

ALCEA GUESTII, A NEW RECORD FOR THE FLORA OF IRAN

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The genus *Alcea* (Malvaceae) with around 70 species has its highest species diversity in SW Asia, especially in Iran. The current study introduces the rare species *A. guestii* as a new record for the flora of Iran. It is an almost well-defined species readily distinguished by its obviously thick textured leaves with dense prominent veins and serrate to serrate-dentate margins among the genus. Dwarf habit, an epicalyx with a length of more than 1/2 as long as the calyx, and dorsally deeply canaliculated yellowish-brown mericarps with long wings are also its other diagnostic traits. Its complete description, distribution map, and conservation status are presented. Also, micrographs of sections of leaf and stem as well the seeds of *A. guestii* using a scanning electron microscope are provided.

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Alcea guestii یک گزارش جدید برای فلور ایران

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جنس *Alcea* یا ختمی از تیره Malvaceae در دنیا دارای حدود ۷۰ گونه است. بالاترین تنوع گونه‌ای ختمی‌ها در شمال غرب آسیا و به ویژه در ایران مشاهده می‌شود. مطالعه پیش‌رو، گونه نادر *A. guestii* را به عنوان یک گزارش جدید برای فلور ایران معرفی می‌نماید. *A. guestii* گونه‌ای متمایز است که توسط صفاتی همچون برگ‌های بسیار ضخیم، حاشیه برگ‌اره‌ای تا اره‌ای-دندان‌های و همچنین شبگه رگبرگی متراکم کاملاً برجسته به خوبی از سایر اعضای جنس قابل تشخیص است. ارتفاع کوتاه، پیش کاسه‌های بلندتر از ۱/۲ طول کاسه و مریکارپ‌های قهوه‌ای متمایل به زرد، با شیار عمیق خلفی و بال‌های بلند از دیگر صفات تشخیصی این گونه می‌باشند. شرح کامل گونه به همراه نقشه پراکنش و سطح حفاظتی آن ارائه شده است. همینطور، عکس‌های میکروسکوپ الکترونی از سطوح ساقه، برگ و بذر آن تهیه شده‌اند.

INTRODUCTION

The genus *Alcea* L. (Malvaceae, or mallow family) comprises about 70 species (Arabameri & Khodayari 2019). This family according to its current expanded circumscription, i.e., Malvaceae s.l. (including Tiliaceae, Sterculiaceae and Bombacaceae) as the largest group of its order is a monophyletic taxon

consisting of 9 subfamilies, and 244 genera with over 4225 species distributed worldwide (Cvetkovic & al. 2021; Wang & al. 2021). Based on the recent treatments, the core Malvoideae corresponds to the traditionally circumscribed family, that is, Malvaceae s.s. (Von Balthazar & al. 2004). Many species of the mallow family, like cotton (e.g. *Gossypium hirsutum*

L.), cacao (*Theobroma cacao* L.), okra (*Abelmoschus esculentus* (L.) Moench), rose of Sharon (*Hibiscus syriacus* L.), hollyhock (*Alcea rosea* L.), etc. are of great economic importance (Cvetkovic & al. 2021).

Although the geographical range of *Alcea* is expanded from E Europe to C Asia, its highest diversity is restricted to SW Asia (Arabameri & al. 2020). In the Flora Iranica account for *Alcea* (Riedl 1976), 39 species, and in Flora of Iran (Pakravan 2008) 35 species have been reported to exist in Iran. Based on the molecular phylogenetic studies, the existing diversity in *Alcea* has probably resulted from recent rapid radiation experienced by the genus (Escobar García & al. 2012). Because of the morphological similarities of epicalyx, *Alcea* had been merged into *Altheae* L. for more than one and a half centuries, but later they were treated as separate genera again (Escobar García & al. 2012). Nevertheless, *Alcea* is clearly distinguished from its close relative the genus *Altheae* based on characteristics of stamens (yellowish with 5-angled staminal column vs. purplish to brownish purple with cylindrical staminal column), carpel structure (sub-bilocular vs. unilocular) and as well the petal size in a way that petals in *Altheae* are obviously smaller (≤ 30 mm vs. ≥ 30 mm) than those in *Alcea* (Cullen 1967; Iljin 1974; Uzunhisarcikli & Vural 2012; Riedl 1976).

