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## **Morphological and anatomical study of some plant species belonging to different families in the Bab Al-Moadham area**

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**Abstract**--The current study included a comparative morphological and anatomical study of leaf epidermal cells with cross-sections of stems and peduncles of different types of plant species belonging to different families. The study included six species: Capparis spinosa, Lantana camara, Mentha piperita, Eucalyptus camaldulensis, Hosta Venusta, Rumex vesic . The formal anatomical study of these species is very important to distinguish between them, as samples of the study were collected from the Bab al-Moadham area in Baghdad. And the diagnosis of species within the same family, and this research included pictures of field samples collected from different and multiple sites within Baghdad and some of its surrounding areas, and included many pictures of the sections that were studied for the different plant organs as well as many tables, and the results of this anatomical study were discussed, especially what is Related to the environment of these species. In this research, the phenotypic and anatomical characteristics of three species belonging to different families were studied: the oleander belonging to the family Oleander, the Nabek belonging to the Sidra family, and the caper belonging to the Qabar family. The six species were compared morphologically and anatomically. The results showed that some phenotypic and anatomical characteristics of the stems, leaves, and peduncles have a good taxonomic value to distinguish between these species, and these characteristics are the length of the stem, thickness and color, as well as the shape of the blade, length and color, and the study of the top and edge of the blade, in addition to the shape of the stem and thickness of the columnar layer. The spongy shape of the leaf, as well as the heterogeneity of epidermal cell shapes in the leaf and stem, and the stomatal index of species.

**Keywords**---anatomical, morphological, capparidaceae, lantana camara, mentha piperita, eucalyptus camaldulensis, hosta venusta, rumex vesicarius.

## Introduction

Capparis spinosa is a plant belonging to the Capparaceae family. It is distributed in different climatic areas of desert areas in the form of a shrub or creeping plants (1). This plant is considered a medicinal plant as it is used in the treatment of renal colic and the treatment of rheumatism (2). The type Lantana camara belongs to the family Verbenaceae, the enamel plant is an aromatic shrub with coarse leaves (3) This plant is useful in the treatment of rheumatism, and the leaves are also used as an antiseptic for wounds and treatment (4) The species Mentha piperita, peppermint spp. Mentha is one of the most important perennial aromatic plants, and it belongs to the family Lamiaceae, and mint is a perennial herbaceous plant with serrated leaves and square-shaped stems, and has a strong aromatic smell and purple flowers (5). Tropical (6) is a perennial evergreen tree, which has a high drought tolerance and ability to adapt to diverse climatic conditions and soils, which makes it popular (7). Parallel sweating is carried on an erect aerial stem (8) This species is characterized by its medicinal and aromatic importance, in addition to the fact that wild species are considered as livestock feed (9) As for the type Rumex vesicarius, sorrel, acidosis, belongs to the Polygonaceae family, the buckwheat family, and western sorrel is the original home of Western Australia. Asia(10) It is a semi-succulent annual pale green herb, branching from the root, the plant is grown as a vegetable(11). It flowers and bears fruit in January and March, respectively (12) and this plant is of medical importance as it is anti-microbial and anti-fungal (13) and shows viral and anti-cancer activities and reduces blood sugar and cholesterol levels (14) (15) and also anti-diarrheal(16).

## Materials and Methods

Fresh specimens of the studied plants were collected from different parts during flowering period from 2021-2022. Then cut into small pieces and fixing in IAA for 24 hours (17), then washed several times with 70% ethyl alcohol and maintained in it. Sections prepared according to -19 (18), with some modifications. Some of sectioning were stained with safranin : glycerin mixture 1:10 .

## The Results & Discussion: Morphological study

The species studied in this research are trees like Eucalyptus camaldulensis, shrubs like Capparis spinosa, Lantana camara and herbs like Hosta venusta, Rumex vesicarius, Mentha spicata. It was clear that the characteristics or characteristics of the six species differed clearly in the length of the flowering sub-stem, where the maximum value of the sub-stem length in the species Eucalyptus camaldulensis was (285), while the lowest average of the stem length was (70) in the Capparis spinosa species, And the stem is erect in most species, or it takes an oblique position in its growth upwards ascending or grows flat on the surface of the soil with a raised top, as in the type Capparis spinosa, hollow or solid, and the

stems are simple or branched from the base, such as *Hosta venusta*, *Rumex vesicarius*, the stems are leafy in all species and the bases of the stems and the upper parts of the roots are woody in most species except for *Hosta venusta*, *Rumex vesicarius*.

As for the outer surface of the stem, it is striped with prominent ribbed lines extending along the leg, and the skin may be smooth without bristles and thorns, as in the species *Mentha spicata*, *Eucalyptus camaldulensis*, *Lantana camara* *Hosta venusta*, *Rumex vesicarius*. As for the stems that contain small thorns, as the two species *Ziziphus spina - Christi* and *Capparis spinosa*. The stem colors of the species under study also varied, as the results showed that the species *Capparis spinosa*, *Mentha piperita* had a dark green stem color, while the species *Eucalyptus camaldulensis*, *Lantana camara*, *Hosta venusta*, *Rumex vesicarius* had a light green color. The results showed that the stems are of taxonomic importance in terms of their shapes. And the nature of its branches and its timing, so it can be used in isolating and identifying species, and this is in agreement with the study (20) and the study of Podlech (2007), as in (Table No. 1).

