



OROBANCHE GARATIACA SARDAR ET ALEDHARI (OROBANCHACEAE): A NEW SPECIES FROM THE KURDISTAN REGION OF IRAQ

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SUMMARY

Orobanche garatiaca Sardar and Aledhari emerged as novel plant species within the Orobanchaceae family, specifically prevalent in the Gara mountain area within the Amadiya District (MAM) of Iraq. This study focused on this newly identified species' primary habitat and distribution patterns. Detailed results from comprehensive identification and morphological studies provided insights into the distinct features and characteristics that differentiate *O. garatiaca* from other related species. The investigation delves into specific aspects of pollen morphology, elucidating details, such as diverse forms, colors, sizes, surface ornamentation, and numerical attributes, contributing to a thorough understanding of the reproductive organ of this newly discovered plant species.

Keywords: *Orobanche garatiaca*, *Orobanchaceae*, new species, Amadiya District, Iraq

Key findings: The *Orobanche garatiaca* is a new plant species added to the science.

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INTRODUCTION

People usually think of parasites as tiny plants without flowers, seeds, or chlorophyll, such as fungi and bacteria, or the scarcely visible eelworms (Nematodes) living at the expense of other plants called hosts. However, several flowering or seed plants are parasitic on economic plants and cause much damage by

stealing their food as partial or total parasites. The mildest parasites grow in the soil like regular green plants but absorb food from the surrounding host plants through minute root connections (Karim, 1978). Orobanchaceae, a prominent plant family in Iraq, includes 210 species distributed across 15 genera (Simpson, 2019). Within Iraq, there are 11 identified species classified into two genera, as

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documented by Al-Rawi (1964) and Gilli (1982). The *Orobanche* L. genus is a member of the Orobanchaceae family of a pure parasitic higher plant taxon. This genus encompasses approximately 133 species found worldwide, as documented by Li (2016) and Renata et al. (2012). The family's variety extends beyond Iraq, with significant species numbers documented in nearby nations (Wien, 1964; Gilli, 1982).

In Turkey, Gilli (1982) has recorded 36 naturally growing species. In Europe, Chater and Webb (1972) identified 45 *Orobanche* species., Wien (1964) documented 47 species in Iran, and Novopokrovsky (1955) reported 81 species in the USSR. Rechinger (1964) accomplished significant contributions by discovering five new species in the lowlands of Iraq. However, discrepancies in species count surfaced from several studies, with Al-Rawi (1964), Ridda and Dawood (1982), Chakravarty (1976), and Karim (1978) reporting 10 Iraqi species.

Researchers have achieved significant discoveries on species identification in particular areas of Iraq. Three species within a specific genus were distinct (Khalaf, 1980). Later, a study recorded five species in the Hawraman highlands (Ahmad, 2013). In contrast, documentation concentrated on a single species discovered on Haibat Sultan Mountain (Fatah, 2003). Notably, specific areas like Choman and Darband Gomaspan had reports of lacking any documented species, as indicated in the studies conducted by Darwesh (2017) and Ahmed (2010). However, Faris (1983) and Hameed (2016) identified four species each in the Pira Magrun Mountains and the Hujran Basin, respectively.

Scientific investigation of Orobanchaceae extends beyond taxonomy to explore the potential medicinal properties of specific species. Chakravarty (1976) noted the traditional use of *O. aegyptiaca* in treating diarrhea and as a remedy for cow blisters in cattle throats. Intriguingly, despite extensive research, no existing references match the features of *O. garatiaca*, suggesting that the examined specimens may represent a novel plant species indigenous to Iraq. Consequently, this study aimed to contribute to the

comprehensive understanding of the Orobanchaceae family in Iraq, emphasizing taxonomic diversity and the potential identification of new species with ecological and medicinal consequences.

MATERIALS AND METHODS

A systematic collection of plant specimens from 2017 to 2020 transpired from diverse locations in the Kurdistan Region, Iraq. The identification process involved the utilization of flora keys, with the cataloged specimens diligently preserved at the herbarium of the College of Education, Erbil-Salahaddin University (ESUH). The examination of Orobanchaceae specimens, specifically *O. garatiaca*, commenced accurately utilizing a Krus's dissecting microscope. A strategic incorporation of environmental considerations proceeded through the utilization of a map (Figure 1).

