

# CENCHRUS SPINIFEX – A NEW GRASS SPECIES FROM CROATIA

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This article reports on *Cenchrus spinifex* Cav. (*Poaceae*) as a new alien species in Croatia. *Cenchrus spinifex* was found in autumn 2023 on the Pelješac peninsula in the southernmost part of the country. It occurs on ruderal sites with sandy soils. The morphology, habitat and distribution of the species in the Mediterranean and south-east Europe are briefly described and discussed.

**Keywords:** eastern Adriatic, invasive alien species, NE Mediterranean, Poaceae, ruderal habitats

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U radu se prikazuje prvi nalaz strane vrste *Cenchrus spinifex* Cav. (*Poaceae*) u Hrvatskoj. Vrsta *C. spinifex* pronađena je u jesen 2023. na poluotoku Pelješcu koji se nalazi na krajnjem jugu države. Biljka je utvrđena na ruderalnim staništima na pjeskovitim tlima. U radu su ukratko opisani morfologija, stanište i rasprostranjenost vrste u Sredozemlju i jugoistočnoj Europi.

**Ključne riječi:** invazivne strane vrste, istočni Jadran, Poaceae, ruderalna staništa, SI Mediteran

## INTRODUCTION

The genus *Cenchrus* L. (*Poaceae*) comprises 107 accepted species distributed in the tropical and subtropical regions of North and South America, Africa, South Asia and Australia (POWO, 2023). *Cenchrus* species are introduced in most European countries (POWO, 2023). VERLOOVE & SÁNCHEZ GULLÓN (2012) reported five native *Cenchrus* species in the Mediterranean region. Since then, the genus *Pennisetum* Rich. was included in the genus *Cenchrus*, as a result of molecular phylogenetic studies (DONADIO *et al.*, 2009). Therefore, according to EURO+MED (2006-2023), 22 *Cenchrus* species and two subspecies are currently listed for the Euro-Mediterranean region.

Milović *et al.* (2010) recorded for the first time a species of the genus *Cenchrus* in Croatia, as *Pennisetum glaucum* (L.) R.Br. in the city of Zadar (northern Dalmatia). *Pennisetum glaucum* was reported as *Cenchrus spicatus* (L.) Cav. in EURO+MED (2006-2023), and both names are listed in POWO (2023) as synonyms of *C. americanus* (L.) Morrone. In addition, *C. longispinus* (Hack.) Fernald has been reported from the northern Adriatic island of Rab (originally attributed to *C. incertus* M.A. Curtis) and from the hinterland of northern Dalmatia (VERLOOVE & SÁNCHEZ GULLÓN, 2012; JASPRICA *et al.*, 2017; NIKOLIĆ, 2024). BORŠIĆ *et al.* (2008) reported *C. spinifex* Cav. as an invasive alien species in the

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country. Later, VERLOOVE & SÁNCHEZ GULLÓN (2012) performed a critical revision of the herbarium material collected in Croatia and proved that all alien *Cenchrus* specimens from Croatia should be attributed to *C. longispinus*. The earliest finding of *C. longispinus* in Croatia was documented by a herbarium specimen deposited in the Herbarium Universitatis Taurinensis (TO), collected in the mid-1960s by F. Della Beffa in the coastal region of Dubrovnik, southern Croatia (VERLOOVE & SÁNCHEZ GULLÓN, 2012).

In this article, we present the first confirmed record of *C. spinifex* in Croatia, found in the southernmost part of the country. *Cenchrus spinifex* (syn.: *C. incertus* M.A. Curtis, *C. carolinianus* Walter, *C. pauciflorus* Benth., ?*C. bambusoides* Caro et E.A. Sánchez; *sensu* NOBIS *et al.*, 2017; POWO, 2023) is more or less widely naturalized as a noxious weed in the Mediterranean region and has been registered on the EPPO Observation List of Invasive Alien Plants (EPPO, 2023). The morphology, habitat and distribution of the species in the Mediterranean region and south-eastern Europe are briefly described and discussed.

## MATERIALS AND METHODS

Initially, the *Cenchrus* species was photographed in its natural habitat by an inhabitant of the village of Žuljana (Pelješac peninsula) in October 2023. Further fieldwork, including the collection of plant material, was carried out in December 2023.