Table 1  
Quantitative and qualitative characteristics of the stems of the studied species,  
measured in millimeters

the color	shank thickness/mm	leg length/mm	Species	s
dark green	(2 – 3) 2.8	(50-75) 70	<i>Capparis spinosa</i>	1
dark green	(2 – 4) 3.6	(220 – 255) 240	<i>Lantana camara</i>	2
dark green	(2 – 3) 2.5	(233 – 250) 240	<i>Mentha spicata</i>	3
light green	(2 – 4) 2.7	(250 – 300) 285	<i>Eucalyptus camaldulensis</i>	4
light green	(5 – 6) 5.4	(220 - 230 ) 225	<i>Hosta venusta</i>	5
light green	(4 – 5) 4.8	(180 – 200) 190	<i>Rumex vesicarius</i>	6

**Leaf:** The leaves of the species studied in this paper are characterized by being simple, full-edged Entire or lobed, and the shape of the entire simple leaf blade varies. *Lantana camara* the leaf shape is Apiculate, in the species *Mentha piperita* the leaf shape is Acute, in the variety *Hosta venusta* it is wavy almost heart-shaped, and in the variety *Rumex vesicarius* is ellipsoidal. The edge, tip, and base of the leaf blade vary according to the type of plant. It may be Entire, Sinuate, Acute, Obtuse, Petiole, or Sesile. Leaves are often distributed on the stem in alternate arrangement, found single. Solitary or fasciculate at one node, and leaves clump. (Table No. 2).

Table 2  
Quantitative and qualitative characteristics of the leaves of the studied species  
measured in millimeters

blade color	blade base	blade tip	blade edge	blade width	blade length	blade shape	Species	s
dark green	obtuse	obtuse	ciliate	3-10 (6.5)	4-18 (11)	obtuse	<i>Capparis spinosa</i>	1
dark green	attenuate	mucronate	serrulate	1-3.5 (2.25)	5-12 (8.5)	obtuse	<i>Lantana camara</i>	2
dark green	attenuate	mucronate	serrulate	2-4 (3)	5-10 (7.5)	obtuse	<i>Mentha piperita</i>	3
light green	attenuate	obtuse	serrulate	2-5 (3.5)	4-15 (9.5)	obtuse	<i>Eucalyptus camaldulensis</i>	4
light green	attenuate	obtuse	entire	1-3.5 (2.25)	5-12 (8.5)	Cuneate-oblong	<i>Hosta venusta</i>	5
light green	cuneate	obtuse	Eliptic	2-4 (3)	4-18 (11)	Eliptic	<i>Rumex vesicarius</i>	6

### Anatomical study

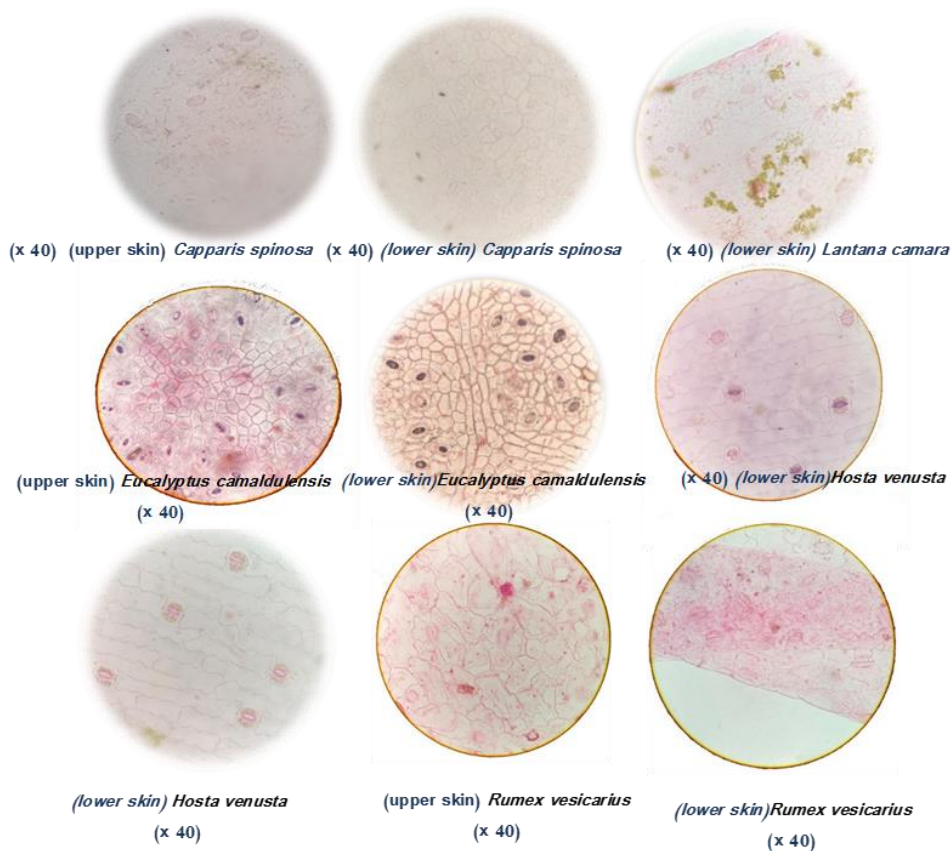
The epidermis (stomatal complexes): Table No. (3), panels (1, 2). Upper epidermis: From the results of the table for plants in the current study, it is noted that the highest rate of stomata length reached (18) in the species *Lantana camara*, and the lowest rate was (7.2) in *Capparis spinosa*, while the stomata width reached a maximum rate of (12.3) in *Rumex vesicarius*. The lowest rate (4.8) was in *Capparis spinosa*. As for the stomata index, its highest rate was (66.6) in the species *Lantana camara*, the lowest rate was (2.5) in *Hosta Venusta*, and the stomata frequency reached the maximum rate (41.4) in *Capparis spinosa*, and the lowest rate was (4.6) in *Hosta Venusta*.

