

**THE ACCOUNT OF *ELATINE AMBIGUA* WIGHT, *E. TRIANDRA*  
SCHKUHR AND *E. HUNGARICA* MOESZ COLLECTED IN  
VOJVODINA (SERBIA)**

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In the course of field research of flora and vegetation, carried out on wetland and saline habitats in Vojvodina (Serbia), we have collected specimens of genus *Elatine* L. belonging to the three species. One of them represents adventive species (*E. ambigua* Wight), recorded for the first time in Serbia at three localities in Srem, while the other two have been discovered at new localities: *E. triandra* Schkuhr at one locality in Srem and *E. hungarica* Moesz at three localities in Banat. They contribute significantly to the present knowledge concerning their recent distribution in Serbia and region.

**Key words:** flora, chorology, Serbia.

## INTRODUCTION

Genus *Elatine* L. (Elatinaceae) includes approximately 27 described species occurring mainly in temperate regions of the Northern Hemisphere

(Heywood *et al.* 2007, Popiela *et al.* 2015). They can be listed among the least known species of many regional and local floras, where in most cases they are equally rare and overlooked due to their sporadic ephemeral appearance only in specific amphibious habitat types, their small proportion, and peculiar, more or less disjunctive distribution pattern. All species are subject to extensive influence of fluctuating water levels and their population size and density often varies considerably from one year to the next (Uotila 2010, Popiela *et al.* 2015).

Given the negative contemporary impacts such as habitat loss, water pollution and climate change, as well as weak competitiveness of some small representatives of *Elatine*, the prospect of their survival in the near future is perceived in many countries as declining, as reflected in the protected status of some of them or their appearance in national and regional Red Lists or Red Books (Bilz *et al.* 2011, Takács *et al.* 2013, Popiela *et al.* 2015).

Five species have been recorded in Serbia to date: *E. alsinastrum* L., *E. hydropiper* L., *E. hexandra* (Lapierre) DC., *E. hungarica* Moesz and *E. triandra* Schkuhr. With the exception of *E. alsinastrum*, all other known species from Serbia are poorly documented. In most cases there is only one field record, sometimes a few; they are often from long time ago and have, subsequently, been repeated on numerous occasions in various publications, even though their accuracy remains questionable in some instances due to the lack of original herbarium specimens and because of frequent confusion between the species within *Elatine* or with *Callitriche* L. (Pančić 1874, Kovács 1929, Blečić 1972, Gajić 1977, Obradović *et al.* 1986, Blaženčić & Blaženčić 1999, Petković *et al.* 1998, Uotila 2010). This data deficiency is apparent in “The Red Data Book of Flora of Serbia 1” (Stevanović 1999) where only *E. triandra* is mentioned (Blaženčić & Blaženčić 1999) and reflected in the fact that only *E. triandra* and *E. hexandra* are specifically protected by Serbian legislation (Anonymous 2010-2011).

In the last four years we had a rare opportunity to observe some small specimens of *Elatine* in the wetland habitats in Banat and Srem, which turned out to be three different species: *E. ambigua* (observed in three localities in Srem and recorded in Serbia for the first time), *E. triandra* (discovered in one new locality in Serbia), and *E. hungarica* (discovered in three new localities in Serbia). These data are contributing to better knowledge of the distribution of these rare and insufficiently known species in the region, and they appear to be most instructive for future nature conservation efforts. Though some of them were previously reported in the form of an abstract (Perić *et al.* 2015), the full account of these findings is presented below for the first time.

## MATERIAL AND METHODS

The herbarium material is stored in Herbarium collections of the Institute for Nature Conservation of Vojvodina province in Novi Sad (PZZP) and partly in the Natural History Museum in Belgrade (BEO). Nomenclature of the vascular plant taxa follows Euro+Med Plantbase (2006+). Author citations comply with the propositions given by Rec 46A, Note 1 of the Code (McNeill *et al.* 2012). Distribution maps are based on literature data and revised data from the Herbarium collections of the Institute of Botany and Botanical Garden Jevremovac in Belgrade (BEOU), the Natural History Museum in Belgrade (BEO) and the Institute for Nature Conservation of Vojvodina province. The description of *E. ambigua* follows Wight (1831), Moesz (1908), Walters (1968), Gorshkova (1949), and Yang & Tucker (2007), with some additional remarks based on the study of specimens that have been collected by the authors. With the exception of the herbarium of the Institute for Nature Conservation of Vojvodina province (designated here as PZZP), herbarium abbreviations used in the text are cited from Thiers (2016+). Distribution data for Serbia are mapped on a 10×10 km MGRS grid system (Lampinen 2001).

