Revision of the genus *Piptatherum* P. Beauv. (Poaceae) in Bosnia and Herzegovina

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Abstract

The paper reviews the results of detailed revision of herbarium material of the genus *Piptatherum* from Poaceae collection kept in the Herbarium of the National Museum of Bosnia and Herzegovina (SARA). Revision of the genus *Piptatherum* P. Beauv. in Bosnia and Herzegovina is presented, with brief nomenclature citations and the key for identification. The original photographs and distributional map, accompany the synopsis for each taxon: *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. subsp. *holciforme*, *P. miliaceum* (L.) Coss. subsp. *miliaceum, P. miliaceum* subsp. *thomasii* (Duby) Freitag and *P. virescens* (Trin.) Boiss.

Keywords: Bosnia and Herzegovina, herbarium, *Piptatherum*, *Poaceae*

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Sažetak

U radu se razmatraju rezultati detaljne revizije herbarijskog materijala roda *Piptatherum* iz zbirke Poaceae koji je pohranjen u Herbariju Zemaljskog muzeja Bosne i Hercegovine (SARA). Prikazana je revizija roda *Piptatherum* P. Beauv. u Bosni i Hercegovini, s kratkim citatima iz nomenklature i ključem za identifikaciju. Izvorne fotografije i distribucijska karta prate sinopsis za svaku svojtu: *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. subsp. *holciforme*, *P. miliaceum* (L.) Coss. subsp. *miliaceum*, *P. miliaceum* subsp. *thomasii* (Duby) Freitag i *P. virescens* (Trin.) Boiss.

Ključne riječi: Bosna i Hercegovina, herbarium, *Piptatherum*, *Poaceae*

Introduction

Piptatherum P. Beauv. is a Eurasian genus with high degree of variability, referred to tribe Stipeae Dumort, and has been considered closely related to the North American genus *Oryzopsis* Mich. The lines of the species of two genera were clarifield by Romaschenko et al. (2011) in the recent phylogenetic study of the genera *Piptatherum* and *Oryzopsis*. Hamasha et al. (2012) further explored generic limits in the group and proposed a new genus *Oloptum* Röser & Hamasha to accommodate *Piptatherum miliaceum* (L.) Coss.

Piptatherum is a medium-sized genus of 25 species distributed in the Old World sub-tropic and temperate regions from Macaronesia to China (Freitag 1975). It is represented by eight species in the Euro-Mediterranean region (Valdés & Scholz 2009). Four taxa of the genus *Piptatherum* have been recorded in the flora of Bosnia and Herzegovina (Struschka 1880, Conarth 1887, Beck von Mannagetta 1903, Lindberg 1906, Maslo 2014).

Table 1. First literature and herbarium records of the genus P*iptatherum* in Bosnia and Herzegovina

Taxon	Literature records	Herbarium records
P. holciforme	Mostar, Lindberg 1906	Mostar, Baenitz 1898 (DR, 048865; DR, 048881)
P. miliaceum	Mostar, Struschka 1880	Počitelj, Ritter 1957 (SARA, 49234)
P. miliaceum subsp. *thomasii*	Mostar, Maslo 2014	Mostar, Maslo 2014 (SARA, 51979)
P. virescens	Gornji Šeher, Conarth 1887	Gomila, Beck 1892 (SARA, 00766; SARA, 00777)

Piptatherum holciforme (M. Bieb.) Roem. & Schult. (synonyms: *Agrostis holciformis* M. Bieb.*; Oryzopsis holciformis* (M. Bieb.) Hack.). *P. holciforme* (Fig. 1) is a caespitose perennial. Culms are erect, or geniculately ascending, 3-5-noded, glabrous, 60-130 cm tall. Leaf sheaths are glabrous. Ligule an eciliate membrane, 3-10 mm long, obtuse to acute. Leaf blades are flat or involute, 15-30 cm x 2-6 mm, with ribbed surface which is rough on both margins. Panicle is lax, ovate, 15-35 cm long and 5-20 cm wide, the branches erect to ascending to spreading, the lower ones paired, rarely in whorls up to 4. Spikelets are ovate to lanceolate, dorsally compressed, 8-12 mm long. Glumes are similar, ovate, exceeding apex of florets, 8-12 mm long, membranous and without keels, with acute apex. Lower glume is 5-8-nerved. Upper glume is 5-7 nerved. Fertile lemma is ovate and dorsally compressed, hairy, 5-nerved, 5-8 mm long with an acute, awned apex. Awn is terminal, 6-10 mm long, slightly bent, caduceus. Palea is coriaceous, 2-nerved and without keels. Caryopsis ellipsoid, dorsally slightly compressed. 2n=24 (Adapted from Freitag 1975 and Clayton et al. 2006).

