

Distribution and conservation status of some rare and threatened orchid taxa in the central Balkans and the southern part of the Pannonian Plain

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Summary: Along with being a centre of plant species diversity and endemism, the Balkan Peninsula is one of the parts of Europe with the highest number of orchid taxa. However, the orchid flora in the central Balkans has not been sufficiently studied. The paper presents the distribution of ten rare and threatened taxa of Orchidaceae in the central Balkans and the southern part of the Pannonian Plain: *Anacamptis papilionacea*, *Epipactis palustris*, *E. purpurata*, *Epipogium aphyllum*, *Goodyera repens*, *Gymnadenia frivaldii*, *Ophrys apifera*, *O. insectifera*, *Orchis militaris* and *O. spitzelii* subsp. *spitzelii*. In addition to field investigation, checking and revision of herbarium material, literature sources were also used for supplementing distribution data. The distribution maps of these taxa in the central Balkans (Serbia and Kosovo region) and the southern part of the Pannonian Plain (Vojvodina) are created on a 10 km × 10 km UTM grid system. Data concerning their habitat preferences, population size and the estimated IUCN conservation status in the study area are provided.

Keywords: Orchidaceae, phytogeography, IUCN conservation status, Balkan Peninsula

The orchid family is one of the largest and most diverse families in the plant kingdom with estimates of about 28 000 species distributed in about 763 genera (CHASE et al. 2015; CHRISTENHUSZ & BYNG 2016). According to HÁGSATER & DUMONT (1996), over 300 orchid species occur in Europe, North Africa and Near East. The reported number of orchid taxa that are distributed in Europe varies, depending on the applied taxonomic concepts, from 116 species and 59 subspecies (MOORE 1980) to ca. 250 species and subspecies (BUTTLER 1991). The Balkan Peninsula is a centre of plant species diversity and endemism (FRAJMAN et al. 2014) as well as one of the parts of Europe with the highest number of orchid taxa (HÁGSATER & DUMONT 1996). Although Mediterranean floristic elements with numerous species endemic to the Aegean part of Greece prevail, a significant number of European or Eurasian orchid species is present as well, whereas a number of orchids of central or northern European origin form their southern distributional limits in the Balkan Peninsula.

The first data about orchid flora in the central Balkans and the southern part of the Pannonian Plain were provided by the botanist Josif Pančić and his students in the mid-19th century (PANČIĆ 1856, 1865, 1874, 1884). In the second half of the 19th century, important information about orchid taxa in the vicinity of Niš (eastern Serbia) was provided by PETROVIĆ (1882, 1885) and in the vicinity of Novi Sad (Vojvodina province) by ZORKÓCZY (1896) as well. Later, in the first half of the 20th century, data about orchid distribution were published by the following authors: FRITSCH (1909), KOŠANIN (1910), ADAMOVIĆ (1911), JURIŠIĆ (1923), NOVÁK (1926) and HAYEK (1933). Moreover, numerous floristic and vegetation papers and theses offer significant insights into the distribution of orchids in Serbia and Kosovo region (e.g. GAJIĆ 1983, 1986; REXHEPI 1986, 2013; KRIVOŠEJ 1989, 1997; STEVANOVIĆ et al. 1991; LAKUŠIĆ 1993; RANĐELOVIĆ 2002; TOMOVIĆ et al. 2007; DURAKI 2008; LAZAREVIĆ 2009; ZLATKOVIĆ 2011). The last papers published about orchids of former Yugoslavia (GÖLZ & REINHARD 1986; PAROLLY 1992)

provided notes on the taxonomy and distribution of some orchid species, albeit mostly from other parts of former Yugoslavia (Croatia, Slovenia, Montenegro), whereas the species from Serbia and Kosovo region were not investigated as extensively. However, the most detailed overview of orchids in Serbia and Kosovo region is presented in the 8th volume of Flora of SR Serbia (DIKLIĆ 1976), where the author noted 54 species and 12 subspecies within 22 genera. In the last decades, several new orchid taxa have been recorded in the flora of Serbia for the first time, e.g. *Ophrys insectifera* L. (KARADŽIĆ et al. 2000), *Epipactis purpurata* Sm. (DJORDJEVIĆ et al. 2010), *Neotinea × dietrichiana* (Bogenh.) H.Kretzschmar, Eccarius & H.Dietr. (DJORDJEVIĆ et al. 2012), *Dactylorhiza fuchsii* (Druce) Soó (DJORDJEVIĆ et al. 2014), *Epipactis distans* Arv.-Touv., *E. pontica* Taubenheim, *E. leptochila* (Godfery) Godfery subsp. *neglecta* Kümpel (DJORDJEVIĆ et al. 2016a), and *E. muelleri* Godfery (DJORDJEVIĆ 2016).

Some of the areas that were most investigated in terms of orchids in Serbia and Kosovo region are Mt Fruška Gora (ČOLOVIĆ-PARABUCKI 1958; OBRADOVIĆ 1966; OBRADOVIĆ et al. 1983; SAVIĆ 1998; SAVIĆ et al. 2008), eastern and southeastern Serbia (ADAMOVIĆ 1911; HILL 1985; PONERT 2014), Mt Kopaonik (LAKUŠIĆ 1993), Mt Prokletije (AMIDŽIĆ & PANJKOVIĆ 2003) and Valjevo mountain range (DJORDJEVIĆ et al. 2016c). The latest study concerning orchid flora dealt with ecology, distribution and abundance patterns of orchids in grasslands and herbaceous wetlands in western Serbia (DJORDJEVIĆ et al. 2016b). Generally, it can be considered that the orchid flora in Serbia and Kosovo region is not sufficiently studied and that the data on the distribution of orchid species are far from complete.

In Serbia, 59 orchid taxa are protected by national legislation (ANONYMOUS 2010), out of which 41 are strictly protected and 18 protected. According to the Red Data Book of Flora of Serbia (STEVANOVIĆ 1999), two orchid taxa were considered to be extinct on the territory of Serbia: *Ophrys lutea* Cav. subsp. *minor* (Tod.) O.Danesch & E.Danesch and *Orchis spitzelii* Sauter ex W.Koch subsp. *spitzelii*. A taxon supposed to be extinct is *Ophrys holoserica* (Burm.f.) Greuter subsp. *holoserica*, whereas four taxa are estimated to be critically endangered in Serbia, i.e. *Ophrys mammosa* Desf., *Epipactis atrorubens* (Hoffm. ex Bernh.) Besser subsp. *borbasii* (Soó) Soó, *Cypripedium calceolus* L. and *Herminium monorchis* (L.) R.Br. (STEVANOVIĆ 1999).

This paper reports on new records of ten orchid taxa in the central Balkans and the southern part of the Pannonian Plain. The aims were: I) to present the currently known distribution; II) to provide a detailed overview of the findings of these taxa obtained by field surveys as well as by the review and revision of herbarium material and literature sources, and III) to propose the IUCN conservation status of these taxa in Serbia and Kosovo region.

Materials and methods

The study area includes the southern part of the Pannonian Plain (the part of Serbia north of the rivers Sava and Danube, i.e. Vojvodina province), the central part of the Balkan Peninsula, i.e. the part of Serbia south of the rivers Sava and Danube, as well as Kosovo region. The study is based on fieldwork between 1995 and 2017. In addition to the field survey, the distribution data were supplemented by checking and revision of herbarium material 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] as well as by literature sources. The identification and revision of orchid taxa were performed according to BUTTLER (1991) and

DELFORGE (2006), whereas nomenclature followed the World Checklist of Kew Gardens (WCSP 2016). The collected plant material was deposited in the Herbarium of the Institute of Botany and Botanical Garden 'Jevremovac', University of Belgrade [BEOU].

During field investigations, we used Garmin eTrex 30 handheld GPS device in WGS84 format to determine geo-coordinates (longitude, latitude) and altitude. The distribution of each orchid taxon in Serbia and Kosovo region was presented on the grid map with squares of 10 km × 10 km, using the Universal Transverse Mercator (UTM) projection, grid zone 34T. New records represent findings of orchid species that have not been registered in the literature for individual UTM squares so far. In addition, we provided an overview of new localities of some species of the same UTM squares, and we confirmed the presence of some species that had been recorded in literature long ago but were not documented by herbarium material. Distribution data were coded using 15 geographical provinces of Serbia and Kosovo region defined by MARKOVIĆ (1970).

During field surveys, we determined the abundance of each orchid species by counting the total number of flowering individuals. In order to estimate the regional conservation status of the presented orchid species in Serbia and Kosovo region, we applied the Red List Categories and Criteria of IUCN (2012).

Results and Discussion

The detailed review of distribution data along with distribution maps of 10 orchid taxa belonging to 7 genera in Serbia and Kosovo region is provided (Figs 1–2).

