

## TAXONOMIC STUDY FOR THE NEW RECORD *OGASTEMMA PUSILLUM* (BORAGINACEAE) IN IRAQ

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### ABSTRACT

During the filed survey of 140-160 kilometers region and on both sides of the highway west of Ramadi city in the western desert district of Iraq, and in late spring of 2019, confirmed the recorded of the *Ogastemma* genus for the first time in Iraq, which was characterized by being a monotypic genus belonging to Boraginaceae family and represented by *Ogastemma pusillum*. After the identification of the species, which was based on the Flora of the neighboring countries, the species was studied taxonomically. The study worked on describing and photographing all the vegetative and floral parts, anatomy of stem, stomatal complex in leaves, and pollen grains. The plant specimens were preserved under the numbers 60264, 60265 in the Iraqi national herbarium. A morphological study showed that there was uniform indumentum of the epidermis of vegetative organs was appressed-hispid, represented by non-glandular trichomes, medium length of 800-1500 micrometer.

Keywords: Plant taxonomy, wild plants, flora of Iraq, western desert.

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دراسة تصنيفية للنوع *Ogastemma pusillum* (Boraginaceae) المسجل جديداً في العراق

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### المستخلص

من خلال المسح الميداني لمنطقة الكيلو 140-160 وعلى جانبي طريق المرور السريع غرب مدينة الرمادي ضمن مقاطعة الصحراء الغربية من العراق، وفي أواخر فصل الربيع من العام 2019 تم تسجيل الجنس *Ogastemma* لأول مرة في العراق، والذي يتميز بكونه جنساً وحيد النوع Monotypic genus يتبع الى العائلة Boraginaceae، متمثلاً بالنوع *Ogastemma pusillum*. بعد تشخيص النوع بدقة، وبالاعتماد على الموسوعات النباتية للدول المجاورة، تمت دراسته تصنيفياً فقد عملت الدراسة على وصف وتصوير جميع الاجزاء الخضرية والزهرية، وتشريح الساق، والمعقد الثغري في الأوراق وحبوب اللقاح. أودعت العينات النباتية تحت الارقام 60264، 60265 في المعشب الوطني العراقي. اظهرت الدراسة المظهرية وجود طراز واحد للكساء الشعيري لبشرة الاعضاء الخضرية بشكل عام، وهو الطراز المشعر الخشن القصير hispid، والذي تمثل بشعيرات غير غدية، متوسطة الاطوال، تراوحت بين 800 - 1500 مايكروميتر.

كلمات مفتاحية: تصنيف النبات، نباتات برية، فلورا العراق، الصحراء الغربية.

## INTRODUCTION

One of the plant families in Iraq is Boraginaceae that involves 2000 species throughout the world which distributed on 100 genera in tropical and temperate regions (18), in Iraq the family Boraginaceae has been poorly studied, which involves 26 genera (3), and about 93 wild species (5). The genus *Ogastemma* Brumitt belongs to Boragineae tribe (11), which is located within Boraginoideae subfamily that belongs to Boraginaceae family (20). *Ogastemma* is characterized for being a monotypic genus, represented by *Ogastemma pusillum* (Coss. & Durand ex Bonnet & Barratte) Brumitt (22), which was distributed in most of the neighboring countries such as Iran (37), Jordan (34), Kuwait (1, 13), Saudi Arabia (15), and Turkey (12), as well as its presence in some nearby countries such as Bahrain (2), Egypt (8), Qatar (29) and United Arab Emirates (18). As for worldwide distribution, Chacon *et al.*, (16) pointed to the presence of the species in Algeria, as Le Floch *et al.*, (21) explained a limited presence of the species in Tunisia, while Verloove (35) said that the Canary Island in Spain included the species, which was one of the desert plants that prefer sandy soils (14). Some of the studies (25,26, 31) similar to this study have recorded new species for Iraq, belonging to the same family during the previous years, namely, *Echium rauwolfii*, *Arnebia hispidissim* and *Paracaryum shepardii* respectively, as well as recording of other species such as *Lotus garcinii* (papilionaceae) within the same distrat (24). One of the characteristics of the Boraginaceae family is the indumentum of vegetative organs, which researchers have been interested, among them is Taia (33) who studied the types and density of trichomes in 66 species belonging to 20 genera distributed in Egypt. As well as studying the natural content the trichomes of calcium phosphate (27, 36). This study assured the occurrence of *Ogastemma pusillum* in Iraq based on modern collection, to be followed by a morphological description of all organs in order to facilitate future identify of the new record species, to add to the Iraqi plants, note that the seventh volume of the Iraqi Flora, which cared about

the Boraginaceae family, unfortunately not issued until this time.

