A new contribution on the distribution of the rare *Veronica scardica* Griseb. (Plantaginaceae) in Croatia

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Abstract

After being reported in Croatia for the first time in 2003, two new localities of the rare species *Veronica scardica* are presented in this paper. Accompanying species and corresponding vegetation are given for both localities. Additionally, morphological characters useful in distinguishing the similar taxa of the section *Beccabunga* are summarized.

Keywords: calcareous fen, lake margin, *Molinion*, *Nanocyperion*, section *Beccabunga*, wet habitats

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Sažetak

Nakon što je 2003. godine po prvi put zabilježena u Hrvatskoj, u ovom su radu predstavljena dva nova nalazišta rijetke vrste *Veronica scardica*. Na oba lokaliteta zabilježene su prateće vrste i pripadajuća vegetacija. Također, navedene su morfološke značajke korisne za razlikovanje sličnih svojti iz sekcije *Beccabunga*.

Ključne riječi: bazofilni cret, *Molinion*, *Nanocyperion*, obala jezera, sekcija *Beccabunga*, vlažna staništa

Introduction

Veronica scardica Griseb. belongs to the section *Beccabunga* (Hill) Dumort (Plantaginaceae), comprising species associated with aquatic and wet habitats. This group includes annual and perennial helophytes, which occur primarily in the temperate regions of the Northern and Southern Hemispheres (Ellmouni et al. 2018), with the diversity centre in southwest Asia (Chrtek & Osbornová-Kosinová 1981).

The species was described by Grisebach (1843) from shady alluvial forests at the confluence of the Black and White Drim in northern Albania. The author named it after the area where it was discovered in 1839, which is dominated by the Šar Mountains (lat. *Scardus Mons*) – hence *V. scardica*.

Veronica scardica is a native European species distributed in Eastern, Central and Southeastern Europe, precisely European Turkey, Greece, Albania, Serbia, Bulgaria, Romania, Croatia, Hungary, Czechia, Slovakia and Austria (Walters & Webb 1972, Marhold 2011). According to GBIF (2021), the species was also recorded in Western (in France, as *Veronica gracilis* (Uechtr.) Velen.) and Northern Europe (Finland). Outside Europe, the species is known from Western Asia (Georgia, Syria and Iran) (Abd El-Ghani et al. 2011, GBIF 2021), while a subspecific taxon *V. scardica* subsp. *africana* Chrtek & Osb.-Kos. is listed in Egyptian flora (Abd El-Ghani et al. 2011, Ellumouni et al. 2018).

Prior to our findings, *V. scardica* was reported from only one locality in Croatia, the banks of the Kupa River near Ozalj. Only two individuals were found growing on fine gravel, accompanied by amphibious plants characteristic of the alliance *Nanocyperion* Koch 1926 (Topić & Ilijanić 2003). Here we present two new localities of *V. scardica* in Croatia, along with comments on its habitat and the associated vegetation. Furthermore, we give a summary of the most useful morphological characters to distinguish the species of section *Beccabunga*.

Materials and methods

The fieldwork was performed during the vegetation seasons 2014 and 2020 in the continental part of Croatia as a part of two independent projects (Fig. 1). Flora and vegetation of a calcareous fen in the settlement Podevčevo (WGS84: 16.2993°E, 46.2013N°) (Varaždin County) were studied in 2014. The fen is situated at the foot of the Mt. Ivanščica, i.e. the peak Čevo, and is associated with several springs on dolomite bedrock, out of which the helocrene one, situated near the local school, and its immediate surroundings, were studied in detail. In 2020, a comprehensive survey of aquatic and riparian vegetation of Savica (Zagreb County) was carried out. This is a complex of 12 artificial, interconnected eutrophic lakes, situated on the left side of the Sava River on Neogene alluvial deposits. The whole area extends over 75 ha, with the lakes occupying 30 ha, and is protected as a significant landscape. Here, new localities of *V. scardica* were discovered along lakes Veliko Jezero (WGS84: 16.024°E, 45.775N°) and Lopočarka (WGS84: 16.027°E, 45.7751N°).

The specimens of *V. scardica* were identified using several identification keys (Walters & Webb 1972, Fischer et al. 1984, Ellmouni et al. 2018, Nikolić 2019) and deposited in the herbarium collection Herbarium Croaticum (ZA) (the acronym is according to Thiers 2021). Accompanying species and corresponding vegetation were recorded in all localities. Nomenclature of plant taxa follows Flora Croatia Database (Nikolić 2005-onwards), while the syntaxonomical system proposed by Mucina et al. (2016) and Škvorc et al. (2017) was applied for the vegetation types.

