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## Report on the new floristic data from Serbia II

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### **Abstract:**

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This paper presents new chorological data for 16 taxa of vascular flora of Serbia (records No. 1-16). These taxa belong to following families: Amaryllidaceae (1-2), Apiaceae (3), Aristolochiaceae (4), Aspleniaceae (5), Asteraceae (6-9), Iridaceae (11), Juncaceae (12), Ophioglossaceae (13), Ranunculaceae (14), Rutaceae (15) and Urticaceae (16), also including the possibly first record of *Opuntia humifusa* (Raf.) Raf., Cactaceae (10) in Serbia.

**Key words:** distribution, chorological data II, Serbia, vascular flora

### **Apstrakt:**

**Bogosavljević, S., Zlatković, B.: Izveštaj o novim florističkim podacima iz Srbije II. *Biologica Nyssana*, 9 (2). Decembar, 2018: 63-75.**

Prikazani su novi horološki podaci za 16 taksona vaskularne flore Srbije (izveštaji br. 1-16). Taksoni pripadaju sledećim familijama: Amaryllidaceae (1-2), Apiaceae (3), Aristolochiaceae (4), Aspleniaceae (5), Asteraceae (6-9), Iridaceae (11), Juncaceae (12), Ophioglossaceae (13), Ranunculaceae (14), Rutaceae (15) i Urticaceae (16), uključujući i najverovatnije prvi podatak o prisustvu vrste *Opuntia humifusa* (Raf.) Raf., Cactaceae (10) u Srbiji.

**Ključne reči:** distribucija, horološki podaci II, Srbija, vaskularna flora

## Introduction

This study represents a continuation of chorological studies of vascular flora of Serbia. New distribution data are presented for 14 plant species and 2

subspecies, including representatives of rare, threatened and protected taxa as well as some invasive species in process of range increase. These data may provide additional information on distribution of taxa included in the edition "Flora of

SR Serbia (I-X)” (Josifović ed., 1970-1977; Diklić, 1977; Nikolić et al., 1986; Sarić & Diklić, 1986), as well as the taxa that will be included in the new edition “The Flora of Serbia” (Stevanović ed., 1992, 2012). In addition, survey of existing literature yielded no previous data on appearance of the invasive species *Opuntia humifusa* (Raf.) Raf. (Cactaceae) in Serbia, so we believe that this was probably the first scientific set of data on its presence in this country.

## Material and methods

Identification of collected plant material was performed according to Josifović ed. (1970-1977), Stevanović, ed. (1992, 2012), Tutin et al. (1964), Nardi (1984), Trinajstić (1990), Majure et al. (2017) and Pardo & Alonso (2017). In addition, some of collected specimens (*Aristolochia lutea* Desf.) were compared to virtual collections at Herbarium of Institute of Botany, University of Vienna (WU) and Herbarium of Botanic Garden and Botanical Museum Berlin-Dahlem (B) (<http://herbarium.univie.ac.at/database/search.php>). The description of species *Opuntia humifusa* was based on literature sources (Petrova et al., 2013; Majure et al., 2017) and combined with observations of collected material. Plant material was preserved and stored at the Herbarium of the Faculty of Sciences and Mathematics, Department of Biology and Ecology, University of Niš (HMN), with acquisition numbers given in the brackets.

Invasiveness status was determined using the terminology according to Lambdon et al. (2008). Distribution of the studied taxa within the territory of Serbia was determined and mapped in UTM grid system (10 x 10 Sq. km., UTM Zone 34T) (Lampinen, 2001). The nomenclature and classification of taxa were matched with The Plant List database (<http://www.theplantlist.org/>). In order to identify regions of the data occurrence in Serbia we used a geographic regionalization according to Marković (1970), modified by Stevanović ed. (1999). Data on population (subpopulation) vulnerability, number of individuals and habitats of the species were based on personal observations.

## Results and discussion

### Amaryllidaceae

#### 1. *Allium guttatum* subsp. *dalmaticum* (A. Kern. ex Janch.) Stearn

- (East): Surroundings of Dimitrovgrad, Gulenovci village, Odorovačko polje, steppe-like habitats in karst field, limestone, 690 m,

FN47, 10.06.2016, B. Zlatković & N. Stanković (HMN 13818).

After new literature data on topic of distribution of this critically endangered taxon in flora of Serbia were published pertaining to Central and Southeastern Serbia (Tomović et al., 2009), the species was also recorded in Eastern Serbia. All previously known sites for this species in Serbia were steppe-like, slightly salt-affected habitats of saltpans. This locality is the first in Serbia where this species was recorded on limestone as a substrate lacking salt deposits, and it appears in a small population of 20-30 individuals just as in all other localities.

#### 2. *Galanthus elwesii* Hook.f.

- (East): Surroundings of Knjaževac, Mt. Tupižnica peak, shrubs and fragments of beech forests, limestone, 1140 m, EP93, 29.03.2017, M. Randelović & S. Bogosavljević (HMN 13819).

According to Jovanović et al. (2016), this species was present in Serbia only in vicinity of Niš and Pirot in Eastern Serbia. The new locality is situated on a limestone plateau of Mt. Tupižnica, in the zone of beech forests, where individuals of this species appear in scrub vegetation, sometimes between stone blocks, as well as within various derivatives of disrupted forest vegetation, primarily in fragments of beech forests. The only species previously recorded in literature for the area of Mt. Tupižnica was *G. nivalis* L. (Fritsch, 1909).

