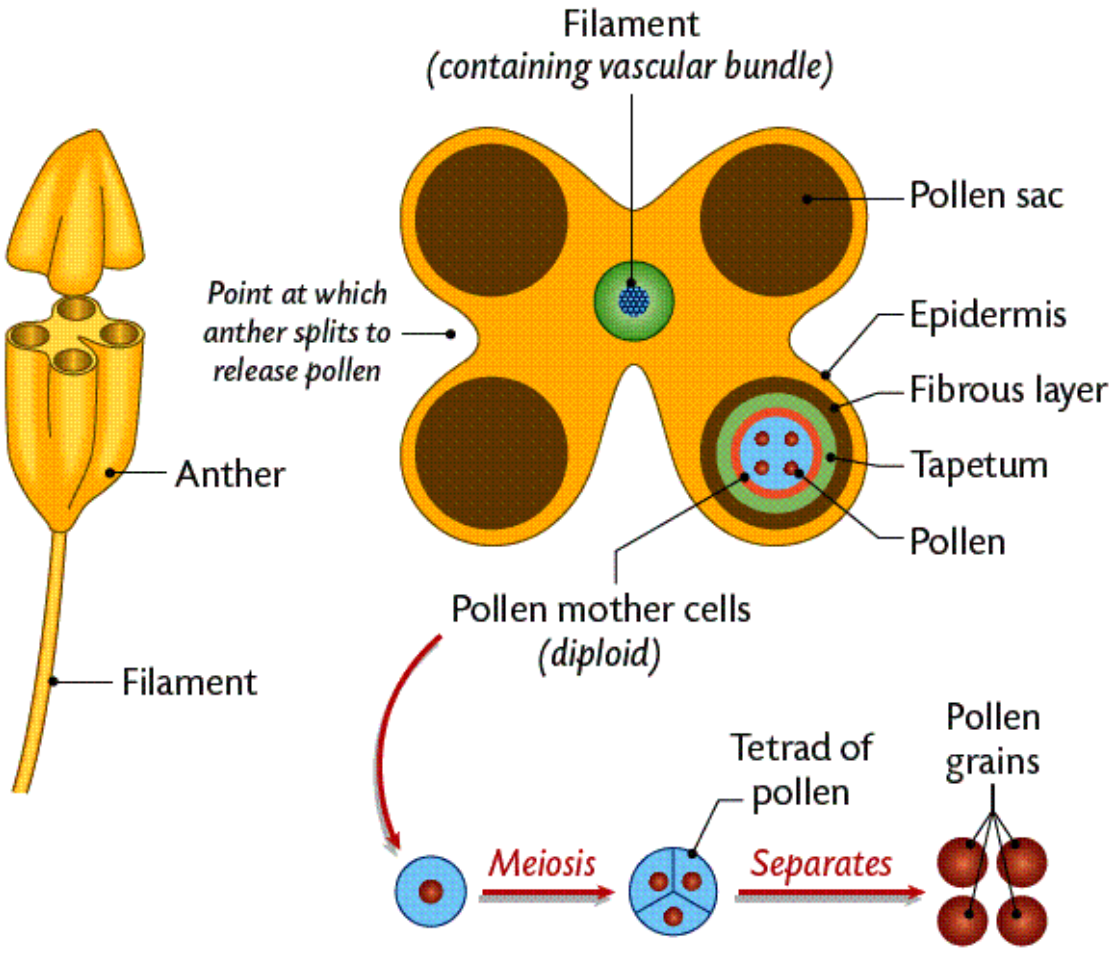
 **Practical** draw an illustarion for reviewing the stamen structure & cases of fusion:

Pollen Grains

What are pollens?

They are the minute structure present in the anther, they are developed to transport from the male gametes to the female part of a flower to perform fertilization.

The study of pollen grains; their structure and their macro- and micromorphological characters is called "Palynology".



