

Introduction to Plant Taxonomy

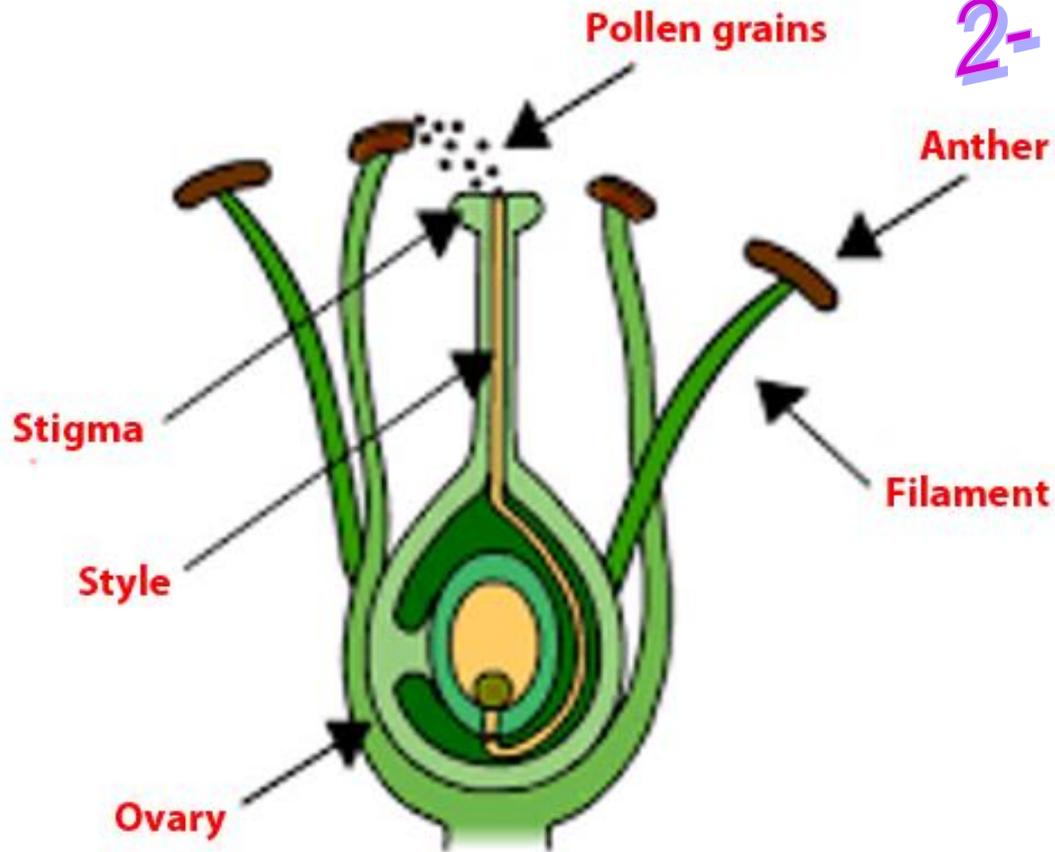
مقدمة في التصنيف الزهري

3rd Lecture

The Essential Whorls

1- Androecium

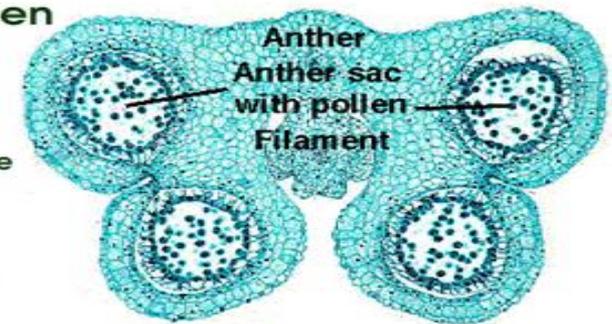
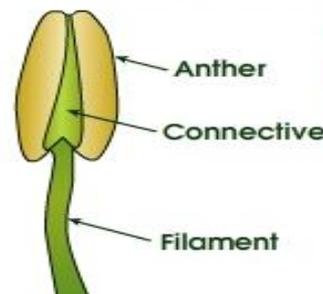
2- Gynoecium



Androecium الطلع

- ❖ The androecium is the male reproductive part of the flower and is composed of a number of **stamens**.
- ❖ Each stamen consists of a **filament**, **anther** and **connective**.
- ❖ The anther has two lobes each of two chambers, called the pollen-sacs, but in many cases there are only two, or even one pollen sac.
- ❖ Pollen grains are developed in the pollen sacs.
- ❖ A sterile stamen (without pollen grains) is known as a **staminode**, as in *Tecoma*
- ❖ **Staminodes** may or may not possess an antherode, a sterile anther-like structure, as in *Jacaranda*