### Apiaceae

#### 3. *Trinia ramosissima* (Fisch. ex Trevir.) W.D.J. Koch

- (East): Surroundings of Knjaževac, Podvis village, dry grasslands, 385 m, EP92, 09.06.2016, coll. S. Bogosavljević & B. Zlatković (HMN 13820).
- (East): Surroundings of Niš, Kunovica village, Ploče plateau, steppe-like grassland, limestone, 659 m, EN99, 15.06.2016, B. Zlatković (HMN 13822).
- (East): Surroundings of Niš, Vlase village, Mt. Seličevica, silicate, 308 m, EN78, 29.06.2005, B. Zlatković (HMN 13821).

In Serbia, *Trinia ramosissima* is relatively rare, with a status of protected species (Anonymous, 2010). According to Butorac et al. (1991) it was recorded in Serbia in a small number of localities in Vojvodina and Central Serbia. New research has shown that this species also appears in Southwestern Serbia (Papović et al., 2014). In the localities

included in this study it was recorded in several small populations in Eastern Serbia, appearing together with other mostly steppe or steppe-Mediterranean elements (*Chrysopogon gryllus*, *Erysimum diffusum*, *Galatella linosyris*, *Linum tenuifolium*, *Scabiosa micrantha*, *Vinca herbacea*). Its habitats include dry pastures, edges of forests and forest glades within the thermophilic oak forests.

## Aristolochiaceae

### 4. *Aristolochia lutea* Desf. (Fig. 1a, b).

- (Central): Ibar river valley, surroundings of Ušće, loose, rocky material in *Juniperus oxycedrus* stand, ultramafite, 410 m, DP61, 22.05.2003, B. Zlatković (HMN 13823).
- (Central): Brezna, Brezanska river gorge, rocky places in oak forest, ultramafite, 350 m, DP72, 06. 2001, B. Zlatković (HMN 13826); Mt. Stolovi, Meljanica gorge, rocky places and thermophilous oak forest, ultramafite, 400 m, DP72, 05.2001, B. Zlatković (HMN 13824).
- (Central): Mt. Stolovi, Čukar, screes and rocky places, serpentinit, 930 m, DP62, 06.2001, B. Zlatković (HMN 13827).
- (Western): Mt. Tara, Brusnica gorge, *Ostrya-Pinetum nigrae*, limestone, CP66, 07.2001, B. Zlatković (HMN 13825).
- (South): Mt. Rujan, Orljak, thermophilous oak forest, silicate, EM67, 06. 06. 2009, B. Zlatković (HMN 13828).

This species belongs to aggregate *Aristolochia pallida* which includes following species: *A. pallida*, *A. tyrrhena*, *A. lutea*, *A. elongata*, *A. macedonica*, *A. croatica* and *A. merxmulleri* (Tatić, 1999). Within the taxonomic revision of genus *Aristolochia* L. by Nardi (1984) it was determined that the name "*Aristolochia pallida* Willd." should only apply to the taxon appearing in the western part of Alps massif, with only a few localities outside of this region, while *A. lutea* is widely distributed in the regions to the East of the Alps, the Apennines and Balkan Peninsula, Pannonia, the Carpathian Mountains and in the most of the Asia Minor. As *A. pallida* and *A. lutea* are morphologically very similar, it should be noted that their most important differential character is ratio between the length of perigone tube and the length of perigone limb. In *A. pallida* the perigone tube is of equal length or slightly shorter than the limb (which is also wider than the tube), while in *A. lutea* the perigone tube is significantly longer than the limb, which is of equal width or slightly narrower than the perigone tube (Nardi, 1984; Trinajstić, 1990) (Fig. 1b). Considering these facts we believe that hypothesis by Tatić et al. (1995), that *A. lutea* is present in Serbia

but misidentified as *A. pallida* in floras, scientific papers and herbarium collections, is justified. This species was first recognized as *A. pallida* in flora of Serbia by Pančić (1874), citing its presence at two localities in Šumadija. Gajić (1970) considers it widespread in Serbia but without citing precise localities. However, in the new edition of Flora of Serbia (Gajić, 1992) it is stated that *A. pallida* does not live in Serbia, while data by Mayer & Greuter (1985), stating that *A. lutea* is present in Serbia, were not taken in consideration. According to our research and the literature references on distribution of *A. pallida*, which within the study area with high probability pertains to the present species (Pančić, 1874; Ilić, 1900; Randelović & Stamenković, 1979; Randelović, 1979/1980; Randelović & Stamenković, 1984; Stamenković, 1985; Tatić et al., 1995; Jotić et al., 2013), it may be concluded that *A. lutea* appears in several regions of Serbia (Fig. 1a), where it is represented by small populations isolated from each other.

## Aspleniaceae

### 5. *Asplenium lepidum* C. Presl

- (East): Surroundings of Knjaževac, Stogazovac village, Ždrelo gorge, crevices in sheltered parts of rocks, 390 m, limestone EP93, 08.05.2016, coll. M. Randelović & S. Bogosavljević (HMN 13829).

