

Convolvulus dorycnium L. (Convolvulaceae) as a new host for *Orobanche mutelii* F. Schultz (Orobanchaceae)

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Abstract

Convolvulus dorycnium subsp. *oxysepalus* (Boiss.) Rech. from the family Convolvulaceae is a new host for *Orobanche mutelii* F. Schultz from Orobanchaceae and it is a new plant addition for the Flora of Iraq. Identification and morphological study have been done for the plants under study, these illustrated by graphs. In addition, some features of the leaf and stem anatomy have been examined.

Key words: *Convolvulus dorycnium*, *Orobanche mutelii*, new host, new addition, Flora of Iraq

Introduction

The plant *Orobanche* is one of the parasitic plants in Iraq that has numerous hosts, where *O. aegyptica* Pers. parasites on *Lycopersicon* Mill. (Tomato), *Nicotiana* L. (Tobacco), *Solanum* L., *Papaver* L., *Zea* L. and *Carthamus* L.; *O. cernua* Loefl. attacks *Artemisia* L.; *O. anatolica* Boiss. & Reut. attacks *Astragalus* L., *Alhagi* Gag. and *Ephedra* L. (Chakravarty, 1976). In addition, *O. cernua* attacks *Petunia hybrida* Hort. ex E. Vilm. (Mattoo and Mattoo, 1977); also attacks *Nicotiana* (Hibberd, et. al., 1999); *O. aegyptica* attacks *Helianthus annuus* L. (Eizenberg, et. al., 2003); *O. crenata* Forsk. attacks *Pisum sativum* L., *Vicia sativa* L., *V. faba* L., *Cicer arietinum* L., *Lens* Mill. (Luque, et. al., 2005); *O. foetida* Poir attacks *Vicia faba* and *Cicer arietinum* (Roman, et. al., 2007) and (Abbes, et. al., 2010); and *O. aegyptica* attacks *Arabidopsis thaliana* (L.) Heynh. (2008).

Convolvulaceae is one of the plant families that found Iraq, which includes 1600 species of 56 genera over the world (Simpson, 2006). In Iraq consist of 27 species within 3 genera (Al-Rawi, 1964). Rechinger (1963) pointed out that 57 species of the genus present in Iran including *C. dorycnium*, while Stace (1972) stated 23 species of the genus *Convolvulus* L. in Europe including *C. dorycnium*. Parris (1976) mentioned 32 species of the genus in Turkey one of them is *C. dorycnium*. Rechinger (1964) in the low lands of Iraq indicated 7 species. Whilst Al-Rawi (1964), Ridda and Daood (1982) and Chakravarty (1976) mentioned, 15, 18, 2 species in Iraq respectively. Khalaf (1980) indicated 4 species of the genus in Sinjar mountain. Each of Faris (1983) and Ahmed (2010) stated 2 species in Pira magrun mountain

and Darband Gomaspan separately. Whilst Fatah (2003) and Hameed (2016) mentioned 1 species in Haibat Sultan mountain and Hujran Basin respectively. In addition, Ahmad (2013) indicated 7 species in Hawraman mountains. Finally, Darwesh (2017) did not indicate any species in Choman region. In all the available references, the study did not discover any species refers to *C. dorycnium*, as a result, the studied specimens of the genus *Convolvulus* regarded as a new plant addition for the Flora of Iraq and as a new host for *O. mutelii*.

The purpose of the current study is to confirm that *C. dorycnium* subsp. *oxysepalus* (Boiss.) Rech. is a new host for *O. mutelii* and confirm *C. dorycnium* subsp. *oxysepalus* as a new plant addition for the Flora of Iraq, as well as, study the morphological features with some leaf and stem anatomy.

