

NOTULAE TO THE NATIVE VASCULAR FLORA IN BOSNIA AND HERZEGOVINA

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New data concerning the distribution of native plant taxa vascular flora in Bosnia and Herzegovina are presented. They include new records as well as confirmations for taxa in the genera *Aurinia*, *Hordeum*, *Molineriella* and *Prasium*. New species for the country are *Molineriella minuta* and *Prasium majus* and the presence of two other species *Aurinia sinuata* and *Hordeum bulbosum* are confirmed.

Keywords: *Aurinia*, Bosnia and Herzegovina, *Hordeum*, *Molineriella*, new records, *Prasium*

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U ovom prilogu iznose se novi podaci o rasprostranjenosti autohtone vaskularne flore u Bosni i Hercegovini. Uključuje nove zapise i potvrde za svoje u rodovima *Aurinia*, *Hordeum*, *Molineriella* i *Prasium*. Nove vrste za zemlju su *Molineriella minuta* i *Prasium majus*, a potvrđeno je prisustvo još dvije vrste (*Aurinia sinuata* i *Hordeum bulbosum*).

Ključne riječi: *Aurinia*, Bosna i Hercegovina, *Hordeum*, *Molineriella*, novi nalazi, *Prasium*

INTRODUCTION

Although research into the vascular flora of Bosnia and Herzegovina (BiH) has a tradition of more than 170 years (FUKAREK, 1954), the state of knowledge about the flora is not entirely satisfactory. This especially true for the Mediterranean, sub-Mediterranean and northern parts of the country, while the flora of the high mountains of the Dinaric Alps could be considered well-known. Since the publication of the first four parts of the edition *Index Florae Bosnae et Hercegovinae* (IFBiH): Fabaceae (MIŠIĆ & ŠOLJAN, 2014), Brassicaceae (BJELČIĆ & ŠOLJAN, 2015), Lamiaceae (ŠILIĆ & ŠOLJAN, 2018) and Poaceae (SARAJLIĆ & ŠOLJAN, 2020), several new records have been confirmed and added to the flora of BiH. With this research, we present four plant taxa as an addition to the richness of the flora: *Aurinia sinuata* (L.) Griseb., *Hordeum bulbosum* L., *Molineriella minuta* (L.) Rouy. and *Prasium majus* L.

MATERIAL AND METHODS

The material is based on a study of literature and herbarium data, and on data collected in the field by the authors in the Mediterranean and sub-Mediterranean region of Bosnia and Herzegovina in the period 2007-2022. The specimens were collected and stored in the Herba-

rium of the National Museum of Bosnia and Herzegovina (SARA), Herbarium of Faculty of Forestry University of Banja Luka (HFS) and the private collection of Đorđije Milanović (DM). The nomenclature and taxonomy of plant taxa in this paper follows Euro+MedPlantBase (EURO+MED 2006), except for the critical genus *Aurinia* Desv. for which the nomenclature proposed by PLAZIBAT (2009) was used.

All records of target species are presented as follows: name of the locality with WGS1984 coordinates recorded in the field using a GPS device, label of the MGRS 10x10 km square modified for the mapping of the Flora of Europe (KURTO *et al.*, 2004), designation and numeration of the available herbarium material with date of collection, name of the legator, elevation, as well as population size observed in the field. Maps were created using QGIS software, with localities represented by different symbols and numbers corresponding to the numeration of the records within the text. The border of the Mediterranean (including sub-Mediterranean) region is given following STEFANOVIĆ *et al.* (1983).

RESULTS AND DISCUSSION

Aurinia sinuata (L.) Griseb.

The genus *Aurinia* Desv. belongs to the tribe Alysseae D.C. and family Brassicaceae Burnett. The genus *Aurinia* comprises seven species mainly distributed on the Balkan and the Apennine Peninsula, of which only *A. saxatilis* (L.) Desv. extends its range from the Balkan Peninsula to central Europe and Asia Minor (REŠETNIK *et al.*, 2020). According to BECK-MANNAGETTA (1916), the presence of three taxa of the genus *Aurinia* in the flora of Bosnia and Herzegovina has been confirmed (*A. petraea* subsp. *corymbosa* (Griseb.) Plazibat, *A. petraea* subsp. *microcarpa* (Vis.) Plazibat and *A. saxatilis* subsp. *orientalis* (Ard.) T. R. Dudley), while the presence of the other three in the country is doubtful (*A. leucadea* subsp. *media* (Host) Plazibat, *A. saxatilis* subsp. *saxatilis* and *Aurinia sinuata* (L.) Griseb). On the other hand, MARHOLD (2011) lists only two taxa for the country: *A. corymbosa* Griseb. and *A. petraea* (Ard.) Schur.

