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A NEW SPECIES OF THE GENUS ACANTHOLIMON (PLUMBAGINACEAE) FROM IRAN

M. Mahmoodi & M. Assadi

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Acantholimon hamadanicum is described and illustrated as a new species from Hamadan Province, in W Iran. The new species belongs to the *Acantholimon* sect. *Acantholimon* (Plumbaginaceae) and is closely related to *A. wendelboi*, but differs from it by glabrous stems and leaves and also the color of calyx limb between the nerves. A distribution map of the new species and its close relatives is provided and the habitat condition, as well as the conservation status of *A. hamadanicum* are discussed.

Mohammad Mahmoodi (correspondence <mahmoodi@rifr-ac.ir>) and Mostafa Assadi, Research Institute of Forests and Rangelands, Agricultural Research Education and Extension Organization (AREEO), P. O. Box 13185-116, Tehran, Iran.

Keywords: *Acantholimon hamadanicum*; new species; *Acantholimon* sect. *Acantholimon*; Hamadan Province; Iran; endemic

گونه جدیدی از جنس Acantholimon (Plumbaginaceae) از ایران

محمد محمودی: استادیار پژوهش مؤسسه تحقیقات جنگلها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران

مصطفی اسدی: استاد پژوهش مؤسسه تحقیقات جنگلها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران

در این مقاله Acantholimon hamadanicum به عنوان گونه جدیدی از استان همدان، در غرب ایران، شرح داده شده است. گونه جدید به بخش sect. Acantholimon تعلق دارد و نزدیکترین گونه به آن A. wendelboi می‌باشد. این گونه به‌دلیل داشتن ساقه و برگ‌های بدون کرک و رنگ کاسه گل، از گونه خویشاوند خود قابل تشخیص است. نقشه پراکنش A. hamadanicum و خویشاوندان نزدیک آن ارائه و شرایط زیستگاهی این گونه و همچنین وضعیت حفاظتی آن بحث شده است.

INTRODUCTION

Acantholimon Boiss. (Plumbaginaceae) is characterized by cushion form habit, spiny leaves, and head-like stigmas. It was described by Boissier (1846) with 22 species. Bunge (1872) revised the genus and raised the number of species to 83 of which 45 were from Iran. Mobayen (1964) prepared a monograph on the genus *Acantholimon* and 119 species recognized by him of which 84 were from Iran. Rechinger and Schiman-Czeika (1974) in the Flora Iranica area reported 164 species, 84 of which were from Iran. Recently, some more new species were described from Iran (Assadi 2003; Assadi 2004; Assadi 2005a; Assadi & Mirtadzadini 2006; Assadi & Zeraatkar 2020). and the number of *Acantholimon* species in Iran by taking *A. hamadanicum* into account increases to 81.

Assadi (2005b) revised the genus for the *Plumbaginacea* account in Flora of Iran and introduced 79 species from Iran. The distribution pattern of the genus in Iran was studied by Assadi (2006), in this study, 82.3% of the species were endemics, which means the genus *Acantholimon* has the highest number of endemics in Iran compared to the other genera in the flora of Iran. In a phylogenetic study, Moharrek & al.

(2017) concluded that several other genera of *Plumbaginaceae* should be transferred to *Acantholimon*, including *Cephalorrhizum* M. Pop. They also concluded that infrageneric classification of the genus is artificial and questionable. Khajoei Nasab & Khosravi (2019) studied areas of endemism of the genus *Acantholimon* in Iran and recognized four areas of endemism.

The aim of this paper is to describe a new species of the genus *Acantholimon* from Iran, Hamadan Province.

MATERIALS AND METHOD

During fieldwork in Hamadan province, a large number of herbarium materials were collected. We encountered unknown specimens of *Acantholimon* with characteristic features of *Acantholimon* sect. *Acantholimon*. Specimens were examined in detail and cross-checked with various *Acantholimon* accounts in the relevant taxonomic literature (Boissier 1879; Rechinger 1974; Bunge 1872; Mobayen 1964; Assadi 2005b). Specimens preserved in the TARI herbarium and type specimen in virtual herbaria (e.g. B, E, G, K, M, P, and W) were examined (acronyms according to Thiers, 2021). Finally, we concluded that two specimens of the collection are new species, which is described here. Among the specimens cited in Flora of Iran under *Acantholimon wendelboi* (Assadi 2006), the specimen Safikhani 1174 seemed to be conspecific with the new species.

