Cyperus eragrostis – an addition to the Bulgarian alien flora

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Abstract. *Cyperus eragrostis*, a native species to South America, is recorded as a new for the adventive flora of Bulgaria. It is currently well established along the roadsides and riverbanks in the vicinities of Brodilovo village (Tsarevo district), Strandzha Nature Park. In Bulgaria, the first herbarium record of *C. eragrostis*, misidentified as *C. glaber*, dates back to 1967. Diagnostic characters of the species, its distribution and probable invasion pathways are commented on and illustrated.

Key words: Bulgaria, Cyperaceae, invasive plant species, Monocots

Introduction

The latest circumscription of the genus *Cyperus* L. comprises *ca.* 950 species (Larridon & al. 2013). Such high diversity has been creating difficulties in its taxonomy, as well as in the determination of taxa, especially of aliens. The genus is rather poorly represented in the European flora: according to Verloove (2014), it comprises 43 species, of which 20 are non-native. After his thorough examination, the alien *Cyperus* in Europe has become more recognizable and determinable.

So far only *C. odoratus* L. has been known as an alien *Cyperus* in Bulgaria. It is often confused with *C. strigosus* L. in many countries of South Europe (Verloove 2014), including Bulgaria (Tzonev & al. 2003; Stoyanov 2010).

Cyperus eragrostis Lam. (Fig. 1) reported here for the first time as naturalized in Bulgaria, is one of the earliest known alien *Cyperus* species in the European flora. It was initially introduced as a gardening plant in the middle of the 19th century. Its invasion and current distribution were summarized by Petřík (2003). Presently, *C. eragrostis* occurs in many countries of South, West and Central Europe and partly on the Balkan Peninsula.

Results and discussion

In the summer of 2017, during a botanical trip in Mt Strandzha, an unknown species of genus *Cyperus* was collected near the village of Brodilovo. Initially, it was erroneously determined as *C. glaber* L., because of its umbel inflorescence with large globose spikes. Subsequently, after detailed examination of the glumes, it was correctly identified as *C. eragrostis*, a new non-native species to Bulgaria.

Further field studies carried out in the same area have confirmed a much wider distribution of *C. eragrostis*. Locally, it behaves like an invasive species. Its ample and vigorous populations were observed southwards of Tsarevo town, along the road towards Brodilovo village and near the hunting shelter westwards of Brodilovo (*see the author's specimens*). This prompts an assumption that *C. eragrostis* is a very old invader of the country. A review of *Cyperus* specimens in the herbaria SO and SOA (acronyms according to Thiers 2008) has confirmed this assumption and has shown that the oldest record of this species in Bulgaria dates 50 years back. All earlier collectors have confused it with *C. glaber* (*see revised specimens*).

Cyperus eragrostis and *C. glaber* have ± similar inflorescences: a simple or seldom compound 5–10-rayed umbel, with ± globose spikes, 1–3 cm in diameter; densely clustered spikelets, 15–30(–50), oblong, distinctly flattened, 5–20 × 2–3 mm, 10–30-flowered; glumes navicular, distichous, imbricate. *Cyperus eragrostis* is essentially distinguished by its glume characters: medially 2-keeled, laterally greenish, off-white to light-brown, with one inconspicuous white vein and conspicuously isodiametric-reticulate surface (versus glumes medially sharply keeled, greenish along the midrib, laterally reddish-brown, with 2–3 elevated veins and non-reticulate surface in *C. glaber*) (Fig. 2).

Distribution in Bulgaria

Cyperus eragrostis is alien to the Bulgarian flora, and so far is found to be naturalized at the floristic regions of the Southern Black Sea Coast, Mt Strandzha and Sofia Region (Fig. 3).

Habitats and probable invasion pathways

In the vicinities of Brodilovo village, *C. eragrostis* grows in muddy, sandy or gravelly, at least temporarily wet habitats, mostly on exposed riverbanks, where it was found in small groups of one to several dozen individuals. In these places, co-occurring species are: *Arctium lappa*, *Chenopodium polyspermum*, *Cyperus longus*, *Eupatorium cannabinum*, *Fallopia dumetorum*, *Galega officinalis*, *Holcus lanatus*, *Juncus conglomeratus*, *Lycopus europaeus*, *Lythrum salicaria*, *Mentha longifolia*, *M. pulegium*, *Persicaria maculosa*, *Rorippa sylvestris*, *Saponaria officinalis*, *Stachys palustris* etc. and some aliens and archeophytes as *Echinochloa crus-galli*, *Erigeron canadensis*, *Phytolacca americana*, and *Xanthium strumarium*.

