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(2023) 6 (2-3) 01–58

#### **SADRŽAJ:**

|   | Str.  |
|---|-------|
| <b>Izvorni znanstveni rad (original scientific paper)</b>   |       |
| <i>S. Maslo</i>   |       |
| New findings and confirmation of the presence of two alien grass species in Croatia:<br><i>Cenchrus longisetus</i> and <i>Sporobolus indicus</i> .....                              | 01–07 |
| <i>D. Kremer, I. J. Košir, Marina Šimunić, Ksenija Karlović, S. Srećec, Renata Jurišić Grubešić</i>   |       |
| Phenolic compounds in <i>Geranium dalmaticum</i> (Beck) Rech. f. and <i>G. macrorrhizum</i> L.<br>(Geraniaceae) growing in Croatia .....  | 08–17 |
| <i>M. Poje, Tajana Pavlinić, Dubravka Dujmović Purgar, M. Kušen, Tatjana Prebeg, Vesna Židovec</i>  |       |
| Otrovne biljne vrste u dječjim vrtićima u četvrti Trešnjevka – sjever u Zagrebu<br>Poisonous plant species in kindergartens of Trešnjevka – north district in Zagreb .....          | 18–31 |
| <i>Emilija Friganović, Duška Ćurić, Tajana Krička</i>   |       |
| Senzorska procjena tjestenine obogaćene maslačkom ( <i>Taraxacum officinale</i> Weber)<br>Sensory evaluation of dandelion ( <i>Taraxacum officinale</i> Weber) enriched pasta ..... | 32–43 |
| <b>Stručni rad (professional paper)</b>   |       |
| <i>Mirjana Šipek</i>  |       |
| Ground-ivy ( <i>Glechoma hederacea</i> L., Lamiaceae) habitats in NE Slovenia: floristic,<br>chorological and syntaxonomic diversity .....  | 44–55 |
| <b>Nekategorizirani rad (uncategorised paper)</b>   |       |
| <i>B. Dorbić</i>  |       |
| Društvene vijesti i obavijesti<br>Social news and announcements .....   | 56–56 |
| <i>Upute autorima (instructions to authors)</i> .....   | 57–58 |

## **New findings and confirmation of the presence of two alien grass species in Croatia:**

### ***Cenchrus longisetus* and *Sporobolus indicus***

Semir Maslo<sup>1</sup>

*izvorni znanstveni rad (original scientific paper)*

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#### **Abstract**

This paper provides new data concerning the presence of two alien grass species in Croatia based on a revision of herbarium material from ZA, ZAHO and ZAGR, literature data and on field observations. Two poorly documented alien grass species *Cenchrus longisetus* M. C. Johnst. and *Sporobolus indicus* (L.) R. Br., are confirmed for the country.

Brief information on the species distribution in Croatia and a discussion of the alien and invasive status in the country is provided. Judging from the literature and field observations both species should be considered as naturalized, non-invasive species in Croatia. The text is illustrated with photographs from the new localities of both species. These new confirmed records allow us to better define the European and national distribution of the targeted species and offer new insights into the alien flora of Croatia.

**Key words:** *Cenchrus*, Croatia, distribution, new record, Poaceae, *Sporobolus*.

#### **Introduction**

The genus *Cenchrus* L. (Poaceae) is a tropical genus belonging to subfamily Panicoideae, tribe Paniceae. The genera *Cenchrus* and *Pennisetum* have been formally merged by Chemisquy et al. (2010) in the genus *Cenchrus* and together include approximately 120 species, mostly from warm regions. In the European vascular flora 13 species have been recorded (Valdés and Scholz, 2009), among which only three are present in Croatia: *Cenchrus longisetus* M. C. Johnst., *C. longispinus* (Kneuck.) Fernald and *C. spicatus* (L.) Cav. (Nikolić, 2015).