Aurinia sinuata (L.) Griseb., Spicil. Fl. Rumel. 1: 271 (1843). (syn.: *Alyssum sinuatum* L., *Alyssoides sinuata* (L.) Medik., *Alyssanthus sinuatus* (L.) Trinajstić, *Vesicaria sinuata* (L.) Cav. (Fig. 1). Plants perennial, branched, 15-50 cm tall, grey-hairy, more or less woody at the base. Basal leaves are oblanceolate to lanceolate, 6-10 cm long, sinuate-dentate, considerably larger than the cauline which are lanceolate and entire. Sepals 3-4 mm. Petals 5-8 mm, notched, pale yellow. Silicula 7-12 mm, orbicular without narrow flattened margin with 4-8 seeds in each loculus. A detailed description of the species can be found in TRINAJSTIĆ (1983) and identification key in PLAZIBAT (2009).

A. sinuata is a species endemic to the Balkan and the Apennine Peninsula, distributed only in Albania (BARINA *et al.*, 2018), Croatia (NIKOLIĆ, 2020), Greece (DIMOPOULOS *et al.*, 2013), Italy (PIGNATTI, 1982) and Montenegro (ROHLENA, 1942).

The species was first recorded for BiH by PANČIĆ (1875) (as *Alyssum sinuatum* L.) for the area of Velika Jastrelica (Bijelagora) in SE Herzegovina near the Montenegrin border. However, the locality mentioned by the author could be situated on the Montenegrin side of the border (Velika Jastrelica, Bijelagora), as stated by ROHLENA (1942). BECK-MANNAGETTA (1916) has reported *A. sinuata* only for Croatia, excluding, at the same time, the presence of this taxon within BiH borders. On the other hand, TRINAJSTIĆ



Fig. 1. *Aurinia sinuata* in the vicinity of Neum a. habitus (left) b. inflorescence with siliculas (right) (© Đ. Milanović)

(1983) indicated *Aurinia sinuata* as being present for Bosnia and Herzegovina, but without citing any localities. More recently, *A. sinuata* is listed as a dubious taxon in Bosnia and Herzegovina (BJEIĆIĆ, 2014), taking into account that there are no voucher specimens in the Herbarium of the National Museum of Bosnia and Herzegovina (SARA).

During research into the flora of the municipality of Neum the species was recorded scattered on both sides of the main road E 65 between Neum and Jazine, where it occurs as a pioneer species on road cuts and semi-ruderal places. Here we provide two localities (Fig. 2):

Locality: Jazine-Neum, on the rock surfaces and road cuts (17.626251 °E, 42.914772 °N). *Material:* HFS 756/2010, 9 May 2010, 40 m, leg. Stupar V., Brujić J., Milanović Đ. & Nikić D.; SARA 53128, 24 April 2022, 40 m, leg. S. Maslo; *MGRS:* YH15; *Population:* twelve flowering individuals and several scattered rosettes.

Locality: Jazine-Neum, semi-ruderal places below the road E 65 (17.623969 °E, 42.916655 °N). *Material:* observation by S. Maslo, 24 April 2022, 40 m; *MGRS:* YH15; *Population:* five flowering individuals.

Hordeum bulbosum L.

The genus *Hordeum* L. belongs to the tribe Triticeae L. and family Poaceae Barnhart. It is a medium-sized genus of 33 species distributed in temperate and arid regions of the world (BLATTNER, 2009). It is represented by 14 species in the Euro-Mediterranean region (VALDÉS & SCHOLZ, 2009). Eight taxa of the genus *Hordeum* have been recorded in the flora of Bosnia and Herzegovina (*H. bulbosum* L., *H. geniculatum* All., *H. marinum* Huds., *H. murinum* subsp. *glaucum* (Steud.) Tzvelev, *H. murinum* subsp. *leporinum* (Link) Arcang., *H. secalinum* Schreb., *H. vulgare* L. subsp. *vulgare* and *H. vulgare* subsp. *distichon* (L.) Körn. (SARAJLIĆ, 2018).

