



Eleocharis carniolica W. D. J. Koch, new species in flora of Montenegro

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Key words: *Eleocharis carniolica*, Semolj, Montenegro, flora.

Ključne besede: *Eleocharis carniolica*, Semolj, Črna gora, flora.

Abstract

During floristic research of acidic bogs, calcareous fens and seasonally flooded (periodically inundated) grassy places in beech forests in Semolj region, *Eleocharis carniolica* W. D. J. Koch was found, which was the first record of that species in vascular plant flora of Montenegro. In surrounding countries, this species was recorded in Bosnia and Herzegovina, Croatia, Slovenia and Albania. This paper provides description of sites, habitat and ecology of *Eleocharis carniolica* W. D. J. Koch in Montenegro.

Izvleček

Med florističnimi raziskavami kislih visokih in karbonatnih nizkih barij v okolici Semolja smo našli vrsto *Eleocharis carniolica* W. D. J. Koch, kar je prvi podatek o pojavljanju te vrste v Črni gori. V sosednjih državah so to vrsto našli v Bosni in Hercegovini, na Hrvaškem, v Sloveniji in v Albaniji. V članku podajamo opis rastišča in ekologijo vrste *Eleocharis carniolica* W. D. J. Koch v Črni gori.

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Introduction

Eleocharis is a cosmopolitan genus represented with 200 to 250 species in World (Govaerts et al. 2007), with as much as 145 species in America (González-Elizondo & Tena-Flores 2000). In Europe, genus is represented with 15 taxa (Walters 1980), six of which occur in Montenegro - *E. acicularis* (L.) Roem. & Schult., *E. palustris* (L.) R. Br., *E. mamillata* H.Lindb. subsp. *mamillata*., *E. mamillata* subsp. *austriaca* (Hayek) Strandh., *E. uniglumis* (Link) Schult., *E. quinqueflora* (Hartmann) O. Schwarz (Rohlena 1942, Birks & Walters 1973, Parolly 1995, Hadžiablahović 2004, Pulević 2005, Blaženčić 2007). The supraspecific classification of the genus *Eleocharis* was recently critically assessed on a worldwide basis (González-Elizondo & Peterson 1997). The new circumscription of several groups proved to be quite different compared with that adopted by earlier authors, including Svenson (1929, 1932, 1934, 1937, 1939), the latest monographer of the genus (Verloove 2015). According to their new system which includes 4 subgenera, 7 sections, 8 series, and 7 subseries the Montenegrin representatives of *Eleocharis* belong to the subgenera *Zinserlingia* T. V. Egorova (*E. quinqueflora*), *Scirpidium* (Nees) Kukkonen (*E. acicularis*) and *Eleocharis*. The last one is further divided in section *Eleocharis* [with series *Eleocharis* (subseries *Eleocharis*: *E. palustris*, *E. mamillata*, *E. austriaca* and *E. uniglumis*) and series *Multicaules* (Beauverd) Svenson ex J. Kern (*E. carniolica*)]. *Eleocharis carniolica* W. D. J. Koch is a rare species that is protected at European level. It is listed on Annex I of the Bern Convention (Anonymous 1979) and Habitat Directive (Anonymous 1992, Appendix IIb and Appendix IVb). This species is also a remarkable so called “community interest” species of the Natura 2000 ecological network (Barina et al. 2011). General distribution of *E. carniolica* species is limited to the central, east and southeast of Europe. *Eleocharis carniolica* populates frequently disturbed wet habitats and pioneer vegetation of marsh annuals among them wet fields and river banks. (Lansdown, R.V. 2013). It grows in wet and marshy meadows, in damp places in forests (moist forest roads and along the paths) and at occasionally flooded places on sandy to mostly clay and clay bases on the riverside, ponds and water reservoirs (Vreš, 2003). *E. carniolica* appears in associations of the coastal alliance *Fimbristylion bisumbellate* and continental *Nanocyperion* (Topić 2005). It is a declining native species in large parts of Europe and is considered as least concern (LC) according to IUCN Red List Category (EU 27, Lansdown, R.V. 2013). In Croatia and Bulgaria this plant is protected (Biodiversity Act 2002, Anonymous 2013) and referred like endangered

EN (Topić 2005, Stoeva 2009). *E. carniolica* is on the red list of endangered species in Italy (Rossi et al. 2013). In Slovenia has also been protected and recorded on the list of vulnerable species (Anonymous, 2002). In Austria, the species is endangered according to the rather old Red List (Niklfeld & Schratl-Ehrendorfer 1999), and the conservation status has deteriorated. Also, *E. carniolica* is considered as vulnerable or endangered in all countries of the Carpathian chain (Witkowski et al. 2003). Recently it has been found in Albania (Barina et al. 2011).