## MATERIALS AND METHODS

In late spring of 2019, during the field trips carried by Herbarium Staff in Center of Desert Studies to study the vegetation of specific locations in western desert, namely the 140-160 kilometer region in west of Iraq on both sides of the highway, among the uncommon species collected was *Ogastemma pusillum*, which has been identified based on some scientific references and neighboring countries Flora (8,15,16,34 ,37). The species was studied taxonomically, based on fresh plant samples, which included a complete morphological description, as well as anatomical stem characteristics, the pictures of the vegetative and floral organs were placed, as well as a species distribution map (Figure 1). The measurements of vegetative and reproductive organs were completed (Table 1). The study relied on the hand sections for the preparation of stem slides with the use of safranin stain to coloring of pollen grains and stomatal complex. The specimens (plate 1) were treated and preserved in Anbar University Herbarium (AUH), and in the Iraqi National Herbarium (BAG) under the numbers 60234 and 60235.

## RESULTS AND DISCUSSION

### Newly recorded species

*Ogastemma pusillum* (Coss. & Durand ex Bonnet & Barratte) Brumitt, Kew Bull. 36:680(1982).

**Syn.:** *Megastoma pusillum* Coss. & Durand ex Balansa, Pl. Algerie 1035(1853), nom. nud., ex Bonnet & Barratte, Ill. Tunis, t. 11. f. 4-11 (1895). *Eritrichium sventeni* Sunding, Bull. Jard. Bot. Macarones. 3: 81 (1977). Annual, herb, appressed- hispid, height 10-15 cm., stem erect or ascending, much branched, cylindrical, covered with densely appressed seta, 6-10 x0.1- 0.3 cm.. Leaves simple, sessile, exstipulate, alternate- spiral, covered with tubercle- based seta, margin entire, apex acute, based truncate- rounded or attenuate, basal leaves linear- very narrowly lanceolate, dull greenish-yellow, 26-35 x1.5-1.8 mm., cauline leaves narrowly lanceolate or linear, dark green, 12-23x1.3x2.5 mm. (Plate 2). Bracts leaf-like, linear- very narrowly lanceolate, margin entire, apex acute, base

truncate, densely erect- strigose margins, light green, 6 - 9 x1.1-1.4 mm.. Inflorescences determinate, helicoid cyme, 33-50 mm. number of flowers 7-13, peduncles stem-like, 8-14 x0.8-1.1 mm.. Flowers actinomorphic, pentamerous, pedicels very short, hispid, dark green, 0.4-0.6 x0.3-0.5 mm.. Calyx of 5 gamosepalous at the base, unequal lobes, linear, margin entire, apex acute - rounded, base truncate, hispid, the lower quarter of the sepal is a membranous margin, shiny green, 3.8- 4.4 x2.1-2.3 mm.. Corolla of 5 gamopetalous, tubular- salverform, lobes imbricate, faucal appendages absent, circular, margin sinuate, apex rounded, glabrous, white, 2.4-3.2x 0.8-1.1 mm.. Stamens 5, in one whorl, anthers ovoid-ellipsoid, yellow, dorsifixed attachment with the filaments, longer than the filiform, 0.6- 0.8x0.3-0.5 mm., filaments filiform, yellow, very short, 0.35-0.45x 0.08- 0.10 m.. Pistil 1, ovary superior, 2 syncarpous, 4 locules, oblate, style single, cylindrical, gynobasic, yellow, 0.32- 0.38x

