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A Taxonomic Study of Species *Peltariaangustifolia* DC. from Brassicaceae Family in Iraq

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ABSTRACT

The research was aimed tostudy themorphological and anatomical characteristics as well as habitatand geographical distributionof species*Peltariaangustifolia* DC., This study indicated that the plant specimens are perennial glabrous herbs, distinguished by the presence of distinct basal and cauline leaves, and simple corymb inflorescence. Flowers perianth consists of four obovate sepals, and four spathulate petals, with hexanderiaandroecium characterized by dilated filaments from the bases and gynoecium consists of obovate ovary and sessile stigma, the fruit reticulate silicula, and the seeds are ovate-elliptical with faintly reticulate configuration. As for the anatomical study, it included the study of the dimensions and characteristics of each root, stem, leaf, as well as the nature of the leaf venation, and cuticular study. A study of the geographical distribution showed that the species is very rare in Iraq. It is located in the mountain region and exclusively in Jabal Sinjar district.

Key words:Anatomy, JabalSinjar, monotypic, *Peltaria*, silicula,venation

دراسة تصنيفية للنوع *Peltariaangustifolia* DC. من العائلة الصليبية في العراق

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الخلاصة

يهدف البحث الى دراسة الصفات المظهرية, والتشريحية, والبيئة والتوزيع الجغرافي للنوع *Peltaria angustifolia* DC., لقد استنتجت الدراسة ان افراد النوع عشبيه دائمية عديمة الشعيرات،تميز النوع بوجود نوعين من الاوراق القاعدية و الساقية،و نورة مشطية بسيطة، الغلاف الزهري يتكون من اربع سبلات سائبةبيضية مقلوبة، واربع بتلات زهرية منفصلة ملعقية الشكل،الاعضاء التكاثرية الذكرية سداسية الاسدية تمتاز بكونها متوسعة الخويطات من القاعدة،الاعضاء التكاثرية الانثوية تتكون من مبيض ذو شكل بيضوي مقلوب وميسم جالس، الثمرة خريدلة ذات عروق شبكية ، البذور بيضوية – اهليلجية الشكل ذات زخرفة شبكية دقيقة. امّاالدراسةالتشريحية فقد شملت دراسة الابعاد والصفات لكل من مقاطع الجذر والساق والورقة فضلا عن دراسة طبيعة تعرق الاوراق, والبشرة, وقداظهرت دراسة التوزيع الجغرافي ان هذا النوع نادر جدا في العراق ويتواجد في منطقة المرتفعات ضمن مقاطعة جبل سنجار حصرا.

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1. Introduction

The genus *Peltaria* Jacp. belong to the Cruciferae family which globally includes about 350 genus and about 2,500 species[1].In Iraq, the family is represented by 80 genus and 177 species [2],. Name of *Peltaria* is derived from Latin wordPelta, meaning as shield-referring to form of the leaf [3]. The genus belongs to the Lunarieae tribe of the Cruciferae family and has five species as reported by Bentham and Hooker[4] or six species as mentioned by Boissier [5]. However, in study of flora Iranica, the genus is represented by only one species[6]. Whereas in the flora of Turkey it represented only two species [7], and recently the genus was been represented globally by three species [8]. In Iraq, the genus is represented by only one species [3].*Peltaria angustifolia* is native for east Aegean island., Iran, Iraq, Lebanon-Syria, Palestine, and Turkey as reported in [3,8,9,10]. [11]Stated that mustard extracted from cruciferous plants is of great importance as a diuretic, used intreatment of cirrhosis of liver and spleen, and is also used in thetreatment of joints. [12]Sanger *et al*. indicated that the most important chemicals in the Cruciferae family that are of taxonomic importance are sterols, fatty acids, and glucosinolates. The family plants contain iron, phosphorus, sulfur, magnesium, arsenic 30% of oils and a little sugar and some vitamins (A, B, and C) [13]. The Cruciferae family is distinguished by containing large amounts of di-theyoltheonate compounds, which are sulfur compounds present in family-owned plants and have a great importance in increasing the effectiveness of cancer destroying enzymes [14]. This research aimeds to enrich Iraqi studies with the exact morphological characters as well as the anatomical features of the root, stem, and leaves as having applications in the fields of phylogenetic relationships [15], and because Ecology is one of the basic sciences of taxonomy. The research also included a study of habitat and distribution of the species, as well as studying the morphological and anatomical features in defiles for the first time in Iraq.