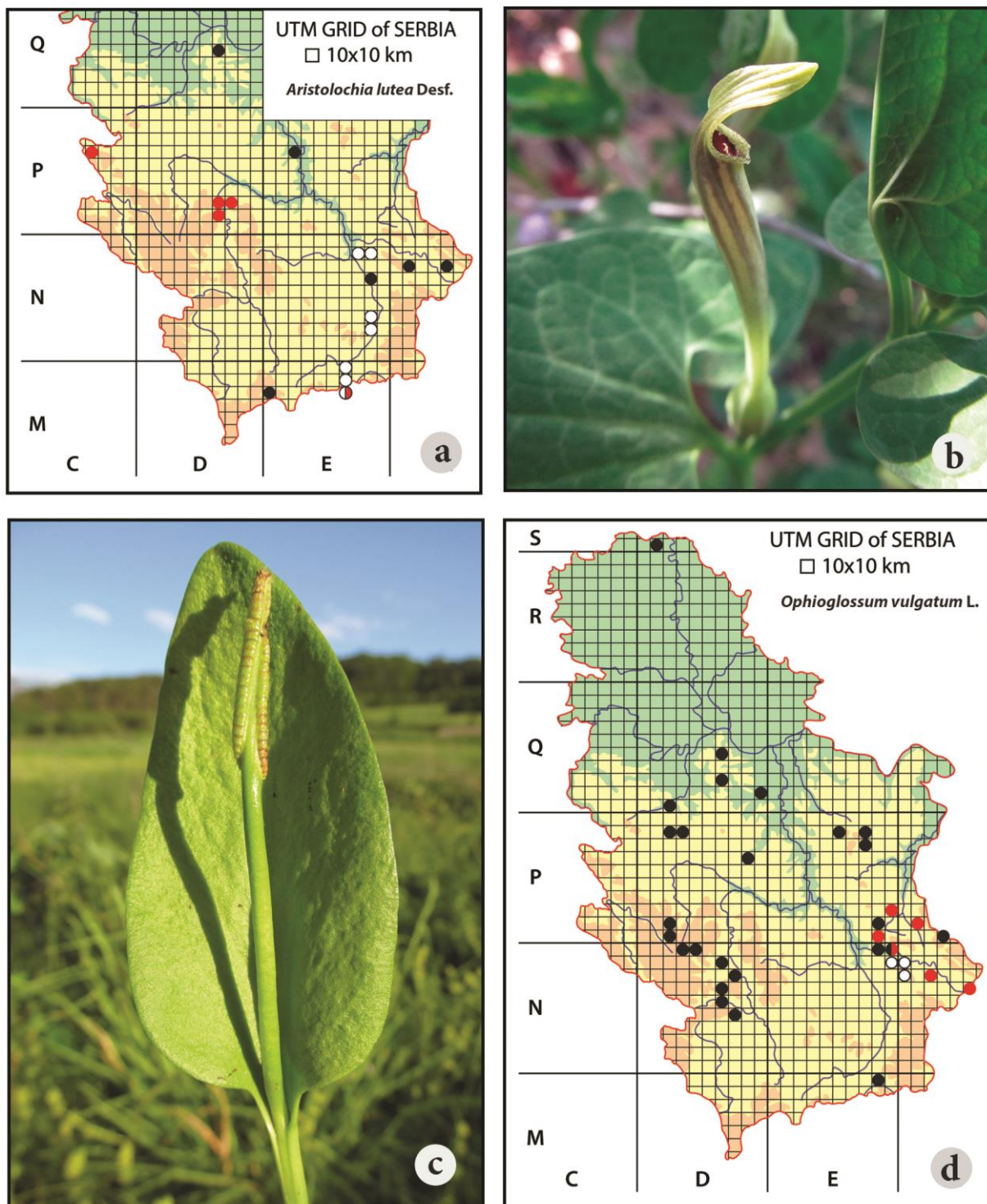
This species of fern inhabits specific protected shaded habitats in crevices of limestone rocks, often appearing in gorges and canyons of hill region (Stevanović et al., 1991). Due to its specific ecological demands it is relatively rare and localized in Serbia, mostly in eastern and western part of state (Stevanović et al., 1991).

## Asteraceae

### 6. *Bidens connata* Muhl. ex Willd.

- (Northeast): The town of Prahovo, Prahovo port, banks of the Danube, 40 m, FQ20, 22.09.2016, coll. S. Bogosavljević, M. Randelović & B. Zlatković (HMN 13830).
- (Northeast): Mihajlovac village, banks of the Danube, 40 m, FQ11, 22.09.2016, coll. S. Bogosavljević, M. Randelović & B. Zlatković (HMN 13831).
- (Northeast): The town of Kladovo, banks of the Danube, ruderal, 40 m, FQ24, 29.10.2016, coll. M. Randelović & S. Bogosavljević (HMN 13832).

*Bidens connata* is characteristic for North America as an autochthonous species, however today



**Fig. 1.** a - Distribution of *Aristolochia lutea* in Serbia; b - *A. lutea* flower; c - *Ophioglossum vulgatum* general appearance; d - distribution of *O. vulgatum* in Serbia (legend: black circles - literature data, red circles - new data, white circles - imprecise literature data).

its presence is also recorded in 14 European countries, including Serbia where it is considered an invasive naturalized species (Bogosavljević & Zlatković, 2015). New data on distribution of this species in Serbia pertain to localities in north-eastern Serbia along river Danube, at the Romanian border.

In Romania this species was recorded only in the southeastern part of country (Anastasiu et al., 2007), but the results of our study indicate that it should be expected in southwestern Romania as well as in northwestern parts of Bulgaria.

### 7. *Bidens vulgata* Greene (Fig. 2a).

- (Northeast): Surroundings of Negotin, Srbovo village, Jasenička reka channel, nitrophilous, damp places along the forest roads, 50 m, FP39, 22.09.2016, coll. S. Bogosavljević, M. Randelović & B. Zlatković (HMN 13833).