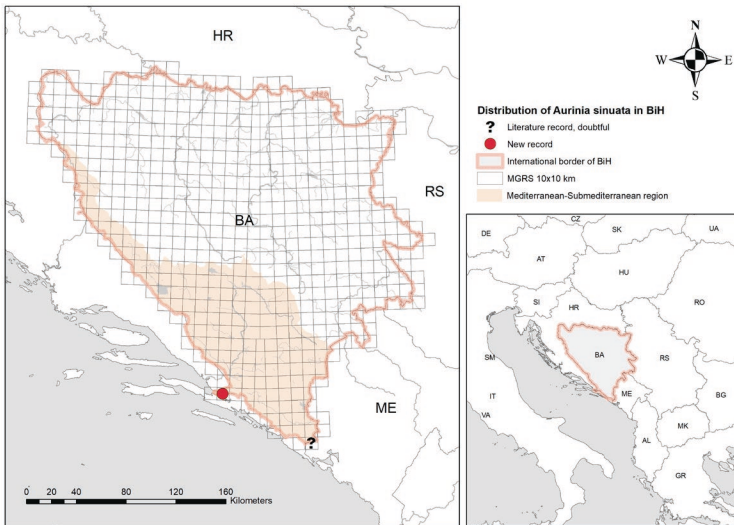


Fig. 2. Distribution of *Aurinia sinuata* in BiH

Hordeum bulbosum L. (Fig. 3) is a caespitose grass, 50-100 cm tall, with large auricles and it is the only species in the genus having a subterranean bulbous swelling at the base of the culm. Leaves are 3-7 mm broad, sometimes pilose on the upper surface. Spike 5-15 cm, dense, compressed. A detailed description of the species can be found in JØRGENSEN (1982).

According to BAUM & BAILEY (1985), *H. bulbosum* L. is divided into two subspecies, *H. bulbosum* L. subsp. *bulbosum* and *H. bulbosum* subsp. *nodosum* (L.) B. R. Baum., which



Fig. 3. *Hordeum bulbosum* in the vicinity of Ljubuški: spike (left), bulbous swelling at the base of the culm (right) (© S. Maslo)

is accepted by VALDÉS & SCHOLZ (2009). The subspecies are very similar, but *H. bulbosum* L. subsp. *bulbosum* has central spikelets glume margins ciliate or sometimes not ciliate while in *H. bulbosum* subsp. *nodosum* they are never ciliate. *H. bulbosum* L. subsp. *bulbosum* is tetraploid and was found from West Greece eastwards to Afghanistan. On the other hand, the diploid *H. bulbosum* subsp. *nodosum* was found in the western Mediterranean area (BAUM & BAILEY, 1985).

Our collected specimens do not have ciliated glume margins of the central spikelet, which could refer them to *H. bulbosum* subsp. *nodosum* with a high probability (see BAUM & BAILEY, 1985). This contradicts a statement by PAPEŠ & BOSILJEVAC (1984) who noted only tetraploid plants in neighboring Dalmatia but fits the spatial distribution of these subspecies provided by BAUM & BAILEY (1985).

H. bulbosum grows in countries around the Mediterranean Sea, but the absence of the species in Egypt is noticeable (VALDÉS & SCHOLZ, 2009). Outside the Mediterranean area the species is recorded in Iraq, Iran, Afghanistan and some countries of the former Soviet Union (JØRGENSEN, 1982). To date, *H. bulbosum* has been reported in the Balkans in Albania (BARINA *et al.*, 2018), Bosnia and Herzegovina (PANTOCSEK, 1874), Bulgaria (GANČEV, 1963), Greece (DIMOPOULOS *et al.*, 2013), Croatia (NIKOLIĆ, 2020), Montenegro (ROHLENA, 1942), North Macedonia (PAPEŠ & BOSILJEVAC, 1984), Serbia (NIKETIĆ & TOMOVIĆ, 2018), Slovenija (GLASNOVIĆ, 2007), and Turkey (MELDERIS, 1985).

The oldest record is that of PANTOCSEK (1874) for Gljiva near Trebinje, which was thereafter reported by BECK-MANNAGETTA (1903) and HAYEK (1933) about half a century later, but never confirmed subsequently.

