How to Cite:
Ali, H. Z., Lateef, Z. A., & Al-Joboury, K. R. (2022). Morphoanatomical study of some species from fabaceae family in Iraq. *International Journal of Health Sciences*, *6*(S4), 6259–6271. https://doi.org/10.53730/ijhs.v6nS4.9545

Morphoanatomical study of some species from fabaceae family in Iraq

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***Abstract*---**The current study dealt with comparative morphological and anatomical study of different species of Leguminosae family in Iraq. The study included seven species: *Albizia lebbeck* Benth. *Alhagi maurorum* Medik., *Cassia sopheral* Roxb. *Leucaena leucocephala* Lam., *Medicago sativa* Boiss., *Trifolium repens* Boiss, *Vicia tenuifolia* Roth. The morpho-anatomical study is very important to distinguish between them. Samples of the study were collected from different areas in Iraq during flowering period between 2021-2022. In the present research, cuticular and epidermal anatomical features were described, in addition to the anatomical features of stems, leaves and petiole. Results showed that some of the morphological and anatomical characters of studied parts have good taxonomic value to distinguish between above studied species. Epidermis characters have taxonomic significance, espeically the nature of anticilinal walls and types of stomatal complexes, while dimensions of stem cells and the rates of the length of stomata were limited taxonomic importance. The general shapes of cross – sections of stem showed great taxonomic significance for isolation species, as well as cortex thickness. the vascular bundles showed taxonomic significance, particularly type, shape, length, and bundle cap fibers shape, all these characters were important to distinguish between these species.

***Keywords*---**taxonomy, morphological, anatomical, fabaceae.

Introduction

Fabaceae family named by Lindley (1836) relative to genus (Faba) , It is an old latin word , which means Legume or Broad bean , which refers to the fruit of the

plant , which is the legal and considered name of the family. (1) Leguminosae was named by Jussleu(1789) the oldest and still used name that refers to the typical fruits of these plants .(2) . It has also called Pea family and Bean family . (3) Fabaceae is the third largest family of flowering plants behind Orichidaceae and Asteraceeae, And the second in terms of economic importance after the family Graminae.(4) . It includes about 751 genera and over 19500 species (5). The family divided into three subfamily : Mimosoideae , Caesalpinoideae, Papilionoideae (6) ,Then it divided into six subfamily based on the morphological of appearance , chemical and chromosomes as well as phylogenetics patterns (7) .It is one of the largest families among Angiosperms which is economically important. It included trees ,shrubs ,climbers and herbaceous plants, perennials or annuals, which are easily recognized by their fruit (Legume).The purpose for the current study is to determined the morphological and anatomical characters to help to distinguish between the studied spices(8) .

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 hrs (9),then washed several times with 70% ethyl alcohol and maintained in it. Sections prepared according to (10,11), with some modifications. Some of sectioning were stained with sufranin : glycerin mixture 1:10 .

Results and Discussion

Morphological study

According to table 1, the characters of the seven species are clearly very differ in the morphological traits, The highest average length of stem for *Vicia tenuifolia* was 245 millimeter ,while the lowest average was 125 millimeter for *Cassia sopheral* ,the results showed that the highest thickness average of stem was 3 millimeter in *Cassia sopheral* ,while the lowest thickness average was 2 millimeter in *Leucaena leucocephala,Vicia tenuifolia* . The study showed that leaves in all species studied compound pair pinnate ,Record the highest length average was 17.5 millimeter in *Albizia lebbeck* , while the lowest length average in *Vicia tenuifolia* was 6.5 millimeter, , It also varied in leaves with the highest thickness average of 6.5 millimeter in *Cassia sopheral*, while the lowest thickness average of 2 millimeter in *Alhagi maurorum.*(12)

Table (1): Morphological characters of the five species

Width blade	Length blade	Stem thickness	Stem length	species	ت
1-4 (2.5)	5-30 (17.5)	1-4 (2.5)	50-280 (165)	*Albizia lebbeck*	1
1-3(2)	4-15 (9.5)	1-3.5 (2.25)	50-250 (150)	*Alhagi maurorum*	2
3-10 (6.5)	4-18(11)	1-5 (3)	40-210 (125)	*Cassia sopheral*	3

1-3.5 (2.25)	5-12 (8.5)	1-3 (2)	100-300 (200)	*Leucaena leucocephala*	4
2-5 (3.5)	4-18 (11)	2-3 (2.5)	110-310 (210)	*Medicago sativa*	5
2-4 (3)	4-18 (11)	1-3.5 (2.25)	50-250 (150)	*Trifolium repens*	6
2-3 (2.5)	3-10 (6.5)	1-3 (2)	190-300 (245)	*Vicia tenuifolia*	7

