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Two new neophytes in the flora of Bosnia and Herzegovina: *Oenothera fruticosa* and *Phacelia campanularia*

Semir Maslo^{1*}, Šemso Šarić²

izvorni znanstveni rad (original scientific paper)

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Abstract

Two new neophytes, *Oenothera fruticosa* L. and *Phacelia campanularia* A. Gray were discovered in the early summer of 2021 during fieldwork in the vicinity of Olovo (Central Bosnia). They are native to North America, but they have been introduced to some areas beyond their natural range. This is the first record of those species for Bosnia and Herzegovina. Brief information on the species distribution in Bosnia and Herzegovina, as well as a discussion of the alien and invasive status in the country are provided. All recently found localities are restricted to road verges and, apparently, reflect a recent human assisted colonization of the species. Judging from the literature and observations in the field both species should be considered casual, non-invasive species in Bosnia and Herzegovina. The text is illustrated with photographs from the new localities of both species.

Key words: Bosnia and Herzegovina, casual alien, distribution, new record, *Oenothera*, *Phacelia*.

Introduction

The genus *Oenothera* L. (Onagraceae) is a genus of approximately 145 species, which are subdivided into 18 sections. The genus is widely distributed in temperate to subtropical areas of North and South America with a few species in Central America. Several species are widely naturalized. The centre of diversity for the genus is in southwestern North America (Wagner et al., 2007). It is represented by 91 species in the Euro-Mediterranean region (Raab-Straube, 2018) of which only two have been reported in Bosnia and Herzegovina: *Oenothera biennis* L. and *Oenothera glazioviana* Micheli (Maslo et al., 2020).

According to Euro+Med PlantBase (EURO+MED 2006) *Oenothera fruticosa* L. has the status of casual species in Belgium (Rostański and Verloove, 2015), Czech Republic (Pyšek et al., 2002),

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Germany (Buttler et al., 2018) and Poland (Mirek et al., 2002). It is noted only as alien species in Croatia (Rottensteiner, 2014) but is not included in Flora Croatica Database (Nikolić, 2022). Only recently it was found in Italy (Galasso et al., 2018) and Sweden (Rostański and Karlsson, 2010).

The genus *Phacelia* Juss. (Boraginaceae) is genus of approximately 210 species. It is mostly native to western North America. The centre of diversity for the genus is California (Walden et al., 2014).

Within the genus *Phacelia*, only 5 species have been recorded in Europe (Raab-Straube, 2017). Up to now, *Phacelia tanacetifolia* Benth. was the only species of the genus reported in Bosnia and Herzegovina (Maslo et al., 2020).

According to Euro+Med PlantBase (EURO+MED 2006) *Phacelia campanularia* A. Gray has the status of casual species only in Czech Republic (Pyšek et al., 2002), but it was found in Austria (Hohla et al., 2015), Belgium (Verloove, 2020), Great Britain (Clement and Foster, 1994) and Sweden (Karlsson, 1997), which is not noted in Euro+Med PlantBase (EURO+MED 2006).

This paper presents a supplement to the list of alien plant species in Bosnia and Herzegovina, as well as to the general distribution of the mentioned aliens in Europe.

Materials and methods

Plant material of two new alien species for the flora of Bosnia and Herzegovina was collected during field investigations of the central part of the country, during the period of June to July 2021. Digital photographs and GPS coordinates were taken in the field, while the specimens were identified with the following keys: *Oenothera fruticosa* with Straley (1978) and *Phacelia campanularia* (Constance, 1951). The nomenclature follows the Euro+Med PlantBase (EURO+MED 2006).

Results and discussion

O. fruticosa is perennial herb, 20-80 cm high. Stems are strictly erect or slightly decumbent, simple or branched at the base, with densely strigose or sparse glandular, erect hairs. Basal leaves are oblanceolate to obovate, 3-12 x 1-3 cm, the petiole 1-4 cm long; cauline leaves 2-6 x 0,2-2 cm, narrowly elliptic to ovate, subglabrous, with ciliate margins and few hairs along the midrib, subentire to coarsely dentate, undulate. Inflorescence is erect, rarely nodding; subtending bracts are linear to lanceolate, 5-40 mm long, 1-10 mm wide. Ovary is 3-15 mm long and 1-3 mm thick. Floral tube is 5-20 mm long. Sepals are 5-20 mm long and 2-3 mm wide with free tips. Petals are 15-25 mm long and 10-20 mm wide, truncate to cleft, often undulate, pale to dark yellow, opening in the morning. Filaments 5-15 mm long, erect; anthers 4-7 mm long. Style 12-20 mm long. Fruit is tetragonal to 4-winged, clavate to oblong, 10-20 mm long and 3-5 mm thick. Seeds are dark reddish brown. Chromosome counts are $n=14, 21$ (mainly adapted from Straley, 1978).