Lower epidermis: (Table 3) showed me the highest rate of stomata length reaching (13.6) in the species *Eucalyptus camaldulensis*, and the lowest rate (7.2) in *Capparis spinosa*, while the stomata width reached a maximum rate (11.6) in *Hosta Venusta*. While the lowest rate was in *Capparis spinosa* it reached (4.8), while for stomata index it reached the highest rate (62.96) in the species *Lantana camara*, while the lowest rate was (3.6) in *Eucalyptus camaldulensis*, and the stomata frequency reached the maximum rate (14) in the species *Lantana camara*, and the lowest rate was (1.3) in *Rumex vesicarius*. The variation in the value of stomata frequency may be in response to certain environmental conditions such as drought, humidity, or intensity of illumination, and this was confirmed by (21) which mentioned that the stomata frequency varies greatly and that this variation exists in different parts of the same leaf as well as in different leaves of the same plant, as it is affected by Environmental conditions, as the small size of the stomata and the increase in frequency may be a kind of adaptation against drought conditions, because it increases the plant's ability to regulate the transport process (22). (23) confirmed the existence of a direct relationship between the stomata frequency and the intensity of illumination, as the stomata frequency increased with the increase in the intensity of illumination. *Hosta venusta*, *Rumex vesicarius*, *Capparis spinosa*, and *caduceus* in the species: *Eucalyptus camaldulensis*, while in the species *Lantana camara* and *Mentha*

piperita. The study also showed the presence of three types of stomata complexes in one leaf whose presence varies according to the species of the genus, the first type: Anomocytic, in which no auxiliary cells are distinguished in the epidermis, which is characterized by the type *Hosta venusta*. The second type: Anisocytic type, consisting of three cells of unequal size, one of these cells is smaller than the other two cells that vary in size and includes the types: *Capparis spinosa*, *Mentha piperita*, *Rumex vesicarius*, and *Lantana camara*. The third type is a staurocytic stomata that is found in *Eucalyptus camaldulensis*. It was found that the types of stomata patterns and the shape of epidermal cells in different types of a number of plant families, and that the correlation between the traits proves the existence of a strong base due to which classification and helps isolate the different species (24).

Table 3  
Shows the characteristics of the upper and lower skin

Frequency rate		stomata guide		lower skin		upper skin		Species	s
lower skin	upper skin	lower skin	upper skin	stomata width	stomata length	stomata width	stomata length		
(8 - 16) 12.6	(30 - 50) 41.4	52.38	55.5	(4 - 6) 4.8	(5 - 10) 7.2	(4 - 6) 4.8	(5 - 10) 7.2	<i>Capparis spinosa</i>	1
(10 - 17) 14	(17 - 10) 12.4	62.96	66.6	(4 - 10) 6.2	(9 - 18) 12	(6 - 12) 9.4	(8 - 20) 18	<i>Lantana camara</i>	2
(5 - 10) 8	(5 - 10) 7.3	44.1	16.6	(9 - 12) 10.5	(10 - 14) 12.2	(9 - 12) 10.5	(9 - 11) 10.2	<i>Mentha piperita</i>	3
(9 - 13) 10.8	(22 - 35) 27.2	7.4	16.6	(9 - 12) 10.5	(10 - 18) 13.6	(6 - 10) 8.4	(10 - 18) 13.6	<i>Eucalyptus camaldulensis</i>	4
(1 - 2) 1.3	(4 - 5) 4.6	3.6	2.5	(11 - 12) 11.6	(11 - 14) 12.3	(9 - 12) 10.3	(10 - 14) 12.5	<i>Hosta venusta</i>	5
(6 - 8) 7	(6 - 10) 8	22.2	16.6	(9 - 13) 10.7	(9 - 10) 9.6	(11 - 14) 12.3	(9 - 10) 9.6	<i>Rumex vesicarius</i>	6



Panel 1. Quantitative and qualitative characteristics of the lower and upper epidermis and stomata of the leaves of the species under study less than 40x.  
Zoom

**The cross section of the leaf blade: (Table No. 4) shows the data of the cross section of the leaf blade. You can also refer to panel No. (3)**

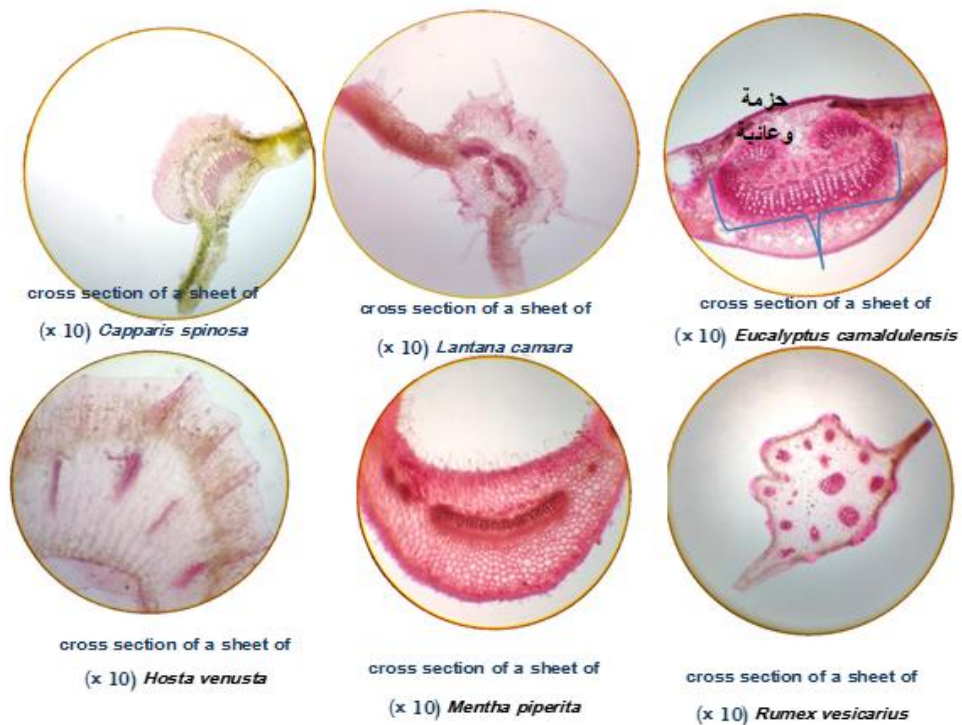
The results obtained for the vertical sections of the leaves of the laminae of the studied species showed many variations in the thickness and shape of the epidermal cells of the studied species. The results showed that it had a simple epidermis and a uniseriate consisting of cells of oval to ovoid elongated shape in the species *Rumex vesicarius*, *Capparis spinosa*, *Lantana camara*. Whereas, in *Mentha spicata*, *Eucalyptus camaldulensis*, these cells were circular to oval in shape, while in *Hosta venusta*, these cells were circular to oblong. The cells are surrounded from the outside by a protective waxy cuticle layer. The species dealt with in the current research differed slightly in the thickness of the dermis. It became clear from the results obtained from the current study that the difference in thickness of the dermis layer may be due to genetic characteristics specific to

the species and not only in response to environmental conditions and this belief is reinforced.

