

Ammannia coccinea Rottb. (Lythraceae): the First Report for the Bulgarian Alien Flora

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Abstract: *Ammannia coccinea* (Lythraceae), a native taxon to North and Central America, is reported for the first time as an alien species to Bulgaria. It was identified in rice fields in Central Bulgaria, in the Thracian Lowland floristic region, in 2016. A brief morphological description is provided based on the materials collected from the Bulgarian localities. The characters, which distinguish *A. coccinea* from the other two species reported for Bulgaria so far, *A. verticillata* and *A. auriculata*, are discussed. Careful examination of the herbarium materials of *Ammannia* spp. stored in the Bulgarian herbaria revealed that all specimens determined as *A. auriculata* had been misidentified and, in fact, they belong to *A. coccinea*. Thus, the first records of the latter species in Bulgaria date back to 1980. *Ammannia coccinea* grows in damp to wet places, at the margins of rice fields. The invasiveness and spreading potential of the species are discussed based on personal observations and data from the literature. *Ammannia auriculata* should be excluded from the list of the Bulgarian alien flora.

Key words: Alien species, Bulgarian flora, rice fields, weeds in rice fields

Introduction

So far the genus *Ammannia* L. (Lythraceae) has been represented by two species in the Bulgarian flora – *A. verticillata* (Ard.) Lam. and *A. auriculata* Willd. (DELIPAVLOV 2011, ASSYOV & PETROVA 2012). *Ammannia verticillata* was recorded more than a century ago in the Black Sea Coast floristic region (Southern) and has not been seen again since the 1960s (BONDEV & POPOV 1971), whereas *A. auriculata* was found in rice fields in the Thracian Lowland floristic region (DELIPAVLOV & CHESHMEDZHIEV 1983). Both species are considered neophytes in Bulgaria.

Here we report for the first time the occurrence of *A. coccinea* in Bulgaria. Our aim was also to review the distribution of *Ammannia* spp. in Bulgaria based on the field survey data and the materials stored in the Bulgarian herbaria.

Materials and Methods

The plant materials were collected in rice-fields in South Bulgaria, in 2016. The herbarium specimens were deposited in the herbarium of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (SOM). The morphological characters were noted from the gathered herbarium specimens and compared with the data from the relevant literature (WEBB 1968, GRAHAM 1979, QIN & GRAHAM 2007, NAQINEZHAD & LARIJANI 2017). The materials deposited in the registered Bulgarian herbaria, SO (herbarium of the Sofia University ‘St. Kliment Ohridski’), SOA (herbarium of the Agricultural University in Plovdiv City) and SOM, have been examined and revised. Data about the habitat and populations of *A. coccinea* are based on personal observations.

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Results and Discussion

During the field survey in the region of Plovdiv City and Pazardzhik Town, South Bulgaria, in 2016, a new species of *Ammannia* was recorded. The specimens collected have been identified as *A. coccinea* Rottb.

Ammannia coccinea Rottb., Pl. Horti Univ. Rar. Progr. 7 (1773) (Figs. 1, 2).

Herbaceous annual, ca. 60-90 cm tall, glabrous. Stems erect, branched. Leaves opposite, sessile, linear-lanceolate, 5-8 × 0.3-0.7 cm, glaucescent, usually auriculate at base. Flowers 3-5 in axillary, subsessile cymes; peduncles 1-3 mm long; pedicels ca. 1-2 mm. Floral tube urceolate; sepals 4(5), epicalyx segments about as long as sepals; petals 4(5), pink to purple, ca. 2 mm, obovate. Style about as long as ovary or slightly longer. Capsule 3.5-4.0 mm in diameter, globose.

Flowering August – September, fruiting October – November.

Ammannia coccinea clearly differs from *A. verticillata* by the longer style (the style is subsessile in *A. verticillata*), and from *A. auriculata* by the bigger capsules (ca. 1.5-3.5 mm in *A. auriculata* and 3.5-5.0 mm in *A. coccinea*), subsessile cymes (at least some peduncles and pedicels are distinctly longer than flower tube in *A. auriculata*) and smaller number of flowers per cyme (ca. 3-15 in *A. auriculata*). Careful examination of the herbarium materials of *Ammannia* spp. stored in SOA revealed that all specimens considered to belong to *A. auriculata* had been misidentified. In fact, they belong to *A. coccinea*. Therefore, *A. auriculata* should be excluded from the list of the Bulgarian flora.