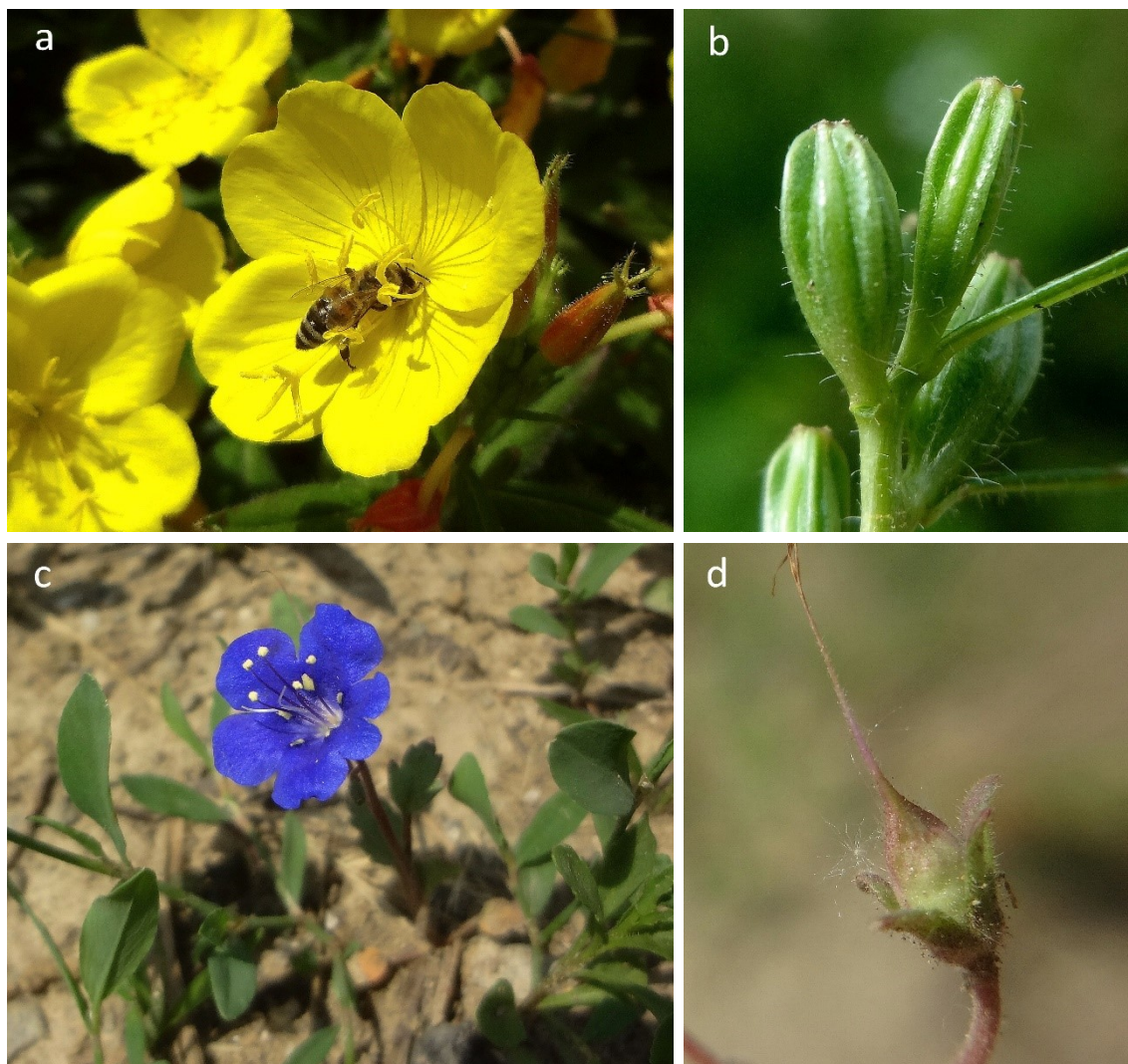


Figure 1. *Oenothera fruticosa* L., a – flower, b – young fruits; *Phacelia campanularia* A. Gray, c – flower, d – young fruit (Photos: Š. Šarić).

According to Straley (1978) *O. fruticosa* is represented by two subspecies namely, *Oenothera fruticosa* L. subsp. *fruticosa* and *Oenothera fruticosa* subsp. *tetragona* (Roth) W. L. Wagner. Both subspecies are very similar but *O. fruticosa* subsp. *tetragona* has broader, usually relatively glabrous, sometimes glaucous, and more dentate leaves; predominately glandular pubescence; and oblong capsules, widest about the middle, with glandular hairs, sometimes also with simple hairs. *O. fruticosa* subsp. *fruticosa* usually has narrower, more strigose leaves, with subentire margins; predominately nonglandular hairs; and clavate capsules, widest above the middle, with simple hairs but without glandular hairs (Straley, 1978).