Anatomical study

Anatomical characters of the stem

According to table 2,plates 1,2 ,3,The anatomical study of the stems of the species showed that the shape of the general section in all the species, except *Vicia tenuifolia,* were characterized as having a circular- circular polygonal shape. In *Vicia tenuifolia* it was rhombic. Histologically, from the outside to the inside, one row of epidermal cells is square-rectangular and sometimes semi-circular in all species, covered from the top by a cuticle layer whose thickness ranged in average of *Albizia lebbeck ,Cassia sopheral ,Leucaena leucocephala,Vicia tenuifolia* 2-2.5 micrometer, while the species ranged *Alhagi maurorum, Medicago sativa,Trifolium repens* 3-3.5 micrometer. As for the average thickness of epidermis, the highest average thickness was recorded in *Vicia tenuifolia* 40 micrometer, while the lowest average was 28 micrometer in *Alhagi maurorum*.

following the epidermis layer of the cortex layer , which differed in thickness and number of cellular layers according to the studied species and the cortex consisted in all species of:

1- chloranchymal cells 2- collenchymal cells 3- parenchymal cells
This is consistent with what both (13,14) have said, stating that the main function of the collenchymal tissue is support and attribution, so it is often found in young stems and herbal plants. As for the vascular tissue, it is represented by vascular bundles separating the cortex and pith, and the bundles are discontinuous in the species *Medicago sativa,Trifolium repens* While they appeared continuous from each other in the rest of the studied species. The shape of the bundles also differed according to the different species, as it was circulate in the species *Cassia sopheral*, *Medicago sativa ,Trifolium repens,* while the shape of the obvate bundles was in the rest of the studied species. The species also varied in the number of xylem arms, as their number was 5-7 in one bundle in *Alhagi maurorum*, *Medicago sativa*, while it ranged from8-6 in *Trifolium repens* , while it ranged from 9-7 in *Cassia sopheral, Leucaenala leucocephala ,Vicia tenuifolia,*and ranged 9-13 in Albizia lebbeck .

Followed by phloem fibers as varied species studied in the degree of thickness as the type Leucaena leucocephala record the highest rate for the thickness of the bark as it was 45 Micrometer while the lowest type Albizia lebbeck record rate,

with a 22 Micrometer. (13) mentioned that the phloem fabric is not dependent on the terminals, but depends on Xylem fabric due to the prominent Xylem formal nature and maintains its structural entity for a long time and stay on the plant body continuously.

Table (2) Cross-section measurements of thoughtful species stems measured by micrometer

Phloem thickness	Xylem arm numbers	Vascular bandle shape	Cortex			Epidermis thickness	Cuticle thickness	Species	ت
			Endocortex thickness	Cloranchymal thickness	Collanchymal thickness				
24-20 (22)	13-9	obvate	10-13 (11.5)	64-32 (48)	140-220 (180)	28-34 (31)	3-2 (2.5)	Albizia lebbaeck	1
35-33 (34)	7-5	obvate	10-6 (8)	30-20 (25)	100-60 (80)	27-29 (28)	4-3 (3.5)	Alhagi maurorum	2
38-30 (34)	9-5	circular	14-8 (11)	58-30 (44)	190-130 (160)	30-34 (32)	3-2 (2.5)	Cassia sopheral	3
49-41 (45)	9-6	obvate	16-10 (13)	24-46 (35)	140-100 (120)	22-36 (29)	1.5-2.5 (2)	Leucaena leucocephala	4
30-23 (26.5)	7-5	circular	17-9 (13)	52-30 (41)	110-90 (100)	38-30 (34)	2.25-3.75(3)	Medicago sativa	5
26-20 (23)	8-6	circular	12-10 (11)	38-30 (34)	130-110 (120)	42-33 (37.5)	2-3.5 (2.75)	Trifolium repens	6
28-22 (25)	9-7	circular	12-8 (10)	40-26 (33)	120-190 (155)	44-36 (40)	1.5-2.5 (2)	Vicia tenuifolia	7

Characters of Transverse Section of petiole Leaf

According to taple 3 and plate 6,The studied species were petiolate, with the exception of *Alhagi maurorum*, as being Apetiolate. This is a taxonomic characteristic of the species. As for the cross-sections of the stems of other species, they showed a difference in terms of the general shape and the shape of the vascular bundles.

In *Albizia lebbeck*, its general section was distinguished by being circular or semicircular, where it was semicircular from the bottom and contained concavity and did not contain it from the top, As for the vascular bundles, they were separate from each other. As for the *Cassia sopheral*, *Trifolium repens*, its shape is distinguished by being semi-ovate and elongated, and the vascular bundles are separated from each other, As for the species, *Leucaena leucocephala* ,*Medicago sativa*,*Vicia tenuifolia*, the general shape was distinguished by being cardiac and the vascular bundles separated from each other.