This is what was explained by (25) when studied, as the plant was characterized by a thick epidermis, despite its presence in low environments. This layer showed a slight variation in its thickness among the studied species (Table No. 4). The maximum thickness of this layer was (5) in the species *Eucalyptus camaldulensis*, while the lowest average thickness of this layer was (0.6) in the species *Hosta venusta*, and the medium tissue Mesophyll of the leaves of the species studied was upper palisade parenchyma and lower spongy parenchyma, and the leaves in these species are described as bifacial, i.e. in the case of the presence of the columnar cells under one surface, except for species *Eucalyptus camaldulensis* and *Hosta venusta*, in which the leaves were bifacial One is located under the top surface and the other is under the bottom surface of the leaf.

The paper in this case is described as mono-facial (that is, in the case of the presence of columnar cells under the top and bottom surfaces) or that it is similar in two faces. The stratum corneum cells are usually located on the upper side of the leaf surface. The cells of the columnar and spongy layers showed a clear difference in the number of rows of cells and in terms of their thickness. In these types, the cells of the mesophyll layer take a compact shape and tend to perpendicular to the surface. They consist of two to three rows of cells. The highest average thickness (18.3) was in *Hosta venusta*, and the lowest rate was (7.2) in *Mentha spicata*. As for the cells of the spongy layer, they also differed in the number of rows and thickness among the studied species, as the number of rows in the species varied. The number of rows of cells in the spongy layer reached 3-4 rows, and the highest rate was (15.6) in the type *Rumex vesicarius*, and the lowest rate (8.6) in Type *Capparis spinose*.

As for the type *Rumex vesicarius*, the cells of the spongy layer were compact and compressed on top of each other and with few interstitial spaces between them. The leaves of the species studied in this research have a medium texture of a unifaceted type, except for the species *Capparis spinosa*, *Lantana camara*, which had a medium texture. It is of a bi-faceted type and this corresponds to what was mentioned by (26) and (27) that the intermediate tissue of the leaves of this family is either bi-faceted or uni-faceted, and these types can be separated from other species by adopting this characteristic, i.e. dividing species into two groups in terms of Being single or bi-faceted, the number of vascular bundles ranged between the studied species, where the maximum rate of bundles was (3.2) in the type *Lantana camara*, and the lowest rate was (0.6) in the type *Hosta venusta*, and it should be noted that these vascular units It has been organized in the form of regular and ordered rows, sometimes separated by parenchymal cells, and for all the types studied.



Panel 2. Cross-sections of the leaves of the species under study

Table 4  
Shows the cross-sections of the leaf blades of the studied species

vascular bundles				Cuticle thickness	blade		Species	s
its shape	show it	length	their number		Thickness of Amadiya layer	thickness of spongy layer		
crescent shape	(40 - 110) 75	(50 - 130) 100	(1 - 2) 1.5	(3-5) 4.2	(10-20) 13.7	(7-10) 8.5	<i>Capparis spinosa</i>	1
circular or arched	(10 - 80) 43.3	(30 - 110) 70	(2 - 4) 3.2	(1 - 2) 1.3	(7 - 20) 15	(5 - 12) 9	<i>Lantana camara</i>	2
circular or elongated	(35 - 150) 111.6	(60 - 90) 73.3	(1 - 2) 1.5	(2 - 3) 2.4	(5 - 10) 7.2	(5 - 12) 8.6	<i>Mentha piperita</i>	3
circular	(20 - 72) 45.6	(40 - 120) 96.6	(1 - 1) 1	(4 - 6) 5	(4 - 10) 6.6	(8 - 15) 10.4	<i>Eucalyptus camaldulensis</i>	4
circular	(7 - 10) 8.7	(25 - 35) 30.5	(1 - 3) 2	(0.5-1) 0.6	(10-30) 18.3	(10 - 20) 14	<i>Hosta venusta</i>	5
circular	(100- 110) 103.3	(110 - 130) 120	(1 - 2) 1.3	(1-3) 2	(10-13) 11	(13 - 20) 15.6	<i>Rumex vesicarius</i>	6

### The cross sections of the stems

The cross-sections of the stems, which were taken from about the middle of a flowering stem, showed important differences in the characteristics of the stems of the species under study, and these differences are represented in the thickness of the cuticle, the thickness of the epidermis, the thickness of the epidermis, the exodermis, the thickness of the bark, the shape of the vascular bundle, and the number of wood arms. (Table 5), plate No. (4). The shapes of the stems of the

species differed, where the stems were circular and semi-circular, including the type *Capparis spinosa*, and the shape of the stem was circular with depressions in the type *Rumex vesicarius*, which was distinguished by the fact that the section had clear protrusions confined by peripheral depressions, and the shape of the stem was rhombic and includes the type *Eucalyptus camaldulensis*, and the shape of the stem is square. It includes the species: *Lantana camara*, *Mentha spicata*, the shape of the leg is semi-circular, winged in the species *Hosta venusta*. The cuticle layer appears in the transverse section in a smooth, flat shape in the species *Eucalyptus camaldulensis*, *Hosta venusta*, while in the rest of the species it appears in the form of serrated and contains simple protrusions or lines and varies in thickness between thin in species to thick in other species and as shown in (Table No. 5)