Material and methods

Specimens of *Eleocharis carniolica* were collected in July 2017 and September 2018 in area of acidic peat bogs and beech forest at the Semolj locality (Central Montenegro). Collected material was dried and stored in the collection of flowering plants and ferns of Natural History Museum of Montenegro (Inventory numbers: 7675; 7760; 9192; 9193). Geocoordinates of every location on which the species was found have been recorded with GPS device Garmin-TrexVista. All relevant literature was used for determination (Walters 1980, Casper & Krausch 2008). Names of all species follow Euro+Med PlantBase nomenclature. NATURA 2000 habitats are congruent with European Union habitat interpretation handbook (EUROPEAN COMMISSION DIRECTORATES GENERAL, 2007), as well as with Types catalogue of Montenegro habitats significant for European Union (Petrović et al., 2012).



Figure 1: Research area.
 Slika 1: Preučavano območje.

Research area

Saddle Semolj is located in the central part of Montenegro, on south-western slopes of Sinjajevina mountain, at 1497 meters a.s.l. It clearly separates the highest point of Sinjajevina, Babin Zub from Lola Mountain and Moračke mountains. Morača, the longest and the most water abounded river of this area, is located on south-west of Semolj and belongs to Adriatic basin. Tušina river, which belongs to Black Sea basin, is located in north-east side of Morača, so the Semolj represents their watershed (Figure 1). Rocks, which are structure parts of this locality, are from Triassic age and are made of limestone in contact with andesites and keratophyses (Kalezić et al. 1973). Few smaller transitional peat bogs and calcareous fens were registered on Semolj. According to Jovanović et al. (1986) ass. *Abieti-Fagetum* (Ht. 1938) Treg. 1957 s. lat. is cited for Semolj area. A snow-forested (boreal) climate, without a dry season during the year, occurs in this area, and it affects the development of typical mountain vegetation (Burić et al., 2012).

Results

During the years 2017 and 2018 floristic research were carried out in quaking bogs and beech forest on Semolj saddle. *Eleocharis carniolica* species has been recorded on four localities: Semolj 1 at N 42°54'32.45", E19°16'24.98" (N. Bubanja, 11.07.2017 Inventory number: 7675), Semolj 2 at N 42°54'24.05", E 19°16'26.13" (S. Vuksanović, 08.07. 2017 Inventory number: 7760) (Figure 2, Figure 3), Semolj 3 at N 42°54'25.42", E19°16'38.01" (S. Vuksanović, 06.09. 2018 Inventory number: 9192) (Figure 6) and Bare at N 42°54'14.68", E19°17'14.36", (S. Vuksanović 06.09. 2018 Inventory number: 9193) (Figure 7). The first two localities are on quaking bogs which belongs to NATURA 2000 habitat



Figure 2 (Slika 2): *Eleocharis carniolica* W. D. J. Koch (Photo: C. Berg).



Figure 3: Herbar specimen (Photo: N. Bubanja).

Slika 3: Herbarijski primerek (Foto: N. Bubanja).

7140 Transition mires and quaking bogs while Semolj 2 features also NATURA 2000 habitat 7230 Alkaline fens (Petrović & al. 2012). Both are surrounded by thick forest consisted of community of beech (*Fagus sylvatica* L.) and mountain maple (*Acer heldreichii* Orph. ex Boiss.). Localities Semolj 3 and Bare are grassy planes in beech forest subjected to seasonally flooding. Semolj 3 is the situated in beech forest surrounded the quaking bogs while locality Bare occupies the southwest slopes of hill on the saddle Semolj at an elevation of 1650 m above sea level. Permanent water is present the most part of year, while during the summer and early autumn these wood pastures are dry. In area shown at locality Semolj 1 in Figure 4 and locality Semolj 3 in Figure 6 the species covers over 30 square meters, at locality Bare in Figure 7 about 10 square meters while in area at locality Semolj 2 shown in Figure 5 only and 2 square meters. *Eleocharis carniolica* at first locality grows almost throughout the entire bog vegetation gradient, and mostly on swamping borders of water surfaces. These parts of bog include several pools of various sizes characterized by the presence of aquatic and wetland species e.g. *Nuphar lutea* (L.) Sm. and *Potamogeton gramineus* L. Further. In most cases, the bog margins are occupied by: *Juncus articulatus* L., *Juncus capitatus* Weigel, *Juncus bufonius* L., *Carex echinata* Murray, *Carex flava* L., *Carex lasiocarpa* Ehrh., *Carex nigra* (L.) Reichard, *Carex rostrata* Stokes, *Menyanthes trifoliata* L., *Pinguicula balcanica* Casper, *Caltha palustris* L., *Parnas-*



Figure 4: Quaking bogs in Semolj 1 (Photo: N. Bubanja).
Slika 4: Plavajoče visoko barje Semolj 1 (Foto: N. Bubanja).



Figure 5: Quaking bogs in Semolj 2 (Photo: S. Dragičević).
Slika 5: Plavajoče visoko barje Semolj 2 (Foto: S. Dragičević).



