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Short communication

Myosotis refracta Boiss. (Boraginaceae), an unexpected forget-me-not in the Slovene flora

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Abstract – *Myosotis refracta* Boiss. is reported as a new and unexpected finding for the Slovene flora. The species was found in three collections stored in the Herbarium LJU from south-east Slovenia, in the Kolpa river valley bordering Croatia. All plants thrived under overhanging dolomite rocks. On account of an earlier misidentification, the respective plant community had been described as the association *Arabido alpinae-Myosotidetum strictae* Accetto 2008, which is here corrected to *Arabido alpinae-Myosotidetum refractae* Accetto 2008 corr. Strgulc Krajšek, Accetto & Jogan 2016. *Myosotis refracta* has a disjunct Mediterranean-southwest Asian distribution. The reported new localities extend its known range more than 500 km in north-west direction, from its nearest known occurrences on the southern Balkan peninsula.

Key words – flora, forget-me-not, Kolpa valley, *Myosotis refracta*, phytocenology, Slovenia

Introduction

Myosotis L., forget-me-not (Boraginaceae) has about 41 species reported from Europe (Grau and Merxmüler 1972). The genus is considered taxonomically difficult, due to the many morphologically similar species that are for practical reasons grouped in several aggregates, such as *M. alpestris* agg., *M. sylvatica* agg., and *M. scorpioides* agg. (Greuter et al. 1984). Eleven species of *Myosotis* were recorded from Slovenia (Strgulc Krajšek 2007, Király et al. 2007) before the revision of herbarium material in Herbarium LJU in 2015, carried out by Strgulc Krajšek. During the revision, an unexpected species, *M. refracta* Boiss., was identified.

M. refracta is morphologically distinct, but easily confused with other small *Myosotis* species. The plants are annual, branching from base, with few-leaved, delicate, stiff branches terminating in long, many-flowered partial inflorescences. The leaves are lanceolate, to 4 cm long. The flowers are small, corolla to 1.5 mm in diameter and pale blue. The calyx is densely covered with patent hooked hairs. Hooked hairs on the base of calyx are strongly deflexed towards the very short pedicel. During ripening, the calyces elongate to ca 4 mm and their pedicels become deflexed, giving the plant a very characteristic appearance in that state. The nutlets are narrow, almost spindle-shaped (Grau and Merxmüler 1972). Phylogenetically (based on ITS), *M. refracta* has a basal position relative to a clade containing most of the Eurasian *Myosotis* species (Winkworth et al. 2002), but poor resolution and plastid marker incongruencies would need more sampling.

The known distribution of *M. refracta* is apparently linked to the southern edge of the Eurasian mountains formed during the Tertiary Alpine orogeny of the Tethyan (palaeo-Mediterranian) region, stretching from Spain to NW India. It has an interesting distribution range from the Iberian peninsula in the West to the western outskirts of Himalaya in the East with at least two disjunctions separated by 1000 or more km and possibly another disjunction in the eastern part of the range, but the data quality for Western Asia is less reliable so it could have been expected also in the mountain ranges around the Black and the Caspian Sea. In the Western Mediterranean its records are limited to the south of Spain. The Eastern Mediterranean disjunction ranges from Albania and Greece to Syria, and the Eastern disjunction spans the area from Pakistan to Himalaya (Chowdhery and Wadhwa 1984). In Spain it is reported for Sierra Nevada where its locus classicus is (Boissier 1841). In the former USSR it is reported only for Eastern Crimea (Fedorov 1981), from Albania several localities were reported just recently (Barina et al. 2009) on limestone areas, with only one older record known from the vicinity of Borsh. In Macedonia Bornmüller 1928 reports it only for Drenovo, but recently Matevski 2010 added several localities scattered in the mountains. In Greece several localities are reported from various mountain ranges (Strid 1991) and Crete (Jahn and Schönfelder 1995). Meikle 1985 reports it

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from 3 localities in the mountains of western Cyprus.

Heller & Heyn 1986 reported *M. refracta* for Cyprus, a major part of Asian Turkey (similarly also Grau 1978), Lebanon, Syria and Israel (especially mountains near Mediterranean coast), NE Iraq and W Iran.

To date, four subspecies of *M. refracta* were described (Grau and Merxmüler 1972, Greuter et al. 1984, Kazmi 1971):

- *M. refracta* subsp. *refracta*: 2n = 44, distribution range: Spain, E Mediterranean region and Krym.
- *M. refracta* subsp. *paucipilosa* Grau: 2n = 20, distribution range: S Greece, Kriti. Turkey. This subspecies has been recognised as a separate species due to karyological, morphological and distributional differences: *Myosotis paucipilosa* (Grau) Ristow & Hand (Hand 2015).
- *M. refracta* subsp. *aegagrophylla* Greuter & Grau: chromosome number unknown, distribution range: Kriti (Greuter and Grau 1970). This taxon is not generally accepted and has been synonymized with nominal subspecies (Hand 2015).
- *M. refracta* subsp. *chitralica* Kazmi: W and C Asia (Afghanistan, Pakistan, Kashmir, NW India, Turkistan, Pamir Alaj, Tien Shan.) (Kazmi 1971, Nasir 2015). According to Hand 2015, this taxon may need critical reconsideration, but see Dickoré 2016.

The differences between subspecies are in the shape of leaves, distribution of hooked hairs on calyx, the extent of calyx deflexion in the fruiting state and in the shape of nutlets (Grau and Merxmüler 1972), but, on the other hand, all these characters are reported as highly variable across the distribution range (Riedl 1967).