During recent research, the species was recorded at several localities in the sub-Mediterranean part of Bosnia and Herzegovina (Fig. 4):

Locality 1: Kovači in Uža swamp near Gabela in the Čapljina municipality, a micro-elevation at the edge of *Phragmites australis* stands with brackish water (43.075901°N,

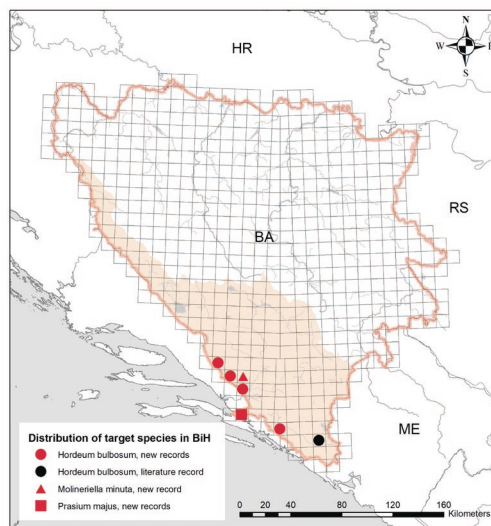


Fig. 4. Distribution of target species in BiH (new records are indicated in red)

17.669126°E); MGRS: YH17; *Material*: DM 66/72-001, 10 May 2010, 2 m, leg. Đ. Milanović, V. Stupar, J. Brujić & D. Nikić; *Population*: ca 100 individuals were registered.

Locality 2: Rudine below the Kijev do village on the Bobani plateau above Popovo polje, abandoned arable lands on terraces (42.800464°N, 17.994538°E); MGRS: YH44; *Material*: DM 66/72-002, 25 June 2018, 550 m, leg. Đ. Milanović; *Population*: numerous (several thousand) individuals.

Locality 3: Ljubuški, along the edge of the ditch on the right side of the main road M 6, between Ljubuški and Čapljina, ca 800 m SE from the junction to the village Međugorje (43.195934°N, 17.558562°E); MGRS: YH08; *Material*: SARA 53130, 25 April 2022, 110 m, leg. S. Maslo; *Population*: several hundred individuals.

Locality 4: Ljubuški, along the edge of the ditch on the left side of the main road M 6, between Klobuk and Vitina, ca 900 m S of the village of Klobuk (43.268080°N, 17.455243°E); MGRS: XH99; *Material*: SARA 53132, 25 April 2022, 123 m, leg. S. Maslo; *Population*: ca 50 individuals scattered along the ditch.

***Molineriella minuta* (L.) Rouy**

The genus *Molineriella* Rouy belongs to the tribe Aveneae Dumort. and family Poaceae Barnhart. It is a Mediterranean genus with three species, *Molineriella australis* (Paunero) E. Rico, *M. laevis* (Brot.) Rouy and *M. minuta* (L.) Rouy. The prevalence of *M. australis* is restricted to the territory of Spain and Morocco, while *M. laevis* is indicated on the Iberian Peninsula and Morocco (VALDÉS & SCHOLZ, 2009).

Molineriella minuta (L.) Rouy, Fl. France 14: 102. 1913. (Fig. 5) (syn.: *Aira minuta* L., *Periballia minuta* (L.) Asch. & Graebn. Annual, stem usually erect, branched at the base or solitary, with approximately 2 nodes, 3-20 cm tall. Leaf sheaths smooth, somewhat inflated. Ligules subacute, membranous, 1-2.5 mm long. Leaf blades filiform, scabrid on margin, 1-2 mm wide, 10-30 mm long. Panicle open, 1-4 cm, broadly ovate. Spikelets numerous, oblong to obovate, 2 flowered, 1.5-2 mm long, pale green to purplish, shiny. Glumes 1.3-1.7 mm long. Lemma 1.3-1.8 mm, narrowly ovate, protrude slightly above the glumes. Palea smooth, slightly shorter than lemma. A detailed description of the species as well as an identification key can be found in CEBRINO CRUZ & ROMERO ZARCO (2017).

M. minuta has been reported in Europe as native in Albania (BARINA *et al.*, 2018), Bulgaria (GEORGIEV, 1963), France (TISON & DE FOUCAULT, 2014), Greece (DIMOPOULOS *et al.*, 2013), Italy (PIGNATTI, 1982), Portugal and Spain (CEBRINO CRUZ & ROMERO ZARCO, 2017), Serbia (NIKETIĆ & TOMOVIĆ, 2018), and Turkey (DOĞAN, 1985). It is also reported as native in Algeria and Morocco and as alien in South Africa and Australia (CLAYTON *et al.*, 2006).