The species *Eucalyptus camaldulensis* recorded the highest rate of cuttlefish, reaching (4.4) micrometers, while the lowest rate of cuttlefish reached (1) micrometer in *Lantana camara*. These differences in the thickness of the cuticle layer may be due to the environmental conditions to which these species were collected in different seasons of the year, as all species lived and existed in almost dry or semi-dry conditions; Therefore, you need a thick cuticle layer to prevent water evaporation, so that the plant tissues are not exposed to wilting and drying. This is consistent with what was mentioned by (28) and that the explanation for the increase in the thickness of the dermis represents a response to drought conditions, and accordingly the species that live in dry or semi-dry environments with thicker dermis than the species that live in low and humid environments. As for the species that had the same thickness as their dermis, where their dermis was of medium thickness, they were found in agricultural environments (29) The epidermis layer shows in the transverse section a clear contrast in its thickness and shapes of its cells and the cuticle layer that covers it, and the cells of the epidermis layer were Uniseriate except for *Lantana camara*, *Mentha spicata*, *Rumex vesicarius*, and the shapes of epidermal cells appeared circular to elongated in all species. The highest average skin thickness was in *Rumex vesicarius* and reached (14.4) micrometers, while the lowest rate was in *Hosta venusta* type and reached (4) micrometers .

The epidermis is followed by the Cortex region, which is the cylindrical region located between the epidermis and the vascular cylinder (30), which in turn differed in thickness according to the different studied species. (8) Micrometer. The cells of the cortex in the two types *Rumex vesicarius* begin with a row of small spherical cells, and this is a feature that distinguishes these two types from other types. The cortex of the species under study was characterized by that it consisted of several rows of collenchyma cells that increased in the area of the corners or protrusions, and decreased in number and thickness in the areas connecting those protrusions. . The number of rows of collenchyma varies between the species under study, as the number of rows in the species *Eucalyptus camaldulensis* ranged between (12-18) rows, while in the species *Lantana camara*, the number of rows of collenchyma ranged (5 - 7) and in the species *Rumex vesicarius* it reached (4 - 8). The collenchyma in these species is of angular or lamellar type, and the colchemia, which is distributed in a continuous ring, was distinguished by the species *Mentha piperita* *Capparis spinosa*, *Hosta venusta*, as well as by several rows of thin-walled parenchymal cells between

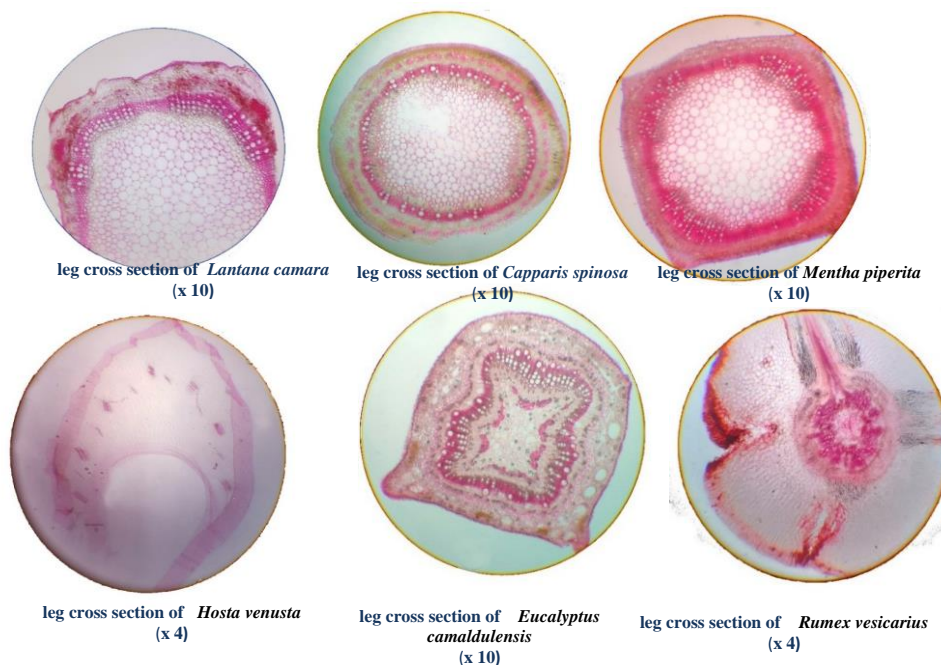
which there are spaces between them in all the species studied. And they also differed in their number, as the shapes of these cells were spherical in the type *Mentha piperita* ranging from (1-3) rows, while these cells were semi-spherical to tetrahedral in the type *Lantana camara*, where the number of rows of parenchyma ranged from (1-4) Also, the type Aerenchyma parenchyma was seen in *Capparis spinosa*, where the number of parenchyma rows ranged between (2-4) rows, as well as in the type *Eucalyptus camaldulensis*, and the number of parenchyma rows ranged (1-6) rows. *Hosta venusta* (1-2) rows.

As for the vascular tissue or the vascular cylinder, it is in all the studied species in the form of a ring of vascular bundles of alternating size, i.e. small and large in size, and these bundles are linked to each other by means of vascular elements, which are more numerous and crowded. These vascular bundles differ among the studied species in terms of their numbers in the stem section as a whole. The maximum number was (26-30) in the species *Mentha spicata*, and the lowest number was (7-10) in the species *Eucalyptus camaldulensis*. The species also differed in the number of wood arms, the maximum rate of wood arms was (10.4) in *Eucalyptus camaldulensis*, while the lowest rate was (3) in the species *Mentha piperita*. The shape of the vascular bundles was circular in the two species *Hosta venusta*, and it was in the form of a crescent-shaped cap in the species *Capparis spinosa*, and they were in the form of elongated elliptic in the species *Lantana camara* and *Mentha spicata*, and they took a broad crescent Widley shape in the species *Eucalyptus*, and in the species *Eucalyptus*. *Rumex vesicarius* The vascular bundles are circular in shape, slightly elongated.