The Pelješac peninsula (area 355 km<sup>2</sup>, max. altitude 961 m a.s.l.) is located on the eastern Adriatic coast in southern Croatia (Fig. 1). The peninsula belongs to the Mediterranean Region, the Eastern Mediterranean Subregion, Adriatic Province, and the Epiro-Dalmatian Sector (see JASPRICA *et al.*, 2023). It is predominantly composed of carbonate rocks. The area experiences a typical Mediterranean climate (Csa subtype of Mediterranean climate): Summers are warm and dry, and winters are mild and rainy (JASPRICA & KOVAČIĆ, 2010). The average annual air temperature is 15.8 °C and the average annual precipitation is 1081.2 mm. North winds are the most frequent winds in this area. This climate enables the development of eu-Mediterranean vegetation dominated by evergreen shrubs and sclerophyllous trees (maquis), with the most important tree species being the holm oak (*Quercus ilex* L.). The Pelješac peninsula is one of the Important Plant Areas (IPAs) in Croatia and part of the Natura 2000 ecological network (JASPRICA & KOVAČIĆ, 2010, for details, see JASPRICA *et al.*, 2023).

To determine the species, we used VERLOOVE & SÁNCHEZ GULLÓN (2012), which presents a revised identification key for *Cenchrus* s.str. (excluding *Pennisetum*; see VERLOOVE, 2012) in the Mediterranean area. A phytosociological relevé was collected using the Braun-Blanquet approach (BRAUN-BLANQUET, 1964). The nomenclature of the taxa follows Plants of the World Online (POWO, 2023). The collected plant material was deposited in the herbarium of Meise Botanic Garden (BR; THIERS, 2023).

## RESULTS AND DISCUSSION

The *Cenchrus* species was observed in its natural habitat by inhabitants of Žuljana village (Pelješac peninsula) in October 2023. During our fieldwork on 9 December 2023, plant specimens were collected and identified as *C. spinifex* (Fig. 2).

It was found as follows: Croatia, southern Dalmatia, Dubrovnik-Neretva County, Pelješac peninsula, Ston municipality, Žuljana village, altitude 5 m a.s.l., geographical coordinates latitude 42°53'27.6" N, longitude 17°27'24.2" E, date 9 December 2023, leg.