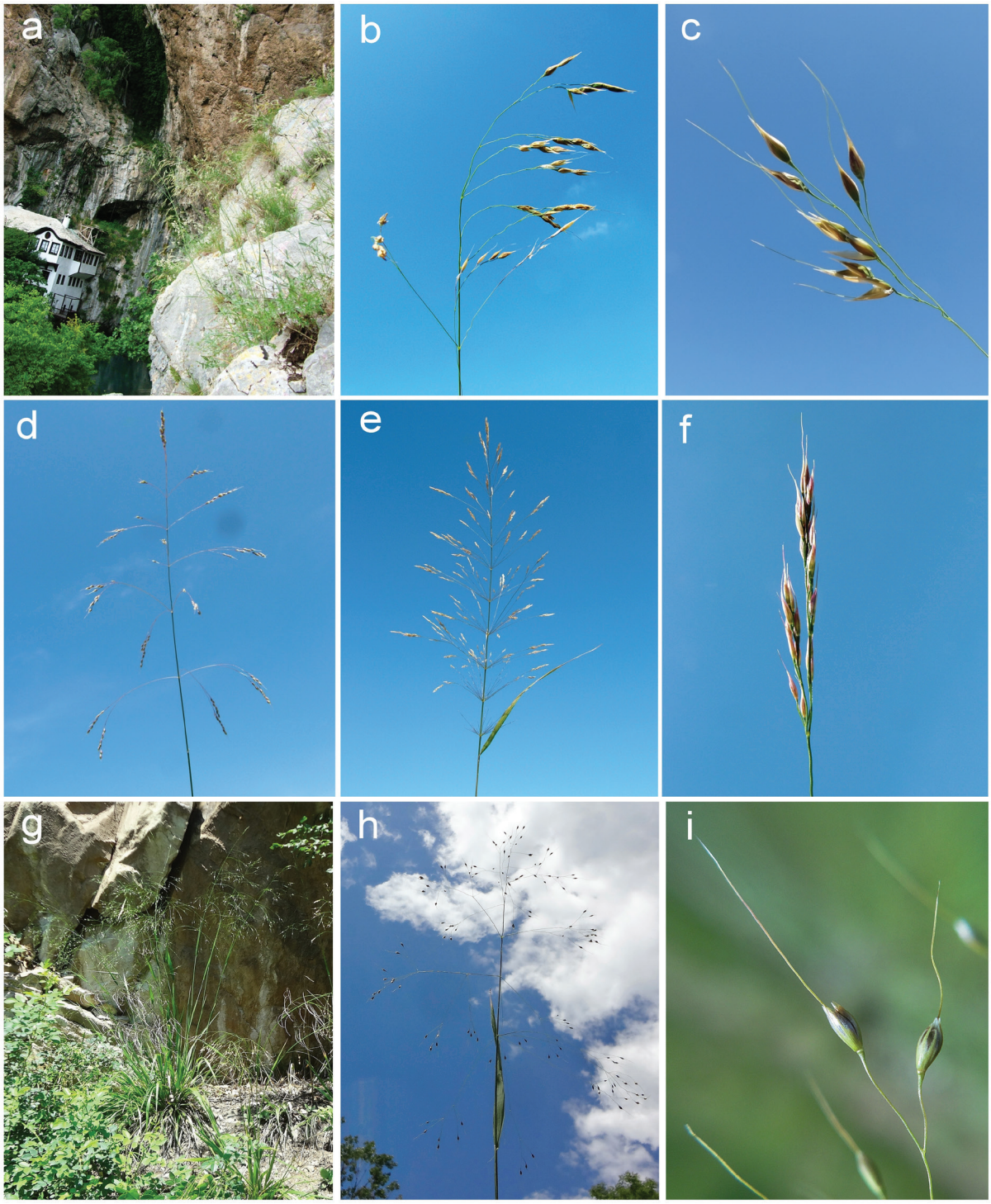

Figure 1. *Piptatherum holciforme* subsp. *holciforme*: habitat (a), panicle (b), spikelets (c); *P. miliaceum* subsp. *miliaceum*: panicle (d); *P. miliaceum* subsp. *thomasii*: panicle (e), spikelets (f); *P. virescens*: habitat (g), panicle (h), spikelets (i) (Photos a-f: S. Maslo, g-i: Š. Šarić).