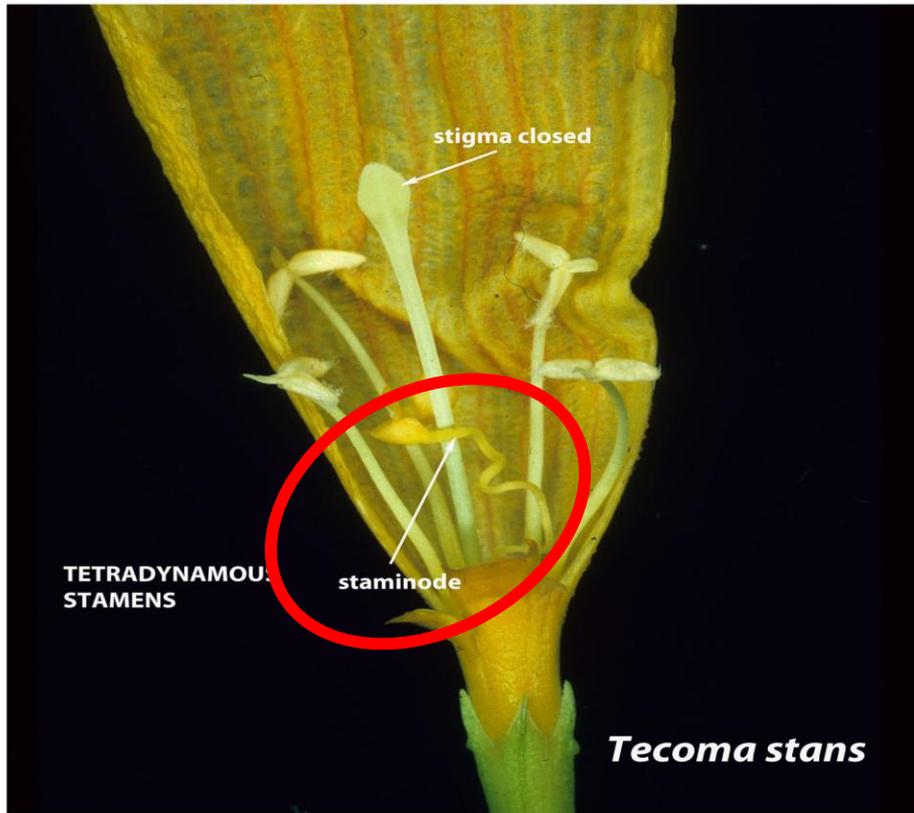
Parts of the stamen



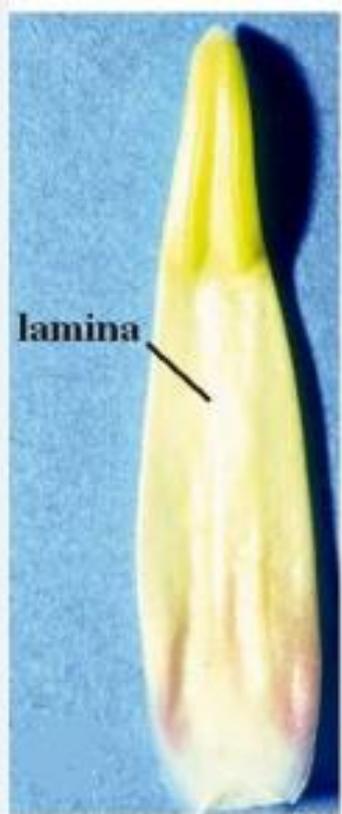
B

A

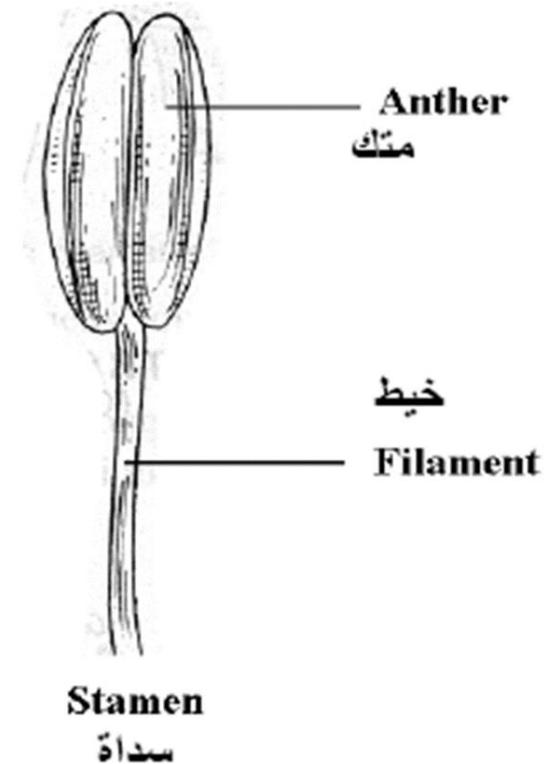
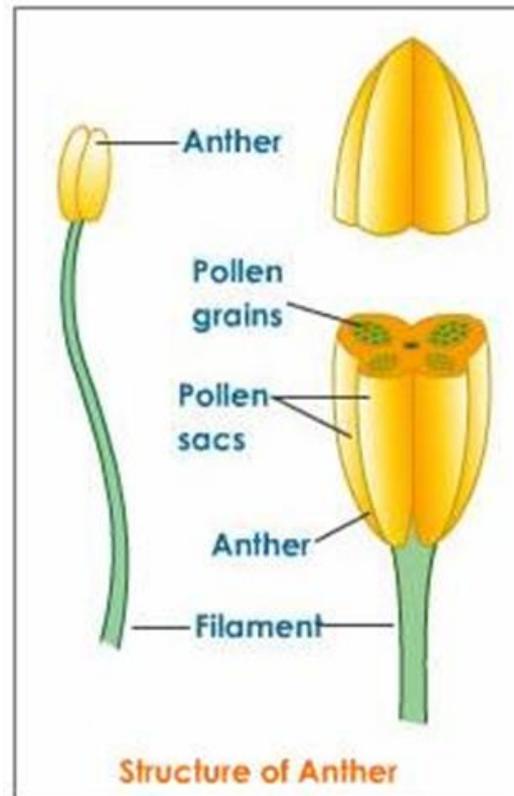
Parts of the stamen (A) and Cross section in an anther showing four pollen sacs (B)



- ✓ Stamens can be leaflike (laminar) : **Example in Gymnosperms**
- ✓ Laminar stamens possess a leaflike, dorsiventrally flattened structure bearing two **thecae**.
- ✓ Filamentous stamens are far more common, having a stalk-like, generally terete filament with a discrete pollen-bearing part, the anther.



Laminar stamen





Nymphaea tuberosa - laminar stamen series

طرق اتصال الخيط بمتك الزهرة Attachment of the Filament to the Anther

There are four principal ways in which the filament is attached to the anther:

- 1) **Basifixed** اتصال قاعدي, when the filament is attached to the base of the anther.
Ex: *Datura sp.*
- 2) **Adnate** when the filament runs up the whole length of the anther from the base to the apex at the back side of the anther, as in ***Magnolia*** عندما يتصل المتك بالخيط علي طول استقامته
- 3) **Dorsifixed** اتصال ظهري, when it is firmly attached to the back of the anther on the mid dorsal side **Ex: *Hibiscus***.
- 4) **Versatile** اتصال متحرك , when it is attached to the back of the anther at one point only and the anther can swing freely in the air, **as in grasses and palms**
لاحظ: للمتك سطحان ظهري وآخر بطني (متجه جهة المتاع).