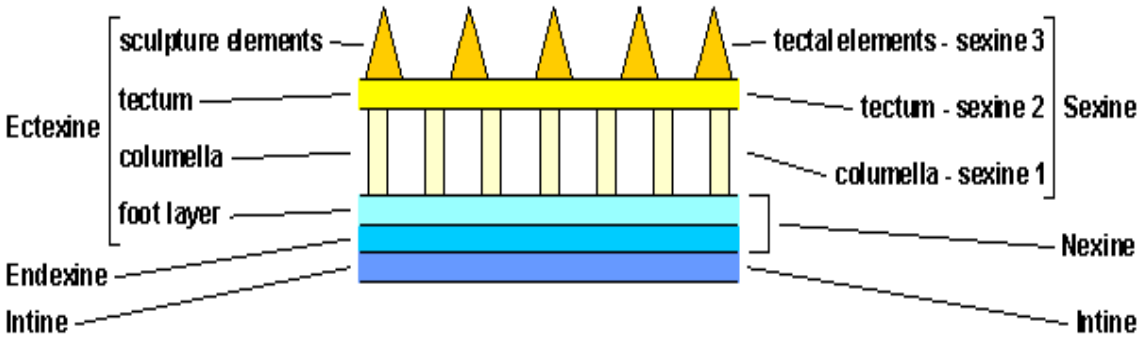
Pollen composition:

Pollen grains must be protected during its journey to the female gamete, so its composition is developed to aid that function. A pollen has a wall which is of two parts:

1. The outer part is "exine", it is formed of an unusual substance called "sporopollenin" which is mostly rough.

2. The inner part is "intine", it is formed of cellulose and it is similar in construction to ordinary cell wall.

Illustration for pollen grain wall structure



Pollens characters:

1) They are microscopic; usually about 15-100 µm.
2) There are various types of pollen grains.

How can different types be recognized?

Each pollen type has its unique set of characters which are related to plant genus, species or family.

Characterization of pollen grains:

There are some main features which distinguish one type of pollen grains

Feature	Importance
Size	Study of measuring pollen diameters.
Shape	Study of measuring P/E ratio to identify the shape (spheroidal, oblate, prolate,…etc.)
Ornamentation	Study of outer wall features such as: pores, furrows, surface sculpturing.
Surface sculpture	Study of cell sculpture as: smooth, granular, reticulate, grooved…etc.)
Germinating pore	Study of type, shape and size of germinating pore

Figure (2): illustrating different pores of pollen grains:

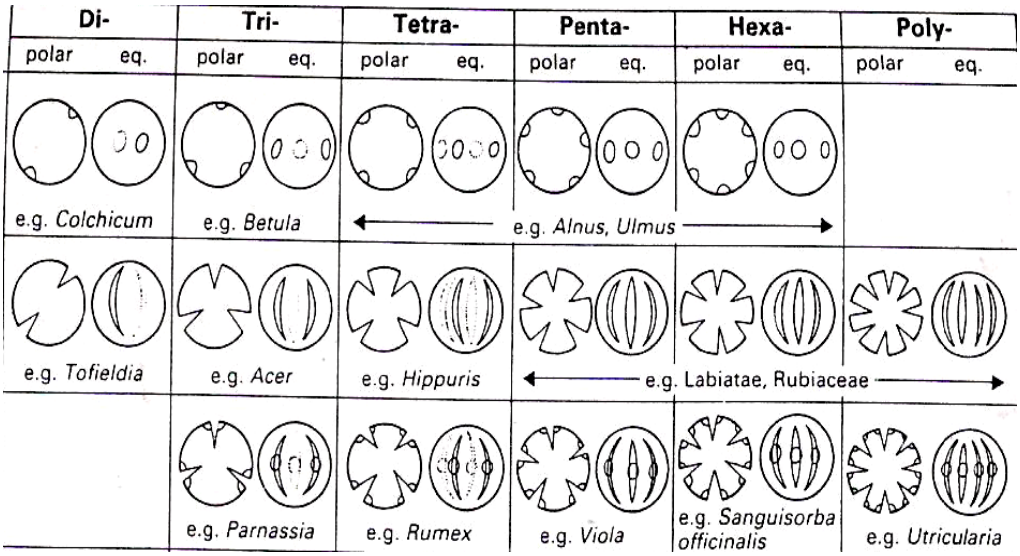
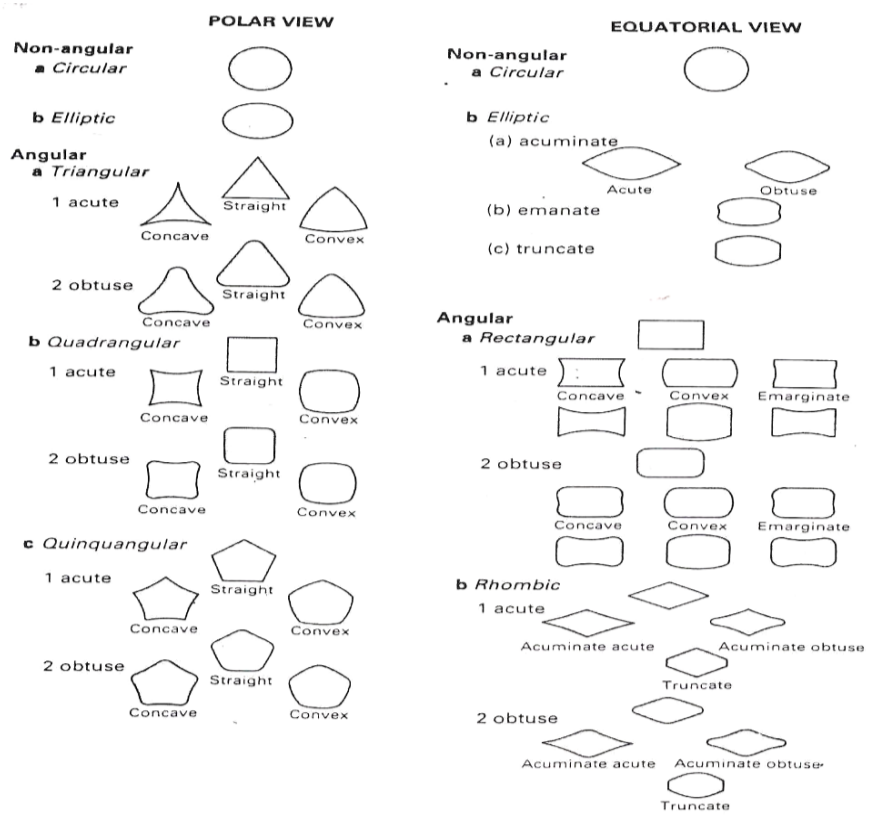