0.12x0.15mm., stigma capitate bilobed, very smooth muricate, dark yellow, 0.15-0.18x0.22-0.25 mm.. The fruiting calyx is like a flowering calyx completely, but it is about 25% larger. Fruit of 4 schizocarpic nutlets, narrowly ovoid in dorsal view , narrowly triangular in ventral view , densely verrucose, dull yellow-brown, 1.3-1.7 x0.7 -0.9 mm., the taxonomic importance of the nutlets were clarified by Hammouda *et al.* (17), who confirmed the stability of their shapes and sizes without change, especially the ornamentation. Seed single, pyriform, glabrous, shiny yellow, 1.1-1.4x 0.6- 0.8 mm. (Plate 3). Pollen grains single, tricolporate, semicircular in equatorial view, deltoid in polar view, angulaperturate, white- light yellow, small size (Plate 4), equatorial axis 12.7- 13.8  $\mu\text{m}$ ., polar axis 11.6-12.8  $\mu\text{m}$ .. Al-Shehbaz (6) mentioned the importance of pollen grains in isolating the species of Boraginaceae family, depending on their shapes, sizes, and a number of colpates.

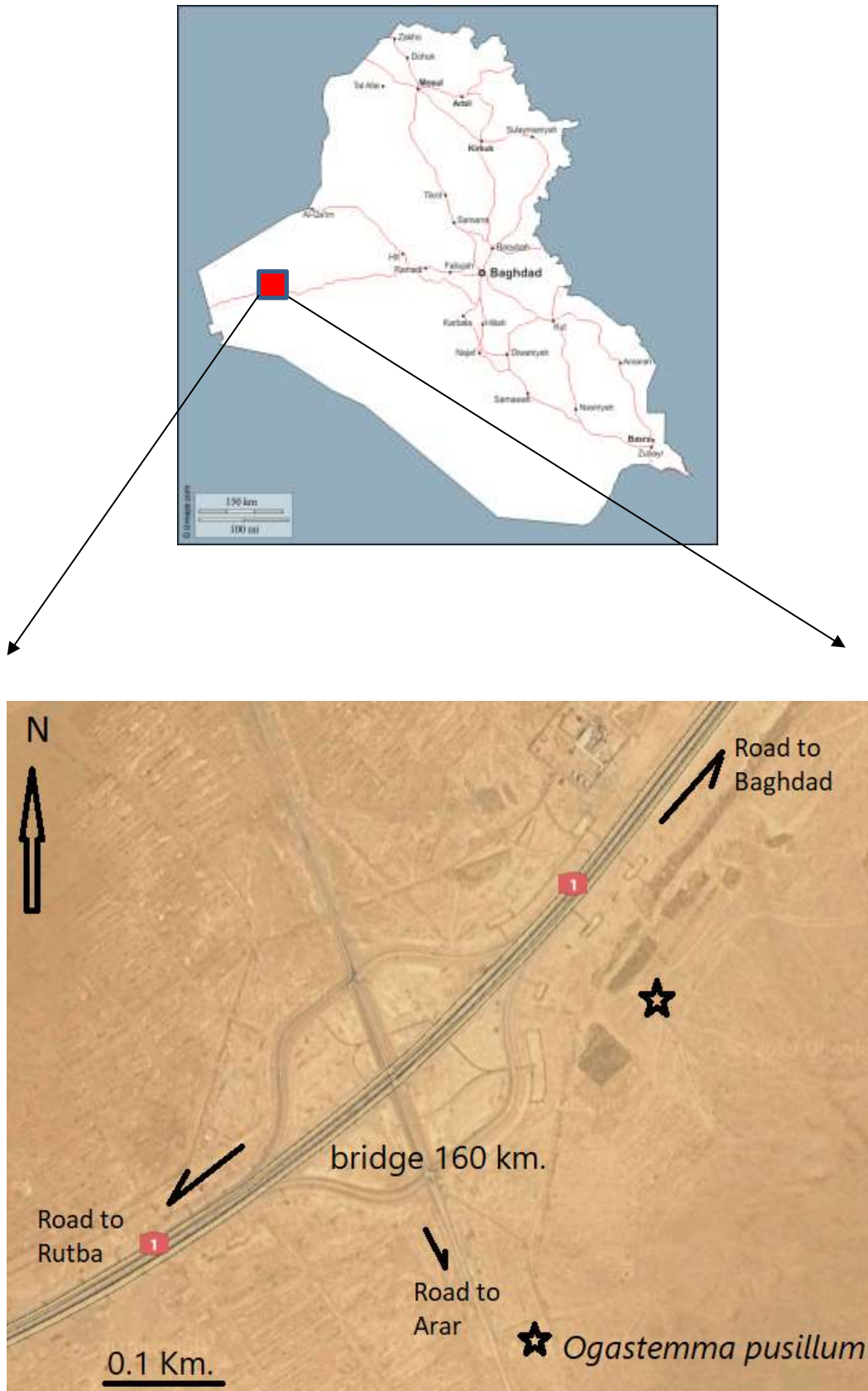
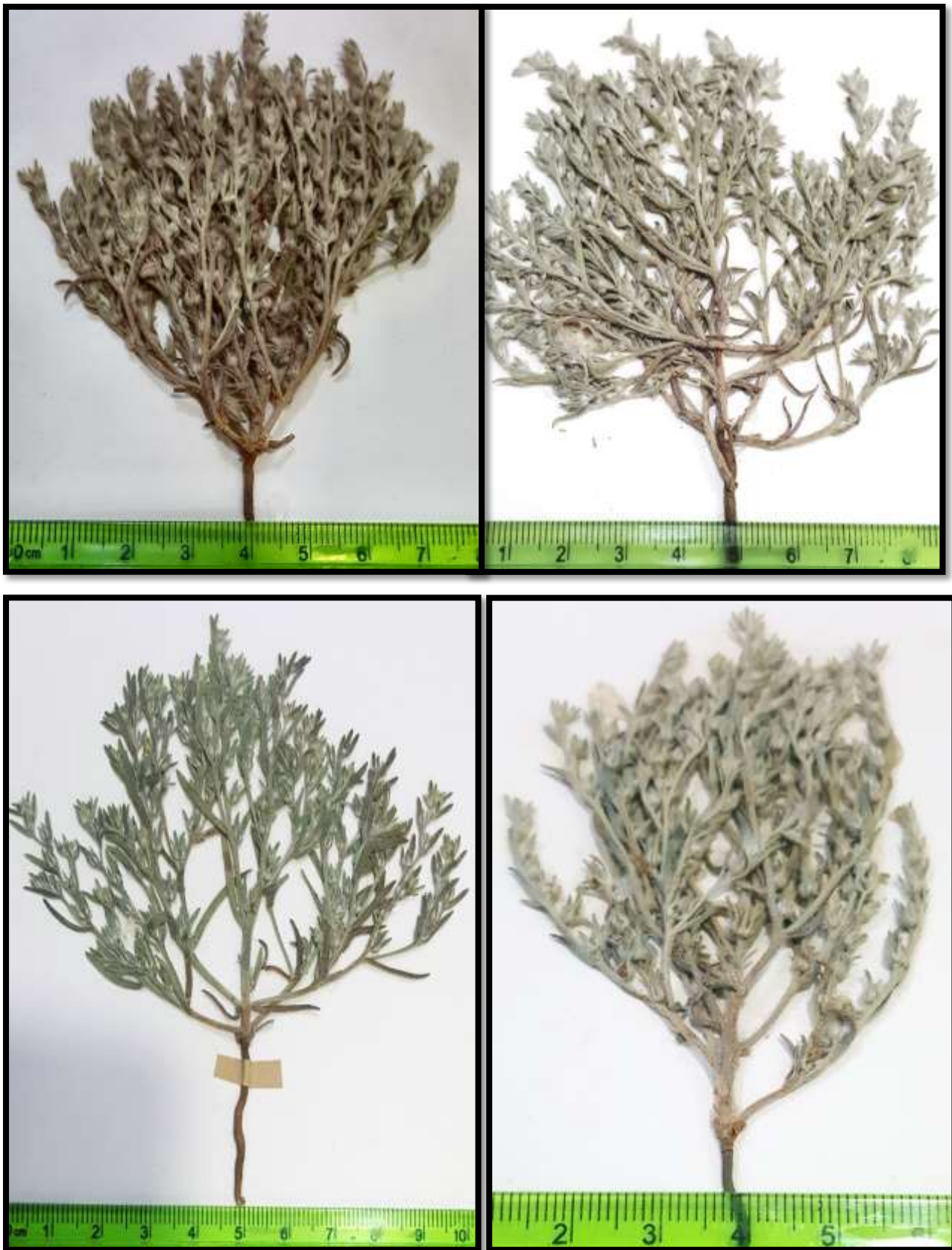