RESULTS AND DISCUSSION

The new species by having almost similar bracteoles, glabrous calyx throat, 1-4-flowered spikelets, permanent vernal leaves, and capitate inflorescence belongs to the section *Acantholimon*

Acantholimon hamadannicum Assadi & Mahmoodi, **sp. nov.** figs. 1-2.

Sect. ***Acantholimon***

Diagnosis: *Acantholimon hamadanicum* differs from *A. wendelboi* Rech. f. & Schiman-Czeika, by having glabrous leaves and stems (not densely hairy), calyx limb between the nerves pale purple to orange color (not white).

Perennial, tufted, glabrous except calyx; tufts ca. 10-20 cm across, rather lax. Vernal leaves 10-30 mm long, ca. 2 mm broad, linear, acute to mucronate, soon wilting and reflexed, membranous and amplexicaul; aestival leaves 30-35 mm long, ca. 1.5 mm broad, spiny, membranous, and amplexicaul. Flowering stems including inflorescence, up to 4 cm long, shortly overtopping the tuft; stem leaf one, ca. 5 mm long, subulate, broadly membranous and amplexicaul, erect to spreading. Inflorescence capitate, 1.5-2 cm long and 1.5-3 cm broad. Lower bracts 5-6 mm long, in lower half ca. 4 mm broad and broadly membranous at the margin, in upper half subulate; upper bracts ca. 10 mm long, broadly ovate, acute, except the middle green nerve membranous. Bracteoles up to 4, ca. 9-10 mm long, obovate, membranous except the middle green nerve, obtuse at the apex. Spikelets 1-4 flowered. Calyx ca. 15 mm long; tube ca. 10 mm long, totally hairy or hairy in the lower part, distinctly 5 nerved; limb ca. 5 mm long, funnel-shaped, pale purple in living state, pale brown in dry state, glabrous, minutely toothed at the apex; five nerved; nerves purple, reaching to the margin of the limb. Petals ca. 25 mm long, soon curved inside and cover anthers and stigmas; limb ca. 7 mm long, narrow, pink. Stamens 5, as long as petals; anthers ca. 1 mm long. Gynoecium ca. 15 mm long; ovary ca. 5 mm long, cylindrical, longitudinally nerved; styles 5; stigmas capitate.

Typus: Hamadan: Hamadan-Qazvin Road, 15 km before Avaj, mountain around Garmak village, 2392 m, 34° 3' 44" N; 49° 9' 25" E, 07.03.2018, M. Mahmoodi & K. Safikhani 103918 (holotypus TARI)

Additional specimens examined (Paratypes): - IRAN. Hamadan Province: Hamadan-Qazvin Road, between Garmak and Soltan Bolagh villages, 35 31 35 N; 49 10 09E, 2394 m, 08.07.2019, M. Mahmoodi & Y. Ajani 106648; 20 km from Razan to Avaj, right side of the road, Garmak region, 10.09.2018, K. Safikhani, A. R. Alidadi & R. Kalvandi 1174.

Affinities

Acantholimon hamadanicum is closely related to *A. wendelboi* Rech. f. & Schiman-Czeika, but differs from it by having glabrous leaves and stems, while in *A. wendelboi* stems and leaves are densely hairy. Moreover, the calyx limb between the nerves in the new species is pale purple to orange color, while in *A. wendelboi* calyx limb between the nerves is white (table 1). The other relative of the new species is *A. glabratum* Assadi that differs from the new species by having dense tufts (not lax), white papery calyx limb (not pale purple), and green limb nerves (not purple).