2. Materials and Methods

The current study relied on plant specimens that were collected from the dry samples which were formerly reserved at Iraqi herbarium as stated in Table (1). Dimensions of vegetable and reproductive parts, fruits and seeds were recorded. Shapes and colors of each of the aforementioned parts were identified, regarding the morphological study. The epidermis of the leaf was peeled and studied according to [16]. The green leaves were cleared out to elucidate the venation system [17]. As for the anatomical study, the cross-sections of the root, stem, and leaf were prepared by using the wax embedding method as mentioned in[18]. The layers were then studied by using a compound microscope type (Novex). Measurements were taken using an Ocular micrometer, and later on photographed using the digital camera (Cannon).The magnification strength was studied based on the next equation: magnifying power= magnifying of the eye lens × magnifying of the objective lens × camera zoom, if any. Geographical distribution relied on aggregated data from the labels of dried herbarium specimens as well as the information of different references about Iraqi plants [19,20,21,22].

Table 1: Herbarium, whose samples were used in the current study, with their abbreviations according to [23]

Herbarium	Abbreviations
Baghdad, Iraq: The University herbarium, college of Science, University of Baghdad.	**B U H**
Baghdad, Iraq: National herbarium of Iraq, Ministry of Agriculture.	**B A G**
Baghdad, Iraq: Iraqi Natural History Research Center and Museum, University of Baghdad.	**B U N H**

3. Results and Discussion

1. Morphological study (Figure 1*)*

The plant is a perennial herb with brown tap roots (130 x 20 cm). Stems erect, and are semi-woody at the base due to secondary growth. Leaves are simple exstipulate. Basal leaves rosette, ovate, acute apex, cuneate leaf base, dentate leaf margin (55 x 38 mm), petiole long (47-68mm). Cauline leaves, sessile, alternate, lanceolate, acuminate apex, cuneate base, denticulate leaf margin (52 x 17 mm), inflorescence corymb, flowers small-sized, pedicellate, bisexual, actinomorphic and hypogynous, and this is consistent with a study of Al- Shehbaz [24]. Calyx has four sepals, valvate, obtuse apex, entire is margin (2.5 × 3 mm). Corolla has four petals, spathulate obtuse apex entire margin is (3 x 4.5mm). Androecium consists of six stamens, two short yellowish filaments (1-1.5 mm) and four yellowish-long filaments (2.5-4 mm) and is expanded below, anthers are oblong, yellow, and dehiscing by longitudinal slits. Gynoecium consists of one pistil of two carpelated leaves, syncarpous, obovate yellowish ovary (2×3 mm), stigma is sessile, parietal placentation. The flower characters represent the main features among other morphological characters that play an important role in separating the groups as a result of their stability during generations in different environments and which is consistent with a study [3]. Silicula ovate - orbicular and yellowish, indehiscent, surface configuration of fruit strongly reticulately veined with (1-2) seeds (7-13x15-20 mm). Seeds ovoid – ellipsoidunwinged, surface configuration is faintly reticulate, yellowish orange(1.5-2.5 mm). The shape, color, and contrast of the seed in its dimensions, and the presence or absence of the wings are all characteristics of classification importance for the species and are also identical to [25].

2.Anatomicalstudy

- *Root* (Figure 2-a,b)

The research results showed that the root in the species *Peltaria angustifolia* is tap root type. The cross-section ovoid undulate, and the study found all samples in secondary growth stage. Periderm tissue appeared as a continuous layer of 3 rows (multiseriate) with rectangular-elongated cells that had straight- undulated walls, and were cuticle free, to enable the root to perform its main function of absorption. The average periderm layer thickness was 39.5µm. Cortex had 6 layers of parenchyma cells with globoid shape and straight to undulate walls, with an average thickness of 298.5µm. Vascular tissues appeared in the secondary growth stage, as they consisted of secondary phloem, vascular cambium, and secondary xylem, which occupied the largest portion of vascular tissue., Due to the importance of this tissue in transporting water to the rest of the plant, and it was also characterized by a large number of vessels carrying in it. In addition to the unequal diameters, the phloem cells showed a difference in their arrangement. They were convex with a slight height from the upper side, the average thickness of phloem and vascular cambium was 182.9µm. As for the xylem elements, they consisted of 9 columns in each columns 6 units of xylem elements. The average thickness of xylem was 91.3 µm, while the thickness of the vascular cylinder was 198.8 µm, and the average diameter of the root was measured as 990.7µm.

