

New records of the rare arctic-alpine moss *Cyrtomnium hymenophylloides* (Huebener) T. J. Kop. in Croatia

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Abstract

Cyrtomnium hymenophylloides (Huebener) T. J. Kop. is a rare arctic-alpine species previously known from only one locality in Croatia. We report two new records in this paper. Firstly, it was found along the hiking path Rossijeva Koliba – Fabrin Dolac – Škrbina Draga (about 1550 m a. s. l.) in the Northern Velebit National Park in 2015. Eight years later, in 2023, a new and unassuming locality was found in the canyon of the River Kamačnik (Gorski Kotar). This site, situated at approximately 400 m a. s. l., represents a rare lower altitude refugium for this species which makes it interesting and noteworthy. Also, as this is the second rare bryophyte species which has lately been found in this area, the canyon of the River Kamačnik should be more thoroughly investigated for more bryological curiosities.

Keywords: glacial relict, moss, River Kamačnik, SE Europe

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Sažetak

Cyrtomnium hymenophylloides (Huebener) T. J. Kop. je rijetka arktičko-alpska vrsta prethodno poznata sa samo jednog lokaliteta u Hrvatskoj. U ovom radu objavljujemo dva nova nalaza ove vrste u Hrvatskoj. Prvi nalaz je iz 2015. uz planinarsku stazu Rossijeva koliba – Fabrin dolac – Škrbina draga (na oko 1550 m n. m.) u Nacionalnom parku Sjeverni Velebit. Osam godina kasnije vrsta je pak pronađena u kanjonu rijeke Kamačnik na otprilike 400 m n. v. što predstavlja zanimljiv refugij južnog dijela rasprostranjenosti koji je ujedno na relativno niskoj nadmorskoj visini. S obzirom da je ovo već drugi nedavni nalaz rijetke vrste mahovine u kanjonu rijeke Kamačnik, zaključujemo da je on vrijedan briološki lokalitet u Hrvatskoj kojeg vrijedi dodatno istražiti.

Ključne riječi: glacijalni relik, mahovina, rijeka Kamačnik, jugoistočna Europa

Introduction

Cyrtomnium hymenophylloides (Huebener) T.J.Kop. is a calcicole, arctic-alpine moss which occurs in the northern hemisphere. It is widespread in the North American Arctic (Miller & Morgensen 1997). In Northern Europe, it is distributed across the Scandinavian countries, as well as Iceland and northern parts of Russia. In other parts of Europe, *Cyrtomnium hymenophylloides* is mostly sporadically distributed in the montane regions such as the Alps or the Dinarides. It is assumed that this species survived as a glacial relict in the southern areas of its distribution and

is therefore almost exclusively found disjunctly in the mountains (Miller & Morgensen 1997). In Western and Central Europe, it has been recorded in Italy, France, Spain, Germany, Austria, Poland, Switzerland (endangered) and Slovakia (vulnerable) (Hodgetts & Lockhart 2020). In the Balkan region it was recorded in Croatia, Bosnia and Herzegovina, Northern Macedonia, Romania (endangered), Montenegro (data deficient) and Serbia (data deficient) (Hodgetts & Lockhart 2020). It commonly grows on wet calcareous rocks, in crevices or wedges of cliffs (Miller & Morgensen