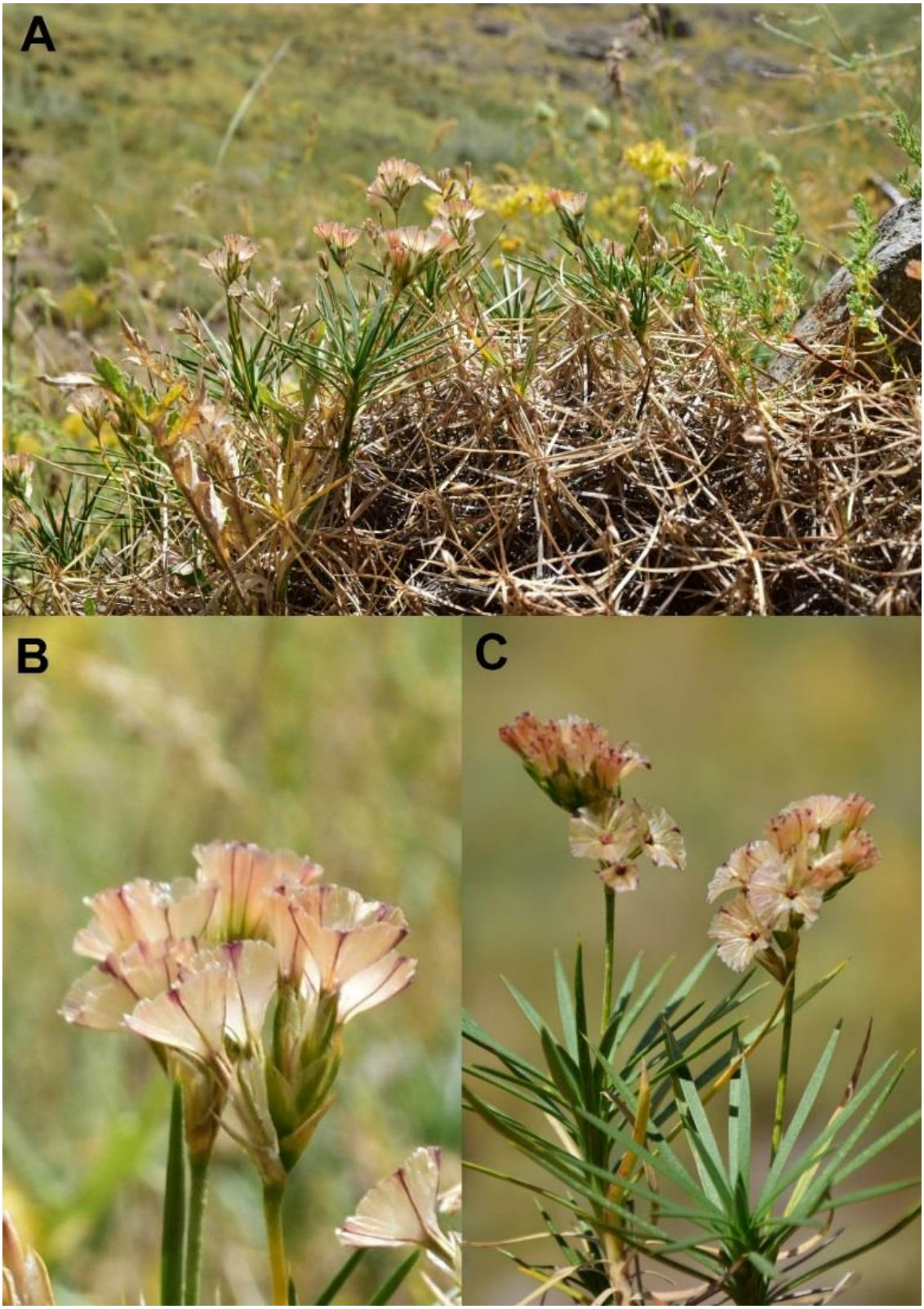

Fig. 1. *Acantholimon hamadanicum* - A: habit of an individual; B: Spikelets and Bracts; C: inflorescence and leaf. - Photographs were taken at the type locality, 3 Jul 2018, by M. Mahmoodi.