The only known record of this species is from a single locality in northwestern Serbia (Tatić & Žukovski, 1973). It originated in North America and was first introduced to Europe in mid-20<sup>th</sup> century, to France and Romania, while today it is present in a number of European countries (Petrova & Vladimirov, 2009). However, due to high morphological and ecological similarity to the widespread species *B. frondosa*, *B. vulgata* probably remained unnoticed in appropriate habitats in most of its artificial range.

### 8. *Erigeron sumatrensis* Retz. (syn. *Conyza sumatrensis* (Retz.) E. Walker, *C. albida* Spreng.)

- (Northeast): The town of Kladovo, banks of the Danube, ruderal, 50 m, FQ24, 29.10.2016, coll. M. Randelović & S. Bogosavljević (HMN 13835).
- (East): Surroundings of Knjaževac, Rgošte village, ruderal, 250 m, EP92, 25.08.2016, coll. M. Randelović & S. Bogosavljević (HMN 13834).
- (Šumadija): The town of Ripanj, ruderal, 255 m, DQ64, 15.09.2017, M. Randelović & S. Bogosavljević (field obs.).

New data on distribution of *E. sumatrensis* in Serbia indicate that the invasive character of this species is becoming more pronounced. Although until recently it was known from Central, South and Eastern Serbia (Zlatković & Bogosavljević, 2014) and Belgrade (Niketić & Jovanović, 2002), the new data also indicate its presence in northeastern Serbia. The locality in northeastern Serbia is situated immediately next to the Romanian border, so this species should be also expected in southwestern Romania, in addition to known records from the southeastern part of that country (Anastasiu & Memedemin, 2012). This species reaches high abundance of individuals in all new localities in Serbia, inhabiting various ruderal habitats within human settlements.

### 9. *Symphotrichum novae-angliae* (L.) G.L.Nesom (syn. *Aster novae-angliae* L.)

- (East): Surroundings of Knjaževac, Rgošte village, Banjica pool, arable fields, 235 m, EP92, 13.10.2013, coll. B. Zlatković & S. Bogosavljević (HMN 13836).

New data on distribution of this invasive species indicate that it continues to spread through Serbia, as expected due to its invasive potential. So far it has been recorded in Eastern and Western Serbia as naturalized, while in many localities it was recorded as a cultivated species (Lakušić & Jovanović, 2012). The population recorded near Knjaževac includes self-propagated individuals in wetlands along the riverbank and the peripheral parts of cultivated plots. Monitoring of this species in the last several years (until 2017) has shown no significant increase in number of individuals or tendencies of range spread.

