

INVESTIGATING THE SITUATION OF *NONEA ECHIOIDES* IN THE FLORA OF IRAN

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Nonea echioides, a species native to the Mediterranean area, is reported from Aras and Qizil Üzan riversides as a rediscovered species for the flora of Iran. A detailed description and photographs of diagnostic features are provided as well as some notes on its micromorphology, distribution and the last state of nomenclature are presented.

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Key words: Boraginaceae; Aras; Aq-dagh; Ardabil; Qizil Üzan

بررسی وضعیت *Nonea echioides* در فلور ایران

محمود بیدار لرد: استادیار پژوهشی، بخش تحقیقات جنگل‌ها و مراتع، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی استان گیلان،

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گونه *Nonea echioides* که یک گونه مدیترانه‌ای است از دو منطقه ساحل رودخانه‌ای (ارس و قزل اوزن) در استان اردبیل به عنوان گونه باز کشف شده برای فلور ایران گزارش می‌گردد. شرح دقیق و تصاویری از صفات تشخیصی این گونه تهیه گردیده و همچنین نکاتی در مورد ریزریخت‌شناسی، پراکنش و آخرین وضعیت نام‌گذاری این گونه ارائه می‌گردد.

INTRODUCTION

Nonea Medik is a genus in the tribe *Boragineae* Bercht. & J. Presl of the *Boraginaceae* Juss. family. This genus comprises approximately 45 species (Weigend & al. 2016, POWO 2019). Pontic-Caucasian Mountains and Irano-Turanian- Anatolian highlands are two centers of diversity of this genus (Selvi & al. 2006, Nejad Falatoury & al. 2011).

A comprehensive revisionary treatment of Iranian *Nonea* species, after Boissier's (1879), has been made by Riedl (1967) in *Flora Iranica*. He listed 12 species with seven subspecies. After that, some new taxa have been described, recorded and taxonomical changes

have been made for *Nonea* species related to Iran (Baytop 1979, Selvi & Bigazzi 2001, Khatamsaz 2002, Pakravan & al. 2009, Nejad Falatoury & al. 2011, 2012). Here we discuss about an already recorded species of *Nonea* in *Flora de l' Iran* (Parsa 1948) as *Nonea ventricosa* (Sm.) Griseb. without a specified specimen, but this record was not accepted by comprehensive related Iranian Floras (Riedl 1967 and Khatamsaz 2002). Here we confirm the existence of this species in Iran by its correct name as *Nonea echioides* (L.) Roem. & Schult. Therefore, the total number of *Nonea* taxa in Iran is 13 species, two of which have two varieties.

MATERIALS AND METHODS

During the field work for determination of Aghdagh protected area and riversides floras in Ardabil province, some specimens of *Nonea* were collected. The collected specimens were crosschecked with various Flora and relevant literatures (Boissier 1879, Popov 1953, Riedl 1967, Baytop 1979, Chater 1972, Selvi & Bigazzi 2001, Khatamsaz 2002, Nejjhad Falatoury & al. 2011, Ahmad 2014, Cecchi & Selvi, 2015 and Mathieu 2019). As well the photos of the herbarium specimens of *Nonea* in E, P, B and W herbaria (acronyms according to Thiers 2019) were consulted in order to confirm the identity of the new species record. The distribution map of recorded plants (fig 2) was produced by geo-referencing the distribution data in the GBIF (2018). Some

morphological characters were measured in the field on living plants, while others were analyzed on herbarium specimens by using stereomicroscope SZ-PT Olympus. Micromorphological analyses were carried out on LEO 1430 VP SEM scanning electron microscope. The collected specimen is preserved in Herbarium of Research Institute of Forests and Rangelands (TARI).

RESULTS AND DISCUSSION

With gynobasic style, 4 nutlets, corolla throat with hairy scales that are not extended inside the corolla tube, subdivided calyx and leafy bracts, the found specimens definitely belong to the genus *Nonea* (fig. 1).