Alcea is known as a taxonomically complicated genus, due to its wide morphological plasticity, the identification of species is most problematic. Accordingly, for accurate identifications, combinations of traits, including morphology of ripened mericarps, characteristics of basal, cauline, and floral leaves of flowering stems, and the ratio of epicalyx to calyx are typically required (Escobar García & al. 2012; Zohary 1963a, b). In addition, various trichome characteristics provide useful evidence for the delimitation of species in *Alcea* (Arabameri & al. 2020). Nevertheless, a few species, such as *A. acaulis* (Cav.) Alef. and *A. fasciculiflora* Zohary both newly reported from Iran can be easily identified by acaulescent habit and fascicled flowers, respectively (Cullen 1967; Kodayari & Arabameri 2019; Riedl 1976).

Many species of *Alcea* are well-known medicinal plants among different folks. Due to their high anthocyanin content, their flowers are used as natural and healthy food colorants. Particularly, leaves and flowers in *Alcea* are rich in mucilage, besides their antihypertensive, antiasthmatic, hypoglycemic, hypolipidemic, and antioxidative properties; different mucilage types are broadly used as stabilizing, thickening, gelling, emulsifying, foaming and encapsulating agents in different industries. Customarily, infusions or decoctions of flowers of hollyhocks as an antitussive, expectorant, febrifuge, and emollient agents are consumed to relieve respiratory system disorders and their side effects such

as cold, influenza, pneumonia, sinusitis, asthma, cough, catarrh, sore throat, tonsillitis and chest pains (Azab 2016; Azadeh & al. 2020; Görhan & Öztürk 2021; Tosif & al. 2021; Waghmare & al. 2021). In addition, based on our survey, some Iranian women wash their hairs by a decoction of *Alcea* flowers and attribute their hair health and beauty to this ancestral hair care method.

The current study, reports the well-defined species, *A. guestii* as a new record for the flora of Iran. SEM micrographs of seed morphology and indumentum of stem and leaf surfaces are provided. Description, distribution map, and conservation status of *A. guestii* are also herein presented.

MATERIAL AND METHODS

During field studies, a species different from known *Alcea* species in the flora of Iran was collected. Later, with more attempts, a few new locations of the same species not so far away from each other were detected. The specimens were cross-checked with other species' previously identified samples and finally using the related references (Cullen 1967; Uzunhisarcikli & Vural 2012; Zohary 1963a) could be identified as *A. guestii*. The voucher specimens (MPH-2941, 2942, and 2943) are deposited at the Medicinal Plants and Drugs Research Institute Herbarium of Shahid Beheshti University, Tehran, Iran. The Distributional map (Fig. 3) of *Alcea guestii* was made using QGIS v. 3.22.3 software (QGIS Development Team, 2022) based on both inferred and projected sites. Area of Occupancy (AOO) and Extent of Occurrence (EOO) were used as geographical statistics in the assessment of the conservation status of the species. AOO considered as the area occupied by the species within its extent of occurrence (EOO) was achieved by the sum of all occupied grid squares. Also, EOO was considered as the area surrounded by the shortest imaginary boundary encompassing all the current occurrence points. Finally, unsuitable habitats in the studied area including the submerged regions were excluded from EOO.

Detailed micrographs of trichome types of stem, leaf, and seed samples were taken by a KyKy-EM3200 Scanning Electron Microscope (SEM).