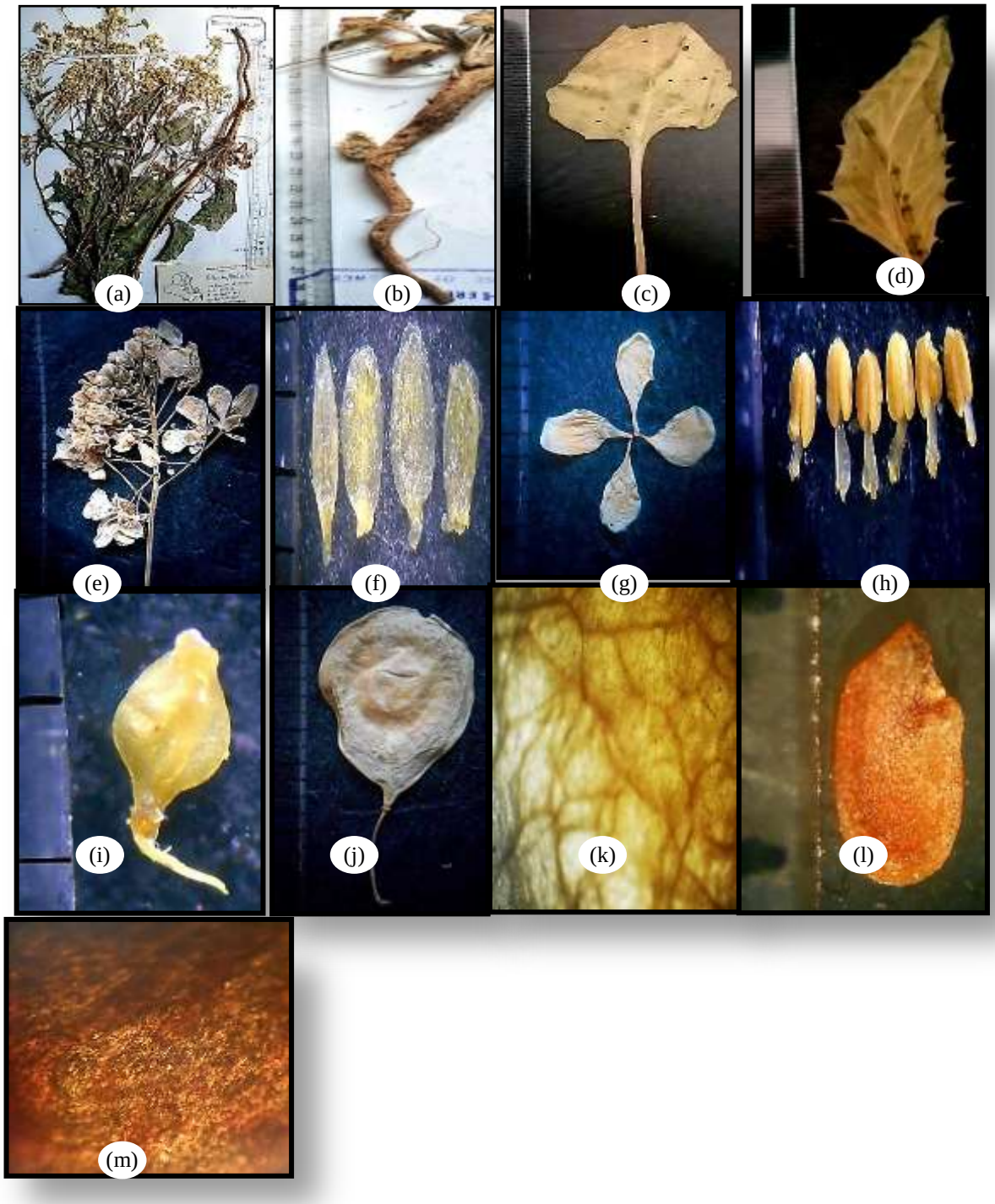

Figure 1: Morphological characters of *Peltariaangustifolia* , a: whole plant , b: root, c:basal leaf, d:cauline leaf, e: inflorescence,f: sepals, g:petal, h: Androecium, i: gynoecium, j: fruit, k:fruit surface configuration, l: seed, m: seed surface configuration 40x.