The meticulous handling of anthers employed a fixation process involving FAA (Formalin-glacial acetic acid-ethyl alcohol). Submerging individual anthers in water or 50% glycerol prevented desiccation. Subsequently, a razor helps split the anther, releasing the pollens while carefully removing the anther wall materials. Applying safranin ensued for pollen staining. The process concluded with placing a coverslip, with various plant components meticulously photographed using a Samsung-A5 mobile camera. The scientific taxonomy employed throughout the study came from authoritative sources, including Harris and Harris (2001), Hesse et al. (2009), and Agashe and Caulton (2019), ensuring the accuracy and consistency of the terminology used in this research.

RESULTS

Morphological study

Orobanche garatiaca Sardar et Aledhari

Glandular-pilose herbs stem measuring 22–24) cm, upright, costate, yellow-brown, 50–100 × 1.1–1.5 mm, branching from the lower half or

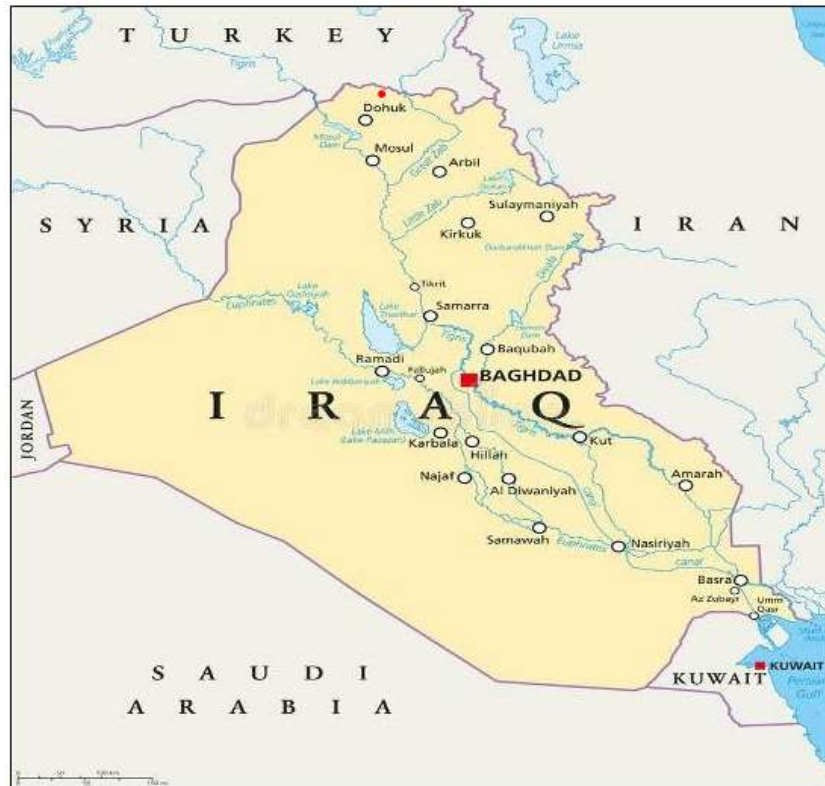


Figure 1. A map of Iraq showing distribution of *O. garatiaca*

base. Hairs on the bottom surface and edge of the sessile prostrate with alternate spiral leaves (scales). Lower cauline leaves are narrowly oval or narrowly lanceolate-oblong, measuring 8–10 × 2.0–3.5 mm, and higher cauline leaves are narrowly ovate at 4.2–6.0 × 1.5–2.0 mm, the entire margin, apex acute-acuminate, base truncate, brown, 10–70) mm dense or loose single-spike inflorescence, with yellow costate peduncle (20–40 × 1.1–1.7) mm. Bracts are narrowly lanceolate, or lanceolate in form, with an entire edge, an acute-acuminate apex, a truncate base, and a brown size of 6–9 × 1.1–2.0 mm. Bracteoles are two narrowly lanceolate-cultrate, with whole border, acuminate apex, truncate base, and brown (2.0–4.5 × 0.6–1.2 mm).