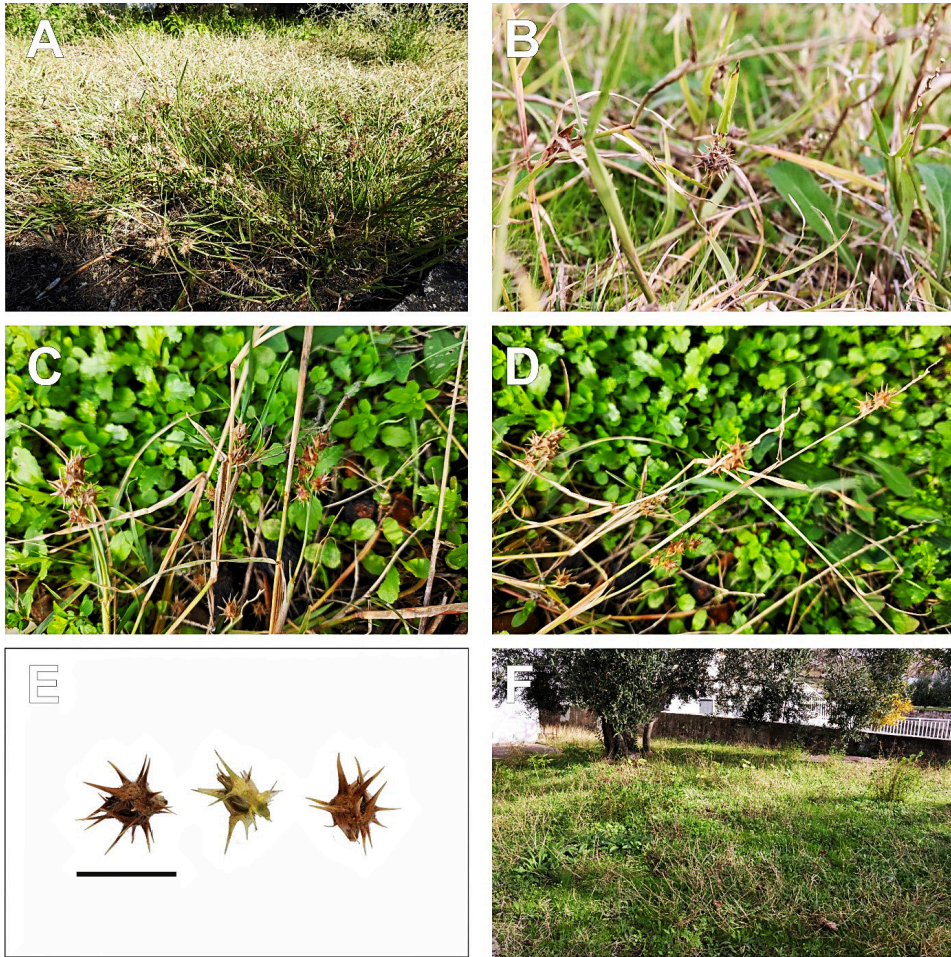


**Fig. 1.** Map of the Pelješac peninsula and its location on the south-eastern Adriatic coast. The black circle marks the village of Žuljana, where *Cenchrus spinifex* Cav. was found for the first time in Croatia. Abbreviations: IT – Italia, SL – Slovenia, HR – Croatia, BiH – Bosnia and Herzegovina, MN – Montenegro, RS – Serbia, RKS – Kosovo, AL – Albania, NMK – North Macedonia. The circle on the map in the lower left corner indicates the research area in the SE European context.

et det. N. JASPRICA, K. DOLINA & F. VERLOOVE, herbarium barcode: BR0000027060445V. The population counted ca. 40 individuals on a total area of approx. 200 m<sup>2</sup>.

*Cenchrus spinifex* was found in two not very well-kept gardens with several mature olive trees on more or less sandy soil. These are disturbed and rather ruderalised sites located along the village path. The plant is spreading in the neighbouring areas along the local road. According to villagers, this plant species has been present in these locations for about five years (M. VILLI, *personal communication*). In general, the increase in tourism in the region, especially after the construction of the Pelješac Bridge, physical changes in ecosystems and global climate change are the factors that contribute most to the introduction and invasion of exotic species in the region (JASPRICA *et al.*, 2023).

The phytosociological relevé [plot size: 16 m<sup>2</sup>; coordinates: latitude 42°53'27.6" N, longitude 17°27'24.2" E; altitude: 5 m a.s.l.; aspect: -; vegetation cover: 100%; date: 9 December 2023] includes the following taxa: *Cenchrus spinifex*, 4; *Erigeron canadensis*, 4; *Sonchus bulbosus*, 3; *Setaria viridis*, 3; *Petrorhagia saxifraga*, 3; *Medicago sativa*, 3; *Clinopodium nepeta*, 3; *Veronica cymbalaria*, 2; *Verbascum sinuatum*, 2; *Stellaria media*, 2; *Geranium molle*, 2; Bryophyta coll., 2; *Plantago lanceolata*, 1; *Parietaria judaica*, 1; *Mirabilis jalapa*, 1; *Gazania* sp., 1; *Ailanthus altissima*, +; *Bidens subalternans*, +; *Cynodon dactylon*, +; *Dactylis glomerata* subsp. *hispanica*, +; *Daucus carota* subsp. *major*, +; *Diplotaxis tenuifolia*, +; *Lantana camara*, +; *Lavandula dentata*, +; *Olea europaea*, +; *Senecio vulgaris*, +; *Sonchus asper* subsp. *glaucescens*, +; *Tagetes minuta*, +; *Galium verrucosum*, r. Most of the taxa are characteristic of the *Digitario sanguinalis-Eragrostietea minoris*, *Chenopodietea*, *Artemisietea*



**Fig. 2.** *Cenchrus spinifex* Cav. in Croatia, South Dalmatia, Dubrovnik-Neretva County, Pelješac peninsula, Ston Municipality, the village of Žuljana. A – habit, B-D – habit (detail), E – burs, F – habitat. Scale bar = 1.2 cm. (photo: A – V. Mihelić Villi, 13 October 2023; B-F – N. Jasprica, 9 December 2023).

