

Plant Taxonomy

College of education for pure science

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Department:- biology



Lecturer

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Class

Third

year:- 2020-2021

Lecture: 1

What is Plant Taxonomy: It's a field of science that includes Description, Identification, Nomenclature, and Classification (the mnemonic DINC for short). Which is considered a major part of Plant Systematic.

History of Plant Taxonomy:

- 1- Babylonians are the first who knew plants and named them before 4500 years ago.
 - 2- Theophrastus (370-285 B.C), THE Greek Scientist, which called the father of modern Botany, he classified plants into four groups:- herbs, subshrubs, shrubs, and trees. He also distinguished between the non-flowering plants and the flowering one.
 - 3- Andrew Caesalpino (1519-1603), was the first scientist who worked for achieving a rational scheme of classification of plants.
 - 4- The eighteen century belongs clearly to Carl Linnaeus (1707-1778). He is the creator of the modern system of nomenclature, also considered the first taxonomist who showed that the reproductive features were of main importance in taxonomy and originator of sexual system of classification.
 - 5- De Candolle (1778-1841), presented a new classification of sexual system of plants, he followed the approach of the natural system in his scheme and put all alike plants together.
 - 6- The current contributors to plant taxonomy in the world conclude, Armen Takhtajan (Russian) and Cronquist. In Iraq, Ali Al-Musawi and Ali Al-Rawi considered the main contributor to Iraq.
- **Classification:** It's the arrangement of taxa into some type of order, the purpose of this field is to provide a system for cataloguing and expressing relationships between these taxa.
- **Taxon:** It's a group of organisms typically treated at a given rank, ex. Magnolio phyta is a taxon placed on the rank of phylum.

Major taxonomic rank

Division :- Spermatophyta

Subdivision :- Angiospermae

Class:- Dicotyledonae

Order :- Rosales

Family:- Rosaceae

Genus :- Rosa

Species :- gallica

Variety :-versicolor

Characters used for plant classification:

- 1- Morphological data :- a/ Micromorphology b/ Gross morphology
- 2- Presence or absence of certain tissues and vegetative organs.
- 3- Similarity and dissimilarity of reproductive structure.

Classification Systems :

1- Artificial classification :- It's the first system which used one or few characters to classify plants.

Carl Linnaeus (1753) was the first to establish this system based on reproductive parts, several plants totally unrelated were classified together for example, Prunus was classified along with Cactus because of the same number of stamens in his system of classification. This system is compelled after Linnaeus time.

2- Natural classification :- This system is based upon several to many characters selected for their value in positively correlating characters to form groups in ranks.

George Bentham (1800-1884) and Joseph Dalton Hooker (1817-1911) produced a work of natural classification of all the genera of gymnosperms and angiosperms (*Genera Plantarum*), their system based on numerous morphological and anatomical characters such as numbers of carpels and others, for example put Cruciferae with Papaveraceae according to the same number of petals.

3- Phyletic or Evolutionary system of classification :- This system arise after the theory of evolution, which emphasizes on relationships by descent of the groups in their systems. The first clearly phyletic system of classification was produced by German botanist, August Wilhelm Eichler, he dealt with the entire plant kingdom. Another system was produced by Adolf Engler and Eugen Prantl based on Eichler system.

Charles Bessey (1915) which his concept of his system are still basically followed today which depending on primitiveness versus characters of descent between and among characters.

4- Cladistic classification system :- It's the most recent comprehensive classification of angiosperm that derived from Angiosperm Phylogeny Group (APG). The rise of this classification combined since 1990 with new DNA sequence data. The APG classification are important for two reasons :-

Taxonomic Components

1. Classification

Plants are arranged into groups of similar characteristics. The groups are considered as categories or **taxa** and form the **taxonomic system**.

2. Identification

To identify and derive the name of an organism by referring to an existing classification.

3. Nomenclature

To provide a scientific name to an organism.

4. Description

To describe the characteristics of a taxon e.g. a family.

NOMENCLATURE

- Nomenclature is important in order to provide the correct name for a plant.

The naming activity is under the control of the 'International Codes of Botanical Nomenclature' (ICBN) published by the 'International Association of Plant Taxonomy' (IAPT).

- The codes are revised at every 'International Botanical Congress'

TAXONOMIC CHARACTERISTICS

1. Morphology

Plant growth habit, leaf arrangement and shape, flower and fruit characteristics.

2. Anatomy

Secondary xylem characteristics, epidermis including trichomes and stomata.

3. Palinology

Pollen characteristics including size, shape, aperture and exine sculpture.