Piptatherum holciforme is native to the East Mediterranean area, extending through the Middle East to Afganistan and Iran (Freitag 1975). According to Valdés & Scholz (2009) the species has been recorded in Europe only in East Mediterranean countries. Only recently it was found in Italy (Terzi et al. 2017). Up to date, *P. holciforme* was reported in the Balkans in Bosnia and Herzegovina (Lindberg 1906), Montenegro (Pulević 2005), Albania (Barina et al. 2018), Bulgaria (Hinkova 1963), Greece (Dimopoulos et al. 2013), North Macedonia, Serbia (Jovanović 1976) and Turkey (Tan 1985). The oldest known Balkan reports are from Bosnia and Herzegovina, Bulgaria, Greece, Montenegro and Serbia (Hayek 1933).

According to Freitag (1975) and Valdés & Scholz (2009) *P. holciforme* is represented by two subspecies in Europe, namely, *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. subsp. *holciforme* and *Piptatherum holciforme* subsp. *longiglume* (Hausskn.) Freitag. The last subspecies is restricted in European area only to Greece. Based on the taxonomic revisions by Freitag (1975), the main differences between *P. holciforme* subsp. *holciforme* and *P. holciforme* subsp. *longiglume* are represented by the length of the spikelet (7-10 mm vs. 9-14 mm), lemma (5-6 mm vs. 7-8 mm), and awn (5-8 mm vs. 11-14 mm).

Piptatherum miliaceum (L.) Coss. (synonyms: *Agrostis miliacea* L.; *Oryzopsis miliacea* (L.) Asch. & Schweinf.). *P. miliaceum* (Fig.1) is a caespitose perennial. Culms are slender to very stout, 5-7-noded, glabrous, 50-150 cm tall. Leaf sheaths are glabrous. Ligule an eciliate membrane, truncate, 0.5-1.5 mm long. Leaf blades are flat, or convolute, 15-30 cm x 5-10 mm, coriaceous with attenuate apex. Panicle is lax, ovate, 20-40 cm long and 6-15 cm wide, the branches ascending to spreading, slender, in whorls of 4-40. Spikelets are ovate to lanceolate; dorsally compressed, 3-3.5 mm long. Glumes are similar, elliptic, exceeding apex of florets, 3-3.5 long, membranous and without keels, 3-nerved, with acute apex. Fertile lemma is obovate and dorsally compressed, 2 mm long, glabrous, dark brown, shiny, with an obtuse, awned apex. Awn is subterminal, 3-5 mm long, slender, caducous. Palea is coriaceous, 2-nerved and without keels. Caryopsis is obovoid, scarcely flattened. Chromosome number is 2n=24 (Freitag 1975 and Clayton et al. 2006).

P. miliaceum is native to the whole Mediterranean region extending to western Asia and Arabia (Freitag 1975). Up to date, *P. miliaceum* was reported in the Balkans in Albania (Barina et al. 2018), Bosnia and Herzegovina (Struschka 1880), Croatia (Nikolić 2020), Greece (Dimopoulos et al. 2013), Montenegro (Rohlena 1942), Slovenia (Jogan 2007), and Turkey (Tan 1985). The oldest known Balkan reports are from Bosnia and Herzegovina, Bulgaria, Croatia, Greece and Montenegro (Hayek 1933).

According to Freitag (1975) and Valdés & Scholz (2009) *P. miliaceum* is represented by two subspecies in Europe, namely, *Piptatherum miliaceum* (L.) Coss. subsp. *miliaceum* and *Piptatherum miliaceum* subsp. *thomasii (*Duby) Freitag. Both subspecies are very similar but *P. miliaceum* subsp. *thomasii* has inflorescences that form more than twenty branches (up to fifty), the majority of them sterile, on the inferior nodes while *P. miliaceum* subsp. *miliaceum* only forms from four to eight branches also on lower inflorescence nodes. Based on molecular phylogenetic studies *P. miliaceum* (s. lat.) was identified as a distinct clade and, therefore, separated generically as *Oloptum* Röser & Hamasha (Hamasha et al. 2012), though it is included in *Piptatherum* for the time being (Valdés & Scholz 2009).