*vulgaris*, and *Ammophiletea* classes. As far as life forms are concerned, hemicryptophytes and therophytes contributed the most, with 11 and 10 species, respectively.

Among the neighbouring Croatian countries, *C. spinifex* has already been reported from Hungary (KIRÁLY, 2009, as *C. pauciflorus* Benth), Italy (VERLOOVE & SÁNCHEZ GULLÓN, 2012, and references therein) and Montenegro (NOBIS *et al.*, 2015). POWO (2023) reported this species in „Yugoslavia“, but the data in this database do not provide clarification of the species' limits in this part of SE Europe (see also PANDŽA & JASPRICA, 2024). In Serbia, ANAČKOV *et al.* (2013) reported *C. spinifex* (as *C. incertus*) from the Pannonian part of the country, but this species was also later attributed to *C. longispinus* (NIKETIĆ *et al.*, 2018). Interestingly, *C. spinifex* was not found in the southernmost part of south-eastern Europe in Albania, while its occurrence in Greece is still doubtful (EURO+MED, 2006-2023).

In general, the distinction between *C. longispinus* and *C. spinifex* has proven problematic throughout the Mediterranean (NOBIS *et al.*, 2015), and this has been discussed and illustrated in detail by VERLOOVE & SÁNCHEZ GULLÓN (2012). In *C. longispinus*, the inner spines of the spikelets are only slightly flattened, while the outer (lowermost) spines are usually bristle-like, in contrast to *C. spinifex*, where the inner spines are conspicuously flattened at the base (up to 3 mm wide) and the bristle-like outer spines are often absent. Spines in *C. longispinus* are numerous, usually 30 to 50 in number, while *C. spinifex* has fewer spines, typically 20 to 30 (VERLOOVE & SÁNCHEZ GULLÓN, 2012).

In Croatia, *C. spinifex* occurs on ruderal sites with sandy soils. In neighbouring Montenegro, this species has also been found in ruderal habitats within both pasmophytic (*Anmophiletea*) and annual vegetation near the coast. Similar habitats have also been reported for *C. longispinus* in Croatia (JASPRICA *et al.*, 2017; NIKOLIĆ, 2024). In Hungary and Serbia, *C. longispinus* occurs mainly in Pannonian grasslands on sandy substrates and embankments along railway lines (KIRÁLY, 2009; NIKETIĆ *et al.*, 2018).

The present findings provide important basic information that should help assess the status of *C. spinifex* in Croatia. Although the species is still considered ephemeral or only locally naturalized in most parts of Europe, we recommend monitoring the species and planning eradication measures if necessary.

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## REFERENCES

- ANAČKOV, G., RAT, M., RADAK, B., IGIĆ, R., VUKOV, D., RUĆANDO, M., KRSTIVOJEVIĆ, M., RADULOVIĆ, S., CVIJANOVIĆ, D., MILIĆ, D., PANJKOVIĆ, B., SZABADOS, K., PERIĆ, R., KIŠ, A., STOJŠIĆ, V. & BOŽA, P., 2013: Alien invasive neophytes of the southeastern part of the Pannonian Plain. *Central European Journal of Biology* **8**, 1032–1043.
- BORŠIĆ, I., MILOVIĆ, M., DUJMOVIĆ, I., BOGDANOVIĆ, S., CIGIĆ, P., REŠETNIK, I., NIKOLIĆ, T. & MITIĆ, B., 2008: Preliminary check-list of invasive alien plant species (IAS) in Croatia. *Natura Croatica* **17**, 55–71.
- BRAUN-BLANQUET, J., 1964: *Pflanzensoziologie. Grundzüge der Vegetationskunde*. Springer-Verlag, New York.
- DONADIO, S., GIUSSANI, L.M., KELLOGG, E.A., ZULOAGA, F.O. & MORRONE, O., 2009: A preliminary molecular phylogeny of *Pennisetum* and *Cenchrus* (Poaceae-Panicaceae) based on the trnL-F, rpl16 chloroplast markers. *Taxon* **58**, 392–404.
- EPPO, 2023: EPPO Global Database. Available from <https://gd.eppo.int/taxon/CCHPA/categorization> [Last access: 26 December 2023].
- EURO+MED, 2006-2023: Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. Available from <http://www.europlusmed.org> [Last access: 15 December 2023].
- JASPRICA, N. & KOVAČIĆ, S., 2010: Pelješac. In: NIKOLIĆ, T., TOPIĆ, J. & VUKOVIĆ, N. (eds.), *Botanički važna područja Hrvatske*, 335–340. Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Školska knjiga d.o.o., Zagreb.
- JASPRICA, N., MILOVIĆ, M., DOLINA, K. & LASIĆ, A., 2017: Analyses of flora of railway stations in the Mediterranean and sub-Mediterranean areas of Croatia and Bosnia and Herzegovina. *Natura Croatica* **26**, 271–303.