Anacamptis papilionacea (L.) R.M. Bateman, Pridgeon & M.W. Chase

New and unpublished records:

NW Serbia: **Mt Jablanik**, Bebići, 44.19218°N, 19.69848°E, UTM CP99, 615 m, ass. *Arrhenatheretum elatioris*, limestone, exp. SW, incl. 25°, 2 individuals, 17 May 2013, coll./det. V. Djordjević [BEOU-17143]; **Mt Maljen**, Kraljev sto (Crna Kamenica), 44.11296°N, 20.04489°E, UTM DP28, 932 m, *Chrysopogono grylli-Danthonion alpinæ* grassland, serpentine, May 2014, pers. comm. and photo documentation M. Radaković, det. V. Djordjević; **Mt Maljen**, Planinica, UTM DP28, 450 m, meadows, serpentine, 28 May 1995, coll. S. Jovanović, T. Zonjić, det. V. Djordjević [BEOU-1421/95]; **Valjevo**, UTM DQ00, Apr 1875, coll. J. Pančić [BEOU-14265];

W Serbia: **Čačak**, Miličevci (Rožanj), 43°59'24.5"N, 20°21'27.4"E, UTM DP47, 533 m, serpentine, May 2016, pers. comm. and photo documentation D. Petrović, det. V. Djordjević;

Šumadija: **Gornji Milanovac**, Brusnica, UTM DP57, 21 May 1988, coll. M. Gačić [BEOU]; **Mt Venčac**, UTM DQ60, May 1914, coll. Th. Soška [BEOU]; **Mt Kotlenik**, Oplanići (the road to Trgoviste), UTM DP74, 01 Jun 2016, coll. S. Krdžić [BEOU-17259];

Pomoravlje: **Ram**, UTM EQ26, 07 Jun 1957, coll. unknown, det. V. Djordjević [BEOU];

Kosovo region: **Prizrenska Bistrica**, UTM DM96, 09 Jun 1923, coll. Th. Soška, det. V. Djordjević [BEOU] (Fig. 1A).

Anacamptis papilionacea is a Mediterranean species distributed east to the Caspian Sea, south to North Africa and north to the foothills of the Alps (DELFORGE 2006). According to KRETZSCHMAR et al. (2007), *A. papilionacea* subsp. *papilionacea* extends in the Apennine and Balkan Peninsula

reaching SW Romania and the Alps in the north, with isolated records having been made in north Turkey. The new localities on Mt Jablanik (Bebići) and Valjevo represent the westernmost, the locality Ram represents the northernmost, whereas the locality Prizrenska Bistrica is the southernmost limit of the species' distribution in Serbia and Kosovo region. This species has been recorded so far in: **NW Serbia:** Mt Maljen (Brežde) – UTM DP29 (SIGUNOV 1977); Mt Suvobor (Slavkovic) – UTM DP39 (KOJIĆ 1959); **Šumadija:** vicinity of Belgrade (PANČIĆ 1865); Belgrade (Topčider) – UTM DQ55 (DIKLIĆ 1976); Jelenac – UTM DQ71 (KOJIĆ 1959); Kozelj – UTM DP49 (KOJIĆ 1959); Bukulja – UTM DQ60 (GAJIĆ 1965); Kragujevac – UTM DP97 (DIKLIĆ 1976); Mt Rudnik (Mutanj) – UTM DP58 (BRKOVIĆ 2015); **Central Serbia:** Mt Pasjača – UTM EN57 (RUŽIĆ 1983); Mt Vidojevica – UTM EN47 (RUŽIĆ 1983); **NE Serbia:** Kladovo – UTM FQ24 (DIKLIĆ 1976); Djerdap – UTM FQ04, FQ14 (PETRIĆ et al. 2010); Mt Stol – UTM EP99 (BLEČIĆ & TATIĆ 1960); **E Serbia:** Niš (Banjsko Polje – UTM EN89, Seličevica – UTM EN78) (PETROVIĆ 1882; DIKLIĆ 1976); Knjaževac – UTM FP02 (DIKLIĆ 1976); Mt Suva planina – UTM EN98 (RANĐELOVIĆ et al. 2000); **S Serbia:** Vranje – UTM EN71 (DIKLIĆ 1976); Predejane, the Predejanska river – UTM EN94 (HILL 1985; TRIČKOVIĆ 2001); Grdelica Gorge, Palojce – UTM EN84, EN94 (SARIĆ & DIKLIĆ 1986); **Kosovo region:** Leposavić (Ibar) – UTM DN87 (PRODANOVIĆ 2006); Priština (Mt Grmija) – UTM EN12 (KRIVOŠEJ 1989); Mt Prokletije – UTM DN21 – rough position (AMIDŽIĆ & PANJKOVIĆ 2003); Paštrik (čuka Čanak) – UTM DM67 (REXHEPI & RUŽIĆ 1985). In total, *A. papilionacea* has been recorded in 33 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1A).

Estimated regional conservation status in Serbia and Kosovo region: Near Threatened – NT.

Epipactis palustris (L.) Crantz

New and unpublished records:

NW Serbia: **Mt Maljen**, Stojići (Ražana Railway Station), 44.06059°N, 19.90911°E, UTM DP17, 493 m, ass. *Junco inflexi-Menthetum longifoliae*, conglomerates, gravels, sands and limestones, exp. NE, incl. 5°, 8 individuals, 01 Jul 2005, 01 Jul 2013, coll./det. V. Djordjević [BEOU-17144, 17145]; **Mt Maljen**, Mrčići (Velika livada), 44.06743°N, 19.91781°E, UTM DP17, 505 m, ass. *Phragmitetum communis*, conglomerates, gravels, sands and limestones, exp. E, incl. 5°, 16 individuals, 01 Jul 2013, coll./det. V. Djordjević [BEOU-17146]; **Mt Jablanik**, Vujinovača, UTM CP99, 20 Jul 1912, coll. M. Gradojević, rev. V. Djordjević [BEO-35081, 35082];

W Serbia: **Mt Zvijezda**, Predov Krst, 43.94011°N, 19.30967°E, UTM CP66, 1086 m, ass. *Equiseto palustris-Eriophoretum latifolii*, limestone, marly limestones and marls, exp. N, incl. 5°, more than 300 individuals, 27 Jun 2013, coll./det. V. Djordjević, M. Josipović [BEOU-17153]; **Mt Zvijezda**, Dikava – Kozulja (Veljov bunar: Purjačine), 43°53'44.5"N, 19°19'23"E, UTM CP66, 1268 m, hygrophilous meadow with *Filipendula ulmaria*, *Carex paniculata*, *Cirsium* spp., *Equisetum* sp., 10–20 individuals, 12 Jul 2016, coll./det. E. Kabaš, S. Djurović [BEOU]; **Mt Tara**, Čemerišta, 43°54'54.1"N, 19°23'23.6"E, UTM CP76, 1190 m, hygrophilous meadow with *Glyceria* sp., *Juncus conglomeratus*, *Mentha longifolia*, *Tussilago farfara*, more than 50 individuals, 13 Jul 2016, coll./det. E. Kabaš, S. Djurović [BEOU]; **Mt Zlatibor**, Gornja Bela Reka (Zmijnjak), 43.58825°N, 19.86816°E, UTM DP02, 940 m, ass. *Junco inflexi-Menthetum longifoliae*, cherts, exp. W, incl. 10°, 2 individuals, 14 Jul 2015, coll./det. V. Djordjević [BEOU-17147]; **Mt Zlatibor**,

Gornja Bela Reka (Peć), 43.56658°N, 19.88518°E, UTM DP02, 1120 m, ass. *Eriophoretum latifoliae* with *Molinia caerulea*, cherts, exp. SE, incl. 20°, 23 individuals, 14 Jul 2015, coll./det. V. Djordjević [BEOU-17148]; **Mt Zlatibor**, Bela Reka, UTM DP02, Jul 1906. coll. unknown, det. V. Djordjević [BEOU]; **Užice**, Kremna, UTM CP85, meadows, coll. K. Urošević, Ž. Jurišić, rev. V. Djordjević [BEO-35064]; **Mt Radočelo**, Mirilovac – Gobelj (Beškovac), 43.46507°N, 20.47523°E, UTM DP51, 1334 m, ass. *Eriophoro-Caricetum paniculatae*, metamorphosed quartz-conglomerates, exp. SE, incl. 20°, 4 individuals, 11 Jul 2016, coll./det. V. Djordjević [BEOU-17249]; **Mt Radočelo**, Mirilovac – Gobelj (Beškovac), 43.46636°N, 20.47684°E, UTM DP51, 1338 m, ass. *Eriophoro-Caricetum paniculatae*, metamorphosed quartz-conglomerates, exp. E, incl. 20°, 11 individuals, 11 Jul 2016, coll./det. V. Djordjević [BEOU-17250]; **Mt Golija**, Biser voda, UTM DN59, 7 Aug 2016, pers. comm. and photo documentation S. Krdžić; **Raška**, Brvenica (Babin Do), UTM DP60, 01 Jul 2016, coll. S. Krdžić [BEOU-17260];

147

and cherts of the Jurassic period), exp. E, incl. 30°, 9 individuals, 04 Jun 2013, coll./det. V. Djordjević [BEOU-17149]; **Mt Jadovnik**, Sopotnica (church), 43.30600°N, 19.73700°E, UTM CN99, 994 m, hygrophilous meadow with *Deschampsia cespitosa*, *Equisetum palustris*, *Carex* spp., ophiolitic mélange (sandstones, shales, marls and cherts of the Jurassic period), exp. SE, incl. 5°, 146 individuals, 20 Jul 2014, coll./det. V. Djordjević [BEOU-17150]; **Jabuka**, Katunište, 43.34643°N, 19.51986°E, UTM CP80, 1247 m, ass. *Eriophoretum latifoliae*, porphyry and quartz-porphyry, exp. N, incl. 15°, more than 150 individuals, 30 Jul 2013, coll./det. V. Djordjević [BEOU-17152];

