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Notes on *Bolboschoenus planiculmis*, a species new to the flora of Bosnia and Herzegovina

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ABSTRACT: This paper presents a survey of *Bolboschoenus* species found in Bosnia and Herzegovina and includes an identification key, distribution data and maps of localities for each species in Bosnia and Herzegovina based on a revision of herbarium specimens from SARA, private collections of the authors, literature data and field observations. The following species are native to Bosnia and Herzegovina: *B. glaucus*, *B. maritimus* and *B. planiculmis*. In this paper, *B. planiculmis* is reported as a species new to the flora of Bosnia and Herzegovina. It was discovered at two localities in August of 2015 and 2016 during field work along the banks of the river Bosna (East Central Bosnia). The paper presents a short morphological description and photographs, as well as a summary of distribution of the species.

Keywords: *Bolboschoenus*, Balkan Peninsula, Cyperaceae, distribution, taxonomy

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The genus *Bolboschoenus* (Asch.) Palla. (Cyperaceae), previously as a part of wider defined *Scirpus* L. (Goetghebeur & Simpson 1991), has an almost cosmopolitan distribution, comprising about 15 species (Browning & Gordon-Gray 2000). It is represented by six species in the European flora (Jiménez-Mejías & Luceño 2011). In the flora of Bosnia and Herzegovina, only two species of the genus *Bolboschoenus*, have been recorded so far: *B. maritimus* (L.) Palla. and *B. glaucus* (Lam.) S. G. Sm. (Beck-Mannagetta 1903; Hroudová *et al.* 2007). *Bolboschoenus planiculmis* is an Eurasian species with general distribution from Central Europe through Russia to the Far East, Central Asia, China, Japan and Iran. In the flora of Former Yugoslavia, this species was known in Croatia, Macedonia, Slovenia and Serbia, but not confirmed for Montenegro (Hroudová *et al.* 2007). The first records of *B. planiculmis* for Bosnia and Herzegovina are herein reported.

To revise the genus *Bolboschoenus*, all literature data were gathered from relevant floristic and phytocoenological references and georeferenced using ARCGIS 10.1. Considering that this genus in Europe has been revised recently (Hroudová *et al.* 2007), and due to the fact that all literature data from the 20th century were recognised as *B. maritimus* s.l. (= *S. maritimus* s.l.), examination of the complete herbarium material containing ripe fruits is the most suitable way to achieve reliable determination of the species. In this connection, the literature data were rejected in the first step and available herbarium vouchers were studied, including ones from the herbarium of the State Museum in Sarajevo (SARA) and private collections of the authors using the following provisional acronyms: DjM - Đorđije Milanović; SM - Semir Maslo; and ŠŠ - Šemso Šarić. The numerations of studied vouchers are mentioned only if it exists in a certain herbarium.

A first examination of the herbarium of SARA, with a parallel review of the references, indicated that most of the literature records were based on existing voucher specimens stored in this herbarium. It implied that there is a possibility to revise almost all literature records as well. To fill any gaps observed in the data, every locality mentioned in the literature but lacking corresponding