## RESULTS AND DISCUSSION

1. ***Elatine ambigua*** Wight in Hooker, Bot. Misc. 2: 103 (suppl. tab. 5) (1831)

Syn. *Potamopithys ambigua* (Wight) Kuntze, Revis. Gen. Pl. 1: 58 (1891); *Elatine triandra* [stat. indet.] *pedicellata* Rouy & Fouc., Fl. France 3: 325 (1896); *E. triandra* var. *pedicellata* Krylov, Fl. Alt. 1: 181 (1908).

**Description.** A small, glabrous, diffuse annual, 1-5(-18) cm long, sometimes producing dense tufts or carpet-like agglomerations. *Stems* spreading, prostrate, rooting at the nodes, richly branched, weakly ascending towards the apex, obscurely angled to rounded, sometimes suffused in reddish or brown colour. *Leaves* are plane, matte green, opposite, shortly petiolate or sessile, petiole (if present) are up to 1 mm long, leaf blade spatulate, oblong-lanceolate, ovate-lanceolate or elliptic, 2-5×0.7(1) mm, entire, apex subacute to obtuse, nerves indistinct, pinnately arranged and with pronounced blackish hydathode at the end of each. *Stipules* embracing the base of the petiole and pedicel, minute, up to 1 mm long, lanceolate, membranous, whitish, with lacerate to dentate margin and acute apex. *Flowers* are delicate, trimerous, alternate, axillary, solitary, pedicellate. *Pedicels* conspicuous, rather thick, (1)1.5-2 mm long, becoming recurved

during fructification. *Sepals* are elliptic-ovate to broadly lanceolate, obtuse, 0.5(1.5)-0.3(0.5) mm, scarious, viridescens, shorter than petals. *Petals* are ovate-lanceolate to elliptic, obtuse, at least twice as long as the sepals, rose to pale rose in colour. *Stamens* are of the same length as the calyx [in our specimens they are up to 1.5 times longer than sepals]. *Ovary* is hypogynous, obovate to oblong-ovoid, styles 3, stigmas simple, brown or reddish. *Capsule* is 3-valved, oblong-ovoid, 1.3-1.5 mm in diameter, concave at summit. *Seeds* are numerous, centrally attached, elliptic-oblong, slightly curved or almost straight, c. 0.5 mm long, yellowish-brown, regularly longitudinally hexagonally alveolate on the surface.  $2n=54$  (Kalinka *et al.* 2015). Flowering time: VII-VIII. Pollination: entomophily, autogamy (Soó 1968). Seed dispersal: epizoochory (Soó 1968). Type in BR (0000006995683).

**Distribution and introduction pathways.** This southern and eastern Asian species is naturally distributed across the Indian subcontinent, the Himalayas, Indochinese Peninsula and China, with disjunctions in Western Siberia, Korea, Japan, Fiji (Moesz 1908, Gorshkova 1949, Walters 1968, Yang & Tucker 2007, Kalinka *et al.* 2015). It was first described as coming from India [*"I have only found it in the moist soil of half dried tanks in the Tanjore district, where it forms large green patches"*] (Wight 1831, 1840). In parts of Australia, North America, Europe and perhaps Africa it is considered introduced and naturalised (Wild 1961, Yang & Tucker 2007, Uotila 2009). In Europe, it is hitherto known in France, Switzerland, Italy, Czech, Slovakia, Hungary, Romania, Bulgaria, Moldova and Ukraine (Walters 1968, Cook 1973, Uotila 2009, Lansdown 2014). The important factor which contributes to its spreading across wetland areas is the diaspore transfer via waterfowls and other similar migrating birds, combined with the apparently long viability of seeds (Uotila 2010, Popiela *et al.* 2015). Also, considering the type of its native habitat (rice fields) and the long history of rice production in some parts of Europe, records of *E. ambigua* published by Moesz (1908) and Cook (1973) suggest that this species was probably connected here and there with the remnants of old abandoned rice fields and that it has been overlooked rather than newly introduced.