According to Valdés & Scholz (2009) *P. miliaceum* subsp. *miliaceum* has been recorded in most Mediterranean countries in Europe. On the other hand *P. miliaceum* subsp. *thomasii* is reported in Europe to Bosnia and Herzegovina (Maslo 2014), Croatia (Freitag 1975), France (Duby 1828), Greece (Freitag 1975), Italy (Pignatti 1982), Slovenia (Jogan 2007), Spain (Devesa 1987) and Turkey (Tan 1985). It has already been reported by older authors (e.g. Hayek 1933) for the Balkans but without details.

Piptatherum virescens (Trin.) Boiss. (synonyms: *Urachne virescens* Trin.; *Oryzopsis virescens* (Trin.) Beck). *P. virescens* (Fig.1) is a caespitose perennial. Culms are slender, 3-4-noded, glabrous, 50-100 cm tall. Leaf sheaths glabrous, the lowermost ones often purplish. Ligule an eciliate membrane, very short, 0.2-0.3 mm long, incised, brownish. Leaf blades are flat, 15-25 cm x 7-9 mm, glabrous on both sides. Panicle is lax, ovate, 8-20 cm long and 3-15 cm wide, the branches ascending, very slender, the lower ones paired, or in whorls up to 4. Spikelets are lanceolate, or ovate; dorsally compressed, 3.5-4.5 mm long. Glumes are similar, elliptic, exceeding apex of florets, 3.5-4.5 mm long, membranous and without keels, with acute apex. Lower glume is 5-nerved. Upper glume is 3-nerved. Fertile lemma is obovate and dorsally compressed, hairy, 3.3-3.8 mm long with an obtuse, awned apex and 2 distinct apical lobes. Awn is subterminal, 10-30 mm long, irregularly bent. Palea is coriaceous, 2-nerved and without keels. Caryopsis is obovoid. 2n=24. (Adapted from Freitag 1975 and Clayton et al. 2006).

P. virescens is native to Europe from Southern France extending through the Balkans to Caucasus and western Asia (Freitag 1975). Up to date, *P. virescens* was reported in the Balkans in Albania (Barina et al. 2018), Bosnia and Herzegovina (Pantocsek 1874), Bulgaria (Hinkova 1963), Croatia (Nikolić 2020), Greece (Dimopoulos et al. 2013), Serbia (Jovanović 1976), Slovenia (Jogan 2007) and Turkey (Tan 1985). The oldest known Balkan reports are from Bosnia and Herzegovina, Bulgaria, Croatia, Greece and Serbia (Hayek 1933).

The field study was conducted between 2010 and 2020. Digital photographs and GPS coordinates were taken in the field. The determination and morphological description of the taxa were based on Freitag (1975), Tan (1985) and Clayton et al. (2006). The nomenclature follows Valdés & Scholz (2009) The distribution of the taxa in Bosnia and Herzegovina is shown on the map using a standard UTM grid 10 × 10 km (Fig. 3). Data on the abundance of the taxa of genus *Piptatherum,* trends of their populations and characteristics of the habitats in Bosnia and Herzegovina were obtained in the course of fieldwork. Data on the current distribution of some taxa of the genus *Piptatherum* are supplemented by contributions from some other authors (J. Brujić, Đ. Milanović, V. Stupar pers. comm.).

Results and discussion

In the Herbarium of the National Museum of Bosnia and Herzegovina (SARA), only seven specimens of the taxa of genus *Piptatherum* were stored (one specimen of *P. holciforme*, two specimens of *P. miliaceum* subsp. *thomasii* and four specimens of *P. virescens*). With a detailed overview of the herbarium collection SARA we have found that two specimens of *P. virescens* collected by Beck near Bosanska Krupa were incorrectly identified as *Oryzopsis miliacea* (L.) Benth. & Hook. ex Asch. & Schweinf. var. *longearistatum* Beck. On the other hand, two specimens of *P. holciforme* were stored in the Herbarium Dresdense, collected by Baenitz 01.06.1898 (Herzegovina, Mostar, Ilići, the source of the River Radobolja) (Fig. 2), incorrectly identified as *Piptatherum paradoxum* (L.) P. Beauv. After our detailed field research, however, we were able to establish that taxa of the genus *Pipatherum* are much more widespread in Bosnia and Herzegovina, as can be seen in data from herbarium collections and from the literature (Fig. 3, Tab. 2).