- *Stem* (Figure 2-b,c)

The cross-section of the stem is an undulate ovoid, surrounded from the outside by the thick and undulating layer of the cuticle with 15.5µmthickness. Epidermal tissue consists of cells of unequal size, which are semi-spherical or ovoid, with an average thickness 32.95 µm. The cortex is located below the epidermis, and it consists of seven to eight rows of angular collenchyma tissue in the form of rings surrounding the section towards the outside with an average thickness 167.4 µm, followed by five to six rows of chlorenchyma tissue arranged

similarly to the arrangement of the previous tissue rings and towards the center and at an average thickness 121.6μm. The chlorenchyma tissue is found in the stems of plants exposed to light. This tissue performs photosynthesis, as well as there is presence of sclerenchyma tissue as fibers along the cortex ring. It is worth noting that the presence of the cells of sclerenchyma and collenchyma tissue give great importance in providing support for the parts of the plant because they are from the supporting tissues as mentioned in [26]. The cortex region follows the area of the vascular cylinder represented by the phloem tissue at an average thickness of 62 μm, followed by the region of the vascular cambium, then inward and towards the center, the xylem tissue area is regulated, with an average thickness of 225 μm. The number of columns of xylem in one vascular bundle reaches 7 columns. As for the pith region, it occupies the center of the transverse section of the stem which lead to the emergence of the stem in solid type, pith is of a group of polygonal or circularthin walled cell with storage function, has the average diameter 298.12 μm, and this corresponds to [27], which stated that one of the stem characteristics in some species of the Cruciferae family is the solid type.

- *Leaf* (Figure 2-e,f)

The results of the anatomical study of the vertical section of the leaf lamina showed that they are surrounded by two layers of epidermal tissue, the upper and lower epidermis, and the epidermis is of the simple type, uniseriate, consisting of cells of different shapes, including ovoid, elongated ovoid, and spherical, as the rate reached the thickness of the upper epidermis is 12.45 μm, while the average of the lower epidermis thickness is 13.75μm. Each of them is covered with a thin cuticle with a thickness of 1.95μm. Mesophyll tissue appeared below the epidermis layer. The study showed that this tissue is distinct to the upper palisade parenchyma layer and the lower spongy parenchyma layer, and is called bifacial mesophyll tissue, which is the usual common form of palisade parenchyma on the upper side (Adaxial) and spongy parenchyma on the lower side (Abaxial) from the dicotyledons leaf. The palisade tissue consisted of one to two rows of elongated cells with narrow intercellular spaces and the average tissue thickness was 72 μm. The spongy parenchyma is loose tissue, leaving it alone, allowing for air lacunae, the cells appeared irregularly arranged, spherical shape, with arrangement in (4) rows. The average thickness of the spongy tissue was 97 μm. Average thickness of the leaf lamina reached 198.8 μm. The study showed that the vascular tissue in the leaf lamina is only an extension of the vascular strip from the stem to the lamina of the leaf. Therefore, the vascular tissue retained its components from the elements of xylem and phloem, and the connection is made to and from all parts of the lamina and also helps to support the lamina, as the main (central) vascular bundle. The largest bundle in the mid rib of leaf it appeared ovoid. The average thickness of the vascular bundle was 42 μm. In addition to the appearance of secondary vascular bundles distribution in the leaf lamina, they decrease in size as we move away from the midrib, as we get closer to the edge of the leaf, as well as appeared in the boundary between the palisade parenchyma and the spongy parenchyma and was simpler in its composition than the main vascular bundle. The results of the current study confirmed the existence of a discrepancy in the anatomical characteristics shown by the leaf of species under study. Leaf is the most botanical parts that possess the anatomical and more stable properties, and this is consistent with [28], which stated that the leaf was widely used in solving the most difficult taxonomic problems between different genera and species.

- *Cuticular study* (Figure 3)

The stomata appeared on both the adaxial and abaxial surfaces of the *Peltaria angustfolia* leaf. Hence, this type of leaf is called Amphistomata, where a higher frequency appeared on the lower surface than on the upper surface. The stomatal complex is anisocytic type, where

the stoma is surrounded by three subsidiary cells varying in size found as stomata clusters. The stomata, were elliptical, consisting of a pair of elongated and kidney shaped guard cells and pair of big subsidiary cells with undulating walls with in average of adaxial 32x28µm and 10 stomata index. While the average of abaxial was 28x29.8µm with 14.9 stomatal index. It is possible to rely on the variation in the dimensions of stomata and evidence of stomatal index as an important anatomical characteristic that helps in diagnosing and isolating the species, especially the presence of stomata clusters which are important diagnostic features as proposedby [29,30]. It is clear from the current study that stomatal complexes are important because they are fixed with one species despite the change of the plant collection site and in different species, and it is also an evidence of the efficiency the plant in the process of photosynthesis [31].