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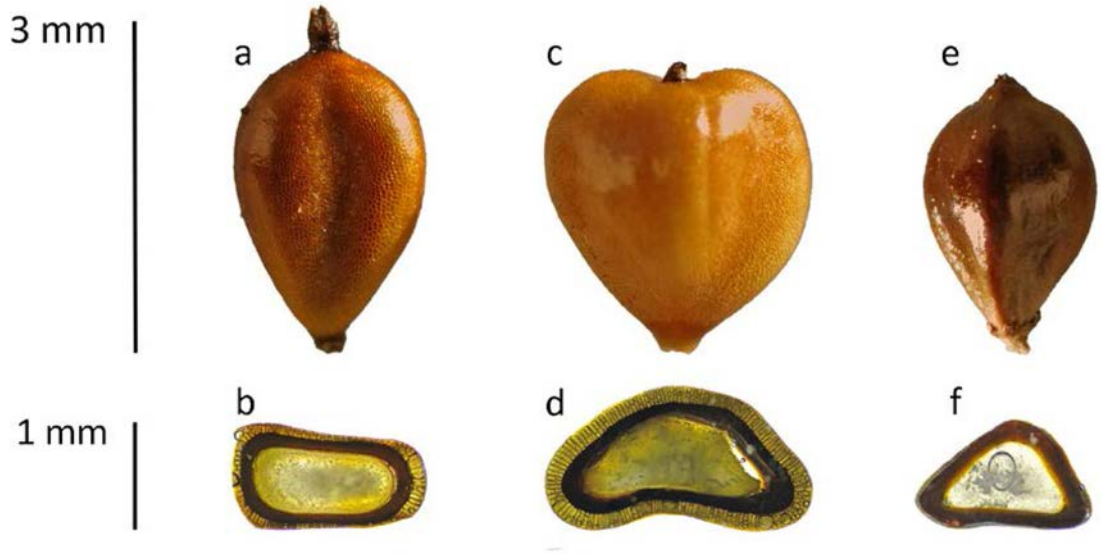

Fig. 1. Ripe fruits and cross sections of achenes of *Bolboschoenus* species from Bosnia and Herzegovina: **a-b)** *B. planiculmis*; **c-d)** *B. maritimus*; **e-f)** *B. glaucus* (photographs taken by Đ. Milanović).

Fig. 2. Inflorescence of *B. planiculmis* with predominantly bifid styles (photograph taken by Š. Šarić).

Fig. 3. Habitat of *B. planiculmis* at the locality of Blizansko polje (photograph taken by Š. Šarić).

herbarium vouchers was studied in the field during the last 5 years in order to collect herbarium material necessary for revision. In that way, we collected material sufficient for revision of known literature records and are now able to refer all published data to at least one herbarium voucher specimen.

Some previously unknown new populations were found during the field work, and the collected specimens were stored in SARA (*B. planiculmis*) and in personal collections (*B. glaucus*). For new records, the exact WGS 1984 coordinates are given.

Identification of the specimens was done according to Hroudová *et al.* (2007), noting that the studied material from Bosnia and Herzegovina (B&H) completely fits the identification key and descriptions provided by the authors. Accordingly, we accepted the revisions published in that paper of the herbarium specimens collected from B&H and stored in three Czech herbaria (PC, PRC, BRNM) without examination of the populations in the field. All revised material is listed in the Appendix, with herbarium acronyms (according to Holmgren *et al.* 1990) and numeration of the studied voucher, locality name, collector and identifier, keeping the name of the original determination in the herbarium and matching literature data (if existing) with the name of the original record from a certain reference. Additionally, in the herbarium of SARA there are three specimens collected from the wider Sutorina area, which was a part of Bosnia and Herzegovina during the Austro-Hungarian period, but which now belongs to Montenegro. This material is also revised and listed in the Appendix, although it does not refer to the research area.