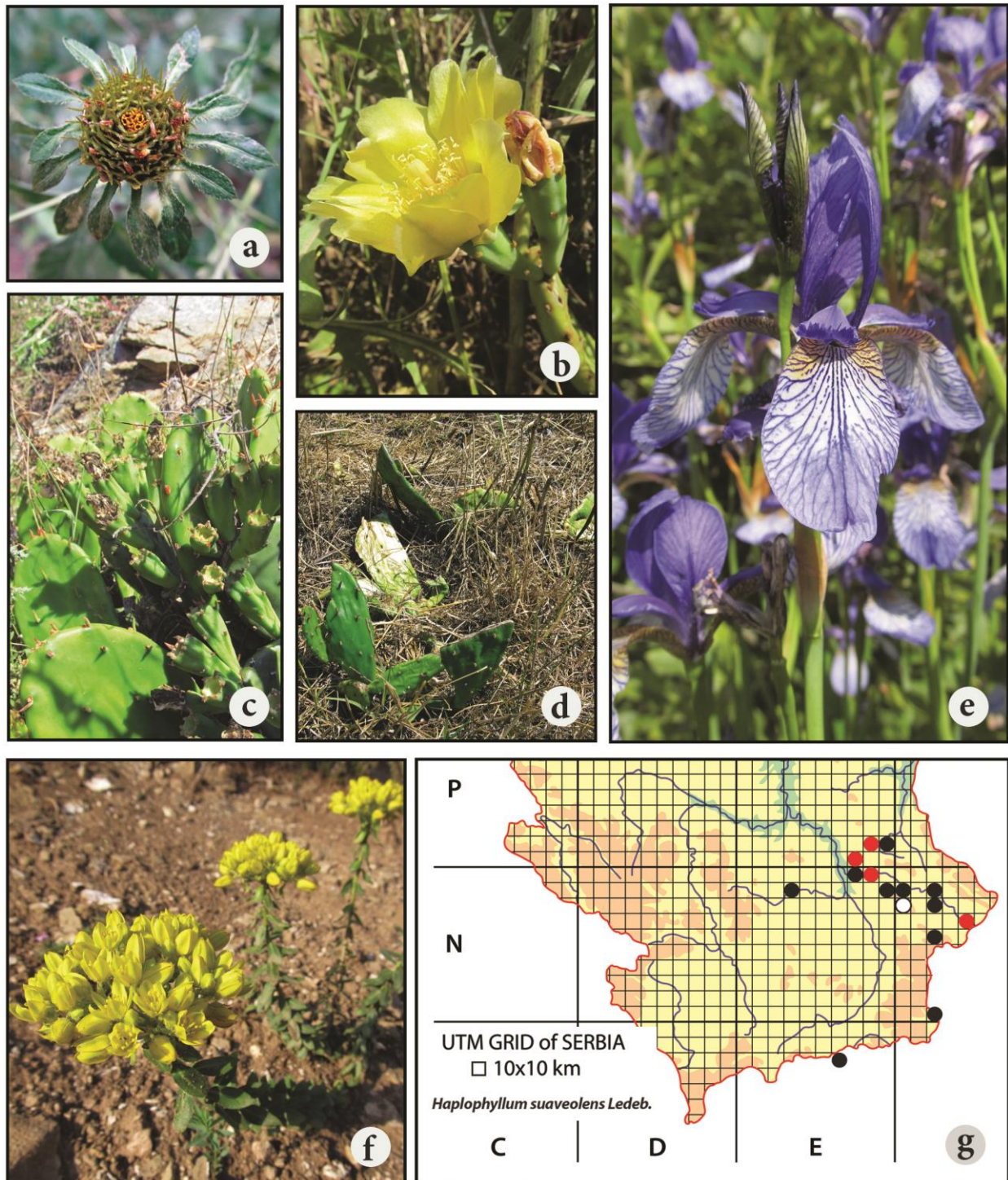
## Cactaceae

### 10. *Opuntia humifusa* (Raf.) Raf., Med. Fl. 2: 247. (1830) (Fig. 2b, c, d)

- (Southeast): Pčinja valley, Jablanica village, dry sand and rocky places, 475 m, EM78, 09.07.2016, coll. B. Zlatković & S. Bogosavljević (HMN 13837).

Family Cactaceae includes about 1810 species, with natural range in tropical and subtropical areas of America (Essl & Kobler, 2008). However, several representatives of this family are considered to be significant allochthonous elements distributed in other warmer parts of the world, while in Europe their invasiveness is mostly connected to the Mediterranean region (Essl & Kobler, 2008). There are 26-29 invasive species of cacti recorded in Europe (Lambdon et al., 2008; Novoa et al., 2015). According to Essl & Kobler (2008) and Novoa et al. (2015), most invasive species from family Cactaceae, at both global (27) and European (20) level, belong to genus *Opuntia* (L.) Mill., which at the same time is also the richest genus of this family (Essl & Kobler, 2008). As a number of species of this genus is used in horticulture, in suitable conditions individuals often show subsponaneous, either reproductive or vegetative dispersal into natural ecosystems (Tashev, 2012). Presence of this species in Serbia was presented in a study by Tashev (2012), where it is mentioned as a naturalized species, and that author cites Erre et al. (2009). However, the overview of original data (Erre et al. 2009) indicates that this was an erroneous interpretation. The other literature data from Serbia do not show presence of *O. humifusa*.

*Opuntia humifusa* is a succulent plant with strongly branching, often creeping and rooting stems. The vegetative shoots in this cactus include tightly connected cladodes. They form links of 1-4 segments, often with lateral branches at the top and at the base. The cladodes are elliptical to oval, dark green, fleshy, sometimes with ridged stripes, 3-17 cm long and 4-12 cm wide, with 4-5 diagonal areoles at the widest part. The glochids are numerous,



**Fig. 2.** a - *Bidens vulgata* infructescence; b - *Opuntia humifusa* flower, c - general appearance, d - mowed plants; e - *Iris sibirica* flower; f - *Haplophyllum suaveolens* general appearance; g - distribution of *H. suaveolens* in Serbia (legend as in Fig.1).

inconspicuous. Spines are absent, which is one of the main characteristics setting this species apart from the other species of complex *Opuntia humifusa*. The flowers are 5-9 cm in diameter, hermaphroditic, while outer layers of perianth are dark green to slightly greyish-green in color. There are 8-9 inner segments and they are bright yellow. The stamens are

numerous, with yellow or yellowish-green filaments. The stigma is white, with 6-7 lobes. The fruit is a berry, 2.5-5 cm long, at first green but becoming red to orange-red as it matures, with areoles and glochids. There are numerous seeds, 4-5 mm wide and with thick coating. The number of chromosomes is  $2n=44$ .

Genus *Opuntia* shows high taxonomic complexity and most species are characterized by high infraspecific variability (Fateryga & Bagrikova, 2017). Some of the species may also be represented by atypical forms within their secondary range, so there are objective problems in species identification (Fateryga & Bagrikova, 2017).

During the last taxonomic revision there were 8 recognized species within the complex *O. humifusa* s.l. (Majure et al., 2017). *Opuntia humifusa* is morphologically most similar to species *O. mesacantha* Raf., which is characterized by presence of spines at least in the terminal part of cladodes. Parts of stem in *O. mesacantha* are more or less easily separable from each other, while there are just 3–4 areoles in the diagonal of the widest part of cladodes.

Population of *O. humifusa* in Pčinja valley is present in dry grassland and stony areas, along the local road, most probably representing a garden escape. Other plants recorded in the same habitat include: *Centaurea stoebe*, *Chondrilla juncea*, *Clinopodium alpinum* subsp. *hungaricum*, *Cynodon dactylon*, *Erodium cicutarium*, *Filago arvensis*, *Herniaria glabra*, *Petrorhagia saxifraga* and *Scabiosa argentea*. The habitats described above are in direct contact with stands of association *Scabioso-Trifolion dalmatici*, as evidenced by the combination of weed and Pontian-submediterranean elements developing under similar ecological conditions. In this phase of spread, the species is successfully reproducing by vegetative means. Although certain individuals produce abundant flowers and fruits, it is not known whether other means of dispersion are present at this locality. Population of *O. humifusa* in Pčinja valley presently occupies space of several ares and is observed to a hundred individuals. This population is observed for several years, and we believe that introduction of this species took place a few decades ago. Mowing was recorded at the locality, leading to partial hindrance to further spread of this species.