To identify these species, we offer here the adjusted key according to Freitag (1975) and Tan (1985):

1 Panicle with branches in whorls of 4-50; spikelets small, 3-3.5 mm long; lemma glabrous; awn 3-5 mm long ..... ***P. miliaceum***

1 Panicle branches solitary, paired, rare in whorls of 3; spikelets 3.5-9 mm long: lemma hairy, awn 6-14 mm **2**

2 Ligules very short, 0.2-0.3 mm long; spikelets 3.5-4.5 mm long; awn 10-13 mm long ..... ***P. virescens***

2 Ligules 3-10 mm long; spikelets 8-13 mm long: awn 6-14 mm long ..... ***P. holciforme***

Figure 2. Herbarium specimen of *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. (Herzegovina, Mostar, Ilići, the source of the River Radobolja, collected by Baenitz 01.06.1898, Herbarium Dresdense, DR 048881).

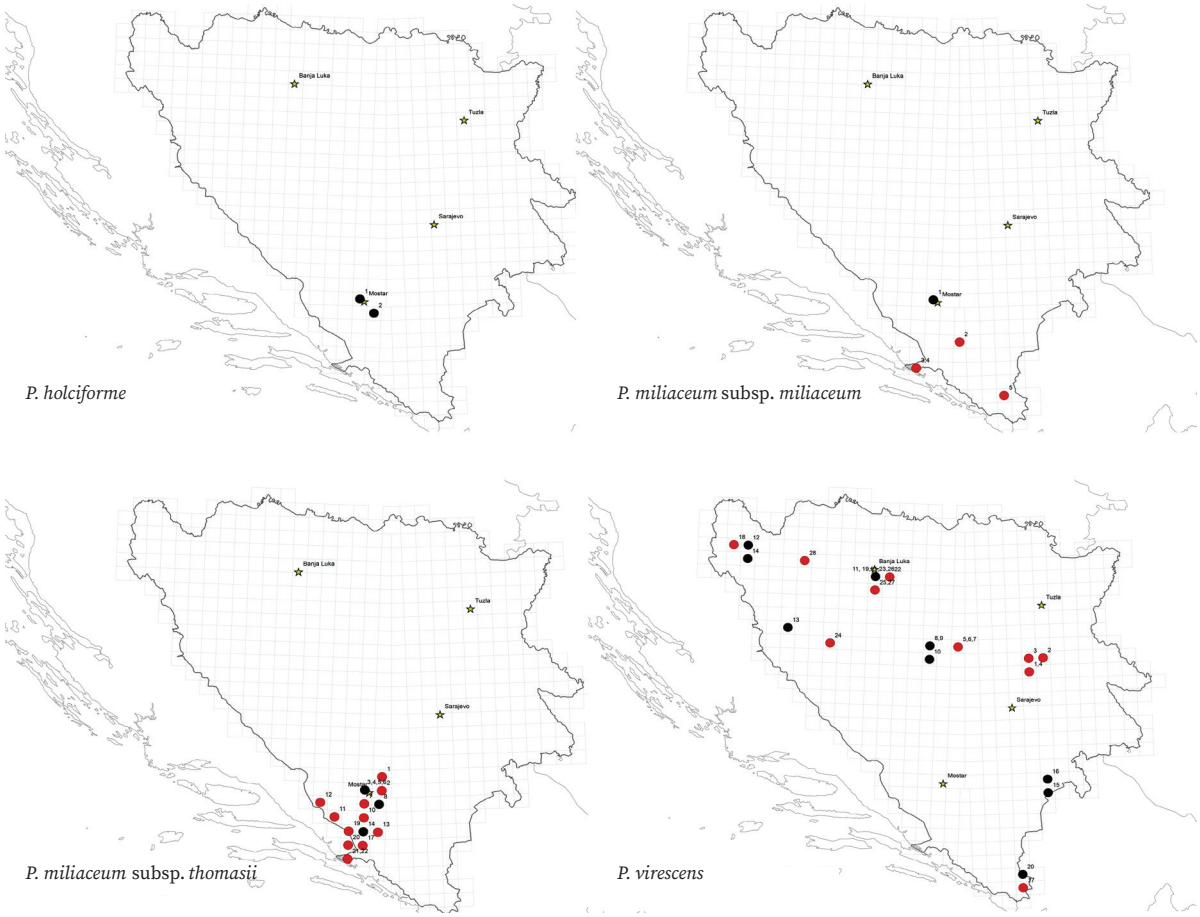

Figure 3. The distribution of *Piptatherum* in Bosnia and Herzegovina where old records are black circles and new records are red circles.