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TAXONOMIC CHARACTERISTICS

4. Cytology

The chromosome number, structure and habit

5. Chemical and molecular

**Alkaloid, phenolic and amino acids contents.
Protein, enzyme and DNA**

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Anatomy in relation to plant taxonomy

Vegetative anatomy

- Parts of plant body that serve to maintain its individual life
- e.g. leaf, root, stem

Floral anatomy

- Essential parts of the flower
- Means for reproduction

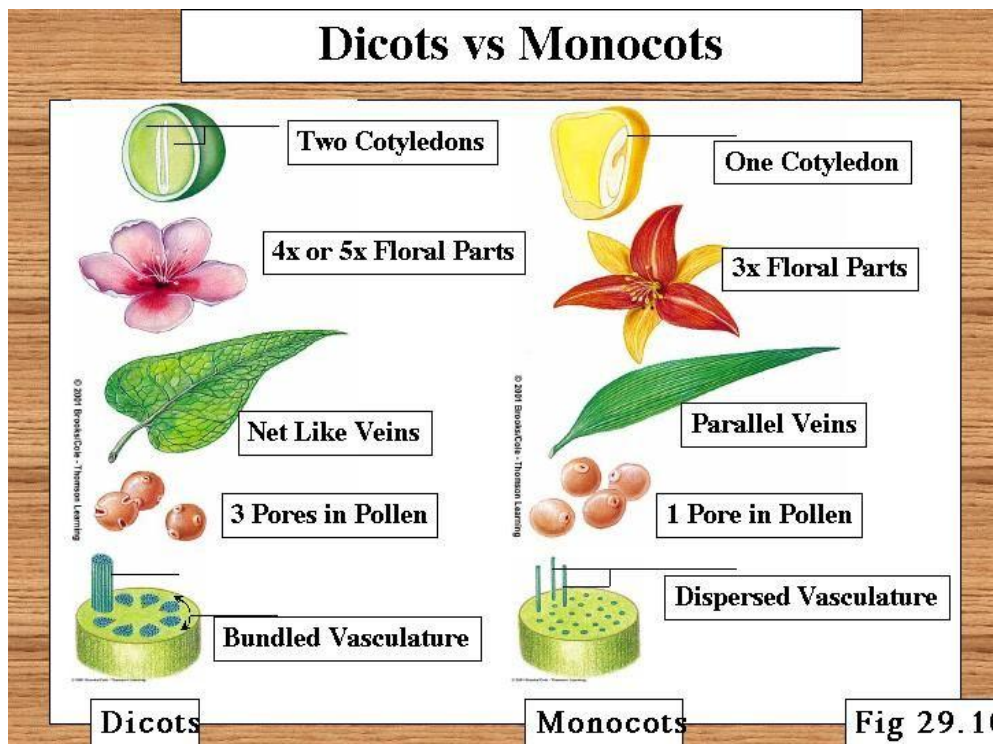
What is plant anatomy?

- **ANATOMY:** study of the **structure** of organisms... looking at cells, tissues

What is plant physiology?

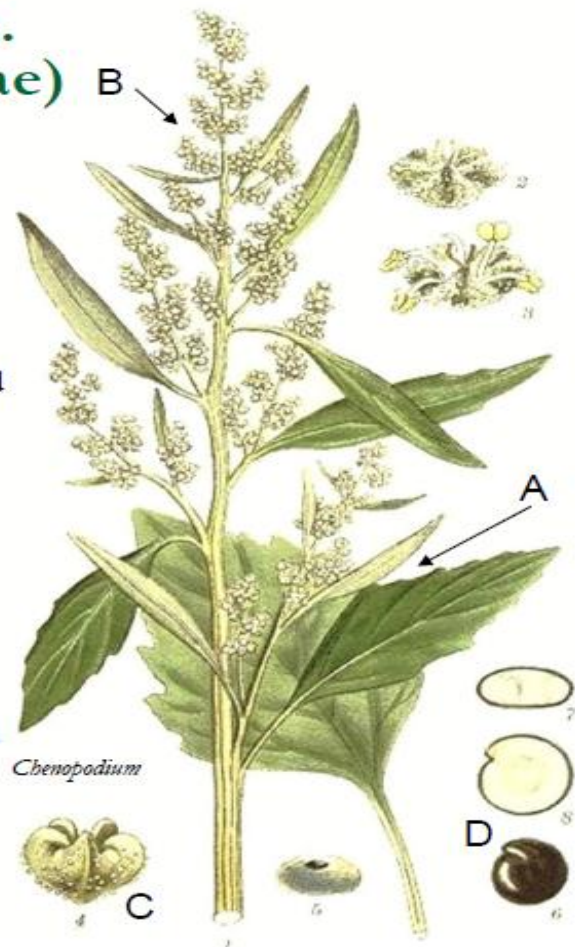
- **PHYSIOLOGY:** study of the **function** of cells, tissues, organs of living things; and the physics/chemistry of these functions...

