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## **Anatomical Study of *Tagetes erecta* (L.) (Asteraceae)**

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### **Abstract**

In this research, *Tagetes erecta* (L.) was studied anatomically. Epidermal anatomical features of stem and leaf was described, in addition to the anatomical features of root, stem, petiole and leaf for the plant which belonging to family Asteraceae. The results showed that some of the anatomical characters have good taxonomic value.

**Key words:** *Tagetes erecta*; Asteraceae; Anatomy; cortical cavities.

### **1. Introduction**

The Asteraceae family containing more than 1600 genera and about 2400 species. It considered as the largest family of vascular plants [1]. *Tagetes* is a genus belongs to this family. It comprised about 50 species of annual and perennial herbaceous plant. *Tagetes erecta* L. locally known as Genda phul (Marigold), is a branching, native to Mexico and other warmer parts of America and neutralized elsewhere in the tropic and subtropics [2,3] *T. erecta* is rapid growing annual flowering with height 6-8 inch reached to 10 feet. It bearing large pompon-like double flower up to 5 in a cross, it is very popular as a garden plant and yields a strongly aromatic essential oil which is used for high-grade perfumes [4,5, 6]. Plant anatomy which is the study of the internal structure of plants, had been a source of fascination and field of scientific inquiry since the time of earlier microscopists [7]. The anatomical features of roots, stems, leaves, petioles, epidermis and stomata are useful anatomical tools and important in systematic botany similar to the use of modern techniques and chemical composition [8,9,10,11,12]. The present study focused on the anatomical characters of this plant to collect as much information as possible with the aim to providing useful taxonomic data that would give further insight into proper classification and identification due to absence of the detailed anatomically of this plant growing in Baghdad.

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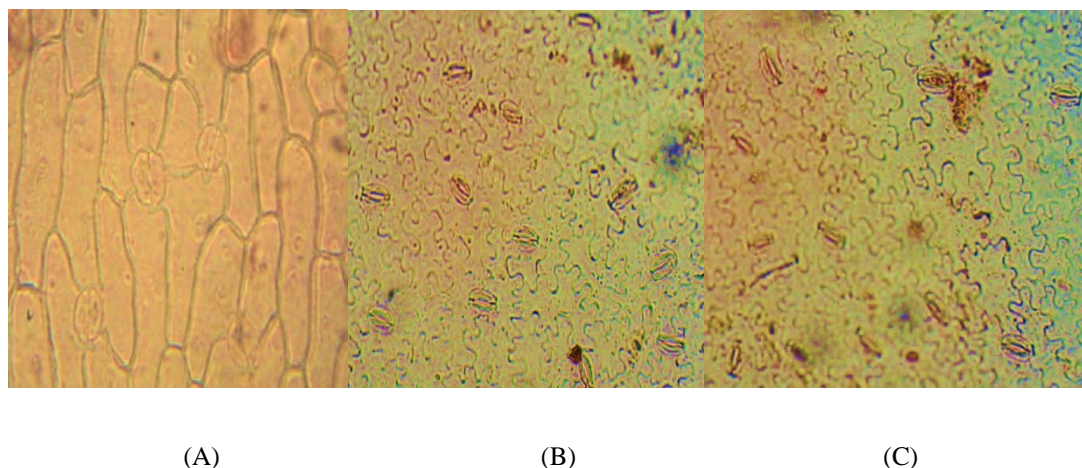
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## 2. Materials and methods

Fresh plant samples were gently collected from different regions of Baghdad, washed with distilled water, then, the needed plant parts cut into small pieces and fixed in FAA solution for 24 hours [13]. Then, the samples were washed with 70% ethyl alcohol solution and maintained in it until uses [14]. Stem and leaf epidermal peels were stained with safranin 0.5% : glycerin mixture (1:10) [15] and the stomatal index (SI) is represented by the formula of [16]. The transverse sections of the studied plant parts were prepared as the method of [17, 18].