Materials and Methods

For collection the plant specimen, various scientific trips have been done to the different districts of northern (Kurdistan region) of Iraq: Amadiya district (MAM), Rowanduz district (MRO), Sulaimaniya district (MSU), Kirkuk district (FKI) and Arbil district (FAR) in 2018. Identification of the specimens has been done by using the keys in Flora of Turkey, the collected specimens were treated herbarially and became formal specimens, then preserved in Herbarium of Education College-University of Salahaddin, Erbil (ESUH). Kruss dissecting microscope has been used in the examining of the collected specimens that belong to *O. mutelii* and *C. dorycnium*. Some environmental notes have been mentioned, and a map (Figure 1) was used. For photographing the plant parts, a mobile camera (Sumsung-A5) were used and the scientific terms that utilized in the present study have been taken from Harris and Harris (2001). The procedure in Al-Mashhadani (1992) has been used in the leaf and stem anatomy, and the information in Metcalfe and Chalk (1950) were utilized.



Fig (1): A map of Iraq shows the location of *O. mutelii* and *C. dorycnium* subsp. *oxysepalus* •

Plate (1): Photograph of *O. mutelii*



Plate (2): Photograph of *C. dorycnium*

Table (1): Selected Herbarial specimens that have been reviewed in the study

Herbarium	specimens Number	Locality	Date of collection	Altitude (m)	Collector
BAG	11884	Avroman	8.6.1948	1250	J. B. Gillett
	1086	Abu-Ghraib	14.11.1956	700	A. Al-Rawi
	7702	Qarachatan	18.4.1947	950	H. Alizzi
ARB	1727	Azmer	16.4.1977	1300	A. Al-Khayat
	6079	Pira- Magrun	28.4.1981	1050	Y. S. Faris
	1213	Mawat	9.5.1979	850	Y. S. Faris
ESUH	1611	Abu-Ghraib	20.9.1981	900	Y. N. Meriwani
	1838	Sulaimaniya	25.4.1980	1200	Y. N. Meriwani
	1029	Safin m.	11.4.1986	870	A. Al-Khayat

Results

Morphological Study

A. *Orobancha mutelii* F. Schultz in Fl. Fr., Mutel, 2: 353 (1835); Flora of low land Iraq, Rechinger, 553 (1964); Fl. Iranica, Wien, 5: 8 (1964); Fl. Turkey, Gilli, 7: 7 (1982).

Syn: *O. ramosa* L. subsp. *mutelii* (F. Schultz) Coutinho, Fl. Port. 566 (1913).

Herbs, pubescent-glandular, (14-16) cm. Stem unbranched, erect, costate, yellow-brown, (60-80)x(3.0-3.5) mm. Leaves (scales) sessile, alternate-spiral, hairs on the lower surface and margin, margin entire, apex acute, base obtuse, brown, narrowly ovate or lanceolate, (5.5-8.5)x(2.5-3.5) mm. Inflorescence a dense simple spike, (12-15)x(1.5-1.8) mm, Bracts like leaves, (5.0-6.5)x(2.4-2.8) mm. Flowers 14-18, hermaphrodite, Epicalyx alternate with calyx teeth, narrowly lanceolate or lanceolate, margin entire, apex acuminate, base obtuse, yellow-brown, (5-6)x(1.0-1.3) mm, Calyx halves connate at base, 2-toothed, teeth (limb) mostly equaling tube, acuminate, brown, (3.0-3.2)x(0.7-0.9) mm, tube (3.1-3.5)x(5-7) mm. Corolla tubular-campanulate, of tube and limb, mauve or pale blue, tube (12-15)x(6-8) mm, limb bilabiate, lower lip 3-lobed, margin entire, apex rounded, (4-5)x(6.7-8.0) mm, Stamens 4, epipetalous, inserted above corolla base, filaments terete, 2 shorter than the others, yellow, (5.0-8.5)x(0.25-0.35) mm, anthers oblong-globoid, yellow, dorsifixed attachment with filaments, (1.5-1.7)x(1.4-1.8) mm. Pistil one, yellow-brown, ovary superior, broadly ellipsoid, glandular, (4.4-5.0)x(2.7-3.2) mm, style 1, terete, glandular, (5.0-5.5)x(0.25-0.30) mm, stigma

2-lobed, rough, (1.2-1.5)x(1.0-1.3) mm. Fruit simple, dry, capsule, orbicular-rotund (ellipsoid), dark yellow, (4-7)x(4.5-7.5) mm. Seeds numerous, linear, semigloboid or very narrowly ellipsoid, reticulate, brown-black, (0.2-0.4)x(0.2-0.25) mm. (Plates 1, 3 and 4; Tables 2, 3 and 4).

