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TAXONOMIC STUDY FOR THE NEW RECORD *CEPHALARIA HIRSUTA* STAPF (DIPSACACEAE) IN IRAQ

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Abstract

Cephalaria hirsute Stapf is a new plant record within Dipsacaceae family in Iraq, from Halgurd mountain. The collected specimens from the area were with different characteristics: Stem densely retrorse pilose below, sparsely pilose above; Leaves simple or lyrate, 1-3 pairs of segments, adpressed pilose; peduncle costate, sparsely pilose; Involucral bracts broadly ovate, apex and base obtuse, pubescent and pilose, receptacular bracts narrowly obovate-oblong, oblong, apex acuminate, base obtuse; Outer calyx or involucel with 4 long and 4 short teeth. Identification and morphological study have been done, these illustrated by graphs. Pollens character have been clarifiedlike shapes, colors, sizes, surface ornamentation and numbers. As well as, some features of the leaf and stem anatomy have been examined.

Key words: Taxonomic study, *Cephalaria hirsuta*, Dipsacaceae, Halgurd mountain, Iraq

Introduction

Dipsacaceae family is one of the families in Iraq, include 350 species of 11 genera over the world (Heukles, 2000), in Iraq consist of 24 species within 4 genera (Al-Rawi, 1964). In Europe, the Dipsacaceae family known as Teasel (Heukles, 2000), as well as, the genus *Dipsacus* L. within same family also known as Teasel (Knopf, 2000). Shishkin (1957), in the U.S.S.R. Flora, indicated 23 species of the genus *Cephalaria*. Whilst in Turkey, Matthews (1972) clarified 29 species, one of them is *C. hirsuta*, Ferguson (1986), in Europe mentioned 14 species, and Migahid (1978), in Saudi Arabia, stated 1 species of the genus. Whilst, Rechinger, (1991) in Iran, indicated 7 species of the *Cephalaria* genus, in addition to Ghahreman and Attar (1999) whom stated 8 species. In the low lands of Iraq, Rechinger (1964) pointed out 2 species. Whilst Al-Rawi (1964), Ridda & Daood (1982) with Ghazanfar and Edmondson (2013) mentioned 5 species of the genus in Iraq. Khalaf (1980) stated the presence of 2 species in Sinjar mountain. Faris (1983) indicated 3 species in Piramagrun mountain, whilst Fatah (2003), Ahmed (2010) and Hameed (2016) mentioned only 1 species of the genus in Haybat Sultan mountain, Darband Gomaspan and Hujran Basin separately. Mahmood (2009) indicated 4 species in Kurdistan Region of Iraq, in addition to Ahmad (2013) who also pointed out 4 species in Hawraman region. Finally, Darwesh (2017) did not indicate any species of the genus *Cephalaria* in Choman region. From the similar studies that involve new plant records in Iraq the study of (Al-Musawi and Majeed, 2013), (Haloob, 2016) and (Sardar, 2017).

The purpose of the current study is to confirm the presence of the species *C. hirsuta* in Iraq and to study the morphological characters, as well as, some ecological notes, pollen grain characters with some features of the leaf and stem anatomy of the species.

Materials and Methods

For plant specimens collection, various scientific trips were made to the different regions of northern districts (Kurdistan region) of Iraq: Amadiya district (MAM), Rowanduz district (MRO), Sulaimaniya district (MSU), Kirkuk district (FKI), Arbil district (FAR) and Nineveh district (FNI) during the year 2017, the specimens of some Iraqi herbaria were utilized, the specimens were identified by using the key in Flora of Turkey, as well as, the specimens were treated herbarially to become formal specimens, and preserved in herbarium of Education college (ESUH). Some environmental notes were cleared, and a map (Fig. 1) was used. For the pollens, anthers were fixed in FAA, 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 pollens, and 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 mobile camera (Sumsung-A5) has been utilized for photographing the different plant parts and the scientific terms that came in the study have been taken from (Harris and Harris, 2001), (Hesse *et al.*, 2009) and (Agashe and Caulton, 2009). For the leaf and stem anatomy, the procedure in (Al-Mashhadani, 1992) has been used and the information in (Metcalfe and Chalk, 1950) were utilized.

Results and Discussion

Morphological Study

Cephalaria hirsuta Stapf in Denkschr. Akad. Wiss.Wein, Math.-Nat. K1. 50:55 (1885), Fl. Turkey, Matthews, 4: 592 (1972).