.The cells of the epidermal layer are surrounded by a thin and wavy cuticle layer. The epidermis layer consists of one row of cells of a spherical shape inclined to oval, followed by the epidermal layer inward, the cortex, which consists of three rows of collenchymal tissue of the lamellar type.(15)

Table (3): Quantitative and qualitative attributes of petiole transversal types measured in micrometer.

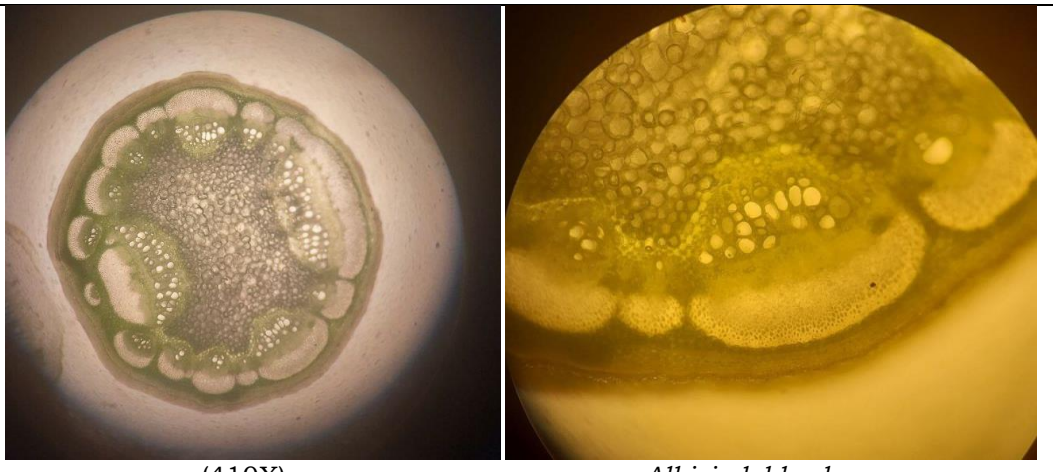
Number conveyor vascular in each arm	Number arm xylem	Shape vascular bundle	Number vascular bundle	Cortex			Epidermis thickness	Cuticle thickness	Species	ت
				Parenchymal thickness	Chlorenchymal thickness	Cholenchymal thickness				
5-4	7-5	crescent	6-5	60-48 (54)	44-34 (39.48)	44-22(33)	22-30 (26)	3-1(2)	Albizia lebbaeck	1
-------	-------	-------	------	--------	---------	---------	-------	------	Alhagi maurorum	2
5-3	6-5	crescent	6-4	43-30 (36.5)	42-36 (39)	39-13 (26)	25-28 (26.5)	2.5-2 (2.25)	Cassia sopheral	3
5-4	7-5	circular	6	40-34 (37)	24-48 (36)	30-25 (27.5)	20-26 (23)	2-1 (1.5)	Leucaena leucocephala	4
6-3	6-5	ovate	5-4	39-29 (34)	28-20 (24)	36-30 (33)	27-19 (23)	2.75-1.25 (2)	Medicago sativa	5
4-3	7-6	ovate	7-6	41-36 (38.5)	32-30 (31)	34-22 (28)	29-19 (24)	2.5-2 (2.25)	Trifolium repens	6
5-3	4-3	ovate	5-4	32-28 (30)	26-21 (23.5)	32-27 (29.5)	28-26 (27)	1.75-1.25 (1.5)	Vicia tenuifolia	7

Characters of Transverse Section of Leaf

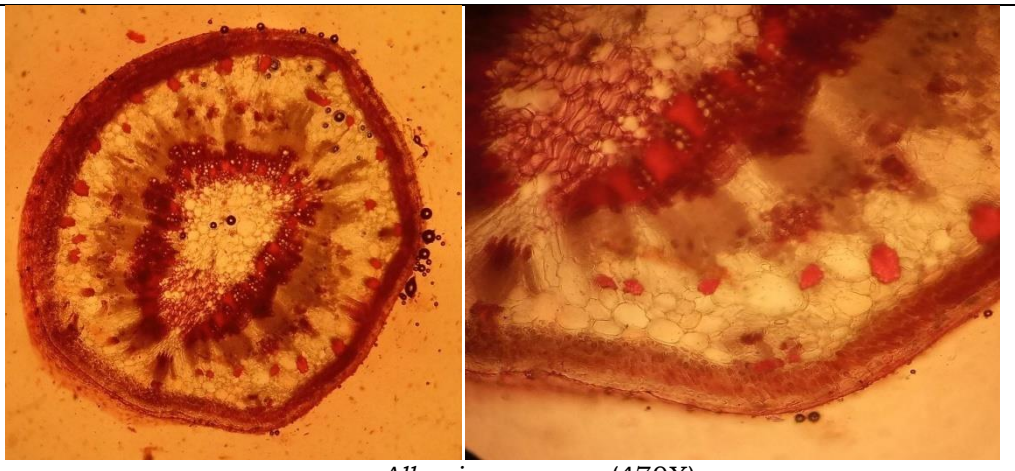
According to plates(7,8),The results of the anatomical study of the vertical sections of the leaf blades showed that they are surrounded by epidermal tissue, the upper and lower epidermis are of thin cuticle and of simple type Uniseriate composed of cells of different shapes, including oval or elongated oval and may be sub spherical .The upper and lower layers of the epidermis have human appendages represented by hairs with variations that may be seated or branching from the area of contact with the epidermis or may be pedunculated or carried on a carrier consisting of several cells and several irregular rows. Two-armed hairs and simple unicellular_uniseriate hairs were also observed .