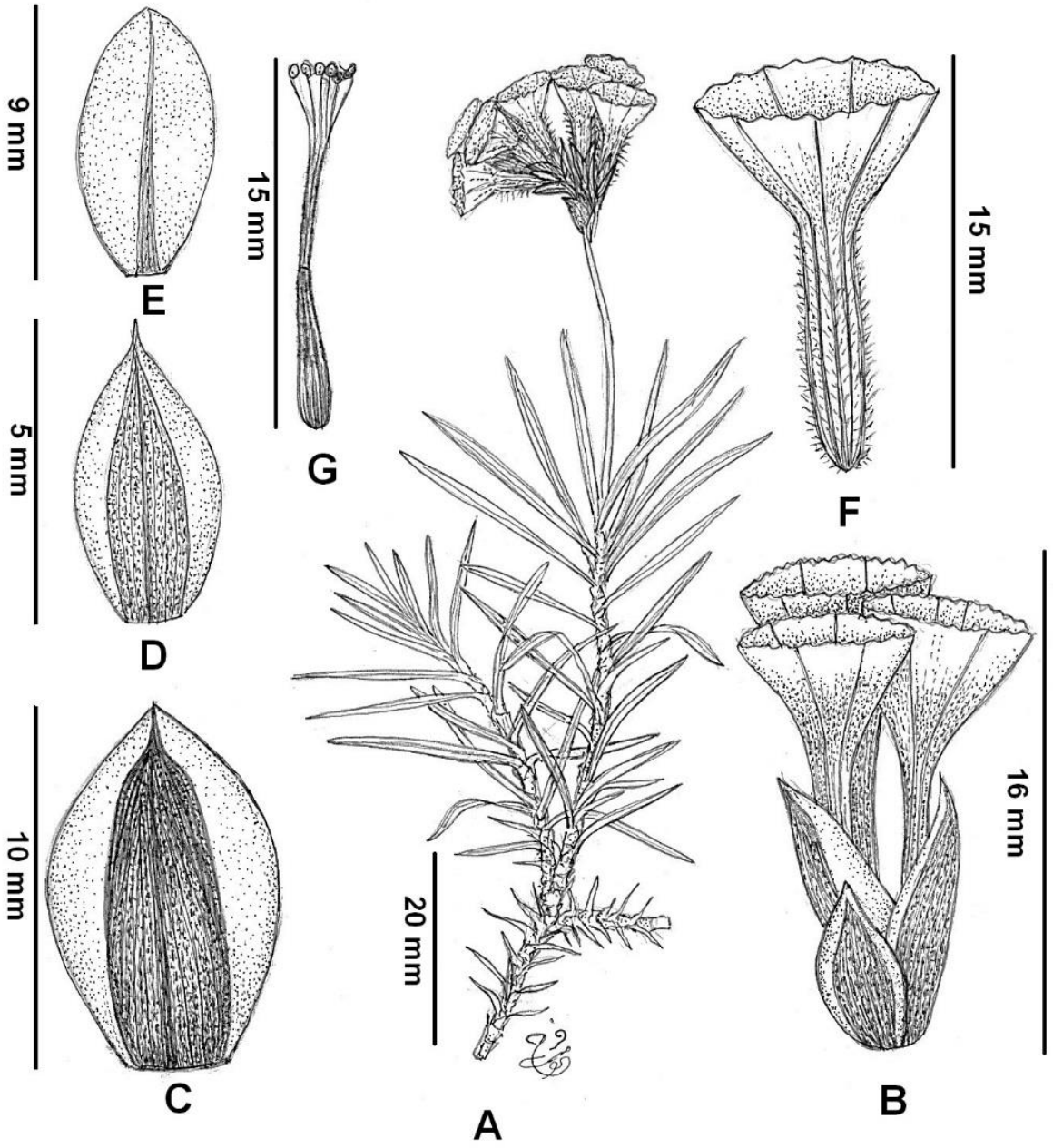

Fig. 2. *Acantholimon hamadanicum* - A: habit; B: spikelet; C: upper bract; D: lower bract; E: bracteole; F: calyx; G: gynoecium. - Drawn by R. Farahdoust from the holotype.