**Distribution in Serbia.** According to what is currently known, *E. ambigua* is confined only to the wetland area between rivers Bosut and Studva in south-western Srem (Fig. 1). Its closest occurrence was recorded in southern Hungary (near Sellye), approximately 150 km to the north-west (Moesz 1908), which corresponds with the distribution patterns observed by Popiela *et al.* (2015).

**FIRST (NEW) DATA**

**Srem:** **CQ 58** Morović, Raškovica-Smogvica: Veliki Orljak puddle, 44° 58' 11.31" N, 019° 09' 29.93" E, 80 m (*Perić, R.* 17-Sep-2013, PZZP); **CQ 67** Višnjićevo, Vinična, on the road between the forest compartments No. 37 and 38, clearing 2, 44° 57' 01.85" N, 019° 13' 42.63" E, 81 m (*Perić, R.* 02-Jul-2013, PZZP); Sremska Rača, Vrtična, puddles on the road between the forest compartments No. 20 and 21, 44° 56' 06.04" N, 019° 15' 05.63" E, 90 m (*Perić, R.* 09-Jul-2014, PZZP).

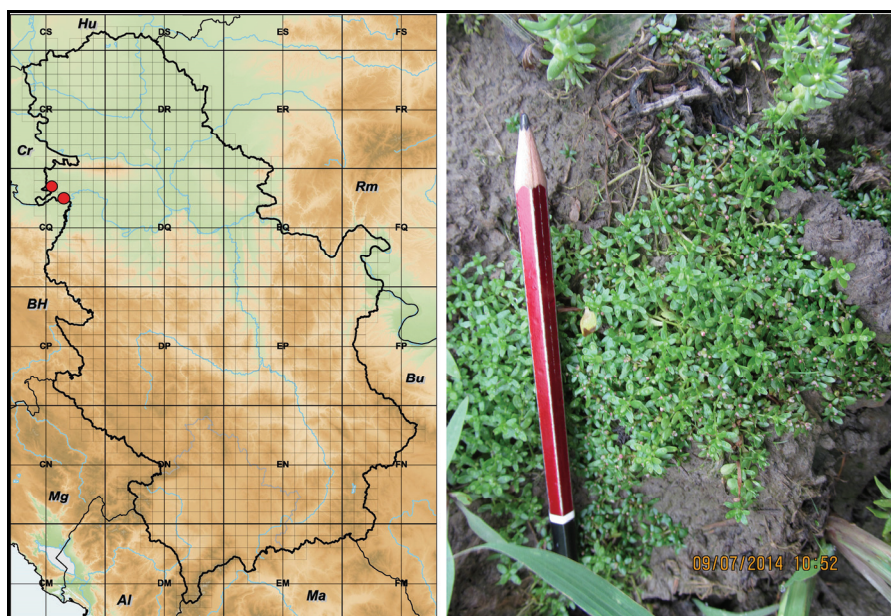


Fig. 1. – Left: known distribution of *Elatine ambigua* in Serbia, right: specimens from Vrtična (Photo R. Perić).

**Habitat.** Temporary inundated and drying-out habitats, developed on bare fine mineral eutrophic soils along stagnant water bodies (lakes, mud puddles, pools, rice fields, irrigation ditches, fish ponds) (Cook 1996, Uotila 2010). Our specimens were collected in all three localities on mineral gleysol rised on top of Holocene paludine sediments (Nejgebauer *et al.* 1971, Vrhovčić *et al.* 1986). Vegetation is principally characterised by representatives of class *Isoëto-Nanojuncetea* Braun-Blanq. & Tüxen, as follows: *Callitriche palustris* L., *Cardamine parviflora* L., *Elatine alsinastrium* L., *Lindernia procumbens* (Krock.) Philcox, *Lythrum portula* (L.) D.A. Webb. (all in Vrtična), *Echinochloa crus-galli* (L.) P. Beauv., *Elatine alsinastrium* L., *Lindernia procumbens* (Krock.) Philcox, *Lythrum hyssopifolia* L., *L. portula* (L.) D.A. Webb, *Ranunculus sceleratus* L. (Vinična) and *Cyperus michelianus* (L.) Delile (Veliki Orljak).