RESULTS AND DISCUSSION

Alcea guestii Zohary, in Israel J. Bot. 12: 3, t. 6 (1963), (Figs. 1 & 2)

Perennial up to 50 cm tall, erect, branched or not; stems smooth or slightly furrowed, heterotrichous, densely tomentose-villous, with long erect or retrorse fasciculate and simple hairs along with short stellate trichomes. Leaves palmatilobate, obviously thick, prominently reticulate-veined beneath, densely stellate-pannose, base truncate, cordate, margin serrate, serrate-dentate; basal leaves orbicular in outline, 4-8 × 4.5-9

cm, non to shallowly 5- (7-)lobed, lobes mostly less than 1/4 as long as the lamina, stipule 3-4-fid, 7-10 mm, lobes linear-lanceolate, petiole up to 15 cm; upper leaves smaller, 1-6 × 1-7 cm, orbicular, triangular in outline, 3-5-lobed, lobes mostly less than 1/3 as long as the lamina, stipule 2-3-fid, 5-10 mm, lobes linear-lanceolate, petiole up to 8 cm. Inflorescence raceme, few-flowered, flowers solitary, distant, pedicel 1-3 cm; epicalyx 13-16 mm, deeply 5-7-lobed, lobes 8-12 mm, more than 1/2 as long as the calyx, lanceolate, apex broadly acute, distinctly striate, stellate-tomentose;

calyx 20-23 mm, 5-lobed, lobes 10-15 mm, distinctly striate, broadly lanceolate, apex broadly acute, densely stellate-tomentose; corolla white, yellowish-white or yellow, sometimes greenish when dried, petals obovate-cuneate, apex emarginated, c. 4-4.5 cm, 2 times as long as the calyx; mericarps 5-6 × 7-7.5 mm, reniform-orbicular, margin smooth, yellowish-brown, obliquely and deeply canaliculated at back, wings unwrinkled, long, folded on another, stellate-tomentose. Seeds reniform, brown, testa surface reticulate, hilum simple hairy.

