Distribution and conservation status of several new and neglected vascular plants in Serbia

Bojan Zlatković[1], Gordana Tomović[2], Vladimir Ranđelović[1], Snežana Vukojičić[2] & Marjan Niketić[3]

[1] Department of Biology and Ecology, Faculty of Natural Sciences, University of Niš, 33 Višegradska St., 18000 Niš, Serbia, e-mail: bojanzlat@yahoo.com (author for correspondence); vladar@pmf.ni.ac.yu

[2] Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade, 43 Takovska St., 11000 Belgrade, Serbia, e-mail: gtomovic@bio.bg.ac.rs; sneza@bio.bg.ac.rs

[3] Natural History Museum, 51 Njegoševa St., 11000 Belgrade, Serbia, e-mail: mniketic@nhmbeo.rs

Receiced: January 19, 2009 ▹ Accepted: March 11, 2009

Abstract. This article presents the distribution of the following new or neglected plants in Serbia: *Botrychium matricariifolium*, *Thesium auriculatum*, *Hypericum montbretii*, *Vicia laeta, Eleocharis mamillata,* and *Vulpia muralis*. The taxonomic remarks, ecological preferences, as well as the status of threat of the presented species in Serbia estimated according to IUCN should provide useful information for plant protection management in this region of the Balkans.

Key words: distribution, endangered plants, new taxa, Serbia, vascular flora

Introduction

The Balkan Peninsula is a region of matching and approval of most diverse floristic influences. In phytogeographical sense this area borders on the C Europe, alpine, boreal and arctic parts of Eurasia from the one side, and the E and C Mediterranean region on the other. Such influences represented by long-term florogenetic and plant migration processes (from the Tertiary, over the Ice Age and especially in the Pleistocene, and up to date) created the original flora of the Peninsula composed of different in origin species (Stevanović & al. 1999).

According to Turrill (1929), the Balkan Peninsula is characterized by the presence of two main types of flora: the Mediterranean and the Central European. Each of these types is typically associated with a corresponding set of vegetation communities and has developed under different climatic conditions. Still, Turrill pointed out that there are transitional areas showing all possible mixtures of species of the two floristic types, but the available evidence is in favour of a geologically recent extension of the Mediterranean type and probably this spreading still continues.

The central part of the Balkan Peninsula, including Serbia, is characterized by a significant number of xerophilous habitat types, which generated adequate conditions for the development and establishment of plant species which belong to the Mediterranean area type. The spread of these plants to the north of the Peninsula is predominantly limited by the influence of the continental climate that is more dominant in the central parts of Serbia. Therefore, a significant number of xerothermophilous elements which originate from the Mediterranean region had spread to the north of the Balkans through the river valleys and canyons after the period of glaciation.

In Serbia many rivers had brought such influences: Morava, Pčinja, Struma, Dragovištica, Beli Drim, Drina, Ibar, Toplica, Nišava, Timok, etc. Thus, distribution of the Mediterranean elements is particularly characteristic for southern parts of Serbia. On the other hand, most habitats favourable for Mediterranean plants had appeared after a strong human impact, i. e. forest clearing and intensive grazing, turning of semi-natural habitats into agricultural land, etc., and had forced the spread of Mediterranean plants inland in the Peninsula.

Furthermore, some important parts of the Balkan Peninsula represent a refugia for diverse floristic elements, not only of the glacial (arctic and alpine), but also of the boreal flora that inhabited the coniferous taiga-like forests, peat-bogs and tundra-like vegetation during the peak of glaciations. Boreal plant species are nowadays limited to specific habitats in the mountains of the Balkan Peninsula. Such habitats are the peat-bogs and mesophilous meadows, as well as the boreal coniferous and mixed, coniferous-beech forests in the mountainous and subalpine region, with sporadic occurrences in the mesophilous deciduous forests in the mountainous zone. The existence of boreal relict species in the Balkans, as one of the southernmost distribution points, undoubtedly is a consequence of plant migration during the Ice Ages. The major refugee species centres of the glacial and boreal flora across the territory of Serbia are the mountain massifs of Šar Planina, Prokletije, Kopaonik, Stara Planina, Tara, and Vlasina highlands (Vukojičić 2008).

The aim of the present article is to examine the distribution patterns of six new or neglected plant species in Serbia, which belong to either Mediterranean or to boreal area types. The complete distribution of these plants in Serbia is based on a compilation of new records and the existing floristic reference literature data. Besides the new field records, some unpublished chorological data on the material deposited in the Herbarium of the University of Belgrade (BEOU) and the Herbarium of the Natural History Museum in Belgrade (BEO) are also included.

Some of the listed taxa are recognized as regionally threatened (IUCN 2001) and should be included in the *Preliminary Red List of Threatened Plant Species of Serbia* (Stevanović & al. unpubl.), or proposed to be protected under the national legislation in the future.

Material and methods

This paper is a continuation of the intensive floristic and chorological studies of the vascular flora of Serbia undertaken recently by the authors of this article (Niketić & Tomović 2003, 2008; Zlatković & al. 2005; Tomović & al. 2007). Besides the field survey, checking and revision of herbarium material and numerous literature sources were used to supplement the distribution records. Distribution of species in Serbia is mapped on a 10 × 10 km^2 UTM grid system (UTM Zone 34T).

The collected material of plant species is deposited in the Herbarium of the Institute of Botany and Botanical Garden "Jevremovac", University of Belgrade (BEOU) and the Herbarium of the Natural History Museum in Belgrade (BEO) (Holmgren & al. 1990; *http://sciweb.nybg.org/science2/IndexHerbariorum.asp*) as well as in the private collection of Bojan Zlatković (BZ).

Descriptions of plants are based on the morphological features of the checked out herbarium specimens as well as on the recent floristic sources (Ball 1968; Robson 1968; Stace & Cotton 1980; Walters 1980; Hendrych 1993; Rothmaler 1993). The estimation of the threatened status of some of the listed species for the territory of Serbia is made according to the IUCN Red List Categories and Criteria (2001), national legislation of Serbia and finally, by following the *Preliminary Red List of Threatened Plant Species of Serbia* (Stevanović & al. unpubl.).

