

Short communication

Small-flowered bittercress, *Cardamine parviflora* L. (Brassicaceae), a new species of the Croatian flora

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Abstract – *Cardamine parviflora* L. was discovered in April 2014 during the study of vascular flora and habitats in the area of Slatina (Slavonia region). It was found in a flooded forest of narrow-leaved ash, in the vicinity of the villages Medinci and Novi Senkovac. The species here grows in wet soil but partially submerged populations were also observed. It presents a new species of the Croatian flora and expands the floristic inventory of Slatina and its surroundings. Other valuable taxa have also been recorded in the area, such as *Carex riparia* Curtis and *Ophioglossum vulgatum* L.

Keywords: *Cardamine parviflora*, flooded forest, Slatina, vascular flora

Introduction

The genus *Cardamine*, one of the largest in the family Brassicaceae, consists of annual to perennial herbs of approximately 200 species worldwide, with the tropical species confined to mountains (CLAPHAM et al. 1987, KUČERA et al. 2005). In the European flora it numbers a total of 54 species (LIHOVA and MARHOLD 2006), whereas in the Croatian flora there are currently 18 species and 4 subspecies (NIKOLIĆ 2014).

The small-flowered bittercress, *Cardamine parviflora* L., occurs in numerous European countries, but is absent from certain parts of the Balkan Peninsula (JALAS and SUOMINEN 1994, MARHOLD 1995). It is already known from specific neighbouring countries of Croatia, such as Italy (PIGNATTI 1982), Hungary (JAVORKA and CSAPODY 1991, HORVÁTH et al. 1995) and Serbia (JOSIFOVIĆ et al. 1972). So far there have been no records for Slovenia (MARTINČIĆ et al. 2010) or, considering the lack of a recent checklist, for Bosnia and Herzegovina (BECK 1903). The Euro+Med Plantbase (MARHOLD 2011) notes the occurrence of this species in Au(A) Bu By Cs Es Fe Ga(F) Ge Hs(S) Hu It La Lt Lu Mo Po Rf(C E K N) Rm SkSr Su Uk(K U).

Cardamine parviflora is a short, erect, hairless annual, 7–22 (–40) cm. Leaves are pinnate, the lower with 5–11 pairs, the upper with 7–13 pairs of linear-oblong, cuneate, entire leaflets. Petals are 1.5–2.5 mm, obovate, white. Siliqua 8–20 × 0.7–0.8 mm, erect

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on patent pedicels (JOSIFOVIĆ et al. 1972, TUTIN et al. 1993). Seeds elliptic, lateral compressed, apex rounded, base mostly truncate, $0.6\text{--}0.8 \times 0.5\text{--}0.7$ mm, narrowly winged (BOJNANSKY and FARGAŠOVA 2007). Phytogeographically it belongs to the Eurasian floral element (CARLSEN et al. 2009). In North America, populations of this species are sometimes treated as *C. parviflora* var. *arenicola* (Britton) O. E. Schulz or as a separate species, *C. arenicola* Britton. In the recent account of the genus in the Flora of North America, North American populations of *C. parviflora* are not treated as taxonomically different from Eurasian ones (AL-SHEHBAZ et al. 2010).

This species is not listed in plant determination handbooks for Croatia (DOMAC 1984, 2002) and it is absent from observational data and herbaria entries in the Flora Croatica Database (NIKOLIĆ 2014). Since *Cardamine parviflora* has not been previously identified in Croatia, it should, therefore, be treated as a new taxon of the vascular flora of Croatia and included in the Flora Croatica Database.

Material and methods

Field research is being conducted at several new localities within the City of Slatina which is situated between the two natural borders, Drava River to the north and foothills of Mt Papuk to the south. One of the localities being studied is the forest area »Medinačko razljevo«, spreading over the southeastern part of the villages Medinci and Novi Senkovac (Fig. 1). It is predominantly covered by pedunculate oak (*Quercus robur*), with the exception of a few flooded sites with populations of black alder (*Alnus glutinosa*) or narrow-leaved ash (*Fraxinus angustifolia*). The terrain elevation throughout the area is around 104 m. The climate is moderate continental with an average annual temperature of 11.3 °C and 726.4 mm of average annual precipitation measured in the period of 2000–2008 (Meteorological and hydrological service).



Fig. 1. The location of *Cardamine parviflora* L. (black dot) within the area of Slatina (Croatia).