Perennial, herbs, (27-32) cm, stem erect, costate, branched (3-6 branches), densely retrorse pilose below, sparsely pilose above, green-brown, (5-7) × (0.16-0.18) cm, branches (2-13) × (0.15-0.20) cm, pilose hairs (0.5-3.0) × (0.04-0.15) mm. Leaves simple or lyrate, 1-3 pairs of segments, opposite-decussate, become smaller upwardly, adpressed pilose, Basal leaves segments oblanceolate-narrowly oblanceolate, narrowly oblong, margin entire, dentate or serrate, apex acuminate, base attenuate, green, large segments (25-100) × (7-20) mm, small segments (25-100) × (7-20) mm, entire leaves (40-130) × (10-30) mm, lower cauline leaves segments cultrate, narrowly oblanceolate, margin entire, dentate or serrate, apex acuminate, base attenuate, green, large segments (30-40) × (6-8) mm, small segments (6-15) × (1-2) mm, entire leaves (30-60) × (15-25) mm. upper cauline leaves segments cultrate-linear, cultrate, oblanceolate-narrowly oblanceolate, margin entire, apex acuminate, base attenuate, green, large segments (8-20) × (1.0-2.5) mm, small segments (4-6) × (0.7-1.0) mm, entire leaves (10-30) × (4-12) mm. Inflorescence a cyme head, globose-semi globose, (11-18) × (14-17) mm, peduncle costate, green, sparsely pilose, (32-160) × (0.8-15) mm. Involucral bracts membranous, numerous rows (5-7), each row with 5-6 bracts, broadly ovate, margin entire, apex and base obtuse, pubescent and pilose, yellow, (5-7) × (1.7-5.5) mm, receptacular bracts membranous, narrowly obovate-oblong, oblong, margin entire, apex acuminate, base obtuse, yellow (apex brown-black), pubescent and pilose, (7.5-9.0) × (3.3-4.2) mm. Flowers numerous, peripheral flowers sterile. Outer calyx or involucel of tube and limb, the tube cup-shaped, with 8 farrows and ridges, pilose, green-yellow, (1.7-2.1) × (1.5-1.7) mm, the limb with 4 long and 4 short teeth, (2.0-3.1) × (1.5-2.0) mm. Inner calyx of tube and limb, the tube ellipsoid-broadly ellipsoid, with 8 farrows and ridges, pubescent upwardly, pilose downwardly, yellow-brown, (2.0-2.3) × (1.7-2.0) mm, the limb with 20-25 minute teeth, pubescent, yellow, (1.0-1.2) × (1.7-2.1) mm. Corolla of tube and limb, the tube of central flowers pubescent and pilose outwardly, pilose inwardly, yellow, (5.2-6.1) × (1.4-1.8) mm, of peripheral flowers (5.8-6.5) × (2.2-2.6) mm, the limb of central flowers with 4 equal lobes or with 2 long and 2 short lobes, obovate-narrowly obovate, apex obtuse, margin crenulate, (3.0-4.0) × (2.0-2.5) mm, peripheral flowers of 4 lobes, one is the larger,

