History of Medicine, 2023, 9(1): 1471–1475
DOI: 10.17720/2409-5834.v9.1.2023.176

Anatomical study of vegetative organs for Anethium graveolens L. (Apiaceae)

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Received: 20 January 2023 **Accepted:** 15 April 2023

Citation: Mohammed MN, Nassrullah IK (2023) Anatomical study of vegetative organs for Anethium graveolens L. (Apiaceae). History of Medicine 9(1): 1471−1475. https://doi.org/10.17720/2409-5834.v9.1.2023.176

Abstract

The current investigation aimed to study anatomical characters of vegetative organs for cultivated species Anethium graveolens L. which belong to the Apiaceae family in Iraq,fresh specimens collected from different regions Baghdad city,the study included vegetative parts (stem,petiole and leaf),the surface epidermis of leaf and stem, the result showed that stomatal types in leaf are anomocytic and diacytic types,while the stomatal types of stem are paracytic and diacytic,the tissues of vegetative parts in term of numbers,types of layers and thickness of each one also studied,the stem nodal anatomy showed that the type is multilacunar type.

Keywords

Anethium graveolens, anatomy, petiole,stem,leaf.

Anethium graveolens L. commonly known as dill, is belong to the family Apiaceae, in Iraq,this family include about 60 genera and 143 species (AL-Mousawi,1987).

This dainty herb derives its name from the Old Nordic dilla, meaning ((to lull)),with dill seed being one of the main ingredients in gripe water,used to sooth e fretful babies . The seventeenth century English herbalist Culpeper wrote of it being employed to treat flatulence and hiccups, and it was regarded as a medicinal herbs (Linford, 2007), Anethium graveolens is native of the Mediterranean Russia its cultivated in many countries,it reach about 60-75 cm high,with feathery leaves on sheathing foot −stalk,finally divided, and flat umbels with yellow flowers (Shelef,2003), is one of the most useful essential oil bearing spices. The seeds are used as a flavoring agent. Essential oil can be extracted from various parts of plant (Chahal et al..2017),

A study of Muhammad and Al-Khesraji(2021) indicated the presence of flavonoids in the vegetative parts (stem and leaves) and flowers, as the compounds Coumarin, Kaempferol, uercetin, and Catchine were identified in the vegetative parts, and Apigenin and Coumarin in the flowers. Mohammed and Nasrullah (2022) indicated in their study that the stem of the species contains tannins. phenolic compound, alkaloids and proteins, Ali and Abd (2017) revealed the presence of alkaloids, phenols, terpenes, saponins, steroids, and volatile oils in the ethanolic extract of dill leaves and indicated its importance in lowering blood lipids.

There are many studies of the medicinal effect of A. graveolens such as the studuies of (Hateet (2015), Mahdi (2016), Nawrooz (2022), Singh et al. (2017) and Yaseen and jasim (2020).

The research aims at a detailed anatomical study of the vegetative parts of the species A. graveolens.

Material and methods

Fresh specimen were collected from different regions in Baghdad city,the upper and lower surface of leaf and surface epidermis of stem were prepared by using forcipes and then transferred to a slide containing a drop of safranin −glycerin,then covered with cover slide and examined under light microscope to study ordinary epidermal cells and stomata (AL-Dabbagh and Nasrullah,2019),stomatal index was calculated

according to the following formula : (S/S+ E), where S and E are the number of stomata and ordinary epidermal cells respectively in microscopic view field (Paul et al.,2017),the cross section of petiole, stem and leaf were prepared by microtome and hand section and stained by toluidine blue or safranin and fast green,stem node was prepared by hand section and stained by Phloroglucinol (Demarco, 2017), dimension were determinate by using an ocular micrometer

Results

Microscopic analysis of the surface epidermis of leaf showed that the ordinary epidermal cells in lower and upper surface of leaf are irregular shape, the tangential walls is undulate in both surface of leaf (plate1),the average dimension of cells is 60.40 Ч40.56 micrometer in upper and lower surface respectively (table,1).

The result show that the leaf is amphistomatic (stomata occur on both surface of leaf),stomatal complexes type are anomocytic and diacytic in both surface of leaf, the average dimensions of stomata reach to 26 Ч 14.73 micrometer and 27.73 Ч14 micrometer in upper and lower surfaces respectively,stomatal index vary between surfaces it reach 15.83 and 26.31 in upper and lower surfaces respectively (table,1).

The ordinary epidermal cells of stem appear oblong to semi irregular, the tangential walls are straight-slightly curved (plate1), the average dimension of cells reach to 74.88 Ч22.88 micrometer (table,1), stomatal complexes type in stem are diacytic and paracytic, while the stomatal index reach to 8.33.