Table 1. Comparison of *Acantholimon hamadannicum* Assadi & Mahmoodi with *A. wendelboi* Rech. f. & Schiman-Czeika and *A. glabratum* Assadi.

Characters	***A. hamadanicum***	***A. wendelboi***	***A. glabratum***
Habit	lax tuft	lax tuft	dense tuft
Diameter of tuft	10-20 cm	up to 30 cm	20-30 cm
Stem and leaf indument	glabrous	densely hairy	glabrous
Vernal leaf	10-30 × 2 mm, acute to mucronate	13-30 × 1.5-2 mm, spiny	7-13 × 1.5 mm, spiny
Aestival leaf	30-35 × 1.5 mm	up to 35 × 1 mm	up to 25 × 1 mm
Stem leaf	1 in number, 5 mm long	1-2 in number, 5 mm long	1-2 in number, 2 mm long
Flowering stem length	up to 4 cm	5-9 cm	up to 3 cm
Spikelet	1-4 flowered	1-3 flowered	1-2 flowered
Bract length	5-10 mm	4.5-6 mm	2.5 mm
Bract shape	ovate to broadly ovate	ovate to broadly ovate	ovate
Bract apex	acute to subulate	acute to shortly mucronate	acute
Bract margin	widely membranous	membranous	narrowly membranous
Bracteole shape	obovate	Lanceolate	Lanceolate
Bracteole apex	obtuse	acute	rounded to shortly mucronate
Bracteole length	9-10 mm	7-9 mm	5.5-8 mm
Calyx length	15 mm	13 mm	16 mm
Calyx limb color	pale purple to orange	white	white papery
Calyx limb nerve	purple	purple	green
Calyx tube	always hairy	always hairy	often glabrous
Petal length	25 mm	15-18 mm	17 mm
Stamen length	25 mm	10 mm	Up to 10 mm
Anther length	1 mm	1.5 mm	1 mm
Gynoecium length	15 mm	10 mm	11 mm

Distribution and habitat

Acantholimon hamadanicum is a local endemic species restricted to a small area in Hamadan Province while its closest relative species (*A. wendelboi*) is more widely distributed and mainly occurs in NW Iran extending to the Central Zagros (fig. 3). *Acantholimon hamadanicum* grows in a mountainous area at an altitude of 2200-2400 m a.s.l. In the habitat of this species, *Astragalus verus* Olivier and *Stipa* sp. are dominant. Other companion species that a considerable number of which are endemics and rare, include: *Achillea biebersteinii* Afan.; *Alyssum lanigerum* DC.; *Astragalus andalanicus* Boiss. & Hausskn. ex Boiss.; *Astragalus brachyodontus* Boiss.; *Astragalus compactus* Lam.; *Astragalus effusus* Bunge; *Astragalus inquilinus* Maassoumi; *Astragalus kirrindicus* Boiss. & Noe.; *Astragalus macrourus* Fisch. & C.A.Mey.; *Astragalus michauxianus* Boiss.; *Astragalus ovinus* Boiss.; *Astragalus paralipomenus* Bunge; *Astragalus straussii* Bornm.; *Astragalus vegetus* Bunge; *Centaurea aucheri* (DC.) Wagenitz subsp. *aucheri*; *Chaerophyllum macropodum* Boiss.; *Cousinia lucida* DC. var. *lucida*; *Euphorbia polycaulis* Boiss. & Hohen.; *Grammosciadium platycarpum* Boiss. & Hausskn.; *Inula oculus-christi* L.; *Malabaila porphyrodiscus* Stapf & Wettst; *Nepeta heliotropifolia* Lam.; *Onosma elwandicum* Wettst.; *Oxytropis kotschyana* Boiss. & Hohen.; *Pimpinella tragium* Vill.; *Scutellaria pinnatifida* A. Hamilt. subsp. *mucida* (Stapf) Rech.f.; *Veronica orientalis* Miller.