Results and discussion

Although considered native to this area and dependant on not so rare habitats, *V. scardica* was reported from Croatia for the first time only relatively recently. The record was from the Kupa River, i.e. downstream of the Ozalj Hydroelectric Power Plant (Fig. 1). The species was growing on gravelly banks within amphibious vegetation, accompanied by

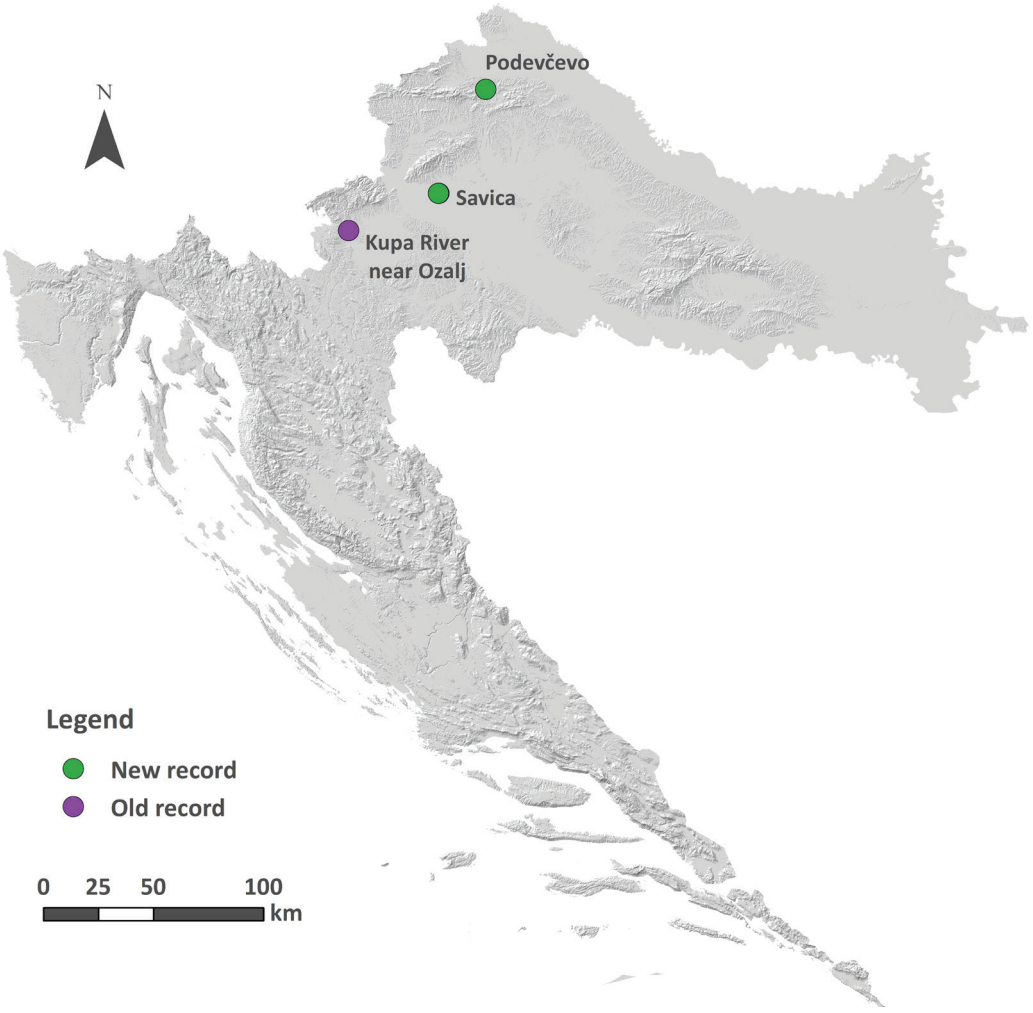

Figure 1. Distribution map of *Veronica scardica* Griseb. in Croatia.

species characteristic of the alliance *Nanocyperion* – *Cyperus fuscus* L. and *C. flavescens* L., along with other species of wet habitats, such as *Echinochloa crus-galii* (L.) P. Beauv., *Leersia oryzoides* (L.) Sw., *Panicum capillare* L., *P. dichotomiflorum* Michx., *Bidens tripartitus* L. and *Polygonum mite* Schrank (Topić & Ilijanić 2003).