Figure (3): illustrating different shapes of pollen grains:



Microscopic study:

All features of pollen grains are studied by LM and SEM.

Preparing slides of pollen grains for examining by Light Microscope (LM):

I. Fresh samples (not fixed slide sample)

Procedures:

1. Use clean dry forceps to pick up anthers from a plant flower.
2. Place an anther or more on a clean dry glass slide.
3. Gently press on anthers to release pollens outside.
4. Dropping of water, glycerin or a mix of both.
5. Cover the sample smear and examine with different magnifications.
6. Report your observations and draw, identify the plant name and family name.

II. Permanent or semi-permanent samples

Procedures:

1. Prepare Glycerin Jelly Mounting Media as follows.

Components

20 g gelatin, 60 ml glycerin (same as glycerol)

2.4 g phenol *Be Very Careful with Phenol* and 70 ml distilled water

Preparation

- Boil dist. Water and measure 70 ml and add to gelatin.
- Boil that again and mix by a glass rod.
- Add glycerin and phenol content and mix.
- Let it to be solid.

N.B. you can add a stain if require and you can also reduce amounts of above components.

2. Repeat steps 1, 2 & 3 as in fresh samples procedures.
3. Cut a small part of the solid jelly, add on pollen sample and mix them.
4. Cover the sample and gently heat to melt glycerin jelly with sample.

5. Quickly add small amount of paraffin wax to be homogenized with sample and to fix the cover. Put the slide sample in an inverse manner to provide more homogeneity between pollen sample, mounting medium and the wax.

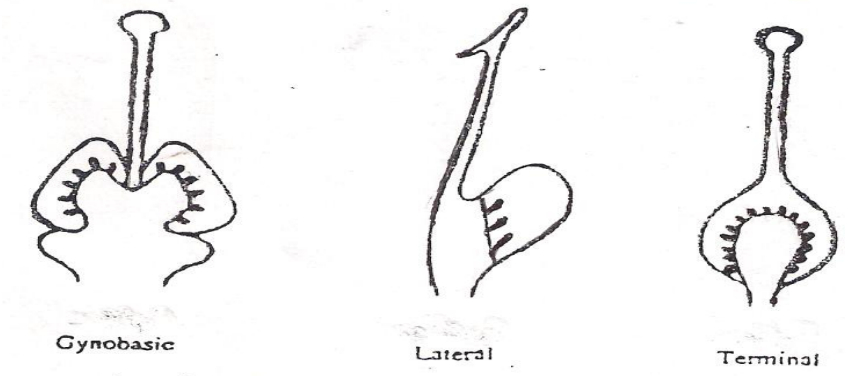
 **Practical:** prepare a fresh or permanent slide samples of pollen grains examine and report your observation with drawing.