Analysis of existing data on distribution of this species in Europe (Fateryga & Bagrikova, 2017) indicates that it is present in 10 countries including Serbia. In half of these countries it is considered an invasive species, and in other half a naturalized species.

Taking into account the total abundance of population, the types of habitats where this species grows and the period of time elapsed since the first record in Serbia, we conclude that *O. humifusa* should be considered to have the status of a casual alien species in our country. At this moment, the species does not pose any significant threat to autochthonous ecosystems and habitats in areas where it has been recorded.

## Iridaceae

### 11. *Iris sibirica* L. (Fig. 2e).

- (East): Surroundings of Knjaževac, Podvis village, reed and sedge beds, 385 m, EP92, 26.05.2016, coll. S. Bogosavljević (HMN 13838).

In Serbia, *Iris sibirica* is one of the strictly protected species (Anonymous, 2010). According to Kostrakiewicz (2007), it belongs to the Euro-Siberian element. Its natural area includes Central and Eastern Europe, from northeastern Turkey, European part of Russia and western Siberia to northern Italy, but presently it is rare throughout the range (Kostrakiewicz-Gieralt, 2013). In Balkan Peninsula this species is rare with a disjunctive range in central Bosnia, Bulgaria, Montenegro and Serbia. In Serbia it was recorded at several localities in Vojvodina, central and western part of country (Stevanović et al., 1993). At the new locality its population includes a small number of individuals thriving in an area of only several square meters. The other species at the site include: *Anacamptis palustris*, *Iris pseudacorus*, *Ophioglossum vulgatum*, *Salix caprea*, *Scirpus silvaticus*, *Typha latifolia* etc. It is necessary to implement special protection measures, while the main negative factors threatening the remaining individuals of *I. sibirica* in this habitat include: drying and turning the natural habitats into cultivated land, succession of wet meadows and reed beds into shrub and forest vegetation, plantation farming of poplar trees etc.

## Juncaceae

### 12. *Juncus capitatus* Weigel

- (East): Surroundings of Pirot, Temska village, Temštica river, wet, eroded sandy and rocky places, 500 m, FN39, 28.05.2016, coll. S. Bogosavljević, M. Randelović & B. Zlatković (HMN 13839).

This threatened taxon was until recently believed to have gone extinct from the territory of Serbia (Randelović, 1999), but this study has shown presence of a third known site (Tomović et al., 2009; Zlatković & Bogosavljević, 2014). This species was first recorded in Eastern Serbia, on eroded wet areas along roads, on silicate substrate.

## Ophioglossaceae

### 13. *Ophioglossum vulgatum* L. (Fig. 1c, d)

- (East): Surroundings of Knjaževac, Podvis village, wet meadows, 385 m, EP92,

- 26.05.2016, coll. *S. Bogosavljević* (HMN 13840).
- (East): Surroundings of Svrlijig, Lalinac village, Lalinac river, wet meadows, 385 m, EP80, 29.04.2016, coll. *S. Bogosavljević, M. Randelović & B. Zlatković* (HMN 13841).
  - (East): Surroundings of Pirot, Barje Čiflik village, Čeltaš, wet meadows, 390 m, FN27, 28.05.2016, coll. *S. Bogosavljević, M. Randelović & B. Zlatković* (HMN 13842).
  - (East): Surroundings of Knjaževac, Gornja Kamenica village, Papratska river, wet meadows, 360 m, FP11, 02.06.2017, coll. *S. Bogosavljević, M. Randelović & B. Zlatković* (HMN 13843).
  - (East): Surroundings of Dimitrovgrad, Mazgoš village, alluvium, 661 m, *Salicetum albo-fragilis*, FN56, 22.06.2013, coll. *B. Zlatković & N. Stanković* (HMN 13844); Protopopinci village, alluvium, 666 m, wet meadows, *Molinio-Arrhenatheretea*, FN56, 22.06.2013, coll. *B. Zlatković & N. Stanković* (HMN 13845).
  - (East): Sićevo gorge, Dolac village, alluvium, 265 m, wet meadows, EN98, 28.05.2016, coll. *B. Zlatković, S. Bogosavljević & M. Randelović* (HMN 13846).

According to Krivošej et al. (2013), *Ophioglossum vulgatum* is distributed from the northernmost areas in Serbia, in Bačka, across Central, West, northeastern and Eastern Serbia, as well as Kosovo and Metohija. The new points of distribution indicate presence of a number of sites for this species in Eastern and southeastern Serbia. This species inhabits fragile habitat types such as wetland and marsh meadows and reed beds, but recorded abundance in new localities was never particularly high. The map of present distribution in Serbia (Stevanović ed., 1992; Zlatković & Randelović, 1993/4; Mihajlović, 1995; Randelović et al., 2000; Zlatković, 2011; Krivošej et al., 2013), including new data on range, is presented in **Fig. 2d**. In Serbia this species is included in the group of plant species protected by law (Anonymous, 2010).

## Ranunculaceae

### 14. *Eranthis hyemalis* (L.) Salisb. (**Fig. 3a, b, c, d, e**)

- (East): Surroundings of Knjaževac, Podvis village, thermophilous oak forests and edges, 325-395 m, N-NE, EP92, 02.03.2017, coll. *M. Randelović & S. Bogosavljević*, 31.03.2017, coll. *M. Randelović & S. Bogosavljević* and 11.04.2017 coll. *M. Randelović & S. Bogosavljević* (HMN 13848, 13847, 13858); Orešac village, Golemi Kamen, thermophilous

oak forests, 365 m, EP92, 05.02.2018, coll. *M. Randelović & S. Bogosavljević* (HMN 13851).