Distribution in Bulgaria

Thracian Lowland floristic region (Fig. 3): margin of rice field north of Gelemenovo Village, Pazardzhik District, 250-260 m a. s. l., N 42.28768°, E 24.31133°, 23.08.2012, V. Vladimirov (photo); ca. 2.5 km north of Tsalapitsa Village, margin of rice field along the road to Saedinie Town, 190 m a. s. l., N 42.209332°, E 24.562244°, 12.10.2016, leg. V. Vladimirov & M. Delcheva (SOM); ca. 3 km North of Tsalapitsa Village, margin of rice field along the road to Saedinie Town, 194 m a. s. l., N 42.214107°, E 24.559780°, 11.11.2016, leg. V. Vladimirov & M. Delcheva (SOM); *loc. ibid.*, 195 m a. s. l., N 42.223843°, E 24.555600°, 11.11.2016, V. Vladimirov & M. Delcheva obs.; rice fields ca. 2.5 km South of Graf Ignatievo Village, 186 m a. s. l., N 42.253736°, E 24.740842°, 16.09.2016, V. Georgiev, S. Tsoneva & Ch. Gussev obs.; rice fields ca. 3.0 km north of Tsalapitsa Village, 194 m a. s. l., N 42.219190°, E 24.557180°, 16.09.2016, V. Georgiev, S. Tsoneva & Ch. Gussev obs.



Fig. 1. *Ammannia coccinea*: A lateral branch (Photo: V. Georgiev)

Other specimens, deposited in SOA and erroneously determined as *A. auriculata*, were examined as well: Tseretelevo Village, Plovdiv District, 28.08.1980, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 37371, 37372, 37373, 37374, 37375, 37376, 37377, 37386, 37387, 37388, 37389); west of Plovdiv City, weed in rice fields, 30.09.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38439); Saedinie Town, weed in rice fields, 30.09.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38430); Voisil Village, Plovdiv District, weed in rice fields, 30.09.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38435); Belozem Village, Plovdiv District, rice fields, 09.10.1981, leg. I. Cheshmedzhiev (SOA 40741) & leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38436, 41888); Manole Village, Plovdiv District, rice fields, 09.10.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38438, 38745); Shishmantsi Village, Plovdiv District, rice fields, 09.10.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38437, 38769); Skutare Village, Plovdiv District, rice fields, 09.10.1981, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 38766, 38767, 38768); Gelemenovo Village, Pazardzhik District, 20.09.1982, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 41374, 41563); Malo Konare Village, Pazardzhik District, rice fields, 20.09.1982, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 41546); Pishtigovo Village, Pazardzhik District, rice field, 20.09.1982, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 41544); Tsalapitsa Village, Plovdiv District, 20.09.1982, leg. D. Delipavlov &



Fig. 2. Flowers of *Ammannia coccinea* (Photo: V. Georgiev)

