

Rare and threatened *Damasonium polyspermum* Coss. (Alismataceae) discovered in Krka National park

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Vedran Šegota (ZA & ZAHO herbarium collections, Division of Botany, Department of Biology, Faculty of Science, University of Zagreb, Marulićev trg 20/II, HR-10000 Zagreb, Croatia; vedran.segota@biol.pmf.hr; corresponding author / autor za korespondenciju)

Vladimir Hršak (Kneza Domagoja 16, HR-10000 Zagreb, Croatia; vhrsak53@yandex.com)

Sanja Kovačić (Botanical Garden, Department of Biology, Faculty of Science, University of Zagreb, Marulićev trg 9a, HR-10000 Zagreb, Croatia; sanja.kovacic@biol.pmf.hr)

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Abstract

The species *Damasonium polyspermum*, exceptionally rare in Croatia, has been found within Krka National park. This is the fourth known site of this strictly protected species in Croatia. It is associated with amphibian vegetation of the drawdown zone around temporary Mediterranean

ponds, where livestock watering plays a key role in maintaining these fragile habitats. Propagation and ex-situ protection of *D. polyspermum* has been initiated within the Botanical Garden of Faculty of Science in Zagreb.

Keywords: drawdown zone, ex-situ protection, livestock watering, Mediterranean temporary pond, southeast Europe

Šegota, V., Hršak, V., Kovačić, S. (2019): Pronalazak rijetke i ugrožene vrste *Damasonium polyspermum* Coss. (Alismataceae) u Nacionalnom parku Krka. Glas. Hrv. bot. druš. 7(1): 27-32.

Sažetak

Iznimno rijetka vrsta *Damasonium polyspermum* pronađena je u Nacionalnom parku Krka. To je četvrto poznato nalazište ove strogo zaštićene vrste u Hrvatskoj. Vrsta je dio amfibijske vegetacije u pojasu oscilacije razine vode oko povremenih

mediteranskih lokvi, ugroženog staništa u čijem održavanju ključnu ulogu ima napajanje stoke. U Botaničkom vrtu Prirodoslovno-matematičkog fakulteta u Zagrebu započeo je uzgoj i ex-situ zaštita ove vrste.

Ključne riječi: ex-situ zaštita, jugoistočna Europa, napajanje stoke, pojas oscilacije razine vode, sredozemne povremene lokve

Introduction

Damasonium polyspermum Coss. is an annual species with predominantly western Mediterranean distribution (Rich & Nicholls-Vuille 2001). As an aquatic herbaceous annual, the species requires specific living conditions of shallow waters, or muds beside ponds exposed to full-sun (Vuille 1986). The plant develops aquatic and terrestrial forms, while particular phases of its life cycle strongly depend on the changes of the water regime, therefore ripening of fruits (stellately radiating, laterally compressed follicles) and dispersion of seeds occurs during the dry phase.

Assessed as vulnerable (VU) in both Global and Mediterranean IUCN Red-lists (de Bélair et al. 2010), it is relatively rare over its entire distribution range, being associated with Mediterranean temporary ponds, a very scarce and largely threatened European wetland habitat (Zacharias & Zamparas 2010). Apparently the species forms larger populations solely in Spain and Morocco, while the population in France shows strong decline. In Portugal, Sicily, Algeria, Libya and Syrian Arab Republic the species is extremely rare, with only one or just few sites hosting its populations (de Bélair et al. 2010). Most recently, the species has been found on the Apennine Peninsula, in the region of Puglia (Carruggio et al. 2016).

In southeastern Europe (Balkan Peninsula) *D. polyspermum* is known only from Croatia (Nikolić & Topić, 2005), where it has been recently assessed as (critically) endangered (Boršić & Posavec Vukelić 2012a) and statutorily strictly protected species (Anonymous 2013). Although Rich & Nicholls-Vuille (2001), revising several herbarium collections, confirmed the presence of this species in north-western part of Greece, de Bélair et al. (2010) still consider its presence in Greece uncertain. In Albania, *D. polyspermum* has not been recognized as a separate species, but is included within the aggregate *Damasonium alisma* sensu lato (Vangjeli et al. 2000), however, not mentioned in the most recent literature (Pils 2016, Barina 2017).

Only three localities of *Damasonium polyspermum* have been documented in Croatia

so far: the island of Murter (Trinajstić et al. 1995, Pandža 1998), Bunari pond (Boršić & Posavec Vukelić 2012a) and Vrana Lake Nature Park (Vuković & Jelaska 2015). Being found relatively recently, additional taxonomical, ecological and threat assessment data are available in Boršić & Posavec Vukelić (2012a).

Material and methods

The flora of the central part of the Krka National Park was investigated during October 2018. Garmin e-trex GPS device was used for recording coordinates. The nomenclature of the species follows Nikolić (2019).