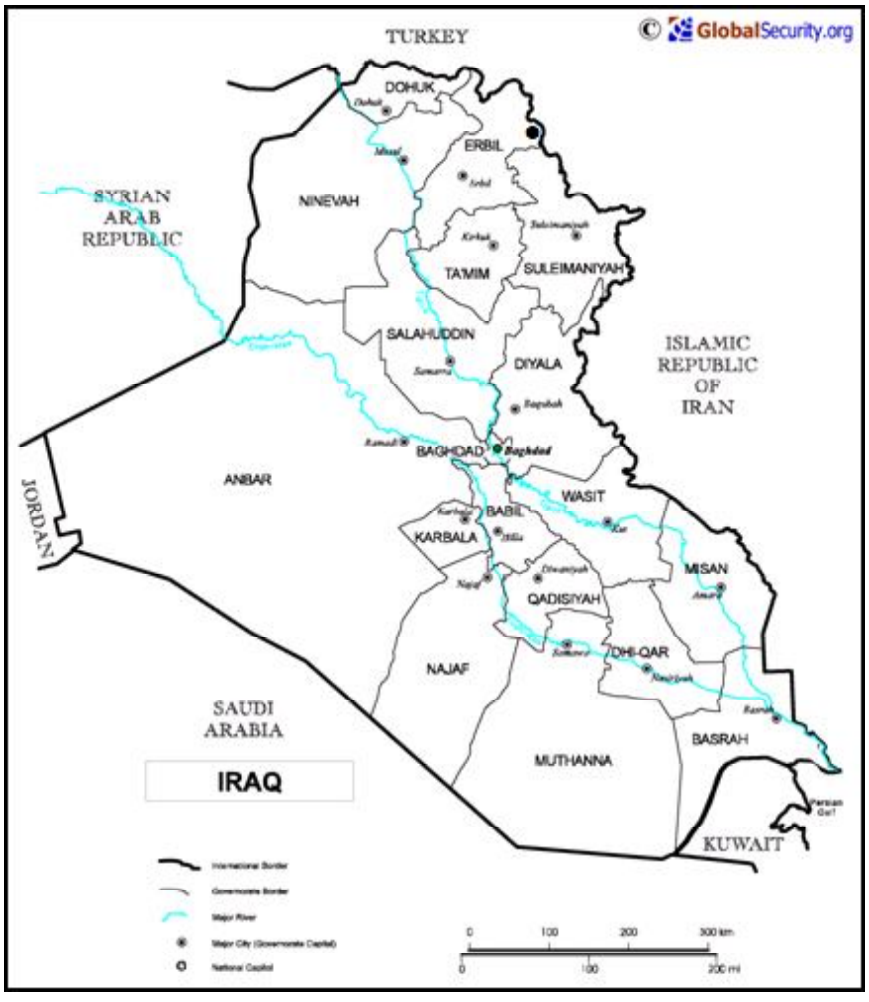


Fig 1: A map of Iraq shows the location of *C. hirsuta* ●

Plate 1: Photograph of *C. hirsuta*

(5.0-7.0) × (2.5-4.0) mm. Stamens 4, exerted, epipetalous, inserted at the base of the corolla limb lobes and alternate with them, filaments filiform, yellow, (4.0-8.0) × (0.15-0.25) mm, anthers cultrate, narrowly oblong, brown, versatile attachment with the filaments, (1.7-2.5) × (0.4-0.7) mm. Pistil single, ovary inferior, uni-locular, single pendulous ovule, narrowly oblong, yellow-white, (1.7-2.1) × (0.5-0.8) mm, (the ovary don't grows in the sterile peripheral flowers), style filiform, terminal attachment with the ovary, yellow, (3.5-4.3) × (0.30-0.40) mm, in the peripheral flowers, the style lengths are shorter (1.8-2.0) mm, stigma oblong-clavate, hollow, reach to the lower quarter of the corolla limb lobes, yellow, (2.5-3.3) × (0.25-0.40) mm, in the peripheral flowers, the stigma shorter, (1.4-2.0) mm. Fruit simple, dry, indehiscent, achenial, cypsela. (Plates 1-3).

Type: [W. Iran] in agro Ecbatanensi (Media), Pichler (iso. K!).

Studied specimens

MRO: ESUH/ Halgurd mountain (north-east of Erbil), 2400 m, 20.7.2017, A. Sardar, S. Al-Dabagh and R. Khdir, 7596.

Environment notes

Found as population within the area, in clay and rocky clay soils; altitude: 2400 m; flowering: July. (Fig. 1).

Palynological Study

Pollens yellow, single, angular, tricolporate, oblate-subspheroidal with obtuse ends in equatorial view, triangular-subspheroidal with obtuse angles and convex sides in polar view, medium size according to (Erdtman, 1971), equatorial axis 40-48 µm, polar axis 41-45 µm, echinate and microechinate surface ornamentation, numerous. (Plate 4).

Anatomical Study

The epidermis is covered by the cuticle layer which is not equal in its thickness from region to region, 2.50-6.25 µm; The epidermal cells shape in the cross sections were oblong, semi-circular, different sizes, straight radial walls, straight or convex external and internal walls, 10-25 µm. the mesophyll of palisade and spongy layers, palisade cells 2-layers, oblong, 3.75-5.00 µm, spongy cells irregular, 5.50-6.25 µm, vascular bundles 7, one is the midrib, concave in shape, Parenchymal tissue surround the vascular bundles with different shapes, circular or semi-circular, the xylem of 12-15 rows of vessels, with thickened walls, 7.5-10.0 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 cells, having different sizes; The thickness of the epidermis depending on the differences in the cell sizes. straight radial walls, straight or convex external and internal walls, 6.25-12.5 µm. The cuticle layer was 2.50-3.75 µm.