- JASPRICA, N., PANDŽA, M. & MILOVIĆ, M., 2023: Floristic composition of the ruderal habitats along the newly built access roads to the Pelješac Bridge: Preliminary results. *Natura Croatica* **32**, 213–231.
- KIRÁLY, G. (ed.), 2009: Új magyar fűvészkönyv. Magyarország hajtásos növényei. Határozókulcsok. [New Hungarian Herbal. The vascular plants of Hungary. Identification key]. Aggteleki Nemzeti Park Igazgatósága, Jósvaló.
- MILOVIĆ, M., MITIĆ, B. & ALEGRO, A., 2010: New neophytes in the flora of Croatia. *Natura Croatica* **19**, 407–431.
- NIKETIĆ, M., TOMOVIĆ, G., PERIĆ, R., ZLATKOVIĆ, B., ANAČKOV, G., DJORDJEVIĆ, V., JOGAN, N., RADAK, B., DURAKI, Š., STANKOVIĆ, M., KUZMANOVIĆ, N., LAKUŠIĆ, D. & STEVANOVIĆ, V., 2018: Material on the Annotated Checklist of Vascular Flora of Serbia. Nomenclatural, taxonomic and floristic notes I. Bulletin of the Natural History Museum in Belgrade **11**, 101–180.
- NIKOLIĆ, T. (ed.), 2024: Flora Croatica Database. Faculty of Science, University of Zagreb. Available from <http://hirc.botanic.hr/fcd> [Last access: 2 January 2024].
- NOBIS, M., ERST, A., NOWAK, A., SHAULO, D., OLONOVA, M., KOTUKHOV, Y., DOĞRU-KOCA, A., DÖNMEZ, A.A., KIRÁLY, G., EBEL, A. L., KUSHUNINA, M., PIWOWARCZYK, R., SUKHORUKOV, A. P., NOBIS, A., VERLOOVE, F., ZALEWSKA-GAŁOZ, J., ZARE, G., BURRI, J.-F., ČAKOVIĆ, D., JĘDRZEJCZAK, E., JOGAN, N., KLICHOWSKA, E., PLISZKO, A., POPOVICH, A. V., STEŠEVIĆ, D., ŠILC, U., TUPITSYNA, N., VASJUKOV, V. M., WANG, W., WERNER, P., WOLANIN, M. N., WOLANIN, M. M. & XIANG, K.-L., 2017: Contribution to the flora of Asian and European countries: new national and regional vascular plant records, 6. *Botany Letters* **164**, 23–45.
- PANDŽA, M. & JASPRICA, N., 2024: First record of *Prangos trifida* (Apiaceae) in Croatia. *Acta Botanica Croatica* **83**, 80–83.
- POWO, 2023: Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Available from <http://www.plantsoftheworldonline.org> [Last access: 12 December 2023].
- THIERS, B., 2023: Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Available from <http://sweetgum.nybg.org/science/ih> [Last access: 30 December 2023].
- VERLOOVE, F., 2012: New combinations in *Cenchrus* (*Panicaceae*, *Poaceae*) in Europe and the Mediterranean area. *Willdenowia* **42**, 77–78.
- VERLOOVE, F. & SÁNCHEZ GULLÓN, E., 2012: A taxonomic revision of non-native *Cenchrus* s.str. (*Panicaceae*, *Poaceae*) in the Mediterranean area. *Willdenowia* **42**, 67–75.