- *Venation of leaf* (Figure 3)

The leaf has one main venation system, reticulate Pinnately system, as it was distinguished by the presence of one major midrib extending from the base of the leaf to the top. In this system, the secondary veins do not end at the edge, but are rather connected to each other in a series of arches and the link is far from the edge of the leaf. Major vein extends from the base of the leaf to the top is called weak-brochidodromous as mentioned in [32]. Secondary veins branches are usually intersected to form areoles, which have shapes that appear quadrilateral or pentagonal in different sizes. As for the ends of veinlets, they are either simple linear, or branched once. So, the study agreed with [33]. The venation system was characterized by accurate and important taxonomic characteristics.

3.Habitat and geographical distribution (Figure 4)

The species *Peltariaangustifolia*is rare in Iraq, collected previously four times only from one locality in mountain region of Iraq (JabalSinjar District (MJS). It found in Jabal Sinjar, and above BaladSinjar. The habitat of the genus is represented in mountain among loose stones in coppiced oak, on limestone at an altitude of 700-1400m .

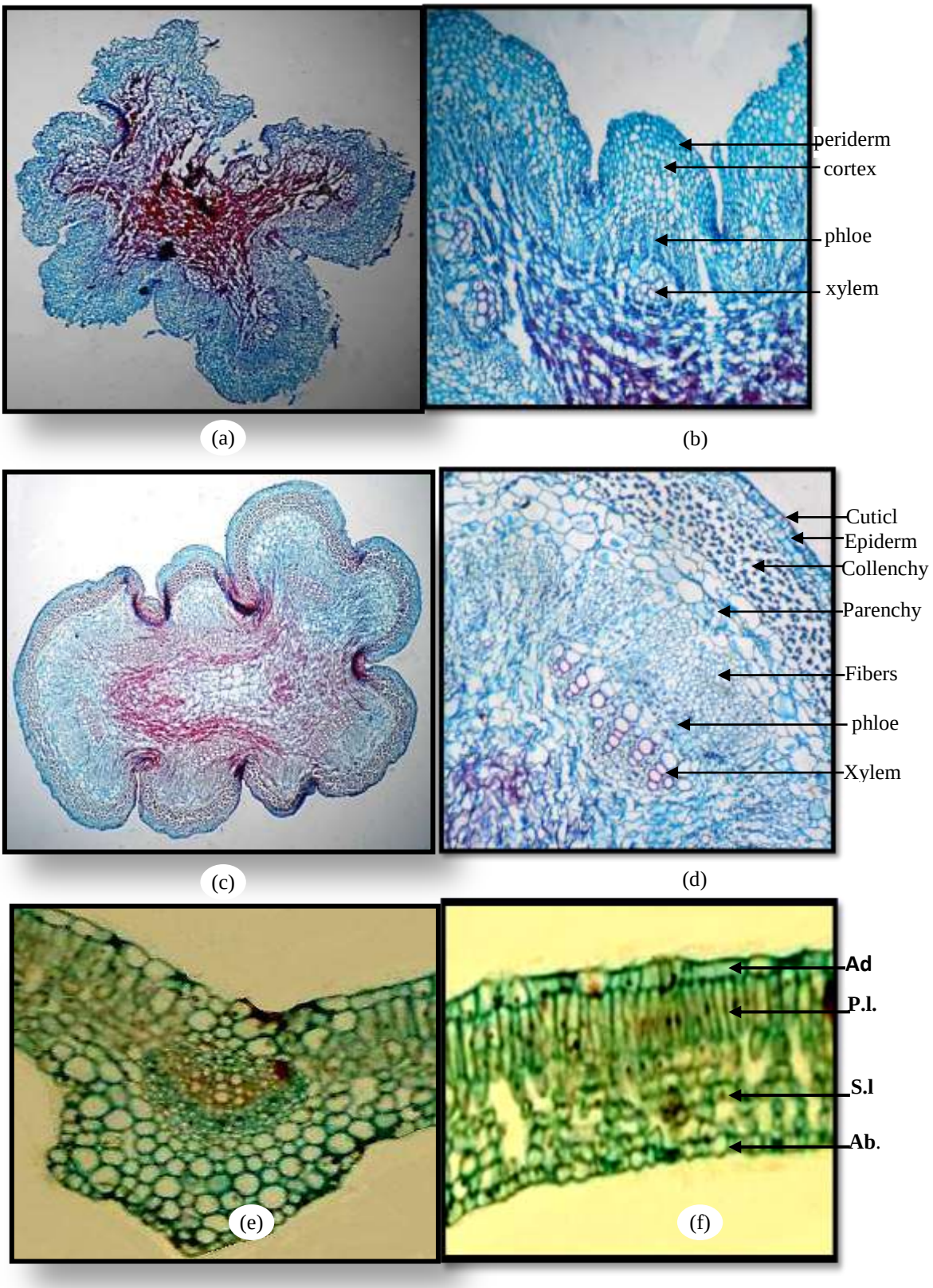

Figure 2: Anatomical sections of*Peltariaangustifolia*root(a, b) root cross section(a) is 80x, (b) magnifying part in 350x, (c,d) stem cross section (c) is 80x, (d) magnifying part in 350x, (e,f) leaf verticalsection, (e)leaf midrib in 300x, (f)leaf lamina section in400x.A.d.: adaxial epidermis, Ab-.: abaxial epidermis, P. l.: Palisade layers, S. l. : Spongy layers.

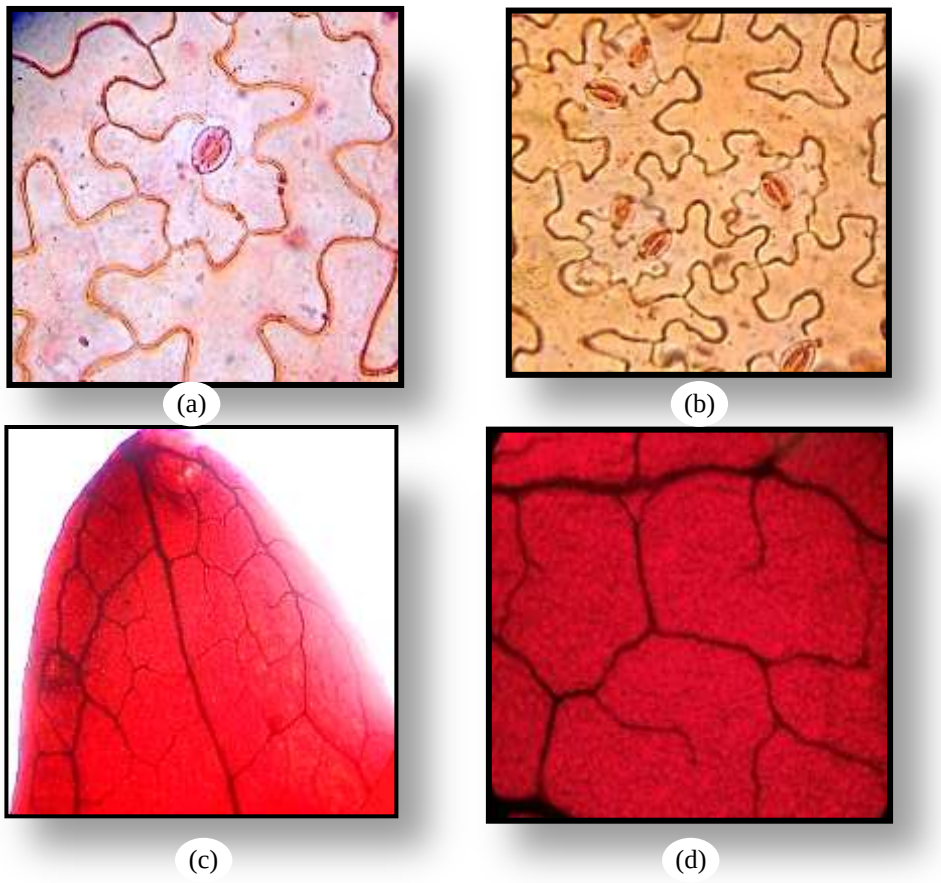

Figure 3: Characteristics of epidermis and venation of leaf, (a) Eepidermis of (Aadaxial) 100X, (b) Eepidermis of (Aabaxial) 100X, (c)Tthe Sshape of the veins near the leaf margin80X, (d)Aareoles and veinlets 140X.