Banat: Belgrade, Borča (Veliko Blato), UTM DQ56, DQ66, Jul 2015, pers. comm. and photo documentation M. Jovanović;

Šumadija region: Kragujevac (Olovak), UTM DP97, Jul 1851, coll. J. Pančić [BEOU-14364];

NE Serbia: Mt Beljanica, UTM EP58, 1872, coll. J. Pančić, rev. V. Djordjević [BEOU-14356];

E Serbia: Mt Stara planina, Jelovica (Lice – Ravnište: Jelovička River Valley), UTM FN48, fen community near the river in the zone of beech forests, silicates, 02 Oct 2015, coll./det. M. Niketić, S. Vukojević, G. Tomović, S. Đurović [BEOU-43747]; **Mt Stara planina**, Donji Krivodol, UTM FN57, 12 Jun 2010, pers. comm. B. Jotić; **Mt Stara planina**, Crni Vrh (Trnovski trap – Kozarnica), 43°23'44"N, 22°36'19"E, UTM FP30, 994 m, 26 Jul 2013, pers. comm. and photo documentation A. Nahirnić;

SE Serbia: Babušnica, Crvena Jabuka, UTM FN15, Jul 2016, pers. comm. and photo documentation V. Janačković, D. Stojanović (Fig. 1B).

Epipactis palustris is distributed throughout Europe, but it is extremely rare in the southern Mediterranean region (JACQUEMYN et al. 2014). Although BUTTLER (1991) and DELFORGE (2006) noted that this species grows mainly on alkaline soils (mostly lime-rich), *E. palustris* was found to grow on both calcareous and non-calcareous geological substrates in Serbia (DJORDJEVIĆ et al. 2016b). The new locality on Mt Zvijezda (Predov krst) constitutes the westernmost limit, whereas the locality on Mt Stara planina (Donji Krivodol) represents the easternmost limit of the species' distribution in Serbia and Kosovo region. Furthermore, the new localities on Mt Maljen and Mt Jablanik represent the single known localities of this species in NW Serbia, whereas the locality Kragujevac (Olovak) is the single known locality in the region of Šumadija. We confirmed the presence of this species in the vicinity of Belgrade, bearing in mind that many years after the first report (PANČIĆ 1865) this species wasn't registered in Belgrade region and was considered an extinct species. *Epipactis palustris* has been found in Serbia so far in: **Bačka**: Bački vinogradi – UTM DS10 (LAKUŠIĆ 1999); Senta – UTM DR28 (LAKUŠIĆ 1999); Subotička peščara – UTM CS90 (BUTORAC 2003); Rumenka – UTM DR01 (LAKUŠIĆ 1999); Futog (Futoške šume) – UTM CR91 (LAKUŠIĆ 1999); Novi Sad (Ratno ostrvo) – UTM DR11 (SAVIĆ 1998; LAKUŠIĆ 1999); **Banat**: Belo Blato – UTM DR51; Deliblato Sands (Grebenac – UTM EQ17; Kajtasovo – UTM EQ26; alongside the Danube river – UTM EQ16) (DIKLIĆ 1976; GAJIĆ 1983; LAKUŠIĆ 1999); **Srem**: Mt Fruška Gora (Čortanovci – UTM DR20) (OBRADOVIĆ 1966; DIKLIĆ 1976; SAVIĆ 1998; LAKUŠIĆ 1999); **W Serbia**: Mt Zlatibor – UTM CP94 (UROŠEVIĆ 1949); Raška (Trnava) – UTM DN69 (VELJKOVIĆ et al. 2016); **SW Serbia**: Tutin (Štavica) – UTM DN45 (PETKOVIĆ 1983); Sjenica (Ljuta bara: above Caričina) – UTM DN08 (LAKUŠIĆ 1999); Pešter (Karajukića bunari – UTM DN27; Begov lug – UTM DN36) (LAZAREVIĆ 2009; LAZAREVIĆ

2016); **NE Serbia:** Resava – UTM EP38 (LAKUŠIĆ 1999); Strmosten – UTM EP48 (LAKUŠIĆ 1999); the confluence of the Zlotska and Beljanska rivers – UTM EP77 (LAKUŠIĆ 1999); **E Serbia:** Mt Vidlič (Basarski kamik) – UTM FN38 (LAKUŠIĆ 1999); Niš – UTM EN79 (LAKUŠIĆ 1999); Visok Izatovac – UTM FN57 (LAKUŠIĆ 1999); Jelašnica – UTM EN89 (NIKETIĆ 1986; LAKUŠIĆ 1999); Mt Stara planina – UTM FP30, FN49 (PETROVIĆ 1882; DIKLIĆ 1976; LAKUŠIĆ 1999); Mt Suva planina – UTM EN98 (RANĐELOVIĆ et al. 2000); **SE Serbia:** Vlasina plateau – UTM FN02 (RANĐELOVIĆ 2002); Pčinja, Trgovište (Vražji Kamen) – UTM EM89 (ZLATKOVIĆ 2011); **Kosovo region:** Mt Šar planina (Dragaš – UTM DM75; Restelica – UTM DM74; Sevce – UTM DM97; Malo Borče – UTM DM97; Ostrovica – UTM DM97; Štrbački Jelovarnik – UTM EM07) (NIKOLIĆ & DIKLIĆ 1979; SARIĆ & DIKLIĆ 1986; LAKUŠIĆ 1999; LAZAREVIĆ 2016). In total, *E. palustris* has been recorded in 53 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1B).

Estimated regional conservation status in Serbia and Kosovo region: Near Threatened – NT. Although the distribution of this taxon in Serbia and Kosovo region is extensive, the number of individual records in each grid cell is low.

Epipactis purpurata Sm.

New and unpublished records:

NW Serbia: Mt Jablanik, Vujinovača (Bebići), UTM CP99, c. 500 m, ass. *Fagetum montanum*, fewer than 5 individuals, Jul 2014, pers. comm. and photo documentation M. Mrvaljević;

W Serbia: Mt Tara, Mitrovac, 43.92081°N, 19.41971°E, UTM CP76, 1105 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. E, incl. 10°, 2 individuals, 16 Jul 2013, coll./det. V. Djordjević [BEOU-17052]; **Mt Tara**, Tisovo brdo – Barski do, 43.91849°N, 19.44393°E, UTM CP76, 1145 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. NE, incl. 15°, 9 individuals, 26 Jul 2016, coll./det. V. Djordjević [BEOU-17251]; **Mt Tara**, Mitrovac (Dečje oporavilište – Manita ravan), 43.91703°N, 19.41591°E, UTM CP76, 1100 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. SW, incl. 2°, 2 individuals, 26 Jul 2016, coll./det. V. Djordjević [BEOU-17252]; **Mt Tara**, Nikolići (Reljin vrh), 43.86347°N, 19.34766°E, UTM CP65, 1140 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. N, incl. 25–30°, 10 individuals, 28 Jul 2016, coll./det. V. Djordjević [BEOU-17256]; **Mt Zvijezda**, Kameno Brdo – Stare kuće, 43.95823°N, 19.31923°E, UTM CP66, 1215 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. E, incl. 10°, 2 individuals, 27 Jul 2016, coll./det. V. Djordjević [BEOU-17253]; **Mt Zvijezda**, Kičelj – Kameno Brdo, 43.95237°N, 19.32443°E, UTM CP66, 1182 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. NE, incl. 10°, 2 individuals, 27 Jul 2016, coll./det. V. Djordjević [BEOU-17254]; **Mt Zvijezda**, Kičelj – Stare Kuće, 43.95681°N, 19.32489°E, UTM CP66, 1120 m, ass. *Piceo-Fago-Abietetum*, limestone, exp. SE, incl. 10°, 2 individuals, 27 Jul 2016, coll./det. V. Djordjević [BEOU-17255];