The cortex consists of 2-3 layers of parenchymal tissue, the cells of different shapes and sizes, 40-80 µm. The vascular tissue is a continuous layer of xylem and phloem which forming a closed cylinder, vessels form radial rows; others distributed in the interfascicular xylem, 70-110 µm. The pith consists of parenchymal cells, polygonal (5-8 faces), with many intercellular spaces, crystals present in the pith cells near the vascular bundles and cells around the vascular bundles, 600-800 µm. (Plate 5-6).

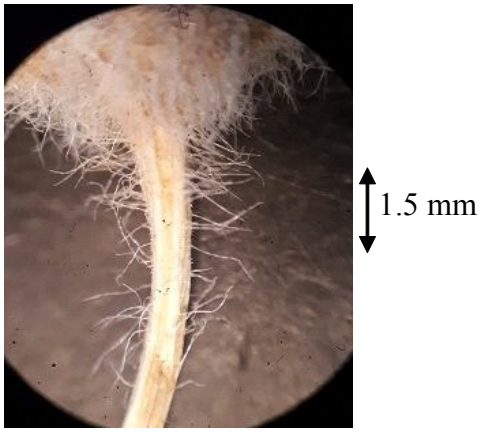
The current work studied the new plant record *C. hirsute* within Dipsacaceae family in Iraq, and included some features as the morphological characters and the environment. Within the literature review about the genus *Cephalaria*in Iraq, involving the plant specimens of National Herbarium of Iraq (BAG), College of Science Herbarium, University of Salahaddin-Erbil, Iraq (ARB) and College of Education Herbarium, University of

Basal leaf

Lower cauline leaves

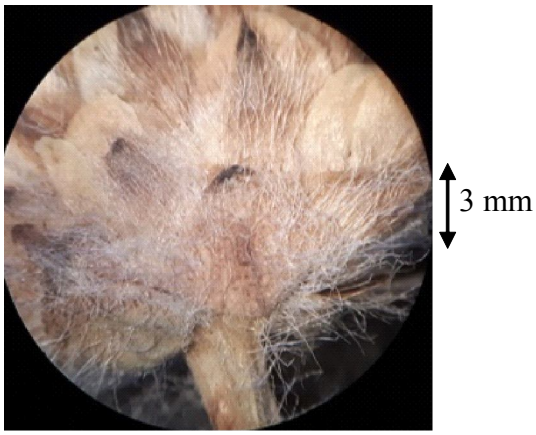
Upper cauline leaves

Retrorse pilose hairs



Sparsely pilose hairs

Head (Capitulum)