Figure 1. Satellite image of studied region (160 km. west of Ramadi- Iraq)

**Table 1. The vegetative and reproductive characters of the studied *Ogastemma pusillum*.\***

		Basal leaves size	Shape	Cauline leaves size	Shape
1	Leaves (mm.)	32.0 x1.7	Liner-very narrowly lanceolate	19.0x2.2	Narrowly lanceolate
2	Inflorescences (mm.)	Bract size	Inflorescence length	Number of flowers	Peduncle length
		7. 3x1.3	43	10	12
3	Calyx (mm.)	Calyx tube size	Calyx lobed size	Sepals	Indumentum
		0.8x1.0	3.3x0.9	unequal	hispid
4	Corolla (mm.)	Corolla tube size	Corolla limb size	Limb shape	Colour
		3.0x0.9	0.7x0.7	circular	white
5	Androecium (mm.)	Anther size	Shape	Filament size	Attachment
		0.7x0.4	Ovoid- ellipsoid	0.40x0.09	dorsifixed
6	Gynoecium (mm.)	Ovary size	Ovary locules	Style Size	Stigma size
		0.5x0.6	4	0.34x0.13	0.17x0.23
7	Fruiting calyx and Fruits (mm.)	Fruiting calyx tube Size	Fruiting calyx lobed size	Nutlet size	Surface
		1.0x1.3	3.9x1.1	1.5x0.8	Densely verrucose
8	Seeds and Pollen grains	Seed size (mm.)	Shape	Equatorial axis (µm.)	Polar axis (µm.)
		1.2x0.7	pyriform	13.2	11.9

\* All values in this table represents the mean of measurements taken from 15 plant samples of *Ogastemma pusillum*.



**Plate 1. Photographs of herbarium samples for *Ogastemma puillum*.**

**Anatomical study:** Stomatal complex anomocytic type, in both surfaces of the blade, more in abaxial, stoma narrowly elliptic, 6 -7  $\mu\text{m}$ ., guard cells kidney like 12-13 x 4-5  $\mu\text{m}$ .

(plate 4), note that some species, such as *Portulaca oleracea* which contained two different patterns of stomatal complex (4). The transverse section of the stem is

curricular, diameter 880  $\mu\text{m}$ ., the epidermis (e) is composed of rectangular cells, the upper surface is covered with cuticle and contains non - glandular hairs. The cortex is 4- 6 layered and consists of chlorenchyma (ch) arranged semi-circular, leaving some areas of collenchyma (co) with 3-4 layered, the single-layered endodermis consists of ellipsoid cells. The vascular cylindrical is very wide and contains 7-9 vascular bundles, distributed regularly, bundle cap is 4-5 layered of sclerenchyma (s) cells. The phloem (ph) is 3-5 layered, the remains of the cambium are not distinguishable. The xylem (x) was composed of vascular units with a thickness of 80-100  $\mu\text{m}$ . . The pith (p) consists of layer spherical or polyhedral parenchymatic cells, with thickness 450-500  $\mu\text{m}$ ., these cells are thin-walled (Plate 5).

**Type:** ALGERIA. Biskra, surles collines incultes, 10 May 1853, Balansa 1035.

#### **Specimens studied**

**DWD:** 160 km. west of Ramadi, highway, 280 m. alt., 4/ 5/ 2019, M.O.Mousa and Herbarium staff, 60264 (BAG)., 155 km. west of Ramadi, highway, 275m. . alt., 24 / 5/ 2019, M.O. Mousa and Herbarium staff, 60265 (BAG).