SW Serbia: Mt Jadovnik, Sopotnica (Osoje), 43.29223°N, 19.74319°E, UTM CN99, 1108 m, ass. *Fagetum montanum*, ophiolitic mélange (sandstones, shales, marls and cherts of the Jurassic period), exp. W, incl. 15°, 2 individuals, 25 Jul 2013, coll./det. V. Djordjević [BEOU-17047]; **Mt Jadovnik**, Sopotnica (Osoje), 43.29183°N, 19.74213°E, UTM CN99, 1100 m, ass. *Fagetum montanum*, ophiolitic mélange (sandstones, shales, marls and cherts of the Jurassic period), exp. N, incl. 20°, 6 individuals, 25 Jul 2013, coll./det. V. Djordjević [BEOU-17048]; **Mt Jadovnik**, Sopotnica (Kaldрма), 43.29423°N, 19.74047°E, UTM CN99, 1032 m, ass. *Fagetum montanum*,

ophiolitic mélange (sandstones, shales, marls and cherts of the Jurassic period), exp. NW, incl. 20°, 2 individuals, 26 Jul 2013, coll./det. V. Djordjević [BEOU-17049]; **Mt Kamena Gora**, Belo Borje (Plandište), 43.29028°N, 19.55240°E, UTM CN89, 1413 m, ass. *Piceetum excelsae*, limestone, dolomitic limestones and dolomites, exp. SE, incl. 5°, 4 individuals, 27 Jul 2013, coll./det. V. Djordjević [BEOU-17050]; **Mt Kamena Gora**, Cijepci, 43.28940°N, 19.56247°E, UTM CN89, 1224 m, ass. *Fagetum montanum*, limestone, dolomitic limestones and dolomites, exp. N, incl. 20°, 2 individuals, 28 Jul 2013, coll./det. V. Djordjević [BEOU-17051]; **Mt Pobijenik**, Ober (hunting lodge), 43.51229°N, 19.53324°E, UTM CP81, 1171 m, ass. *Abieti-Fagetum*, limestone, exp. E, incl. 20°, 4 individuals, 25 Jul 2015, coll./det. V. Djordjević [BEOU-17163]; **Mt Pobijenik**, Ober (hunting lodge), 43.51283°N, 19.53369°E, UTM CP81, 1152 m, ass. *Abieti-Fagetum*, limestone, exp. NE, incl. 25°, 7 individuals, 25 Jul 2015, coll./det. V. Djordjević [BEOU-17164]; **Mt Pobijenik**, Lisa stena (Njivice), 43.51266°N, 19.53995°E, UTM CP81, 1141 m, ass. *Abieti-Fagetum*, limestone, exp. N, incl. 20°, 4 individuals, 25 Jul 2015, coll./det. V. Djordjević [BEOU-17165] (Fig. 1C).

Epipactis purpurata is distributed in the temperate zone of western and central Europe, where it occurs north to Denmark, Britain and the Baltic States, west to France and south to the Alps, Balkans and Transylvania in Romania (RANKOU 2011). It has recently been found on Mt Grammos, close to the Greek-Albanian border (ANTONOPOULOS & TSIFTSIS 2012). This species has been found in **NW Serbia**: Mt Maljen (Bukovi) – UTM DP18 for the first time in Serbia (DJORDJEVIĆ et al. 2010). The new localities on Mts Tara and Zvijezda represent the westernmost limits, the locality on Mt Jablanik is the northernmost, whereas the localities on Mts Jadovnik and Kamena Gora constitute the southernmost limits of the species' distribution in Serbia and Kosovo region. It may be assumed that *E. purpurata* has a wider distribution in Serbia and Kosovo region and the neighboring countries (Bosnia and Herzegovina and N Montenegro), due to the presence of potentially suitable habitats. Currently, *E. purpurata* has been recorded in eight 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1C).

Estimated regional conservation status in Serbia and Kosovo region: Vulnerable – VU B1ac(i,ii,iii,iv) + 2ac(i,ii,iii,iv).

Epipogium aphyllum Swartz

New and unpublished records:

SW Serbia: **Mt Zlatar**, Runjeva glava (Kurpćusko vrelo), 43.42826°N, 19.78979°E, UTM DP00, 1267 m, ass. *Abieti-Fagetum*, limestone, exp. N, incl. 10°, 2 individuals, 23 Jul 2014, coll./det. V. Djordjević [BEOU-17154] (Fig. 1D).

Epipogium aphyllum is a mycoheterotrophic plant which occurs throughout temperate Eurasia with hotspots of records in boreal and subboreal parts of Scandinavia and the foothills of the Alps (TAYLOR & ROBERTS 2011). The southern limit of its distribution in the Balkans and Europe is southern Pindos mountain range in Greece (SCHULER 2007). In the Balkans, this species often grows in beech (*Fagus sylvatica*) forests, mixed forest community *Abieti-Fagetum* as well as spruce (*Picea abies*) forests. The finding of *E. aphyllum* on Mt Zlatar is the first record of this species on the territory of southwestern Serbia. The new locality on Mt Zlatar represents the westernmost limit of its distribution in Serbia and Kosovo region. This species has been known so far in: **Pomoravlje**: Jagodina, Mt Belica – UTM EP16 (PANČIĆ 1856; TOMOVIĆ et al. 2007); **NE Serbia**:

Mt Beljanica – UTM EP58 (DIKLIĆ 1976); **E Serbia:** Mt Rtanj – UTM EP74 (PANČIĆ 1874; DIKLIĆ 1976); **Kosovo region:** Mt Prokletije – UTM DN21 – rough position (AMIDŽIĆ & PANJKOVIĆ 2003). In total, *E. apyllum* has been recorded in five 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1D).

Estimated regional conservation status in Serbia and Kosovo region: Endangered – EN B2ac(iii,iv).

***Goodyera repens* (L.) R. Br.**

New and unpublished records:

W Serbia: Mt Tara, Mitrovac (Crveni potok), 43.91441°N, 19.41943°E, UTM CP76, 1077 m, ass. *Omorikae-Piceeto-Abieto-Fageto-Alnetum* mixtum, proluvium, exp. E, incl. 10°, more than 650 individuals, 24 Jul 2016, coll./det. V. Djordjević [BEOU-17258];

SW Serbia: Mt Ćetanica, UTM DN09, *Pinus sylvestris* forest, limestone, fewer than 5 individuals, 05 Aug 2012, coll./det. I. Janković, G. Čokanović [BEOU-35382]; **Canyon of the river Mileševka**, Vrata (Brdo poskoka), UTM DN09, *Picea omorika* forest, 16 Jul 2011, pers. comm. J. Novaković;

Kosovo region: Pečka Bistrica, UTM DN32, coll. Lomejko, det. V. Djordjević [BEOU] (Fig. 1E).

Goodyera repens is a boreal species distributed mainly throughout northern, central and western Europe (DELFORGE 2006). A recent study has shown that the most important factor affecting the distribution of this species in its southern distribution limits in Greece is soil nutrient content, especially phosphorus indicating that this plant occurs mainly on very nutrient-poor soils (TSIFTSIS et al. 2012). The particularity in Serbia is that it grows in forests of the paleoendemic conifer species *Picea omorika* (OSTOJIĆ 2005). In addition, in Serbia and Kosovo region this species inhabits *Pinus sylvestris* forests, the forest community *Piceetum excelsae* as well as mixed forest communities with *Picea abies*, *Abies alba* and *Fagus sylvatica*. The new localities on Mt Ćetanica and in the canyon of the river Mileševka constitute the second and the third known locality of this species in southwestern Serbia. This species has been reported so far in: **W Serbia:** Mt Zlatibor (Tornik) – UTM CP93 (NOVÁK 1926); Mt Tara (Aluška planina, Crvene stene, Rastište) – UTM CP66 (ČOLIĆ 1964; OSTOJIĆ 2005; LAZAREVIĆ et al. 2013); Mt Zvezda (Soko stene) – UTM CP67 (ČOLIĆ 1953); Mt Zvezda (Studenac) – UTM CP66 (ČOLIĆ 1953); **SW Serbia:** Gostun (Dubočica Gorge) – UTM DN08 (LAZAREVIĆ et al. 2013); **Central Serbia:** Mt Kopaonik, Metode (Lisičije stene) – UTM DN89 (LAKUŠIĆ 1993); **E Serbia:** Mt Suva planina – UTM EN98 (PANČIĆ 1884; FRITSCH 1909; DIKLIĆ 1976); Mt Stara planina – UTM FP30 (DIKLIĆ 1976); **Kosovo region:** Mt Prokletije – UTM DN21 – rough position (AMIDŽIĆ & PANJKOVIĆ 2003). In total, *G. repens* has been recorded in eleven 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1E).

Estimated regional conservation status in Serbia and Kosovo region: Vulnerable – VU B2ab(iii).

***Gymnadenia frivaldii* Hampe ex Griseb.**

New and unpublished records:

W Serbia: Mt Golija, Česta vrela, 43.31848°N, 20.39799°E, UTM DN59, 1620 m, ass. *Eriophoro-Caricetum paniculatae*, phyllites, exp. N, incl. 25°, 4 individuals, 25 Jun 2014, coll./det. V. Djordjević [BEOU-17155]; **Mt Golija**, Česta vrela, 43.31924°N, 20.39625°E, UTM DN59, 1612 m, ass. *Eriophoro-Caricetum paniculatae*, phyllites, exp. N, incl. 15°, 26 individuals, 25 Jun 2014, coll./det. V. Djordjević [BEOU-17156]; **Mt Golija**, Česta vrela, 43.31789°N,

20.39923°E, UTM DN59, 1624 m, ass. *Eriophoro-Caricetum paniculatae*, phyllites, exp. W, incl. 15°, 2 individuals, 10 Aug 2014, coll./det. V. Djordjević [BEOU-17157];

Central Serbia: Mt Kopaonik, road to Suvo Rudište, UTM DN89, 1750 m, fen community, 11 Jul 1987, coll. D. Lakušić [BEOU]; **Mt Kopaonik** (Kadijevac: Crvene bare), UTM DN89, 1700 m, fen community, 03 Jul 1998, coll. D. Lakušić [BEOU-8630]; **Mt Kopaonik**, the valley of the Samokovska River, UTM DN89, fen community, 26 Jun 1954, coll. M. Popović, det. V. Djordjević [BEOU]; **Mt Kopaonik**, fen on the ridge, to Krčmar, UTM DN89, 24 Jun 1951, coll. Lj. Borisavljević [BEOU];

E Serbia: Mt Stara planina (Tri Čuke), UTM FN49, 1882, coll. J. Pančić [BEOU-14328]; **Mt Stara planina**, Arbinje, UTM FN49, 27 Jul 1998, coll. G. Tomović, B. Zlatković [BEOU-11657]; **Mt Stara planina**, Sveti Nikola, UTM FP21, 1887, coll. S. Petrović [BEOU]; **Mt Stara planina**, Dugo Bilo, UTM FP30, 23 Jun 1958, coll. V. Linther [BEO] (Fig. 1F).