Table 2. Georeferenced data on the distribution of *Piptatherum* in Bosnia and Herzegovina (Data from literature and herbarium data are marked in bold).

Species	Number and name of the locality	WGS coordinates	UTM quadrant	Literature data/ collector
P. holciforme	1 Mostar, Ilići	43°21'19" N, 17°45'33" E	YJ20	Baenitz 1898 (DR, 048865; DR, 048881)
P. holciforme	2 Blagaj, Vrelo Bune	43°15'21"N, 17°54'07" E	YH39	Maslo & Abadžić 2015 (SARA, 51978)

Species	Number and name of the locality	WGS coordinates	UTM quadrant	Literature data/ collector
P. miliaceum subsp. *miliaceum*	1 Mostar, Carina	43°21'28" N,17°48'32" E	YJ20	Maslo 2014
P. miliaceum subsp. *miliaceum*	2 Stolac	43°05'08" N, 17°57'35" E	YH47	Maslo, S.
P. miliaceum subsp. *miliaceum*	3 Neum	42°55'27" N, 17°36'42" E	YH15	Maslo, S.
P. miliaceum subsp. *miliaceum*	4. Tanko Sedlo, Klek, Neum	42°55'03" N, 17°35'40" E	YH15	Milanović, Đ. (pers. comm.)
P. miliaceum subsp. *miliaceum*	5 Trebinje	42°42'35" N, 18°21'33" E	YH15	Milanović, Đ. (pers. comm.)
P. miliaceum subsp. *thomasii*	1 Mostar, Potoci	43°24'47" N, 17°52'38" E	YJ31	Maslo, S.
P. miliaceum subsp. *thomasii*	2 Mostar, Vrapčići	43°23'22" N, 17°51'42" E	YJ30	Maslo, S.
P. miliaceum subsp. *thomasii*	3 Mostar, Raštani	43°22'17" N, 17°49'50" E	YJ20	Maslo, S.
P. miliaceum subsp. *thomasii*	4 Mostar, Podhum	43°20'16" N, 17°48'09" E	YJ20	Maslo, S.
P. miliaceum subsp. *thomasii*	5 Mostar, Pasjak	43°21'00" N,17°48'50" E	YJ20	Maslo 2014 (SARA, 51979)
P. miliaceum subsp. *thomasii*	6 Mostar, Carina	43°21'28" N, 17°48'32" E	YJ20	Maslo, S.
P. miliaceum subsp. *thomasii*	7 Mostar, Jasenica	43°16'34" N, 17°49'03" E	YH29	Maslo, S.
P. miliaceum subsp. *thomasii*	8 Blagaj, Vrelo Bune	43°15'21" N, 17°54'07" E	YH39	Maslo & Abadžić 2015

Species	Number and name of the locality	WGS coordinates	UTM quadrant	Literature data/ collector
P. miliaceum subsp. *thomasii*	9 Buna	43°14'47" N, 17°50'22" E	YH39	Maslo, S.
P. miliaceum subsp. *thomasii*	10 Žitomislići	43°12'25" N, 17°47'39" E	YH28	Maslo, S.
P. miliaceum subsp. *thomasii*	11 Ljubuški	43°11'45" N, 17°32'60" E	YH08	Maslo, S.
P. miliaceum subsp. *thomasii*	12 Ljubuški, Koćuša	43°14'53" N, 17°27'10" E	XH99	Maslo, S.
P. miliaceum subsp. *thomasii*	13 Stolac, Radimlja	43°05'33" N, 17°55'24" E	YH37	Maslo, S.
P. miliaceum subsp. *thomasii*	14 Karaotok	43°03'58" N, 17°45'09" E	YH27	Maslo, S.
P. miliaceum subsp. *thomasii*	15 Počitelj	43°08'05" N, 17°43'49" E	YH27	Ritter 1958 (SARA, 49234)
P. miliaceum subsp. *thomasii*	16 Tasovčići	43°06'50" N, 17°43'02" E	YH27	Maslo, S.
P. miliaceum subsp. *thomasii*	17 Svitava	43°00'57" N, 17°48'28" E	YH26	Maslo, S.
P. miliaceum subsp. *thomasii*	18 Čapljina, Mogorjelo	43°05'58" N, 17°42'06" E	YH27	Maslo, S.
P. miliaceum subsp. *thomasii*	19 Gabela	43°03'44" N, 17°41'35" E	YH17	Maslo, S.
P. miliaceum subsp. *thomasii*	20 Doljani	43°02'55" N, 17°39'59" E	YH16	Maslo, S.
P. miliaceum subsp. *thomasii*	21 Neum	42°55'27" N, 17°36'42" E	YH15	Maslo, S.
P. miliaceum subsp. *thomasii*	22 Dramotina, Klek, Neum	42°55'03" N, 17°35'40" E	YH15	Milanović, Đ. Pers. Comm.
P. virescens	1 Olovo	44°07'30" N, 18°34'19" E	CP08	Šarić, Š.

