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NEW LOCALITY AND THREAT STATUS OF *DAMASONIUM POLYSPERMUM* COSS. (ALISMATACEAE) IN CROATIA

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The species *Damasonium polyspermum* Coss. (Alismataceae) was first recorded in Croatia in 1994 in Jezera on the island of Murter. The species was discovered in September 2011, and confirmed in June 2012, at the pond Bunari, near Krka National Park. According to the Habitats Directive, this pond belongs to the priority habitat type 3170 *Mediterranean temporary ponds. It is used for watering livestock, which maintains an open habitat necessary for this species. As a very rare and threatened species, *D. polyspermum* should be included in the Red List of vascular flora of Croatia as an endangered species: EN B1ab(iii,v)+2ab(iii,v).

Keywords: rare species, threatened species, IUCN, Red List, Mediterranean temporary ponds, Habitats Directive, NATURA 2000

Boršić, I. & Posavec Vukelić, V.: Novo nalazište i status ugroženosti vrste *Damasonium polyspermum* Coss. (Alismataceae) u Hrvatskoj. Nat. Croat., Vol. 21, No. 2., 349–356, 2012, Zagreb.

Vrsta *Damasonium polyspermum* Coss. (Alismataceae) je prvi put u Hrvatskoj zabilježena 1994. godine u Jezerima na otoku Murteru. U rujnu 2011. vrsta je otkrivena na lokvi Bunari, kod Nacionalnog parka Krka, gdje je i potvrđena u lipnju 2012. godine. Prema Direktivi o staništima, ova lokva pripada prioritetnom stanišnom tipu 3170 *Mediteranske povremene lokve. Lokva se koristi za napajanje stoke koja održava otvoreno stanište neophodno za ovu vrstu. Kao vrlo rijetka i ugrožena vrsta, *D. polyspermum* bi trebao biti uvršten na Crveni popis vaskularne flore Hrvatske kao ugrožena vrsta: EN B1ab(iii,v)+2ab(iii,v).

Ključne riječi: rijetka vrsta, ugrožena vrsta, IUCN, Crveni popis, mediteranske povremene lokve, Direktiva o staništima, NATURA 2000

INTRODUCTION

The genus *Damasonium* is a small genus of the monocot family Alismataceae (water-plantains). It comprises the North American species *D. californicum* Torr., the Australasian species *D. minus* Buch and, depending on the taxonomic treatment, one to three European and Mediterranean species. DANDY (1980) accepts only species *D. alisma* Mill. in Europe. In this species he included *D. polyspermum* Coss., considering that it was »not worth taxonomic recognition«. According to the newer taxonomic studies, three species of the genus could be recognized in Europe and Mediterranean: *Damasonium alisma* Mill., *D. bourgaei* Coss. and *D. polyspermum* Coss. (VUILLE, 1987; RICH & NICHOLLS-VUILLE, 2001).

The most useful characteristics for distinguishing between the species of the genus *Damasonium* relate to carpels. Their size, shape and number of seeds allow

easy discrimination between *D. polyspermum*, *D. alisma* and *D. bourgaei* (RICH & NICHOLLS-VUILLE, 2001). *D. polyspermum* has large, narrowly triangular carpels tapering from the base gradually to the apex. In each carpel there are (4-)5-8 seeds, which are smaller than in the other two species. They are oblong, 0.9-1.2(-1.4) mm long and 0.5-0.7(-0.9) mm wide. *D. polyspermum* also has 1-2(-4)-whorled inflorescence while *D. alisma* has 1-4(-6) whorls in composed inflorescence (RICH & NICHOLLS-VUILLE, 2001).