Gynoecium

It is the structure that refers to producing the ovule in angiosperms. It is typically the innermost whrol of structure of a flower. The unit of gynoecium, whether of a lone carpel or multiple carpes, consists of:

1- Ovary: enlarged part containing the placenta pearing the ovule. A chamber in the ovary called a locule or a cell. There may be a single locule or more than one, if they are many, the walls dividing the are called septa.

2- Style: a stalk-like tube allowing pollen grains to reach the ovule. The style may differ in its attaching to the ovary.



3- Stigma: its name derived from the greek word that means mark or puncture, it is found usually at the tip of the style and is mostly sticky feathery to capture pollens.

Types of Gynoecia

According to the composition of carpels; study the following terms:

Gynoecium composition	Gynoecium terminology
• Single carpel	Monocarpous or unicarpellte gynoecium
• Multiple distinct carpels	Apocarpous gynoecium
• Multiple connate carpels	Syncarpous gynoecium

Degree of Connation:

Connation refers to the fusion of all or some of carpel parts and there are different cases as that:

1- Carpel(s) free at three parts.

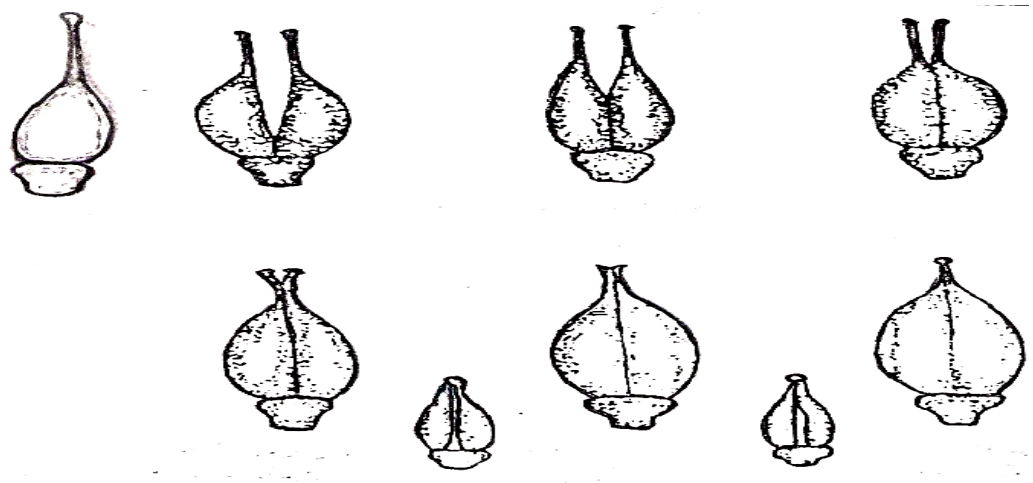
2- Carpels fused at the ovaries while style and stigma are free; fusion also may be completely or partially.

3- Carpels fused at ovaries and styles but stigma stills free; e.g. *Althaea rosa* (Malvaceae), with free branched stigma whereas branches equals fused carpels number.

4- Carpels fused at styles, stigmas while ovaries remain distinct; e.g. *Vinca rosa* (Apocynaceae). The fusion may be completely or partially, when completely no branches for stigmas can be recognized.

5- Carpels fused at three parts (completely).

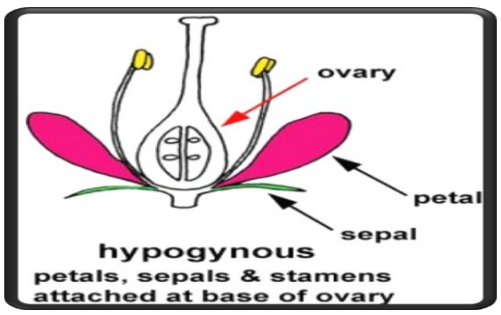
6- Carpels fused at stigmas only while styles and ovaries are free.