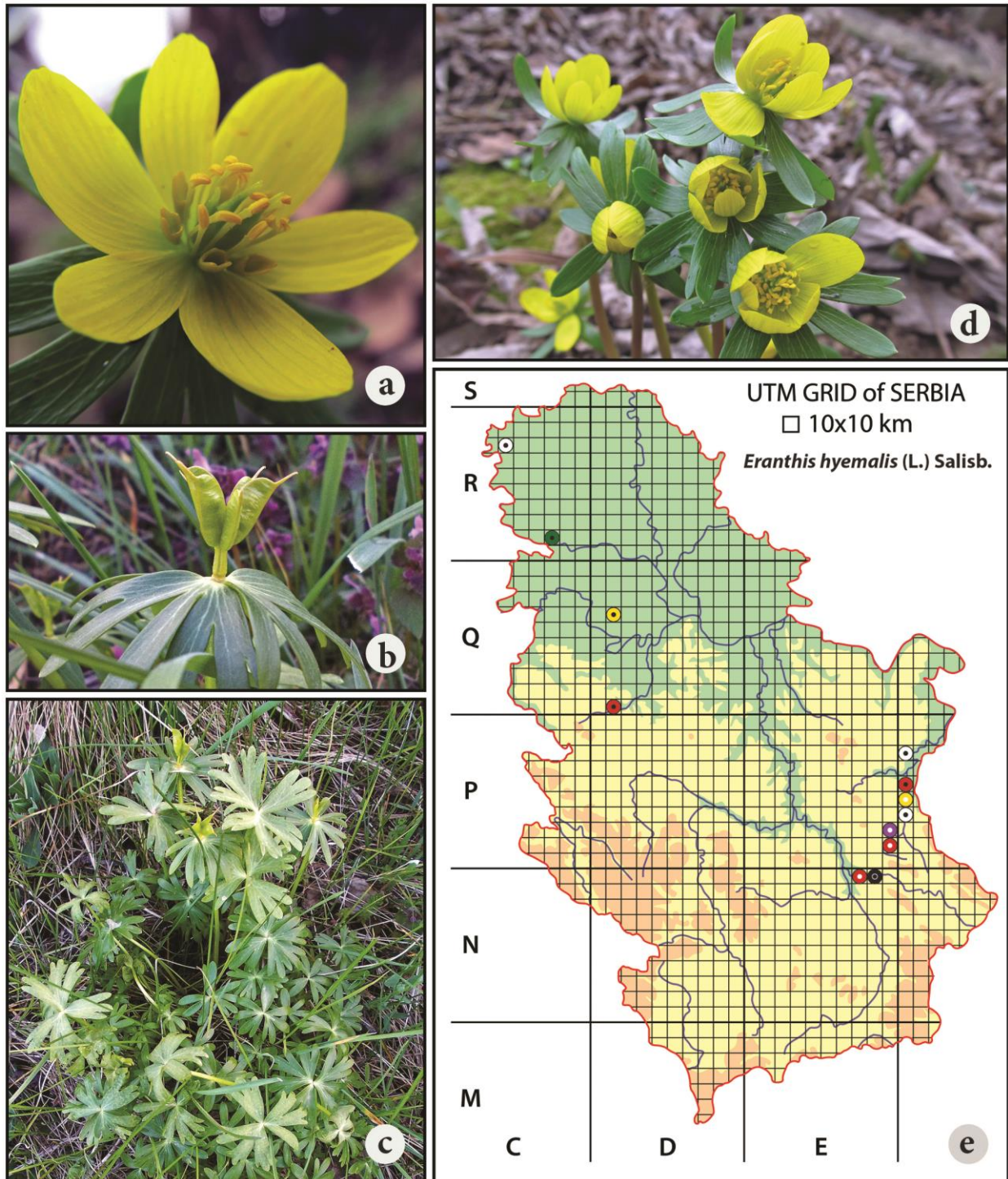
- (East): Surroundings of Knjaževac, Orešac village, Ploča, *Carpino orientalis-Quercetum mixtum*, 600 m, EP91, 13.03.2018, coll. *M. Randelović & S. Bogosavljević* (HMN 13852).
- (East): Surroundings of Zaječar, Vratarnica village, Zmijanac (Provalina), oak forests, 235 m, FP04, 24.04.2017, coll. *M. Randelović & S. Bogosavljević* (HMN 13849).
- (East): The town of Niš, Gorica hill (Tri Lipe), forest fragments and lime plantations in suburban area of the city, 265 m, EN79, 12.02.2017, coll. *B. Zlatković* (HMN 13850).

In Serbia *Eranthis hyemalis* is included in the category of strictly protected species (Anonymous, 2010), and as a critically endangered taxon it was included in the Red Book of Flora of Serbia (Budak, 1999). At the locality in Eastern Serbia (Podvis), this species lives at the edges but also inside thermophilous oak forests developed on higher, warmer slopes of the gorge of Svrliški Timok. At this locality, the population developed on the surface area of about 10 ha in form of seven smaller spatial fragments, each with 50-100 individuals. As part of this area is mostly inaccessible, we assume that this population includes a much greater number of individuals. Our estimate of ratio of flowering/fruit-bearing vs. juvenile individuals in this population is 30:70. In addition to *E. hyemalis*, the habitat at Podvis site also includes following herbaceous species: *Anemone apennina*, *Arabis procurrens*, *Asplenium ceterach*, *A. trichomanes*, *Cardamine graeca*, *Corydalis solida*, *Ficaria verna*, *Fragaria vesca*, *Glechoma hederacea*, *Hedera helix*, *Helleborus odoratus*, *Lamium purpureum*, *Orchis purpurea*, *Polypodium vulgare*, *Potentilla micrantha*, *Ruscus aculeatus*, *Smiranium perfoliatum* etc.