Grassy roadside ditches between Tsarevo town and Brodilovo village are the other ephemerally moist sites the species occupies. In this

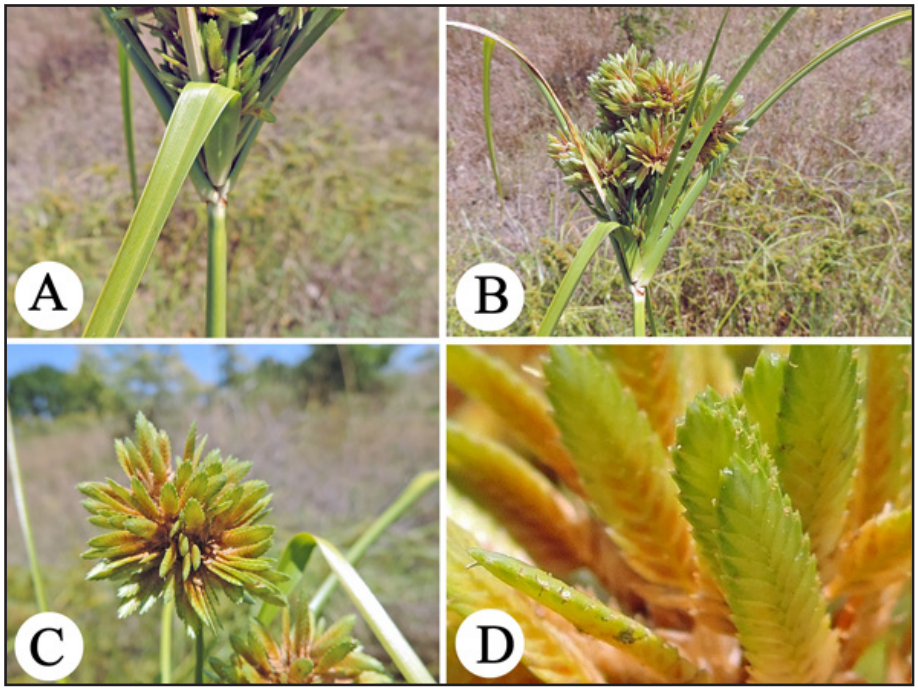

Fig. 1. *Cyperus eragrostis*: **A** – bract; **B** – inflorescence; **C** – spike; **D** – spikelets (roadside ditches between Tsarevo town and Brodilovo village, photos Zh. Barzov).

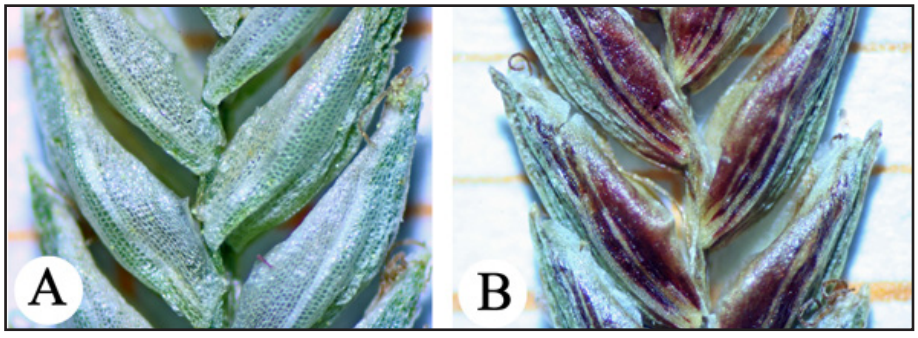

Fig. 2. Comparison of glume surfaces of *Cyperus eragrostis* (**A**) and *Cyperus glaber* (**B**) (photos S. Stoyanov).

habitat, which is drier than the previously mentioned one and with a considerable presence of ruderal species, *C. eragrostis* reaches the highest abundance of about a few hundred plants.

Cyperus eragrostis was first collected in the coastal region of Tsarevo town in 1967. How the species has reached this locality remains unknown. Perhaps, it has been imported to Bulgaria either as an ornamental plant, or casually, with seeds of agricultural crops. During subsequent invasion, the species has probably followed the transportation (roads from Tsarevo towards Ahtopol town and Brodilovo village) and river (Veleka river and its tributaries) corridors as effective pathways for spreading (Fig. 4).

The locality near Bankya town (Sofia district) is quite distanced (*ca.* 400 km) from the species' localities at the coastline and certainly results from another invasion. Whether the species has only been there for a short time or is permanently established, is still to be investigated.