Results and discussion

Ophioglossaceae

1. *Botrychium matricariifolium* (Retz.) A. Braun ex W.D.J. Koch (Fig. 1)

General distribution. Europe: C Europe, Scandinavia and European part of the Russian Federation, with some isolated spots in the south (SE France, Corse, the Apennine and Balkan Peninsulas); North America: C and E Canada and N, C and E parts of the United States. This species belongs to the amphiatlantic boreal-subboreal floristic element. Distribution of this boreal plant is still poorly known in the Balkan Peninsula. According to the *Atlas Florae Europaeae* (Jalas & Suominen 1972), it is represented by only one 50 × 50 km^2 area of the mentioned territory that be-

longs to Quafë e Guricus in N Albania (Hayek 1924). After the publication of AFE 1, the species was also found in Croatia (Marković 1975) and Bulgaria (Stoeva 1991; Dimitrov 1994).

Distribution in Serbia. *Serbia* (*Eastern*): Stara Planina Mts, peak Tupanar, *Nardetum strictae*, Permian red sandstone, 1900 m, 09.07.2006, FP-30, coll./det. *B. Zlatković* & *V. Ranđelović* (BEOU 16261) (Fig. 2).

A new record of *B. matricariifolium* in Serbia was made for the first time by Zlatković & Ranđelović (2007). Small sites within the Balkans represent important refugia across the area of this boreal relict species.

Description. A perennial herbaceous plant with 4-20 cm long leaves. Lamina compound, nearly sessile, oblong, ovate or deltate-ovate, two-pinnate, longer then wide, almost glabrous, with dichotomous free veins. Pinnae and pinnules oblong to ovate, obtuse and tapering to the apex, entire or crenate, with usually not very pronounced midrib. Fertile spikes are compound, with sub sessile free sporangia sorted in two rows. $2n = ca.$ 180 (Rothmaler 1993).

Two species, *B. multifidum* (S.G. Gmel.) Rupr. and *B. lunaria* (L.) Sw. were reported from Serbia (Vukićević 1992). *Botrychium matricariifolium* differs from the first species in oblong, longer then wide and almost completely glabrous lamina and in 2-pinnate lamina and segments with more or less conspicuous midrib from the second one.

Conservation status. The population of *B. matricariifolium* in Serbia is very poor, represented by about 50 individuals and requires urgent conservation measures. According to the IUCN Red List Categories and Criteria (2001), its conservation status should be estimated as **Critically Endangered** [CR B1ab(ii,iii,iv); D] in Serbia.

Botrychium matricariifolium grows in the vegetation of high-mountain pastures in Stara Planina Mts. It inhabits a subalpine pasture community *Nardetum strictae* Greb. 1950 on bedrock composed of red Permian sandstone, at the west slopes of the mountain. It was found together with the following vascular plants and lichens: *Nardus stricta* L., *Thymus vandasii* Velen., *Crepis viscidula* Froel., *Achillea lingulata* Waldst. & Kit., *Crocus veluchensis* Herb., *Thamnolia vermicularis* (Sw.) Schaer., *Cetraria islandica* (L.) Ach, etc.

Fig. 1. *Botrychium matricariifolium*

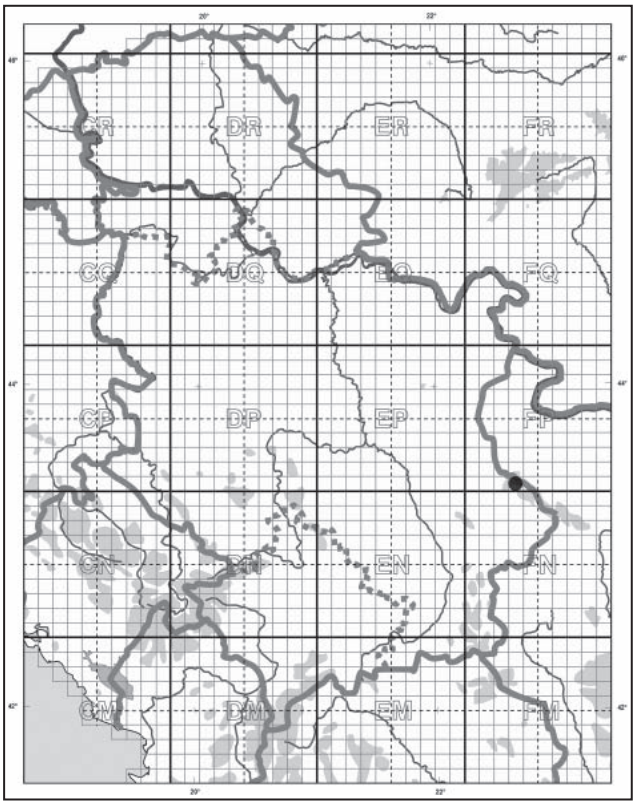

Fig. 2. Distribution of *Botrychium matricariifolium* in Serbia.

Santalaceae

2. *Thesium auriculatum* Vandas

General distribution. Balkan Peninsula (C, E and SE parts of the Dinaric Alps in Bosnia and Herzegovina, Montenegro, W, NW & SW Serbia).

Distribution in Serbia. *Serbia* (*Northwestern*): Mt Medvednik, CP-99, coll. *J. Pančić* sub *T. divaricatum*, rev. *R. Hendrych* (BEOU 465); *Serbia* (*Western*): Mokra Gora, 1866, 1875, coll. *J. Pančić* sub *T. divaricatum*, rev. *R. Hendrych* (BEOU 466, 468, 15057); Mt Mučanj, DP-72, coll. *anonymous* sub *T. divaricatum*, rev. *R. Hendrych* (BEOU); Ovčarsko-Kablarska Gorge, 06.1926, DP-36, coll. *Th. Soška* sub *T. divaricatum*, rev. *R. Hendrych* (BEOU); Mt Tara, gorge of river Derventa, 06.1877, CP-66, coll. *J. Pančić* sub *T. diffusum* (BEOU 15059), rev. *R. Hendrych* (BEOU); Mt Zvezda, Galine, Brusnički stream, limestone, 22.06.2002, CP-66, coll. *B. Zlatković* & *D. Ostojić* (BEOU 16262), det. *B. Zlatković*; Užice, surroundings, 23.07.1877, coll. *anonymous* sub *T. divaricatum,* rev. *R. Hendrych* (BEOU); Užice, coll. *J. Pančić* sub *T. divaricatum*, rev. *R. Hendrych* (BEOU 15058); *Serbia* (*Southwestern*): Prijepolje, canyon of river Mileševka, limestone rocks, 08.07.2002, CP-90, coll./det. *Zlatković, B.* (BEOU 16080) (Fig. 3). *Thesium auriculatum* is a regional endemic of C & E Dinaric Alps in the Dinaric Mountain Province. Some localities in W Serbia represent the northernmost points of the species distribution.