Table 5  
Qualitative and quantitative characteristics of the cross-sections of the stems of the studied species measured in micrometers

Phloem thickness	vascular bundle		Cortex					Epidermis thickness	Cuticle thickness	Species	s
	Number arm xylem	Number vascular bundle	Number Paranchyma	Paranchyma thickness	Number Cholenchyma	Cholenchyma thickness	Cortex thickness				
(25 - 45) 35	(3 - 4) 3.4	19 - 13	4 - 2	(58-30) 25	متوزعة بشكل حلقة مستمرة	(110-130) 120	(5 - 15) 8	(5 - 8) 5	(2 - 5) 3	<i>Capparis spinosa</i>	1
(5 - 15) 10.2	(5 - 10) 7	15 - 10	4 - 1	(39-13) 26	7 - 5	(35-43) 39	(5 - 10) 7.2	(4 - 10) 6.2	(1 - 1) 1	<i>Lantana camara</i>	2
(1 - 5) 3	(8 - 14) 10.7	30 - 26	3 - 1	(30-25) 27.5	متوزعة بشكل حلقة مستمرة	(24-48) 36	(5 - 20) 10.6	(4 - 6) 5	(3 - 4) 3	<i>Mentha spicata</i>	3
(7 - 15) 10.4	(8 - 16) 13	10 - 7	6 - 1	30-26 28	- 12 18	(30-20) 25	(8 - 25) 13.6	(5 - 11) 8	(3 - 6) 4.4	<i>Eucalyptus camaldulensis</i>	4
(10 - 30) 20	(3 - 5) 4.2	18 - 12	2 - 1	41-36 38.5	متوزعة بشكل حلقة مستمرة	(34-22) 28	(12 - 20) 15	(3 - 5) 4	(1 - 3) 1.7	<i>Hosta venusta</i>	5

(12 - 20) 15.2	(5 - 8) 6.3	20 - 15	4 - 2	32-28 30	8 - 4	(32-27) 29.5	(15 - 35) 29	(2 - 30) 14.4	(2 - 4) 2.6	<i>Rumex vesicarius</i>	6
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Panel 3. Cross-sections of the stems of the species under study

### Leaf petiole

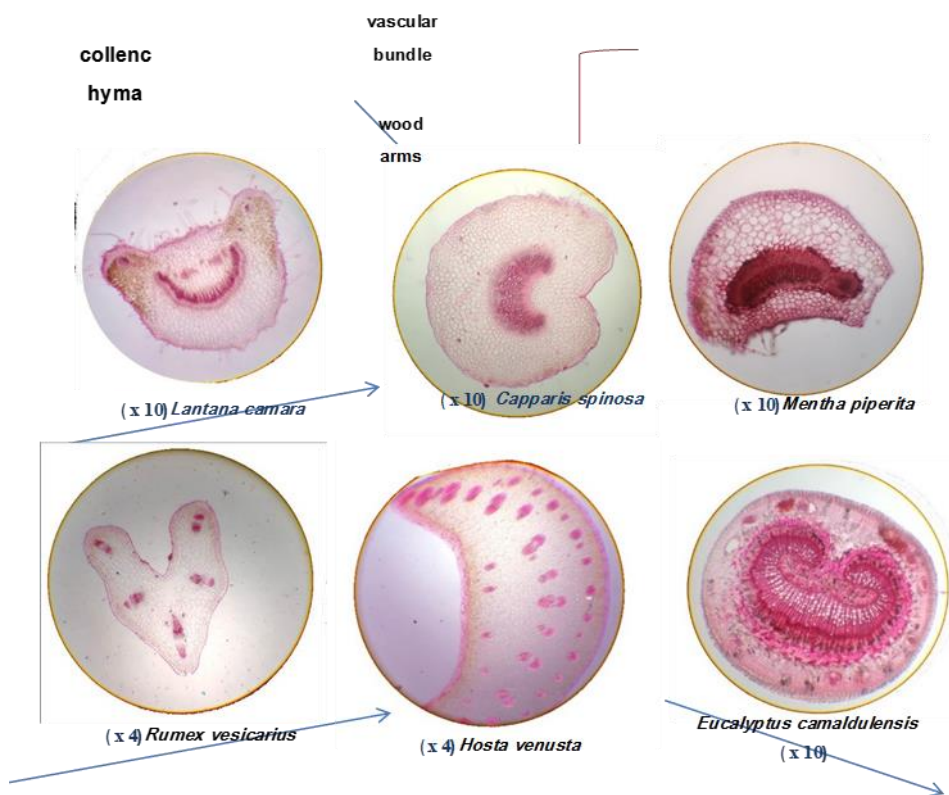
The transverse sections of the leaf stalk that were taken from the basal or (lower), middle and upper parts of it showed a heterogeneity between the species that were studied. In general, the leaf stalk section differs in terms of shape, intensity of curvature, as well as in the number of vascular bundles (which appear in the form of an arc) Gradually from bottom to top. The stem segments of the studied species were distinguished by several shapes, including oval to elongated ovule in *Capparis spinosa*, *Mentha spicata*, *Eucalyptus camaldulensis*, heart-shaped in *Rumex vesicarius*, *Hosta venusta*, the stem takes a round-winged shape, and in *Lantana camara* circular shape. The cross-section of the stalk consisted of an uneven outer layer called the dermis or the cuticle, with an average thickness of between (4.8)  $\mu\text{m}$  as a maximum in *Eucalyptus camaldulensis* and (0.5)  $\mu\text{m}$  as a minimum in the species *Hosta venusta*. Cubic to elongated (Cubical-Oblong) interspersed in most species with the bases of simple bristles.

The average thickness of the epidermis was recorded (36) micrometers in the species *Hosta venusta* as a maximum to (4.6) micrometers in the two species *Lantana camara* as a minimum, then it was observed that layers of cortex tissue were observed. Cortex, and the results showed that the highest rate of crust layer

thickness was (105) in *Hosta venusta*, while the lowest rate of crust layer thickness was (11) in *Eucalyptus camaldulensis*. Rows of parenchymal cells were found that differed in their number and shapes according to different species, as the highest rate of bundles (3) was in the two species *Hosta venusta* and *Rumex vesicarius*, where the vascular bundles were distinguished by being separated from each other in the form of two vascular bundles, one small and the other large. The average in the two species *Capparis spinosa* and *Mentha spicata* was (1) one vascular bundle. The number of transporting vessels in each arm was also calculated. The highest rate was in *Hosta venusta* (10.4), and it was (2.2) in *Rumex vesicarius* as a minimum.