## 3. Results and discussions

Study of the anatomical characters has been used to clarify taxonomic status and help in identification of different species [19,20]. Leaf and stem epidermal tissue characters have an important role in taxonomy and determination of numbers of plants. The foliar epidermal cells of *T. erecta* were irregular undulated walls on both leaf surfaces with mean length reached to 180.24  $\mu\text{m}$  and 167.5  $\mu\text{m}$  adaxial and abaxial surface, respectively. While, the mean width these cells reached to 23.12  $\mu\text{m}$  on adaxial and 22.35  $\mu\text{m}$  on abaxial surfaces. Cells of the lower leaf side have more undulation than the upper leaf side and easier to peel due to they are overlies the spongy layer (Fig.1.A&B).



**Figure 1:** Ordinary epidermal cells and stomatal complexes of *T. erecta*

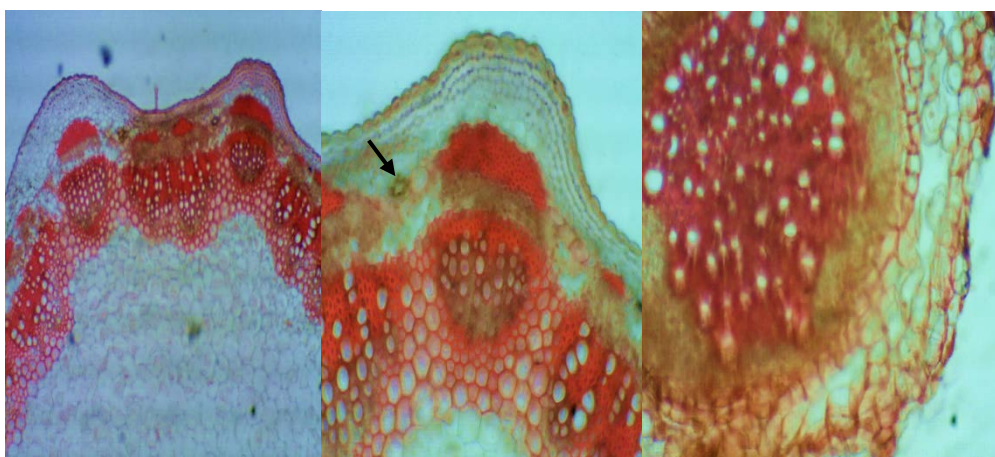
Stem epidermal cells were oblong with straight walls with mean length reached to 224.5  $\mu\text{m}$  and mean width 48.35  $\mu\text{m}$  (Fig.1.C). Stomata found on stem and both leaf surfaces (Amphistomatic), they were Ranunculaceous type with SI 25 on stem epidermis, 24 adaxially and 28 abaxially. Stomata was oblong kidney shape with a mean length 32.5  $\mu\text{m}$ , 40.8  $\mu\text{m}$  and 42.25  $\mu\text{m}$  and mean width 18.3  $\mu\text{m}$ , 21.76  $\mu\text{m}$  and 23.55  $\mu\text{m}$  on stem, adaxial and abaxial epidermis, respectively. In transverse section of root, epidermis consists of a single layer of rectangular to oblong rectangular cells with a mean thickness reached to 25.33  $\mu\text{m}$ . Below the epidermis, cortex appeared with 6-10 rows of parenchymatous cells of 220.53  $\mu\text{m}$  thickness, some of these cells stored starch grains (storage parenchyma tissue). The phloem consists ring of cuboidal and rectangular cells with a thickness reached to 198.5  $\mu\text{m}$ . A regular diffused porous wood observed in the center of the root with a half diameter 350.5  $\mu\text{m}$  (Fig. 2.A).

The stem of *T. erecta* showed a circular shape in cross sections with 9-10 ridges and furrows, and showed the tissue beginning with a cutinized oblong ovate to circular ovate epidermal cells with a mean thickness 25.25  $\mu\text{m}$ . Below the epidermis, cortex layer comprised of angular collenchyma in the ridges and furrows regions and 4-5 rows of lamellate collenchyma then 2-3 rows of ovate parenchyma cells in the remain regions of the stem. Mean thickness of these tissues was 65.24  $\mu\text{m}$ , 89.54  $\mu\text{m}$  and 53.22  $\mu\text{m}$  of angular, lamellar and parenchyma layers, respectively (Fig.2.B).