Within the upper and lower epidermal layers, the mesophyll is arranged, which is composed of five rings of simple parenchymal tissue and composed of semi-spherical cells surrounding the vascular bundle of a crescent shape, in which the cells of the cortex are arranged in layers facing the lower epidermal layer, followed by the xylem cells that are arranged facing the upper epidermal layer This arrangement is characteristic of the vascular bundles of dicotyledonous (16) .(On both sides of the vascular bundle, the median tissue region consists of the palisade parenchyma, which is composed of two rows of elongated and compact cells, and this is contrary to what was indicated and this difference may be due to the different environments of the plant studied, and the other layer is the spongy parenchyma, which is composed of a group of dislocated and irregular arranged spheroid cells, thus the leaf blade is bifacial.

As for the study of the epidermis of the leaves, it indicated the spread of stomata on both the upper and lower surfaces. Thus, the leaf is of the Amphistomatic type, with a greater number of stomata on the lower surface than on the upper. As for the shapes of these stomata, they are elliptical consisting of a pair of renal and elongated guard cells and auxiliary cells. Their number varies according to the different types of stomata complexes, which may be Paralytic, Anomocytic, or Hemiparacytic. The heterogeneous model is the most prevalent among the models. As for the normal cells, they have Undulate walls.

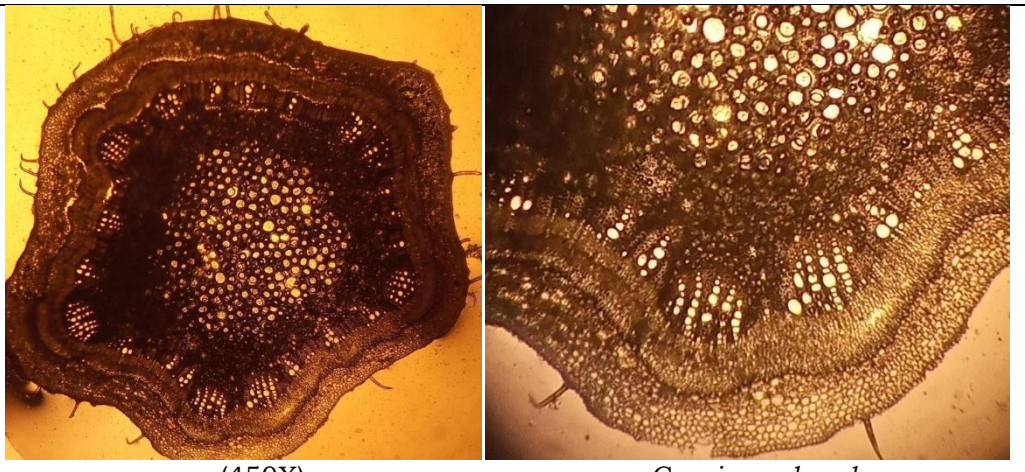


(410X) *Albizia lebbeck*

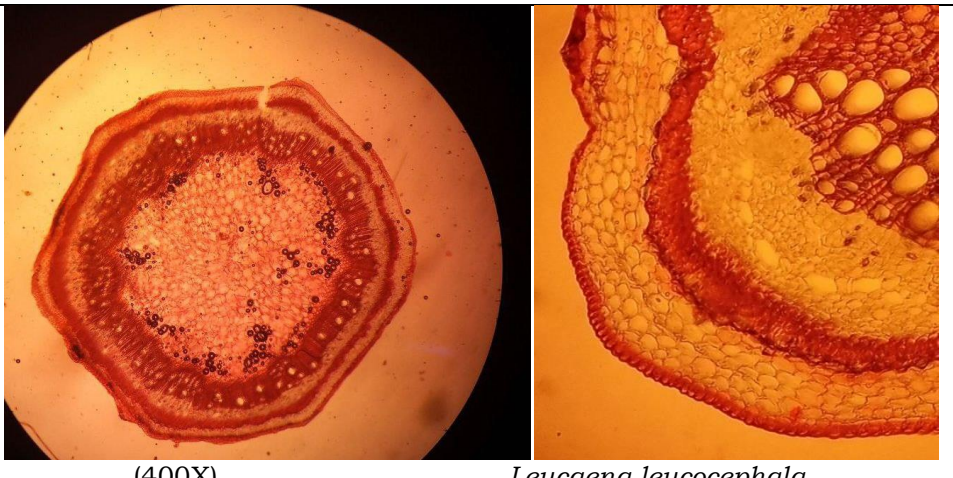


Alhagi maurorum (470X)