In Croatia only *D. polyspermum* has been recorded. Its distribution is predominantly western Mediterranean (France, Spain, Portugal, Morocco and Algeria) with

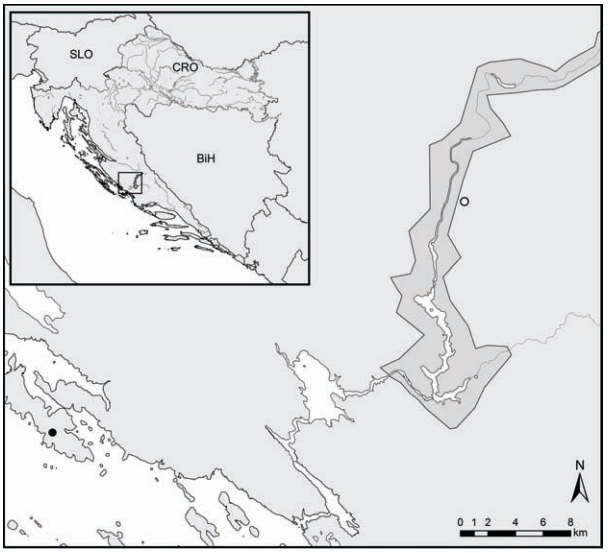

Fig. 1. Distribution map of *Damasonium polyspermum* Coss. in Croatia (black circle: Jezera on the island of Murter-first locality; open circle: the pond Bunari-new locality, darker grey: Krka National park)

Fig. 2. Aquatic form of *Damasonium polyspermum* Coss., on 14th June 2012 (photo by I. Boršić)

Fig. 3. Terrestrial form of *Damasonium polyspermum* Coss., on 14th June 2012 (photo by I. Boršić)

Fig. 4. Dry specimen of *Damasonium polyspermum* Coss., on 8th September 2011 (photo by V. Posavec Vukelić)

only few localities further to the east (Greece, Sicily and Libya), while *D. bourgaei* is more widespread around the Mediterranean, extending eastwards to India. *D. alisma* is the most northerly taxon, occurring mostly in England and France, with few localities in Portugal, Italy, Russia and Ukraine (RICH & NICHOLLS-VUILLE, 2001).

D. polyspermum is an annual, heliophilous plant, the size and robustness of which greatly vary depending on whether it grows subterrestrially or in water of different depths (DANDY, 1980). It grows in Mediterranean temporary ponds with muddy soils and seasonally fluctuating water levels. These habitats are shallow water bodies, flooded during winter and spring for a period long enough to support development of aquatic vegetation. For *D. polyspermum*, a flooded phase is necessary for seed germination and growth of leaves, which is followed by flowering and seed production during late spring up to the dry period. Ripening of fruits and dispersal of seed, on the other hand, occurs during the dry phase (MICHAUD, 2004).

Because information on *D. polyspermum* in Croatia is insufficient, it is listed as data deficient (DD) species in the Red List of vascular flora of Croatia (NIKOLIĆ &

TOPIĆ, 2005). It is strictly protected by the Nature Protection Act (ANONYMOUS, 2005; ANONYMOUS, 2008; ANONYMOUS, 2011) and listed in the Ordinance on Designating Wild Taxa Protected and Strictly Protected (ANONYMOUS, 2009).

MATERIALS AND METHODS

Floristic investigations of ponds in and near Krka National Park were carried out in September 2011 and April and June 2012. Positions of the investigated ponds were determined using Garmin GPSMAP 60CSx GPS Receiver. Species were determined using standard determination keys and iconographies (JÁVORKA & CSAPODY, 1975; TUTIN *et al*., 1968–1980; TUTIN *et al*., 1993; DOMAC, 1994; ROTHMALER, 1991). The nomenclature of the species was determined according to the Flora Croatica database (NIKOLIĆ, 2012). A distribution map was prepared using ESRI GIS ArcMap 9.3 software. Threat status of *Damasonium polyspermum* in Croatia was determined according to the IUCN criteria for assessment of relative risk of extinction (ANONYMOUS, 2010).