The literature used in determination of the plant material was JOSIFOVIĆ et al. (1972), PIGNATTI (1982), ROTHMALER (2009) and TUTIN et al. (1993). The exact location of the species was recorded on-site using a handheld GPS device modified for the HTRS96/TM national coordinate system. A corresponding Central European MTB/64 quadrant is also given as a means of indirect mapping (NIKOLIĆ 2006).

The wider area around the subject species was floristically surveyed and the observational records will be added to the Flora Croatica Database. Samples of several plant specimens were collected and deposited in Herbarium Croaticum (ZA) and in a personal collection.

Results and discussion

In April 2014, during the course of ongoing botanical research in the area of Slatina (PRLIĆ 2012, 2013), the forest area »Medinačko ražljevo« was surveyed and, as a result, an unknown plant species was recorded and identified as *Cardamine parviflora* L. (Fig. 2). It was found in a flooded forest of narrow-leaved ash and summer snowflake (*As. Leucojofraxinetum angustifoliae* Glavač 1959), between the stream Slatinska Čadavica (denoted as »Jova r.« on the recent topographic map) and an intermittent stream that cuts through the forest area. It is not very frequent in the investigated forest area and was only discovered in small interspersed populations. A representative population of the species can be found at the coordinates E598894 N5065374 which are located in the 0272.432 MTB/64 quadrant. A fairly rich ground layer with additional important plant species (ANONYMOUS 2013, NIKOLIĆ 2014) was also observed at the site (Tab. 1).

Tab. 1. List of plant species recorded in the study area. Strictly protected and red list species are underlined.

Vegetation layer	Recorded plant species
Tree-layer	<i>Acer campestre</i> , <i>Fraxinus angustifolia</i> , <i>Quercus robur</i> , <i>Ulmus minor</i>
Shrub-layer	<i>Acer tataricum</i> , <i>Cornus sanguinea</i> , <i>Crataegus monogyna</i> , <i>Frangula alnus</i> , <i>Ligustrum vulgare</i> , <i>Prunus spinosa</i> , <i>Pyrus pyraeaster</i>
Ground-layer	<i>Ajuga reptans</i> , <i>Alliaria petiolata</i> , <i>Alopecurus pratensis</i> , <i>Angelica sylvestris</i> , <i>Athyrium filix-femina</i> , <i>Caltha palustris</i> , <i>Cardamine amara</i> , <i>Cardamine flexuosa</i> , <i>Cardamine parviflora</i> , <i>Cardamine pratensis</i> , <i>Carex elata</i> , <u><i>Carex elongata</i></u> , <i>Carex remota</i> , <u><i>Carex riparia</i></u> , <i>Carex vulpina</i> , <i>Cirsium canum</i> , <i>Colchicum autumnale</i> , <i>Cruciata laevipes</i> , <i>Dryopteris filix-mas</i> , <i>Eleocharis palustris</i> , <i>Erigeron annuus</i> , <i>Euphorbia palustris</i> , <i>Galium aparine</i> , <i>Galium palustre</i> , <i>Glechoma hederacea</i> , <i>Hedera helix</i> , <i>Humulus lupulus</i> , <u><i>Iris pseudacorus</i></u> , <i>Lamium maculatum</i> , <i>Lamium purpureum</i> , <i>Leucocorydalis aestivum</i> , <i>Lychnis flos-cuculi</i> , <i>Lycopus europaeus</i> , <i>Lysimachia nummularia</i> , <i>Mentha aquatica</i> , <i>Oenanthe fistulosa</i> , <u><i>Ophioglossum vulgatum</i></u> , <i>Phragmites australis</i> , <i>Ranunculus auricomus</i> , <i>Ranunculus repens</i> , <i>Rorippa amphibia</i> , <i>Rosa canina</i> , <i>Rubus caesius</i> , <i>Scutellaria hastifolia</i> , <i>Solidago gigantea</i> , <i>Stellaria media</i> , <i>Symphytum officinale</i> , <i>Taraxacum officinale</i> , <i>Tephrosia crispa</i> , <i>Thlaspi alliaceum</i> , <i>Urtica dioica</i> , <i>Valeriana dioica</i> , <i>Valeriana officinalis</i> , <i>Veronica serpyllifolia</i>



Fig. 2. *Cardamine parviflora* L.: a) habitus, b) inflorescence and c) leaves.