Table 6  
Qualitative and quantitative characteristics of the cross-sections of the stems of the studied species measured in micrometers

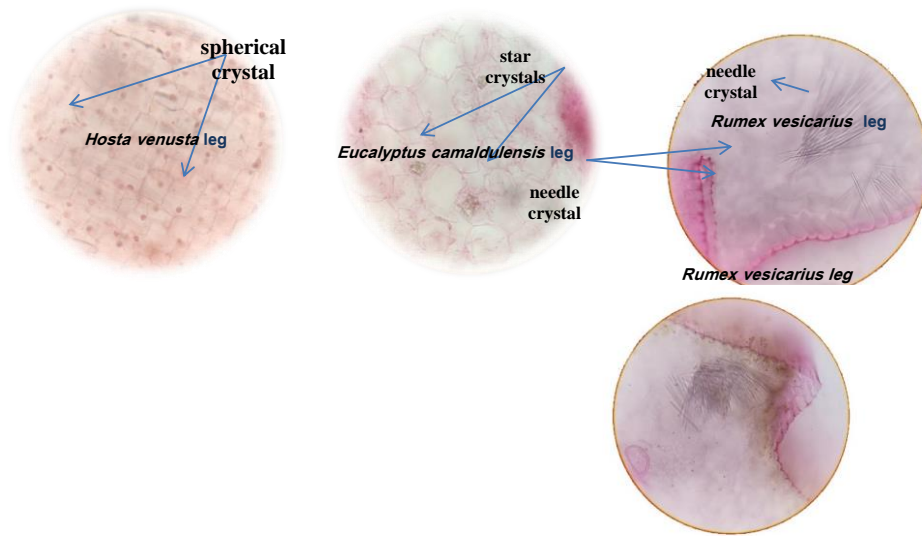
vascular bundle			Cortex					Epidermis thickness	Cuticle thickness	Species	s
number of vessels in each arm	Number arm xylem	Number vascular bundle	Number Parenchyma	Parenchyma thickness	Number Chlorenchyma	Chlorenchyma thickness	Cortex thickness				
(3 - 5) 4.5	(10 - 18) 13.8	(1 - 1) 1	4 - 5	(25 - 40) 31.6	----	----	(10 - 30) 19	(5 - 12) 9.4	(1 - 3) 2	<i>Capparis spinosa</i>	1
(3 - 7) 5	(15 - 20) 17	(1 - 3) 1.8	3 - 5	(60 - 85) 73.3	3 - 4	(30 - 45) 37	(10 - 30) 17	(3 - 6) 4.6	(1 - 2) 1.8	<i>Lantana camara</i>	2
(3 - 6) 4.5	(14 - 22) 15	(1 - 1) 1	6 - 8	(80 - 100) 90	5 - 6	(60 - 80) 70	(10 - 22) 13.8	(6 - 10) 8	(2 - 5) 3.4	<i>Mentha spicata</i>	3
(4 - 7) 5.4	(10 - 16) 12.4	(2 - 4) 2.8	5 - 6	(90 - 100) 95	7 - 8	(70 - 85) 78.3	(8 - 15) 11	(8 - 11) 9.2	(4 - 6) 4.8	<i>Eucalyptus camaldulensis</i>	4
(8 - 15) 10.4	(10 - 25) 17.5	(1 - 4) 3	1 - 2	(18 - 20) 19.1	----	----	(95 - 125) 105	(20 - 55) 36	0.5	<i>Hosta venusta</i>	5
(2 - 3) 2.2	(1 - 5) 3.2	(2 - 4) 3	2 - 3	(20 - 50) 36.6	2 - 3	(50 - 60) 56.6	(15 - 45) 33	(15 - 32) 23	(2 - 4) 3	<i>Rumex vesicarius</i>	6



Panel 4. Cross-sections of the stems of the species under study

### Crystals

It was found through the current study that there are three types of crystals found in some parts of some studied plants. The first type is the stellate crystals, which were observed in the species *Lantana camara*, where crystals appeared in the stem part and a cross-section of the leaf, while in the type *Eucalyptus camaldulensis*, they appeared in the stem, peduncle and cross-section of the leaf, and for the species *Rumex vesicarius*, a star crystal appeared in the cross-section of the leaf. As for the second type, they are stylus crystals. They were observed in the stems of *Hosta venusta*, where the rate of crystals reached (23.3) crystals, and the spheroids appeared in the stems of *Rumex vesicarius*, where the rate of crystals reached 17. As for the third type, it is the spherical sphaeroplast crystals, which were found in the stems of the type *Rumex vesicarius*, and the average crystals in it were (55) spherical crystals.



Panel 5. Crystals in sections of the species under study

### Conclusions

- The phenotypic and anatomical characteristics are of great importance in diagnosing, classifying, separating and isolating taxonomic ranks.
- The study also showed the presence of three types of stomata complexes in one leaf whose presence varies according to the species dependent on the genus. The first type is: Anomocytic, in which no auxiliary cells are distinguished in the epidermis, which is characterized by the type *Hosta venusta*. The second type: Anisocytic type, consisting of three cells of unequal size, one of these cells is smaller than the other two cells that vary in size and includes the types: *Capparis spinosa*, *Mentha piperita*, *Rumex vesicarius*, and *Lantana camara*. The third type is a staurocytic stomata that is found in *Eucalyptus camaldulensis*.
- The vascular bundles were distinguished by being separated from each other in the form of two vascular bundles, one of them small in size and the other in large size, and the lowest rate was in the two species *Capparis spinosa* and *Mentha spicata*.
- The cells of the epidermal layer were uniseriate except for *Lantana camara*, *Mentha spicata*, *Rumex vesicarius*, the cells of the epidermal layer were bi-row.
- The presence of stellar, spherical and needle crystals was found in the sections of some species.