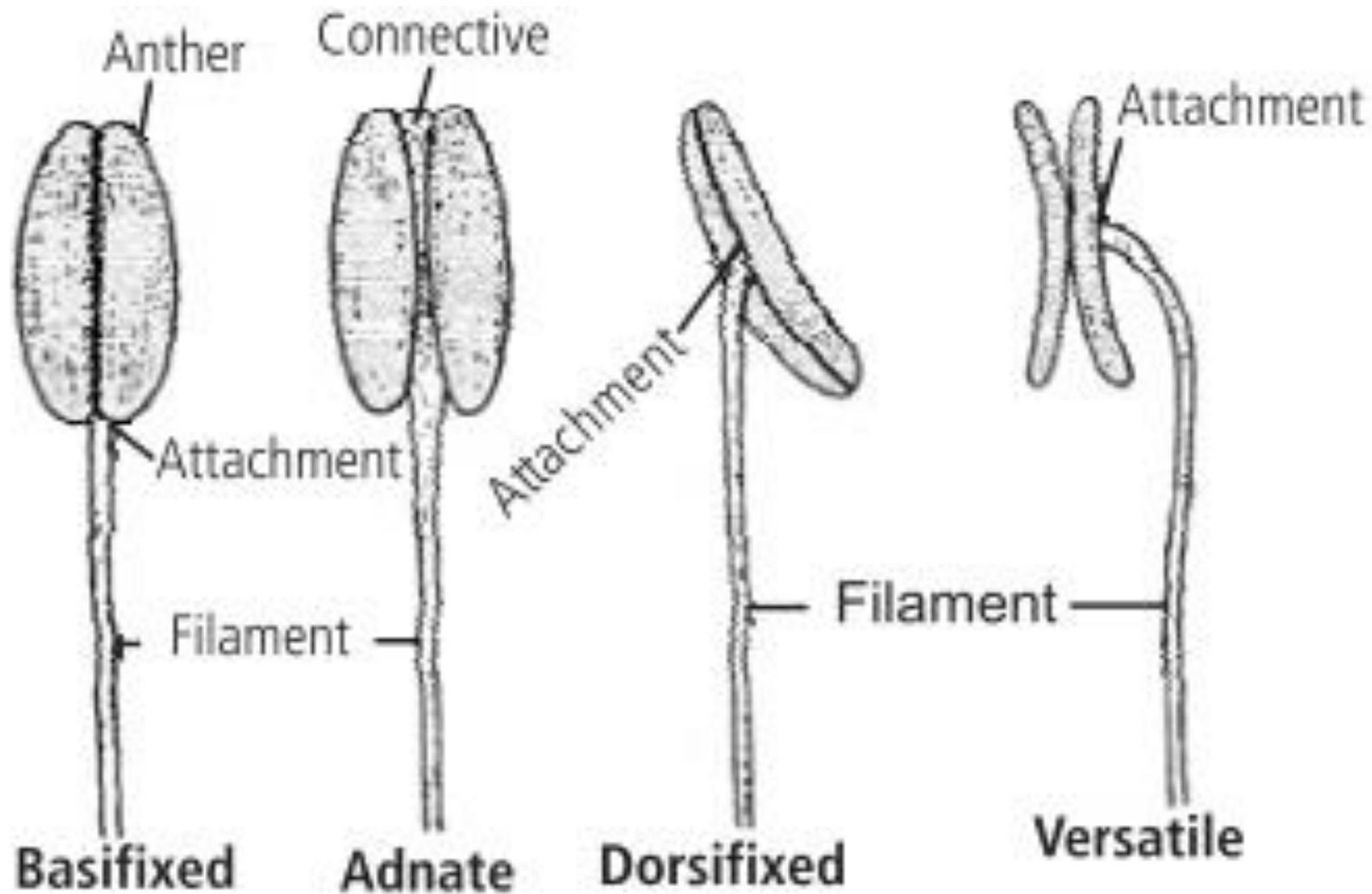


Fig.: Forms of fixation of anthers



Basifixed



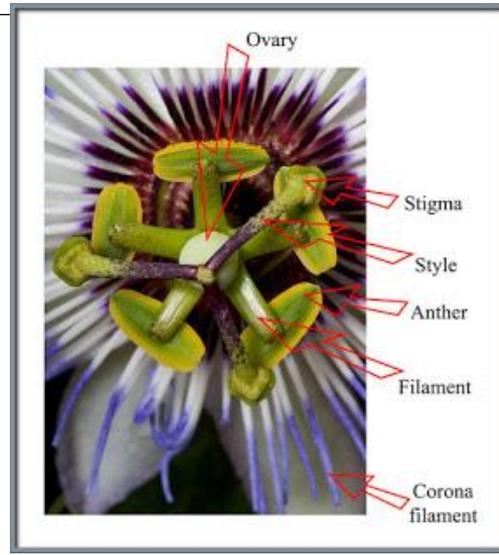
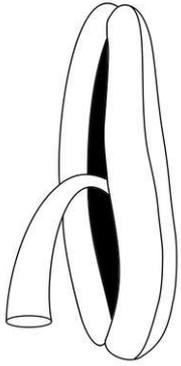
Dorsifixed *Sesbania sesban*



Adnate-Filament خيط ملتحم
يلتحم الخيط بكامل طول السداة:



زهرة نبات اللوتس : *Nelumbium*



زهرة نبات الألام أو الساعة Passiflora



نباتات العائلة النجيلية grasses

متقلب (طليق الحركة) Versatile – Filament

Union of Stamens اتحاد الأسدية

- Stamens may either remain free (**apostemonous**) or be fused.



Union of Stamens: Fusion of stamens among one another or with other

It is of two types, namely: cohesion of stamens إلتحام الأسدية , and adhesion of stamens إلتصاق الأسدية .

- **Cohesion of stamens:** Fusion of stamens among one another. إلتحام الأسدية ببعضها البعض

On the basis of cohesion, androecium of the following types:-

- a) **Adelphous** when the stamens are united by their filaments only forming bundles , and the anthers remaining free. إذا التحمت خيوط الأسدية فقط وظلت المتك سائبة

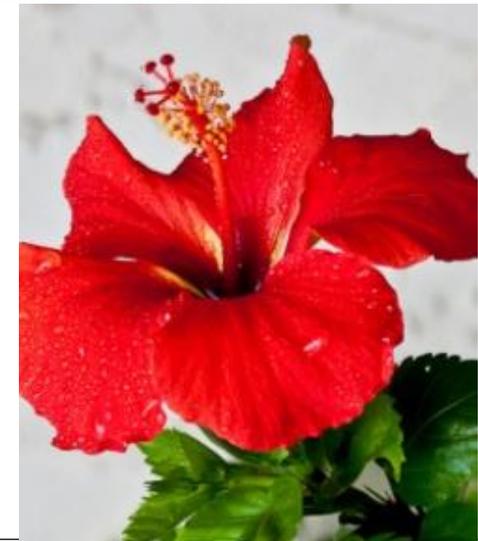
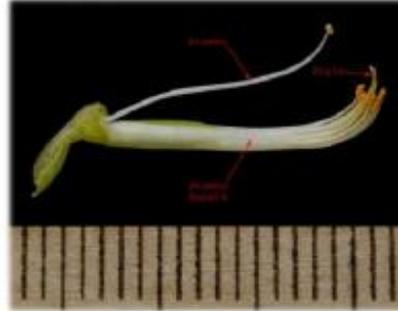
Based on the number of bundles, it is of three types:-

- I. **Monadelphous** (*monos*, single; *adelphos*, brother), the filaments of all the stamens are united together into a single bundle called the staminal tube ending in free anthers. **Example: Hibiscus rosa-sinensis**
- II. **Diadelphous Stamens** (*di*, two), the filaments are united into two bundles, the anthers remaining free. **Example: Papilionaceae**, in which nine stamens are united in one bundle and one is free
- III. **Polyadelphous Stamens** (*polys*, many), When the filaments united to form more than one bundle but the anthers are free. **Example: Ricinus, Citrus.**

(3) قد تلتحم الاسدية في عدة حزم
ويقال للاسدية في هذه الحالة عديدة
الأنبوبة السدائية **polyadelphous**
كما في الملوخية والبرتقال.