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The species *Cenchrus longisetus* M. C. Johnst. (syn. *Pennisetum villosum* Fresen) is native to East Africa (Eritrea, Ethiopia, and Somalia). It was introduced for ornament and became naturalized in the Mediterranean region (El Mokni and Verloove, 2019). It is currently known as alien in some European countries: Croatia, France, Germany, Greece, Italy and Spain (Valdés and Scholz, 2009). This species has been reported as occurring in Croatia (Sustipan, Split) by Ruščić (2003), which was not substantiated by herbarium material accessible data in officially registered herbarium collections and has not been confirmed since.

The genus *Sporobolus* R.Br. (Poaceae) is a cosmopolitan genus belonging to subfamily Chloridoideae, tribe Zoysieae (Peterson et al., 2007). It is one of the largest genera within the subfamily, including about 200 species predominantly distributed in the tropical and subtropical areas of the world. In the European vascular flora six species have been recorded (Valdés and Scholz, 2009), among which four are present in Croatia: native *Sporobolus pungens* (Schreb.) Kunth. and three alien species, *S. indicus* (L.) R. Br., *S. neglectus* Nash. and *S. vaginiflorus* (A. Gray) A. W. Wood (Nikolić, 2015).

The species *Sporobolus indicus* (L.) R. Br (syn. *Agrostis indica* L.) is native to North America, currently known as alien in some European countries: Bulgaria, Czech Republic, France, Germany, Greece, Italy, Montenegro, Portugal, Spain and Switzerland (Valdés and Scholz, 2009). It was recorded as new to Slovenia (Glasnović and Jogan, 2009), Serbia (Perić et al., 2013), Austria (Eichberger et al., 2015), Albania (Barina, 2017) and recently Hungary (Bauer and Verloove, 2023). This species has been reported as occurring in Croatia (Istria) by Starmüchler (2003), without precise locality, which was not substantiated by accessible in officially registered herbarium collections and has not been confirmed since.

As no previous records have been mentioned in the Flora Croatica Database (Nikolić 2015), this species is regarded as a new alien for Croatia. Regarding the history of the spread of *S. indicus* in Europe referencing goes to Bauer and Verloove (2023).

The author wanted to report new findings of two poorly documented alien grass species in Croatia (*C. longisetus* and *S. indicus*). The aim of the study is to enable the monitoring of the further spread of the mentioned species, their ecology and potential invasiveness.



**Figure.1.** *Cenchrus longisetus* on the lawns of Park Sustipan (Split), 1 a – naturalized habitat, 1 b – panicle; *Sporobolus indicus* in the vicinity of Živogošće (car-camp Dole), 2 a – naturalized habitat, 2 b – panicle (Photos by S. Maslo).

## Materials and methods

The material is based on the study of literature data, herbarium material from ZA, ZAHO and ZAGR and on data collected in the field in central Dalmatia, in the period 2007-2023. The specimens were collected and stored in the Herbarium ZA and in the private collection of the author. Digital

photographs were taken in the field, while the specimens were identified with the following keys: *Cenchrus longisetus* with Clayton (1980) and *Sporobolus indicus* (Hansen, 1980). The nomenclature follows the Euro-Med checklist (EURO+MED 2006).

### **Study species**

*C. longisetus* is matforming perennial, rhizomatous grass, up to 60 cm high. Culms are geniculately ascending, or decumbent, with glabrous nodes and sheaths. Ligule is very short, membranous, with a row of long hairs. Life-blades are 7-15 cm long and 2-6 mm wide, flat to folded, with ciliate margins. Inflorescence is a compact, terminal panicle, spiciform; oblong, or ovate, white, 2-12 cm long, 1-2 cm wide. Spikelets 1 to 4 in a fascicle. Fascicles are short-peduncled with a tuft of white hairs at base. Involucral bristles are numerous, spreading, the inner ones are very plumose, the longer are 4 -5 cm long. A detailed description of the species can be found in Clayton et al. (2006)

*S. indicus*, sensu latissimo, is a fairly variable complex and many of separate species have been recognized within the complex (Clayton, 1965). However, if a narrow species concept would apply, then all plants seen from Europe should be assigned to *S. indicus* (L.) R. Br., and this is the classification currently adopted also in Euro+Med PlantBase (Valdés and Scholz 2009).