### Sources and References

1. AL-Amiry , SH. M. H.( 2006). A taxonomical and Anatomical study of some genera of tribe Asteraeae ( Astereaceae) in Iraq. M.Sc. Thesis, Kufa Univ. In Arabic).

2. AL-Ani ,A.J., Nadir ,M.T .and Al-Khazraji .N.R. (1996) The antimicrobial activity of volatile oil isolated from some Iraq plants .J. AL-Anbar University .11.1: 82-86.
3. Al-Qadi, Abdullah Abdul-Hakim. (1997) . Uses of some plants in Libyan folk medicine. part One. Fifth Edition. General Company for Paper and Printing. the corner .
4. Bindumadhava, H., J. Tamak, K. Mahavishnan, A.P. Upadhyay, M. Varghese and N. Sharma, (2011). Clonal propagation in *Eucalyptus camaldulensis* using minicutting technique, *Current Science*, 101(12): 1578-1585.
5. Choi, B. and Ohashi, H. (1996). Pollen morphology and taxonomy of *Hedysarum* and its related genera of the tribe *Hedysareae* (*Leguminosae-Papilionaceae*). *J. Jap. Bot.*, 71:191-213.
6. Christenhusz, M. J. M. and Byng, J. W. (2016). "The number of known plants species in the world and its annual increase". *Phytotaxa*. Magnolia Press. 261 (3): 201–217.
7. Esau, K. (2006). *Esau's Plant anatomy: meristems, cells, and tissues of the plant body, their structure, function, and development*. Ray F. Evert. (3rd Ed.). Hoboken, New Jersey. Canada, 607PP.
8. Fahn, A. (1974). *Plant anatomy*. Second ed. Pergamon press. Oxford. 612 PP.
9. Fahn, A. (1974). *Plant anatomy*. Second ed. Pergamon press. Oxford. 611 PP.
10. Harman, G.E. (2006). Overview of mechanisms and uses of *Trichoderma* spp. *Phytopathology*, 96(2):190-194.
11. Harshaw, D., Nahar, L., Vadla B., Saif-e-Naser, G. & Sarker, S. (2010). Bioactivity of *Rumex obtusifolius* (*Polygonaceae*). *Archives of Biological Science Belgrade* 62(2): 387-392.
12. Jebakumar, A.Z., Hassan, S.N., Siju, K. & George, P.M. (2011). Anti-diarrhoeal Activity of ethanolic extract of *Rumex vesicarius* Seed. *International Journal of Phytotherapy* 1(1): 6-10.
13. Jildirim, A., Mavi, A. & Aydankara, A. (2001). Determination of antioxidant and antimicrobial activities of *Rumex crispus* L. extract. *Journal of Agricultural Food Chemistry* 49(8): 4083-4089.
14. Khalid, A., Mir, A.K., Mushtaq, A., Muhammad, Z., Muhammad, A. & Farooq, A. (2009). Taxonomic diversity of stomata in dicot flora of a district tank (N.W.F.P.) in Pakistan. *African Journal of Biotechnology* 8(6): 1052-55.
15. Metcalf, C. R. and L. Chalk. (1950). *Anatomy of the dicotyledons*. Oxford at the clarendon press. 1500 PP.
16. Morton, J.F.(1994). *Lantana*, or red sage(*lantana camara* L. , [ *Verbenaceae* ] ) , notorious weed and popular garden flower, some cases of poisoning in Florida. *Econ. Bot.* 45, 255-241.
17. Panduraju, T., Rao, R.S. & Kumar, P.S. (2009). A study of antimicrobial activity of *Rumex vesicarius* L. *International Journal of Pharmacy and Technology* (1)I: 21-25.
18. Podlech, D. and Sytin, A. 2002. New species of *Astragalus* L. (*Leguminosae*) sect. *Hololeuce*, *Onobrychoidei*, *Ornithopodium* and *Synochreati* and a new section *Baldaccia*. – *Sendtnera*, 8: 155-166.

19. Post, G.E. (1932) . Flora of Syria , Palestine and Sinai . Vol. I . American press , Beirut . 658 pp
20. Rawi A. Wild plants of Iraq. (1964). Ministry of Agriculture & Irrigation . Abu Ghiraib- Iraq .
21. Romani A, Pinelli P, Mulinacci N, Vincieri FF, Tattini M. Identification and quantification of polyphenols in leaves of *Myrtus communis*. *Chromatographia*. (1999);49:17-20.
22. Rudall, P. (1980). Leaf anatomy of the subtribe Hyptidinae (Labiatae). *Bot. J. Linn. Soc.* 80: 319 – 340.
23. Safwat M, Mohammed A, Ahmed M, Samar D. Botanical investigation of *Orobanche crenata*. *International J. Pharm. Res. Innov.* (2017); 2: 8-21.
24. Selvi, F. and Bigazzi, M. (2001). Leaf surface and anatomy in Boraginaceae tribe Boragineae with respect to ecology and taxonomy of lora,196:269-285.
25. Singh, N.P., Lakshminarasimhan, P., Karthikeyan, S. & Prasanna, P.V. (eds.) (2001). Flora of Maharashtra State: Dicotyledones-vol.-II (Combretaceae-Ceratophyllaceae) Botanical Survey of India, Calcutta.
26. Srivastava, R.C. (2014). Family Polygonaceae in India. *Indian Journal of Plant Sciences* 3(2): 112-150.
27. Watson , L. ; M.J. Dallwitz ( 1992 ) . The Families of Flowering Plants : descriptions , illustrations , identifications and information retrieval . U .S .A
28. Yagueddu, G., V. Comparatore and G. Paoletti (2009). Identification of Six Papilionaceae species by epidermal characteristics: Microanalysis of hand-composed mixtures. *Bol. Soc. Agrent. Bot.*, 44(3-4): 305-315.
29. Yildirim Yildirim et al.(2014)