Involucral bracts

Plate 2: Plant parts of *C. hirsuta*

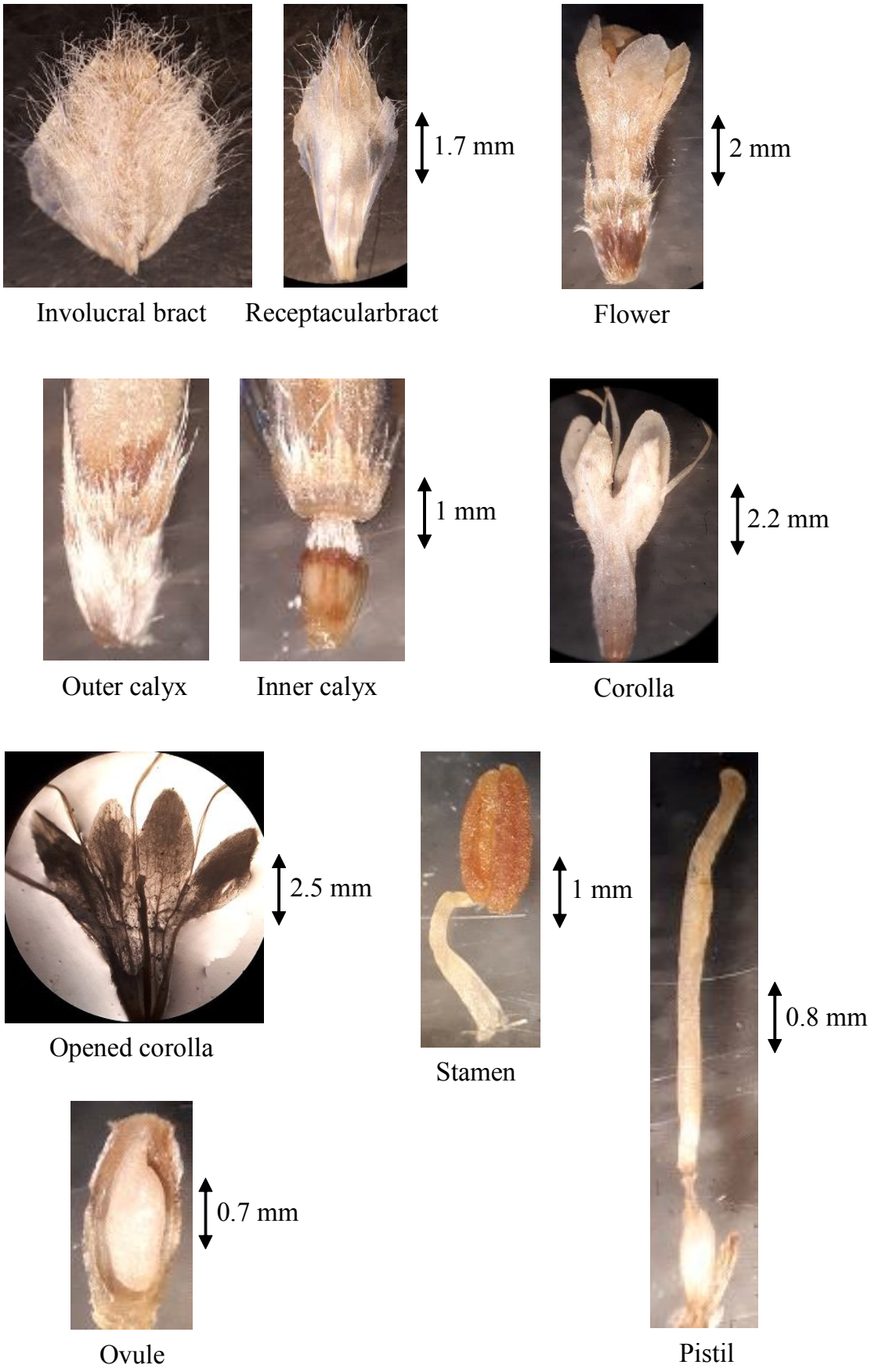