This species was neglected in the *Flora of Serbia* (Kojić 1973; Sarić & Diklić 1986). Bearing in mind the aforementioned herbarium material from BEOU, one can conclude that Hendrych was the first who noticed its presence in Serbia. Unfortunately, the territorial division of the Former Yugoslavia was not given in *Flora Europaea* (Hendrych 1964, 1993) and he only mentioned "Mountains of Jugoslavia and N. Albania". In the *Atlas Florae Europaeae* (Jalas & Suominen 1976) only two dots (50 × 50 square km) in the bordering area of W and SW Serbia could be noticed. Besides that, there is a report on the occurrence of uncertain and dubious taxon *T. divaricatum* Jan ex Mert. & Koch subsp. *vandasii* Rohlena in the canyon of river Ljutina (Sutjeska), in the vicinity of Priboj in SW Serbia (Lakušić & Redžić 1989, sub "*T. vandasii*" comb. prov.). This record is doubtful and probably refers to *T. auriculatum*.

Description. A perennial plant, herbaceous or woody in the base, not stoloniferous, hemiparasitic. Stems c. 25-30 cm high, ascending or erect, simple or branched in the upper part. Leaves narrowly linear, 1-veined. Inflorescence paniculate, with long, racemose or subspicate branches. Flowers often subsessile and more or less secund. Bracts and bracteoles equal to flowers; bracts enlarging into fruit, up to six or more times as long as fruit. Perianth broadly campanulate, 5-lobed. Nut ellipsoid, 4–5 times as long as the persistent perianth, which has small but prominent extra lobes (auriculae) of the disc between the five lobes. The last attribute clearly distinguishes *T. auriculatum* from all other species of the genus *Thesium* in Serbia.

The species inhabits steep, rocky slopes in the canyons and gorges of C, E & SE Dinaric Alps. It was recorded in endemic, chasmophytic vegetation on limestone cliffs and rocks of *Edraianthion jugoslavici* Lakušić 1968 alliance and *Amphoricarpetalia* Lakušić 1968 vegetation order.

Conservation status. According to IUCN Red List Categories and Criteria (2001) its conservation status should be estimated as **Near Threatened** (NT) in Serbia.

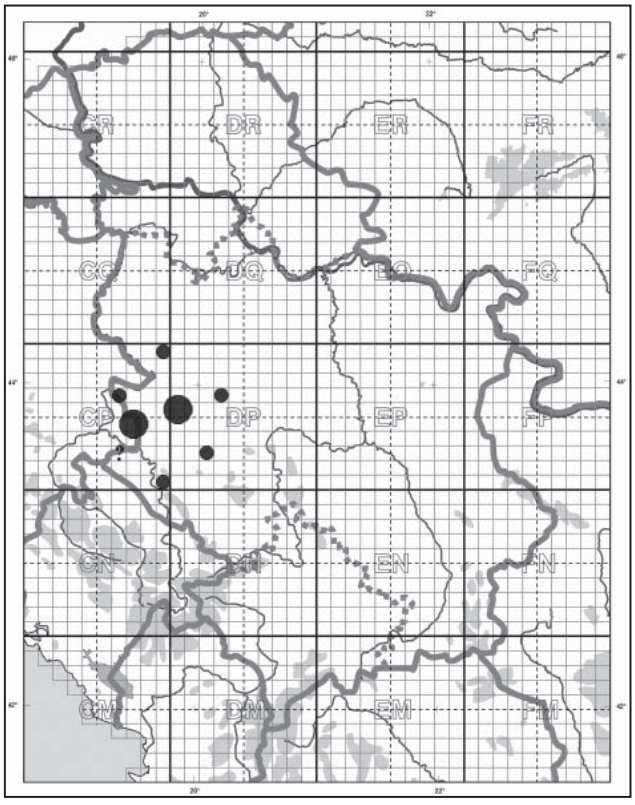

Fig. 3. Distribution of *Thesium auriculatum* in Serbia.

Guttiferae (Hypericaceae)

3. *Hypericum montbretii* Spach (Fig. 4)

General distribution. Europe: SE parts of the Balkan Peninsula (Macedonia, Greece, Turkey in Europe), ?S Ukraine; Asia: Turkey (Anatolia), Syria and Georgia.

Distribution in Serbia. *Serbia* (*Southeastern*): Mt Kozjak, Delinovački Rid, migmatite, 16.05.2004, EM-78, coll./det. *B. Zlatković* (BEOU 16255); Mt Kozjak, Goleme Uši, migmatite, 16.05.2004, EM-78, coll./det. *B. Zlatković* (BZ, no. 1205); Mt Starac, Karaula, fine-grained biotite gneiss, 04.06.1995, EM-78, coll./det. *B. Zlatković* (BEOU 16256); Mt Kozjak, Gornji Starac village, fine-grained biotite gneiss, 07.1999, EM-78, coll./det. *B. Zlatković* (BEOU 16260); Mt Široka, Dumbije, leptynolite and mica schist, 12.06.2004, EM-88, coll. *B. Zlatković, N. Ranđelović, S. Stojanov* & *D. Avramović*, det. *B. Zlatković* (BEOU 16257); Pčinja river gorge, Vogance village, fine-grained biotite gneiss, 25.04.2000, EM-88, coll./det. *B. Zlatković* (BEOU 16258); Pčinja river gorge, from Vogance to Jablanica villages, peak Kostin Čukar, fine-grained biotite gneiss, 15.05.2004, EM-89, coll./det. *B. Zlatković* (BEOU 16259) (Fig. 5).

Occurrence of *H. montbretii* in SE Serbia represents the northernmost point of the species distribution in the Balkans and extension of its range from Macedonia. During revision of the herbarim material in BEOU and BEO, the following new data for the flora of the *Republic of Macedonia* have been found: Strumica, Peraj, 10.06.1925, coll. *P. Černjavski* (BEO 08756); Strumica, Adžilivert, 01.05.1926, 16.07.1937, coll. *I. Rudski* (BEO 08753, 08751); Strumica, Careve Kule, 17.07.1937, coll. *I. Rudski* (BEO 08752); Demir Kapija, river Gradeška, 20.06.1925, coll. *P. Černjavski* (BEO 08755); Demir Kapija, Javorlica gorge, 14.06.1925, coll. *P. Černjavski* (BEO 08754, 08758); from Radovište and Strumica to Orahovica, Gradište, Šuriljasto Brdo, 22.05.1926, coll. *P. Černjavski* (BEO 08760); Mt Ograždeh, Ilovica, nearby the second water mill, 27.04.1926, coll. *P. Černjavski* (BEO 08761); Mt Voden, coll. *Kindl* (BEOU 1901).