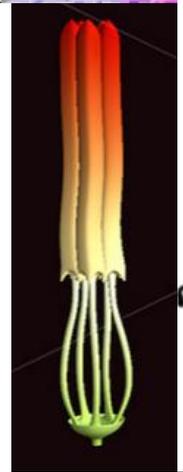
(2) قد تلتحم الخيوط في حزمتين
ويقال للاسدية ثنائية الأنبوبة
السدائية **diadelphous**، كما في
بسلة الزهور.

(1) قد تكون الاسدية ملتحمة
بخيوطها في حزمة واحدة تسمى
وحيدة الانبوبة السدائية
monadelphous، كما في
الفصيلة الخبازية (البامية -
القطن - الكركديه).



b) **Syngenesious (= Synantherous)**: when the stamens are united by their anthers only and the filaments remaining free. **Example: *Helianthus annuus*.**

c) **Synandrous**: when the stamens are united by both the filaments and the anthers. **Example: *Cucurbita***



قلبي

أنبوبة متكئة

Synandrous
(الكوسة)

Synantherous

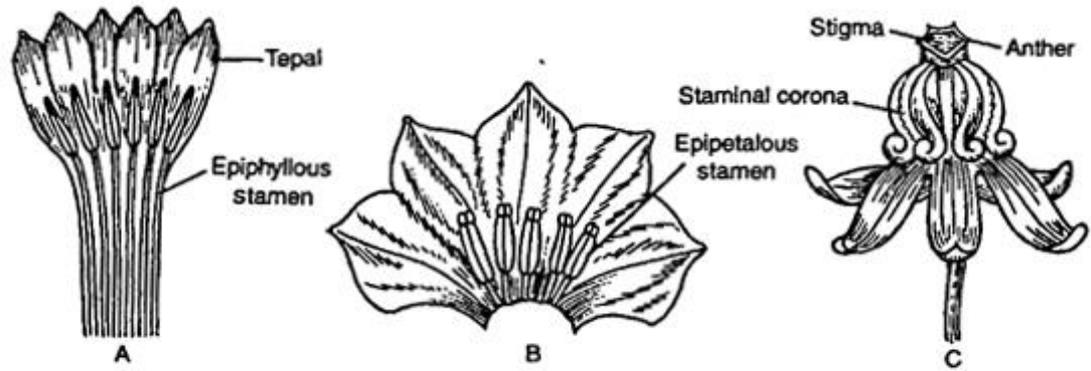
Adhesion of Stamens إلتصاق الاسدية

Adhesion of Stamens: fusion of stamens with other floral parts like calyx, corolla, gynoecium.

The adhesion of the stamens is of three types:

- (1) **Epipetalous**, when they are attached, wholly or partially by their filaments, to the corolla **as in Solanaceae and Verbenaceae**.
- (2) **Epiphyllous or epitepalous** , when attached to the perianth, as in *Liliaceae*
- (3) **Gynandrous (Gynostegium)** , when united with the carpels, either wholly or by their anthers only, as in *Calotropis procera* .





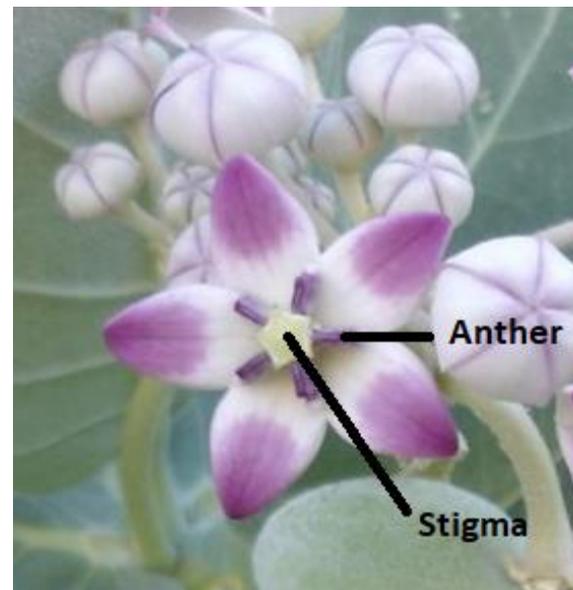
Different types of adhesion of stamens : A. Epiphyllous of *Polyanties*, B. Epipetalous of *Solanum* and C. Gynostegium of *Calotropis*



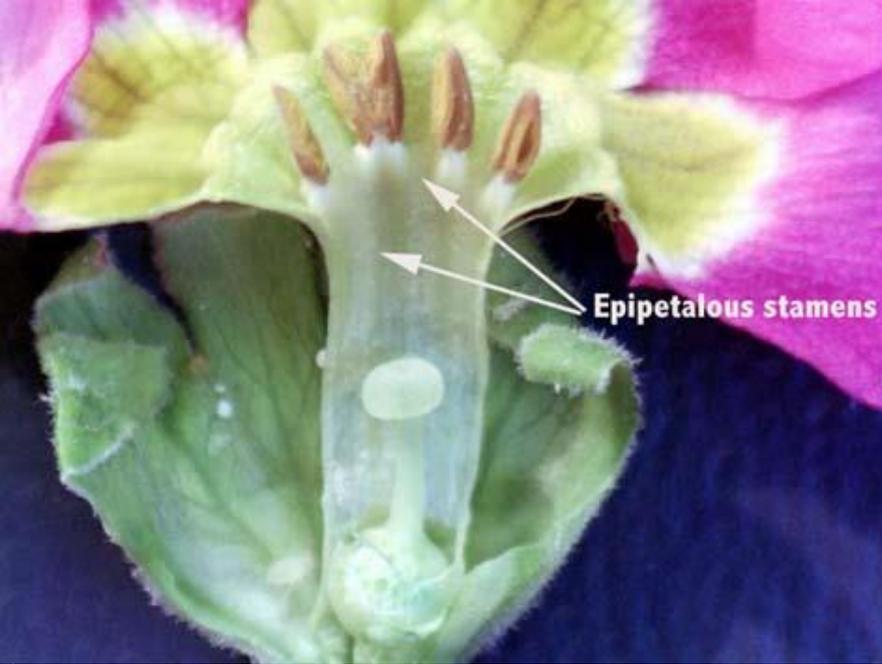
epipetalous stamens



epiphyllous stamens



Gynandrous stamens (*Calotropis*)