Species	Number and name of the locality	WGS coordinates	UTM quadrant	Literature data/ collector
P. virescens	2 Olovo, Ćude	44°08'39" N, 18°40'09" E	CP19	Šarić, Š.
P. virescens	3 Olovo, Bukov Do	44°11'09" N, 18°33'02" E	CP09	Šarić, Š.
P. virescens	4 Olovo, Paska Luka	44°07'44" N, 18°34'05" E	CP08	Šarić, Š.
P. virescens	5 Zenica, Vranduk	44°17'35" N, 17°54'46" E	YK30	Šarić, Š.
P. virescens	6 Zenica, Vranduk	44°17'39" N, 17°54'05" E	YK30	Šarić, Š.
P. virescens	7 Zenica, Višegrad	44°17'50" N, 17°54'01" E	YK30	Šarić, Š.
P. virescens	8 Zenica, Ljubatovo	44°17'34" N, 17°40'46" E	YK10	Šarić, Š.
P. virescens	9 Travnik, Vlaška Gromila	44°17'57" N, 17°42'08" E	YK10	Brandis 1914 (SARA 1275)
P. virescens	10 Travnik, Rječica	44°12'32" N, 17°44'12" E	YJ19	Brandis 1914 (SARA 768)
P. virescens	11 Gornji Šeher, Banja Luka	44°44'40" N, 17°09'45" E	XK75	Conarth 1887
P. virescens	12 Bosanska Krupa, Velika Gomila	44°53'24" N, 16°04'08" E	WK87	Beck 1903 (SARA 00766, SARA 00767)
P. virescens	13 Klekovača, Ataševac	44°25'13" N, 16°26'18" E	XK11	Beck 1903
P. virescens	14 Grmeč, Gredoviti vrh	44°47'27" N, 16°01'35" E	WK86	Boller 1892
P. virescens	15 Suha	43°19'04" N, 18°39'37" E	CN19	Protić 1902
P. virescens	16 Tjentište	43°20'55" N, 18°41'27" E	CP10	Protić 1902
P. virescens	17 Skočigrm	42°41'14" N, 18°31'31" E	BN92	Pantoscek 1874

Species	Number and name of the locality	WGS coordinates	UTM quadrant	Literature data/ collector
P. virescens	18 izvor Dobrenice ispod Ostrošca	44°54'8" N, 15°54'48" E	WK77	Milanović, Đ. (pers. comm.)
P. virescens	19 Cer	44°45'8" N, 17°12'52" E	XK75	Brujić, J. (pers. comm.)
P. virescens	20 Poklonac kod Lastve, Trebinje	42°41'48" N, 18°25'59" E	BN93	Stupar, V. & Brujić, J.
P. virescens	21 Magareći potok, Banja Luka	44°44'43" N, 17°11'5" E	XK75	Miletić et al. 2016
P. virescens	22 Bijeli potok kod Čelinca	44°43'56" N, 17°16'9" E	XK85	Milanović, Đ. (pers. comm.)
P. virescens	23 Starčevica, Banja Luka	44°45'13" N, 17°11'60" E	XK75	Milanović, Đ. (pers. comm.)
P. virescens	24 Izvorište Sane kod Donje Pecke	44°19'4" N, 16°50'35" E	XK74	Milanović, Đ. (pers. comm.)
P. virescens	25 Đekića stijena kod Karanovca	44°40'37" N, 17°13'57" E	XK74	Milanović, Đ. (pers. comm.)
P. virescens	26 Klisura Suturlije	44°45'28" N, 17°9'23" E	XK75	Stupar, V. (pers. comm.)
P. virescens	27 Kanjon Vrbasa kod Zvečaja	44°40'24" N, 17°9'44" E	XK74	Milanović, Đ. (pers. comm.)
P. virescens	28 Vodopad Blihe kod Sanskog mosta	44°47'27" N, 16°31'49" E	XK26	Milanović, Đ. (pers. comm.)