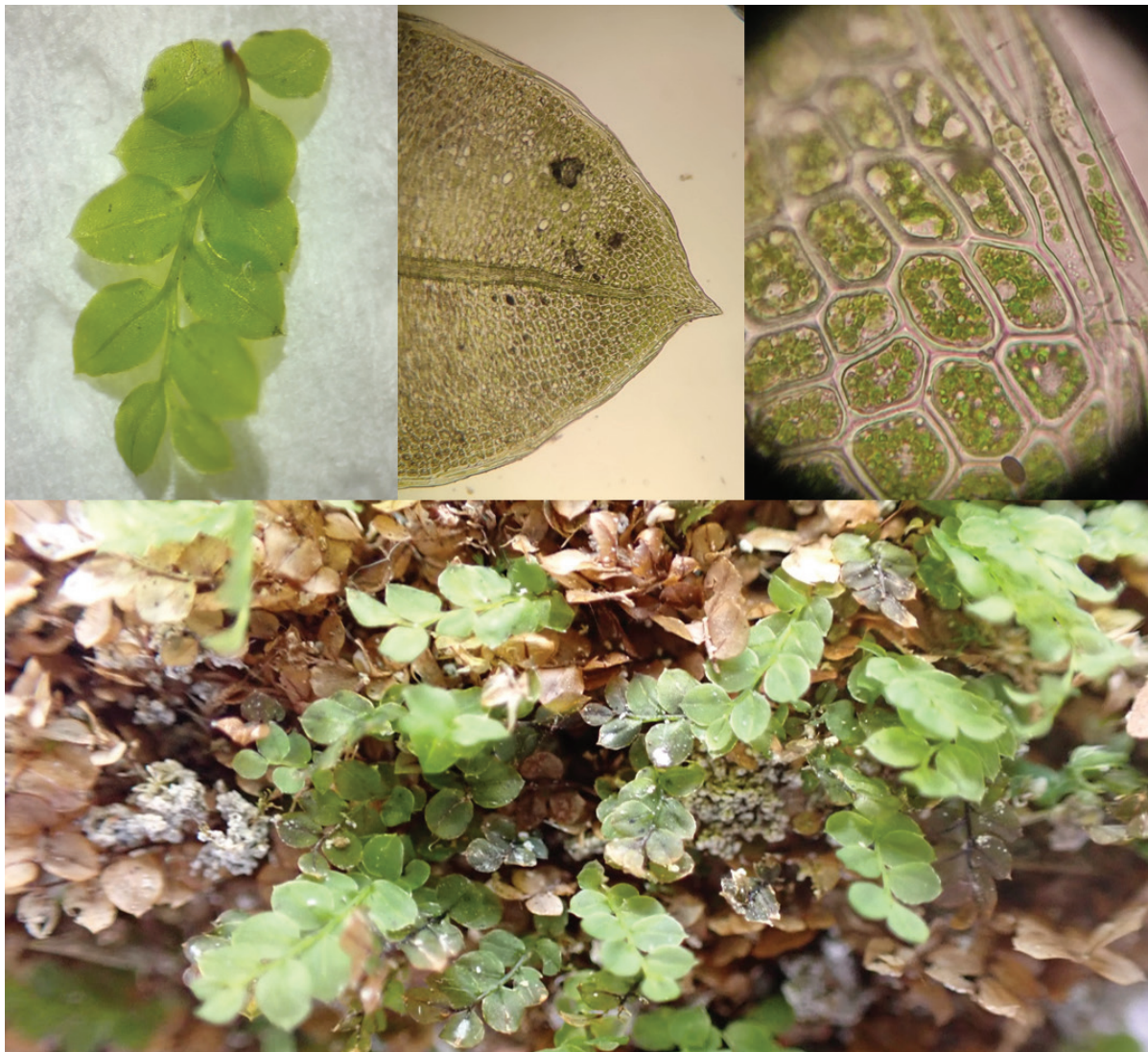


Figure 1. *Cyrtomnium hymenophylloides* specimen from the canyon of the River Kamačnik.

1997, Frey et al. 2006). Its preference for this kind of habitat, which is often unapproachable, makes it harder to find and record. Plants are usually found sterile as the species is dioicous – the female plants are widely distributed, while the male plants are restricted to the northern areas (Miller & Morgensen 2000). Consequently, sporophytes (capsules) have been evidently found only once in Sweden (Persson 1915); however, the novel study of Persson's herbarium material did not reveal any sporophytes (Miller & Mogensen 2000).

In Croatia, *Cyrtomnium hymenophylloides* was found for the first time in 2008, in a snowbed scree with long-lasting snow cover at the bottom of a doline at 1540 m a. s. l. near Rožanski Kukovi, in Northern Velebit National Park (Blockeel et al. 2009).