#### **Geographical distribution**

*Ogastemma* is a monotypic genus, in 1982 researcher Brumitt (9) suggested this name for the species under study. *Ogastemma pusillum* seems to be mainly a Saharo - Sindian element distribution, it was distributed a very long time ago in sandy soils from sea level to 1000 m in North Africa, Algeria, Tunisia, Libya, Mauritania, Egypt, and Morocco, according to Zaeifi and Rammazanzade (37). In Jordan, it is considered an endangered species that has been placed in red list (34), while it has been able to increase its geographic distribution through continuous migration and success in

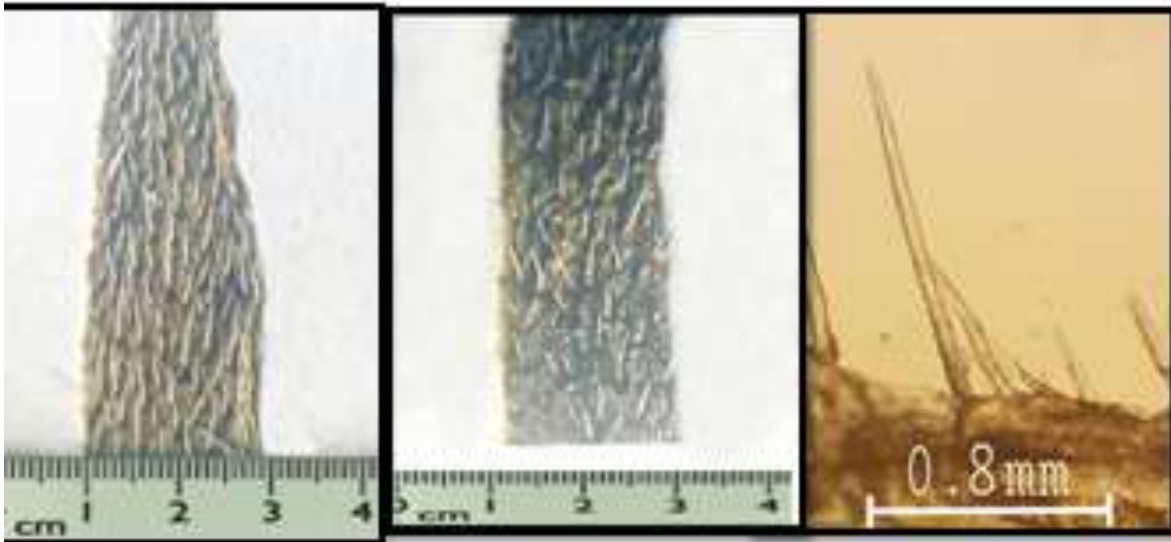
new and appropriate environments, in 1994, it was first time recorded in Kuwait (9), Ghazanfar (15) recorded the presence of the species in 1998 in Saudi Arabia, only one year later (1999), the species was recorded in United State of Emirates (7), Zaeifi and Ramazanzade (37) recorded the same species in 2007 in Iran, and in the same year, the species was first recorded in Qatar (29). This new species distribution was adapted to new world climate changes, especially in temperature, this is confirmed by Nathan and Muller-Landau (28), and Schurr *et al.*, (32) when they said that long-distance dispersal in central to species expansion following climate change. Mendoza- Diaz (23) said in his study of the Boraginaceae family that the characteristics of the *Echinochilon* genus are reminiscent of the *Ogastemma* genus, this is because of the similarity of the two genera and their genetic convergence, while Langstrom (19) studied the two genera and gave an accurate description of them, referring to the basic characteristics of isolating the genera, the recall from them the *Echinochilon* characterized by being perennial, shrublet, up to 100 cm., glabrous to glandular-hairy, the calyx is much smaller than the corolla, nutlets ovoid to cordate, smooth, white or reddish, pollen grains rectangular to square, 2-3 colporate. All Iraqi references of wild plants did not indicate to the presence of *Ogastemma* in Iraq, such as Flora of Lowland Iraq (30), and Al-Rawi (5) listing of geographical distribution of wilad plants in Iraq, also a comprehensive survey of the Iraqi Herbarium did not find any specimen of the genus, therefore, this study is confident of recording the genus for the first time in Iraq.