*S. indicus* is a perennial, usually densely tufted, with erect culms, up to 100 cm high. Leaves basal and cauline. Sheaths smooth, often shiny, margin ciliolate, otherwise glabrous. Ligule is a fringe of hairs, up to 0.5 mm long. Leaf-blades folded to more or less flat, linear, filiform in the upper part, gradually tapering to a very fine point, 10-30 cm long, 2-7 mm wide. Panicles contracted and spiciform, then often interrupted at base, to effuse, 10-30 cm long and 0.6-1 cm wide (Fig. 1c,d), Spikelets solitary, lanceolate, subterate, ca 2 mm long, yellowish, pale to nearly blackish green. Lower glume ovate to elliptic, 0.6-1 mm long, membranous, without keels, 1-veined. Upper glume ovate 0.9-1.3 mm long, membranous, without keels, 1-veined. Lemma ovate to oblong, 1.3-2 mm long, 1-3 nerved. Palea elliptic to oblong, 1.2-1.9 mm long, not easily split by the seed. Caryopsis with free soft pericarp, oblong, 1-1.3 mm long, obtuse (Clayton, 1965, Hansen, 1980 and Clayton et al. 2006).

### **Results and discussion**

The first finding of *Cenchrus longisetus* for Croatia comes from Split in December 1998, found on the stony lawns of Park Sustipan (Ruščić, 2003). Upon re-visit of the site twenty-five years later, in February 2023, I observed about twenty tufts growing on waste places and on the stony lawns of Park Sustipan (43°30'04" N; 16°25'28" E, leg. S. Maslo 11.02.2023, private herbarium, Maslo) (Fig. 1a, b). This locality is still the only known finding of the species in Croatia; grown for ornament and sometimes escaped. In the area of Split, the plant is grown as an ornamental, and thus horticulture is considered to have been one of the introduction pathways. Following the framework proposed by

Blackburn et al., 2011, I consider *C. longisetus* to be a naturalized alien species in the territory of Croatia, currently in the C3 category (Individuals surviving in the wild in the location where introduced, reproduction occurring, and population self-sustaining).

During field research in central Dalmatia in July 2007, the presence of the species *Sporobolus indicus* in Croatia was confirmed, four years after the first report from the Istrian peninsula. It was recorded in the area of Živogošće (car-camp Dole), 20 km from the city Makarska, (43°10'16" N; 17°11'53" E, leg. S. Maslo 08.07.2009, herbarium ZA 5654). Plenty of plants were observed in a single site of about 200 square meters (Fig. 2a,b), on xeric grassland near sea level with *Paspalum dilatatum* Poir. with which it co-occurs in places. Approximately at the same time it was registered in the city of Supetar (island Brač), within the city's lawns and the undeveloped habitat within the ruderal flora. Further findings were in the area of Split in 2013. Localities as well as the distribution map can be found in Nikolić (2015).

*S. indicus* seems to be established in the area now. Since 2007, the plant has managed to survive in the habitats where it was originally observed and has spread along nearby roads and pathways. In July 2011 I observed this neophyte growing even like weeds in the cracks of the concrete next to the camp toilets. Observations during the period between 2007-2022, indicate that this neophyte has been spreading in the area of car-camp. Following the framework proposed by Blackburn et al., 2011, I can consider *S. indicus* as a naturalized alien species in the territory of Croatia, currently in the C3 category (Individuals surviving in the wild in the location where introduced, reproduction occurring, and population self-sustaining). The area where it was found is frequently visited by many tourists from different countries, so it is likely that it was inadvertently introduced this way.

## **Conclusion**

During the latest field research in the area of central Dalmatia, the presence of 2 lesser-known alien grasses in the flora of Croatia was confirmed. Both species show a stable population and can be safely labeled as naturalized species in Croatia. The presence of the *Cenchrus longisetus* was confirmed after the first finding 25 years ago in the area of Sustipan in Split. About 20 tussocks with numerous culms were recorded. On the other hand, *Sporobolus indicus* was recorded in several localities with the largest population in Dole near Živogošće. In that locality, the species covers several hundred square meters, with a tendency to spread further if it takes on an invasive behavior. The potentially invasive behavior of this species should be monitored in the following years.

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