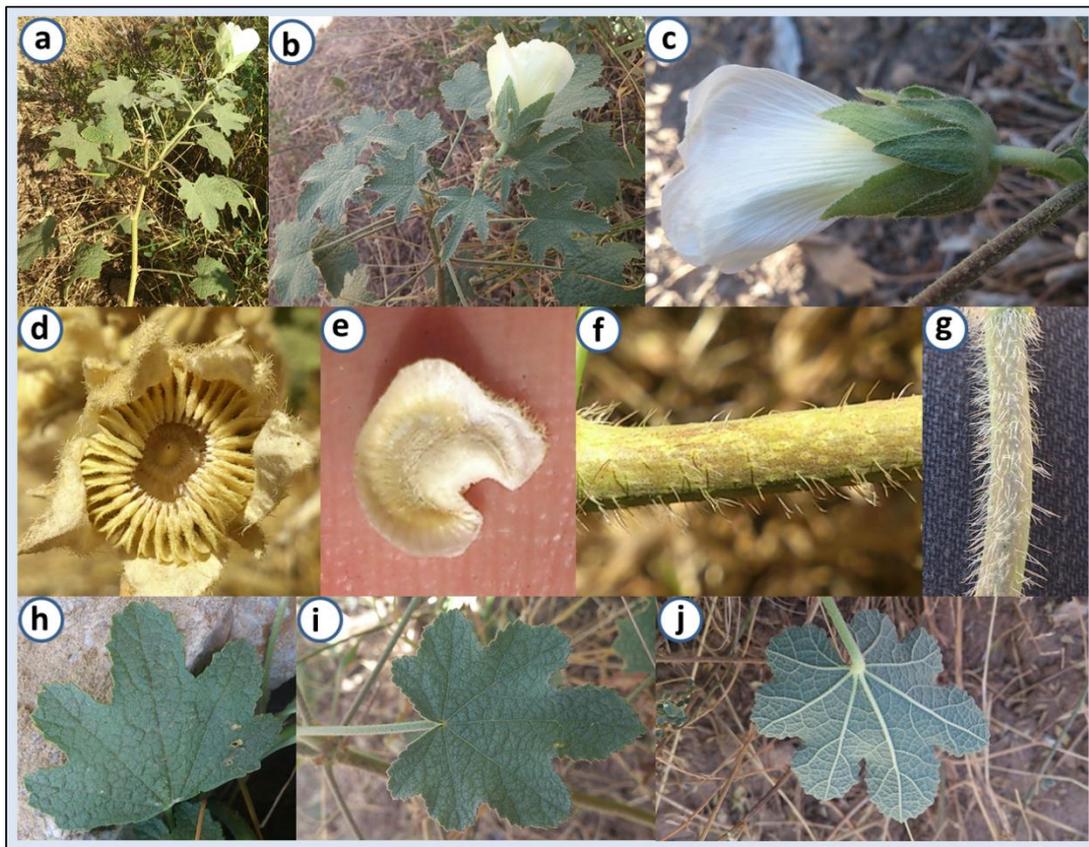


Fig. 1. *Alceae guestii*, a-b: habit; c, flower; d, schizocarp; e, mericarp; f-g, simple and fascicled trichomes on the stems; h, basal leaf; i, cauline leaf; j, prominent venation on the lower surface of a leaf.

Specimens examined: Iran, W Azerbaijan, Urmia, Silvana, Valley of Jermi, 37°25' 00" N, 44°48'23" E, 1650 m, 11 August 2018, Bahadori (MPH-2941); Urmia, Silvana, the western slopes of Shaharchayi dam, 37°26' 41" N, 44°51'12" E, 1600m, 6 September 2019, Bahadori & Arabameri (MPH-2942); Urmia, Zeyveh toward Razhan, roadsides, 37°21' 24" N, 44°53'23" E, 1700 m, 8 July 2019, Arabameri & Alijanpoor (MPH-2943).

Habitat and ecology: *A. guestii* inhabits roadsides and rocky foothills within grasslands or open shrubland formations at an estimative altitudinal range of about

1500-1800 m a.s.l. The species in the area were usually associated with some herbaceous and shrubby species, such as *Tanacetum polycephalum* Sch.Bip., *T. canescens* DC., *Fibigia suffruticosa* (Vent.) Sweet, *Salvia multicaulis* Vahl, *Onosma sericea* Willd., *Cirsium haussknechtii* Boiss., *Gypsophila ruscifolia* Boiss., *Thymus kotschyanus* Boiss. & Hohen., *Ziziphora clinopodioides* Lam., *Noaea mucronata* (Forssk.) Asch. & Schweinf., *Daphne mucronata* Royle, *Rhamnus persica* Boiss., *Cotoneaster morulus* Pojark., etc.