Although this species has been frequently assigned to the genus *Pseudorchis* (syn. *Leucorchis*), a recent molecular phylogenetic analysis has shown that this taxon is embedded well within the genus *Gymnadenia* (BATEMAN et al. 2006). *Gymnadenia frivaldii* is a species with a relatively small range in Europe restricted to high-mountain belts on the Carpathians and the central and eastern Balkans (DELFORGE 2006). It has been recorded in northern Greece, former Yugoslavian Republic of Macedonia, eastern Albania, Transylvanian Romania, southwestern Bulgaria, Montenegro and Serbia and Kosovo region (DIKLIĆ 1976; BATEMAN et al. 2006; DELFORGE 2006; REXHEPI 2013). This species inhabits fen communities mainly on siliceous substrates (STEVANOVIĆ et al. 1991; DJORDJEVIĆ et al. 2016b). A recent study showed that in western Serbia this species is an indicator of the vegetation class *Scheuchzerio-Caricetea fuscae* as well as of the schists-gneiss-phyllites type of geological substrates (DJORDJEVIĆ et al. 2016b). The new localities on Mt Golija represent the single known localities of this species on the territory of western Serbia, whereas the locality Mt Stara planina (Sveti Nikola) constitutes the northernmost limit of its distribution in Serbia and Kosovo region. In Serbia and Kosovo region, this species has been known so far in: **Central Serbia:** Mt Kopaonik (Pajino preslo) – UTM DN89 (STEVANOVIĆ et al. 1991); **E Serbia:** Mt Stara planina (Krvave bare) – UTM FN49 (DIKLIĆ & NIKOLIĆ 1961); Mt Stara Planina (Babin zub) – UTM FP30 (MIŠIĆ & DINIĆ 1998); **SE Serbia:** Vlasina plateau, Bukova Glava (the valley of the river Murina) – UTM FN12 (ZLATKOVIĆ et al. 1993); **Kosovo region:** Mt Šar planina (Piribeg – UTM EM06; Brezovica: mountain lodge – UTM EM07; Plavilo – UTM EM07) (SARIĆ & DIKLIĆ 1986; REXHEPI 2013; LAZAREVIĆ 2016); Mt Šar planina (Veljinbeški Rid, Tija voda, Šutman, Šutmanska river spring, Prizrenska Bistrica spring, Jažinačko Lake – UTM DM96; Durlov potok, Čelipinsko vrelo, Veljinbeški Rid, Prevalac – UTM DM96, Konjuška – UTM DM96; Livadica) (SARIĆ & DIKLIĆ 1986; RANĐELOVIĆ et al. 1998; REXHEPI 2013; LAZAREVIĆ 2016); Mt Šar planina, Kobilica (Treskavac, Ljubinske uši) – UTM DM86 (DURAKI 2008); Mt Prokletije, Mokra Gora – UTM DN64 (REXHEPI 2013); Mt Prokletije, Mokra Gora (Savine Vode) – UTM DN64 (LAZAREVIĆ 2016); Mt Prokletije (Kurvala – UTM DN31; Đeravica, Derviš kom – UTM DN20; Nedžinat – UTM DN22) (DIKLIĆ & NIKOLIĆ 1961); Mt Prokletije (Bogićevica – UTM DN21; Pločice – Bogićevica – UTM DN21; Dobroške planine – UTM DN21; Junička planina – UTM DN30) (AMIDŽIĆ & PANJKOVIĆ 2003; REXHEPI 2013). In total, *G. frivaldii* has been recorded in sixteen 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 1F).

Estimated regional conservation status in Serbia and Kosovo region: Vulnerable – VU B2ab(iii). According to REXHEPI (2013), the conservation status of *G. frivaldii* in Kosovo is estimated as Near Threatened – NT.

Ophrys apifera L.

New and unpublished records:

NW Serbia: **Mt Gučevo**, Tadići, 44.46211°N, 19.18220°E, UTM CQ52, 403 m, ass. *Festucetum valesiacae*, limestone and sandstones, exp. W, incl. 15°, 2 individuals, 07 Jun 2014, coll./det. V. Djordjević [BEOU-17160]; **Mt Sokolska planina**, Soko grad, 44.26897°N, 19.42892°E, UTM CQ70, 445 m, ass. *Orno-Ostryetum*, limestone, exp. S, incl. 30°, 7 individuals, 06 Jun 2014, coll./det. V. Djordjević [BEOU-17159]; **Mt Sokolska planina**, Književača, 44.27245°N, 19.43629°E, UTM CQ70, 649 m, ass. *Brometum erecti*, dolomites and dolomitic limestones and sandstones with alevrolytes, exp. SW, incl. 25°, 1 individual, 06 Jun 2014, field obs. V. Djordjević; **Petnica**, UTM DP19, Jun 2017, pers. comm. and photo documentation J. Novaković;

W Serbia: **Mt Tara**, Derventa canyon, UTM CP66, 29 May 1994, coll. V. Stevanović, S. Jovanović, S. Pavić, det. V. Djordjević [BEOU-1941/94]; **Mt Kablar**, Vidova (near the tunnel), 43.92633°N, 20.22618°E, UTM DP36, 325 m, ass. *Quercetum cerris*, gabbro, exp. SW, incl. 40°, 2 individuals, 09 Jun 2013, coll./det. V. Djordjević [BEOU-17158] (Fig. 2A).

Ophrys apifera is distributed in central and southern Europe as well as in North Africa and the Middle East, eastward to the Caucasus (DELFORGE 2006; WCSP 2016). In Serbia, this species grows in the grassland communities of the order *Festucetalia valesiacae* and the alliance *Cirsio-Brachypodium pinnati* (DJORDJEVIĆ et al. 2016b). Moreover, it inhabits the woodland community *Quercetum cerris* and *Ostrya carpinifolia* forests. The new locality on Mt Gučevo represents the westernmost limit of its distribution in Serbia and Kosovo region. In Serbia and Kosovo region, this species has been recorded so far in: **Banat:** Deliblato Sands – UTM EQ17 (DIKLIĆ 1976; GAJIĆ 1983); **NW Serbia:** Mt Sokolska planina (Soko grad) – UTM CQ70 (DIKLIĆ 1976); **W Serbia:** Užice – UTM DP05 (DIKLIĆ 1976); Mt Kablar (Rošci: Glavaj) – UTM DP36 (BRKOVIĆ 2015); Mt Suvobor (Pranjani, Glavaj: Goli breg) – UTM DP36 (BRKOVIĆ 2015); **Šumadija:** vicinity of Belgrade – UTM DQ55 (PANČIĆ 1865); vicinity of Kragujevac – UTM DP97 (DIKLIĆ 1976); Kraljevo (Čukojevac) – UTM DP84 (DIKLIĆ 1976); **Central Serbia:** Raška – UTM DN69 (DIKLIĆ 1976); **E Serbia:** Mt Seličevica (Perutina) – UTM EN78 (FRITSCH 1909); Donji Dušnik – Sopotnica – UTM EN97, EN98 (PONERT 2014); Pirot, Mt Vidlič (the Vučje Hill) – UTM FN37 (JOTIĆ et al. 2011); Pirot, Mt Vidlič (the Tepoš plateau) – UTM FN37 (JOTIĆ et al. 2013); Gornja Koritnica – UTM FN07 (JOVANOVIĆ 1956); **Kosovo region:** Priština (Mt Grmija) – UTM EN12 (KRIVOŠEJ 1989); Leposavić (Ibar) – UTM DN87 (PRODANOVIĆ 2006); Mt Šar planina – UTM DM96 (ZZPS 2006); Mt Ošljak – UTM DM97 (KRIVOŠEJ 1997). In total, *O. apifera* has been recorded in twenty 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 2A). However, the total population size of this species is small.

Estimated regional conservation status in Serbia and Kosovo region: Near Threatened – NT.

Ophrys insectifera L.

New and unpublished records:

W Serbia: **Mt Tara**, Zgoreljak – Todosina peć., 43.95277°N, 19.41110°E, UTM CP76, 783 m, ass. *Orno-Ostryetum*, limestone, exp. NE, incl. 35°, 11 individuals, 16 May 2017, coll./det.