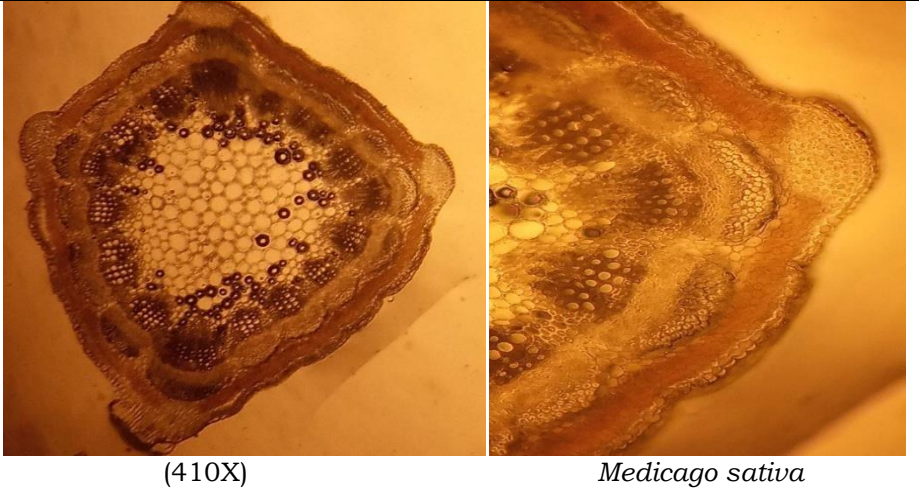
Plate (1) : Cross section in stem



(450X) *Cassia sopheral*

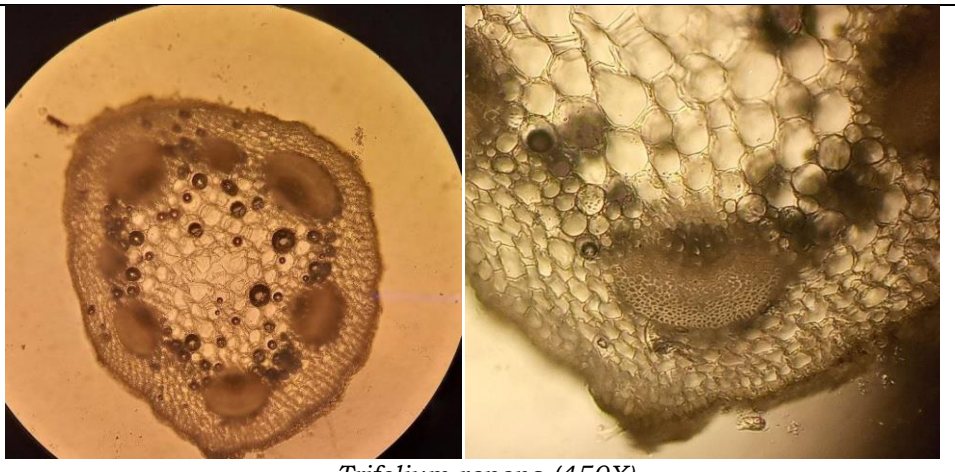


(400X) *Leucaena leucocephala*

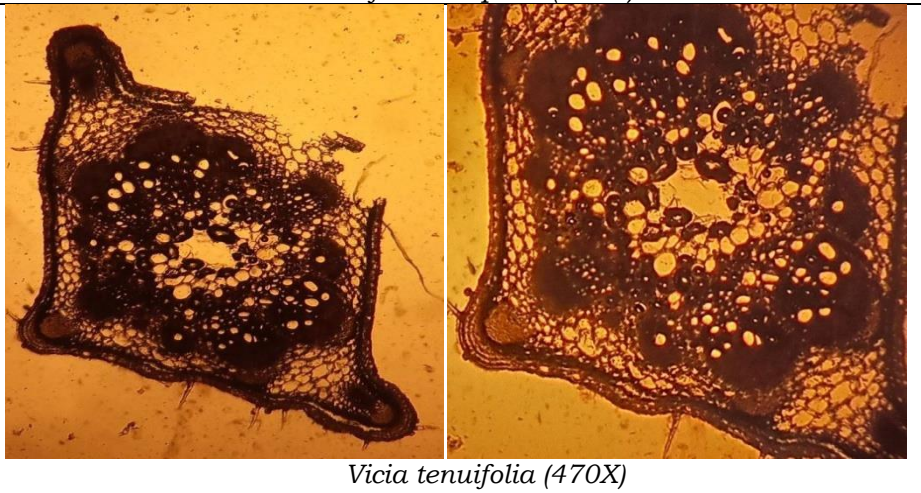


(410X) *Medicago sativa*

Plate (2) : Cross section in stems



Trifolium repens (450X)

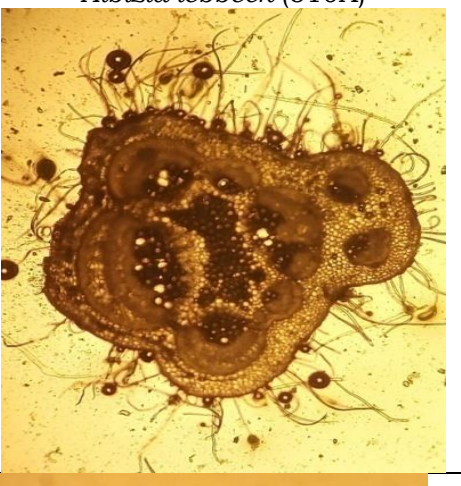