Compare between Monocote & Dicote



Amaranthaceae s. lat. (incl. Chenopodiaceae) AMARANTH FAMILY

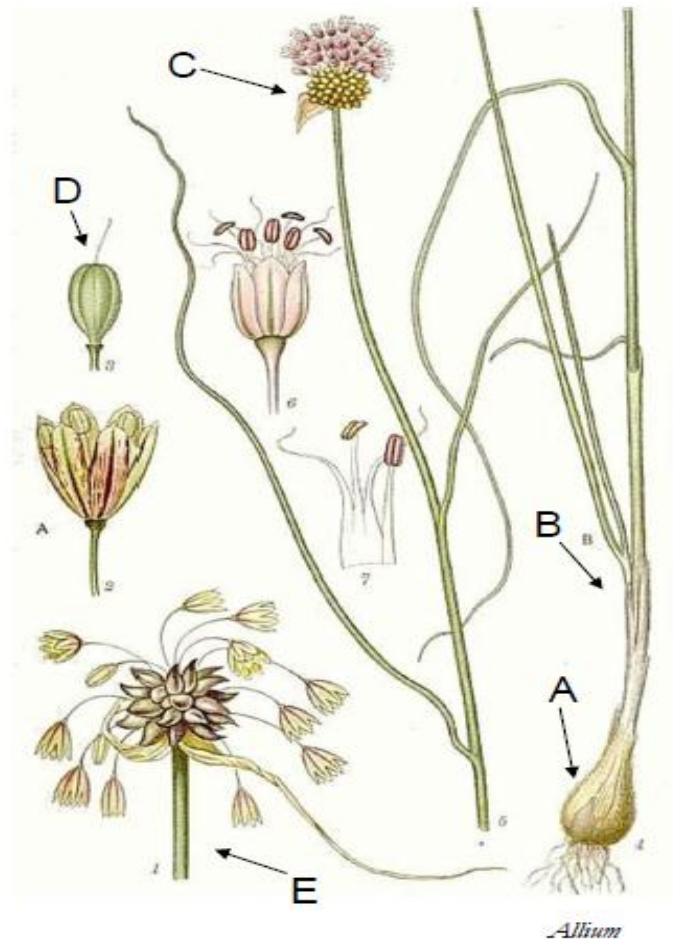
- Herbs or shrubs (rarely trees or vines), often reddish, many salt-loving plants (halophytes)
- Stems often succulent, and/or jointed
- Leaves alternate, simple (A)
- No stipules
- Flowers small, actinomorphic (B)
- Sepals usually 3-5, free or fused basally, surrounding the fruit (C)
- Petals absent
- Stamens as many as sepals, positioned on the inside of each sepal
- Ovary superior or half-inferior, 1-3 fused carpels, one locule and one ovule, basal placentation
- Fruit a berry, capsule, or nutlet
- Seeds strongly curved (D)



Amaryllidaceae

AMARYLLIS & ONION FAMILY

- Biennial or perennial herbs (monocots)
- with bulb (A) at base
- Simple, narrow leaves in basal rosette (B), often only in two directions (2-ranked)
- Inflorescence a terminal umbel (C), sometimes with bulblets on a leafless stem
- Tepals 6, anthers 6
- Hypanthium (fused tepals and base of stamens) often present (not in *Allium*)
- Ovary superior (D) or inferior, 3-carpellate
- Fruit a capsule
- Seeds many, hard, black (covered with phytomelans)
- Onion-like smell in *Allium*