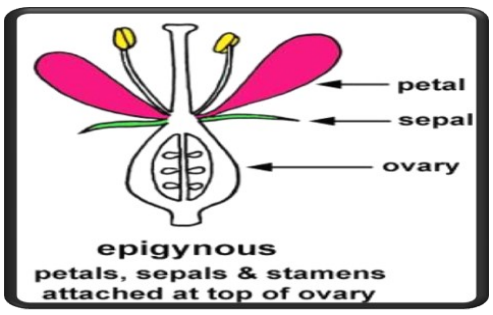
Remember that

Carpel position or flower position

Hypogynous flower

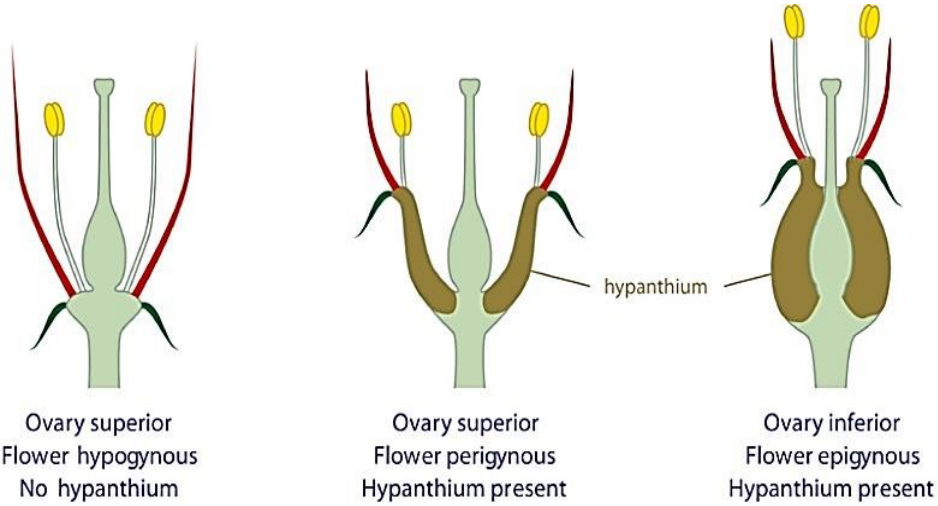


Epigynous flower



Superior ovary

Inferior ovary



Practical draw an illustarion for reviewing the carpel structure & cases of fusion:

Angiospermae

Selected plant families of Dicotyledons & Monocotyledons

Monocot vs. Dicot

Flowering plants are divided into **monocots** (or **monocotyledons**) and **dicots** (or **dicotyledons**). This comparison examines the morphological differences in the leaves, stems, flowers and fruits of monocots and dicots.

Comparison chart

	Dicot	Monocot
Embryo	As the name suggests, the dicot embryo has two cotyledons.	Monocotyledons have one cotyledon in the embryo.
Leaf venation	Leaf veins are reticulated (branched).	Leaf veins are parallel.
Flowers	Petals in multiples of four or five.	Petals in multiples of three.
Root Pattern	Taproot system	Fibrous roots
Secondary growth	Often present	Absent
Stem and vascular system	Bundles of vascular tissue arranged in a ring. The vascular system is divided into a cortex and stele.	Bundles of vascular tissue scattered throughout the stem with no particular arrangement and has no cortex.
Pollen	Pollen with three furrows or pores.	Pollen with a single furrow or pore.
Presence or absence of wood	Both herbaceous and woody	Herbaceous
# of seed leaves	2 seed leaves	1 seed leaf
Examples	Legumes (pea, beans, lentils, peanuts) daisies, mint, lettuce, tomato and oak are examples of dicots.	Grains, (wheat, corn, rice, millet) lilies, daffodils, sugarcane, banana, palm, ginger, onions, bamboo, sugar, cone, palm tree, banana tree, and grass are examples of plants that are monocots.