The author of *M. refracta* (Boissier 1841) reported its rocky habitats in the subalpine to alpine belt, and obviously the species is a high mountain dweller in the southern parts of its distribution. In cooler areas, as in Macedonia it was found to range from the lowlands to the montane belt, 200–1000 m a.s.l. (Matevski 2010), and in Crimea is found in shaded rocky places in the lowlands (Fedorov 1981). All authors reported rocky habitats and pioneer plant communities. More specific ecological conditions are reported for Macedonia, where the species can also be found along paths (Matevski 2010). Meikle 1985 reports it from diabase and serpentine gravel on slopes, and, most precisely its ecology is described in Mountain flora of Greece as including »rocky pastures, often in somewhat damp, semi-shaded, nutrient rich places« (Strid 1991).

Material and methods

A revision of all available material of the genus *Myosotis* stored in the Herbarium LJU (University of Ljubljana, Biotechnical Faculty, Department of Biology) was carried out in 2015. Identifications were checked using the keys in Flora Europaea (Grau and Merxmüler 1972), and characters given in other publications including original descriptions: Boissier 1841, Greuter and Grau 1970, Hand 2015.

Results and discussion

Three specimens of *Myosotis refracta* Boiss. from the Kolpa valley area in southeast Slovenia were identified in the Herbarium LJU. All had been collected by M. Accetto between the years 1999 and 2007, and previously misidentified as *M. stricta* Link ex Roemer & Schultes:

1) 0454/3 Slovenia: SE Slovenia, valley of river Kolpa, Osilnica, above Ribjek by Kolpa, foothill of overhanging rock wall, E from Mož, 200 m a.s.l., leg. M. Accetto, 2. 5. 2007. LJU10133797.
2) 0454/4 Slovenia: SE Slovenia, valley of river Kolpa, Osilnica, rock wall E of Fistov rep, 940 m a.s.l., leg. M. Accetto, 6. 6. 1999. LJU10119844.
3) 0454/3 Slovenia: SE Slovenia, valley of river Kolpa, Osilnica, rock wall Fistov rep, 710 m a.s.l., leg. M. Accetto, 30. 5. 1999. LJU10119845.

The Slovene plants can clearly be referred to the type subspecies, *Myosotis refracta* subsp. *refracta* (Fig. 1) and with habitus and morphology very similar to the illustration of the type specimen from Spain (Boissier 1841).

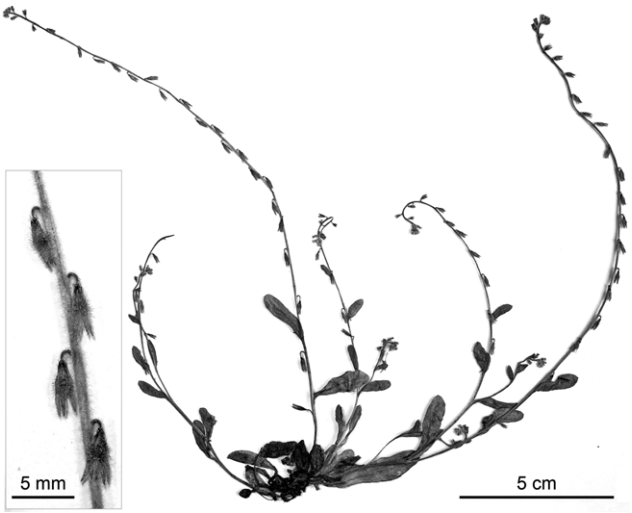

Fig. 1. The herbarium specimen of *Myosotis refracta*, collected on 2nd of May 2007 in Slovenia in valley of river Kolpa by M. Accetto (LJU10133797), photo by: A. Kladnik.

The flowering time of the species is early spring. Specimens from Slovenia, sampled in May, were already in fruiting state.

The ecological conditions in all three localities in Slovenia, where herbarium specimens of *M. refracta* were collected, were very similar: narrow rocky shelves below overhanging dolomite rocks (slightly sheltered from rain), in open habitats on fine dolomite debris, slopes facing north-west or east. *Myosotis refracta* was growing together with: *Arabis alpina* subsp. *alpina*, *Poa bulbosa*, *Sesleria juncifolia* subsp. *kalnikensis*, *Cardaminopis arenosa*, *Taraxacum laevigatum* agg., *Anisantha tectorum*, *Hornungia petraea* and few other species. Due the specific habitat and species composition, a new association from the *Alysso-Sedion* alliance, »*Arabido alpinae-Myosotidetum strictae*« had been described (Accetto 2008). *Myosotis refracta* (at

that time erroneously determined as *M. stricta*) actually comprises the edificator species of the new association, selected on account of its relatively high mean cover value. In accordance with International Code of Phytosociological Nomenclature (Weber et al. 2000) the name of association has now to be changed to *Arabido alpinae-Myosotidetum refractae* Accetto 2008 corr. Strgulc Krajšek, Accetto & Jogan 2016, nom. corr. hoc loco.

The gap between the known distribution range (Grau and Merxmüler 1972) and the newly discovered localities in Slovenia is more than 500 km. Due to early flowering and extreme ecological conditions of *M. refracta* habitats it is highly possible that the species could have been overlooked in similar habitats along the Dinarides.

Myosotis refracta is not the only representative of Boraginaceae with such extreme ecology; a comparable one is *Asperugo procumbens* L. (Martinčič 2007). With their obvious adaptation to epizoochorous fruit dispersal we can think of some animal species adapted to rocky cliffs as potential vectors. Wild goats have already been mentioned in literature as sharing habitats with *M. refracta*, but as the diasporae are really tiny, also some bird of the rocky habitats as *Tichodroma muraria* (L., 1766) (wallcreeper) might have been a vector. That would be especially important for long-distance dispersal.

According to the previously known distribution and its recent discovery occurrence in Slovenia, it seems possible that *Myosotis refracta* may be found in other localities along the Dinaric arc, such as in Croatia and Montenegro.

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