RESULTS AND DISCUSSION

The species *Damasonium polyspermum* was first recorded in Croatia in 1994 in Jezera on the island of Murter, north Dalmatia (TRINAJSTIĆ *et al*., 1995). It has hitherto been the only known locality of this species in Croatia. On 8th September 2011, during floristic research of Mediterranean ponds in and near Krka National Park, the species was found in the pond Bunari (locally also known as Mamutovac) northeast of the village of Popovići, just outside the national park border. The Gauss-Krüger coordinates of the pond are 5581030 and 4865730 (Fig. 1). Specimens of *D. polyspermum* were abundant and already completely dry, but with well-developed distinctive star-shaped fruits. The pond was visited again on 25th April 2012, but no specimens of the species were found. On 14th June 2012, the pond was revisited and at the time flowering and fruiting specimens of *D. polyspermum* were found. During this last visit, two forms of the species were observed – an aquatic (Fig. 2) and a terrestrial form (Fig. 3), while in September only dry remnants of the terrestrial form were present (Fig. 4). Aquatic specimens were bigger, with larger, floating leaves, opposed to the dwarf terrestrial plants. Bunari Pond, like other habitats of *D. polyspermum* (MICHAUD, 2004), also has fluctuating water level: in April and June it was approximately 15m in diameter (Fig. 5) while in September it was completely dry (Fig. 6). It is used for watering livestock which explains the rather disturbed soil around the pond. It is especially noticeable in the narrow belt around the water surface which is characterized by sparse, species-poor vegetation cover dominated by specimens of *D. polyspermum*. Other species growing in this zone are: *Eleocharis palustris* (L.) Roem. et Schult., *Polygonum aviculare* L., *Polygonum lapathifolium* L. and *Rorippa sylvestris* (L.) Besser. As a very light-demanding therophyte, *D. polyspermum* is very sensitive to any plant cover in the germination stage and does not compete well with tall, perennial species (MICHAUD, 2004). Therefore we assume that trampling and soil disturbance caused by cattle helps to control surrounding vegetation and to maintain an open space. Open space is, except for *D. polyspermum*, also necessary for some other species characteristic of Mediterranean temporary ponds, like *Pilularia minuta* Durieex A.Braun (RHAZI, 2004a). Trampling,

on the other hand, causes burial of seeds in soil, thus impeding their germination (MICHAUD, 2004), as is the case with some other species, such as the western Mediterranean species *Elatine brochonii* Clavaud which is unable to germinate if covered even by a thin layer of soil (RHAZI, 2004b). However, seeds of *D. polyspermum* probably remain viable for a long time (longevity was shown for *D. alisma* Miller by BIRKINSHAW (1994)) so they can germinate in the following years if they are brought to the surface and the conditions are favorable. Irregular flooding in the zone around the pond is also considered to be the key environmental factor in decreasing competition among plants (RHAZI *et al*., 2006).

Mediterranean temporary ponds provide suitable habitats for many different aquatic plant and animal species, some of which, like *D. polyspermum*, are considered rare and threatened. On the other hand, these habitats are under major threat due to human activities, such as change of water level, hydrological regimes, urbanization and agriculture (ZACHARIAS & ZAMPARAS, 2010). They are recognized as very important for nature conservation and are considered a priority habitat type for conservation of the NATURA 2000 network of the European Union (NATURA code 3170, ANONYMOUS, 1992). *D. polyspermum* (listed as *Damasonium alisma*) is specified as a characteristic plant species of this habitat type (ANONYMOUS, 2007). As the pond Bunari is one of only two localities of *D. polyspermum* in Croatia, it should be included in the Croatian proposal for NATURA 2000 network as a site for habitat type 3170 *Mediterranean temporary ponds.

Over its entire distribution area, *D. polyspermum* is considered to be a rare and threatened species, so today it is listed as vulnerable (VU) in the IUCN Red List (DE BÉLAIR *et al*., 2009). Its range is severely fragmented and natural populations are in decline due to habitat degradation and destruction. Several populations in France have already been lost over the past few years, and those still existing are very small and isolated from one another in all range states (DE BÉLAIR *et al*., 2009; MICHAUD, 2004). Habitat loss combined with small area of occupancy poses a major threat for the survival of the species.