According to the literature data and herbarium materials stored in the Herbarium of the National Museum of Bosnia and Herzegovina (SARA), and our own field study, we could conclude that *P. virescens* has scattered distribution in the central (mountainous) part of Bosnia and Herzegovina. On the other hand, *P. holciforme* subsp. *holciforme*, P. *miliaceum* subsp. *miliaceum* and *P. miliaceum* subsp. *thomasii* are only present in the Mediterranean part of the country. New data on distribution of *P. virescens* in Bosnia and Herzegovina indicate that this species is present in mesophytic broadleaved forest and shrub vegetation, especially in the continental part of the country. Although until recently it was found only on 10 localities in Bosnia and Herzegovina, the new data also indicate its presence on 18 new localities in Bosnia and Herzegovina (Tab. 2, Fig. 3).

P. miliaceum is a fairly common grass in the Neretva River Valley, south of the city of Mostar. This species reaches high abundance in various disturbed habitats along roadsides, ditches, abandoned fields, dry riverbeds, and dumping grounds. It is quite surprising that the species was previously recorded in only four localities on the territory of Bosnia and Herzegovina. Our field research showed a significantly higher presence of the species, and we recorded it at 22 localities (Tab. 2, Fig. 3). *P. miliaceum* subsp. *thomasii* has usually been included in *P. miliaceum.* First published in Botanicon gallicum by Duby, as *Milium thomasii* (Duby, 1828), and later in Flora Orientalis by Boissier (1884), as *Piptatherum miliaceum* L. β *thomasii,* which is accepted by Freitag (1975) as *Piptatherum miliaceum* (L.) Coss. subsp. *thomasii* (Duby) Boiss. Only recently this taxon has been included in the new genus *Oloptum* Röser & Hamasha as *Oloptum thomasii* (Duby) Banfi & Galasso (Banfi & Galasso 2014). It differs from the type subspecies in having densely verticillate panicles with 10-50 or more often sterile branches on the lowest whorl (Freitag 1975). Previous and unspecific records of *P. miliaceum* for Bosnia and Herzegovina need revision as in our experience *P. miliaceum* subsp. *thomasii* is by far more common than the first. However, *P. miliaceum* subsp. *thomasii* was usually not considered and subsumed under *Oryzopsis miliacea* or *Piptatherum miliaceum*, respectively. They can be identified without difficulty if fully developed panicles are present.

Both subspecies are present in Bosnia and Herzegovina, with *P. miliaceum* subsp. *thomasii* by far more common than *P. miliaceum* subsp. *miliaceum.* They differ in their ecology (the latter taxon preferring distinctly mesic habitats on moist ground).

P. holciforme is a very rare species in the flora of Bosnia and Herzegovina (Tab. 2, Fig. 3). The species was recorded at only two separate localities in the vicinity of Mostar in southern Herzegovina, where it was found in karstic canyons near the source of the river Radobolja in Ilići near Mostar as well as the source of the river Buna. At the current localities, the species is represented by only a few individuals. The specimens collected in Buna have a spikelet of 10 mm, a lemma of 6 mm and an awn of almost 10 mm. According to Freitag (1975), lemma size is the most reliable character for distinguishing the two subspecies. Therefore, populations from Herzegovina are assigned to the nominal subspecies, namely *Piptatherum holciforme* (M. Bieb.) Roem. & Schult. subsp. *holciforme.*

P. holciforme subsp. *holciforme* is known only from two restricted localities in Bosnia and Herzegovina. Localities from Mostar and Blagaj, as well as those from Italy (Terzi et al. 2017), mark the western limit of the distribution ranges of this taxon in Europe.

It is suggested that this taxon should be placed under the IUCN threat category "Critically Endangered (CR)" (IUCN 2012), because the estimated area of occupancy is less than 10 km2 (criterion B2) and it is known only from two localities in the country (criterion B2a). The population size of the taxon is estimated to be less than 10 mature individuals (criterion C2a(i)). In addition, the distribution area of the species may be destroyed by various anthropogenic effects.

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