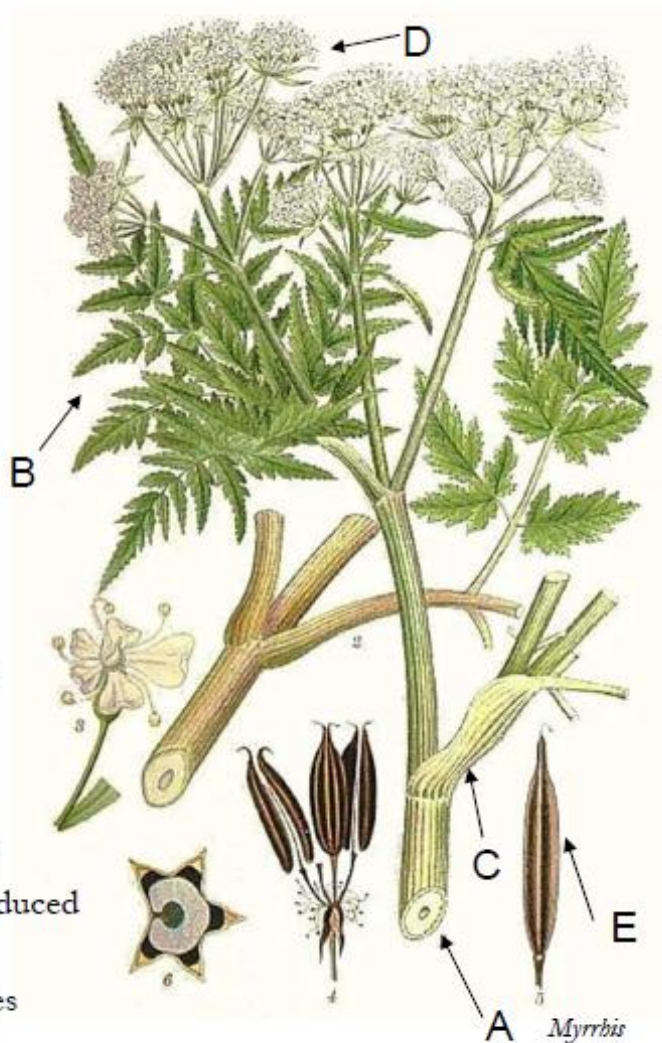
Anacardiaceae CASHEW & POISON IVY FAMILY

- Trees, shrub, lianas, or perennial herbs
- With resin ducts and laticifers (sap often toxic)
- Often pinnately compound leaves (A)
- Flowers 5-merous, small, with nectary disc (B)
- Stamens 5 or 10 (B)
- One ovule per carpel, 1-5 carpels in a fruit
- Fruit a drupe



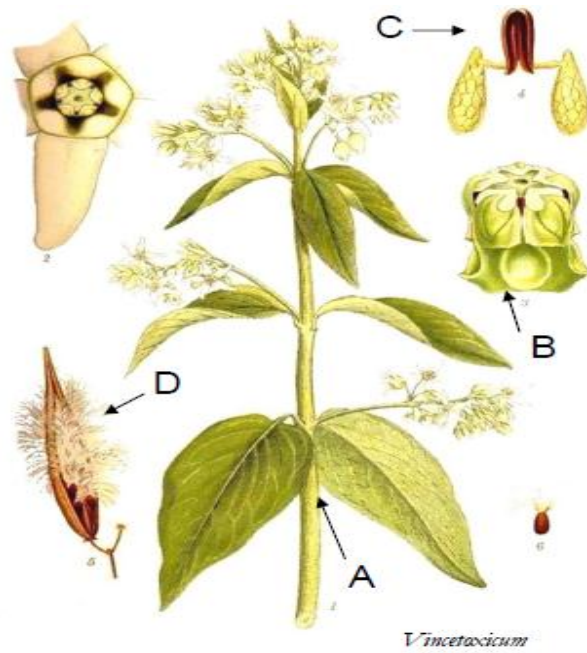
Apiaceae CARROT FAMILY

- herbaceous
- Aromatic, some very poisonous (oils, resins)
- Stems hollow (A)
- Leaves alternate, often dissected or lobed (B), pinnate venation
- Leaf petiole broadened with sheath (C) surrounding stem or base of leaf
- Flowers arranged in double umbels (D); small, white or yellow, many
- Petals 5, not fused, sepals reduced or absent
- Fruit is a dry fruit that divides into 2 parts (E, schizocarp)



Apocynaceae MILKWEED & DOGBANE FAMILY

- Leaves opposite, simple (A), pinnate venation
- Leaf margin smooth (A)
- Stipules absent (A)
- Latex (milky sap) in all branches and leaves
- Sepals 5, Petals 5, sometimes fused
- Ovary superior
- Anthers often fused, and sometimes fused with style head to a gynostegium (B), pollen in pollinia (C) in some species
- Fruit usually with 2 separate carpels, developing into 1-2 dry capsular parts or berries
- Seeds often with tufts of hairs at one end (D)