T. S. in Monocot Stem

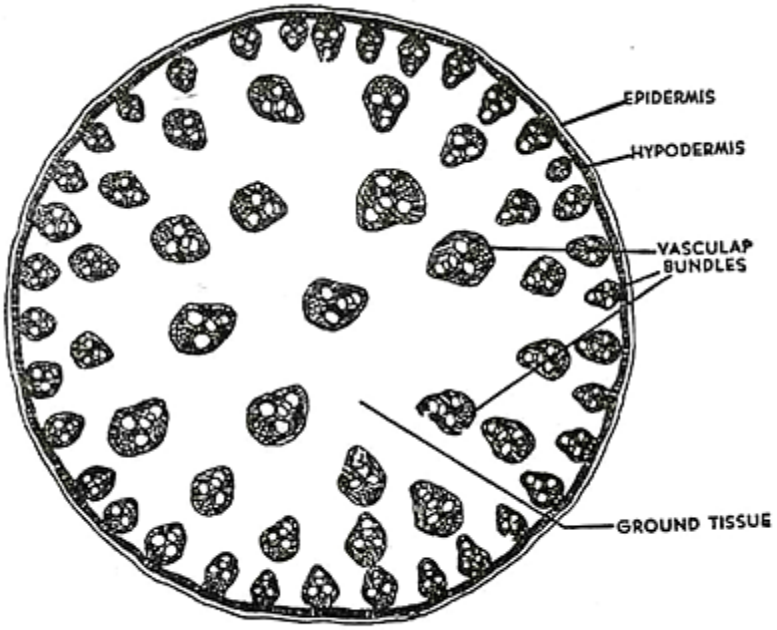
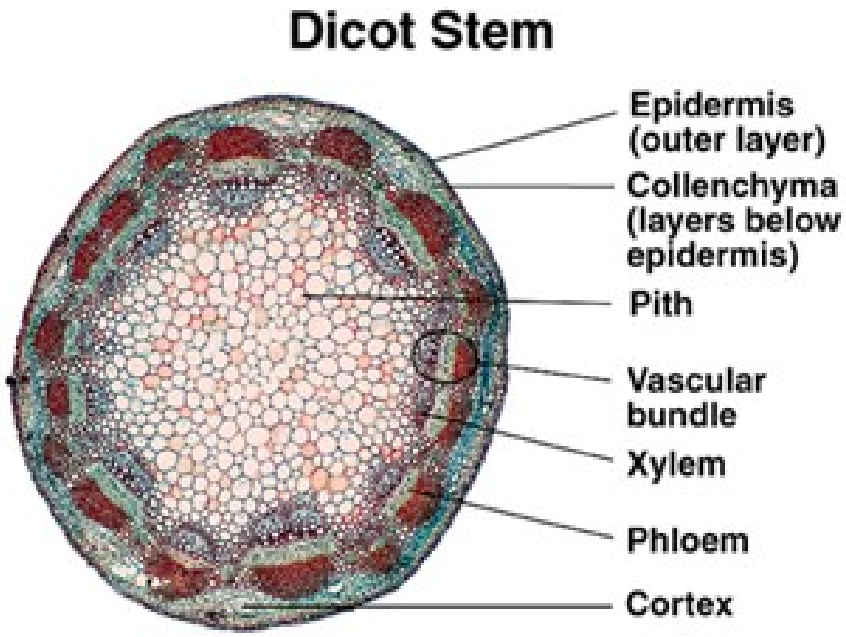
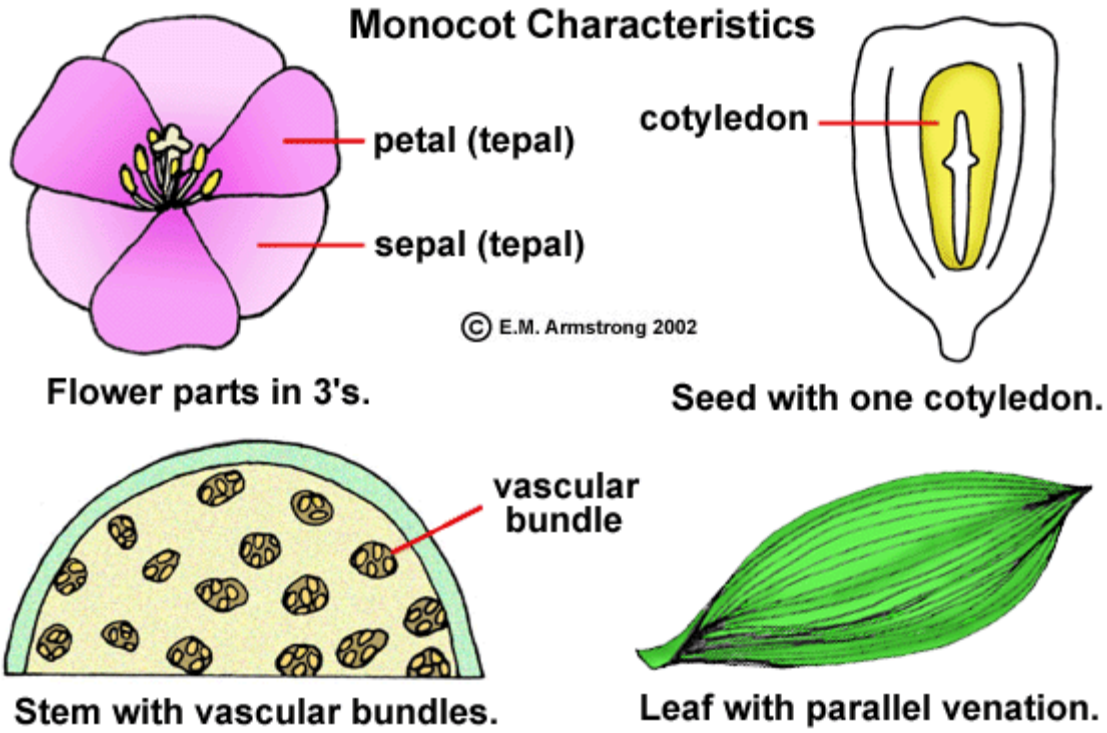
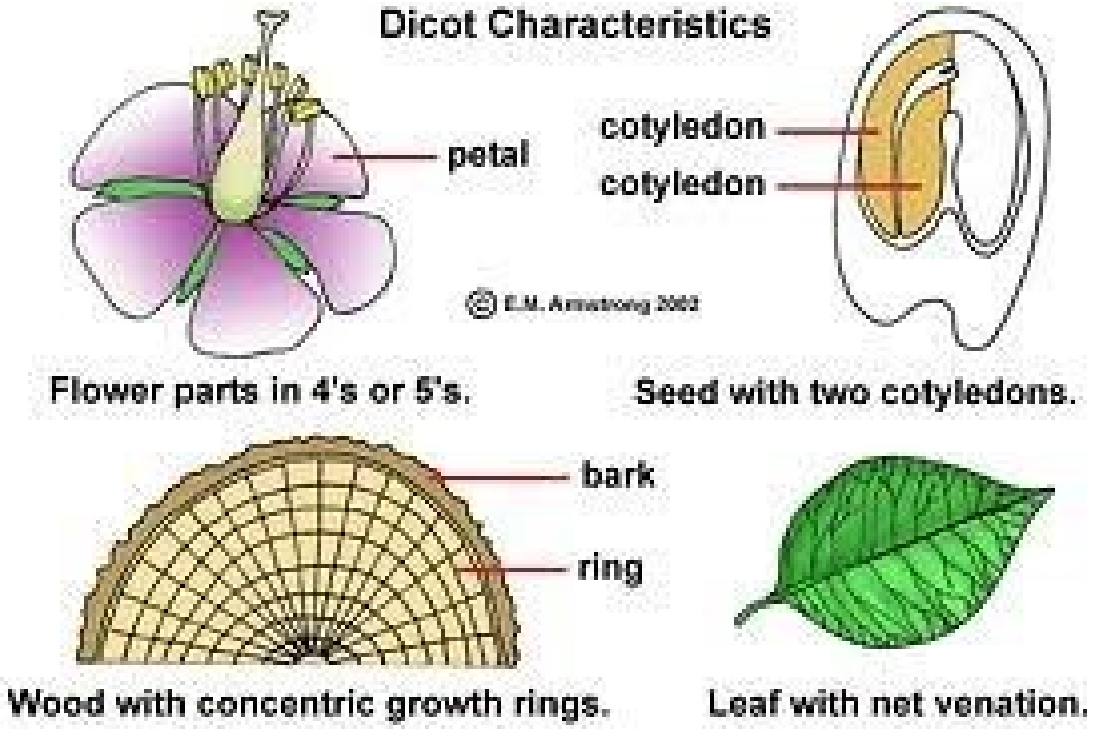


