

Taxonomic Study of the New Record *Epilobium anatolicum* Hausskn. subsp. *anatolicum* (Onagraceae) in Iraq

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Abstract

Epilobium anatolicum Hausskn. subsp. *anatolicum* is a new record from Onagraceae family in Iraq, present in Hasarost mountain (north-east of Erbil) in Rowanduz district (MRO). The identification of the plant specimens confirmed by the keys in the available references, Morphological description was done, and some distinguishing characters are given. Pollen grains characters have been studied such as shapes, colors, sizes, surface ornamentation and numbers. In addition, some features of the leaf and stem anatomy have been examined.

Key words: *Epilobium anatolicum*, Onagraceae, Rowanduz district, Iraq.

Introduction

The Onagraceae family includes 650 species throughout the world and distributed on 24 genera (Simpson, 2006), in Iraq contain 9 species distributed on 2 genera (Al-Rawi, 1964). In the Flora of U.S.S.R., Shishkin (1949) indicated 51 species of the genus *Epilobium* Spach. involving *E. anatolicum*. Migahid (1978) in the Saudi Arabia stated 1 species which is *E. hirsutum* L., while Post (1932) mentioned 10 species in Syria, Palestine and Sinai. Chamberlain and Raven (1972) in Turkey stated 21 species of the genus including *E. anatolicum*. In Europe, Raven (1968) mentioned 27 species of the genus involving *E. anatolicum*. In Iran, Raven (19--) pointed that 29 species of the genus *Epilobium* present, whilst Ghahreman and Attar (1999) indicated 19 species. In the Flora of low land Iraq, Rechinger (1964) mentioned 1 species that is *E. hirsutum*. Each of Guest (1933), Zohary (1946) and Blakelock (1948) stated that 4 species of the genus present in Iraq, but Al-Rawi (1964) mentioned 6 species and Ridda and Daood (1982) indicated 7 species, whilst Ghazanfar and Edmondson (2013) mentioned 5 species. Each of Faris (1983), Fatah (2003), Ahmed (2010), Hameed (2016) and Darwesh (2017) did not indicate to any species of the genus *Epilobium* in Piramagrun, Haibat Sultan, Gomaspan, Choman and Hujran respectively. Khalaf (1980) mentioned 1 species in Sinjar mountain, whilst Ahmad (2013) stated 4 species in Hawraman mountains. Chakravarty (1976) indicated that the species *E. hirsutum*, one of the Iraqi plants, is a poisonous, causing epileptiform convulsions. The juice of the plant reported to use as an application for warts treatment in certain regions of South Africa. Al-Saadi and Al-Mayah (1982) stated that the genera *Epilobium*, *Jussiaea* L., and *Ludwigia* L. are aquatic plants in Iraq from the Onagraceae family. The researches of Al-Musawi and Majeed (2013), Haloob (2016) and Sardar (2017) like the present study involve new plant records in Iraq.

The research assured the occurrence of *Epilobium anatolicum* subsp. *anatolicum* in north of Iraq according to recent collections, as well as aimed to study the morphological characters, pollen grains with leaf and stem anatomy, in order to adding some information for aiding the identity of the species in the present study.

Materials and Methods

Plant specimens' collection, Field trips in different regions of northern districts (Kurdistan Region) of Iraq was done in 2017. By using the keys especially in Flora of Iraq, Flora of Turkey and Flora Iranica, the specimens have been identified, then treated and preserved in herbarium of Education College (ESUH). Some ecological notes and the presence location as shown in the map (Figure 1) have been given. Were obtained pollen grains, anthers by the fixing in FAA, and then a single anther removed and placed in a drop of water or 50% glycerol (the latter to prevent the material from drying out). The anther was

dissected with a scalpel to extrude the pollen grains. The anther wall material was removed after crushing pollen grains, and a drop of safranin was added, then a cover-slip was slide on top of the pollen. (Simpson, 2006). A Sony camera has been used for photographing the different plant parts and the scientific terms that used in the study have been taken from Harris and Harris (2001), Hesse et al. (2009) and Agashe and Caulton(2009). leaf and stem anatomy ,were prepared according to the procedure in Al-Mashhadani(1992) and the information which was mentioned in Metcalfe and Chalk (1950) were used.