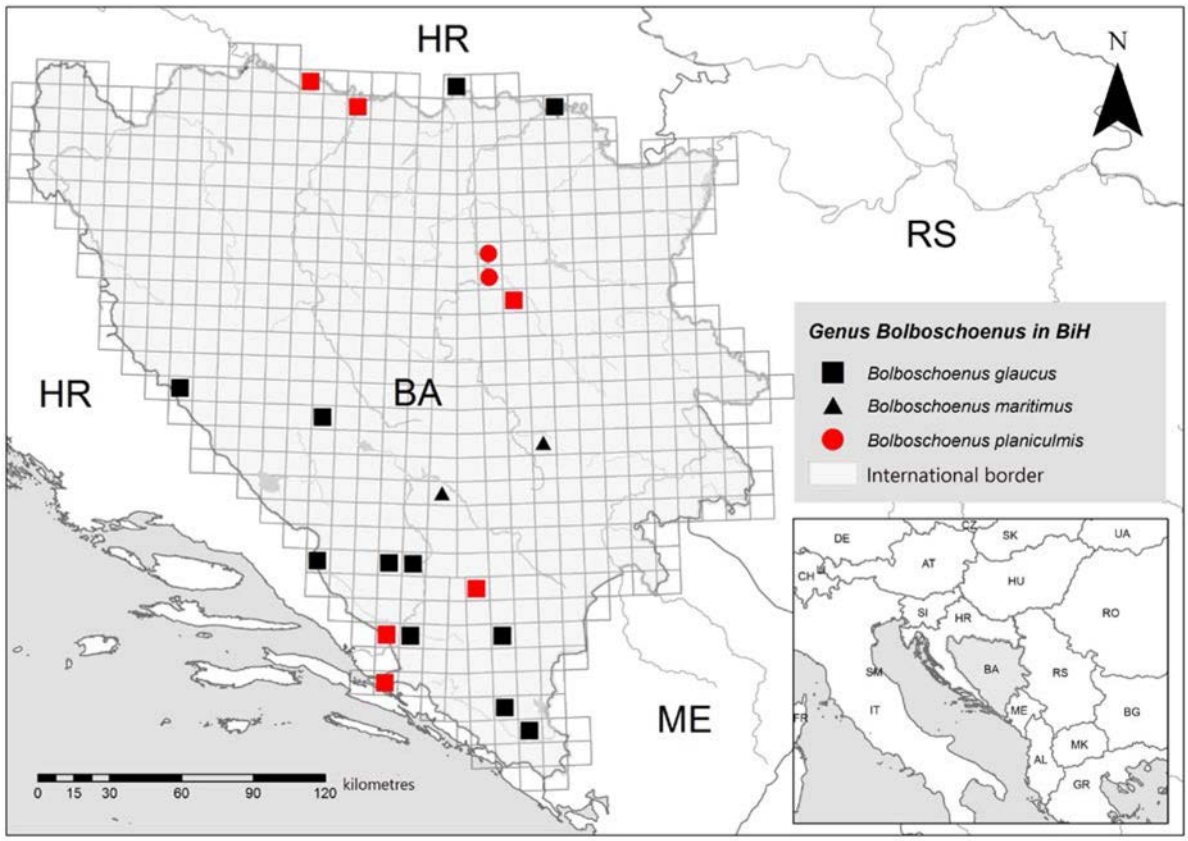

Fig. 4. Distribution of species of the genus *Bolboschoenus* in Bosnia and Herzegovina. New records are indicated by red symbols.

The nomenclature follows Jiménez-Mejías & Luceño (2011). The distribution of all species of the genus in Bosnia and Herzegovina is shown on a standard UTM grid (10×10 km) using different symbols. On the map localities gathered from the literature are indicated by black symbols, while new data are indicated by red.

Bolboschoenus planiculmis (F. W. Schmidt) T. V. Egorova (synonym: *Scirpus planiculmis* F. W. Schmidt) belongs to a taxonomically problematical species complex (*B. maritimus* agg.). Key differences between these species lie in variability of the inflorescence, the number of styles and persistence of perianth bristles on the ripe achenes, but mainly in shape and structure of the achenes (Fig. 1). To identify these species, we offer the following adjusted key [after Hroudová *et al.* (2007) and Greuter & Raus (2012)]:

1. Inflorescence usually a richly branched anthelodium consisting of a central group of 6-12 sessile spikelets and 4-8 rays bearing fascicles of 2-7 spikelets or rarely single spikelets. Perianth bristles mostly persistent on ripe fruits. Achenes small. 2.0-3.1 mm long and 1.5-2.2 mm wide, obovate, convex on abaxial side, exocarp clearly thinner than the mesocarp, styles trifid ***B. glaucus***.
1. Inflorescence head-like, consisting of 1-8 sessile spikelets or composed of a central group of 3-8 sessile spikelets and 1-2 branches bearing one or two spikelets. Perianth bristles caducous. Achenes 3.0-4.0 mm long and 2.0-2.7 mm wide, elliptical, obovate to broadly obovate, convex or concave on abaxial side, styles bifid or trifid 2
2. Achenes convex on abaxial side, lenticular, plano-convex to subtrigonous in cross section, exocarp frequently twice as thick as the mesocarp, styles predominantly trifid. ***B. maritimus***
2. Achenes concave on both the adaxial and the abaxial side, oval, concave or plano-concave in cross section, exocarp approximately as thick as the mesocarp, styles predominantly bifid. ***B. planiculmis***

Bolboschoenus planiculmis is a perennial plant, 40-90 cm tall. Description: rhizomes richly branched, reddish brown, bearing spherical or ellipsoid tubers up to 15 mm in diameter. Stem trigonous to sharply trigonous, sides flat or slightly depressed, grey-green or green, with elongated internodes. Leaves as long or longer than stem; sheaths 4-10 cm long, yellow-brown or grey-green to dark brown. Blades 3-4.5 mm wide, flat or folded, keeled, grey-green or green, smooth, slightly scabrid towards to top. Inflorescence either head-like, formed of only 1-3 sessile spikelets, or poorly branched, formed of a central group of 3-7 sessile spikelets and 1-2(-4) rays bearing single spikelets

or fascicles of 2 -3(-5) spikelets. Rays 5-30(-45) mm long. Spikelets 10-20 mm long and 5-8 mm wide, ovate, obtuse, light brown. Floral bracts 7-9 mm long and 3-4 mm wide, yellow-brown, with arista of up to 2 mm. Perianth bristles 4-5, caducous, mostly shorter than achene. Anthers 2-4 mm long, styles bifid (Fig. 2). Achenes 3.1-3.8 mm long and 2.2-2.5 mm wide, obovate, biconcave or flat-concave, grey-brown, beak of up to 0.3 mm, surface with a distinct polygonal network. Pericarp in cross-section with well developed exocarp formed by one layer of cylindrical cells radially elongated and filled with air. Chromosome number: $n = 54, 55$ (Jarolímová & Hroudová 1998; Hroudová *et al*. 2006, 2007).

Bolboschoenus planiculmis most frequently inhabits temporarily flooded field depressions, wet ditches and other secondary habitats (in Central Europe) and occurs only rarely in the littoral of fishponds or streams (Hroudová *et al*. 2007). In Bosnia and Herzegovina it occupies similar habitats. It has been discovered along the Bosna River in East Central Bosnia in three small and scattered populations at two localities (Appendix), where it occupies depressions and shallow water along the river banks (Fig. 3) in almost mono-dominant plant communities. The number of flowering specimens is not higher than 200 individuals.

Analysis and examination of the available herbarium material shows that the most suitable and reliable determination of the species is based on ripe achenes. The material studied from Bosnia and Herzegovina completely confirms the statement by Hroudová *et al*. (2007) about the persistence of bristles and nature of achenes (their shape, structure and cross-section), which is clearly visible in Fig. 1. Moreover, due to their higher specific gravity caused by the lack of an elongated cell of exocarp filled with air, the achenes of *B. glaucus* sink in water, even when they are completely dried. The ratio between the number of sessile spikelets and spikelets on rays proves to be a stable character for species determination if it is studied on well developed mature individuals within the population, which is also in line with the findings of Hroudová *et al*. (2007). This fact could be very useful for the determination of herbarium material lacking achenes.

Inasmuch as all data published before Hroudová *et al*. (2007) about the genus *Bolboschoenus* in Bosnia and Herzegovina (Pantocsek 1874; Formanek 1888; Murbeck 1892; Beck-Mannagetta 1903; Schiller 1903; Vandas 1909; Malý 1928; Bjelčić 1954, 1985, 1988; Ritter-Studnička 1953, 1954, 1956, 1973; Bajić 1977; Bajić & Ritter-Studnička 1978; Jasprica & Carić 2002; Jasprica *et al*. 2003), recognised only *B. maritimus* s.l., a total of 29 herbarium vouchers were used for revision of the genus (Appendix) and an overview of distribution of the revised species in the country (Fig. 4).