Some of the cortex cells stored starch, others were chlorenchyma especially the outermost layers. In the innermost layers of the cortex, schizogenous secretory canals observed, they were surrounding by a layer of small thickened walls semi-rectangular parenchymatous cells.

The diameter of these canals ranging between 13.6  $\mu\text{m}$  to 27.2  $\mu\text{m}$  (Fig. 2.C). Stele composed of 20-25 oblong-conical vascular bundles separated from each other by a lignified sclerenchyma tissue. Numbers of bundles in the stem have a high taxonomic value [21]. Pith cells were big, spherical and polygonal with thin walls and increased in size towards the stem center and their walls become thinner. Structure of petioles was very important and used in taxonomy of some species [22]. Petiole of *T. erecta* has semi-deltoid with concave abaxial side (Fig. 2.D), epidermis was uniseriate of oblong ovate cells with 8.15  $\mu\text{m}$  thickness. Cortex comprised of 6-10 rows of ovate parenchymatous cells with 71.33  $\mu\text{m}$  mean thickness. A total of 11-15 vascular bundles with 12-17 rows of tracheary elements observed with secretory cavities imbedded between them (Fig. 2.E). Observation of cortical canals in stem and petiole of *T. erecta* were in line with the work of [23,24]. The cavity of vascular plants were relevant taxonomic characters and important taxonomical feature [25].

Both upper and lower epidermis of the leaf were composed of a single layer of ovate and oblong ovate ordinary cells with mean thickness 16.32  $\mu\text{m}$  adaxially and 17.68  $\mu\text{m}$  abaxially. Mesophyll was not homogenous, divided to palisade with 1-2 rows of 108.8  $\mu\text{m}$  adaxially and spongy with 5-7 rows of 115.5  $\mu\text{m}$  abaxially. Midrib composed of a single circular elliptic collateral vascular bundle with 7-9 rows of tracheary elements (Fig.2.F).

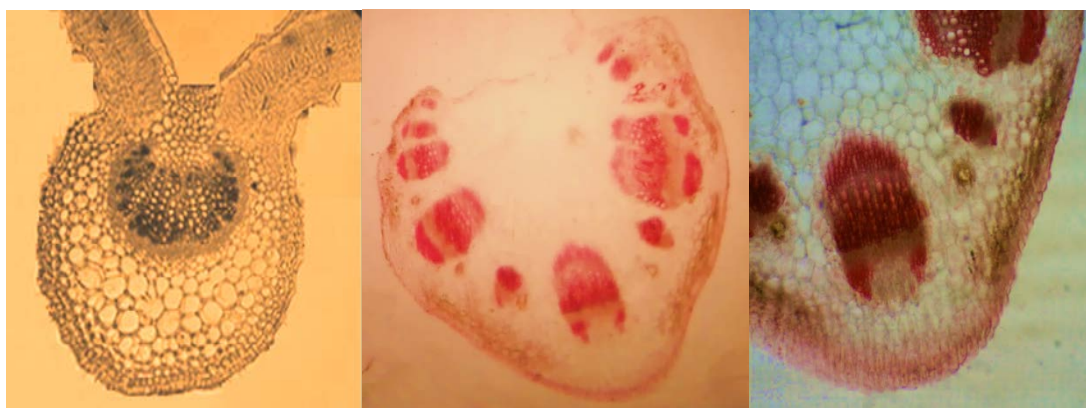


(A)

(B)

(C)

(A): Adaxial side, (B): abaxial side, (C):stem epidermis



(D)

(E)

(F)

**Figure 2:** (A): C.S in root, (B): C.S in stem, (C):C.S. in stem show cavity, (D): C.S. in petiole, (E): C.S. in petiole show cavity, (F): V.S. in leaf.

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