This oriental – E Mediterranean representative of the section *Drosocarpium* Spach. is new for the flora of Serbia. In the valley of river Pčinja it is common and represented by a large population. It has a very similar habitus and could be easily confused with *Hypericum rochelii* Griseb., a more or less common plant in C, E and S Serbia (Stjepanović-Veselčić 1972). The new locations of *H. montbretii* in SE Serbia are distant from the closest ones in Macedonia (Micevski 1995) and Bulgaria (Jor-

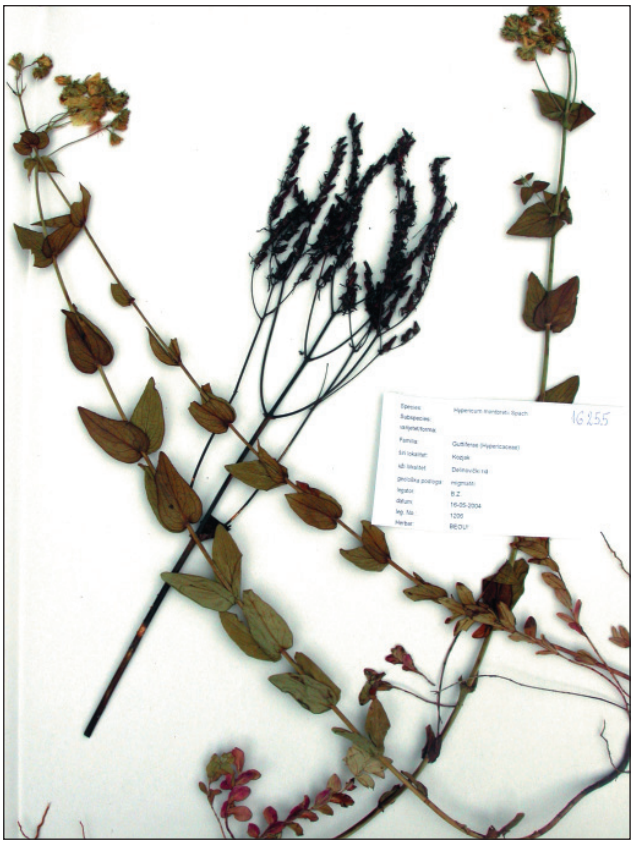

Fig. 4. *Hypericum montbretii* (herbarium sheet).

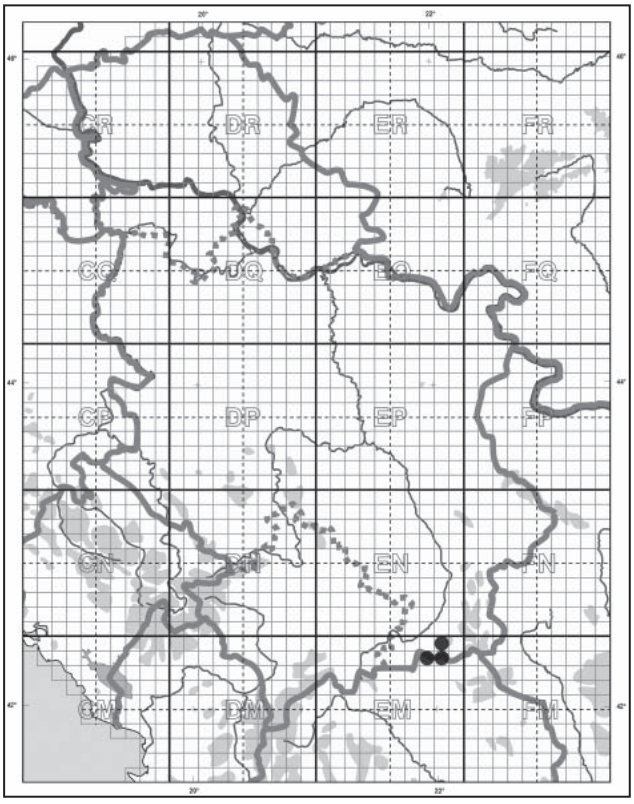

Fig. 5. Distribution of *Hypericum montbretii* in Serbia.

danov & Kožuharov 1970) and represent the northern limits of the species distribution in the Balkans.

Description. A perennial herb, erect or procumbent in the base, up to 60 cm high stems. Leaves 15-50 mm, ovate to oblong, usually opposite, often black-glandular ciliate. Sepals acute to acuminate, rather sparsely black-glandular ciliate and with few or no superficial black dots. Petals occasionally with subapical, superficial black dots. Capsule without dorsal vittae, but with numerous round, orange vesicles. *Hypericum montbretii* is very similar to the other representatives of sect. *Drosocarpium*, especially to *H. rochelii* and *H. perfoliatum* L. It can be distinguished by the narrowly pyramidal capsule and almost linear patent or deflexed sepals in the fruit.

Hypericum montbretii inhabits exposed slopes covered by thermophilous oak woods, as well as rocky and grassy habitats with scattered groups of *Quercus cerris* L. and *Juniperus oxycedrus* L.

Conservation status. The valley of river Pčinja is the single known locality in Serbia where *H. montbretii* grows. The population is represented by a large number of individuals, but spatially restricted and requires urgent conservation measures. The conservation status of the taxon should be estimated as **Endangered** [EN B2b(ii,iii,iv)c(i,ii,iii)] in Serbia.

Leguminosae

4. *Vicia laeta* Ces. (syn. *V. barbazitae* Ten. & Guss.) (Fig. 6)

General distribution. Europe: C Mediterranean region (France, Italy, Corse, Sicily and Malta archipelago) and S parts of the Balkan Peninsula (Macedonia, Bulgaria, Greece); Asia: Turkey (Anatolia).