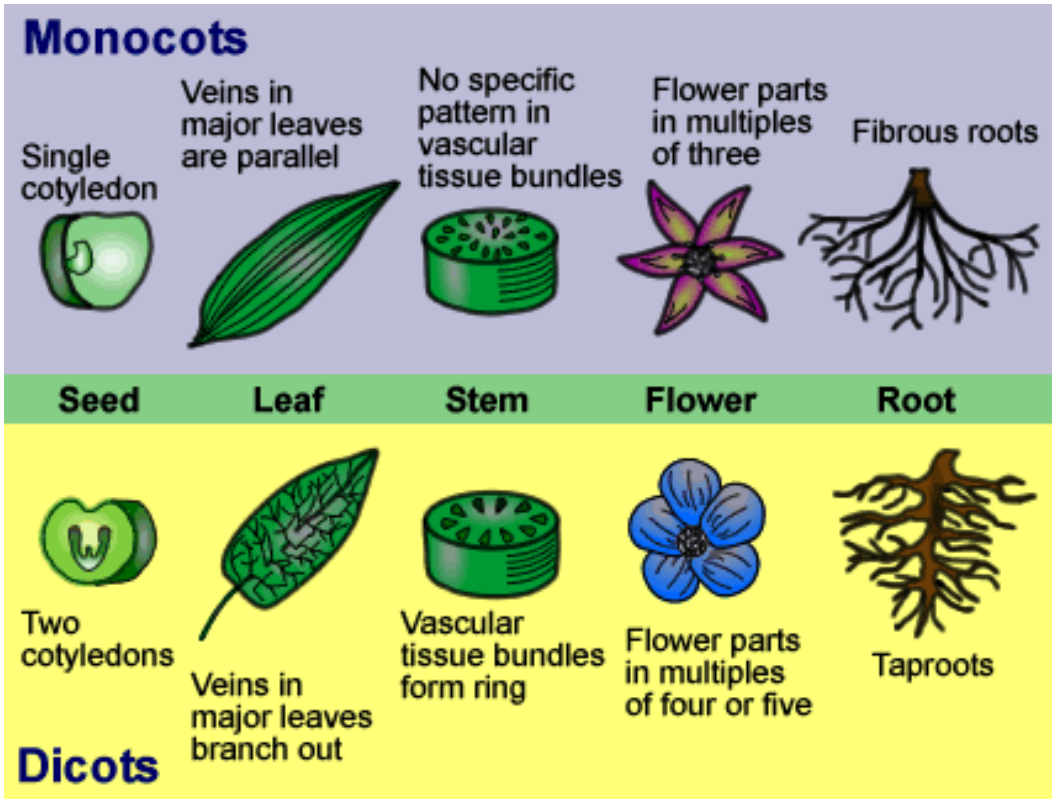
Fig. 150. Transverse section of a maize stem showing the plan of arrangement of tissues (diagrammatic).