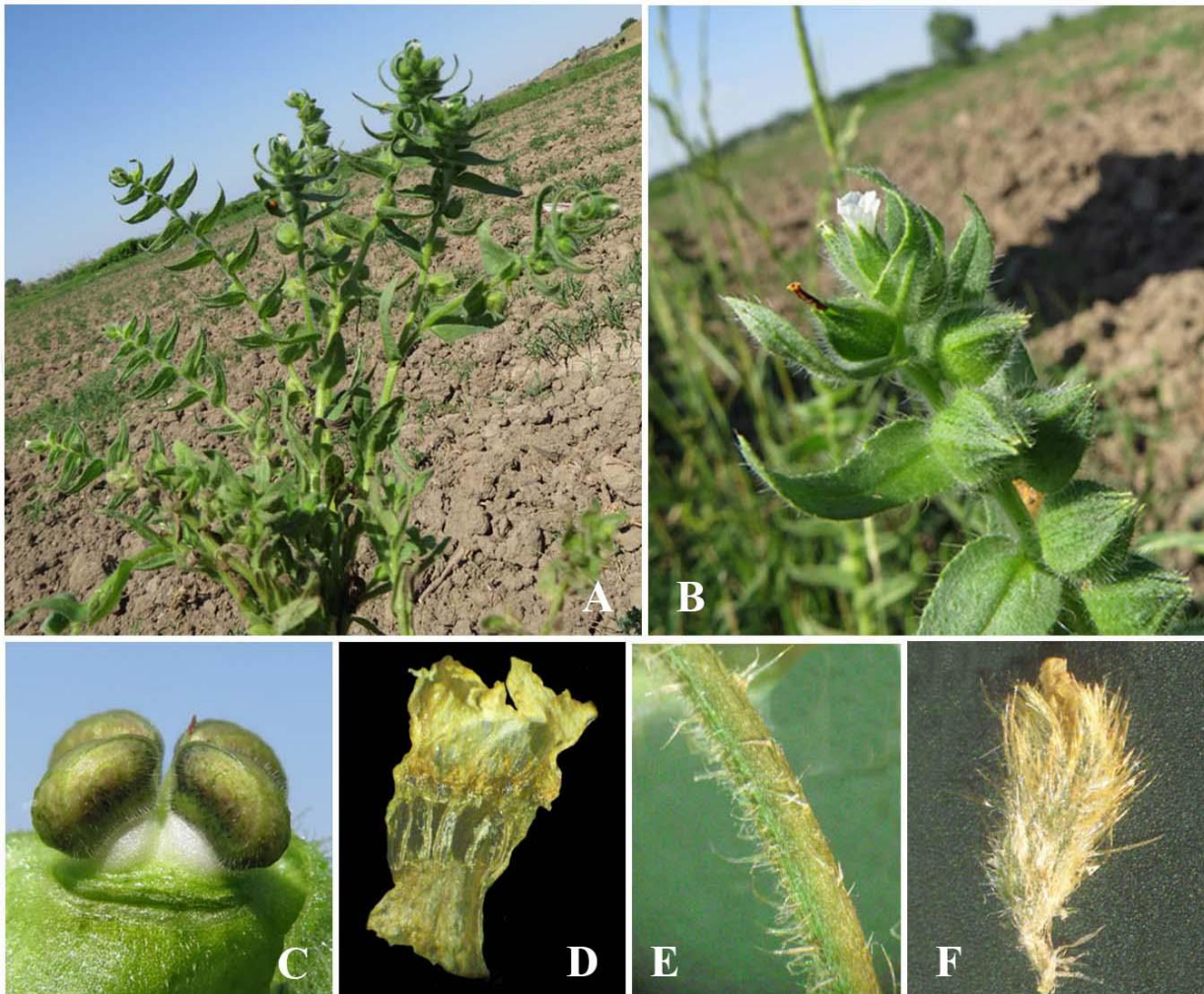


Fig. 1 *Nonea echioides*, A, habit; B, inflorescence and flower; C, seeds; D, corolla in dry state; E, stem indumentum; F, dried flower.

Nonea echinoides (L.) Roem. & Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 4: 71 (1819).

Homotypic *syns*: *Lycopsis echinoides* L., Sp. Pl., ed. 4, 1: 781 (1762); *Anchusa echinoides* (L.) M.Bieb., Fl. Taur. -Caucas. 1: 123 (1808); *Anchusa ventricosa* Sm. in Sibth. & Sm., Fl. Graec. 2: 58 (1836); *Nonea ventricosa* (Sm.) Griseb., Spic. Fl. Rumel. 2 (4): 98 (1844).

Types: [Armenia] "in America [lege Armenia]". Lectotype (Edmondson 1977: 29): [Spain] 14.5.1753, Löffling, 71/7, ex Herb. Alströmer (S-LINN). Paralectotypes (designated by Cecchi & Selvi, 2015): [Spain] "Ex Hispania", s.d, Loefling 146, 71/9, ex Herb. Casströmii (S-LINN 09-35911); s.loc, s.d., s.coll. (LINN-HL 190.6). (fig. 4)

Heterotypic *syns*: *N. alba* DC. in DC. & Lam., Fl. Franc. (DC. & Lamarck), ed. 3. 6: 420 (1815); *N. ventricosa* (Sm.) Griseb. f. *alba* (DC.) Fiori in Fiori & Bég., Fl. Italia [Fiori, Béguinot & Paoletti] 2 (3): 373 (1902).