Araceae AROID FAMILY

- Shrubs, vines, or herbs, sometimes aquatic; often fleshy
- Rhizomes (A), corms, tubers common
- Leaves simple, with reticulate or parallel venation (B)
- Inflorescence a terminal spadix of tiny flowers, subtended by a colored leaf/bract (spathe) (C)
- Flowers sometimes unisexual, highly reduced, sessile (D)
- Fruits usually berries (E)



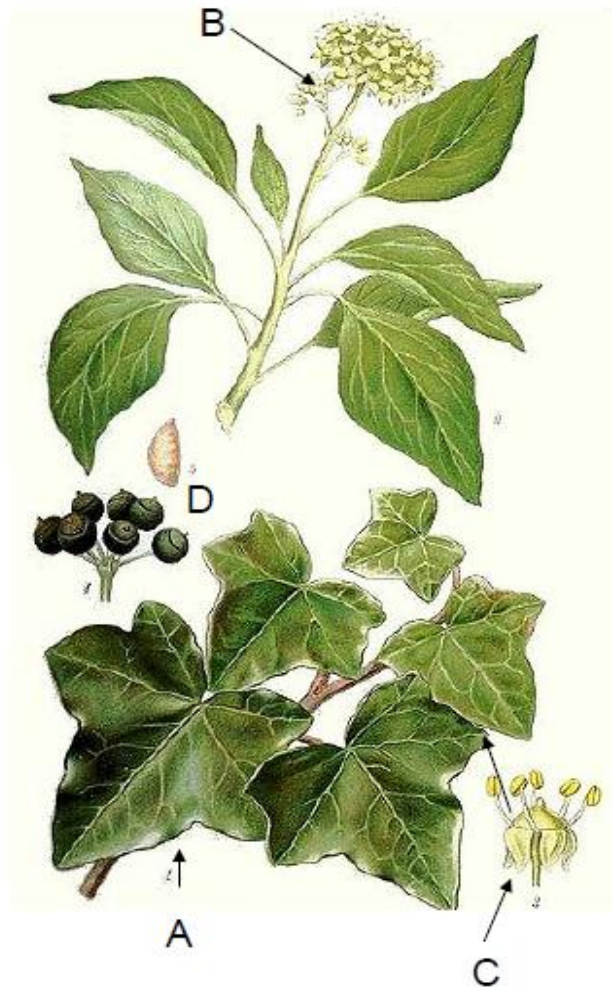
Note: Lemnaceae is now included in the Araceae.

Araliaceae

GINSENG

FAMILY

- Trees, shrubs, lianas, or herbs.
- Leaves alternate, simple (A), palmate, or pinnate (often divided or lobed)
- Flowers arranged in terminal umbels(B), heads, or panicle; small, white or yellow, many (B)
- Petals 5, not fused, sepals reduced or absent (C)
- Fruit a berry (D), drupe or dry fruit



Asphodelaceae

ALOE FAMILY

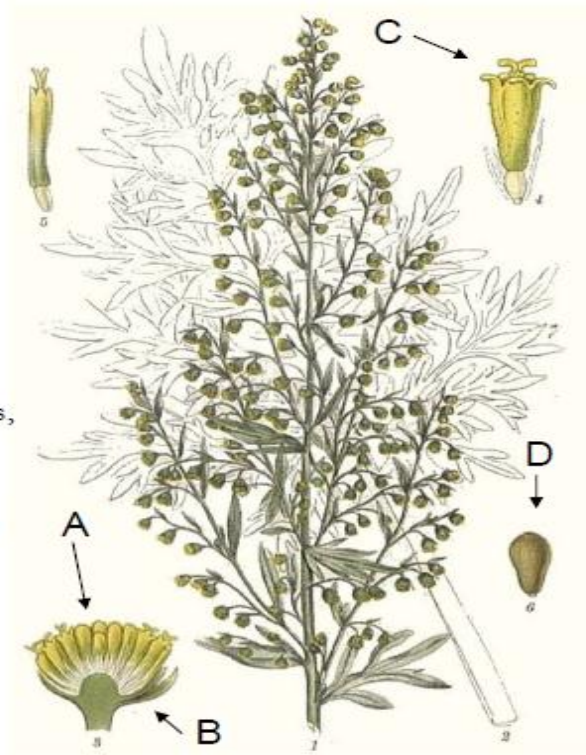
- Herbs, shrubs, rarely trees
- Succulents, especially leaves
- Leaves simple, alternate, parallel-veined, often with spiny or dentate margin (A)
- Inflorescence a raceme or panicle
- Flowers actinomorphic or zygomorphic
- Tepals 3+3, sometimes fused
- Stamens 6
- Ovary superior, 3 fused carpels, 3 locules, axile placentation (B)
- Fruit a capsule
- Seed with an aril