Figure 6 (Slika 6): Semolj 3 (Photo/Foto: S. Vuksanović).

sia palustris L., *Gymnadenia frivaldii* Hampe ex Griseb., *Dactylorhiza cordigera* subsp. *bosniaca* (Beck) Soó, *Dactylorhiza majalis* (Rchb.) P.F.Hunt & Summerh., *Sphagnum* spp., etc. The second investigated bog locality is just a part of a mire complex comprising alkaline fen, transitional bog and hydrophilous tall herb fringe community. In this locality, *E. carniolica* occurs in margin of calcareous fen with *Carex flava* L., *Carex leporina* L., *Carex echinata* Murray, *Carex panicea* L., *Carex nigra* (L.) Reichard, *Blysmmus compressus* (L.) Link, *Parnassia palustris* L., *Dactylorhiza cordigera* subsp. *bosniaca* (Beck) Soó, *Pinguicula balcanica* Casper, *Molinia caerulea* (L.) Moench and others. The last two localities (Semolj 3 and Bare) are disturbed grassy places in beech woods, seasonally inundated. In first of them (Semolj 3) *Eleocharis carniolica* grows on acidic poor sandy soil surrounding with *Juncus effusus* L., *Carex leporina* L., *Deschampsia caespitosa* (L.) P. Beauv., *Ranunculus repens* L., *Galium palustre* L., *Lysimachia nummularia* L., *Carex pallescens* L., *Spergularia rubra* (L.) J. Presl & C. Presl., *Cardamine pratensis* L., *Polygonum aviculare* L., *Gnaphalium uliginosum* L. Locality Bare populates with dense tufts of *Deschampsia caespitosa* (L.) P. Beauv. On the margin, sandy substrate occupies tussocks of *Eleocharis carniolica* accompanied with *Carex*



Figure 7: Tussocks of *Eleocharis carniolica* on locality Bare.
 Slika 7: Šopi vrste *Eleocharis carniolica* na lokaliteti Bare.

leporina L., *Ranunculus repens* L., *Potentilla recta* L. and *Hypericum maculatum* Crantz. On the most positions, populations of *Eleocharis carniolica* are dense but represented by a small number of specimens.

Discussion

Eleocharis carniolica is widespread and locally common, however it does show local declines in many parts of Europe (Lansdown 2013). It is on Red lists of endangered species, vulnerable or near threatened species in majority of European countries: Croatia (Topić 2005), Bulgaria (Stoeva 2009), Italy (Rossi et al. 2013), Slovenia (Anonymus 2002), Slovakia (Turis et al. 2014), Poland (Kopeć & Michalska-Hejduk 2012), Hungary (Király 2007) etc. In most of the countries of Europe *Eleocharis carniolica* is found in similar habitats, mainly in swampy and seasonally flooded semiaquatic habitats. Such habitats are rare in most of the countries of Europe, and often in strong decline due to floodplain regulation and draining. It grows in several localities in Croatia along the ponds, mainly in the association *Dichostyli-Fimbristyletum dichotomae* H-ić, 1953, class *Isoëto-Nanojuncetea* Br.-Bl. & Tx. (1943) (Protection of Biodiversity of the Sava River Basin

Floodplains 2008–2009) with one spot in forest association *Sphagno-Piceetum* s.l. Vukelić 2012 (Šegota & Alegro 2016). In Slovenia, it was found at several localities within the class *Isoëto-Nanojuncetea* Br.-Bl. & Tx. 1943 in ass. *Molinietum caeruleae* s. lat., and association with *Cyperetum flavescens* (Vreš 2004). In Croatia, Bosnia and Herzegovina, as in Slovenia, this species is present at NATURA 2000 habitats 3130 Oligotrophic to mesotrophic standing waters with vegetation of *Littorelletea uniflora* and/or *Isoëto-Nanojuncetea* (Protection of Biodiversity of the Sava River Basin Floodplains 2008–2009). Recently, *Eleocharis carniolica* has been found in Albania in a shallow depression on serpentine baserock with more or less closed vegetation at an elevation of nearly 1700 m above sea level (Barina et al. 2011). In Italy this species builds association *Junco tenagejæ – Eleocharietum carniolicæ* ass. nova, while in Romania it is found in associations *Agrostetum caninae* Harg 1942 and *Juncetum effuse* Soó (1931) 1949 (Lasturci & Beccatini 2009, Stzmari et al. 2014). In Poland, this species is present in Natura 2000 habitats 3130 Oligotrophic to mesotrophic standing waters with vegetation of *Littorelletea uniflora* and/or *Isoëto-Nanojuncetea*, 3270 Rivers with muddy banks with *Chenopodium rubrii* p.p. and *Bidention* p. p. vegetation and 6410 *Molinia* meadows on calcareous, peaty, clayey-silt-laden soils (*Molinion cerulæae*) (Wojciech 2004). The new locality in Montenegro (Semolj saddle) is far away of its adjacent populations in Croatia, Slovenia, Bosnia and Herzegovina and Albania. This can be explained by the fact that this species is able to long distance distribution by birds, and also by the fact that wetlands of Montenegro and their surroundings are insufficiently explored. Moreover, peat bogs in southeastern Europe are sparse and relict habitats, scattered across the area in rare localities.


Conclusion

Quaking bogs in Semolj with surroundings (beech forest), as well as other smaller bogs in Montenegro require more detailed and comprehensive botanical research. Future research will be focused on confirmation of the presence of *Eleocharis carniolica* in other similar habitats in Montenegro. Also, all populations of *E. carniolica* on the saddle Semolj will be estimated and observed according to their size and dynamics.

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