One specimen of *D. polyspermum* has been collected, dried, pressed and stored within *Herbarium Croaticum* collection (ZA) (Thiers 2018). Ripen fruits and seeds were also collected. All the activities followed the Special Permit issued to the Botanical Garden of the Faculty of Science, for the years 2018/2019 (*Special Permit to collect seed of strictly protected species of Croatian autochthonous flora in the wild, for scientific purposes and ex-situ conservation in Zagreb University Botanical Garden of the Faculty of Science, issued by Croatian Ministry of Environment and Energy concerning the years 2018/2019: Class: UP/I-612-07/17-48/178; Reg. No.: 517-07-1-1-1-18-4; January 25th 2018.*)

The collected material was stored at room temperature for less than a month, and transported to the Botanical Garden facilities in mid-November 2018, for the purpose of preliminary studies of the germination and possible inclusion of *D. polyspermum* in the Programme of ex-situ protection of threatened and strictly protected species of Croatian flora (Sandev et al. 2013, Kovačić et al. 2014). Small amount of seeds has been preserved in the Carpological collections of the Botanical department in Zagreb.

Dry fruit pods were manually opened, and seeds counted under the magnifier. Approximately 70 seeds were sown in a lidded transparent plastic container on November 21st, using double autoclaved, heavily sodden sowing-mix, with some loam and petty

limestone gravel added. Particular references or techniques for cultivating *D. polyspermum* are not available, therefore the procedure followed the general terms of the Alismataceae family described by Baskin & Baskin (1998). Care was taken to design the procedure to mimic the conditions in the wild during wintertime. The sealed container was placed in a light, cold glasshouse surroundings, with the minimum night temperature approx. 10°C, and maximum day temperature approx. 20°C. The exact values of temperature depended on the amount of available sunlight. Water was added when necessary, to keep the compost saturated.

Results and discussion

Damasonium polyspermum was found on 25th October 2018 around a small pond on the plateau above the left bank of the Krka River, within the Krka National park (Fig. 1). The pond has not been recognized nor named on any topographic map available. The site (43° 56' 19.27"N, 15° 59' 51.57"E) is located northwest from the hamlet of Popovići (D. Bogetić) and southeast from the hamlet of D. Mudrinići, at the elevation of 234 m a.s.l.

The pond is oval shaped, around 4 m wide and 10 m long, surrounded by approximately 3 m wide drawdown zone with muddy substrate saturated with water at the time of our visit (Fig. 1). About ten

specimens of *D. polyspermum* were found on site, exclusively in terrestrial form, with developed fruits (Fig. 1). The scan image of collected specimen is publicly available in Virtual Herbarium (Rešetnik & Šegota 2019) under ZA49294 code. Half of the specimens were already completely dry with some umbels even detached from ground. No aquatic forms with floating leaves were noticed within the pond. The plant cover of the drawdown zone was very scarce, with only *Eleocharis palustris* (L.) Roem. et Schult. and *Mentha pulegium* L. being more abundant, while *Polygonum aviculare* L., *Agrostis stolonifera* L., *Juncus articulatus* L. and *Potentilla reptans* L. were rare. Within the pond, dense submersed macrophytic vegetation, comprised of *Ceratophyllum demersum* L., *Myriophyllum verticillatum* L. and *Potamogeton crispus* L., was developed. A typical sub-Mediterranean thicket vegetation (*Quercus pubescens* Willd., *Carpinus orientalis* Mill., *Paliurus spina-christi* Mill. and *Juniperus oxycedrus* L.) was encompassing the pond, however, some old, mature downy oak trees were preserved around the pond. We can not be certain about the current use of the pond, however, we presume that it is used for livestock watering. Namely, the presence of mature trees suggests that this site was in the past maintained for this purpose, whereas trees are usually kept to serve as a shaded shelter for livestock during the summer heat.