This species was found growing on wet soil and, in places, partially submerged in the water as the locality was lightly inundated at the time of the field research. These are relatively open microhabitats not overgrown by other plants. Such habitat conditions are particularly suitable because the species prefers periodically flooded and open lowland areas (ZLINSKÁ 1990). The small-flowered bittercress is already known from certain communities of alliances such as *Nanocyperion* Koch 1926, *Phalaridion arundiaceae* Kopecky 1961 or *Phragmition communis* Koch 1926 (ZLINSKÁ 1992, MARHOLD 1995).

When the first populations of *Cardamine parviflora* were recorded in early April, these plants were already in flower and some of the specimens were even producing fruit at the time. This can be considered an early flowering time as the literature indicates it starts flowering in May, lasting until August in Northern Europe (MARHOLD 1995, GREY-WILSON and BLAMEY 2003). In Serbia it is known to bloom a second time during the autumn (JOSIFOVIĆ et al. 1972).

The extent of occurrence of this species in the area of Slatina is restricted to less than 12 ha (0.12 km²) of narrow-leaved ash forest. A field survey in the area has also recorded that the population consists of fewer than 500 adult individuals. Consequently, according to the IUCN standards (NIKOLIĆ 2005), *Cardamine parviflora* should be treated as a critically endangered (CR) species in Croatia. Although there are no known immediate threats to the habitat, further studies need to be conducted in order to monitor the population size. As an ephemeral annual plant, it is usually present in a wide area but changes particular, open, often flooded, microhabitats from year to year; therefore its preservation at a particular spot might require a certain form of active management.

Cardamine parviflora can possibly be confused with other members of the genus *Cardamine*. In the Croatian flora, it bears the closest resemblance to *C. pratensis*, however, the latter is different in its significantly larger petals, usually grey-green leaves and orbicular basal leaflets. There is also a possibility of confusion with *C. impatiens* which has marginally larger petals, but the leaves are auriculate at the base and its leaflets are dentate or lobed. Additionally, it may be mistaken for *C. hirsuta* which bears a distinctive basal rosette at anthesis. *Cardamine parviflora* can be clearly distinguished in the field by its small petals, emphasized leaf pinnation and entire leaflets. As a newly recorded species with a very delimited area of occurrence, it is a valuable addition to the Croatian flora.

References

- AL-SHEHBAZ, I. A., MARHOLD, K., LIHOVÁ, J., 2010: *Cardamine* Linnaeus. In: FLORA OF NORTH AMERICA EDITORIAL COMMITTEE (eds.), *Flora of North America: North of Mexico*, Volume 7, Magnoliophyta: Salicaceae to Brassicaceae, 464–484. Oxford University Press, Inc., New York, Oxford.
- ANONYMOUS, 2013: Regulations on the strictly protected species (In Croatian). Narodne novine 144/13. Retrieved June 12, 2014 from http://narodne-novine.nn.hr/clanci/sluzbene/2013_12_144_3086.html
- BECK, G., 1903: *Flora of Bosnia, Herzegovina and Novopazarski Sandžak*, Volume I: Gymnospermae and Monocotyledones (In Serbo-Croatian). Zemaljska štamparija, Sarajevo.
- BOJNANSKY, V., FARGAŠOVA, A., 2007: *Atlas of seeds and fruits of Central and East-European flora, The Carpathians Mountains Region*. Springer, Dordrecht, The Netherlands.