2. *Elatine triandra* Schkuhr, *Bot. Handb.* 1: 345 (1790)

**NEW DATA**

**Srem:** **CQ 68** Višnjićevo, Obodnjača pond, 44° 58' 11.22" N, 019° 15' 25.93" E, 82 m (Perić, R., Stojišić, V. 20-Jun-2013, PZZP!).

**KNOWN DISTRIBUTION IN SERBIA**

**Bačka:** **DR 25** Stari Bečej ["Óbecse"], south of the city ["Alsórért"] (Kovács 1929: 125, "rare").

**NE Serbia:** **EP 69** Žagubica, springhead of Mlava (May-2003, Avramović *et al.* 2004: 54).

**SE Serbia:** Vlasina: **FN 02** (Blaženčić, J., Blaženčić, Ž. 18-Aug-1989, BEOU; Randelović, V. 01-Sep-1990, HMD; Blaženčić & Blaženčić 1991: 73; Randjelović & Blaženčić 1996: 212; Blaženčić & Blaženčić 1999: 287; Randelović & Zlatković 2010: 53); **FN 13/FN 12** eastern bank, ass. *Elatino (triandrae)-Eleocharidetum acicularis* (Randelović, V. 28-Aug-1992, HMD; Blaženčić & Blaženčić 1999: 287; Randelović & Zlatković 2010: 53).

**GENERAL DATA**

**Serbia** (Hayek 1925: 519; Domac 1950: 162; Gajić 1980b: 122; Petković *et al.* 1998: 24).

**INCORRECTLY CITED DATA** (referring to *Callitriche cf. stagnalis*):

**NE Serbia:** Đerdapska klisura (Iron Gate): **FQ 14** Tekije-Petrovo Selo ["Petrovo Selo"] (Pančić, J. May-[1]872, "In stagno ad Petrovo Selo going from Tekije", rev. Uotila, P. Sep-2009, BEOU; Pančić 1874: 192, Blečić 1972: 126, Petrić *et al.* 2010: 43).

Beside the historical data for Iron Gate, derived from misidentified *Callitriche* specimens, and one unverified record from Bačka, the only recent data confirming the known presence of *E. triandra* in Serbia have relied on three records made within three UTM squares in the hilly areas of eastern and south-eastern Serbia. Our most recent record of *E. triandra* in south-western Srem (Obodnjača pond) is the first certain but unfortunately also the only contemporary evidence of its presence in Vojvodina (Fig. 2). We found only a few submerged groups (superficially resembling a multitude of flooded germs mixed with errant minute filaments projecting under shallow water) dispersed across less than five square metres, together with *Alisma lanceolatum* With., *Alopecurus aequalis* Sobol., *Elatine alsinastrum* L., *Eleocharis palustris* (L.) Roem. & Schult., *Glyceria fluitans* (L.) R. Br. and *Lindernia* sp.

All our specimens from the Obodnjača pond are aquatic forms that, at first glance, seem much alike to some *Callitriche*; however, they can be easily distinguished by their flower and fruit morphology and the presence of stipules and hydathodes (Uotila 2010). Some of our specimens have

developed *both* sessile and subsessile flowers with an almost indiscernible, short pedicel (much shorter than those found in *E. ambigua*), which can be partly addressed to one particular – and, from the taxonomical point of view rather unjustly emphasized – type described as *E. t. var. micropoda* Seub., *Elatin. monogr.* 42 (1845).