Type: [Algeria] Bone (Annaba), Mutel (holo. P).

Studied samples

MSU: ESUH/ Mergapan-Pira Magrun mountain (North-West of Sulaimaniya), 800 m, 20.4.2018, A. Ghafoor and A. Sardar, 7717.

Environment notes

The plant was found as parasitic individuals on *C. dorycnium*, in the rocky clay soils; altitude: 800 m; flowering: April-June. (Figure 1).

B. Convolvulus dorycnium subsp. *oxysepalus* (Boiss.). in Ost. Bot. Zeitschr. 94: 170 (1948); Fl. Iranica, Rechinger, 2: 12 (1963); Fl. Europaea, Stace, 3: 80 (1972); Fl. Turkey, Parris, 6: 204 (1976).

Herbs, adpressed pubescent-pilose, Woody-based, perennial, (60-70) cm. Stem erect, rigid, divaricate branched, green, (400-600)x(1.0-1.5) mm. Leaves sessile, alternate-spiral, margin entire, apex acute or acuminate, base obtuse, green, lower cauline leaves narrowly oblong, narrowly ovate or narrowly oblanceolate, (5-20)x(1.5-6.0) mm, upper cauline leaves lanceolate, narrowly oblanceolate or oblanceolate, (5-22)x(1-7) mm. Inflorescence solitary or a cyme (2-4 flowers), Bracts, cultrate, narrowly oblong, lanceolate or oblanceolate, margin entire, apex acute-acuminate, base obtuse, green, (3.0-5.2)x(1.0-1.3) mm. Flowers axillary and terminal, hermaphrodite, pedicel costate, green, (3-4)x(0.3-0.5) mm, Calyx 5 sepals, 2 outer and 3 inner, adpressed pubescent-pilose, outer sepals lanceolate-narrowly oblong, margin entire, apex acute-acuminate, green, (5.0-7.5)x(2.0-2.5) mm, inner sepals lanceolate, margin entire, apex acute, green, (6.0-7.3)x(2.0-2.2) mm, Corolla funnelform, veins pubescent from the outer, pink, (11.0-14.5)x(2.3-5.5) mm, Stamens 5, epipetalous, inserted above corolla base, filaments filiform, yellow, (3.5-5.0)x(0.25-0.30) mm, anthers oblong, yellow, basifixed attachment with filaments, (1.7-2.0)x(0.6-0.8) mm. Pistil one, ovary superior, narrowly oblong-oblanceolate, green-yellow, (1.5-2.0)x(1.4-1.6) mm, style 1, filiform, yellow, (3.3-4.0)x(0.15-0.20) mm, stigma 2-branched, rough, yellow, (3.0-3.4)x(0.10-0.15) mm. Fruit simple, dry, capsule, obovoid or very broadly obovoid, yellow, (4.5-6.0)x(3.5-5.0) mm, nectar disc present at the base of ovary, yellow. Seeds numerous, oblong, globoid-semigloboid, soft hairy, brown, (3.0-3.3)x(2.5-2.8) mm. (Plates 2, 5 and 6; Tables 2, 3 and 4).

Lectotype: [Palestine] ad Tiberiadem, Boissier (G).

Studied samples

MSU: ESUH/ Mergapan-Pira Magrun mountain (North-West of Sulaimaniya), 800 m, 20.4.2018, A. Ghafoor and A. Sardar, 7718.

Environment notes

The plant was found as scattered individuals, in the rocky clay soils; altitude: 800 m; flowering: April-June. (Figure 1).