Flowers were numerous, hermaphrodite, Calyx halves connate at base, 2-toothed, teeth triangular, somewhat longer than the tube, brown, with tube at 2.5–5.6 × 2.1–4.2 mm, teeth (3.0–5.0 × 0.6–1.5 mm), tube (2.5–5.6 × 2.1–4.2 mm), teeth (3.0–5.0

× 0.6–1.5 mm), tube (2.5–5.6 × 2.1–4.2 mm). The corolla tubular-campanulate, glandular, violet, tube (8.5–15.0 × 3.0–4.2 mm), limb bilabiate, margin dentate, apex emarginate, glandular abaxially and at margins, tube (8.5–15.0 × 3.0–4.2 mm), limb bilabiate, margin dentate, apex emarginate, glandular abaxially and at margins, lower lip (3-lobed), glandular-pilose adaxially, upper lip (2-lobed), (2.2–3.0 × 3.1–5.2 mm), stamens (4), epipetalous, inserted on lower quarter of corolla tube, filaments terete, glandular-pilose at the base, yellow, (8.2–9.0 × 1.0–1.3 mm), anthers oblong, pointed at the tip, yellow, versatile attachment, brown-yellow pistil, superior ovary, ovoid (3.1–5.0 × 1.5–3.5 mm); style 1, terete, glandular (5.0–9.0 × 0.2–0.5 mm); stigma 2-lobed (0.5–0.7 × 0.8–1.1 mm). Fruit is simple, dry, capsule-shaped, ovoid or broadly oblong, glandular, and brown, measuring 4.2–5.5 × 2.3–3.5 mm. Seeds are abundant and oval-narrowly ovoid (Figures 2 and 3).