Specimens from Olovo have fruits with clearly glandular hairs (Fig. 1. b), so populations from Bosnia and Herzegovina obviously belong to *Oenothera fruticosa* subsp. *tetragona* (Roth) W. L. Wagner.

The North American species *O. fruticosa* has its only Bosnian populations in the area of Olovo (Central Bosnia) where it was discovered in 2021. The species was found in three localities around the town of Olovo (Fig. 2) in the different types of habitats: in dry roadside ditches and dry meadows on the left bank of the Krivaja river.



Figure 2. The recent findings of *Oenothera fruticosa* L. and *Phacelia campanularia* A. Gray, in Bosnia and Herzegovina (the distribution map was made by Aldin Boškailo)

Locality 1: It is located in Prisoje, in dry roadside ditches, about 1 km NE of Jelaške (Olovo) (44°17'22" N; 18°24'51" E; elevation 413 m.). Only five specimens were recorded.

Locality 2: The second locality is pretty close to the first, located in the village of Jelaške (Selišta), left bank of Krivaja river (44°17'08" N; 18°24'31" E; elevation 435 m.) About 6 specimens were recorded.

Locality 3: dry meadows along the roadsides in the village Jelaške (Podgaj), near the town of Olovo (44°17'10" N; 18°23'39" E; elevation 526 m.). Only three flowering plants with young fruits were observed.

Locality 4: Careva Ćuprija, Olovo, left bank of Krivaja River, dry meadow (44°16'13" N; 18°25'43" E; elevation 386 m.). Population counted 6 plants, surrounded by numerous individuals of *Crepis biennis* L., *Dactylis glomerata* L., *Galium mollugo* L. and *Holcus lanatus* L.

In the area of Olovo the plant is grown as an ornamental plant, and thus horticulture is considered to have been one introduction pathway. Following the framework proposed by Blackburn et al., 2011, we can consider *O. fruticosa* as a casual alien species in the territory of Bosnia and Herzegovina, currently in the C2 category (Individuals surviving in the wild in location where introduced, reproduction occurring, but population not self-sustaining).

Phacelia campanularia is an erect simple or branched annual, 10-60 cm high. The leaves are alternate, ovate to oblong, 1,5-7,5 x 1-5 cm, crenate to dentate, obtuse, the basal ones long-petioled. They are glandular-pubescent and often have a purplish cast on the reverse side. Flowers are several to numerous, long-pedicellate in lax, open cymes; the cymes simple or few-branched, 10-30 cm long, erect in fruit. Calyx-lobes linear-oblong 4-12 mm long, somewhat accrescent; corolla blue, funnellform-campanulate, deciduous, 1,5-4 cm x 1-4 cm, the lobes obovate, 4-10 mm long, much longer than the calyx. Capsule oblong-ovoid, 8-12 mm long, acuminate. Seeds oblong-ovoid, 1-1.5 mm long, brown (mainly adapted from Constance, 1951, Schmidt, 1982 and Cullen, 2000).

The first finding of this species for Bosnia and Herzegovina is from Central Bosnia at the beginning of June 2021, near the town of Olovo. Only one flowering plant with young fruits was observed at a rubbish soil dump on the right bank of Stupčanica River in the area of Karagino polje (44°07'47" N; 18°35'16" E; elevation 537 m.) (Fig. 1c, d). At that locality, *P. campanularia* was accompanied by *Aethusa cynapium* L., *Barbarea vulgaris* R. Br. *Cardaria draba* (L.) Desv., *Euphorbia falcata* L., *Medicago minima* (L.) Bart. and *Vaccaria hispanica* (Mill.) Rauschert. *P. campanularia* is often included in wildflower seed mixtures and is most likely self-sown from nearby gardens. Following the framework proposed by Blackburn et al., 2011, we can consider *P. campanularia* as a casual alien species in the territory of Bosnia and Herzegovina, currently in the C0 category (individuals released into the wild (i.e. outside of captivity or cultivation) in a location where introduced, but incapable of surviving for a significant period).

Conclusion

The exact origin of these species from Bosnia remains uncertain, but it is most likely that fruit or some seeds obtained from nearby gardens were thrown at this locality. Both species are grown as ornamentals, and thus horticulture is considered the most possible pathway for their introduction.

Judging from literature and observations in the field, it can be inferred that these species may naturalize and form locally extensive stands, especially *O. fruticosa* subsp. *tetragona*. However, at least in the Bosnian localities, they do not show invasive behavior. Therefore, at present, they should be considered casual, non-invasive species. This is congruent with the observations from other places in Europe (e.g., Rostański and Verloove, 2015; Hohla et al., 2015; Verloove, 2020). The potentially invasive behavior of these species should be monitored in the following years

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