Phenology: Flowering and fruiting occur from June to July.

Etymology: The specific epithet is based on the name of Hamadan Province where the specimens of the new species have been collected.

Conservation status: *Acantholimon hamadanicum* is a local endemic species known so far only from a few localities that are very close to each other. The AOO is

measured at about 0.02 km^2, and the EOO is 0.06 km^2. There are no protection plans in the habitat of the new species and also extensive human impacts are observed in the area, which has led to the destruction of the habitat. According to our observations, a large part of the region was plowed for dryland cultivation between 2018 and 2019, which led to a significant destruction of the habitat of the newly discovered species. As a consequence, and following the IUCN Red List criteria (IUCN 2019), *A. hamadanicum* is here defined as Critically Endangered: CR [criteria, B1b (iii) +B2 b (iii)].

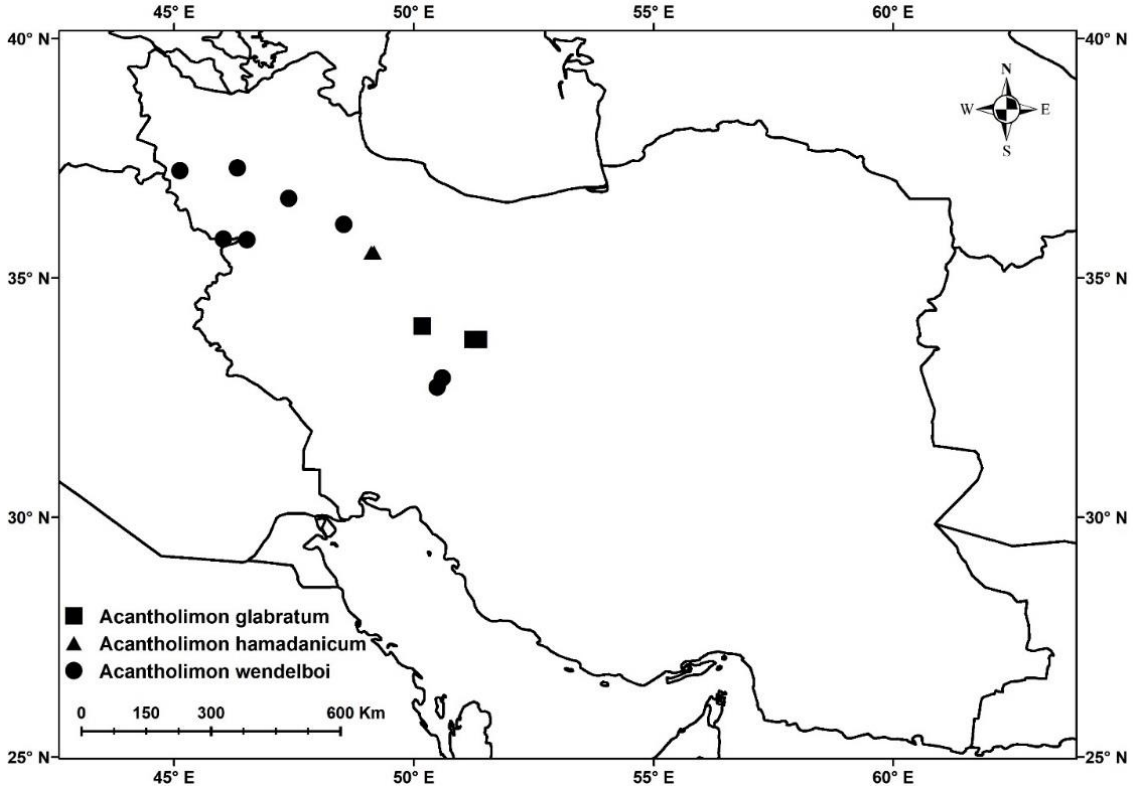

Fig. 3. Distribution map of *Acantholimon hamadanicum* and *A. wendelboi*.

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