Methods

Observations were made in August of 2015 and in July of 2023. Photo documentation was made and

the specimens were collected for the herbarium collection Herbarium Croaticum (ZA) where the identification was confirmed using Frey et al. (2006). Accompanying bryophyte and vascular plant species were recorded for the second locality. The nomenclature of the bryophytes follows Hodgetts et al. (2020), and for vascular plants Euro+Med PlantBase (Euro+Med 2006-onwards).

Results and discussion

We report two new localities of *Cyrtomnium hymenophylloides* in Croatia.

The species was firstly recorded on the 21st of August 2015 along the hiking path Premužićeva Staza (Rossijeva Koliba) – Fabin (Vabin) Dolac – Škrbina Draga within the Northern Velebit National Park, while surveying dwarf *Pinus mugo* krummholz vegetation along the Premužićeva Staza. The species was found in a small and shallow semi-cave in the vicinity of the hiking path. The

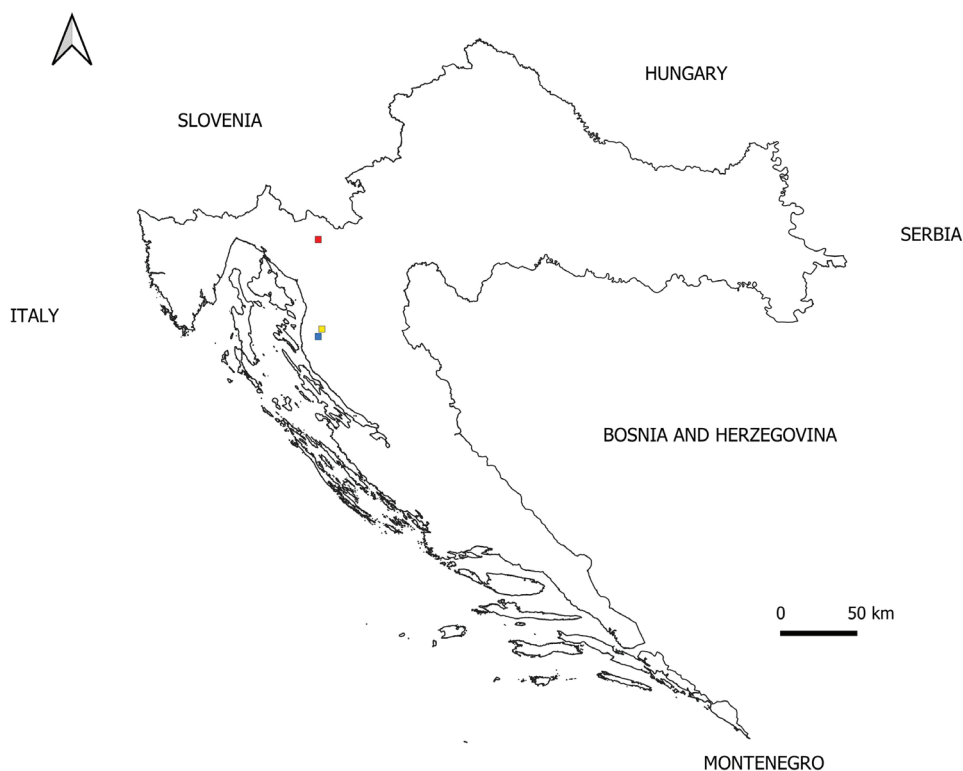


Figure 2. Geographical position of the records – squares indicate geographical position of the River Kamačnik (red square), Rožanski Kukovi (blue square) and Škrbina draga (yellow square).

exact coordinates and accompanying species were not recorded on site. The locality is situated within the subalpine beech forests, at about 1550 m a. s. l. The very microhabitat features fine-grained sediment within the shaded calcareous crevice. This locality is several hundred meters air distance from the first known locality near Rožanski Kukovi, however, due to refugial cave character of the habitat, those two populations are not connected. The voucher specimen is stored in Herbarium Croaticum collection (ZA) under the number 77892 (collectors V. Šegota and A. Alegro).