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Asteraceae ASTER & SUNFLOWER FAMILY

- Herbaceous usually
- Leaves variable, with pinnate venation
- Inflorescence a head (capitulum, A) with many flowers, with involucre bracts surrounding it (B)
- Flowers small, either tubular (C) or tongue-shaped (ligulate)
- Sepals absent
- Petals fused, usually with 5 small lobes (C)
- Anthers fused into a ring around style
- Ovary inferior
- Fruit a dry nut (achene, D), often with hairs on top (pappus)



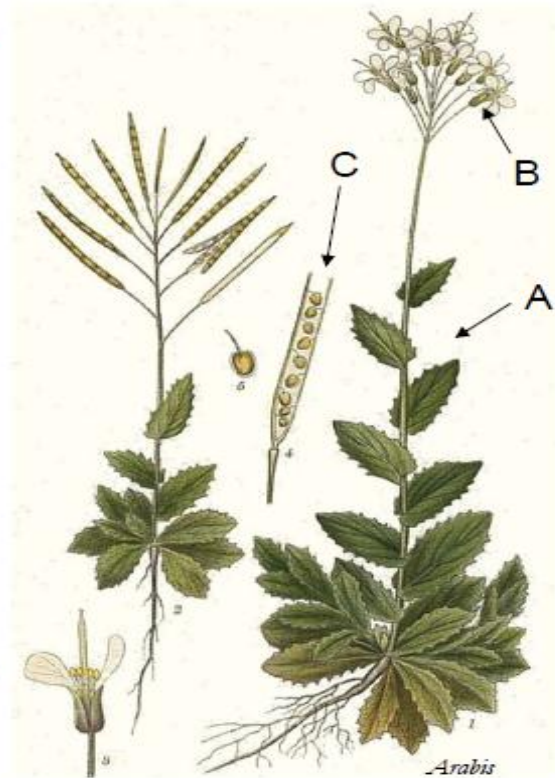
Artemisia

Asteraceae ASTER & SUNFLOWER FAMILY



Brassicaceae s. str. MUSTARD FAMILY

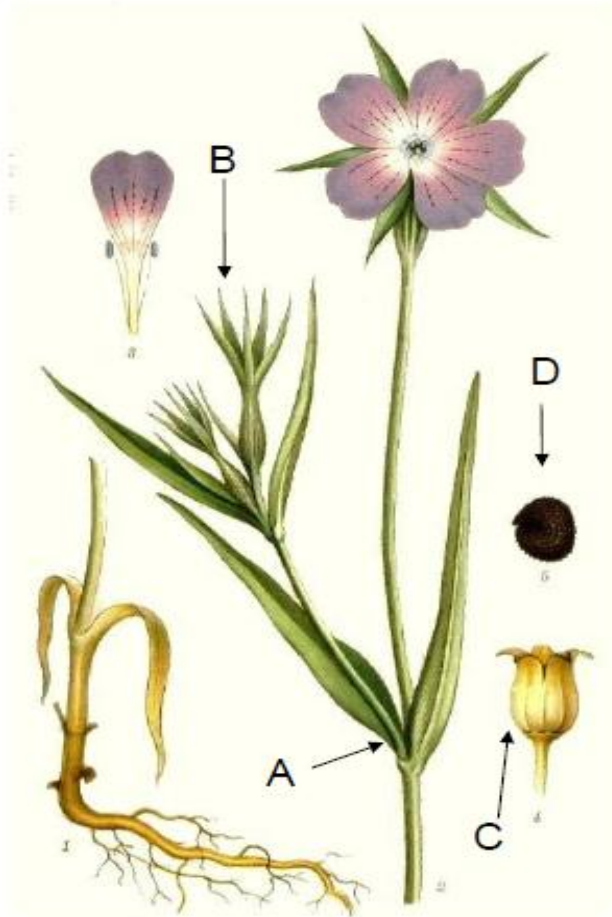
- Herbaceous
- With mustard oils
- Leaves simple, alternate (A), often lobed, with pinnate venation
- Leaf edge often dentate (A) or lobed
- Inflorescence a raceme
- Petals 4, not fused, forming a cross + from above (B), white, yellow, or pink
- Stamens 6 (4 longer, 2 shorter)
- Fruit a dry capsule with inner wall (silique; C)