Stem

Basal leaves

Cauline leaves



Abaxial indumentum

Adaxial indumentum

Non-glandular hairs



Stem branched

Plate 2. Vegetative organs of *O. pusillum*.



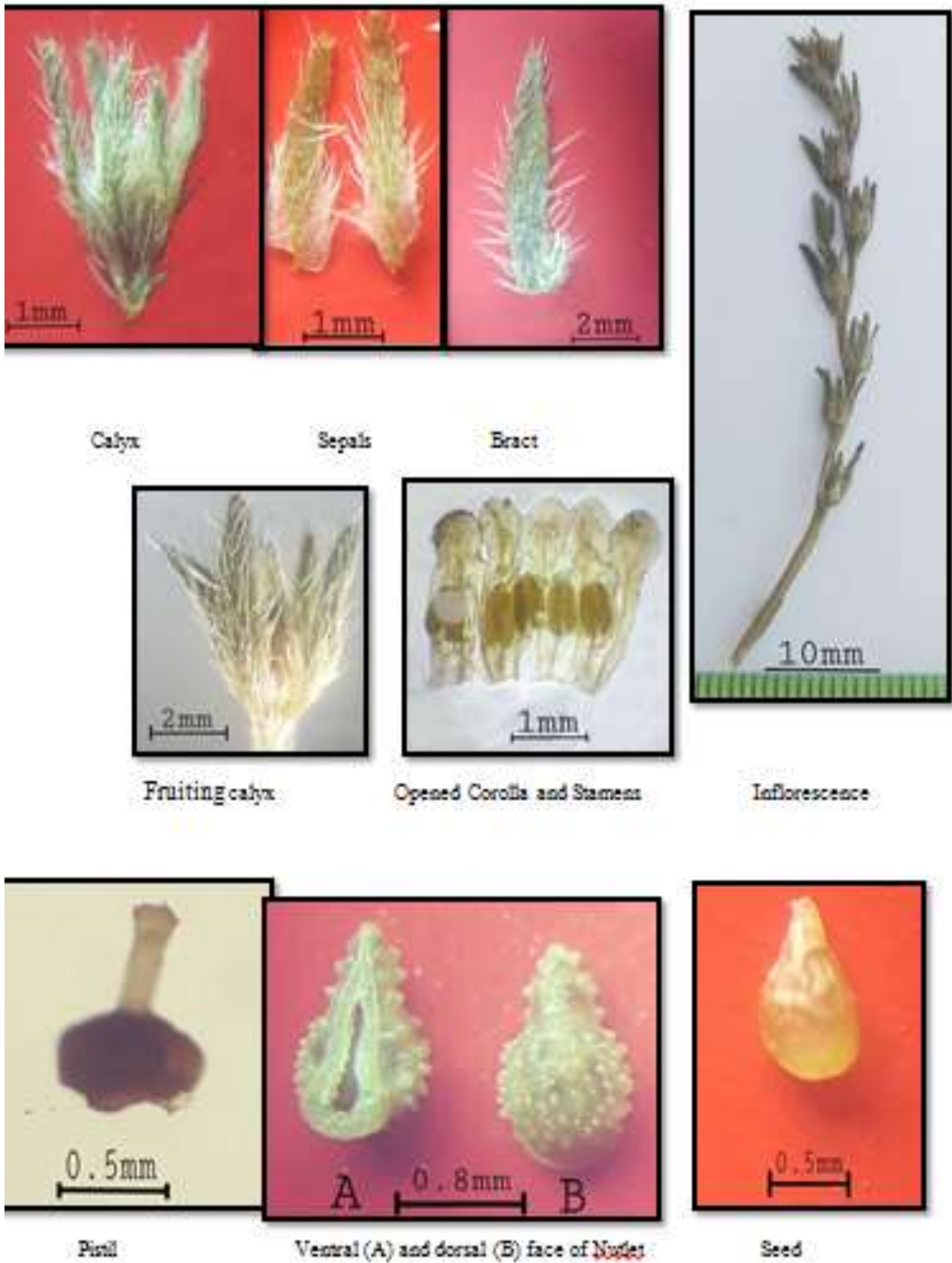
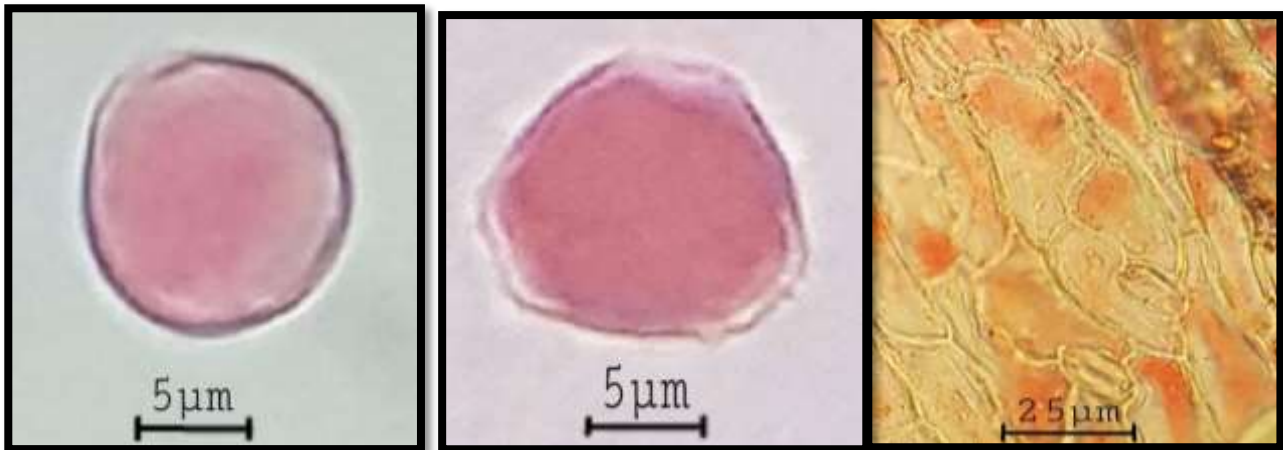