Epipetalous stamens

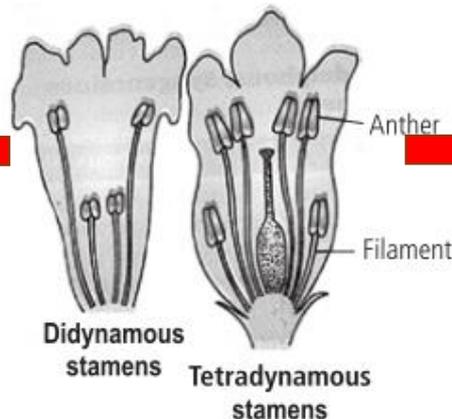


أسدية فوق المتاع Gynandrous

Length of Stamens تباين أطوال الاسدية

➤ Stamens are usually of equal length but in some families the length of stamens may differ, the most notable examples are:-

- (1) **Didynamous** (*di*, two; *dy-namis*, strength): there are four stamens, of which two are long and two short, as in Lamiaceae, e.g., *Ocimum* الريحان.
- (2) **Tetradynamous** (*Tetra*, four): there are six stamens; the inner four are long and the outer two short, as In Brassicaceae e.g. *Brassica napus* اللفت
- (3) **Heterostemnous**: has stamens with a range of different lengths, as In *Cassia*
- (4) Sometimes flowers with longer stamens and others with shorter stamens; are borne by the same plant, this case is known as **dimorphic stamens**.





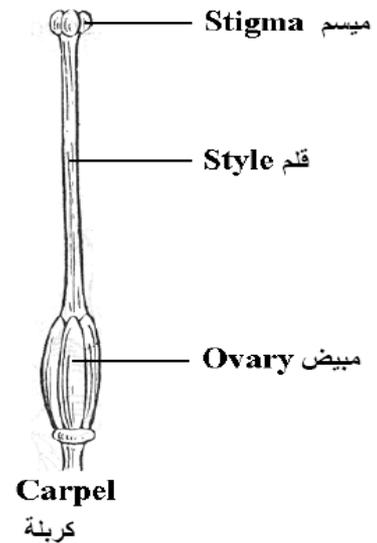
Cassia sp.

ظهر في الصورة زهرة الكاسيا وهي تحتوى عشرة أسدية ثلاثة أسدية طويلة (في الأسفل) وأربعة أسدية متوسطة الطول (في الوسط)، وثلاثة أسدية قصيرة (في الأعلى)

The Gynoecium or Pistil المتاع

- 1) Gynoecium (gyne = female) or pistil refers to all female organs of a flower.
- 2) Pistil is composed of one or more carpels, which bear female sex cells (ovules) in the embryo-sacs.
- 3) The carpel, defined as a modified, typically conduplicate megasporophyll that encloses one or more ovules.
- 4) **Each carpel consists of three parts - stigma, style and ovary**
- 5) The pistil may be simple made of one carpel or compound made of two or more united or free carpels.

- The ovary is the part of the pistil containing the ovules.
- **Placenta** are the tissues of the ovary that bear the ovules.
- **A funiculus** is a stalk that may lead from the placenta to the ovule.
- **Style** is a generally stalk-like, non-ovule-bearing portion of the pistil between the stigma and ovary. Styles may be absent in some pistils.
- Stigma is the pollen-receptive portion of the pistil.





Prunus mexicana

With regard to the number of carpels, the gynoecium may be

(1) **Monocarpous** (*Mono*, single; *karpos*, fruit or ovary) as in papilionaceous plants: ex. *Vicia faba*, and others.

(2) **Polycarpous** (*Poly*, many ; *karpos*, fruit or ovary): made of two or more carpels.

➤ **With regard to the fusion of carpels, the compound (Polycarpous) gynoecium has two main types:**

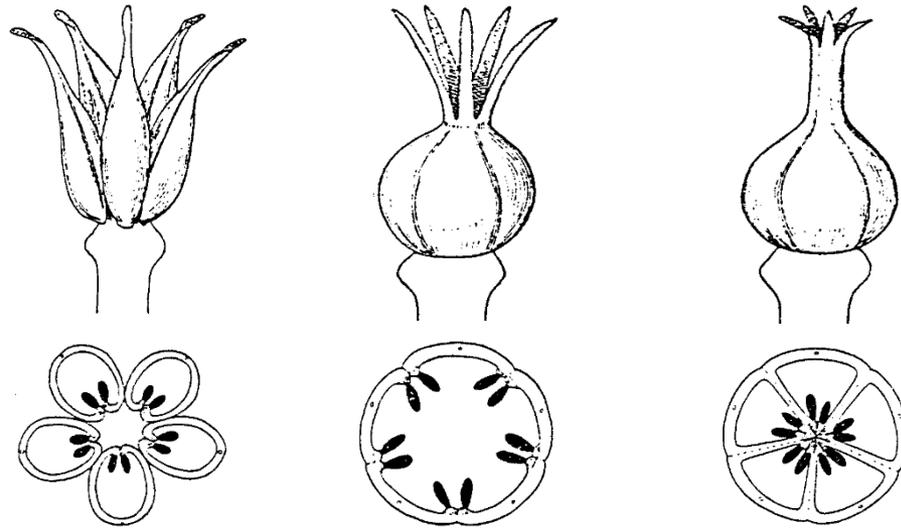
1) **Apocarpous** (*apo*, free; *karpos*, fruit or ovary) as in many plants such as in *Rosa*, and others.