In 2014, we found a small population of up to ten individuals on the remains of a calcareous fen near the settlement Podevčevo (Fig. 1). The species was growing in the mosaic vegetation belonging to the alliance *Molinion caeruleae* Koch 1926 (meadows on wet soils at low altitudes of temperate Western and Central Europe) interspersed with smaller areas with species characteristic of the alliance *Nanocyperion* (pioneer dwarf cyperaceous vegetation with other annual plants and a considerable number of bryophytes which grow on moist substrates at the margins of lakes and ponds, on sandy banks of rivers and channels, in dune valleys and ditches in moist arable fields). The habitat condition recorded in 2014 is the result of an advanced natural succession of the calcareous fen (alliance *Caricion davallianae* Klika 1934). *Veronica scardica* was here accompanied by species such as *Carex distans* L., *C. flacca* Schreb., *C. flava* L., *Cyperus fuscus*, *Epilobium parviflorum* Schreb., *E. tetragonum* L., *Equisetum palustre* L., *Eriophorum latifolium* Hoppe, *Festuca arundinacea* Schreb., *Juncus articulatus* L., *J. bufonius* L., *J. inflexus* L., *Lythrum salicaria* L., *Molinia caerulea* (L.) Moench, *Potentilla erecta* (L.) Raeusch. and *Rubus caesius* L.

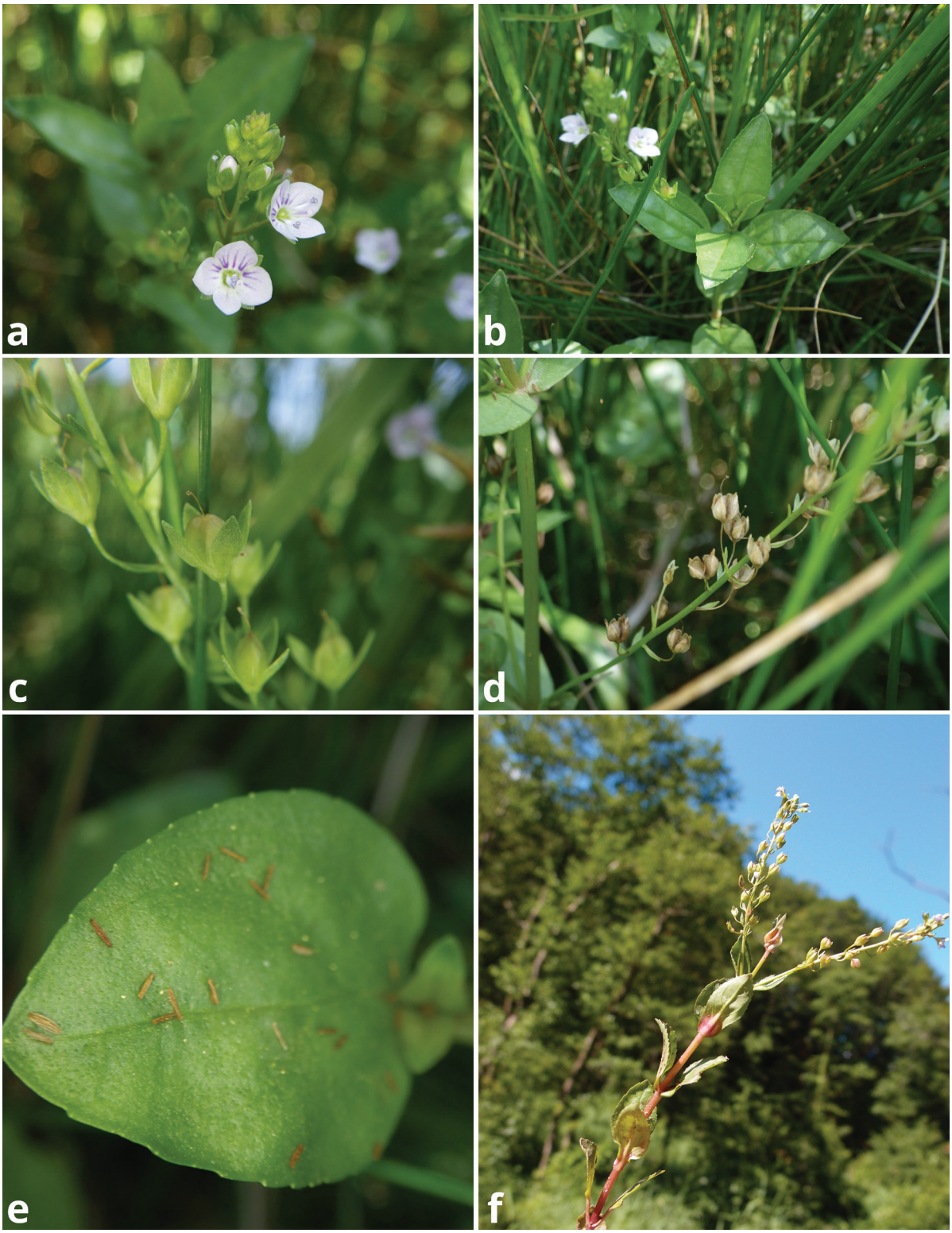

Figure 2. *Veronica scardica* Griseb.: flowers (a), habitus (b, f), fruiting racemes (c, d), leaf (e) (Photos: A. Rimac and Lj. Borovečki-Voska).