T. S. in Dicot stem




Monocot Characteristics
petal (tepal)
sepal (tepal)
© E.M. Armstrong 2002
cotyledon
Flower parts in 3's.
Seed with one cotyledon.
vascular bundle
Stem with vascular bundles.
Leaf with parallel venation.


Dicot Characteristics
petal
© E.M. Armstrong 2002
cotyledon
cotyledon
Flower parts in 4's or 5's.
Seed with two cotyledons.
bark
ring
Wood with concentric growth rings.
Leaf with net venation.



Next, we have to draw an attention to study different families of monocots and dicots. Standing on the most popular comparing characters.

Family name:

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Classification:

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Life form (habit):

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Leaves morphology:

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Floral characters:

1. Inflorescence:

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2. Perianth:

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3. Androecium:

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4. Gynoecium**:**

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Fruit:

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Dissected flower name:

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Floral formula:

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Drawing

Floral diagram F.D.

Longitudinal section L.S.

Pollen grains:

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Draw different views of pollen grains:

Family name:

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Classification:

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Life form (habit):

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Leaves morphology:

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Floral characters:

1. Inflorescence:

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2. Perianth:

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3. Androecium:

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4. Gynoecium**:**

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Fruit:

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Dissected flower name:

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Floral formula:

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Drawing

Floral diagram F.D.

Longitudinal section L.S.

Pollen grains:

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Draw different views of pollen grains:

Family name:

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Classification:

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Life form (habit):

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Leaves morphology:

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Floral characters:

1. Inflorescence:

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2. Perianth:

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3. Androecium:

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4. Gynoecium**:**

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Fruit:

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Dissected flower name:

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Floral formula:

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Drawing

Floral diagram F.D.

Longitudinal section L.S.

Pollen grains:

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Draw different views of pollen grains:

Practice approval sheet

Student name: …….. Faculty/year: …….. Section: ……..

Date	Lesson	Evaluation	Signature
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Evaluation proposal

Presence/absence	Laboratory notebook	Others
Practical degree	Semester Periodic degree	Oral degree

***Notice**

You must keep this proposal and introduce it in the practical test.

Signature
Course Prof.

المراجع العلمية
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Internet site:
http://delta-intkey.com
http://wikipedia.com