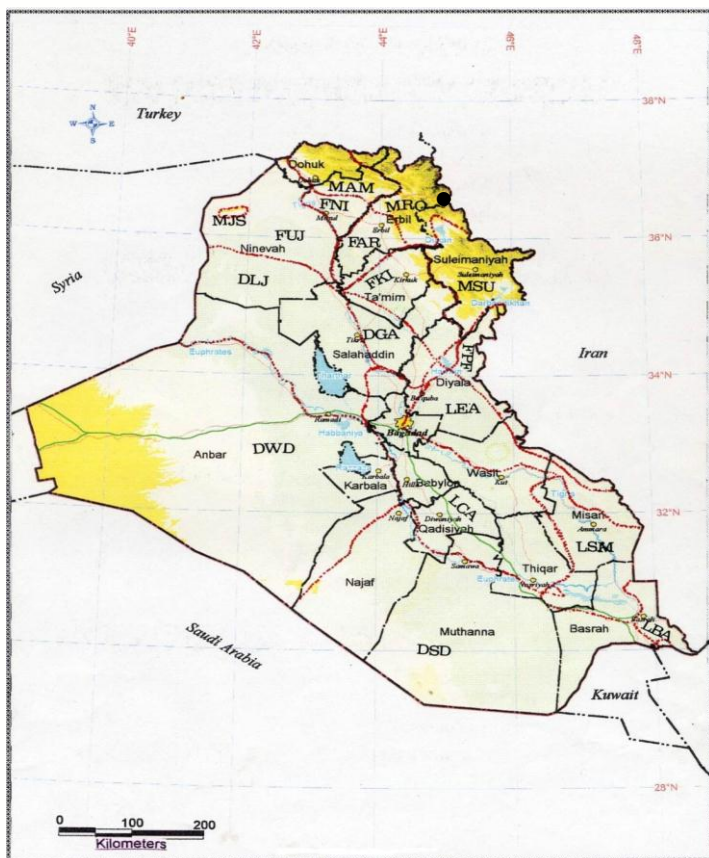


Fig (1): A map of Iraq shows the regions and districts depending on Guest (1966) and FAO (2002)

Plate (1): Photograph of *E. anatolicum* subsp. *anatolicum*

● *E. anatolicum* subsp. *anatolicum*

Results

Morphological Study

E. anatolicum Hausskn. subsp. *anatolicum* Ic: Leveille, Ic. Epil. t. 131 (1910); Fl. Turkey, Chamberlain and Raven, 4: 191 (1972).

Plant description

Perennial, rhizomatous, herb, height 30-58 cm, stem erect, glabrous below, glandular-pubescent above, green-brown, 22-41x0.3-2.3 cm, branches 9-11x0.16-0.18 cm. Leaves simple, exstipulate, petioles very short, 0.3-0.5 mm, decurrent in to 2 raised lines down stem, opposite-decussate in the lower half, alternate-spiral in the upper half, enlarge upwardly, margin entire, dentate or serrate, apex acute, base obtuse or truncate, pubescent-glabrous; basal leaves narrowly oblanceolate, elliptic or oblong, green-yellow, 17-21x4-8 mm; lower cauline leaves oblanceolate, narrowly oblanceolate, cultrate or elliptic-narrowly elliptic, green, 21-34x5-7 mm; upper cauline leaves cultrate or narrowly lanceolate, green, 20-31x4-6 mm. Bracts cultrate or lanceolate, margin dentate, apex acute, base obtuse, densely pubescent,

green, 11-19x2-5 mm. Inflorescence a simple raceme, densely glandular or glandular-pubescent, Flowers actinomorphic, 4-merous, 16.0-28.4x3-4 mm, pedicel costate, glandular-pubescent, green, 4-10x0.2-0.3 mm, Calyx of 4 sepals, free, ovate-broadly oblong, margin entire, apex acute, base truncate, glandular-pubescent, green, 2.5-3.7x1.7-2.1 mm. Corolla of 4 petals, oblanceolate-narrowly oblong, margin entire, apex emarginate, base truncate, pale pink, 4.0-6.4x1.2-2.3 mm, Stamens 8, in two whorls, 4 long antisepalous, 4 shorter antipetalous; filaments filiform, yellow, long ones 1.5-2.2x0.15-0.20 mm, short ones 0.7-1.0x0.10-0.12 mm; anthers narrowly oblong, yellow, basifixed attachment with the filaments, 0.5-0.7x0.15-0.20 mm. Pistil 1, ovary inferior, cylindrical, 4-locular, 4-furrows and ridges, glandular-pubescent, yellow, 8-12x1.0-1.3 mm; style single, filiform, yellow, 1.7-2.0x0.2-0.3 mm; stigma clavate, yellow, 1.0-1.4x0.20-0.25 mm. Fruit stalk 7.5-12.0x0.5-0.7 mm, fruit a capsule, cylindrical, dehiscent into 4-valves, glandular-pubescent, green or green-yellow, 40-60x0.8-1.6 mm. Seeds numerous, obovoid or narrowly obovoid, coarsely papillose, comose, lacking endosperm, yellow-brown, 1.0-1.3x0.3-0.5 mm, coma hairs white, 5.0-8.5 mm. (Plates 1-3).