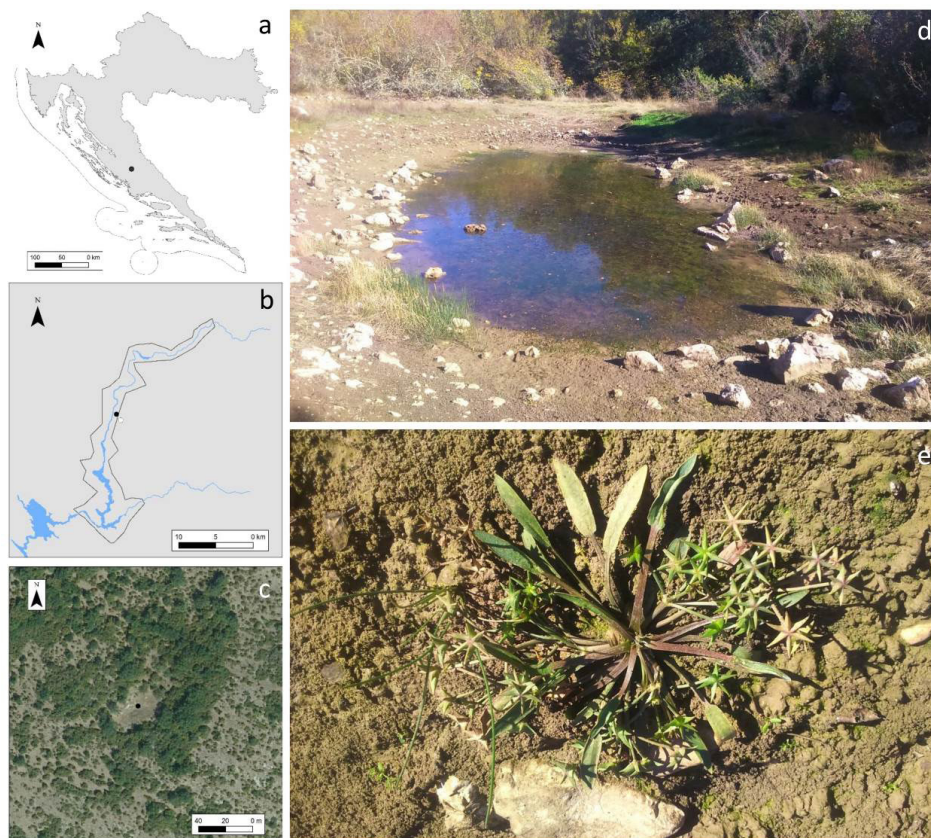


Figure 1. New finding site of *Damasonium polyspermum* in Croatia (a), within Krka National park (b); digital orthophoto (c) and a photograph of the finding site (d) with terrestrial form of the species (e) (Photos: V. Šegota).

This particular site is just one kilometre aerial distance northwest from the Bunari pond, located next to the border of the Krka National park, where *D. polyspermum* has been found six years ago (Boršić & Posavec Vukelić 2012a), and where livestock watering takes place regularly. Comparing the floristic composition of Mediterranean temporary ponds in Krka National park in general (Boršić & Posavec Vukelić, 2012b), we can see that the similarity between these two sites is relatively high. Therefore, we can assume that these two populations are interconnected through cattle and probably some wild animals (mammals and birds) playing a key role in their stability, through habitat maintenance (trampling and soil disturbance) and diaspore (fruits, seeds) dissemination.

A great ecological similarity between our site and all previously recorded sites in Croatia (Trinajstić et al. 1995, Pandža 1998, Boršić & Posavec Vukelić 2012, Vuković & Jelaska, 2015) points to a very narrow habitat preference of *D. polyspermum*. In the same time, these habitats are clearly threatened and facing decline due to the abandonment of traditional agriculture (Zacharias & Zamparas 2010, Rhazi et al. 2012). Keeping in mind that these habitats often host other rare and threatened plants (Rhazi et al. 2012, Vuković et al., 2018), they should be kept and maintained as temporary ponds, as a necessary measure of preserving these peculiar plants.

The examination of pods revealed six or seven seeds within each follicle. As for seed germination, first cotyledon of *D. polyspermum* appeared two weeks after sowing, on December 4th 2018, and during the following month the germination was erratic. As of January 4th 2019, a total of 15 seedlings have germinated; out of which five developed the first grass-like leaves until mid-January (up to 12 mm long), while the others were still in a cotyledon state (8-10 mm long) (Fig. 2). Every morning, when the lid is removed, the cotyledons carry a single droplet of water (guttation), and are allowed to aerate. The lid is then sealed again for the night. In February 2019 the second round of seeds (until then stored at cold glasshouse temperature) will be sown indoors, while in late March we are planning to sow the rest outdoors. It will be interesting to see if the germination occurs, as the Alismataceae family apparently have recalcitrant seeds (Baskin & Baskin 1998) in which viability is lost if the seed moisture content drops below 30-65%, depending on the species. The viability of many aquatic plants (incl. *Alisma plantago-aquatica*) is increased with scarification (Baskin & Baskin 1998); therefore, this treatment should be considered in future germination experiments. Adult individuals will eventually be added to the Botanical Garden collection of Croatian rare and statutorily protected species to obtain more seed for further studies.



Figure 2. Semi-ripen fruits (a) and seed (b) of *Damasonium polyspermum* (Photos: N. Koletić); sowing substrate on December 12th 2018 (c) (Photo: S. Kovačić) and young seedlings on January 4th 2019 (d) (Photo: V. Štamenković).

Conclusion

Newly found pond with *Damasonium polyspermum* within the Krka National park is the fourth known locality of this species in Croatia, representing a valuable contribution to the knowledge on the distribution of this rare plant. As a characteristic species of the Mediterranean temporary ponds, *D. polyspermum* should be regularly monitored and protected, as already suggested for some other species of this highly vulnerable habitat type (Vuković et al. 2018). Furthermore, efforts should be made to protect and maintain these threatened habitats, as valuable reservoirs of rare and threaten plants (Rhazi et al. 2012). If the germination and further cultivation in the facilities of Zagreb Botanical Garden of the Faculty of Science proves successful, the species will be added to the Garden collection of ex-situ protected plants of Croatian flora. This collection may even be used as source of plant material, should any reintroduction of *D. polyspermum* be planned in the future.

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