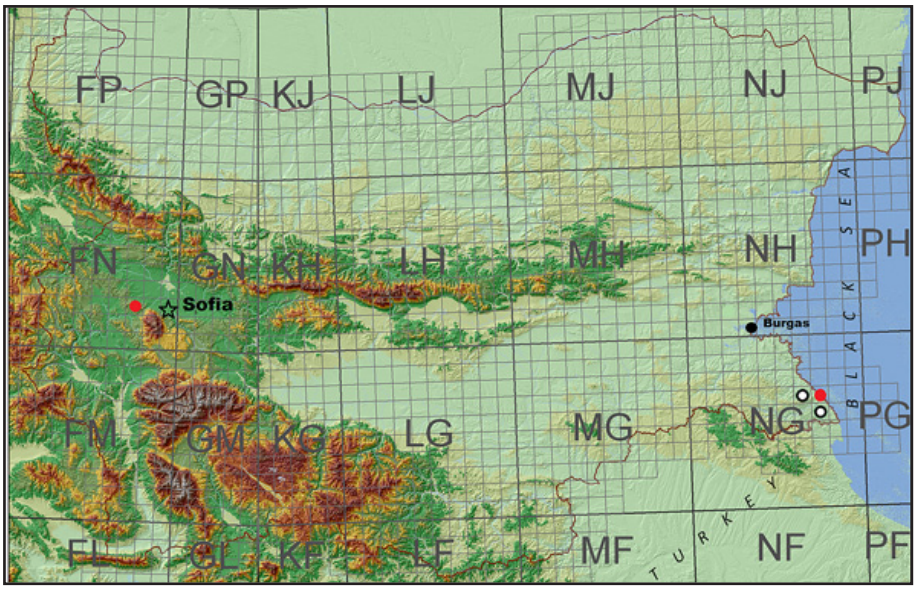

Fig. 3. Distribution map (10×10 km UTM squares) of *Cyperus eragrostis* in Bulgaria (historical records – red solid circles; recent records – white circles with black outline).

Fig. 4. Map of the probable invasion pathways of *Cyperus eragrostis* along the Bulgarian Black Sea Coast and Mt Strandzha (localities – red solid circles; year of herbarium records – in red; invasion corridors – red dotted lines).

Appendix. List of *specimina visa*

***Author-collected specimens*:** Bulgaria. Mt Strandzha: westwards of Brodilovo village, Tsarevo district, along a dirt road towards the hunting shelter, in grassy places, 15 m a.s.l., 42.08984°N, 27.84545°E, 22.07.2017, *S. Stoyanov* (SOM 174511); 1.5 km westwards of Brodilovo village, Tsarevo district, near the hunting shelter, in moderately moist grassy places, 15 m a.s.l., 42.09006°N, 27.83820°E, 29.07.2017, *Zh. Barzov* (SOM 174512); westwards of Brodilovo village, Tsarevo district, in moderately moist grassy places, on the muddy banks of river Elenitsa, near cattlesheds, 18 m a.s.l., 42.09218°N, 27.83253°E, 29.07.2017, *Zh. Barzov* (SOM 174513, 174514); 2.5 km westwards of Brodilovo village, Tsarevo district, after the hunting shelter, on exposed gravelly places on the right bank of river Elenitsa, 35 m a.s.l., 42.09517°N, 27.83027°E, 29.07.2017, *Zh. Barzov* (SOM 174515); southwards of Brodilovo village, Tsarevo district, at the bridge of river Veleka, in sandy alluvial terrains on the left bank of the river, 10 m a.s.l., 42.08166°N, 27.86024°E, 29.07.2017, *Zh. Barzov* (SOM 174516); 2 km southwards of Tsarevo town, along the road towards Brodilovo village, in grassy places in the roadside ditches, 75 m a.s.l., 42.14825°N, 27.85414°E, 29.07.2017, *Zh. Barzov* (SOM 174517, 174518).

Revised specimens: The specimens listed here have been misidentified as *C. glaber*. Bulgaria. Prope Mičurin (presently Tsarevo town) ad Pontum (= Black Sea), 08.1967, *E. Božilova* (SO 08651, 30633); 300 meters from river Veleka, along the road towards Ahtopol town, 19.07.1983, *I. Cheshmedzhiev* (SOA 41835), 22.07.1983, *I. Cheshmedzhiev* (SOA 41824); Ahtopol, at the Veleka river, 4.07.1985, *D. Delipavlov* & *I. Cheshmedzhiev* (SOA 42804); Mt Lyulin, near Mihaylovo village (presently a residential district of Bankya town), 07.1992, *V. Nikolov* & *D. Stoyanov* (SO 96288).

Examined specimens for comparison: France. Dep. Hérault, Hérépian commune, 22.08.1894, *Henssen* (SOA 23062, sub *C. vegetus* Willd.); Dep. Landes, ad margines pratorum prope Dax, 09.1908, *Neyraut* (SO 08771, sub *C. vegetus*); Dep. Hérault, Lamalou-les-Bains commune, 20.09.1910, *Fourès* (SOM 116505, sub *C. vegetus*); USA. California, San Diego County, San Luis Rey river, southwards of Bonsall, 24.07.1946, *Fiker* (SOM 119774); Netherlands. Prov. Limburg, Maas river, northwards of Itteren town, 02.09.1959, *Kern* (SOM 114304).

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