Approximation of population (subpopulation) size at a different locality within the same gorge (Golemi Kamen) has shown that number of *E. hyemalis* was even greater than in the first mentioned locality, considering more than a thousand individuals. As both localities are situated within the same UTM square, the total number of individuals in the UTM square is probably more than 1500. At the locality Ploča there were only a few dozen recorded individuals within the stand of oriental hornbeam shrub.

Another group (100-150 individuals) of *E. hyemalis* was also recorded in anthropogenously altered forest stands and linden plantations at hill Gorica (Tri Lipe) in immediate vicinity of Niš. However, this population develops in an immediate vicinity of a human settlement and almost certainly is spontaneous in origin.





**Fig. 3.** **a** - *Eranthis hyemalis* flower, **b** - fruit, **c** - general appearance, native habitat, **d** - subsontaneous specimens; **e** - distribution of *E. hyemalis* in Serbia and observed number of individuals (legend: circles with black dots in center - literature data, circles with white dots in center - new data): white circle - not observed, green circle - above 10000 individuals, purple circle - between 1500 and 10000 individuals, yellow circle - between 100 and 1500 individuals, red circle - under 100 individuals; black circle - probably extinct population.

The observe of number of individuals in other populations in Eastern Serbia, at localities (Vratarnica, Provalina) known from literature sources (Petrović & Lakusić, 2017), is at about several hundred individuals, but a surprisingly small

number of reproductively mature individuals was recorded in field studies. In all known localities a high percentage of individuals were infected by a type of parasitic fungus.

In light of new literature data (Petrović & Lakusić, 2017), and results of our own fieldwork, *E. hyemalis* should remain within the group of critically endangered (CR) taxa of flora in Serbia, as it is represented by a small number of spatially distant natural populations with a relatively small number of individuals. However, it is important to note that the region of Eastern Serbia, according to observed population sizes in all known localities, contains a significant part of population of this species in Serbia. Localities in vicinity of Knjaževac and Zaječar are, after the locality near Bačka Palanka (Panjković et al., 2015; Kiš et al., 2016), certainly the richest habitats in Serbia. Therefore we believe that it is necessary to take conservation measures so this species would survive in these localities in Eastern Serbia. The locality near Vratarnica is already enclosed within the Nature Park Stara Planina (Anonymous, 2008), but the locality near Knjaževac is not included in any form of spatial protection. The modified distribution map of *E. hyemalis* in Serbia, with addition of new distribution points and data on reevaluated number of individuals in comparison to Budak (1999) and Petrović & Lakusić (2017), is presented in **Fig. 3e**.

## Rutaceae

### 15. *Haplophyllum suaveolens* Ledeb. (**Fig. 2f, g**)

- (East): Surroundings of Svrljig, Plužina village, Visoka Stena, dry grasslands, 750 m, EP81, 18.05.2018, coll. *M. Randelović & S. Bogosavljević* (HMN 13853).
- (East): Surroundings of Dimitrovgrad, dry steppe-like habitats, 610 m, FN46, 15.05.2018, coll. *S. Bogosavljević, M. Randelović & B. Zlatković* (HMN 13854).
- (East): Surroundings of Niš, Sićevo village, rocky places, 360 m, EN89, 20.05.2014, coll. *B. Zlatković* (HMN 13855).
- (East): Surroundings of Niš, Kamenica village, dry grasslands, 440 m, EP70, 23.05.2014, coll. *B. Zlatković* (HMN 13856).

The range of this steppe species reaches from southern Siberia to Asia Minor on one side, and Romania and the eastern part of Balkan Peninsula on the other side (Mayer & Wraber, 1974). Within the Balkan Peninsula the species is present in Bulgaria, Macedonia, Greece, Albania and Serbia (Hayek, 1924; Tutin et al., 1968). It inhabits dry, grassy, partially rocky terrain on limestone substrate. *Haplophyllum suaveolens* is a strictly protected species in Serbia (Anonymous, 2010). Population size is observed to a few hundred in vicinity of Svrljig and only a handful of individuals in new localities in vicinity of Niš and Dimitrovgrad. The present

distribution of this species in Serbia is presented in **Fig. 2g**, according to literature data (Diklić, 1973; Lakušić & Niketić, 1988; Randelović et al., 2000; Randelović et al., 2007; Pavlović et al., 2018) and results of our current research.

## Urticaceae

### 16. *Parietaria lusitanica* L. subsp. *serbica* (Pančić) P.W.Ball

- (East): Surroundings of Knjaževac, Stogazovac village, Ždrelo gorge, fissures of sheltered rocks, 390 m, limestone EP93, 08.05.2016, coll. *M. Randelović & S. Bogosavljević* (HMN 13857).

This subendemic species inhabits limestone rock shelters, cave entrances and other similar habitats of southern Carpathians, Dobrogea and eastern part of Balkan Peninsula (Stevanović et al., 2014). The new locality fits within the southwestern part of global range of this rare species. In Serbia, *Parietaria lusitanica* subsp. *serbica* is protected by law (Anonymous, 2010).

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