Hitherto, *D. polyspermum* was listed as data deficient (DD) in the Red List of vascular flora of Croatia (NIKOLIĆ & TOPIĆ, 2005). It is now found at two locations in Croatia: Jezera on the island of Murter and the pond Bunari, which in total make an extent of occurrence (EOO) of the species less than 100 km^2 and area of occupancy (AOO) less than 10 km^2. It has not been seen for several years in the first locality (PANDŽA, pers. comm.). This area was surveyed on 15th June 2012 but it had recently been mowed and no specimens of *D. polyspermum* were found. Because of changes in habitat it is possible that it is extinct in this locality, together with other rare and threatened species (e.g. *Myosurus minimus* L., *Lythrum portula* (L.) D.A.Webb) occurring in the locality (PANDŽA, pers. comm.). On the other hand, due to their longevity, there is a high probability that viable seeds of *D. polyspermum* are still present in Jezera and that they would germinate if conditions in the habitat are improved. In the newly reported locality, the pond Bunari, the species is numerous and its habitat is in favorable status, due to its maintenance (see above). Abandonment of traditional cattle breeding poses a plausible threat for this location, as a direct consequence of processes of depopulation and deruralization, which are especially accentuated in the Dalmatian hinterland (KLEMPIĆ BOGADI & PODGORELEC, 2009). Other plausible threats for this pond are invasive alien species,

Fig. 5. Bunari Pond – new locality of *Damasonium polyspermum* Coss. in June (photo by I. Boršić)

Fig. 6. Bunari Pond – new locality of *Damasonium polyspermum* Coss. in September (photo by V. Posavec Vukelić)

especially the species *Paspalum paspalodes* (Michx.) Scribn. (BORŠIĆ *et al.*, 2008), which spreads aggressively around some other investigated ponds in this area.

If the species is considered extinct in the first locality, it would be proposed to be listed as critically endangered: CR B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v), with only one location left and continuing decline in the EOO, AOO, quality of its habitat, number of locations and number of mature individuals. If it is assumed that *D. polyspermum* still exists in the first locality, it should be assessed as endangered: EN B1ab(iii,v)+ 2ab(iii,v), with two locations and continuing decline of habitat and number of mature individuals. Until additional information about sizes and dynamics of its populations is gathered (especially in the locality Jezera on the island of Murter), which will most probably cause upgrading of our threat category (to CR), we propose that *D. polyspermum* is included in the Red List of vascular flora of Croatia as an endangered species: EN B1ab(iii,v)+2ab(iii,v).

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Financial support for this research, which was carried out within the framework of the »Assessment and valorization of abandoned habitats of Krka National Park area suitable for revitalization with inclusion of Krka National Park expert and ranger service and local community, determination of conservation objectives and Management plan development (2010–2015)« program financed by the Public Institution Krka National Park, is gratefully acknowledged. We wish to express our gratitude to Marija Pandža and Milenko Milović for help with *D. polyspermum* identification, Marija Pandža for the data and help during fieldwork in the Jezera locality, Luka Katušić for help with the application of IUCN criteria and categories and useful comments, Tim Rich for valuable literature, and Neven Vukelić for valuable comments and suggestions in the manuscript. We are also grateful to Marin Popović for improving the English text.

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SAŽETAK

Novo nalazište i status ugroženosti vrste *Damasonium polyspermum* Coss. (Alismataceae) u Hrvatskoj

I. Boršić & V. Posavec Vukelić

Vrsta *Damasonium polyspermum* Coss. (Alismataceae) je u Hrvatskoj prvi put zabilježena 1994. godine u Jezerima na otoku Murteru. U rujnu 2011. vrsta je otkrivena na lokvi Bunari, kod Nacionalnog parka Krka, gdje je i potvrđena u lipnju 2012. godine. Ovdje je vrsta brojna, a njezino stanište u povoljnom stanju. Ta lokva, prema Direktivi o staništima, pripada prioritetnom stanišnom tipu 3170 *Mediteranske povremene lokve, te bi trebala biti uvrštena u hrvatski prijedlog mreže NATURA 2000. Lokva se koristi za napajanje stoke koja održava otvoreno stanište neophodno za ovu vrstu. Napuštanje tradicionalnog stočarstva te potencijalno širenje stranih invazivnih biljaka (posebno vrste *Paspalum paspalodes* (Michx.) Scribn.) predstavlja vjerojatnu prijetnju za ovu vrstu na lokvi Bunari. Kao vrlo rijetka i ugrožena vrsta, *D. polyspermum* bi trebao biti uvršten na Crveni popis vaskularne flore Hrvatske kao ugrožena vrsta: EN B1ab(iii,v)+2ab(iii,v).