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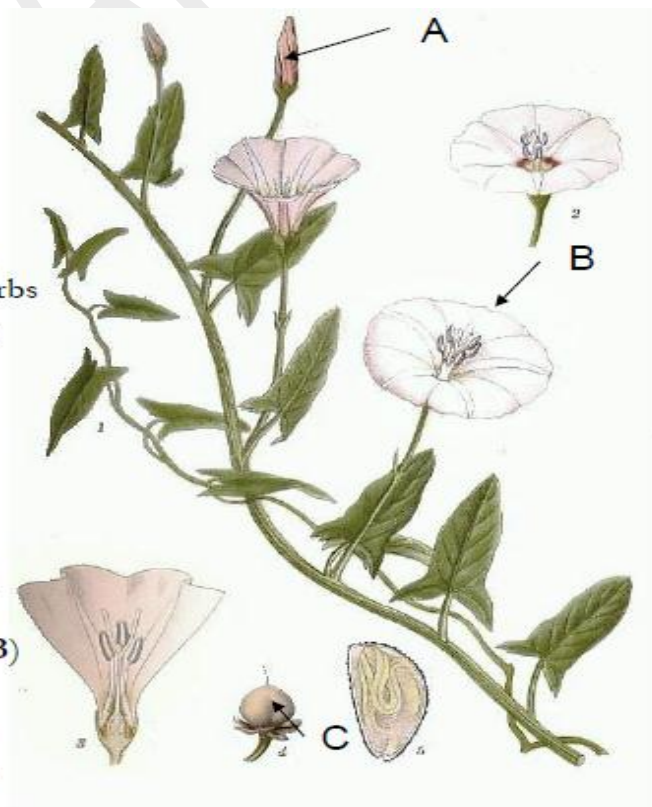
Caryophyllaceae CARNATION & PINK FAMILY

- Herbaceous
- Leaves opposite (A), simple, with pinnate venation
- Leaf edge smooth
- Stems often with thickened nodes (A) at base of each leaf pair
- Sepals 5, fused (B)
- Petals 5, not fused
- Fruit a dry capsule opening at top (C)
- Seeds attached to central column inside capsule
- Seeds many, black, often strongly curved (D)



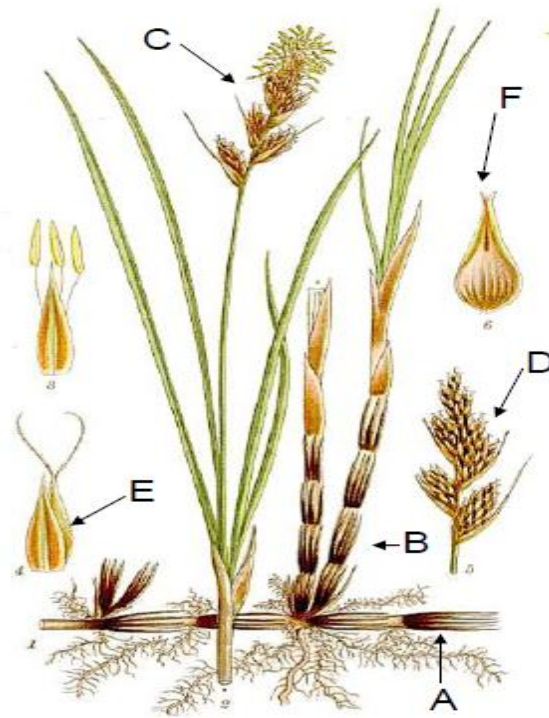
Convolvulaceae MORNING GLORY FAMILY

- Herbaceous vines (usually), or woody vines, trees, or herbs
- Branches twining clockwise
- Leaves simple or divided, alternate
- Flowers often solitary, mostly 5-merous
- Corolla buds twisted (A)
- Large corollas, fused petals, trumpet- or funnelshaped, with 5 folds in the corolla (B)
- Superior ovary (C)
- Fruit usually a capsule, less often a berry, nut, or drupe.