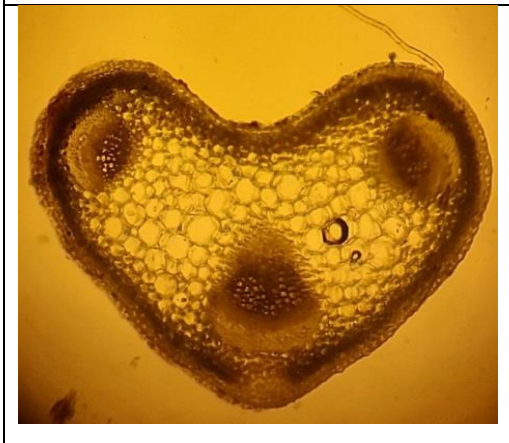
Vicia tenuifolia (470X)

Plate (3) : Cross section in stems

Cassia sopheral (560X)

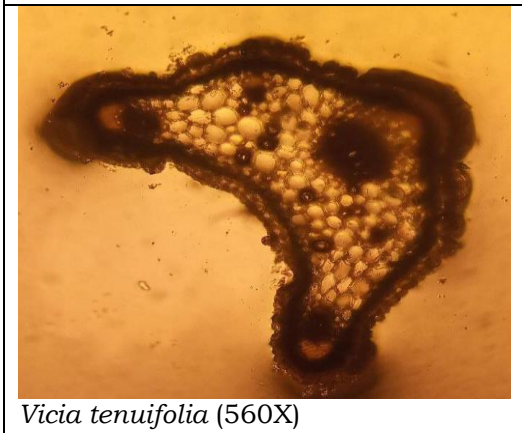
Albizia lebbeck (510X)



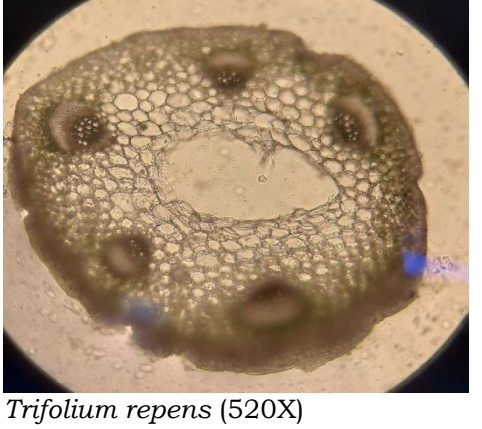


Medicago sativa (510X)

Leucaena leucocephala (520X)



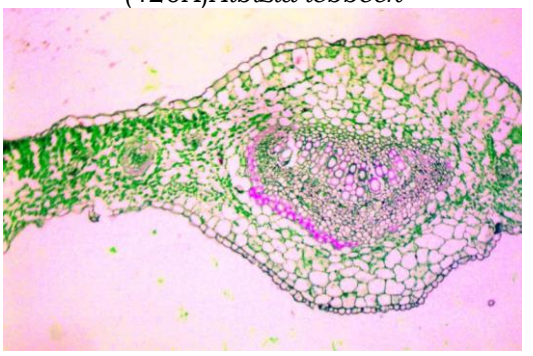
Vicia tenuifolia (560X)

