

Lab.5 Non-living components

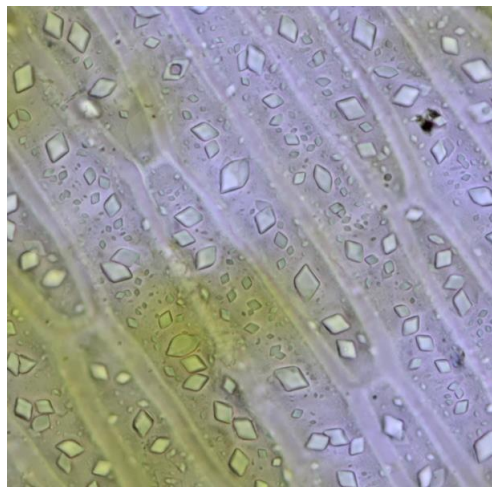
2- Calcium oxalate crystals: - They are distributed in many plant species. The crystal formation is generally intracellular and inside the vacuoles of specialized cells called idioblast. In many plants, oxalates might be metabolized very slowly. However, they might have a toxic effect when accumulating in excess quantities. They can be found in any organs of plant like root, stem, leaf, floral organs and fruits.

***Functions of calcium oxalate crystals

- A- Remove excess oxalate or calcium, other functions of CaOx crystal formation in plants include high-capacity calcium (Ca) regulation
- B- Protection against herbivores from eating plant parts.
- C- Participating in calcium homeostasis and storage of calcium.
- D- Participating in metal detoxification and tissue support.
- E- Tolerance to heavy metals

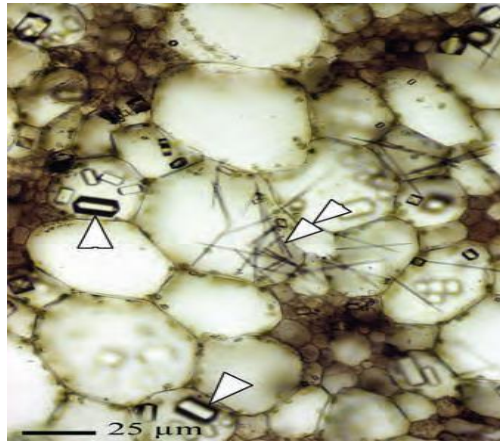
Furthermore, the presence or absence of crystals may represent useful taxonomic characters and also be used for understanding the evolutionary relationships of plant species. Calcium oxalate crystals have been classified into five main groups based on their morphology: as **prismatic**, **druses**, **styloids**, **raphides** and **crystal sand**.

A- Prismatic crystals:- They are colorless crystal with a shape resembling a prism.



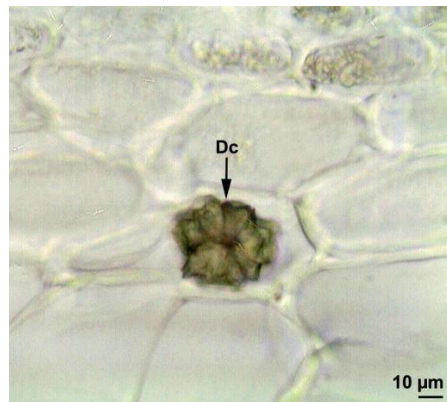
Prismatic crystals in the epidermis of *Dracaena marginata*

B- Raphides:- They are the most commonly form of crystals, they are distinguished by their pointed needle-like shape and range in length from around 16 up to 300 μm in some plants. Raaphides are typically observed in large numbers and closely packed and arranged in parallel in regular cylindrical bundles or thinner as in leaves and stems.