Lectotype: [Turkey A5 Amasya] between Toptscha and Mersiwan (Merzifon) Wiedemann 260 (JE! LE!)-fide Raven, op. cit. 193.

Studied specimens: MRO: ESUH/ Hasarost mountain (north-east of Erbil), 1700 m, 12.7.2017, A. Sardar, S. Al-Dabagh & R. Khdir, 7594.

Environment & Presence: Present as individuals in the region, on the rocky soils; altitude: 1700 m; flowering: July.

Palynological Study

Results of pollen grains showed pollens yellow, single (sometimes tetrads), triporate, oblate in equatorial view, triangular-sub-spheroidal in polar view, medium according to Erdtman (1971), 2-3 thin threads project from pollens surface seen in polar and equatorial view called viscin threads: acetolysis resistant threads arising from the exine (Hesse et al., 2009), equatorial axis 37.5-42.5 μm , polar axis 25.00-31.25 μm , reticulate surface ornamentation, numerous. (Plate 4).

Anatomical Study

The epidermis of the leaf is covered by the cuticle layer which is not equal in its thickness from region to region, 1-3 μm ; The epidermal cells shape in the cross sections were oblong, semi-circular or irregular, straight or sinuate radial walls, straight or convex external walls, straight or concave internal walls, 500-700 μm . The mesophyll is homogenous (without palisade layer), cells of different shapes and sizes, polygonal, irregular or oblong, intercellular spaces present, vascular bundles number was 5-7, one is the midrib. Parenchymal tissue of 3-7 layers surround the vascular bundles with different shapes, polygonal, irregular. The xylem fiber wall thickened, 25.0-32.5 μm .

A cross section of the middle of a flowering stem has been taken to be the material of the stem anatomy. The epidermis was a single continuous layer of elongate, semi-circular cells or irregular having different sizes; The thickness of the epidermis depending on the differences in the cell sizes. straight or sinuate radial walls, straight or convex external walls, straight or concave internal walls, 2.5-5.0 μm . The cuticle layer was 1.0-6.0 μm .

The cortex consists parenchymal cells, have intercellular spaces, the cells oblong or irregular of different sizes. The number of the cortical layers is 5-6 layers, and 5.0-12.5 μm in diameter. The vascular tissue is continuous layer of irregular cells; small vessels; fibers present, parenchyma is paratrachial and scanty, intraxylary phloem present, 62.5-125.0 μm . The pith consists of parenchymal cells, polygonal or irregular, with many intercellular spaces, 175-225 μm . The pericycle consist of fibers. (Plate 5).