Anatomical Study (for *O. mutelii*)

In the leaf, the epidermis is covered by the cuticle layer which is not equal in its thickness from region to region, 2.0-5.0 μm ; The epidermal cells shape in the cross sections were oblong, ovate, quadrate, irregular, different sizes, straight or oblique radial walls, straight or convex external and internal walls, 15.0-30.0 μm . the mesophyll of dense homogenous cells, oblong, circular, semi-circular, irregular, with different sizes, more intercellular spaces, most cells have a projection inter the adjacent cell, 450-720 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, circular, semi-circular, quadrate or irregular cells, having different sizes, straight or oblique radial walls, straight or convex external and internal walls; the thickness of the epidermis depending on the differences in the cell sizes, 20-40 μm . The cuticle layer was 2.0-8.0 μm .

The cortex consists of numerous layers (8-14) of parenchymal tissue, the cells of different shapes and sizes, oblong, semi-circular or irregular, with intercellular spaces, 320-500 μm . The vascular tissue as a ring, of xylem and phloem, xylem of vessels, phloem more developed than xylem, xylem 80-120 μm phloem 60-90 μm . The pith consists of parenchymal cells, oblong, circular, semi-circular, irregular, with different sizes, intercellular spaces present, 400-600 μm . (Plate 7 and Table 5).

Table (2): Plant hight with Stem, Leaves and Bract dimensions

Species	Hight (cm)	Stem (mm)		Leaves (mm)		Bracts (mm)	
		length	width	length	width	length	width
<i>O. mutelii</i>	14-16	60-80	3.0-3.5	5.5-8.5	2.5-3.5	5.0-6.5	2.4-2.8
<i>C. dorycnium</i>	60-70	400-600	1.0-1.5	5.0-22.0	1.0-7.0	3.0-5.2	1.0-1.3

Table (3): Calyx, Corolla and Stamen dimensions in mm

Species	Calyx		Corolla		Stamens			
					filament		anther	
	length	width	length	width	length	width	length	width
<i>O. mutelii</i>	6.1-	5.7-	16.0-	12.7-	5.0-	0.25-	1.5-	1.4-
	6.7	7.9	20.0	16.0	8.5	0.35	1.7	1.8
<i>C. dorycnium</i>	5.0-	2.0-	11.0-	2.3-5.5	3.5-	0.25-	1.7-	0.6-
	7.5	2.5	14.5		5.0	0.30	2.0	0.8

Table (4): Pistil and Fruit dimensions in mm

Species	Pistil						Fruit	
	ovary		style		stigma			
	length	width	length	width	length	width	length	width
<i>O. mutelii</i>	4.4-5.0	2.7-3.2	5.0-	0.25-	1.2-	1.0-1.3	4.0-	4.5-
			5.5	0.30	1.5		7.0	7.5
<i>C. dorycnium</i>	1.5-2.0	1.4-1.6	3.3-	0.15-	3.0-	0.10-	4.5-	3.5-
			4.0	0.20	3.4	0.15	6.0	5.0

Table (5): Leaf and Stem cross section thickness in μm

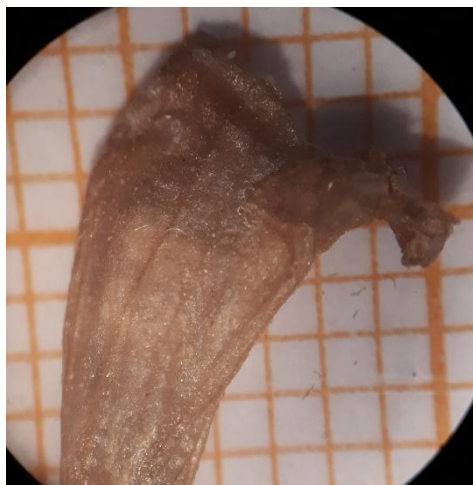
Species	leaf			stem				
	cuticle	epidermis	mesophyll	cuticle	epidermis	cortex	xylem	phloem
<i>O. mutelii</i>	2.0-	15.0-30.0	450-720	2.0-	20-40	320-	80-	60-90
	5.0			8.0		500	120	