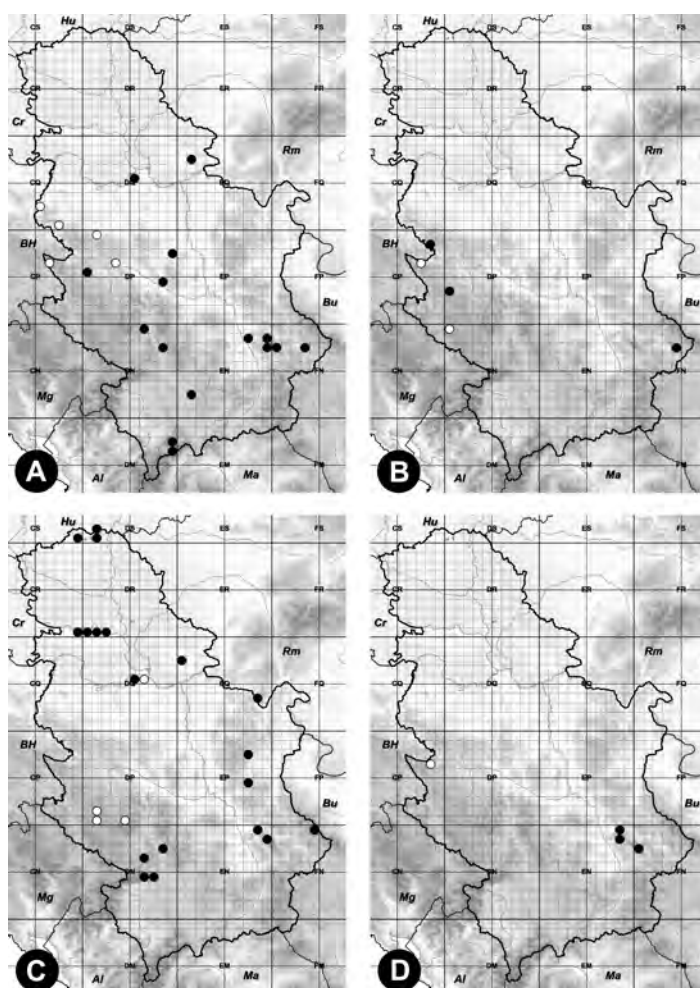


Figure 2. Distribution of orchid species in Serbia and Kosovo region (white dot – new and unpublished data; black dot – published data). A – *Ophrys apifera*; B – *O. insectifera*; C – *Orchis militaris*; D – *O. spitzelii* subsp. *spitzelii*.

V. Djordjević [BEOU-46639]; **Mt Tara**, Duge peč. – Jabučka peč. (Grablje), 43.94971°N, 19.42061°E, UTM CP76, 852 m, ass. *Orno-Ostryetum*, limestone, exp. N, incl. 45°, 3 individuals, 16 May 2017, coll./det. V. Djordjević [BEOU-46640]; **Mt Tara**, Duge peč. – Jabučka peč. (Grablje), 43.94920°N, 19.42204°E, UTM CP76, 828 m, ass. *Orno-Ostryetum*, limestone, exp. N, incl. 60°, 2 individuals, 16 May 2017, coll./det. V. Djordjević [BEOU-46641]; **Mt Tara**, Perla – Kozje stene (Perudo), UTM CP76, c. 900 m, ass. *Ostryetum carpinifoliae* s.l., limestone, fewer than 5 individuals, 09 Jun 2013, field obs. and photo documentation L. Novaković, det. V. Djordjević;

SW Serbia: Mt Jadovnik, Milošev Do (Gvozd: česma na Kosi), 43.32478°N, 19.78156°E, UTM DN09, 1228 m, the grassland community of the order *Festucetalia valesiaca*, ophiolitic mélange (sandstones, shales, marls and cherts of the Jurassic period), exp. SE, incl. 30°, 2 individuals, 04 Jun 2013, coll./det. V. Djordjević [BEOU-17161] (Fig. 2B).

Ophrys insectifera is a central European species stretching from Ireland and central Scandinavia and the Baltic region to the mountains of northern Spain to the central Apennines, the Dinaric mountains, Romania, northern and central Greece and the Ukraine, whereas it is absent from the

Mediterranean lowlands (FAY et al. 2015). The localities on Mt Tara constitute the westernmost limit of its distribution in Serbia and Kosovo region, whereas the locality on Mt Jadovnik represents the single known locality of this species on the territory of southwestern Serbia and southernmost limit of its distribution in the Dinaric part of Serbia. This species has been recorded so far in: **NW Serbia**: Trešnjica River Canyon – UTM CP88 (KARADŽIĆ et al. 2000); **W Serbia**: Mt Zlatibor, the village of Gostilje – UTM DP03 (ZLATKOVIĆ et al. 2005); and **E Serbia**: Pirot, Mt Vidlič (Paterica) – UTM FN47 (ZLATKOVIĆ et al. 2005). In total, *O. insectifera* has been recorded in five 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 2B).

Estimated regional conservation status in Serbia and Kosovo region: Endangered – EN B2ab(iii); D.

Orchis militaris L.

New and unpublished records:

W Serbia: Mt Golija, Vrhovi – Tičar, 43.43146°N, 20.264637°E, UTM DP40, 1398 m, ass. *Festuco-Agrostietum capillaris*, limestone, which is man-strewn along the road, exp. NE, incl. 5°, 2 individuals, 23 Jun 2014, coll./det. V. Djordjević [BEOU-17162];

SW Serbia: Nova Varoš, Pavlovića Brod, UTM DP11, limestone, 22 May 2002, coll. G. Tomović, T. Živković, det. V. Djordjević [BEOU-15992]; **Uvac**, southwestern slopes of the gorge, near a dam, UTM DP10, 900 m, ass. *Fraxinus ornus*-*Crataegus monogyna* shrubs, 23 May 1996, coll. D. Lakušić, det. V. Djordjević [BEOU-302/96];

Šumadija: Belgrade, Bolečki potok, UTM DQ65, 1886, coll. unknown, rev. V. Djordjević [BEOU] (Fig. 2C).

Orchis militaris is a Eurasian species distributed from southeastern Sweden and Russia, throughout central European countries to northern Spain, central Italy, Romania, Bulgaria, Greece and European Turkey (FARRELL 1985). In Serbia and Kosovo region, this species has been recorded so far in: **Bačka**: Subotička peščara – UTM CS90 (GAJIĆ 1986); Bački vinogradi - Horgoš – UTM DS10 (GAJIĆ 1986); Selevenjska pustara – UTM DS11 (BUTORAC & HULO 1992); **Banat**: Deliblato Sands (Mala Tilva) – UTM EQ07 (GAJIĆ 1983; LAKUŠIĆ 1999); **Srem**: Mt Fruška Gora (Glavica, Širine, Brankovac, Stražilovo, Sremski Karlovci, Sremska Kamenica, Iriški Venac, Čerević, Belješevo, Paragovo, Popovica, Beočin – Crveni Čot, Erdelj, Čortanovci, Osovlje, Petrovaradin, Bukovac) – UTM DR00, DR10, DR20, CR90 (ČOLOVIĆ-PARABUCKI 1958; JOVANOVIĆ 1960; DIKLIĆ 1976; OBRADOVIĆ et al. 1983; SAVIĆ 1998); **SW Serbia**: Mt Rogozna – UTM DN66 (RATKNIĆ et al. 2011); **Šumadija**: Belgrade – UTM DQ55 (PANČIĆ 1865); **NE Serbia**: Mt Malinik – UTM EP77 (DIKLIĆ 1976); Djerdap – UTM EQ83 (PETRIĆ et al. 2010); **E Serbia**: Mt Stara planina – UTM FN49 (ADAMOVIĆ 1911; DIKLIĆ 1976); Mt Suva planina – UTM EN98 (RANĐELOVIĆ et al. 2000); Sićevo Gorge, Oblik – UTM EN89 (ZLATKOVIĆ 1999); Mt Rtanj – UTM EP74 (LAKUŠIĆ 1999); **Kosovo region**: Radopolje – UTM DN64 (TOMIĆ-STANKOVIĆ 1967); Ibarski Kolašin – UTM DN74 (TOMIĆ-STANKOVIĆ 1967); Kamilja – UTM DN87 (PAVLOVIĆ et al. 2002). In total, *O. militaris* has been recorded in 23 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 2C). However, the population size of individual populations is very small.

Estimated regional conservation status in Serbia and Kosovo region: Near Threatened – NT.

Orchis spitzelii Saut. ex W.D.J. Koch subsp. *spitzelii*

New and unpublished records:

W Serbia: Mt Tara, Crnjeskovo above the Rača monastery, UTM CP86, karst, 10 May 1914, coll. K. Urošević, det. N. Košanin [BEOU] (Fig. 2D).