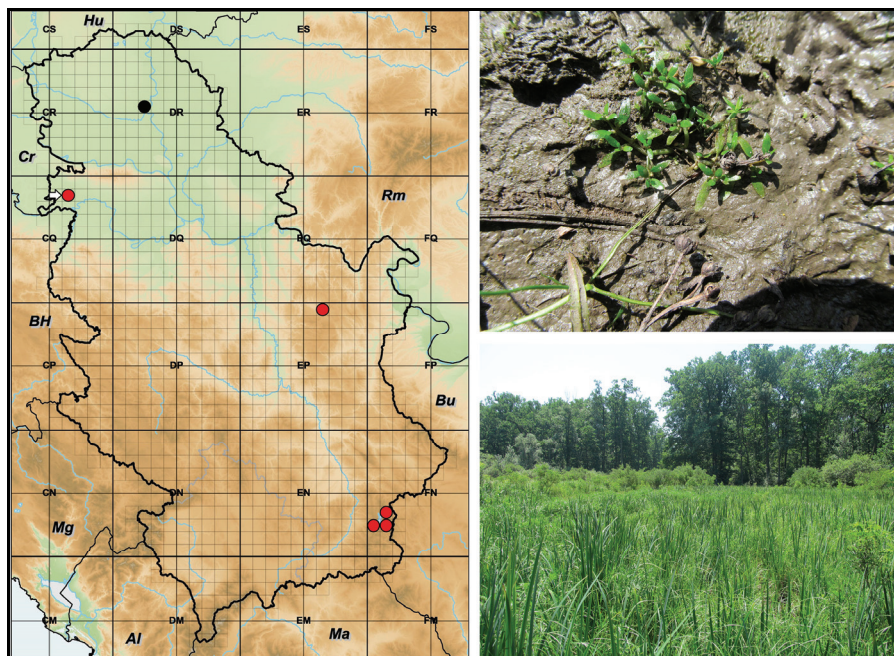


Fig. 2. – Left: distribution of *Elatine triandra* in Serbia with historical (from the year 1929) (black circle) and recent records (after the year 2000) (red circles) with our record marked with white arrow, upper right: individuals of *E. triandra* pulled out from the water, the resemblance with *Callitriche* is obvious, bottom right: Obodnjača pond (Photo R. Perić).

### 3. *Elatine hungarica* Moesz, *Magyar Bot. Lapok* 7: 24 (1908)

#### NEW DATA

**Banat:** **DR 36** Bočar, Lanište, 45° 45' 54.02" N, 020° 12' 54.57" E (Perić, R., Rilak, S., Kartalović, V. 17-May-2016, PZZP!); **DR 35** Novo Miloševo, Crvene štale, 45° 41' 24.47" N, 020° 12' 23.78" E, 74 m (Perić, R., Stojšić, V., Rilak, S., Kartalović, V. 26-May-2016, PZZP!); **DR 82** Sečanj-Boka, Čot, ≈ 45° 21' 03.37" N, 020° 47' 17.94" E, 73 m (Perić, R. 29-May-2013, PZZP!).

#### KNOWN DISTRIBUTION IN SERBIA

**Bačka:** **CR 37** Bezdán (Jávorka 1925: 722).

**Banat:** DR 37 Padej, Betlehen,  $\approx 45^{\circ} 50' 43.76''$  N,  $020^{\circ} 08' 19.01''$  E, 74 m (Perić, R. 20-Jul-2011, PZZP; BEO; Takács *et al.* 2013: Electronic Appendix: 2).

#### GENERAL DATA

**Serbia** (Gajić 1980a: 85; 1980b: 122; Petković *et al.* 1998: 24); **Vojvodina** (Gajić 1977: 70); **N Banat:** ass. *Elatine hungarica*-*Ammannia verticillata* (Slavnić 1951: 154, 160).

Although apparently more frequent in appropriate habitats than the previously described species, this pretty plant can be most easily spotted in the field because of the strikingly reddish-rose colour of its parts during the flowering and fructification time. As far as we know, it can be considered as certainly present in Serbia only in four localities embedded in vast saline areas of northern and middle Banat (Fig. 3), where it occurs primarily between the tussocks of *Agrostis stolonifera* L. in desiccating saline ponds or along deep furrows of eroded soil surface and in drying puddles on field roads, quite often accompanied by *Callitriche palustris* L., *Elatine alsinastrum* L. and *Ranunculus lateriflorus* DC. In almost all the visited localities *E. hungarica* is found to be a particularly rare species, with its individuals vaguely distributed in groups and singularly on less than one square meter (the only exception being the population near Sečanj, which extends across a few dozen square metres). As a result of the highly fragmented area of occupancy, the extent of occurrence and the noted extreme fluctuations in frequency, based on the latest IUCN criteria (<http://www.iucnredlist.org>) its threat status in Serbia can currently be considered as critically endangered (CR B2a,c(i, ii)).