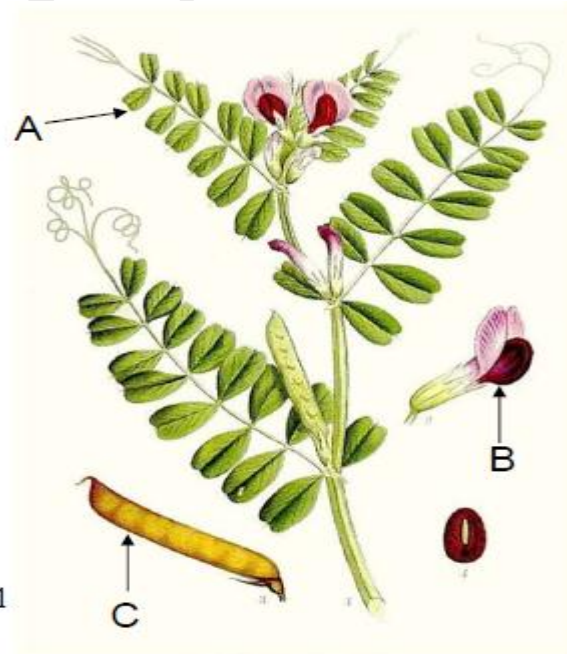
Cyperaceae SEDGE FAMILY

- Herbaceous monocot
- Stems often as rhizomes (A) and upright culms (B)
- Stems 3-sided, without nodes, solid, not hollow
- Leaves linear, grass-like, with parallel veins, arranged at 3 angles (tristichous)
- Leaves sheathing at base
- Inflorescence often divided into male and female parts (C), as spikelets (D) on terminal branches
- Flowers small, unisexual, sitting behind a bract (E)
- Sepals and petals absent (rarely present)
- Anthers 3, hanging free
- Ovary superior, often inside a bottle-shaped structure (perigynium, F)
- Fruit a small, 1-seeded nut



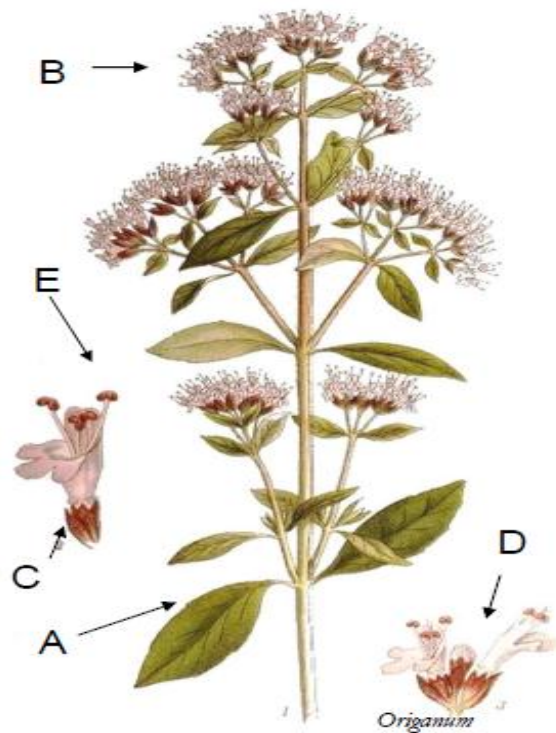
Fabaceae BEAN FAMILY

- Mostly herbaceous, some trees and shrubs
- Leaves alternate, compound (A, with many small leaflets), sometimes with tendrils
- Stipules at base of each leaf (variable in size)
- Corolla of 'butterfly-type' (B), bilateral with 5 parts: banner/standard, wings, keel
- Keel hidden between wings
- Stamens and style hidden inside keel
- Stamens 10, 9 often fused
- Fruit a bean (legume, C), a dry capsule without inner dividing walls, and with seeds attached to one side
- Seeds splits in 2, nutrients stored in dicotyledons inside seed



Lamiaceae MINT FAMILY

- Herbaceous (some woody in the tropics)
- Aromatic, with essential oils, often hairy with glands in or on leaves or glandular hairs
- Leaves opposite, simple (A), arranged at 180 degrees angle to each other (looks like cross from above)
- Stipules absent (A)
- Stem usually quadrangular
- Flowers in groups (verticillasters) in leaf axils or in terminal spikes (B)
- Sepals fused, 5 (C)
- Corolla 2-lipped (D)
- Stamens 2 or 4 (E)
- Fruits: 4 nutlets hidden inside calyx



Liliaceae s. str. LILY FAMILY

- Perennial herbs
- Bulbs or rhizomes (A)
- Does not smell like onion
- Leaves alternate (rarely whorled), often basal, sheathing at base, parallel-veined (B)
- Inflorescence terminal, raceme or solitary flower
- Tepals 6, free (C), often spotted or striped, with nectaries at base
- Stamens 6, free.
- Ovary superior, 3-carpellate, 3 locules (D), axile placentation
- Style single, stigma 3
- Fruit a capsule
- Seeds flattened, ellipsoid to rounded