The cross section of petiole is semi cordate shape with depression in middle upper surface (plate,2),the cross section of petiole comprise of epidermis layer micrometer which consist of one row of cells interspersed with stomata,epidermis covered by cuticle layer, which has an average thickness reach to 2.42 micrometer(table,2),beneath epidermis occur chlorenchyma tissue which appear like palisade tissue and this tissue surround petiole except the regions where the collenchyma patches occur, there are three collateral vascular bundles vary in size two lateral and one central, with two subsidiary bundles beneath upper surface . collenchyma patches are distributed in four regions one of the patches under depression of upper surface,two lateral patches and one patches in lower surface, secretory canals present under collenchyma patches except the patch in upper epidermis .

The cross section of stem appears ribbed due to the presence of collenchyma patch which numbered 8-10(table,2),occur under the epidermis and alternate with chlorenchyma tissue which appear like palisade tissue,epidermis consist of one row of single cells covered by cuticle layer, vascular cylinder consist of isolated vascular bundles arranged in a ring, The secretory canals lie between the collenchyma patches and the vascular bundle lying below it(plate, 3), the pith region is hollow (plat,3)

The stem node anatomy showed that it belong to multilacunar type which multiple bands are separated and leave multiple gaps (plate, 4)

Lamina comprise of upper epidermis covered by cuticle The mesophyll tissue is located just below the epidermis it was composed of 1-2 rows of compact elongated cells, with an average thickness (109.2) micrometer (table,4), While the spongy layer consisted of 2-3 rows of cells leaving intercellular spaces between them with an average thickness(45.93) micrometer,lower epidermis follows spongy layer The spongy layer covered on the outside by a thin layer of cuticle.

The vertical section of leaf showed that the midrib region appeared convex on the lower surface and flat on the upper surface, the central collateral vascular bundle surrounded by sclerenchyma tissue, secretory canal placed under vascular bundle, and was characterized by its absence of collenchyma tissue, the palisade and spongy tissue continued in the midrib region.,(plate, 5).

Discussion

The results showed that the leaf is amphistomatic (stomata occur on both surface of leaf), stomatal complexes type are anomocytic and diacytic in both surface of leaf, Metcalf and Chalk (1950) indicated that the stomata types in Apiaceae family is anomocytic in most studied species, and in some species diacytic or paracytic . and this agree also with Watson and Dallwitz(1992) who mentioned that the type of stomatal complexes in the family are paracytic or anomocytic,

The study showed that the number of stomata in the upper surface is less than the number of stomata in the lower surface, and this is due to the adaptation of plants to reduce water loss through transpiration (Niu et al., 2005).

Metcalf and Chalk (1950) explained that the shape of petioles is one of the distinguishing characteristics of the species because it is less affected by environmental conditions, they also explain that the shape of petioles has taxonomic importance in distinguishing species belonging to Apiaceae, the study showed the presence of collenchyma patches in petioles, and this consistent with Metcalf and Chalk (1950)who explained the

presence of these patches in the petiole Apiaceae family .the study show also the presence of chlorenchyma tissue which appear like palisade tissue,Nasrullah and AL-Husaini (2011) stated that the presence of the chlorenchyma tissue which like palisade tissue evidence of its active role in photosynthesis.

Metcalf and Chalk (1950) referred to the stems of species belonging to the Apiaceae family that are hollow at the nodes only, while the species A.graveolens was distinguished by the fact that the stem is hollow and occupies the pith region with parenchyma cells only at the node region.

The result showed that nodes is multilacunar type and this agree with Watson and Dallwitz (1992), who mentioned that nodes usually multilacunar type, or tri-lacunar type in the family. Both (Sinnott and Bailey, 1914; Bailey, 1956) indicated that multilacunar type are associated with the presence of leaf sheath, multilacunar type is renewed in a small number of dicotyledonous families (Howard, 1974 and Dickison, 1980) The results showed that the central collateral vascular bundle surrounded by sclerenchyma tissue,Metcalf and Chalk (1950) mentioned that the tissue that surrounds the central bundle of leaves of the Apiaceae family has taxonomic value in distinguishing species, as the bundle may be surrounded by parenchyma, collenchyma, or sclerenchyma tissue. The results also showed the presence of secretory canals in the leaf, and this is consistent with what Watson and Dallwitz(1992),and Bani and Mavi(2020) who indicated the presence of secretory canals in the leaf.

Table (1): surface epidermis of leaf and stem measured by micrometer (µm).