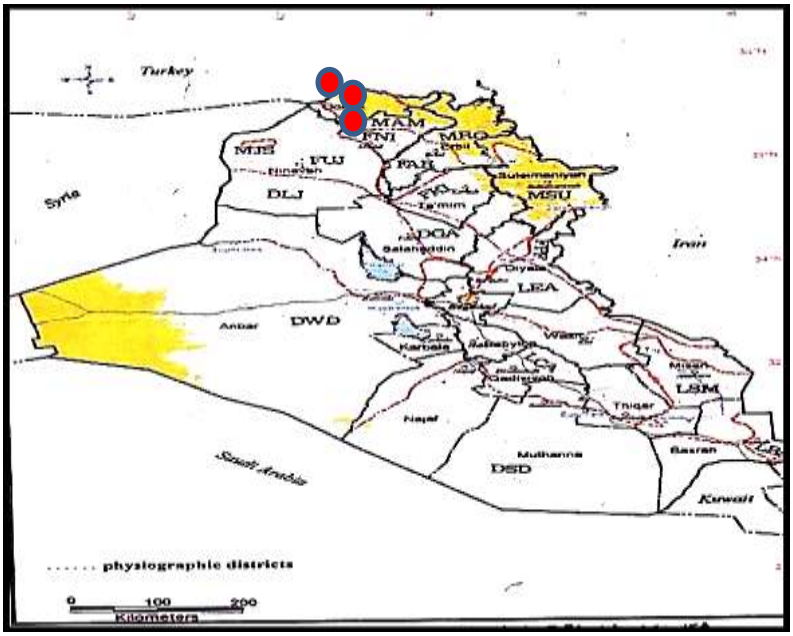

Figure 3: Distribution map of *Peltariaangustifolia*in JabalSinjar District (MJS)

4. Referencess

[1] I,A,M, Al-dobaissi, and R.K.H. AL-Masoudi, "Study of fruits morphological features for 33 species belong to cruciferae family in Iraq,". *Iraqi journal of agricultural science*, vol. 52, no. 4, pp. 1039-1049, 2021doi.org/10.36103/ijas.v52i4.1415

[2] A.H.I. AL-Mousawi, :*Plant Taxonomy:* First Edition, Dar Al Kuttab for Printing and Publishing, University of Mosul, 1987, pp:378

[3] I.C. Hedge, J.M. Lamond, and C.C.Townsend: *Cruciferae. In: Flora of Iraq Vol. 4 part two*:Ministiry of Agriculture & agrarian reform, Republic of Iraq,1980, pp. 1199

[4] G. Bentham, and J.D. Hooker, :*GeneraPlantarum, Vol.I*: Reeve, London, 1862

[5] E.Boissier,*Flora Orientalis. Vol I.:*Geneva et Basilear, ApudH,Georg, BibliopolamLugdnni,1867.

[6] J. Hedge, and K.H. Rechinger: *FloraIranica 57:*AkademischeDruck- u. Verlagsanstalt, Graz,1968,pp:45-327.

[7] P.H. Davis :*Flora of Turkey And the East Aegean Islands. Vol. I.*: Edinburgh, Unir. Press, 1965,pp: 272 -488.

[8] D. Al-Eisawi, "Taxonomic synopsis of Brassicaceae for the flora of Jordan,"*Webbia; Raccolta de Scritti Botanici*, vol. 71, pp. 219-226, 2016.http://dx.doi.org/10.1080/00837792.2016.1184393

[9] P. Authier, andJ. Covillot, "Catalogue actualisé des plantes de l'île de Rhodes (Grèce) Saussurea,"*Travaux de la SociétéBotanique de Genève*, vol.41, pp.131-170, 2011

[10] L.J. Musselman, "Checklist of Plants of Lebanon and Syria" http://ww2.odu.edu/~lmusselm/plant/lebsyria/Checklist of Lebanon Plants.pdf., 2011

[11] M. Rhman, A. Khatun,L. Lin, and B. Barkla,"Brassicaceae mustard: traditional and agronomic uses in Australia and NewZealand,"*Molecules,* vol.23, pp. 231-249, 2018 http://dx.doi. org/10.3390/molecules23010231

[12] S. Sanger, Z.W. Shen,N.B. Deus,and M.H. Zenk, "The biosynthesis of Lunaria in seeds of Lunariaannua," *phytochemistary*, Vol.47,pp.375-387,1998

[13] W. Jabr, :*Medical Plant Lexicon. Second edition*:Aljeel .London,1998, pp: 450