Cauline leaves



Inflorescence



Corolla



Calyx and Epicalyx



Corolla lobes apex

Plate (3): Different plant parts of *O. mutellii*



Stamens

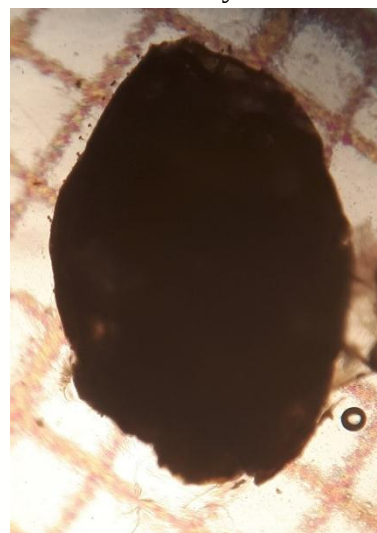


Ovary

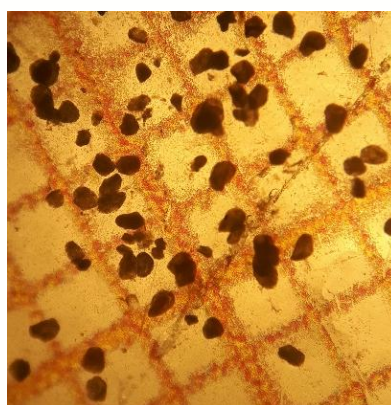


Style and Stigma

3 mm



Capsule



Seeds

Plate (4): Reproductive parts of *O. mutellii*



Lower cauline leaves



Upper cauline leaves



Inflorescence



Flower

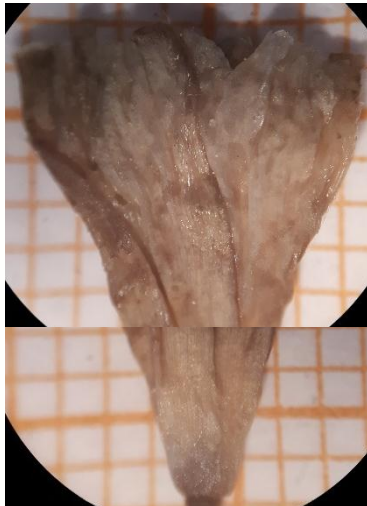


Outer sepals



Inner sepals

Plate (5): Different plant parts of *C. dorycnium*



Corolla



Stamens



Single stamen

3 mm



Pistil



Capsule



Seeds

Plate (6): Reproductive parts of *C. dorycnium*

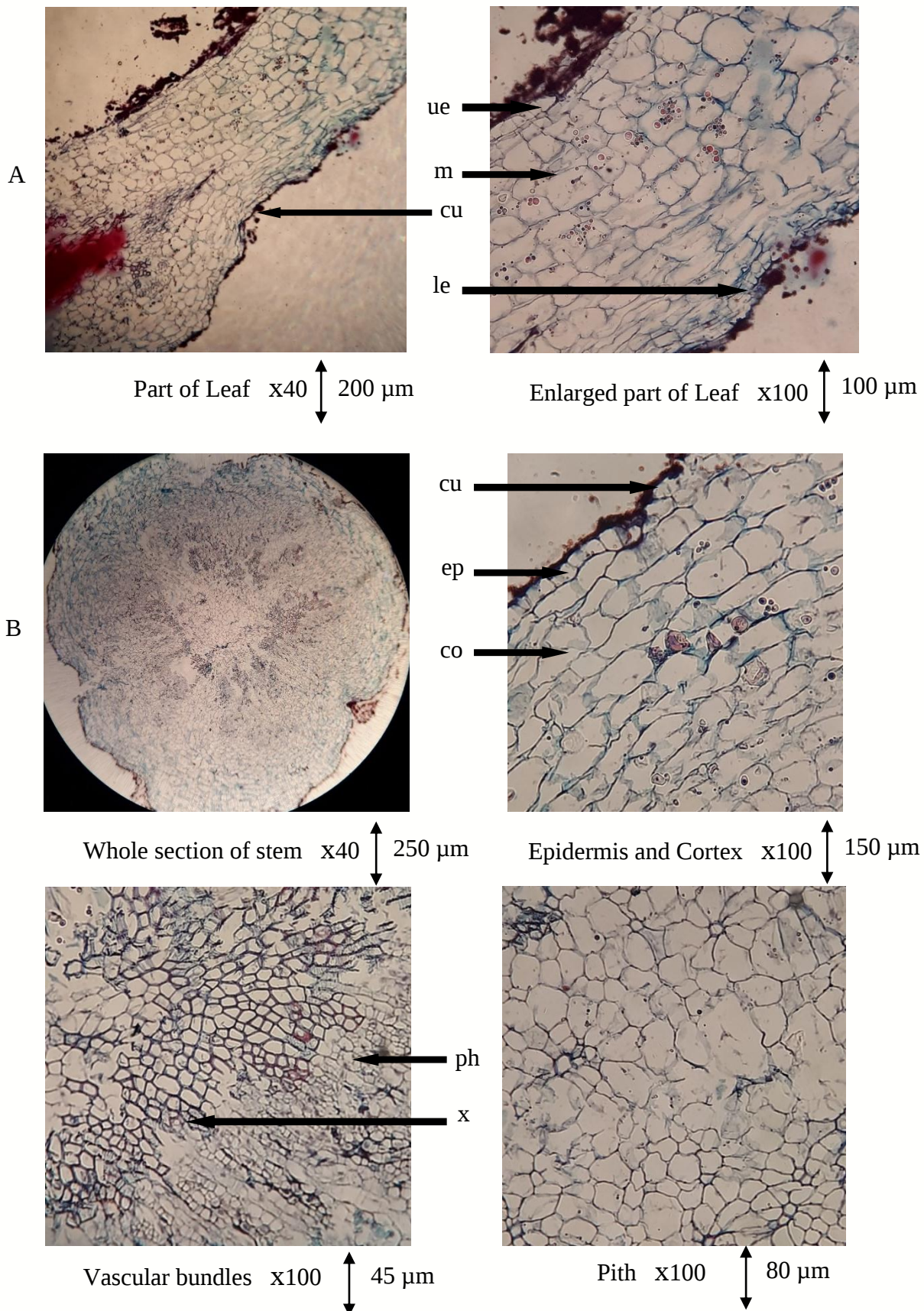


Plate (7): C.S. of: A. Leaf and B. Stem of *O. mutelii*: cu: cuticle; ue: upper epidermis; m: mesophyll; le: lower epidermis; ep: epidermis; co: cortex; ph: phloem; x: xylem

Discussion

The current work studied *C. dorycnium* subsp. *oxysepalus* from the family Convolvulaceae as a new host for *O. mutelii* from Orobanchaceae and as a new plant addition in Iraq, and included some features like the morphological characters and environment notes, in addition, some anatomical features for *O. mutelii*. Within the literature review about the genus *Convolvulus* in Iraq, involving the preserved 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 study did not discover any specimens belongs to *C. dorycnium*, as a result, the study regarded the studied specimens of the genus *Convolvulus* as a new plant record for the Flora of Iraq and as new host for *O. mutelii* from Mergapan-Pira Magrun mountain. (Table 1)

C. dorycnium has some characteristics differ from the related species that is *C. reticulatus* Choisy which present in Iraq and has the subsequent diagnostic characters: plant with adpressed pubescent-pilose hairs, leaves apex acute or acuminate, base obtuse, Inflorescence solitary or a cyme, flowers axillary and terminal, outer sepals lanceolate-narrowly oblong, margin entire, apex acute-acuminate, corolla veins pubescent from the outer, pink, (11.0-14.5)x(2.3-5.5) mm. The leaf anatomy showed that the mesophyll of dense homogenous cells with more intercellular spaces, vascular bundles 8-11. In the stem, cortex consists of numerous layers of parenchymal tissue, the vascular tissue as a ring, xylem of vessels, phloem more developed than xylem, the pith consists of parenchymal cells, with intercellular space. (Plate 7).

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