Distribution in Serbia. *Serbia* (*Southeastern*): Mt Kozjak, slopes above St. Prohor Pčinjski Monastery, *Carpinetum orientalis*, 27.04.2000, EM-78, coll./det. *M. Niketić* & *G. Tomović* (BEO 20000404); Mt Starac, Gornji Starac village, thermophilous forest of oak and thickets, *Orno-Quercetum pubescentis*, fine-grained biotite gneiss, 21.04.2004, EM-78, coll. *B. Zlatković, D. Jović* & *S. Puzović*, det. *B. Zlatković* (BZ, no. 2572); Pčinja river gorge, Jablanica village, thermophilous forest of oak and thickets, *Orno-Quercetum pubescentis*, fine-grained biotite gneiss, 21.04.2004, EM-89, coll. *B. Zlatković, D. Jović* & *S. Puzović*, det. *B. Zlatković* (BZ, no. 2540); Pčinja river gorge, Barbace village, thermophilous forest of oak and thickets, *Orno-Quercetum pubescentis*, fine-grained biotite gneiss, 21.04.2004, EM-79, coll. *B. Zlatković* & *D. Đorđević*, det. *B. Zlatković* (BZ, no. 2535); Pčinja river gorge, from Vogance to Jablanica village, peak Kostin Čukar, fine-grained biotite gneiss, 15.05.2005, EM-89, coll. *B. Zlatković* & *N. Stamenović*, det. *B. Zlatković* (BZ, no. 1414) (Fig. 7).

Fig. 6. *Vicia laeta*

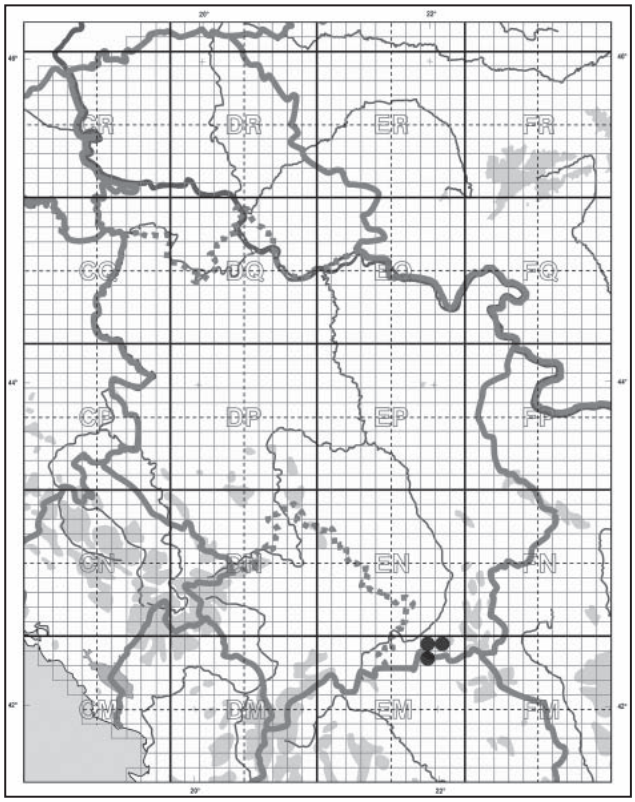

Fig. 7. Distribution map of *Vicia laeta* in Serbia.

Few, relatively small and distant subpopulations of this species were found in the lower reaches of the valley of river Pčinja (Niketić 2000). The closest species findings consider localities in Macedonia (Micevski 2001) and Bulgaria (Kuzmanov 1992). New records for *V. laeta* in Serbia represent the northern limits of its distribution in the Balkans.

Description. Sparsely or densely pubescent annual plant, 30-60 (80) cm high. Leaves consist of 3-6 pairs of leaflets with a branched tendril on the top. Leaflets obovate to elliptical, 10-20×8-12 mm, terminaly notched and mucronate. Flowers solitary, 18-22 mm long, very shortly pedunculate. Calyx teeth equal, about as long as tube; corolla yellow with blue wings; legume brown, 40×6-8 mm, glandular and sparsely pubescent when young, glabrous at ends; seeds 8–10, hilum 1/6 of the circumference of the seed.

The species belongs to the section *Vicia*, and can be distinguished by the size of calyx teeth, corolla length and stain, colour and pubescence of the legume from the most similar *V. grandiflora* Scop.

Vicia laeta inhabits exposed slopes covered by scattered thermophilous oak woodland and thickets. It was found at lower altitudes, on siliceous ground covered with *Orno-Quercetum pubescentis* and other thermophilous, mainly forest vegetation.

Conservation status. As it was mentioned before, the species population in the valley of river Pčinja is represented by a small number of individuals inhabiting a relatively small area. The threatened status of this species in Serbia is estimated as **Critically Endangered** [CR B1b(ii,iii,iv)c(i,ii,iii)].

Cyperaceae

5. ***Eleocharis mamillata*** H. Lindb. f. (Fig. 8)

General distribution. Europe: C Europe, European parts of Russia, the Ukraine, Romania, isolated spots in Corse, Balkan Peninsula and the Apennines; Asia: Siberia, up to Mongolia, China and Japan in the east. An Eurasian (Eurosibirian) boreal-subboreal species.

Distribution in Serbia (Fig. 9)

Eleocharis mamillata* subsp. *mamillata

Serbia (*Southeastern*): Vlasina plateau**,** Bratanov Del, muscovite-chlorite schist, 11.06.2007, FN-02, coll./det. *B. Zlatković* & *V. Ranđelović* (BEOU 16265); Vlasina, 15.07.1948, coll. *D. Milovanović*, det. *B. Zlatković* (BEOU); Mt Ostrozub, Dobro Polje, 23.06.1953, FN-04, coll. *D. Milovanović*, det. *B. Zlatković* (BEOU).

Fig. 8. *Eleocharis mamillata* subsp. *mamillata*

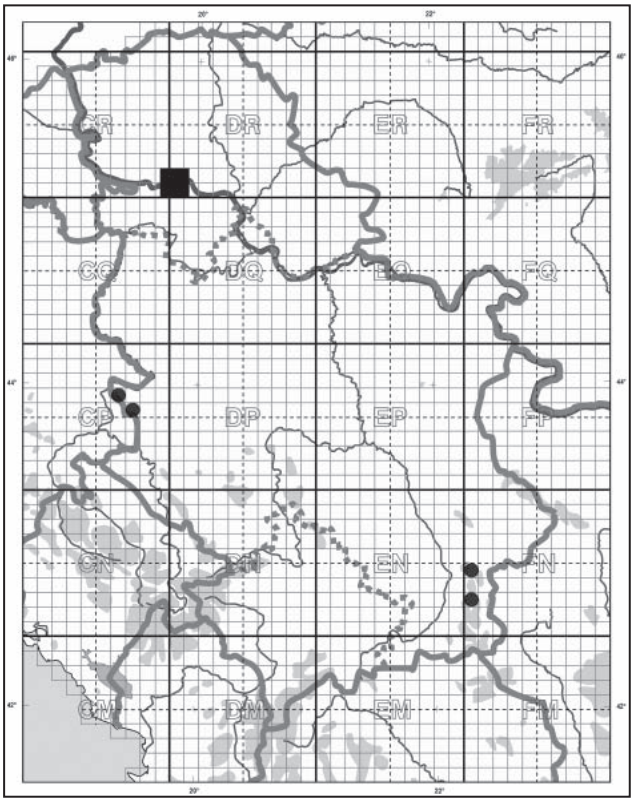

Fig. 9. Distribution of *Eleocharis mamillata* in Serbia.