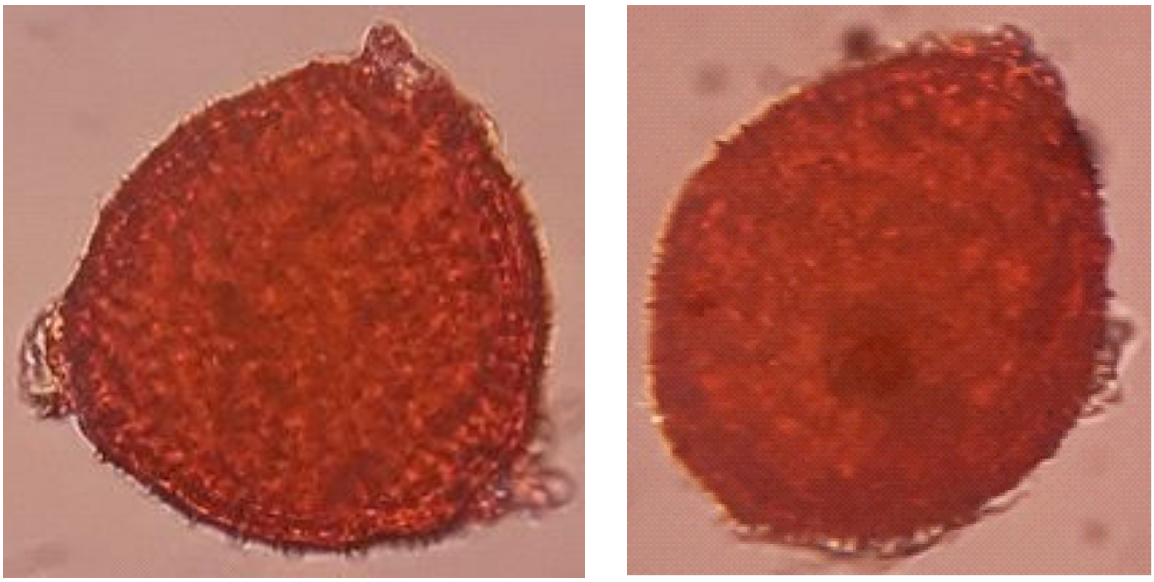
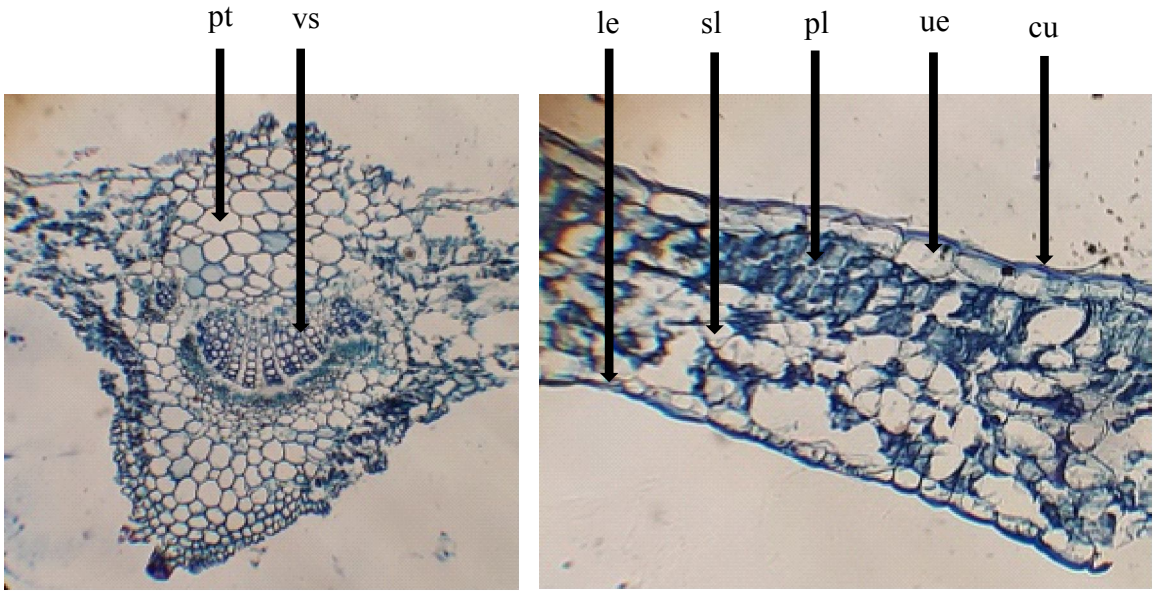