The most frequently occurring species of the genus in Bosnia and Herzegovina is *B. glaucus*. The species is found quite often in karst poljes, in continental lowlands and in sub-Mediterranean parts of the country with strong maritime influence. On the other hand, *B. maritimus* and *B. planiculmis* are very rare species in the flora of Bosnia and Herzegovina, each of them recorded from only two localities.

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REFERENCES

Bajić D. 1977. Ekološko-sistematska istraživanja vodene, močvarne i priobalne vegetacije. In: Kosorić Đ (ed.), *Sastav i karakteristike životnih zajednica Neretve (od Mostara do granice sa SR Hrvatskom) za period do ljeta 1976. godine*, pp. 1-26, Elaborat Biološkog instituta Univerziteta u Sarajevu, Sarajevo.

Bajić D & Ritter-Studnička H. 1978. Istraživanje makrovegetacije Hutova blata. In: Vuković T & Kosorić Đ (eds.), *Studija sadašnjeg stanja ekosistema Hutova* **2**, pp. 1-38, Study of the Biological Institute of Faculty of Science, University of Sarajevo, Sarajevo.

Beck-Mannagetta G. 1903. Flora Bosne, Hercegovine i novopazarskog Sandžaka **1**(1,2), Gymnospermae i Monocotyledones. *Glasnik Zemaljskog Muzeja u Bosni i Hercegovini* **15**(2): 185-230.

Bjelčić Ž. 1954. Flora i vegetacija bare Velika Tišina kod Bosanskog Šamca. *Godišnjak Biološkog Instituta Univerziteta u Sarajevu* **7**(1-2): 188-189.

Bjelčić Ž. 1985. Istraživanje makrofitske vegetacije. In: Vuković T (ed.), *Hutovo blato - praćenje stanja u ornitofaunističkom rezervatu 1983-1984*, pp. 20-39, Zavod za zaštitu spomenika kulture, prirodnih znamenitosti i rijetkosti Bosne i Hercegovine, Sarajevo.

Bjelčić Ž. 1988. *Makrofitska flora i vegetacija Hutova blata*. Zbornik radova Savjetovanja „Hutovo blato - stanje i perspektiva zaštite", Sarajevo-Hutovo blato 29-30.10.1987. Zavod za zaštitu kulturno-istorijskog i prirodnog nasljeđa Bosne i Hercegovine, 7-26.

Browning J & Gordon-Gray KD. 2000. Patterns of fruit morphology in *Bolboschoenus* (Cyperaceae) and their global distribution. *South African Journal of Botany* **66**(1): 63-71.

Formanek E. 1888. Beitrag zur Flora von Bosnien und der Hercegovina. *Österreische Botanische Zeitschrift* **38**: 271-279.

Goetghebeur P & Simpson DA. 1991. Critical notes on *Actinoscirpus*, *Bolboschoenus*, *Isolepis*, *Phylloscirpus* and *Amphiscirpus* (Cyperaceae). *Kew Bulletin* **46**: 169-178.

Greuter W & Raus Th. 2012. Med-Checklist Notulae 31. *Willdenowia* **42**: 287-295.

Holmgren PK, Holmgren NH & Barnett LC. 1990. Index Herbariorum. Part I: the herbaria of the world. 8th ed. *Regnum Vegetabile* **120**: 1-693.

Hroudová Z, Marhold K & Jarolímová V. 2006. Notes on *Bolboschoenus* species in Austria. *Neilreichia* **4**: 51-73.