Orchis spitzelii occurs from Sweden in the north, throughout central, southwestern, southeastern Europe, western Asia to northern Africa (Algeria and Morocco) in the south (DELFORGE 2006; WCSP 2016). It was considered to be extinct on the territory of Serbia (PETKOVIĆ 1999). The locality on Mt Tara represents the westernmost limit of its distribution in Serbia and Kosovo region and the single known locality of this species on the territory of western Serbia and the Dinaric part of Serbia. This species has been known so far in **E Serbia:** Koritnik (Banjsko brdo) – UTM EN89 (PETROVIĆ 1885); Mt Suva planina (Mosor) – UTM EN88 (PETROVIĆ 1885); Mt Suva planina (Rakoš) – UTM FN07 (ADAMOVIĆ 1911). However, the occurrence of the species at mentioned localities were not confirmed in recent time. In total, *O. spitzelii* subsp. *spitzelii* has been recorded in four 10 × 10 km² UTM grid cells in Serbia and Kosovo region (Fig. 2D).

Estimated regional conservation status in Serbia and Kosovo region: Extinct – EX.

Conclusions

New chorological data of ten orchid taxa provided by field investigations together with literature data as well as data from herbarium collections were used to complete the distribution maps of these taxa in Serbia and Kosovo region. The results show that some taxa previously considered being rare taxa in Serbia and Kosovo region actually have a wider distribution (e.g. *A. papilionacea*, *E. palustris* and *O. apifera*). The most frequent taxa in regard to their number of UTM squares of 10 km × 10 km are *E. palustris* (53 grid cells), *A. papilionacea* (33), *O. militaris* (23) and *O. apifera* (20). Other taxa occur in a smaller number of squares, from 4 (*O. spitzelii* subsp. *spitzelii*) to 16 (*G. frivaldii*).

Applying the IUCN (2012) Red List Categories and Criteria in Serbia and Kosovo region, the current regional threatened status of *E. aphyllum* and *O. insectifera* is estimated as Endangered, whereas the conservation status of *E. purpurata*, *G. repens* and *G. frivaldii* is estimated as Vulnerable. The taxa whose conservation status is estimated as Near Threatened are *A. papilionacea*, *E. palustris*, *O. apifera* and *O. militaris*, whereas the current conservation status of *O. spitzelii* subsp. *spitzelii* in Serbia and Kosovo region is estimated as Extinct. The species *E. purpurata* and *O. insectifera* should be included in the Red Data Book of Flora of Serbia and the official list of strictly protected species in Serbia, whereas the other eight presented orchid taxa are already protected in Serbia by national legislation as strictly protected species (ANONYMOUS 2010). The authors suggest future research that includes detailed chorological, taxonomic, genetic and ecological studies of these species as well as of other taxa from the family Orchidaceae on the territory of Serbia and Kosovo region and the neighboring countries of the Central Balkans.

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References

- ADAMOVIĆ L. (1911): Flora of southeastern Serbia. – Rad Jugoslav. Akad. Znan. Umj. **188**, Mat.–Prir. Razred. **50**: 84–140 [318–374]. [In Serbian]
- AMIDŽIĆ L. & PANJKOVIĆ B. (2003): Vascular flora. – In: AMIDŽIĆ L., JANKOVIĆ M., JAKŠIĆ P. [eds]: Prokletije of Metohija: The natural and cultural heritage. – Institute for Nature Conservation of Serbia, Belgrade. [In Serbian]
- ANONYMOUS (2010): Ordinance on the proclamation and protection of protected and strictly protected wild species of plants, animals and fungi. – Official Gazette of the Republic of Serbia **5**. [In Serbian]
- ANTONPOULOS Z. & TSIFTSIS S. (2012): *Epipactis purpurata* Sm. and *Epipactis leptochila* (Godf.) Godf. subsp. *neglecta* Kümpel (Orchidaceae), two new *Epipactis* taxa for the flora of Greece. – Ber. Arbeitskreis. Heimische Orchid. **29**: 81–99.
- BATEMAN R. M., RUDALL P. J. & JAMES K. E. (2006): Phylogenetic context, generic affinities and evolutionary origin of the enigmatic Balkan orchid *Gymnadenia frivaldii* Hampe ex Griseb. – Taxon **55**: 107–118.
- BLEČIĆ V. & TATIĆ B. (1960): Beitrag zur Kenntnis der Vegetation Ostserbiens. – Bull. Inst. Jard. Bot. Univ. Belgrade **2**: 119–130.
- BRKOVIĆ D. L. (2015): Vascular flora of mountainous areas of northwestern Serbia and Šumadija regions – ecological phytogeographical study. – Dissertation, Faculty of Biology, University of Belgrade.
- BUTORAC B. (2003): Landscape of exceptional quality Subotica Sands, a proposal to be put under protection as a natural resource of great importance. – Novi Sad, Serbia: The study of the Institute for Nature Conservation of Serbia: 49–68. [In Serbian]
- BUTORAC B. & HULO I. (1992): Phytocoenological, floristic and ornithological values of the 'Selevenjska wasteland' area as a basis for protection. – Zaštita Prir. **45**: 65–76. [In Serbian]
- BUTTLER P. K. (1991): Field guide to orchids of Britain and Europe. – Swindon, UK: The Crowood Press.
- CHASE M. W., CAMERON K. M., FREUDENSTEIN J. V., PRIDGEON A. M., SALAZAR G. A., VAN DEN BERG C. & SCHUITEMAN A. (2015): An updated classification of Orchidaceae. – Bot. J. Linn. Soc. **177**: 151–174.
- CHRISTENHUSZ M. J. M. & BYNG J. W. (2016): The number of known plants species in the world and its annual increase. – Phytotaxa **261**(3): 201–217.
- ČOLIĆ D. B. (1953): The habitats of Serbian spruce on the right side of the Drina river. – Zaštita Prir. **4–5**: 425–659. [In Serbian]
- ČOLIĆ D. B. (1964): The origin and succession of forest communities with Serbian spruce (*Picea omorika* Panč.) on Mt. Tara. – Zaštita Prir. **29–30**: 65–90. [In Serbian]
- ČOLOVIĆ-PARABUCKI S. (1958): Orchids (Orchidaceae) of Fruška Gora. – Zaštita Prir. **12**: 31–36. [In Serbian]
- DELFORGE P. (2006): Orchids of Europe, North Africa and the Middle East. – London: A. & C. Black.
- DIKLIĆ N. & NIKOLIĆ V. (1961): New data on the sites of plant species in Serbia. – Bull. Nat. Hist. Mus. Belgrade **17**: 215–235. [In Serbian]
- DIKLIĆ N. (1976): Orchidaceae Lindl. – In: JOSIFOVIĆ M. [ed.]: Flora of SR Srbije 8: 36–116. – Belgrade: Serbian Academy of Sciences and Arts. [In Serbian]

- DJORDJEVIĆ V. (2016): *Epipactis muelleri* (Orchidaceae-Neottieae), a species new to the flora of Serbia. – *Phyton* (Horn) **56**(2): 303–312.
- DJORDJEVIĆ V., JAKOVljević K. & STEVANOVIĆ V. (2016a): Three taxa of *Epipactis* (Orchidaceae-Epidendroideae) new for the flora of Serbia. – *Phyton* (Horn) **56**(1): 77–89.
- DJORDJEVIĆ V., JOVANOVIĆ S. & STEVANOVIĆ V. (2014): *Dactylorhiza fuchsii* (Orchidaceae), a new species in the flora of Serbia. – *Arch. Biol. Sci.* **66**: 1227–1232.
- DJORDJEVIĆ V., TOMOVIĆ G. & LAKUŠIĆ D. (2010): *Epipactis purpurata* Sm. (Orchidaceae) – a new species in the flora of Serbia. – *Arch. Biol. Sci.* **62**: 1175–1180.
- DJORDJEVIĆ V., TSIFTSIS S., JAKOVljević K., ŠINŽAR-SEKULIĆ J. & VUKOJIČIĆ S. (2012): First record of a natural hybrid *Neotinea* × *dietrichiana* (Orchidaceae) in Serbia. – *Phytol. Balcan.* **18**: 163–171.
- DJORDJEVIĆ V., TSIFTSIS S., LAKUŠIĆ D., JOVANOVIĆ S. & STEVANOVIĆ V. (2016b): Factors affecting the distribution and abundance of orchids in grasslands and herbaceous wetlands. – *Syst. Biodivers.* **14**(4): 355–370.
- DJORDJEVIĆ V., TSIFTSIS S., LAKUŠIĆ D. & STEVANOVIĆ V. (2016c): Niche analysis of orchids of serpentine and non-serpentine areas: Implications for conservation. – *Pl. Biosyst.* **150**(4): 710–719.
- DURAKI Š. (2008): Vascular flora of high mountain ridge Kobilica on Mt Šar planina. – Master's Thesis, Faculty of Biology, University of Belgrade. [In Serbian]
- FARRELL L. (1985): Biological flora of the British Isles: *Orchis militaris* L. – *J. Ecol.* **73**: 1041–1053.
- FAY M. F., TAYLOR I. & SAYERS B. (2015): *Ophrys insectifera*. – *Bot. Mag.* **32**: 51–62.
- FRAJMAN B., PACHSCHWÖLL C. & SCHÖNSWETTER P. (2014): Contributions to the knowledge of the flora of Dinarides (Balkan Peninsula). – *Phyton* (Horn) **54**: 27–46.
- FRITSCH K. (1909): Neue Beiträge zur Flora der Balkanhalbinsel, insbesondere Serbiens, Bosniens und der Herzegowina I. – *Mitt. Naturwiss. Vereines Steiermark* **45**: 131–183.
- GAJIĆ M. R. (1965): Contribution to the knowledge of the flora of central and southern Šumadija. – *Glasn. Muz. Šumarstva Lova* **5**: 7–54. [In Serbian]
- GAJIĆ M. (1983): Flora of Deliblato Sands. – Novi Sad: Faculty of Science, Institute of Biology, Pančevo: Forest-Industrial Complex 'Pančevo', Special Nature Reserve 'Deliblato sands'. [In Serbian]
- GAJIĆ M. (1986): Flora and vegetation of Subotica-Horgoš sands. – Faculty of Forestry, University of Belgrade. [In Serbian]
- GÖLZ P. & REINHARD H. R. (1986): Orchideen in Jugoslawien. – *Mitteilungsbl. Arbeitskreises Heimische Orchid. Baden-Württemberg* **18**: 689–827.
- HÁGSATER E. & DUMONT V. [ed.] (1996): Orchids: status, survey and conservation action plan. – Gland: IUCN.
- HAYEK A. (1933): *Prodromus Florae Peninsulae Balcanicae* 3. – *Repert. Spec. Nov. Regni Veg.* **30**: 371–416.
- HILL D. A. (1985): Orchids in southern parts of Serbia: some recent findings. – Niš, Serbia: Centenary symposium of the 'The Flora around Niš': 41–43.
- IUCN (2012): IUCN Red List Categories and Criteria: version 3.1. [2nd ed.] – Gland & Cambridge: IUCN.
- JACQUEMYN H., BRYN R. & HUTCHINGS M. J. (2014): Biological Flora of the British Isles: *Epipactis palustris*. – *J. Ecol.* **102**: 1341–1355.
- JOTIĆ B., MARKOVIĆ M., PETROVIĆ B., FUSIJANOVIĆ I., PAVLOVIĆ D. & RANĐELOVIĆ V. (2011): The vascular flora of the Vučje hill near Pirot city (Eastern Serbia). – *Biologica Nyssana* **2**: 91–106.
- JOTIĆ B., MILJKOVIĆ M., MARKOVIĆ M., ZLATKOVIĆ B. & RANĐELOVIĆ V. (2013): The vascular flora of the Tepoš plateau around Pirot city (Eastern Serbia). – *Biologica Nyssana* **4**: 19–33.
- JOVANOVIĆ B. (1956): About climatogene forest of southeastern Serbia. – *Zborn. Rad. Srpska Akad. Nauka Inst. Ekol.* **7**: 3–35. [In Serbian]