Plate 3: Reproductive parts of *C. hirsuta*



Polar view Equatorial view

Plate 4: Pollens of *C. hirsuta* × 400



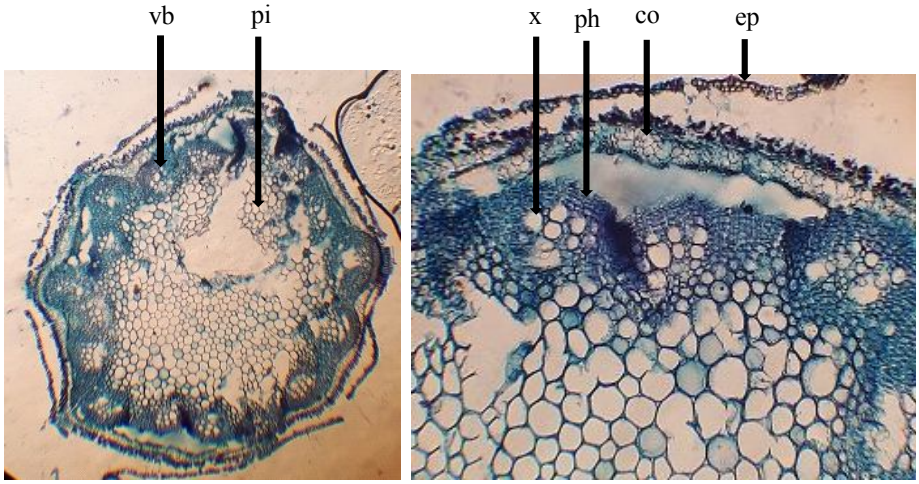
Leaf midrib region Partof leaf

Plate 5: C.S. of the leaf of *C. hirsuta* × 100

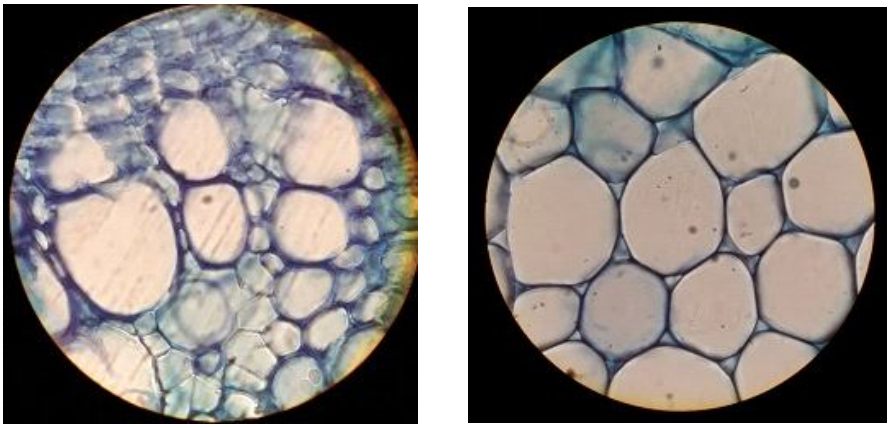
cu:cuticle; ue:upper epidermis; le:lower epidermis; pl:palisade layer; sl:spongy layer; pt:parenchymal tissue; vs: vesseles

Salahaddin-Erbil, Iraq (ESUH), the researcher did not find any plant specimens belongs to *C. hirsuta*, therefore the study regarded the studied plant specimens as a new record for the Flora of Iraq from Halgurd mountain.

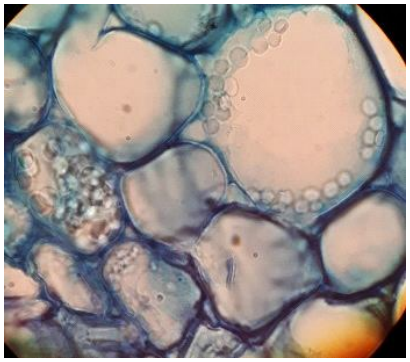
C. hirsuta has some characters differ from the related species that is *C. microcephala* Boiss. which found in Iraq and has the following characteristics: Stem densely retrorse pilose below, sparsely pilose above; Leaves simple or lyrate, 1-3 pairs of segments, adpressed pilose; peduncle costate, sparsely pilose; Involucral bracts broadly ovate, apex and base obtuse, pubescent and pilose, receptacular bracts narrowly obovate-oblong, oblong, apex acuminate, base obtuse; Outer calyx or involucel with 4 long and 4 short teeth. Pollens were single, tricolporate, oblate-subspheroidal in equatorial view, triangular-subspheroidal in polar view, medium size according to (Erdtman, 1971), echinate and microechinate surface ornamentation, numerous in number. Leaf anatomy showed that the mesophyll of palisade and spongy layers, palisade cells 2-layers, spongy cells irregular, vascular bundles 7, Parenchymal tissue surround the vascular bundles, the xylem of 12-15 rows of vessels;



Whole section X40 Enlarged part X100



Vascular bundleX1000 Pith cellsX1000



CrystalsX1000

Plate 6: C.S. of the stem of *C. hirsuta*
ep: epidermis; co: cortex; ph: phloem; x: xylem;pi: pith; vb: vascular bundle

the stem anatomy showed that the cortex consists of 2-3 layers of parenchymal tissue, xylem and phloem forming a closed cylinder, vessels form radial rows, others distributed in the interfascicular xylem, the pith consists of parenchymal cells, polygonal (5-8 faces), with many intercellular spaces, crystals present. (Plate 5-6).

References

Agashe, S.N. and E. Caulton (2009). Pollen and Spores, Applications with Special Emphasis on Aerobiology and Allergy. Science Publishers, Enfield, NH, USA: 400 pp.

Ahmed, K.H. (2010). The Vascular Plants of Darband Gomaspan and the Adjacent Areas in Erbil Province. High Deploma

Thesis, Salahaddin University, *Erbil,* Iraq: 19.

Ahmad, S.A. (2013). Vascular Plants of Hawraman Region in Kurdistan Iraq. Ph.D. Dessartation, University of Sulaimani, Sulaimaniya, Iraq: 91.

Al-Mashhadani, A.N. (1992). A Comparative Systematic Study of the genus *Onosma* L. (Boraginaceae) in Iraq. Ph.D. Dessartation, Baghdad University: 137-138.

Al-Rawi, A. (1964). Wild plants of Iraq with their distribution. Ministry of Agriculture & Irrigation, State board for agricultural & water resources research, National Herbarium of Iraq, Baghdad: 102.

Darwesh, D.T.D. (2017). Plant Biodiversity and Ethnobotanical Properties of Various Plants in Choman (Erbil-Iraq). M. Sc. Thesis, Kahramanmara?Sütçü Ýmam University, Graduate School of Natural and Applied Sciences University, Kahramanmara?, Turkey: 130 pp.

Faris, Y.S. (1983). The Vascular Plants of Pira Magrun mountain. M. Sc. Thesis, Salahaddin University, Erbil, Iraq: 49-51.