Hroudová Z, Zákravský P, Ducháček M & Marhold K. 2007. Taxonomy, distribution and ecology of *Bolboschoenus* in Europe. *Annales Botanici Fennici* **44**: 81-102.

Jarolímová V & Hroudová Z. 1998. Chromosome number within the genus *Bolboschoenus* in Central Europe. *Folia Geobotanica* **33**: 415-428.

Jasprica N & Carić M. 2002. Vegetation of the natural park of Hutovo blato (Neretva river delta, Bosnia and Herzegovina). *Biologia, Bratislava* **57**(3): 505-516.

Jasprica N, Carić M & Batistić M. 2003. The Marshland Vegetation (*Phragmito-Magnocaricetea, Isoeto-Nanojuncetea*) and Hydrology in the Hutovo Blato Natural Park (Neretva River Delta, Bosnia and Herzegovina). *Phyton (Horn, Austria)* **43**(2): 281-294.

Jiménez-Mejías P & Luceño M. 2011. Cyperaceae. In: *Euro+Med Plantbase - the information resource for Euro-Mediterranean plant diversity*. Published at http://ww2.bgbm.org/EuroPlusMed [Accessed August 2018].

Malý K. 1928. Prilozi za floru Bosne i Hercegovine X. *Glasnik Zemaljskog Muzeja u Bosni i Hercegovini* **40**(1): 107-168.

Murbeck S. 1892. Beitrage zur Kenntnis der Flora von Sudbosnien und der Hercegovina. *Lunds Universitets Arsskrift* **27**: 1-182.

Pantocsek J. 1874. Adnotationes ad floram et faunam Hercegovinae, Crnagorae et Dalmatiae. *Verhandlungen des Vereins für Natur-und Heilkunde zu Presburg* **2**: 1-143.

Ritter-Studnička H. 1953. Prilozi za floru Bosne i Hercegovine II. *Godišnjak Biološkog Instituta Univerziteta u Sarajevu* **6**(1-2): 21-38.

Ritter-Studnička H. 1954. Flora i vegetacija livada kraških polja Bosne i Hercegovine. *Godišnjak Biološkog Instituta Univerziteta u Sarajevu* **7**(1-2): 25-110.

Ritter-Studnička H. 1956.Vegetacijske slike sa teritorija budućeg jezera Jablaničke hidrocentrale. *Naše starine* **3**: 299-305.

Ritter-Studnička H. 1973**.** Neufunde und seltene Pflanzen aus Bosnien und der Herzegowina. *Acta Botanica Croatica* **32**: 253-260.

Schiller J. 1903. Beiträge zur Flora von Bosnien und der Herzegovina. *Mitteilungen des Naturwissenschaftlichen Vereins an der Universitaet Wien* **1**: 49-58.

Vandas C. 1909. *Reliquiae Formánekianae. Enumeratio critica plantarum vascularum, quam itineribus in Haemo peninsula et Asia Minore (Bithynia) factis collegit Dr. Ed. Formánek*. Sumptibus Comitiorum Marchionatus Moraviae, Brunae.

REZIME

Napomene o *Bolboschoenus planiculmis*, novoj vrsti flore Bosne i Hercegovine

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U radu se navode podaci o distribuciji i taksonomiji vrsta roda *Bolboschoenus* u Bosni i Hercegovini, na osnovu revizije herbarijumskog materijala iz herbarijuma SARA, podataka iz literature, te terenskih istraživanja autora. Do sada su u Bosni i Hercegovini konstatovane tri vrste ovoga roda uključujući *B. planiculmis* koja se ovde navodi kao nova vrsta. Konstatovana je na 2 lokaliteta u avgustu 2015. i 2016. godine tokom terenskih istraživanja duž obala reke Bosne (istočna centralna Bosna). Rad predstavlja kratki morfološki opis, fotografije kao i kartu distribucije u Bosni i Hercegovini.

Ključne reči: *Bolboschoenus*, Balkansko poluostrvo, Cyperaceae, distribucija, taksonomija