Furthermore, *V. scardica* was recorded in early September 2020 along the margins of lakes Lopočarka and Veliko Jezero within the Significant Landscape Savica, situated in the eastern suburban part of the City of Zagreb (Fig. 1). Although this semi-natural marshland area was floristically inventoried 15 years ago (Alegro et al. 2013), *V. scardica* was not recorded then. Now it was present with only a low number of individuals, up to ten in both locations, similar to the previous records in Podevčevo and near Ozalj. *Veronica scardica* was here accompanied by the species characteristic of wet habitats and margins of water bodies, such as *Cyperus fuscus*, *C. serotinus* Rottb., *Polygonum mite*, *Bidens frondosa* L., *Echinochloa crus-galli*, *Leersia oryzoides*, *Eleocharis palustris* (L.) R. Br., *Mentha aquatica* L., *Phalaris arundinacea* L., *Lythrum salicaria*, *Lycopus europaeus* L., *Carex pendula* Huds., *Scutellaria galericulata* L., *Solanum dulcamara* L. and *Epilobium hirsutum* L.

Within its natural areal in Europe and North Africa, this helophyte species is also known from marshes and other wet places, growing along streams, rivers, pools, in wet river valleys and alluvial forests, frequently associated with serpentine bedrock (Grisebach 1843, Walters & Webb 1972, Fischer et al. 1984, Abd El-Ghani et al. 2011), which has not been the case with Croatian populations so far.

Along with several morphologically relatively similar species, *V. scardica* belongs to the section *Beccabunga*, a group of semi-aquatic *Veronica* species, which can be often difficult to distinguish. *Veronica scardica* is completely glabrous, with stem and leaf bases sometimes tinged purple. Fistulose stems can be ascending from the procumbent rooting base or less often completely erect. Leaves are never subsucculent, a feature that clearly distinguishes this species from *V. beccabunga* L. Additionally, *V. beccabunga* has petiolate, orbicular, ovate or oblong leaves with obtuse apex. On the other hand, the upper leaves of *V. scardica* are often ovate-rhombic and subsessile and semi-amplexicaul, while the lower are ovate and shortly petiolate. They are relatively small, up to 30 mm long and 18 mm wide, with a cuneate base, obtuse to an acute apex and shallowly serrate margin, which can sometimes be almost entire. Other relatively similar species of this section have longer leaves, which are usually more than 3 times as long as wide, while in *V. scardica* this ratio is lower. Therefore, there is a difference in the leaf shape as well, with leaves being ovate-lanceolate in *V. anagallis-aquatica* L., lanceolate or linear-lanceolate in *V. anagalloides* Guss. and linear-lanceolate or linear in *V. catenata* Pennell. These species have sessile leaves, except for *V. anagallis-aquatica* having some of the lower leaves on the petioles.

Axillary racemes of *V. scardica* are (2-)3-6(-8) times as long as their subtending leaf, with the fertile part 3-10(-15) cm long with loosely arranged flowers. Racemes are always glabrous, which can be a useful characteristic to distinguish *V. scardica* from *V. anagalloides* and some individuals of *V. anagallis-aquatica*. Furthermore, racemes are usually alternate in *V. scardica*, while opposite in *V. anagalloides*, *V. anagallis-aquatica* and *V. catenata*. Fruiting pedicels of *V. scardica* are 5-7 mm long, (1.5-)2-3 times as long as the oblanceolate, 1.5-4(-6) mm long bracts. They are erecto-patent to horizontally patent, with the fruit not in a vertical position, but oblique. Fruiting calyx is 3-3.5(-4.5) mm long with erect, oblanceolate to obovate sepals, widest in the upper half, with obtuse to slightly subacuminate apex. Corolla is 4.5-6 mm in diameter, pale lilac-purple to pale pinkish, with violet or pink veins. The capsule is 2.5-3(-3.5) mm long and 2.0-2.3(-2.7) mm wide, a little shorter than or almost equalling the calyx, slightly obovate or orbicular, usually slightly longer than wide, with a rounded-subtruncate apex, which has a short and narrow sinus, sometimes almost lacking (Walters & Webb 1972, Fischer et al. 1984, Ellmouni et al. 2018, Nikolić 2019).

We hope that this short communication on new localities of *V. scardica* in Croatia will serve as a reminder of its distinctive morphological traits and preferred habitats, which might contribute to new records of this rare and likely overlooked species across the country.

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