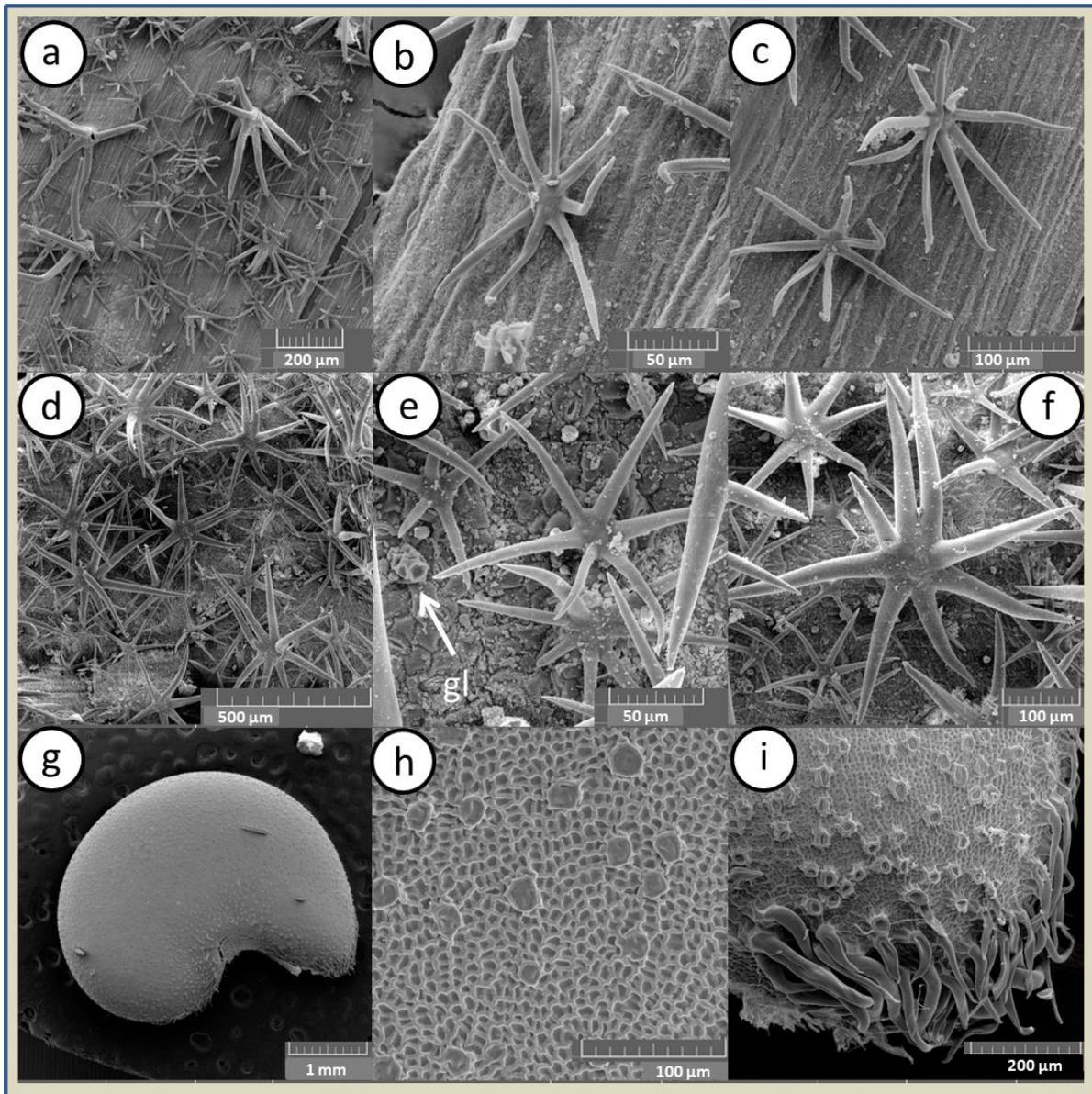


Fig. 2. SEM micrographs of the stem (a-c), leaf (d-f), and seed (g-i) surfaces of *Alcea guestii*; a-c: short stellate and long fascicled trichomes; d-f, stellate trichomes with sparse capitulate glands (gl); g, the reniform shape of a seed; h, reticulate surface ornamentation; j, the hilum covered with simple hairs and broken trichome scars.

Phenology: the species in W Azerbaijan blooms about from early June to September and is in fruit from late June to mid-September.

General distribution: N Iraq, SE Turkey, NW Iran, Irano-Turanian element, (Fig. 3).

Conservation status: Although the species in Iran is known from a few localities, no severe fragmentation along its distribution range was detected. The estimated EOO and AOO were near 96 and 15 km². The most

evident threat in the region was assumed to be overgrazing, although road constructions and Shaharchayi dam impoundment might have extirpated many individuals or even subpopulations from the region. Accordingly, at the regional level *A. guestii* can be classified as an Endangered species (EN) based on the following criteria B1ab (iii)+B2ab (iii)+C2a (IUCN 2019). The global assessment of species can be defined after surveying Iraq's population.