The carpel fusion التحام الكرابل

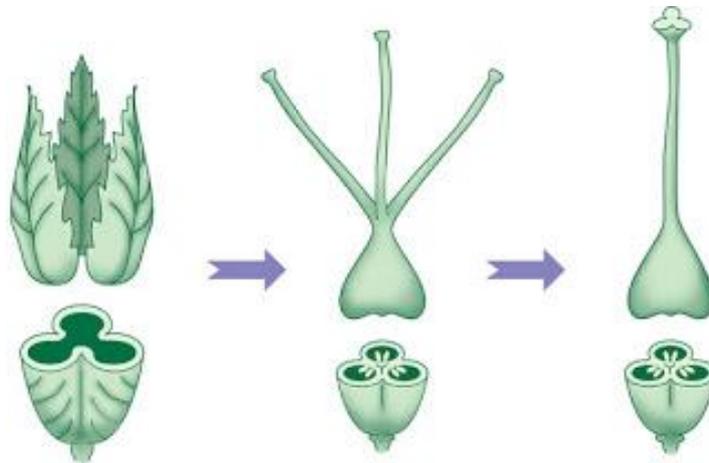
2) **Syncarpous** (*syn*, together or united): gynoecial fusion is one in which carpels are connate as is commonly found in the flowering plants.

➤ **In a syncarpous gynoecium, the degree of carpel fusion can vary considerably:**

- A. The ovaries are united but the styles and stigmas are free. **E.g., *Linum*.**
- B. The ovaries are united to form a compound ovary, the styles are united completely while the five stigmas are free. **E.g., *Hibiscus rosa-sinensis*.**
- C. The carpels are completely united. **E.g., *Citrus* الموالح**
- D. The carpels have free ovaries, and styles uniting only at the stigma. **E.g., *Apocynaceae* and *Asclepiadaceae***



Diagrammatic representation of carpel fusion: A = Syncarpous pistil, B = Apocarpous ovaries; free styles, C = Apocarpous ovaries and styles, free stigmas



Derivation of syncarpic gynoecium (3 carpels, 1 pistil, 1 or 3 styles)

Vinca rosea
APOCYNACEAE

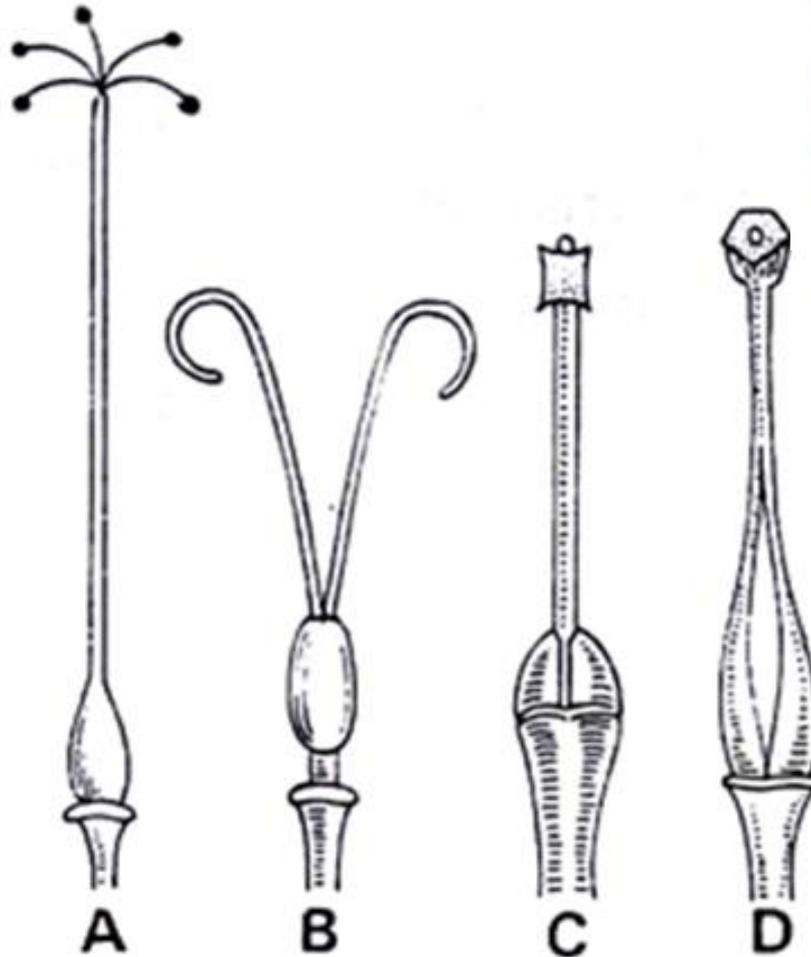


MOHAMED OWIS BADRY

Nerium oleander
APOCYNACEAE



MOHAMED OWIS BADRY



GYNOECIAL FUSION . A, pistil of *Hibiscus rosa-sinensis* with free stigmas; B, pistil with free styles; C, pistil of *Nerium* with free ovaries; D, pistil of *Calotropis* with free ovaries and styles.

Style position/ or attachment of style to the ovary

طرق اتصال القلم بالمبيض

➤ **Style position** is the placement of the style relative to the body of the ovary.

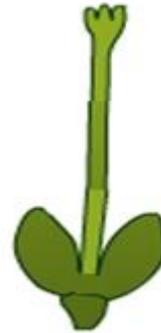
1. **Terminal or apical style position** is one arising at the ovary apex.
2. **Lateral style position** is one arising at the side of an ovary, as in members of the Rosaceae, such as *Fragaria*.
3. **Gynobasic style** arises from the base of the ovary. In **Labiatae**, the ovary is peculiarly, four-lobed so that the ovary apex is depressed at the centre of the four lobes. As a result, the style appears to arise from the central base of the ovary.



Terminal



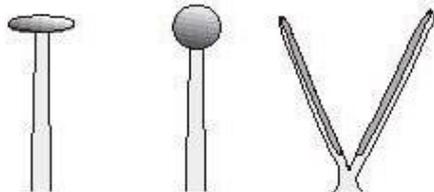
Lateral



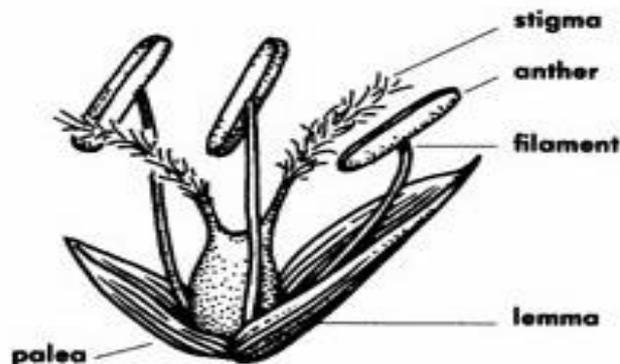
Gynobasic

Stigma الميسم

- **Stigma is a discrete structure that is receptive to pollen grains.**
- The stigma is usually placed on the style. Sometimes, there may be no style, the stigma being placed on the top of the ovary as in *Papaver*, and is termed **sessile**.
- **stigma has different types:** **Discoid**, with stigma(s) disk-shaped; **globose**, with stigma(s) spherical in shape; **linear**, with stigmas long and narrow in shape; and **plumose**: stigmas with feathery, trichome-like extensions, often found in wind-pollinated taxa (e.g., in **Cyperaceae, Graminae**)



discoid globose linear



Plumose stigma



Sessile stigma in *Papaver*

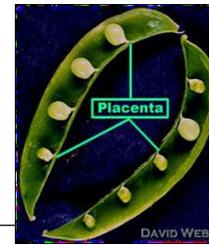
Placentation المشيمي

- The placenta is a ridge of parenchymatous outgrowth in the inner wall of the ovary to which the ovule or ovules are attached via a funiculus.
- Placentation is the manner in which the placenta and ovules are distributed in the cavity of the ovary.