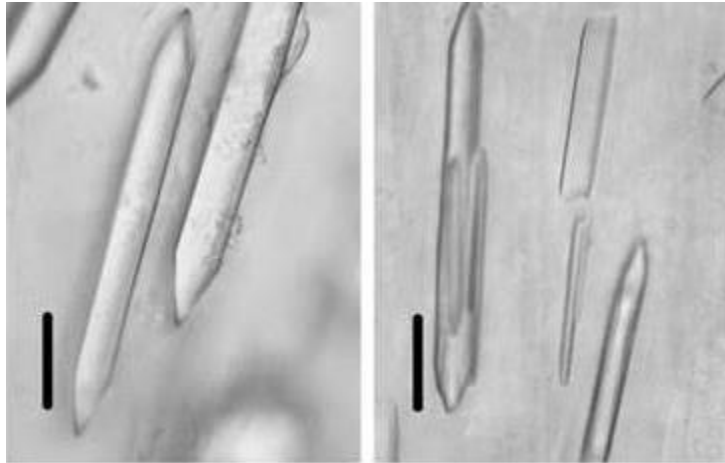
C.S of *Tradescantia* sp. stem showing prismatic crystals (arrowheads) and raphide crystals (double arrowhead)

C- Druses: - They are a common occurrence in many plants and are usually star-like in shape and are thought to be a defense against herbivory due to their toxicity



Druses crystal in the stem of *Tribulus terrestris*

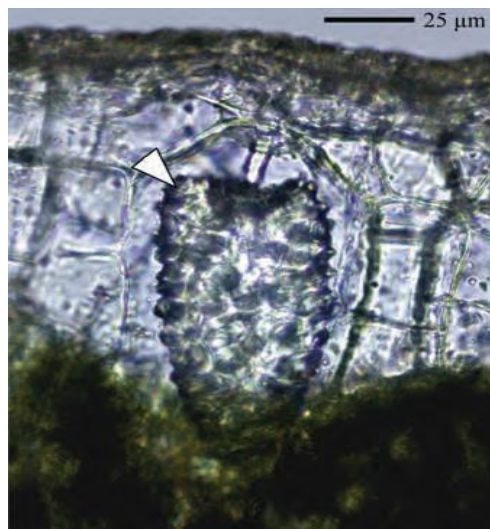
D- Styloids: - They are elongated crystals, with pointed ends, they are a diagnostic feature of certain families, including Agavaceae, Iridaceae and Asteraceae.



Styloids in Asteraceae

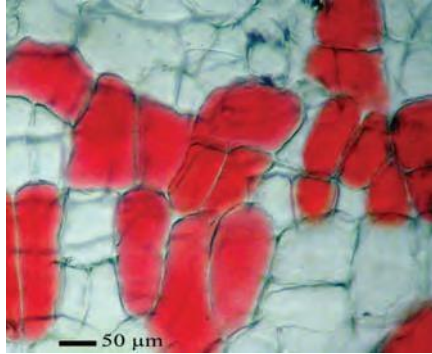
E- Sand crystals: - They are formed by accumulation of small individual crystals, it is found in the leaves of *Beta vulgaris*

3- Calcium carbonate crystal: - It is very unusual calcium carbonate crystals (cystoliths) in specialized large epidermal cells called lithocysts. The calcium carbonate is deposited around a cell wall extension found in the leaves of Rubber plant (*Ficus elastica*).



T.S. of a rubber plant leaf showing a large cystolith (arrowhead)

Four-Vacuolar pigments:-They are pigments found in the vacuoles like Anthocyanins which are red or blue water-soluble pigments that are found within vacuoles. Roots of garden beet (*Beta vulgaris*), some fruits, and many red and purple petals have cells with anthocyanin pigments in their vacuoles.



Unstained section of beet root showing cells with vacuoles filled with anthocyanin pigment

Practical work:-

- 1- Prepare thin sections of *Tradescantia zebrina* stems (at least 20 cm from the growing tip), place in a drop of water on a microscope slide and cover with a cover glass. Prismatic and raphide crystals will appear.
- 2- Prepare thin sections of sweet potato (*Ipomoea batatas*) roots or stem or leaves of *Tribulus terrestris* (distributed widely in Baghdad), mount them in water under a cover glass, and observe the druse crystals.
- 3- Prepare thin transverse sections of a portion of a rubber plant leaf and mount in water under a cover glass. Several lithocysts should be visible and these may have Cystoliths.
- 4- Prepare thin sections of a garden beet root, mount in water under a cover glass, and observe parenchyma cells containing anthocyanins.
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