Eleocharis mamillata* subsp. *austriaca (Hayek) Podp.

Serbia (*Western*): Mt Tara, Zaovine village, 1866, CP-75, coll. *J. Pančić* sub *E. uniglumis*, rev. *B. Zlatković* (BEOU 12412); Mt Tara, Batura, 5 km towards peak Crvene Stene, 20.08.2000, CP-66, coll. *V. Stevanović* & *S. Vukojičić* sub *E. palustris* (BEOU 14449), rev. *B. Zlatković*

The presence of this neglected boreal species and subspecies in Serbia is associated with only few literature data collected from two very distinct regions. It was reported for the first time in the vicinity of Novi Sad, in *Bačka region***,** by Obradović & Budak (1974). Some 30 years later, *E. mamillata* was found in *Southeastern Serbia* (Vlasina region) by Zlatković & Ranđelović (2007). Obviously, it is a very rare species in Serbia. Recent distribution, excluding the neglected spot in the Pannonian Plane, includes only five localities in two distant mountainous regions of Serbia. Except for the records from Vlasina Plateau, there are only a few herbarium specimens in BEOU from Mt Tara, Mt Ostrozub, and again Vlasina region that have confirmed its presence in the country. Two subspecies of *E. mamillata* have been recognized by checking out the herbarium collections and material from the field: the typical one is in the Southeast Serbia and subsp. *austriaca* is in the area of West Serbia. In order to find out the complete plant distribution in Serbia, it will be necessary to revise large amounts of cited literature and records for similar and related species *E. palustris* (L.) Roem. & Schult.

Description. A caespitose perennial plant, with short rhizome and underground stolons. Stems simple, glabrous, leafless, except for basal sheaths, weak and easily cracked, with 8–16 vascular bundles (visible especially in dried material as distinct ridges). Inflorescence single, many-flowered, terete terminal, yellowish-brown to dark- brown spikelet with spirally arranged glumes and two subequal empty glumes in the base. Nut usually finely punctate, rounded by well-developed bristles, with a persistent swollen style-base (stylopodium). $2n = 16$ (Walters 1980).

Typical subspecies (subsp. *mamillata*) is characterized by mammiform stylopodium, much wider then long, with obvious constriction at junction with nut. Bristles (5-)6–8, usually much longer then nut. Stems with 8–12 vascular bundles as distinct ridges. Spikelets in ripe fruit ovoid to broadly conical, usually dark-brown.

Eleocharis mamillata subsp. *austriaca* differs by stems, with 12–16 vascular bundles and ripe fruit spikelets broadly conical and yellowish-brown. Stylopodium at least twice longer than wide, with small constriction at junction with nut. Nut surrounded by (4-)5(-6) long bristles.

Eleocharis mamillata can be distinguished from other members of *E. palustris* group by short, much wider than long stylopodium, and perianth consists of 5–8 (rarely 4) long bristles. It grows in vegetation that covers occasionally flooded lake banks composed of boggy soil. This type of vegetation is included within the alliance *Nanocyperion flavescentis* W. Koch 1926 and order *Nanocyperetalia* Klika 1935. It was recorded in the plots of association *Elatino triandrae-Eleocharetum acicularis* V. et N. Ranđelović 1995, together with the following species: *Ranunculus flammula* L.*, Eleocharis palustris, Eleocharis acicularis* (L.) Roem. & Schult.*, Carex curta* Good.*, Crypsis alopecuroides* (Piller & Mitterp.) Schrad.*, Ranunculus repens* L.*, Carex echinata* Murray*, Carex ovalis* Good. etc.

Conservation status. The species is threatened, and according to IUCN Red List Categories and Criteria (2001) its conservation status should be estimated as **Endangered** [EN B2b(ii,iii,iv)c(ii,iv)] in Serbia.

Gramineae

6. *Vulpia muralis* (Kunth) Nees (Fig. 10)

General distribution. Europe: S, SW and SE parts; Asia: W parts of Asia and Arabian Peninsula; Africa: N Africa and Macaronesia; introduced in S Africa, S America (W and S parts with Brazil) and Australia.

Distribution in Serbia. *Metohia*: Đakovica, meadows, 23.05.1913, DM-49, coll. *N. Košanin* (BEOU), det. *B. Zlatković*; Prizren, the gorge of river Prizrenska Bistrica, 05.05.1913, DM-87, coll. *N. Košanin* (BEOU), det. *B. Zlatković*; *Serbia* (*Southeastern*): Pčinja river gorge**,** Šaprance village, marl, shale and sandstones, 15.07.2004, EM-89, coll./det. *B. Zlatković* (BEOU 16148); Mt Široka, Dumbije, 12.06.2004, EM-88, coll. *B. Zlatković, N. Ranđelović, S. Stojanov* & *D. Avramović* (BEOU 16149), det. *B. Zlatković*; Mt Kozjak**,** Delinovački Rid, fine-grained biotite gneiss, 16.07.2004, EM-78, coll./det. *B. Zlatković* (BZ, no. 1884) (Fig. 11).

The occurrence of this species in SE Serbia represents the northernmost limits of its spread from the Mediterranean region to the C Balkan Peninsula.

Fig. 10. *Vulpia muralis* (herbarium sheet).