Subsequently, the species (Fig. 1) was found on the 15th of July 2023, in the canyon of the River Kamačnik (Fig. 2), a Significant landscape in the Gorski Kotar Region, next to the town of Vrbovsko. It was found almost solitary in shade on bare soil in the crevice of calcareous rock, approximately 2 meters above the walking path (45.3647N°, 15.0694E°) (Fig. 3). The rock is exposed to the northwest at approximately 400 m a. s. l. Even though the canyon is touristically attractive and frequently visited by hikers, it doesn't seem to be degraded or threatened by human activity. Furthermore,

the rock crevice where *Cyrtomnium* was found is almost too high out of reach and therefore also not threatened. Recorded accompanying species were: *Orthothecium rufescens* (Dicks. ex Brid.) Schimp., *Marchantia quadrata* Scop., *Reboulia hemisphaerica* (L.) Raddi, *Asplenium trichomanes* L. and *Cyclamen purpurascens* Mill. The voucher specimen is stored in Herbarium Croaticum (ZA) collection under the number 77891 (collectors M. Bučar and V. Šegota).

Both newly discovered populations are small in number, only a dozen of shoots were recorded on each site. We found no specimens containing perigonia nor perichaetia, thus population are classified as sexually undifferentiated. However, since the female plants are globally distributed throughout the range of the species, and the much rarer male plants are restricted to the far northern fringe of its range, we would expect female populations in these latitudes. Reproduction through spore dispersal is unknown in this species, but asexual vegetative dispersal of stem fragments by wind or water over longer distance is likely the principal means of spreading in treeless landscape (Miller 1996, Miller & Mogensen 1997). This is certainly not



Figure 3. The canyon of the River Kamačnik and *Cyrtomnium hymenophylloides* habitat.

the case with the newly discovered sites in Croatia, where populations are restricted to small semi-cave microhabitats surrounded with the forest environment. A number of studies point to sex-differential distributions of many bryophytes, some of them indicating differential tolerance to desiccation of leaf fragments transported by wind among female and male plants in several species of *Mniaceae* family (Newton 1971, Mogensen 1981), which may explain why female plants of *C. hymenophylloides* were more successful (showed better ecological plasticity) in their dispersal and establishment on glaciated terrains (Miller & Mogensen 1997).

Our record of the species in Kamačnik Canyon is the second instance of an arctic or subarctic bryophyte species being found near a source of a river in the mountainous part of Croatia at a relatively low altitude. Alegro et al. (2018) reported *Myurella sibirica* near the source of the River Kupa and assumed that local relief features and the low water temperature influence the formation of suitable microhabitat features even at low altitudes. Additionally, all findings of *Cyrtomnium hymenophylloides* in Croatia are noteworthy as this area represents the disjunct areal within the species' arctic-alpine geographical affinity. It has been hypothesised that disjuncts at lower elevation sites represent possible example of populations persisting as relicts in favourable microhabitats, which have remained similar to those that existed at the end of the Pleistocene, whereas the mountain-top disjuncts perhaps arose mainly by postglacial dispersal southward (or northward) from regions of more continuous distribution (Miller 1996). Such microhabitats, which became refugia for this and other arctic-alpine and boreo-alpine species (e.g. *Herzogiella striatella* (Brid.) Z. Iwats (Šegota et al. 2023), *Drepanium fastigiatum* (Brid.) C. E. O. Jensen (Šegota et al. 2020), *Microhypnum sauteri* (Schimp.) Kučera et Ignatov (Šegota et al. 2020) and *Dichodontium flavescens* (Dicks.) Lindb. (Alegro et al. 2019)) in the post-glacial changing environment, are quite rare and thus floristically very important in Croatia. Therefore, they should

be given special attention considering further research, management and protection.

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