Ordinary cell			Stomatal cell			Part
Dimension		Stomatal complex	Stom. index	Dimension		
W.	L.			W.	L.	
40.56	62.40	diacytic, anomocytic	15.38	14.73	26.00	Upper epidermis of leaf
30.16	66.56	diacytic, anomocytic	26.31	14.73	27.73	Lower epidermis of leaf
22.88	74.88	Diacytic, paracytic	8.33	16.46	22.53	Stem epidermis

L: Length, W: Width

Table (2): Anatomical characters of petiole and stems measured by micrometer (µm).

organ	cuticle Thic.	epidermis Thic.	collenchyma			chlorenchyma		parenchyma	
			Thic.	type	No.	Thic.	No.	Thick.	no.
petiole	2.42	15.6	26	annular	1-2	97.06	2-4	243.87	4-6
stem	3,98	17.3	97	annular	8-10	64.13	3-4	83.2	3-4

Table (3): Vascular bundles characters of petiole and stem measured by micrometer(µm).

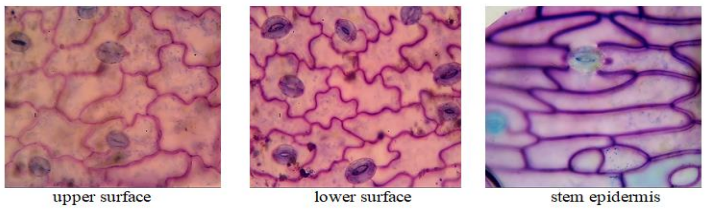
organs	dimension		No.	Phloem thickness	Xylem thickness	fiber thickness
	length	width				
petiole	225.33	174	3-5	29.03	112.45	32.06
stem	234.33	34.58	24-26	39.86	138.66	-

Table (4): characters of vertical section in the (Lamina) measured by micrometers (µm).

Cuticle thickness		Epidermis thickness		Palisade layer		Spongy layer	
Upper surface	Lower surface	Upper surface	Lower surface	Thickness	Rows	Thickness	Rows
0.60	0.86	16.46	15.16	109.2	1-2	131.3	2-3

Table (5): characters of midrib region in the leaf measured by micrometers (µm)

Parenchyma thickness		Central bundle			
Upper	Lower	Dimension	Phloem thickness	Xylem thickness	Fiber thickness
27.73	17.33	87.5Ч69.3	17.33	25.33	7.6



upper surface lower surface stem epidermis

Plate (1): surface epidermis of leaf and stem (400X).

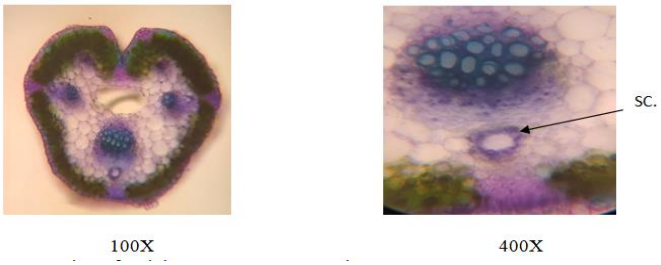


Plate (2): cross section of petiole, SC= Secretory canal.

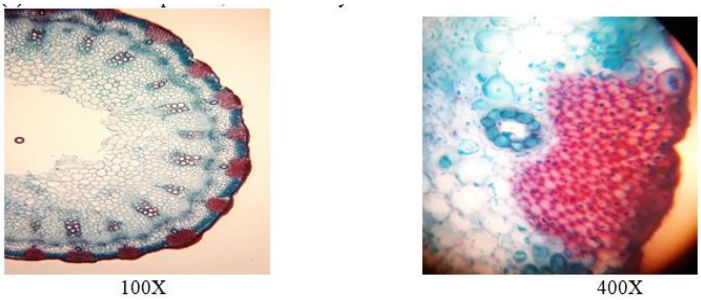


Plate (3): cross section of stem.

Plate (4): cross section of stem node, G=Gap, T=Traces (40X).

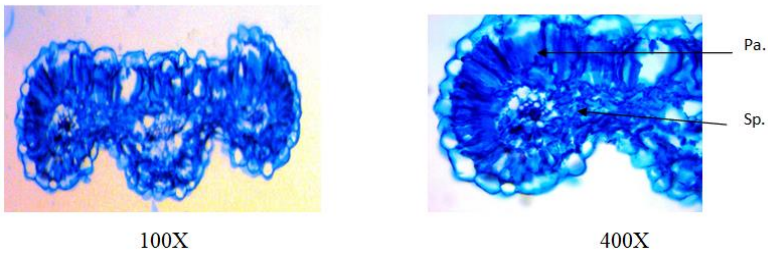


Plate (5): vertical section of leaf, Pa=Palisade layer, Sp=Spongy layer.