#### CONCLUSION

All small members of the genus *Elatine* L. in Serbia are poorly documented, with rather few recent records. This can be largely explained by the loss of habitat and the ephemeral appearance of most *Elatine* species. Our collected data confirm these assertions. In the last four years we have collected specimens of three *Elatine* species, namely: *E. triandra* Schkuhr, *E. hungarica* Moesz and *E. ambigua* Wight. The presence of the first species in Serbia is supported by historical (two herbarium records and one literature record) as well as recent data (one herbarium and three literature records). *E. hungarica* is attested by one historical literature record and several recent data (four herbarium and one literature record). The third species (*E. ambigua*) has been recently recorded in Serbia for the first time. Although *E. ambigua* is an adventive species, its affinity towards ecologically similar ephemeral habitat types, shared with other small *Elatine* species, could be viewed as a possible indicator of their potential presence.



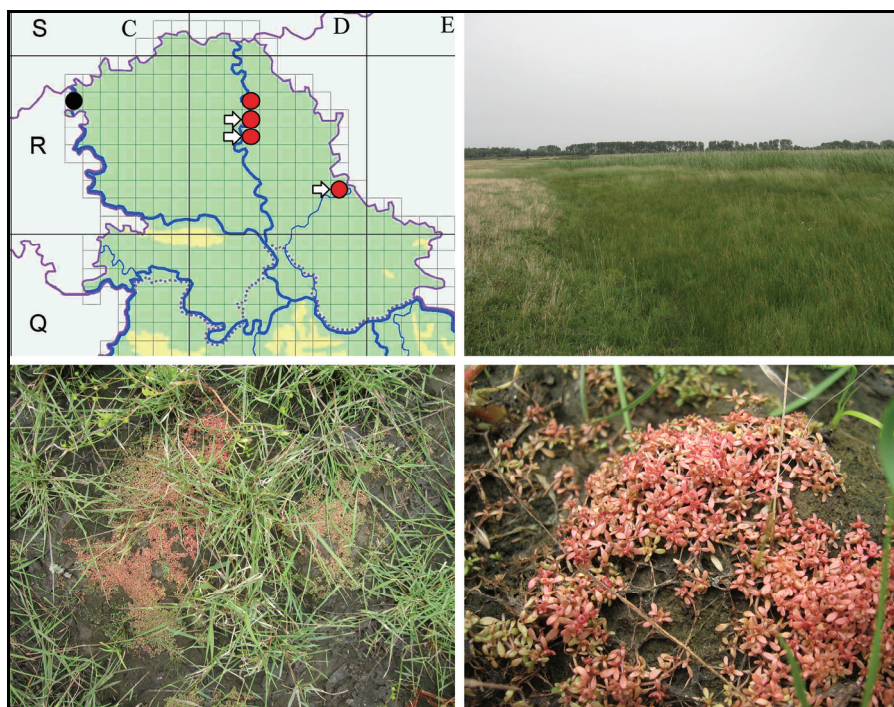


Fig. 3. – Upper left: distribution of *Elatine hungarica* in Serbia with historical (from the year 1925) (black circles) and recent records (after the year 2000) (red circles) with our records marked with white arrow respectively, upper right and bottom left: its typical habitat as this desiccating saline pond between Sečanj and Boka, bottom right: a closer look at the plant on the same locality (Photo R. Perić).

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**ПРИКАЗ ВРСТА *ELATINE AMBIGUA* WIGHT, *E. TRIANDRA* SCHKUHR  
И *E. HUNGARICA* MOESZ САКУПЉЕНИХ У ВОЈВОДИНИ (СРБИЈА)**

РАНКО ПЕРИЋ, ВИДА СТОЈШИЋ, САРА РИЛАК, СИНИША ШКОНДРИЋ

РЕЗИМЕ

Током теренских истраживања флоре и вегетације обављеним на влажним и заслањеним стаништима Војводине (Србија) сакупили смо примерке рода *Elatine* L. који припадају трима врстама. Једна од њих (*E. ambigua* Wight) је адвентивна врста која је забележена први пут у Србији, а друге две су забележене на новим локалитетима: *E. triandra* Schkuhr на једном локалитету у Срему и *E. hungarica* Moesz на три локалитета у Банату, што у значајној мери доприноси садашњем познавању њиховог распрострањења у Србији и региону.