- CARLSEN, T., BLEEKER, W., HURKA, H., ELVEN, R., BROCHMANN, C., 2009: Biogeography and phylogeny of *Cardamine* (Brassicaceae). *Annals of the Missouri Botanical Garden* 96, 215–236.
- CLAPHAM, A. R., TUTIN, T. G., MOORE, D. M., 1987: *Flora of the British Isles*, 3rd Edition. Cambridge University Press, Cambridge.
- DOMAC, R., 1984: *Flora of Croatia and neighbouring regions* (In Croatian). Školska knjiga, Zagreb.
- DOMAC, R., 2002: *Flora of Croatia* (In Croatian). Školska knjiga, Zagreb.
- GREY-WILSON, C., BLAMEY, M., 2003: *Cassell's wild flowers of Britain & Northern Europe*. Domino Books, London.
- HORVÁTH, F., DOBOLYI, Z. K., MORSCHHAUSER, T., LÓKÖS, L., KARAS, L., SZERDAHELYI, T., 1995: *Flora Database 1.2. Taxon-list and attribute data* (In Hungarian). MTA Ökológiai és Botanikai Kutatóintézet, Vácrátót-Budapest.
- JALAS, J., SUOMINEN, J., 1994: *Atlas Florae Europaeae 10 – Cruciferae (Sisymbrium to Aubrieta)*. Committee for Mapping the Flora of Europe, Helsinki.
- JAVORKA, S., CSAPODY, V., 1991: *Iconography of the flora from the south-eastern part of Central Europe* (In English, Latin and Hungarian). Akadémiai Kiadó, Budapest.
- JOSIFOVIĆ, M., STJEPANOVIĆ, L., JANKOVIĆ, M. M., GAJČ, M., KOJIĆ, M., DIKLIĆ, N., 1972: *Flora of SR Serbia III* (In Serbian). Srpska akademija nauka i umetnosti, Beograd.
- KUČERA, J., VALKO, I., MARHOLD, K., 2005: On-line database of the chromosome numbers of the genus *Cardamine* (Brassicaceae). *Biologia (Bratislava)* 60, 473–476.
- LIHOVÁ, J., MARHOLD, K., 2006: Phylogenetic and diversity patterns in *Cardamine* (Brassicaceae) – A genus with conspicuous polyploid and reticulate evolution. In: SHARMA, A. K., SHARMA, A. (eds.), *Plant genome: biodiversity and evolution*, Vol. 1C, Phanerogams (Angiosperms–Dicotyledons), 149–186. Science Publishers, Enfield, New Hampshire.
- MARHOLD, K., 1995: Taxonomy of the genus *Cardamine* L. (Cruciferae) in the Carpathians and Pannonia III. *Folia Geobotanica & Phytotaxonomica* 30, 397–434.
- MARHOLD, K., 2011: Brassicaceae. In: *Euro+MedPlantbase – the information resource for Euro-Mediterranean plant diversity*. Retrieved October 21, 2014 from <http://ww2.bgbm.org/EuroPlusMed/PTaxonDetail.asp?NameCache=Cardamine%20parviflora&PTRef-Fk=7200000>
- MARTINČIČ, A., WRABER, T., JOGAN, N., PODOBNIK, A., TURK, B., VREŠ, B., RAVNIK, V., FRAJMAN, B., STRGULC-KRAJŠEK, S., TRČAK, B., BAČIĆ, T., FISCHER, M. A., ELER, K., SURINA, B., 2010: *Flora of Slovenia – key to the identification of ferns and flowering plants*, 4th ed. (In Slovenian). Tehniška založba Slovenije, Ljubljana.
- NIKOLIĆ, T., 2005: Assessment of threats (In Croatian). In: NIKOLIĆ, T., TOPIĆ, J. (eds.), *The Red book of vascular flora of Croatia*, 24–34. Ministry of Culture, State Institute for Nature Protection, Zagreb.
- NIKOLIĆ, T., 2006: *Flora – handbook for inventory and monitoring* (In Croatian). State Institute for Nature Protection, Zagreb.
- NIKOLIĆ, T., 2014: *Flora Croatica Database*. Department of Biology, Faculty of Science, University of Zagreb. Retrieved June 12, 2014 from <http://hirc.botanic.hr/fcd>
- PIGNATTI, S., 1982: *Flora d'Italia*, Vols. 1–3. Edagricole, Bologna.

- PRLIĆ, D., 2012: A contribution to the vascular flora of the Slatina region. *Natura Croatica* 21, 21–48.
- PRLIĆ, D., 2013: Phytogeographical characteristics of the Slatina district (In Croatian). MS Thesis. Subdepartment of Quantitative Ecology, Department of Biology, University of Josip Juraj Strossmayer in Osijek.
- ROTHMALER, W., 2009: Exkursionsflora von Deutschland, Band 3, Gefäßpflanzen (Atlasband). Spektrum Akademischer Verlag, Heidelberg.
- TUTIN, T. G., BURGESS, N. A., CHATER, A. O., EDMONDSON, J. R., HEYWOOD, V. H., MOORE, D. M., VALENTINE, D. H., WALTERS, S. M., WEBB, D. A., 1993: *Flora Europaea*, Volume 1: Psilotaceae to Platanaceae, 2nd Edition. Cambridge University Press, Cambridge.
- ZLINSKÁ, J., 1990: A new locality of *Cardamine parviflora* L. in the Záhorská nížina lowland (In Slovakian). *Biologia (Bratislava)* 45, 71–72.
- ZLINSKÁ, J., 1992: *Cardamine parviflora* im Inundationsgebiet des Flusses Morava. *Biologia (Bratislava)* 47, 593–595.