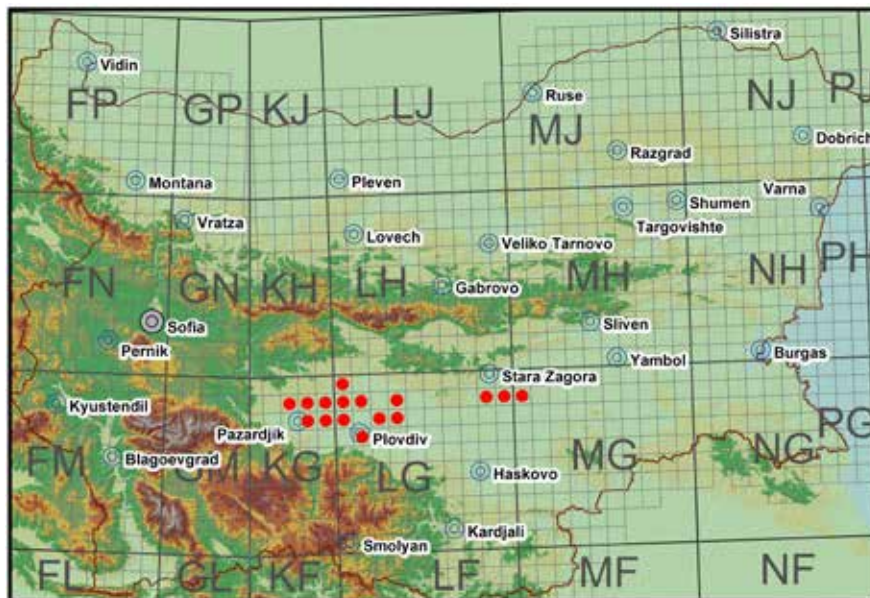


Fig. 3. UTM-distribution map of *Ammannia coccinea* in Bulgaria

I. Cheshmedzhiev (SOA 41543); nearby Plovdiv City, rice fields, 26.09.1984, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43197); Graf-Ignatievo Village, Plovdiv District, rice field, 26.08.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43045); Rakovski Town, rice field, 26.08.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43041, 43042); Saedinenie Town, Plovdiv District, rice field, 26.08.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43044); Tsarimir Village, Plovdiv District, rice fields, 26.08.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43078); Chernogorovo Village, Pazardzhik District, rice fields, 04.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43069, 43071, 43072, 43073); Dobrovnitsa Village, Pazardzhik District, rice field, 04.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43046, 43043); Malo Konare Village, rice fields, Plovdiv District, 04.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43076); Pishtigovo Village, Pazardzhik District, rice fields, 04.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43070); puddles of water by Belozem Village, Plovdiv District, 16.09.1991, leg. I. Cheshmedzhiev (SOA 46189); Grudevo (now Bozduganovo) Village, Stara Zagora District, rice fields, 17.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43074); Kolarovo Village, Stara Zagora District, rice field, 17.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev

(SOA 43054, 43059, 43060, 43061, 43062) & 19.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43057, 43058); Pamukchii Village, Stara Zagora District, rice field, 17.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43055, 43076, 43079) & 19.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43056); Trankovo Village, Stara Zagora District, rice fields, 17.09.1985, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 43052, 43053, 43064, 43065, 43066, 43067, 43068, 43069, 43083); Gelemenovo Village, Pazardzhik District, rice field, 20.09.1989, leg. D. Delipavlov & I. Cheshmedzhiev (SOA 41541).

Distribution worldwide

The species is native to North and Central America, from the USA to Brazil (BRIFFA & LANFRANCO 1984). Introduced to Asia and Europe (WEBB 1968, QIN & GRAHAM 2007). In Europe, reported as an alien in France, Italy, Portugal and Spain (VALDÉS 2012+). In the countries neighbouring to Bulgaria, it has been reported from Greece (RAUS 1997) and Turkey (VALDÉS 2012+).

Habitats, spreading potential and uses

In Bulgaria, the species was recorded mainly in rice fields and occasionally in small water puddles adjacent to the rice fields. Usually, it is scattered at the margins of these fields. Seeds of *Ammannia* spp. retain their viability for many years, although germination rate significantly decreases with time (LES 2017). Seeds of *A. coccinea* are floating on the water surface and may appear as contaminants of the rice seeds. They have dormancy and require at least 100 days of cold stratification, day/night temperature fluctuation and light for optimal germination (LES 2017). Petri-dish and

pot experiments showed that *A. coccinea* is photoblastic and requires temperature higher than 15°C and soil burial depth shallower than 3 cm for successful germination and seedling emergence (SHEN et al. 2010). Personal observations on the management practices in the rice fields suggest that the seeds of all species growing there are transported by the running water, and especially by the machineries used for land cultivation – large amounts of mud containing all fallen seeds of the weedy species stick to the tyres of the machines and are transported all around. There is a possibility that the seeds of *A. coccinea* are transported to the irrigation canals, and from there, to the associated river systems.

There are literature data that the foliage and seeds of *A. coccinea* are consumed by some birds and mammals, e.g. *Branta canadensis* (Linnaeus, 1758), *Myocastor coypus* (Molina, 1872), and ducks (Anatidae). The Mohave and Yuma tribes collected the seeds of the species and used them as food in baking, after grinding (LES 2017).

Ammannia coccinea was first collected in Bulgaria in 1980. Since then it has survived in the rice fields and small water puddles nearby for nearly 40 years already. Therefore, it should be regarded as a naturalised species in the rice field habitats in Bulgaria.

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