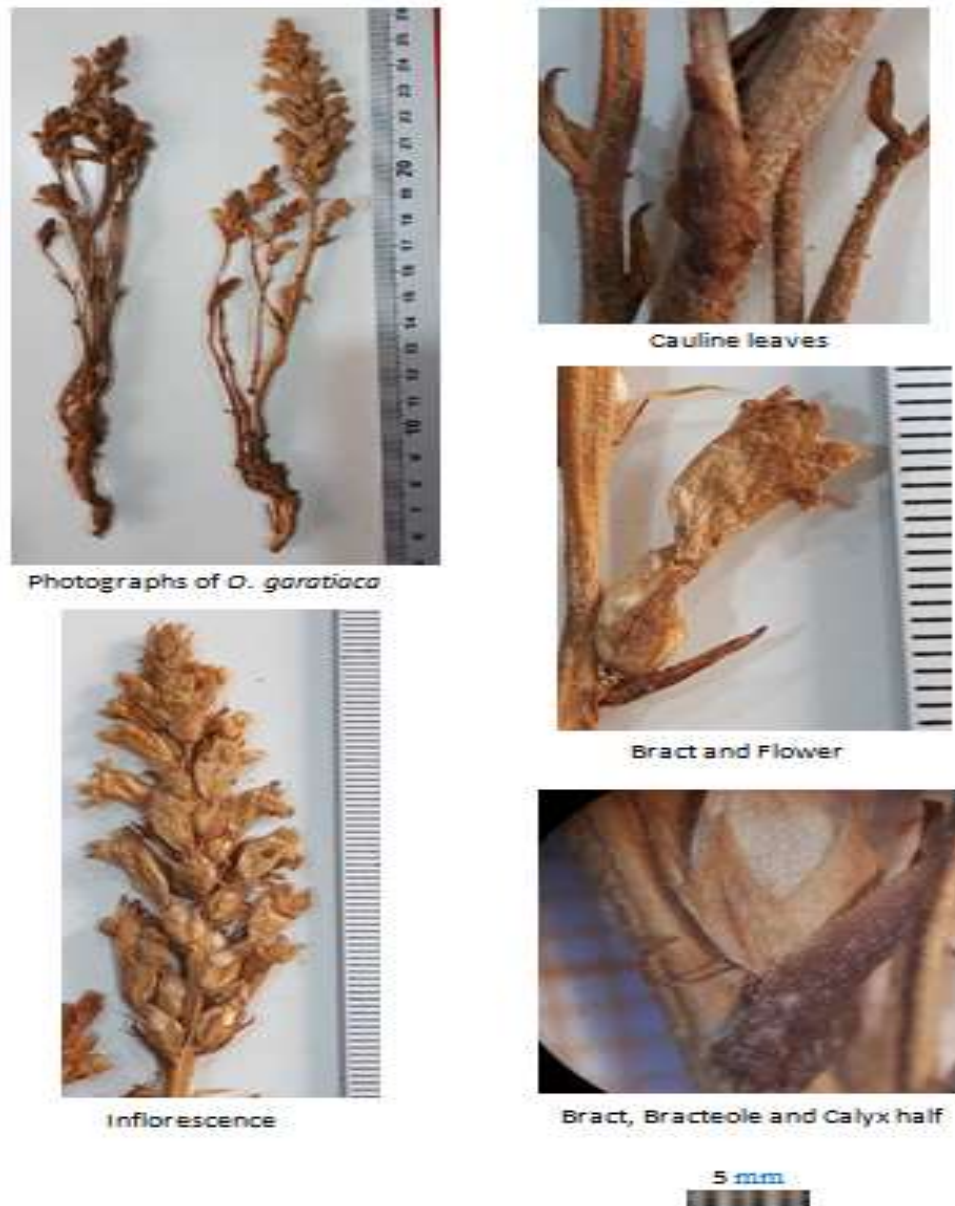


Figure 2. *O. garatiaca* with different plant parts.

The common name of the *Orobanche* is Broomrapes, which are yellowish, brownish, or purplish plants attached to the host plant roots. In addition, it is vernacularly called Alhalook in Arabic and Gurga in Kurdish. The plant *Orobanche* refers to the Division - Angiospermae, Class - Dicotyledoneae, and Order - Lamiales in the plant kingdom.

Holotype: [N. Iraq], Gara mountain (Duhok), 1800 m, (7854).

Studied samples

MAM: ESUH/ Gara mountain (East of Duhok) within Amadiya District, 1800 m, 28.5.2019, A. Sardar and H. Hasan, 7856.

Environmental description

The plant came from rocky clay soils as parasitic individuals on *Astragalus* sp.; altitude: 1800 m; flowering: May (Figure 1).



Figure 3. Reproductive parts of *O. garatiaca*.

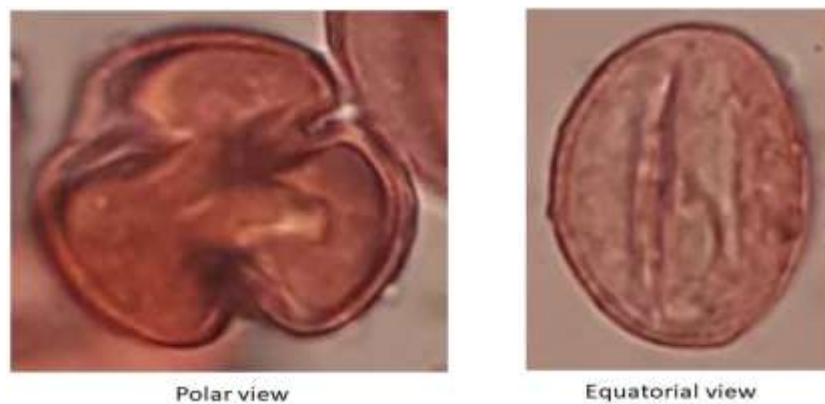


Figure 4. LM. Micrographs of pollen grains of *O. garatiaca* × 100.

Palynological investigations

Pollen grains exhibit distinct characteristics, presenting as solitary entities with a tricolpate structure. In the polar view, they manifest as yellow, spheroidal, or semi-spheroidal shapes, while in the equatorial view, their form is ellipsoidal. Despite their diminutive size, they feature intricate details, with a polar axis ranging from 10.0 to 12.5 μm and an equatorial axis spanning 13.75 to 17.5 μm . The surface of these pollen grains shows a mark of tuberculate ornamentation, presenting numerous intricacies, as illustrated in Figure 4.

DISCUSSION

The latest investigation marks a significant botanical breakthrough in Iraq by documenting a previously undiscovered species within the Orobanchaceae family, identified as *Orobanche garatiaca*. The meticulous examination of morphological traits and habitat characteristics has contributed novel insights into the biodiversity of the Gara mountain area in Iraq, underscoring the importance of this region in hosting unique and understudied plant species (AL-Rawi, 1964).