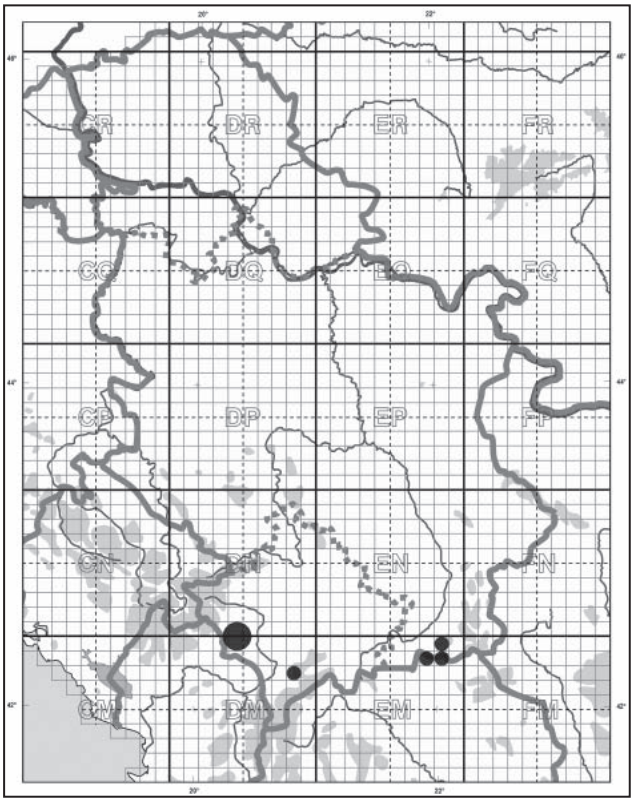

Fig. 11. Distribution of *Vulpia muralis* in Serbia.

Description. An annual plant, with usually 10-60 cm long, erect stems. Inflorescence a sparingly branched, usually erect panicle or, seldom, raceme 3-15 cm, ± well exerted from the uppermost leaf-sheath. Pedicels 0.5-3.5 mm. Spikelets 5-10 mm (excluding awns), disarticulating below each fertile floret; most florets fertile; distal 1–2(-3) florets gradually reduced and male or sterile. Lower glume 1-3(6) mm, ¼ – ½ as long as upper; upper glume 4-8(-10) mm (including awn up to 2 mm). Lemma 4-7(-10) mm, with an awn usually 2-3 times as long, 0.8-1.3 mm wide, finely 5-veind; callus *ca.* 0.2 mm, rounded, glabrous. Anthers 1(-3), 0.3-0.7 mm, usually included in anthesis. Ovary glabrous. $2n = 14$.

The species belongs to section *Monachne* Dumort. It is similar and often confused with *V. myuros* (L.) C.C. Gmel., a common and widespread species in Europe and also naturalized out of its native range. Among the other differences, the most obvious one is that *V. muralis* has long exerted and gracile inflorescence, while in the *V. myuros* it is more robust and covered with the uppermost leaf-sheath.

Vulpia muralis mainly appears in pioneer, open, thermophilous and grassy annual vegetation of the alliance *Vulpio-Lotion* H-ić 1960 and order *Thero-Brachypodietalia* Br.-Bl. 1936, on sandy soils, or rocky ground composed of marl, shale and sandstones, as well as silicate biotite gneiss.

Conclusions

Four newly recorded species for Serbia are presented here: *Botrychium matricariifolium, Hypericum montbretii*, *Vicia laeta,* and *Vulpia muralis*. Furthermore, the first herbarium records are given from the same territory for two neglected plant species: *Thesium auriculatum* and *Eleocharis mamillata*. By including the comprehensive literature data, we have created the final distribution maps for the listed taxa on the territory of Serbia. On the basis of compilation of chorological, ecological and conservational information on the listed taxa we have found out the following facts:

The new locality of *B. matricariifolium* in the high-mountainous region in E Serbia fits into the known range of this species in the Balkans. Our field observations have shown that this plant is extremely rare in its natural habitats in Serbia.

For the neglected endemic species *T. auriculatum*, we have presented the first herbarium records for the

territory of Serbia in seven UTM squares. The new findings in Serbia show extended distribution of a taxon restricted to the Illyrian Floristic Province.

Seven chorological records of *H. montbretii* within three mapped units are presented for Serbia. Some additional chorological spots are given for Macedonia.

The closest findings of *V. laeta* refer to localities in Macedonia and Bulgaria, while records in SE Serbia represent the northern limits of the species general distribution.

Data on the occurrence of *E. mamillata* in Serbia are related to one single spot in N Serbia. Records of this plant in SE Serbia and three unpublished herbarium data contribute to better understanding of its distribution. Revisions of the material have recognized two subspecies of *E. mamillata*: the typical one in the SE and subsp. *austriaca* in W Serbia.

The occurrence of *V. muralis* in Serbia shows the northern limit of its spread from the Mediterranean to the Central Balkan Peninsula. Four new records are reported: two discovered in SE Serbia and two based on herbarium specimens from the Metohia region.

On the basis of estimated conservation status according to IUCN Red List Categories and Criteria (2001) we proposed following species to be included in the next volume of *Red Data Book of Flora of Serbia* and protected by national law: *Botrychium matricarifolium*, *Thesium auriculatum*, *Hypericum montbretii*, *Vicia laeta* and *Eleocharis mamillata*.

Acknowledgements. The Ministry of Science and Technological Development of the Republic of Serbia has supported this research under Grants 143015 "Diversity of Flora and Vegetation of the Central Balkans – Ecology, Chorology and Conservation" and 142054B "Secondary Metabolites: Composition, Biological and Antioxidative Activity". The authors are also grateful to the anonymous reviewers whose comments considerably improved this manuscript.

References

Ball, P.W. 1968. *Vicia* L. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **2**, pp. 129-136. Cambridge Univ. Press, Cambridge.

Dimitrov, D.S. 1994. New chorological data for the flora of Bulgaria. – God. Sofiisk. Univ. "St. Kliment Ohridski" Biol. Fak., 2. Bot., **85**: 211-213.

Hayek, A. 1924. Zweiter Beitrag zur Kenntnis der Flora von Albanien. – Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr., **99**: 101-223.

Hendrych, R. 1964. *Thesium* L. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **1**, pp. 70-72. Cambridge Univ. Press, Cambridge.

Hendrych, R. 1993. *Thesium* L. – In: **Tutin, T.G.** (eds), Flora Europaea. Ed. **2**. Vol. **1**, pp. 83-86. Cambridge Univ. Press, Cambridge.

Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. 1990. Index Herbariorum. Part 1. The Herbaria of the World. – Regnum Veg., **120**: 1-693. Continuously updated at http://sciweb.nybg.org/science2/IndexHerbariorum.asp

IUCN. 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. Gland, Cambridge.

Jalas, J. & Suominen, J. 1972. Atlas Florae Europaeae. Distribution of Vascular Plants in Europe Vol. **1**. *Pteridophyta* (*Lycopodiaceae* to *Polypodiaceae*). The Commitee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.

Jalas, J. & Suominen, J. 1976. Atlas Florae Europaeae. Distribution of Vascular Plants in Europe Vol. **3**. *Salicaceae* to *Balanophoraceae*. The Commitee for Mapping the Flora of Europe & Societas Biologica Fennica Vanamo, Helsinki.