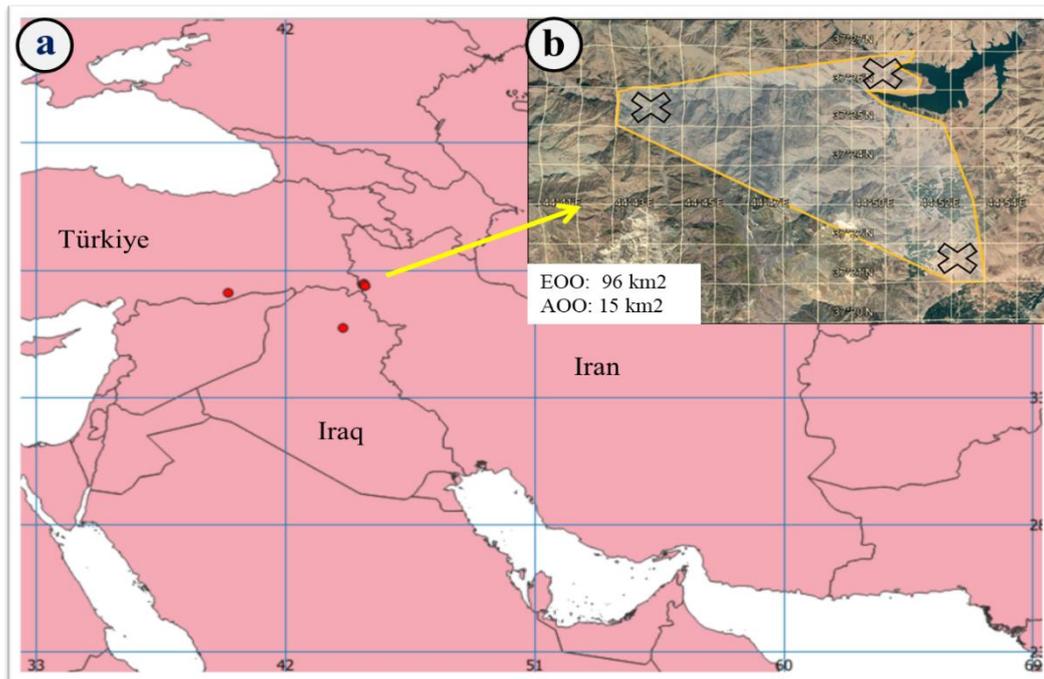


Fig. 3. Distribution of *Alcea guestii*; a, the global distributional range, including N Iraq, SE Turkey and NW Iran; b, the regional distributional range in W Azerbaijan, Iran.

Note: *Alcea guestii* is a rare species first described from N Iraq and later recorded from SE Turkey, where it is considered a Critically Endangered (CR) taxon (Cullen 1967; Uzunhisarcikli & Vural 2012; Zohary 1963a). Spatially, the Iranian population in comparison with Turkish populations is closer to the type location that is Altun köprü of Iraq and in accordance with geographical distance morphologically is roughly more corresponding to the type description. *A. guestii* is mainly characterized by obviously thick textured leaves with prominent veins and serrate to serrate-dentate margins, by which it can be readily distinguished from other congeneric species. *Alcea gusetii* together with *A. arbelensis* Boiss. & Hausskn. and *A. kurdica* (Schltdl.) Alef. is included in the artificial *Alcea kurdica* species

group, of which the two first members are rare, while the latter is both a widespread and a polymorphic species (Zohari 1963b). Apart from its aforesaid unique traits, *A. guestii* is distinguished from *A. kurdica* by the ratio of epicalyx to calyx (more than 1/2 vs. less than 1/2 as long as the calyx) and wings of mericarp (long folded vs. short straight) and also from *A. arbelensis* by division pattern of leaves (leaves lobed up to 1/3 lamina vs. leaves divided up to the base into oblong-linear lobes) and dorsal canaliculus of mericarp (deeply vs. barely canaliculated). Also, *A. setosa* distributed in Turkey, Cyprus, and Syria is considered another close species to *A. guestii*, which is clearly recognized by its wingless mericarps (Table 1) (Uzunhisarcikli & Vural 2012).

Table 1. Diagnostic traits compared among *Alcea guestii* and its close species.

species	traits	mericarp wings	mericarp dorsal furrow	epicalyx /calyx ratio	leaf shape	leaf lobe shape
<i>Alcea guestii</i>		long, folded	deeply canaliculated	>1/2	palmatifid-palmatifid	oblong, rounded, deltoid
<i>Alcea arbelensis</i>		short, horizontally projecting	barely canaliculated	>1/2	almost palmatifid	oblong-linear, oblong
<i>Alcea kurdica</i>		short, straight	lately canaliculated	<1/2	palmatifid-palmatifid	oblong, rounded, deltoid
<i>Alcea setosa</i>		wingless	barely canaliculated	>1/2	entire-palmatifid	rounded, deltoid, oblong

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