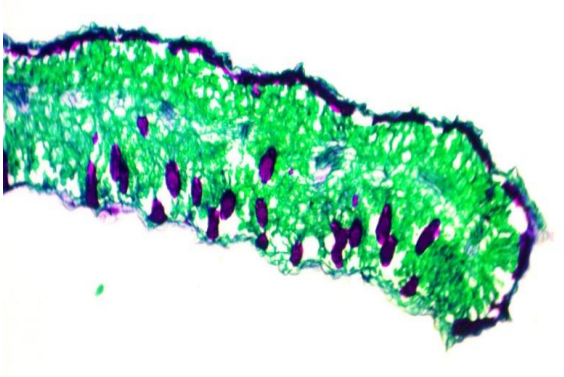


Trifolium repens (520X)

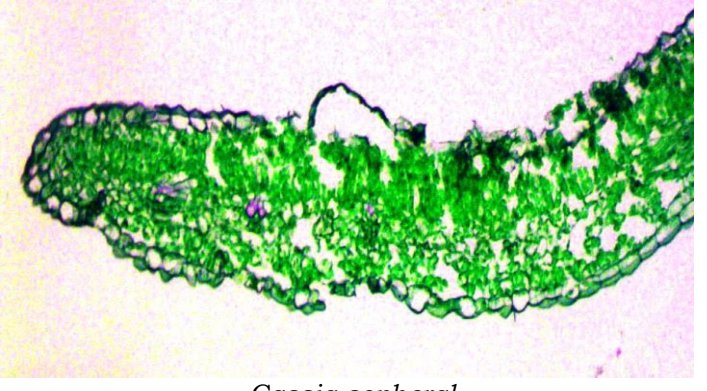
Plate (6): Cross Section in petiole leaf

(420X)*Albizia lebbeck*



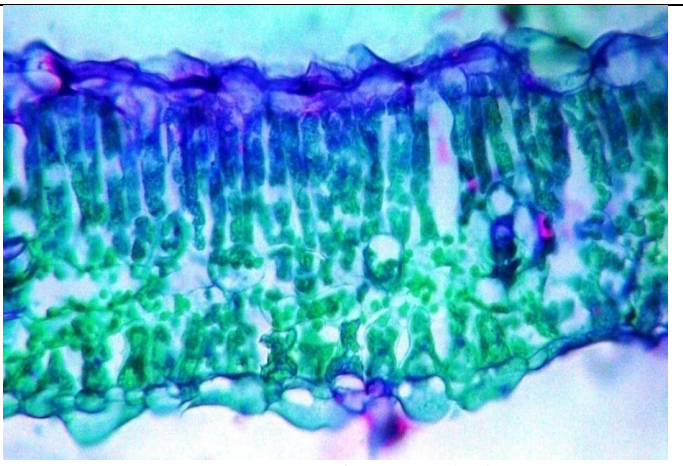


Alhagi maurorum (410X)



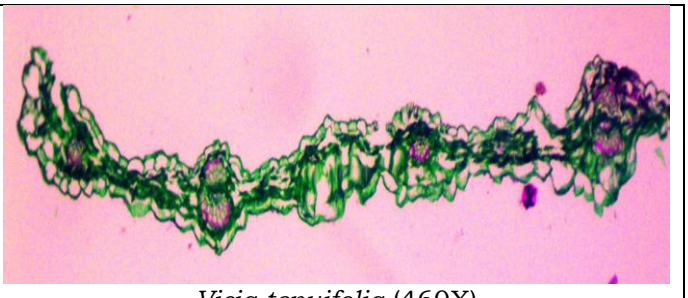
Cassia sopheral

Plate (7) Cross section in leaf



Leucaena leucocephala

Medicago sativa



Vicia tenuifolia (460X)