Type: [France] "dans les blés sur les deux rives du Rhône audessous d'Avignon, à Tarascon et à Aramon". Lectotype (designated by Cecchi & Selvi, 2015): [France] "Tarascon et Aramon, 2 rives du Rhone", 1810, Requier, Herb. Candolle 4542 (G-DC 137568) (fig. 5).

Annual; stems prostrate to ascending, 10-40 cm long, branched from base, hispid-setose. Leaves lanceolate, along margin more or less denticulate, obtuse or acute, 2-5 cm long, 0.5-0.8 (1.1) cm wide, lower leaves spatulate gradually tapering at base, median and upper leaves sessile. Cymes short in flower, elongating in fruit, dense, 4-8 cm long; bracts lanceolate, acute, longer than flowers; pedicels very short, drooping; calyx subsessile, flowering calyx 4-5 mm, ¼ divided, fruiting calyx, fruiting calyx 8-13 mm, broadly subspherical-ovoid, slightly bristly-downy, but with rather many thin acicular bristles, the teeth as long as the undivided part, triangular-lanceolate, rather narrow and long- acuminate; corolla 6-8 mm, white, exceeding the calyx, limb 4-5 mm diameter, erect-patent. Faucal scales reduced to tufts of hairs. Annulus hairy. Stamens inserted regularly at same level, anthers 1-1.2 mm. Nutlets transversely reniform, 3-3.5 mm long, 1.5-2 mm high, blackish to dark brown, rugose, ribbed, puberulent, reticulate, ring around, ventral attachment ring large up to 1 mm.

Specimens studied: Iran, Ardabil Province: Aras riverside, Beatweem Torbat kani and Assad kandi villages, 39°28'0.60"N, 47°25'53.38"E, 123 m, 15.5.2019, M. Bidarlord and Pour Amini 107641; Ardabil Province: Qizil Üzan riversides, Nimehil village, 37°14'46.93"N, 48°24'52.03"E, 680 m, M. Bidarlord. 10.5.2018.

This species is a Mediterranean element (Baytop 1979) and its distribution range extend more westward from Northwest Africa, Europe and Cyprus to Turkey and Iraq (fig. 2). In Iran it grows on the Aras and Qizil Üzan on the river banks. In other words, Iran is the most eastern limit of its distribution. It is worthy mentioned that this species grows in waste land or as a weed (Baytop 1979). *N. echinoides* was collected in wet meadow habitats (fig. 1). This species is accompanied with other wet meadow species such as *Lolium rigidum* Gaudin, *Alopecurus myosuroides* Huds., *Geranium dissectum* L., *Trifolium repens* L., *Ranunculus marginatus* d'Urv., *Valerianella dactylophylla* Boiss. & Hohen. and *Bromus* spp. Flowering & Fruiting: May to July.

This species is listed in Flora USSR (Popov 1953), Flora Europaea (Chater 1972) and Flora Turkey (Bavtop 1979) under the name *N. ventricosa* (Sm.) Griseb. Parsa (1948) recorded the name *N. ventricosa* (Sm.) Griseb. without specified specimen from Iran. According to latest literature (Cecchi & Selvi 2015, POWO 2019, Mathieu 2019) *N. ventricosa* is a synonym of *N. echinoides* which has not previously been mentioned in the literature about Iran's flora.

In some references (e.g. Khatamsaz 2002) *Lycopsis echinoides* L. have been considered, as a synonym of *Huynhia pulchra* (Willd. ex Roem. & Schult.) Greuter & Burdet, which is now synonymous with *Arnebia pulchra* (Willd. ex Roem. & Schult.) Edm. (Edmondson 1977, 1978). According to Edmondson (1977, 1978), *Lycopsis pulchra* Willd. ex Roem. & Schult. is a synonym of *Huynhia pulchra* (Willd. ex Roem. & Schult.) Greuter & Burdet. Edmondson has detailed the reason for this mistake and has designated the proper lectotypes for these taxa in his papers (Edmondson 1977, 1978).

In fact, *Nonea* and *Huynhia* are easily distinguishable by their distinct morphological differences. So that, they belong to two tribes. Diagnostic characteristics are as follows: division of calyx (subdivided in *Nonea* and divided to base in *Huynhia*), corolla's color (white in *N. echinoides* and yellow with blackish purple patches in *Huynhia*), corolla throat's scales (present in *Nonea* and absent in *Huynhia*), stamens inserted (irregularly in *Huynhia* and regularly in *N. echinoides*). The shape of the nutlets is also quite different in the two genera. As mentioned, the specimens mentioned here, clearly belong to the genus *Nonea*.

According to the red list's categories and criteria (IUCN 2016) and distribution map (fig. 2) of *N. echinoides* (GBIF 2018), it has a relatively wide distribution range (Approximately 6,083,337 km²) and thus it is evaluated as LC (Least Concern) globally. In

Iran, it has a very restricted extent of occurrence (EOO=150 km²) and area of occupancy (AOO=0.750 km²). According to the very peculiar habitats of fragmented populations in the riparian zone and severe grazing pressure, the conservation status of this newly recorded species in the flora of Iran is evaluated as Critically Endangered.