[14] Al-Ghalabi, I.A. (2012). A Comparative Taxonomic Study of *Erysimum* L. In Iraq, MSc. Thesis, College of Science for Girls pp:160

[15] V.H. Heywood, :*Flowering Plants of the World:* Oxford University Press, 1968,pp: 335

[16] A.N. Khaleel, and I.A.M.Al-dobaissi, "Trichomes Morphological Diversity in Some Species from Related Tribes of Asteraceae Family in Iraq" *Iraqi Journal of Science*, vol.63, no. 6, pp.2362-2372, 2022DOI: 10.24996/ijs.2022.63.6.5

[17] M.A. Kamel, and M.M. Elbous," The leaf architecture and its taxonomic significance in Capparaceae from Egypt" *ActaBiologica szegediensis*,vol.51, no.2, pp.125-136

[18] I.A.M Al-Dobaissi,"Morphological and anatomical investigation of the genus *Vaccaria*(wolf.) Caryophyllaceae in addition to its geographical distribution in Iraq,"*IOSR-JPBS*, vol. 12, no. 5, pp. 40-48, 2017.

[19] M. Zohary,*The Flora of Iraq and It's Phytogeographical Subdivisions*: *Government press Baghdad*, 1946, p.161

[20] K.H. Rechinger, :*Flora of Lowland Iraq*: *Verlag von. J. Cramer*, 1964.

[21] A. Al-Rawi, *:Wild Plants of Iraq with Their Distribution:* Ministry of Agriculture & Irrigation, State board for agricultural & water resources research, National Herbarium of Iraq, Baghdad, 1964,pp: 102.

[22] Th. J. Ridda, and W.H. Daood, :*Geographicaldistribution of wild Vascular plants of Iraq:* National Herbarium of Iraq,1982, 140pp.

[23] P.K. Holmgren, N.H. Holmgren, and L.C. Barnell, *:Index Herbarium 8th ed*.: New York. Botanical garden,Bronx,U.S.A., 1990.

[24] I.A. Al-Shehbaz, :*Brassicaceae In: Boufford, D.E. (ed). Flora of Noth America vol. 7*.: *Oxford university press, New York Oxford*,2010, 224-747

[25] R.K.H. AL-Masoudi, and K.I.A. AL-Shammary,"Morphological study of pollen grains and seeds in eight species from the family Cruciferae in Iraq,"*Baghdad J. of Science*vol.4, no.14, pp.669-676, 2017.

[26] R.K.H. AL-Masoudi,"Morphological, anatomical and geographical distribution studies of species *Horwoodiadicksoniae* (Turrill) in Iraq,"*The Iraqi journal of Agricultural Sciences*, vol. 50, no. 6, pp.1613-1620, 2016.

[27] C.R. Metcalfe, and L. Chalk, :*Anatomy of Dicotyledons. Vol.2*: clarendon press, Oxford, 1950,pp:1500.

[28] S.A. Aliwy, "Systematical comparative for two species Amaranthusalbus L. and AmaranthusgracilisDefs.,"*The Iraqi journal of Agricultural Sciences*,vol.48,no.3,pp.852-859, 2017.

[29] L. Serna, and C. Fenoll. "Tracing the ontogeny of stomatal clusters in Arabidopsis with molecular markers."*The plant journal*, vol. 12, no.4, pp. 747-755, 1997.

[30] Y. Gan, L. Zhou, Z.J. Shen, Z.X. Shen, Y.G. Zhang, and G. X. Wang"Stomatal clustering, anew marker for environmental perception and adaptation in terrestrial plants" *Botanical studies*, vol. 51, pp. 325-336, 2010.

[31] N. M. Al-Abide, and K.I Al-shammary, "Indumentum studies and types of crystals in some species of the genera from the tribe Brassiceae for the family Brassicaceae in Iraq," *Tikrit Journal of pure science*, vol. 17,no.1, pp.118-129, 2012.

[32] L.J. Hickey,"Classification theorchiture of dicotyledon leaves,"*Amer. Bot.*,vol. 60, no.1, pp.17-23, 1973.

[33] A. Ash, L.J. Hickey, P. Wilf, B. Ellis, K. Johnson, and S. Wing, Manual of Leaf Architecture Morphological Description and Categorization of Dicotyledonous and net-veined Mono-cotyledonous angiosperms. Leaf architecture working Group, Smithsonian Institution, pp. 65. 1999.