References

AL-Dabbagh, Z.M. And Nasrullah, I.K. (2019) Surface epidermis of leaf and indumentum for five species of the genus Galium in Iraq, Plant archives,19(1) : 1915-1918.

Ali, D. E., H. and Abd,N.S.(2017) The effect of alcoholic extract of Anethium graveolens in alloxan induced diabetic rats,Iraqi Journal of Market research and consumer protection,9(2) : 73-80.

AL-Mousawi,A.H.(1987) Plant Taxonomy,1st ed. Ministry of Higher Education and Scientific Research,Univ. of Baghdad, 379pp.

Baily, I.W. (1956) Nodal anatomy in retrospect. J. Arnold Arb .,37:269-287.

Bani, B. and Mavi, D.Ö(2020) New morphological and anatomical data on the genus Fuernrohria (Apiaceae),Phytotaxa, 429(1) : 48-56.

Chahal,K.K. ; Monika ; Kumar, A. ; Bhardwaj, U, and Kaur, R.(2017) Chemistry and biological activities of Anethum graveolens L. (dill) essential oil: A review, Journal of Pharmacognosy and Phytochemistry; 6(2): 295-306.

Demarco, D. (2017) Histochemical analysis of plant secretory structures. In: Pellicciari, C. and Biggiogera, M. (eds) Histochemistry of single molecules, methods and protocols. Springer science business media L.L.C., pp 313-330.

Dickison, W, C. (2000) Integrative plant anatomy,Academic press, San Diego, California,USA,533 pp.

Howard, R.A (1974) The stem-node-leaf continuum of the dicotyledoneae, J. Arnold Arb.,55(2): 125-181

Linford, Jinny (2007) Apocket guide to herbs, Parragon books, ltd, U. K.,255 PP.
Mahdi, N.M. (2016) Antibacteriac effect of dill seed oil Anethium graveolens,Kufa journal for nursing sciences,6(2):1-8.
Mohammed, M.N. and Nasrullah,I.K.(2022) Stem histochemical analysis of three medicinal species from Iraq, Mohammed and Nassrullah, Journal of Genetic and Environmental Resources Conservation, 10(3):219-224.
Muhammad, Z. B. andAl-Khesraji, T. O. (2021) A Study of chemical content in some species of tribe Apieae / Apiace. Ibn Al-Haitham journal for pure and applied science, special issue, 29-37
Metcalf,C.R. and Chalk,L. (1950) Anatomy of the dicotyledons .1st ed. Vol. 1 and Vol.2, Oxford clarendon press, London,1500p.
Nasrullah,I.K. and AL-Husaini, A.F.(2011) The morphological,anatomical and pollen grains of the basile Ocimum bascilicum L. (Labiatae) in Iraq, journal of the college of basic education, 71 :643-655.
Nawrooz,M.S.(2022) Preparation,diagnosis and evaluation of the effectiveness of a mixture of alcoholic extracts of cumin and dill against bacteria and fungi, Kerbala journal of pharmacy,1: 314-320.
Niu, S.L; Jiang, G. M; Wan, S.Q.; Liu, M.Z.; Gao, L.M. and Li, Y.G. (2005) Echophysiological acclimation to different soil moisturesin plants from a semi- arid sandland, Journal of Arid environments, 63: 353-365
Paul. V; Sharma, L; Pandy,R. and Meena, R.C.(2017) Measurements of stomatal density and stomatal index on leaf /plant surfaces,manual of ICAR sponsored training programme on ((physiological techniquesto analyze the impact of climate change on crop plants)) 16-25 January,2017 Delhi,27-30. , Division of physiology,IARI, New
Shelef, L.A. (2003) Herbs of Umbelliferae in (Encyclopedia of Food Sciences and Nutrition), Elsevier Science Ltd
Singh, S.; Dass,S.S. ; Singh, G. ; Perotti, M. ; Schuff,C. and Catalan, C.A.N.(2017) Comparative studies of chemical composition,antioxidant and antimicrobial potentials of essential oils and oleoresins obtained from seeds and leaves of Anethium graveolens L.,Toxicol,open access,3:119
Sinnott, E.B. and Baily, I.W. (1956) Nodal anatomy and morphology of stipules,Am. J. Bot.,1(9) :441-453
Watson, L. and Dallwitz, M.J. (1992) The flowering of plants :description,illustrations,identification,and information retrieval, version,26th September 2022.
Yaseen,S,M. and Jasim,R.Z.(2020) Review article : biochemical hypolipidemic action of some herbs and medicinal plants, Diyala j, for pure science,17(1): 44-56.