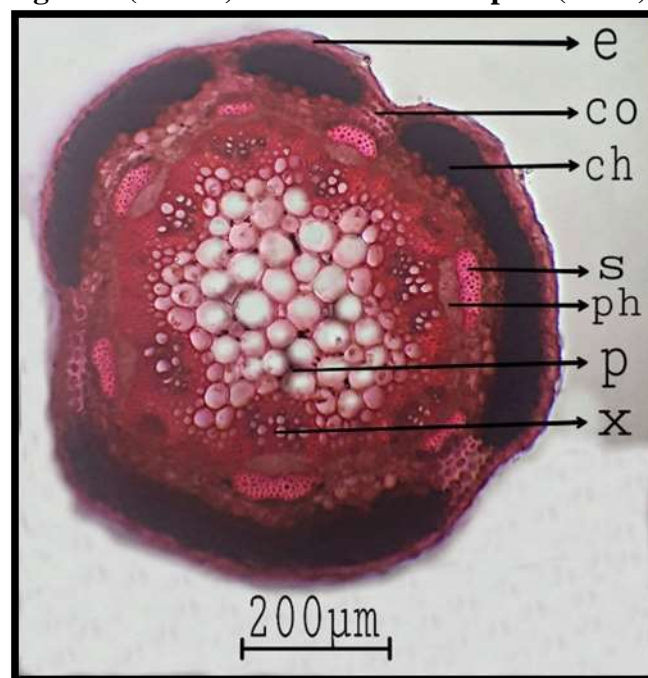
Plate 3. Reproductive organs of *O. pusillum*.



Equatorial view

Polar view

Leaf epidermis

**Plate 4. Pollen grains (1000 x) and Stomatal complex (100 x) of *O. pusillum*.****Plate 5. Transverse section of stem (100 x) of *O. pusillum*.****REFERENCES**

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