Jordanov, D. & Kožuharov, S. 1970. *Hypericum* L. – In: **Jordanov, D.** (ed.), Fl. Reipubl. Popularis Bulgaricae. Vol. **4**, pp. 224-262. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).

Kojić, M. 1973. *Santalaceae*. – In: **Josifović, M.** (ed.), Flore de la Republique Socialiste de Serbie. Vol. **5**, pp. 382-389. Acad. Serbe Sci. & Arts, Belgrade (in Serbian).

Kuzmanov, B. 1992. *Vicia* L. – In: **Jordanov, D.** (ed.), Fl. Reipubl. Popularis Bulgaricae. Vol. **6**, pp. 442-498. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).

Lakušić, R. & Redžić, S. 1989. The Flora and the Vegetation of Vascular Plants in Refugial-Relict Ecosystems in the Canyon of the River Drina and its Tributaries. – In: **Lakušić, R. & al.** (eds), Flora and Vegetation of Vascular Plants, as well as Fauna of Symphyla, Pauropoda and Mollusca in the Refugial-Relict Ecosystems in the Canyons of Tara, Piva, Komarnica, Lim and Drina Rivers. The Montenegrin Acad. Sci. & Arts. Glasnik of the Section of Natural Sciences, **7**: 107-205 (in Serbian).

Marković, Lj. 1975. *Botrychium matricariifolium* (Retz.) A. Br. ex Koch in der Flora Kroatiens. – Acta Bot. Croat., **34**: 157-158 (in Croatian).

Micevski, K. 1995. *Hypericum* L. – In: **Micevski, K.** (ed.), The Flora of the Republic of Macedonia. Vol. **1**, book **3**, pp. 486-501. Macedonian Acad. Sci. & Arts, Skopje (in Macedonian).

Micevski, K. 2001. *Vicia* L. – In: **Micevski, K.** (ed.), The Flora of the Republic of Macedonia Vol. **1**, book **5**, pp. 1202-1231. Macedonian Acad. Sci. & Arts, Skopje (in Macedonian).

Niketić, M. 2000. New taxa for the flowering flora of Serbia and neighbouring areas. – In: 6th Symp. on Flora of SE Serbia, Abstracts, p. 32. Biol. Soc., "Dr Sava Petrović", Faculty of Technology, Univ. Niš, DD "Zdravlje" Leskovac, Sokobanja Municipality, DOO "Adonis", Sokobanja (in Serbian).

Niketić, M. & Tomović, G. 2003. Chorological additions to some Submediterranean and Pontian taxa in the flora of Serbia. – Phytol. Balcan., **9**(3): 503-511.

Niketić, M. & Tomović, G. 2008. Survey of some rare and endangered plants in Serbia with new chorological data. – Bull. Nat. Hist. Mus. Belgrade, **1**: 113-148.

Obradović, M. & Budak, V. 1974. Some floristic and geographic characteristics of saline soils in the Novi Sad area. – Matica Srpska. Ser. Nat. Sci., **46**: 14-32 (in Serbian).

Robson, N.K.B. 1968. *Hypericum* L. – In: **Tutin, T.G. & al.** (eds.), Flora Europaea. Vol. **2**, pp. 261-269. Cambridge Univ. Press, Cambridge.

Rothmaler, W. 1993. *Botrychium* Swartz. – In: **Tutin, T.G. & al.** (eds.), Flora Europaea. Ed. **2**. Vol. **1**, pp. 83-86. Cambridge Univ. Press, Cambridge.

Sarić, M.R. & Diklić, N. (eds) 1986. Flore de la Republique Socialiste de Serbie. Acad. Serbe Sci. & Arts, Belgrade (in Serbian).

Stace, C.A., & Cotton, R. 1980. *Vulpia* C.C. Gmelin. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **5**, pp. 154-156. Cambridge Univ. Press, Cambridge.

Stevanović, V., Jovanović, S., Lakušić, D. & Niketić, M. 1999. Characteristics of the flora of Serbia and its phytogeographicl division. – In: **Stevanović, V.** (ed.), The Red Data Book of the Flora of Serbia. Vol. **1**, pp. 393-399. Minist. Environm. R Serbia, Fac. Biol., Belgrade Univ., Inst. Prot. Nat. R Serbia, Belgrade.

Stjepanović-Veseličić, L. 1972. *Hypericum* Lindl. – In: **Josifović, M.** (ed.), Flore de la Republique Socialiste de Serbie. Vol. **3**, pp. 104-125. Acad. Serbe Sci. & Arts, Belgrade (in Serbian).

Stoeva, M.P. 1991. *Botrychium matricariifolium* A. Braun ex Koch – a new species recorded for the Bulgarian flora. – Fitologija, **40**: 81-82.

Tomović, G., Vukojičić, S., Niketić M. & Lakušić, D. 2007. New chorological data on some threatened and rare plants in Serbia. – Arch. Biol. Sci., **59**(1): 63-73.

Turrill, W.B. 1929. The Plant Life of the Balkan Peninsula. A Phytogeographical Study. Clarendon, Oxford.

Vukićević, E. 1992. *Botrychium* Sw. – In: **Sarić, M.** (ed.), Flore de la Serbie. Vol. **1**, pp. 100-102. Acad. Serbe Sci. & Arts, Belgrade (in Serbian).

Vukojičić, S. 2008. Glacial relicts in orophytic flora of Serbia, Montenegro and Republic of Macedonia. – *Ph.D. Thesis*. Fac. Biol., Univ. Belgrade (unpubl.).

Walters, S.M. 1980. *Eleocharis* R. Br. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **5**, pp. 281-284. Cambridge Univ. Press, Cambridge.

Zlatković, B., Ranđelović, V. & Jušković, M. 2005. New floristic records in Serbia and Northern Macedonia. – In: Proc. 8th Symp. on Flora of SE Serbia and Neighbouring Regions, pp. 1-5. Dept. Biol. & Ecol., Fac. Sci. & Math., Univ. Niš, Biol. Soc., "Dr Sava Petrović", Niš.

Zlatković, B. & Ranđelović, V. 2007. Data on distribution of plant species in southeast Serbia. – In: 9th Symp. on Flora of SE Serbia and Neighbouring Regions. Abstracts, p. 21. Dept. Biol. & Ecol., Fac. Sci. & Math., Univ. Niš, Biol. Soc. "Dr Sava Petrović", Niš (in Serbian).