Pollen and Nutlet micromorphology: Grains were monad, zonocolporate, prolate and isopolar, with a polar length of 11-15 μm and equatorial length of 10-12 μm. The number of apertures ranged from 4 to 5 (4- colporate or 5-colporate). Apertures were fusiform, 5-7 μm long and 1-2.5 μm wide. The apertures were smooth or thickened by the presence of from the apocolpial to the mesocolpial regions. Sculpture was continuous, psilate- punctate with the exception of the

equatorial zone, which was reticulate or microreticulate (fig. 3). This species sculpture close to *N. caspica* group (Nejhad Falatoury & al. 2011).

Results of nutlets size, shape, pubescence, surface structure and the structure of the basal ring (fig. 3) are confirmed previous results on this species nutlets' micromorphology (Karimov & Illarionova 2018).

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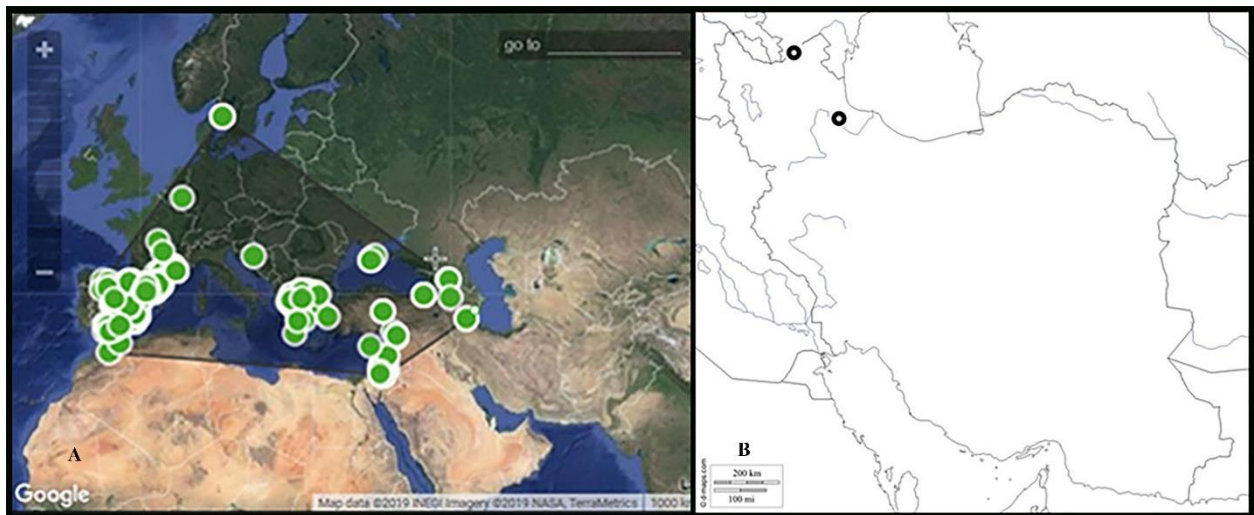


Fig. 2. A, Extent of Occurrence of *Nonea echioides* in the world and, B, occurrence in Iran.

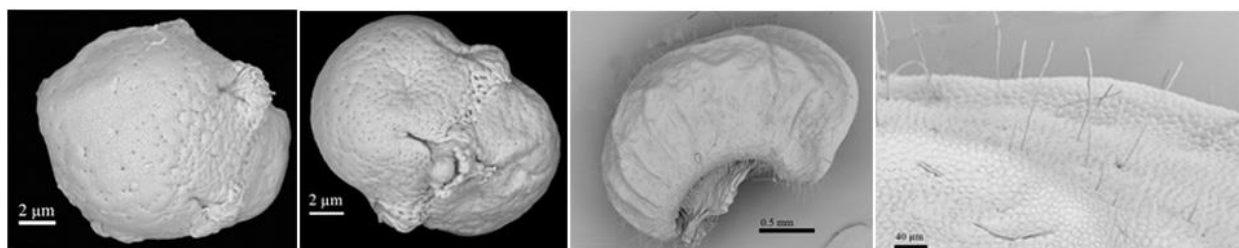


Fig. 3. SEM micrographs of *Nonea echioides*: A, polar view of pollen grain; B, equatorial view of pollen grain; C, achene; D. achene surface.



Fig. 4. Paralectotype of *Nonea echinoides*, Spain, Loebl. [Löfling] s.n. (S09-35911).



Fig. 5. Lectotype of *Nonea alba*. France, Requieron, E. s.n. (G00137568).

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