Roots, Basal leaves &
Lower cauline leaves



Bracts



Upper cauline leaves



Inflorescence with Fruits

Plate (2): Plant parts of *E. anatolicum* subsp. *anatolicum*



1 mm

Flower



0.6 mm

A part of Opened Flower



0.7 mm

Sepal, Petal & 3 Stamens



0.5 mm

Stigma with Upper part of Style



0.8 mm

Ovary



0.7 mm

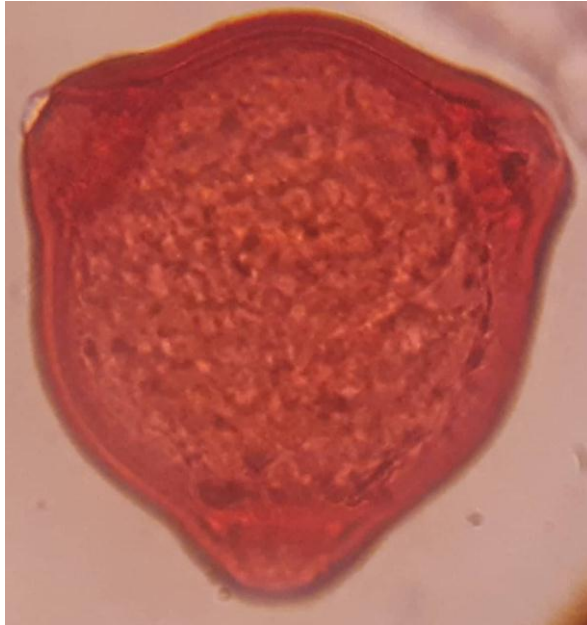
Seed with Coma



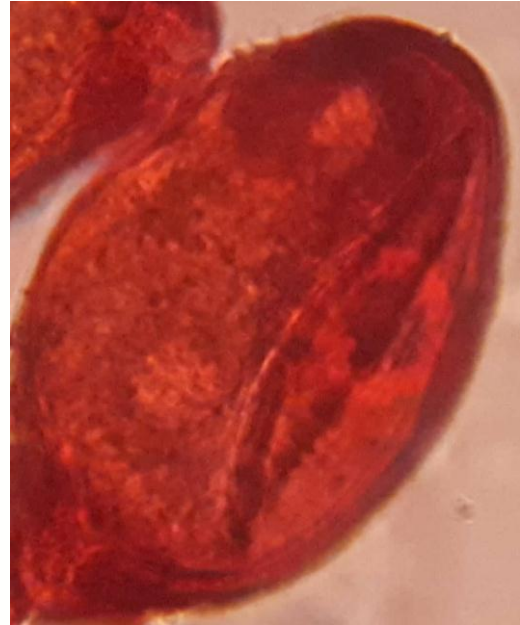
0.2 mm

Seed without Coma hairs

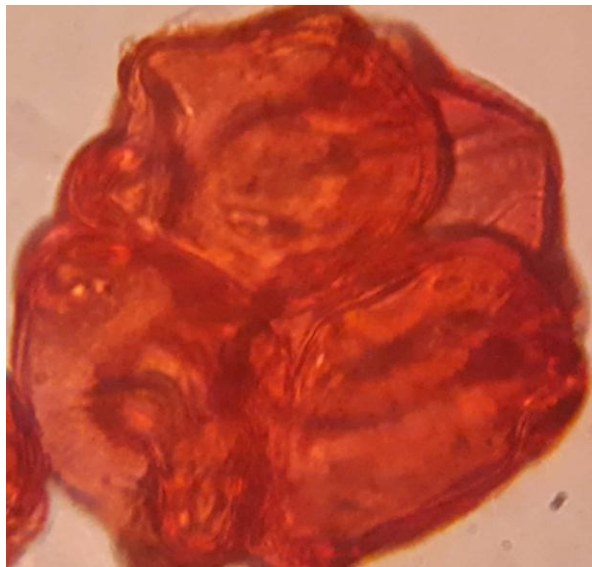
Plate (3): Reproductive parts of *E. anatolicum* subsp. *anatolicum*