The species was not previously recorded for BiH (see SARAJLIĆ & ŠOLJAN, 2020). During the latest research between Mostar and Međugorje the species has found at following locality (Fig. 4):

Locality: Međugorje, in open xerothermic grassland communities located between the villages Međugorje and Bijakovići, (17.687828 °E, 43.192703 °N); MGRS: YH18; *Material*: SARA 51976, 11 April 2007, 161 m, leg. S. Maslo; *Population*: ca 40 individuals scattered along the path.

The observed population covered an area of about 0.1 ha, with uneven spatial structure and numbers up to 40 individuals. In this locality, the species was accompanied

by *Aegilops neglecta* Bertol., *Alopecurus rendlei* Eig, *Carex caryophyllea* Latourr., *Anacamptis morio* (L.) R. M. Bateman, Pridgeon & M. W. Chase, *Parentucellia latifolia* (L.) Caruel, *Poa bulbosa* L., *Ranunculus millefoliatus* Vahl and *Sherardia arvensis* L. Upon a renewed visit to the site in April 2022, we observed that the number of individuals was almost unchanged. Perhaps it is more widespread and probably overlooked in the area, due to its dwarf stature and similarity to other dry land grasses such as *Aira caryophyllea* L., from which it can be distinguished by its looser panicle and glumes that usually do not exceed the awnless lemmas.



Fig. 5. *Molineriella minutain* the vicinity of Međugorje: habitus (left) b. spikelets (right) (© S. Maslo & Đ. Milanović)

Prasium majus L.

The genus *Prasium* L belongs to the tribe Stachydeae Dumort. and family Lamiaceae Martinov. It is a monospecific genus and contains only one known species *Prasium majus* L., native to the Mediterranean region of Europe, North Africa, and the Middle East.

Prasium majus L. (Fig. 6) is a small, densely branched shrub up to 1 m tall with woody, hairless stems, often climbing. Leaves are glossy, dark green, ovate with toothed margins, 2-5 cm long. The flowers are 17-20 mm long and grow at the tips of the stems. The petals are white to pale cream. The calyx is broadly campanulate in fruit. A detailed description of the species can be found in MILL (1982).

P. majus grows in countries around the Mediterranean Sea, but the absence of the species in continental France is noticeable (EURO+MED, 2006). Up to date, *P. majus* was reported in the Balkans in Albania (BARINA *et al.*, 2018), Greece (DIMOPOULOS *et al.*, 2013), Croatia (NIKOLIĆ, 2020), Montenegro (ROHLENA, 1942), and Turkey (MILL, 1982). Literature data do not indicate the presence of this species in Bosnia and Herzegovina (ŠILIĆ, 2016). Although only a few individuals were recorded, it is expected that this insufficiently known taxon has a wider distribution in coastal Herzegovina, bearing in mind the suitable habitats (Fig. 4):

Locality 1: Klek Peninsula, maquis along the macadam road between Tanko Sedlo and Jazine (17.600141 °E, 42.917599 °N). MGRS: YH15; *Material:* HFS 695/2010, 9 May 2010, 54 m, leg. Đ. Milanović, V. Stupar, J. Brujić & D. Nikić; SARA 53133, 24 April 2022, 54 m, leg. S. Maslo; *Population:* several flowering shrubs scattered along the roadside.

Locality 2: Klek Peninsula, maquis along the macadam road between Tanko Sedlo and Jazine (17.611471 °E, 42.914802 °N). MGRS: YH15; *Material:* SARA 53134, 24 April 2022, 60 m, leg. S. Maslo; *Population:* three flowering shrubs scattered along the roadside.

The species *Aurinia sinuata* was recorded by PANČIĆ (1875) from the site in Velika Jastrebrica on the border of Herzegovina and Montenegro, but this record remained suspect as this species does not grow in the high mountains and was therefore marked with “?” in the IFBiH (BJELČIĆ & ŠOLJAN, 2015). *Hordeum bulbosum* was recorded by PANTOCSEK (1874) on Gljiva above Trebinje and regularly listed in the IFBiH (SARAJLIĆ & ŠOLJAN, 2020), but never confirmed thereafter. *Molineriella minuta* and *Prasium majus* have not been found in Bosnia and Herzegovina.



Fig. 6. *Prasium majus* from Klek Peninsula: inflorescence (left), habitus (right) © S. Maslo

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