➤ Types of placentation:

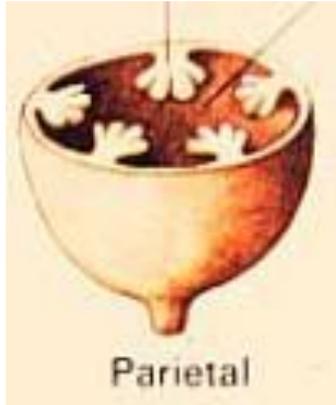
- 1) **Marginal:** The ovary is developed by the union of one megasporephyll along the ventral suture. The placenta forms a ridge along this suture.

Example: ovary of pea (Leguminosae).

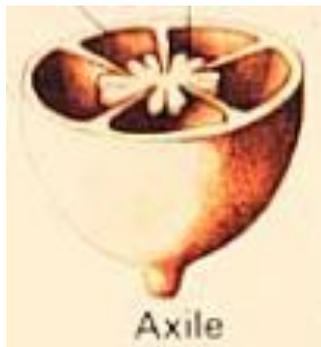


➤ Types of placentation:

- 2) **Parietal:** when two or more carpels unite along the ventral sutures, with the placentae on the ovary walls. **Example: Cruciferae.**

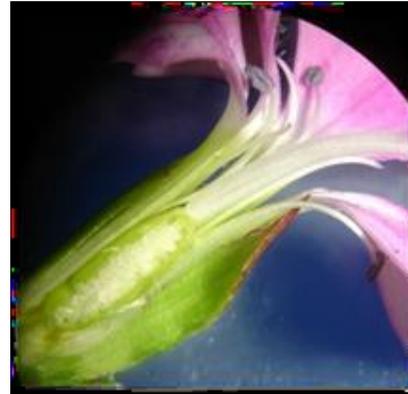


- 3) **Axile:** with the placentae arising from the column in a compound ovary with septa, common in many flowering plants such as the **Liliaceae.**

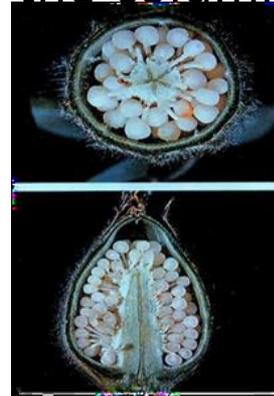


➤ Types of placentation:

- 4) **Central:** with the placentae along the column in a compound ovary without septa. Ex: *Dianthus* القرنفل



- 5) **Free-central:** similar to central, but the column is short and not attached to the apex of the ovary.



➤ Types of placentation:

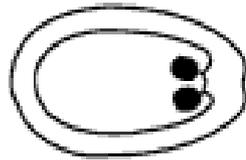
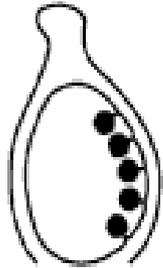
- 6) **Basal:** with a placenta at the base of the ovary, as occurs in **Nyctaginaceae**



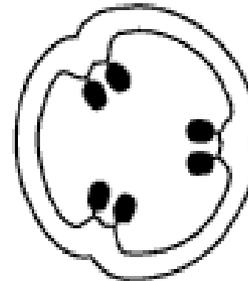
- 7) **Apical or pendulous:** with a placenta at the top of the ovary, as in **Umbelliferae**



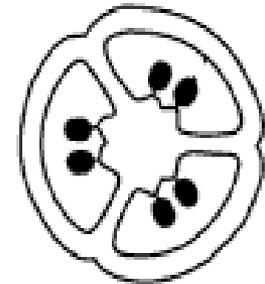
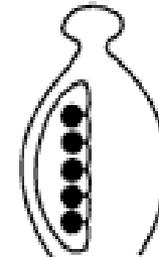
Types of placentation



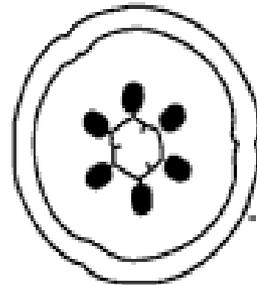
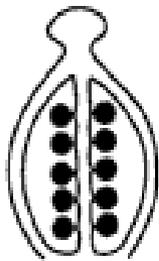
marginal