Polar view



Equatorial view

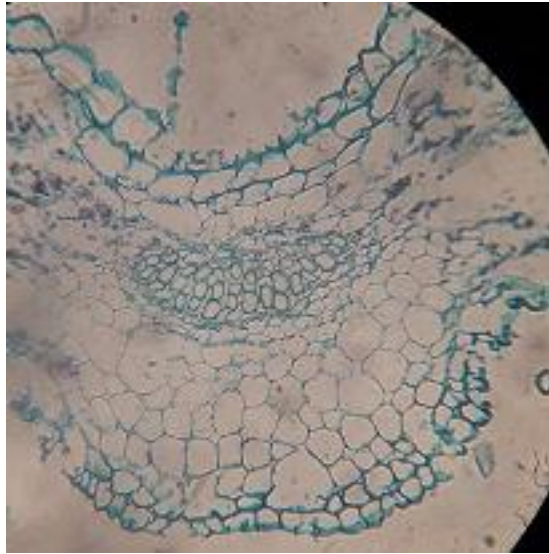


Tetrad

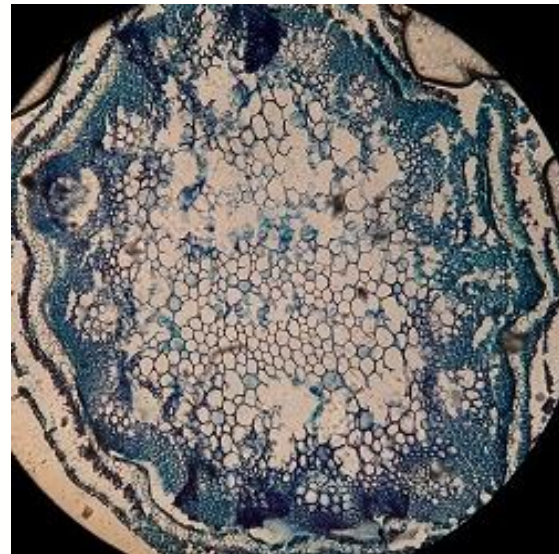


Vicin threads

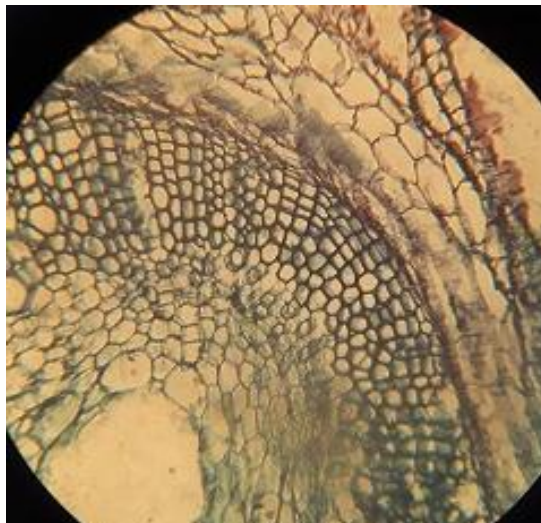
Plate (4): Pollens of *E. anatolicum* subsp. *anatolicum* x100



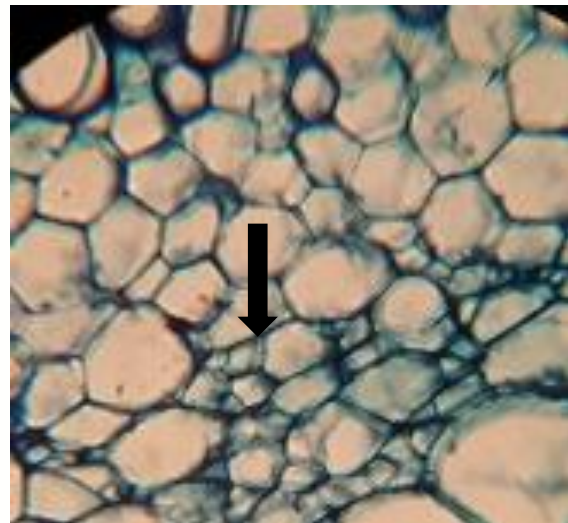
Leaf midrib C.S. x40



Stem C.S.x10



Enlarged part of Stem C.S. x40



Interxylary phloem x100

Plate (5): Leaf and Stemanatomy of *E. anatolicum* subsp. *anatolicum*

Discussion

The study dealt with a new plant of the genus *Epilobium* that is *E. anatolicum* subsp. *anatolicum* within the Onagraceae family in Iraq, the study included some features like the morphological characters and the environment. Within the literature review related to the genus *Epilobium* in Iraq, including the plant specimens of National Herbarium of Iraq (BAG), College of Science Herbarium, University of Salahaddin-Erbil, Iraq (ARB) and College of Education Herbarium, University of Salahaddin-Erbil, Iraq (ESUH), the researcher did not find any specimens belongs to *E. anatolicum*, for this reason, the plant regarded as a new plant species add to the Flora of Iraq.

E. anatolicum subsp. *anatolicum* has some characters differ from the near species which is *E. tetragonum* L. that found in Iraq and has the following characteristics: perennating by rhizomes; stem glabrous below, glandular-pubescent above, Leaves decurrent in to 2 raised lines down stem, Inflorescence with densely glandular or glandular-pubescent hairs, stigma clavate, not emarginate; Seeds obovoid or narrowly obovoid, coarsely papillose. Pollens were single (sometimes tetrads), triporate, oblate in equatorial view, triangular-subspheoidal in polar view, medium in size, 2-3 thin threads project from pollens surface seen in polar and equatorial view called viscin threads, reticulate surface ornamentation and numerous in number. Leaf anatomy showed that the mesophyll is homogenous (without palisade layer), (5-7) vascular bundles; The number of the cortical layers in the stem were 5-6 layers, have intercellular spaces. The vascular tissue of a continuous layer; vessels small; fibers present, parenchyma is paratrachial (parenchymal cells constitute a complete circular sheath around the vessels) and scanty, intraxylary phloem present. The pith consists of parenchymal cells with many intercellular spaces. The pericycle consist of fibers.

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