There are mistletoes, small and big, or called dwarf and leafy mistletoes, which have lost their contact with soil and depend on their hosts for all the water and dissolved mineral substances. Some have green leaves and stems, which manufacture their starch and sugar as carbohydrates for nutrition. These are the partial or semi-parasites, and complete or total parasites are never green. Their leaves are usually small to inconspicuous scales, and their roots are the only functional organs for food absorption. Then, highly modified root takes advantage of the host tissue for nourishment (Karim, 1978). *Orobanche garatiaca* exhibits distinct features closely aligning with *O. nana* Noe ex G. Beck, presenting a plant structure with a height ranging between 22–24 cm, glandular-pilose stems, and branching, along with narrowly lanceolate-cultrate, acuminate bracteoles. Noteworthy distinctions include triangular calyx teeth longer than the tube, neither intense nor inclined corolla, emarginate lobes of the lower lip, and glandular-pilose filaments at the base, further characterized by a glandular style. Table 1 meticulously outlined these diagnostic traits, firmly establishing *O. garatiaca* as a distinct and newly identified species within the genus *Orobanche* in Iraq (Gilli, 1982).

Table 1. Morphological differences between *O. garatiaca* and *O. nana*.

<i>O. garatiaca</i>	<i>O. nana</i>
Plant 22-24 cm, glandular-pilose, glandular	Plant 4-30 cm, glandular-pubescent
Stem branched	Stem Unbranched or branched
Bracteoles narrowly lanceolate-cultrate, acuminate	Bracteoles linear-subulate
Calyx teeth triangular	Calyx teeth subulate
Calyx teeth longer than tube	Calyx teeth equalling tube
Corolla not intense and not inclined	Corolla intense and inclined
Corolla's lobes of lower lip emarginate	Corolla's lobes of lower lip acute
Filaments glandular-pilose at base	Filaments sparsely-pubescent at base
Style glandular	Style sparsely glandular- puberulent under the stigma

O. nana Noe ex G. Beck, Monogr. Orob. 92, t. 1 f. 11 (1890). Syn: *Phelipaea ramosa* (L.) C.A. Meyer var. *nana* Boiss., FI. Or. 4:499 (1879)! *Orobanche ramosa* L. subsp. *nana* (Reuter) Coutinho, FI. Port. 566 (1913). Ic: Beck, Monogr. Orob. t. 1 f. 11 (1890).

Unbranched or branched, 4-30 cm. Calyx teeth subulate, equalling tube. Corolla intense blue-violet, less often lavender or mauve, 11-17 mm, inclined, lobes of lower lip acute. FI. 3-7. On a variety of hosts, s.l-1500 m.

Type: [Jugoslavia] prope Fiume (Rijeka), in Trifolio scabro, Noe 1352 (holo. W!), (Gilli, 1982).

Comparison with existing botanical studies conducted by Al-Khayat (1993), Riedl (1981), Al-Mayah and Al-Asadi (2016), Ghazanfar and Haloob (2017), Hamodie (2018), Abdulrahman and Shahbaz (2020), Sardar *et al.* (2020), and Haloob *et al.* (2021) reveals parallels in unveiling new plant species within Iraq. It reinforces the uniqueness and richness of Iraq's flora, with each study contributing to the expanding body of knowledge on its indigenous plant species. The confirmation of *O. garatiaca* as a new and distinctive addition to the world's plant taxonomy promotes the significance of Iraq in global botanical research (AL-Rawi, 1964).

Furthermore, by integrating this investigation with an extensive literature analysis, this research confirms the existing enumeration of *Orobanch* species in Iraq to 11 (Ridda and Daood, 1982). The findings from both studies highlight the importance of ongoing exploration and systematic documentation of the nation's plant diversity, elucidating the ecological implications and potential applications of these identified species in fields, such as medicine, agriculture, and conservation. This discovery significantly improves our understanding of Iraq's floral landscape, motivating a continued commitment to botanical study and conservation measures (Chakravarty, 1976).

CONCLUSIONS

A new plant species, '*Orobanch garatiaca*,' became an addition to the science. The study also revealed the specific aspects of pollen morphology, such as diverse forms, colors, sizes, surface ornamentation, and numerical attributes, contributing to a thorough understanding of the reproductive organ of this newly discovered plant species.

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has proven to be an essential contribution to the research, allowing for a thorough exploration and analysis of these plant specimens, thereby enriching an understanding of the diverse flora within this taxonomic group.

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