Fatah. H.U. (2003). The Vascular Plants of Haibat Sultan mountain and the Adjacent Areas. M. Sc. Thesis, University of Sulaimani, Sulaimaniya, Iraq: 38.

Ferguson. I.K. (1986). In: *Flora Europaea.* **Vol.4.** Cambridge Univ. Press: 57-58.

Erdtman, G. (1971). Pollen Morphology and Plant Taxonomy, Angiosperms. Hafner publishing company, New York:18.

Ghahreman, A. and F. Attar (1999). Biodiversity of Plant Species in Iran. Central Herbarium, Tehran Univ., Tehran, Iran: 83.

Ghazanfar, S.A. and J.R. Edmondson (2013). *Flora of Iraq,* **Vol.5**, P.2, Ministry of Agriculture-Iraq, by Royal Botanic Gardens, Kew: 298-302

Hameed, M.A.H. (2016). Vascular Plant Taxa of Hujran Basin-Erbil/ Iraq. M. Sc. Thesis, Kahramanmara? Sütçü Ýmam University, Graduate School of Natural and Applied Sciences University, Kahramanmara?, Turkey: 74.

Harris, J.G. & M.W. Harris (2001). Plant Identification Terminology, An Illustrated Glossary. 2nd edition, Spring Lake Publishing, Spring Lake, Utah, United States: 206 pp.

Hesse, M., H. Halbritter, R. Zetter, M. Weber, R. Buchner, A. Frosch-Radivo and S. Ulrich (2009). Pollen Terminology, An illustrated handbook. Springer- Verlag/Wien, Austria: 219

Heukles, P. (2000). Wild Flowers of Britain and Europe, Harper Collins Publishers, 77-85 Fulham Palace Road-London W6 8JB: 607.

Khalaf, M.K. (1980). The Vascular Plants of Jabal Sinjar. M. Sc. Thesis, Baghdad University, Baghdad, Iraq: 65.

Knopf, A.A. (2000.) Field guide to wild flowers, Castern region (North America). National Audubon Society, Alfred A. Knopf Publisher, New York: 492.

Matthews, V.A. (1972). In: *Flora of Turkey,* **Vol. 4.** Edinburgh at the University press: 585 – 597.

Metcalfe, C.R. and L. Chalk (1950). Anatomy of the Dicotyledons, Leaves, Stem, and Wood in Relation to Taxonomy with Notes on Economic Uses. Vol. 1, Oxford, at the Clarendon press: 780-781.

Migahid, A.M. (1978). *Flora of Saudi Arabia.* **Vol. 1,** Riyadh Univ. publ.: 534.

Rechinger, K.H. (1964). Flora of low land Iraq. Weinheim verlag von. *J. Cramer,* wein: 578-579.

Ridda, T.J. and W.H. Daood (1982). Geographical distribution of wild vascular plants of Iraq. National Herbarium of Iraq, *Un. publ.:* 68.

Mahmood, Sh. A.F. (2009). Systematic Study of the *Genera Cephalaria* (L.) Schrad. and *Dipsacus* L. (Dipsacaceae) in Kurdistan Region of Iraq. M. Sc. Thesis, University of Sulaimani, Sulaimaniya, Iraq: 187.

Rechinger, K.H. (1991). *Flora Iranica.* No.168, Akademische Druck-u.

Sardar, A. Sh. (2017). A New Record of Saxifraga a fghanica Aitch. & Hemsl. (Saxifragaceae) in Iraq. *Iraqi Journal of Science,* **58(1B)**, College of Science, University of Baghdad, Iraq: 222-229.

Simpson, M.G. (2006). *Plant Systematics.* Elsevier Academic Press, USA: 259.

Shishkin, B.K. (1957). *Flora of the U.S.S.R.,* Vol.24. Izdatelstro Akademii Nauk SSSR, Moskva-Leningrad: 20-37.

Verlagsanstalt, Graz-Austria : 8-18. Al-Musawi, A.H. and I.A. Majeed (2013). New record species-from the family Euphorbiaceae in Iraq. *Iraqi Journal of Science,* **54(3)**, College of Science, University of Baghdad, Iraq: 536-546. Haloob, A. (2016). A New Record for the Flora of Iraq: *Limonium Meyeri* (Plumbaginaceae). *Indian Journal of Plant Sciences,* **5(1)**, An Open Access, Online International Journal: 8-10.http://www.cibtech.org/jps.htm