parietal

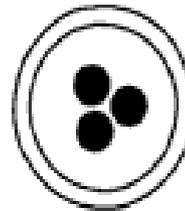


axile

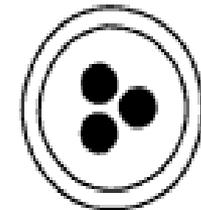


Central

free-central

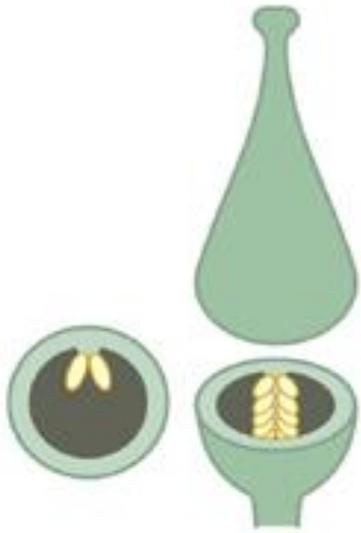


basal

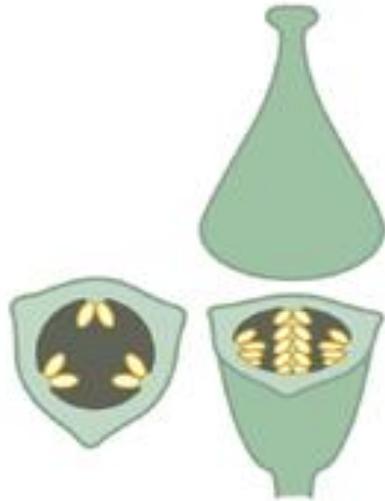


apical

Types of ovules placentation



Marginal



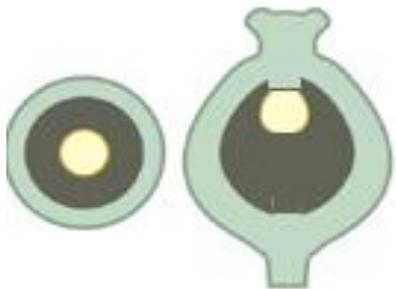
Parietal



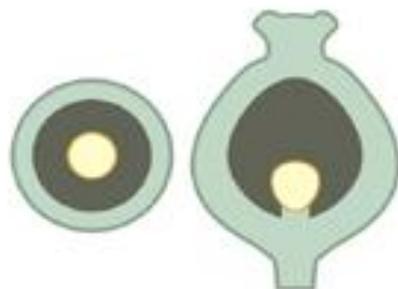
Axile



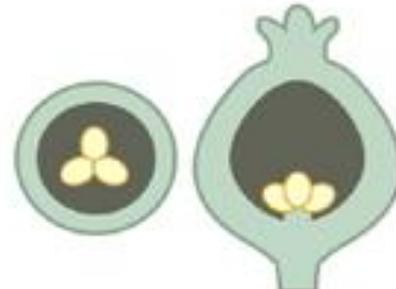
Free-central



Apical



Basal



Basal

Incomplete flower الأزهار الناقصة

Complete flower: is a flower having all four major series of parts (sepals, petals, stamens, and carpels)

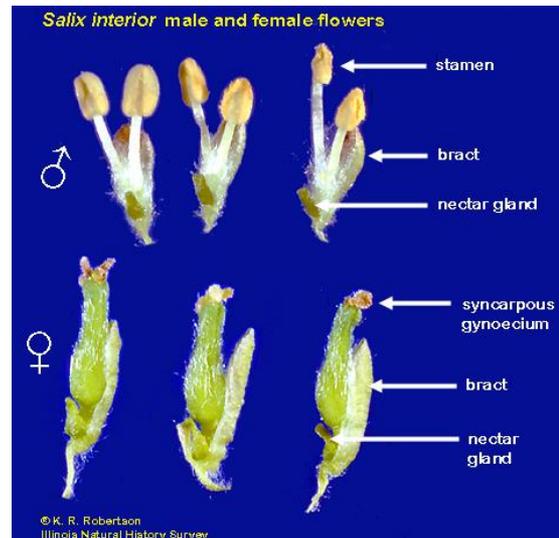
Incomplete flower: is a flower lacking one or more of the four major whorls of parts (e.g., any unisexual flower, or a bisexual flower lacking a corolla).

Bisexual flower with undifferentiated perianth



زهرة البصل *Allium cepa*

Unisexual flower



زهرة الصفصاف *Salix* sp.

جنس الزهرة و جنس النبات Flower sexuality and plant sexuality

A. جنس الزهرة يشير إلي وجود او اختفاء اعضاء التكاثر المذكرة والمؤنثة في الزهرة.

- Flowers having both androecium and gynoecium are said to be bisexual or perfect, and those having- only one of them are said to be unisexual.

• أزهارا وحيدة جنس imperfect (unisexual) وتكون مذكرة فقط staminate/ male أو مؤنثة فقط pistillate/ female.



Staminate flower

Pistillate flower

Unisexual flower



Bisexual flower

جنس الزهرة وجنس النبات Flower sexuality and plant sexuality

جنس النبات يشير إلى وجود أو اختفاء الأزهار الخنثى ووحيدة الجنس على النبات.

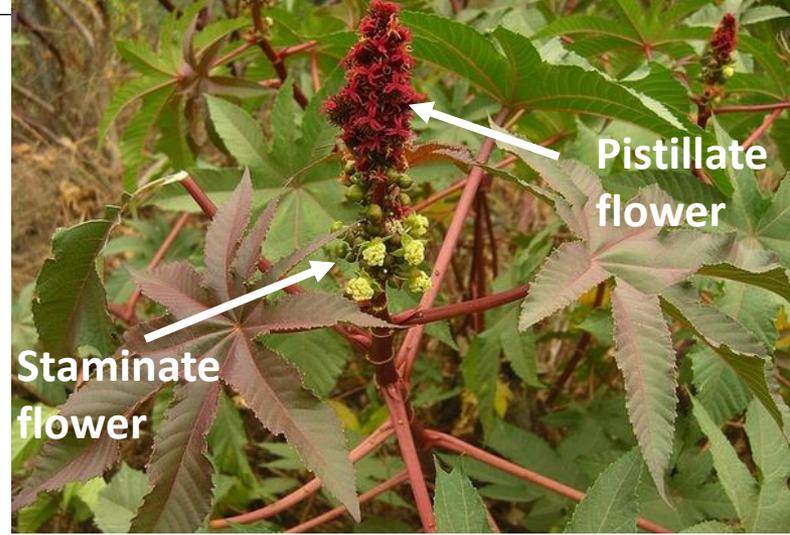
1. A hermaphroditic plant is one with only bisexual flowers ; e.g., *Allium cepa*.
2. A monoecious (mono, one + oikos, house) plant is one with only unisexual flowers, both staminate and pistillate on the same individual plant; e.g., *Ricinus communis*, *Zea mays*.
3. A dioecious (di, two + oikos, house) plant is one with unisexual flowers, but with staminate and pistillate on separate individual plants (i.e., having separate male and female individuals; e.g., *Phoenix dactylifera*.
4. Polygamous is a general term for a plant with both bisexual and unisexual flowers ; e.g., *Citrus sp*.

نبات متعدد الجنس وحيد المسكن Polygamous: نباتات تحمل أزهارا خنثى ووحيدة الجنس في نفس الوقت

مثال الليمون البلدي



Allium cepa البصل



Ricinus communis الخروع



النخيل (مذكر)

Phoenix dactylifera



النخيل (مؤنث)

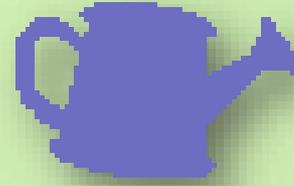


Bisexual flower
Staminate flower

الليمون
Citrus sp.

Pistillate flower

THE END



لا تؤجل عمل اليوم إلى الغد... فإن لكل يوم عملاً