Plate (8) Cross section in leaf

References

1. Bruneau, A.; Doyle, J. J.; Herendeen, P.; Hughes, C. E.; Kenicer, G.; Lewis, G. ; Mackinder, B. ; Pennington, R. T. ; Sanderson, M. J.; Wojciechowski, M. F.; Koenen, E. (2013). Legume phylogeny and Classification in the 21st century: progress, .prospects and lessons for other species-rich clades. University of Zurich. Taxon, 217-248.
2. Lewis, G. ; Schrire, B. ; Mackinder, B. and Lock, M. 2005. Legumes of the world. Kew: Royal Botanic Gardens,Kew. pp577.
3. Dangi, R.S., Lagu, M.D., Choudhary, L.B., Ranjekar, P.K. & Gupta, V.S. (2004) Assessment of genetic diversity in *Trigonella foenumgraecum* and *Trigonella caerulea* using ISSR and RAPD markers. *BMC Plant Biology* 4: 13–18.
4. Al-Saadi, M. (2013). Asystematic study of the genus *Trifolium* L. Leguminosae in Iraq. Thesis. coll.of sci. Univ. Kuf.
5. Christenhusz, M. J. M. and Byng, J. W. (2016). The number of known plants species in the world and its annual increase. Phytotaxa., 261(3):201-217.
6. Bentham, L. G. and Hooker, J. D. (1862). Genera Plantarum. London, 1(1): 524.
7. Azani, N.; Babineau, M.; Bailey, C. D.; Banks, H.; Barbosa, A. R.; Pinto, R. B., Boatwright, J. S.; Borges, L. M.; Brown, G. K.; Bruneau, A.; Candido, E. Cardosa, D.; Chung, K. F.; Clark, R. O.; Conceicao, A. S.; Crisp, M.; Cubas, P.; Delgado-Salinas, A.; Dexter, K. G.; Doyle, J. J.; Duminil, J.; Egan, A. N.; Delaestrella, M.; Falcao, M. J.; Filator, D. A.; Fortuna-Perez, A. P.; Fortunato, R. H.; Gagnon, E.;Gasson, P.; Rando, J. G.; Azevedotozzi, A. M. G. D.; Gunn, B.; Harris, D.; Haston, E.; Hawkins, J. A.; Herendeen, P.S.; Hughes, C.E.; Iganci, J. R. V.; Javadi, F. H.; Kanu, S. A.; Kazempour-osaloo, S.; Kite, G. C.; Klitgaard, B. B.; Kochanovski, F. J.; Koenen, E. J. M.; Kovar, L.; Lavin, M.; Roux, M. L.; Lewis, G. P.; Delima, H. C.; Lopes-Roberts, M. C.; Mackinder, B.; Maia, V. H.; Malecot, V.; Mansano, V. F.; Marazzi, B.; Mattapha, S.; Miller, J. T.; Mitsuyuki, C.; Moura,T.; Murphy, D. J.; Nageswara-Rao, M.; Nevado, B.; Neves, D.; Ojeda, D.; Pennington, R.T.; Prado, D.E.; Prenner, G.; De-Queiroz, L. P.; Ramos, G.; Ranzato, F. F. L.; Ribeiro, P. G.; Rico-Arce, M. L.; Sanderson, M. J.; Santos-Silva, J.; Sao-Mateus, W. M. B.; Silva, M. J. S.; Simon, M. F.; Sinou, C.; Snak, C.; Desouza, E. R.; Sprent, J.; Steele, K. P.; Stejer, J. E.; Steeves, R.; Stirton, C. H.; Tagane, S.; Torke, B. M.; Toyama, H.; Cruz, D. T. D.; Vatanparast, M.; Wieringa, J. J.; Wink, M.; Wojciechowski, M. F.; Yahaya, T.; Yi, T. and Zimmerman, E. (2017) Anew subfamily classification of the Leguminosae based on a taxonomically comprehensive phylogeny. Taxon., 66(1): 44-77.
8. Safwat M, Mohammed A, Ahmed M, Samar D. Botanical investigation of *Orobanche crenata*. International J. Pharm. Res. Innov. (2017); 2: 8-21.
9. 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).
10. Rawi A. Wild plants of Iraq. Ministry of Agriculture & Irrigation . Abu Ghiraib-Iraq (1964).
11. Safwat M, Mohammed A, Ahmed M, Samar D. Botanical investigation of *Orobanche crenata*. International J. Pharm. Res. Innov. (2017); 2: 8-21.

12. Small, E., Brookes, B. & Lassen, P. (1990) Circumscription of the genus *Medicago* (Leguminosae) by seed characters. *Canadian Journal of Botany* 68: 613–629.
13. Esau, K. 1965. Plant anatomy Sec. ed. John wiley and sons , New York , 767 pp.
14. Fahn, A. 1974 plant anatomy. zed. Pergman press. Oxford. 661pp.
15. Mohammad, R.; Azarnoosh, J.; Yazdanbakhsh, Z. 2013. Anatomical study of *Astragalus* L. sect. Caprini (Leguminosae) from NE Iran. J. Bio. & Env. Sci., 7(2): 173-180.
16. Metcalfe, C. R. and L. Chalk.(1950) Anatomy of the Dicotyledons Leaves, Stem and Wood in Relation to Taxonomy. Oxford. Clearendon Press.Vol.II: pp.1500.
17. Thaib, P. K. P., & Rahaju, A. S. (2022). Clinicopathological profile of clear cell renal cell carcinoma. *International Journal of Health & Medical Sciences*, *5*(1), 91-100. https://doi.org/10.21744/ijhms.v5n1.1846
18. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Health and treatment of diabetes mellitus. *International Journal of Health Sciences*, *5*(1), i-v. https://doi.org/10.53730/ijhs.v5n1.2864