- JOVANOVIĆ B. (1960): Mixed forest of oaks with the hornbeam on Mt Fruska Gora. – Bull. Nat. Hist. Mus. Belgrade **16**: 23–42. [In Serbian]
- JURIŠIĆ Ž. J. (1923): Contribution to the flora of Southern Serbia. – Spomenik 60, Prvi Razred **10**: 3–45. [In Serbian]
- KARADŽIĆ B., MARJANOVIĆ Ž., MIJOVIĆ A., MARINKOVIĆ S. & POPOVIĆ R. (2000): *Ophrys insectifera* L., a new orchid species in flora of Serbia. – Arch. Biol. Sci. **52**: 11–12.
- KOJIĆ M. (1959): Abundance, role and importance of *Chrysopogon gryllus* Trin. in grassland communities of Western Serbia. – Arch. Poljopr. Nauk. **12**: 13–32. [In Serbian]
- KOŠANIN N. (1910): Elements of Vlasina flora. – Muz. Srpske Zemlje **10**: 1–42. [In Serbian]
- KRETZSCHMAR H., ECCARIUS W. & DIETRICH H. (2007): The orchid genera *Anacamptis*, *Orchis* and *Neotinea*. Phylogeny, taxonomy, morphology, biology, distribution, ecology and hybridization. [2nd ed.]. – Bürgel: Echino Media Verlag.
- KRIVOŠEJ Z. (1989): Flora of Mt Grmija near the city of Priština. – Master's Thesis, Faculty of Science, University of Belgrade. [In Serbian]
- KRIVOŠEJ Z. (1997): Vascular flora of Mt Ošljak. – Dissertation, Faculty of Biology, University of Belgrade. [In Serbian]
- LAKUŠIĆ D. (1993): High mountain flora of Mt Kopaonik – ecological-phytogeographical study. – Master's Thesis, Faculty of Biology, University of Belgrade. [In Serbian]
- LAKUŠIĆ D. [ed.] (1999): Plants that are disappearing: Ex situ conservation of internationally important plants of Yugoslavia. – Belgrade: Ecological Society of Serbia, Institute for Nature Conservation of Serbia. [In Serbian]
- LAZAREVIĆ P. (2009): Floristic-ecological study of peat bog Peštersko polje in SW Serbia. – Master's Thesis, Faculty of Biology, University of Belgrade. [In Serbian]
- LAZAREVIĆ P. (2016): Fens of the class *Scheuchzerio-Caricetea fuscae* (Nordh. 1936) R. Th. 1937. in Serbia – floristic and vegetation characteristics, threats and protection. – Dissertation, Faculty of Biology, University of Belgrade. [In Serbian]
- LAZAREVIĆ P., KRIVOŠEJ Z., TOMOVIĆ G. & STEVANOVIĆ V. (2013): Reports 79–86. – In: VLADIMIROV V., DANE F., STEVANOVIĆ V. & TAN K. [eds]: New floristic reports in the Balkans 22 – Phytol. Balcan. **19**: 279–283.
- MARKOVIĆ M. (1970): The geographical areas of the Socialist Federal Republic of Yugoslavia. – Belgrade: Institute for textbooks and teaching aids Serbia. [In Serbian]
- MIŠIĆ V. & DINIĆ A. (1998): The vegetation of nature preserves on the Stara Planina Mt Zaječar, Serbia: Proceedings of the 5th Symposium on flora of Southeastern Serbia: 129–138.
- MOORE D. M. (1980): Orchidaceae. – In: TUTIN T. G., HEYWOOD V. H., BURGESS N. A., MOORE D. M., VALENTINE D. H., WALTERS S. M. & WEBB D. A. [eds]: Flora europaea 5: 325–350. – Cambridge: Cambridge University Press.
- NIKETIĆ M. (1986): Phytogeographic features of the Jelašnička gorge near Niš. – Master's Thesis, Faculty of Biology, University of Belgrade. [In Serbian]
- NIKOLIĆ V. & DIKLIĆ N. (1979): New data on the sites of plant species in Serbia (VIII). – Bull. Nat. Hist. Mus. Belgrade **34**: 31–44. [In Serbian]
- NOVÁK F. (1926): Ad florae Serbiae cognitionem additamentum primum. – Preslia **4**: 37–56.
- OBRADOVIĆ M. (1966): Phytogeographical analysis of the flora of Fruška Gora. – Novi Sad: Matica Srpska. [In Serbian]
- OBRADOVIĆ M., BUDAK V. & BOŽA P. (1983): New infraspecific taxa of orchids (Orchidaceae Lindl.) in the flora of Vojvodina. – Matica Srpska **64**: 119–130. [In Serbian]
- OSTOJIĆ D. (2005): Ecological factors of the natural maintenance and restoration of Serbian spruce populations in Tara National Park. – Dissertation, Faculty of Forestry, University of Belgrade. [In Serbian]

- PANČIĆ J. (1856): Verzeichniss der in Serbien wildwachsenden Phanerogamen, nebst den Diagnosen einiger neuer Arten. – Verh. K. K. Zool.-Bot. Ges. Wien **6**: 475–598.
- PANČIĆ J. (1865): Flora around the city of Belgrade. According to the analytical method compiled by Dr. Josif Pančić. – Belgrade: Državna Štamparija. [In Serbian]
- PANČIĆ J. (1874): Flora of the Principality of Serbia or vascular plants that grow wild in Serbia. According to the analytical method agreed by Dr. Josif Pančić. Flora Principatus Serbiae. – Belgrade: Državna Štamparija. [In Serbian]
- PANČIĆ J. (1884): Additions to the Flora of the Principality of Serbia. – Belgrade: Državna Štamparija. [In Serbian]
- PAROLLY G. (1992): Die Orchideenflora Montenegros. – Mitteilungsbl. Arbeitskreis Heimische Orchid. Baden-Württemberg **24**(2): 141–391.
- PAVLOVIĆ D., MILOSAVLJEVIĆ V., MILOSAVLJEVIĆ N. & PANJKOVIĆ B. (2002): Flora of the Kamilja mountain. – Kopaonik, Serbia: Conference 'S planinom u novi vek': 159–166.
- PETKOVIĆ B. (1983): Marsh vegetation in the area of Tutin. – Bull. Inst. Jard. Bot. Univ. Belgrade **17**: 61–102. [In Serbian]
- PETKOVIĆ B. (1999): *Orchis spitzelii* Sauter ex W. Koch subsp. *spitzelii*. – In: STEVANOVIĆ V. [ed.]: Red Book of Flora of Serbia 1: 83–85. – Belgrade: Ministry of Environment of the Republic of Serbia, Faculty of Biology, University of Belgrade, Institute for Nature Protection of the Republic of Serbia.
- PETRIĆ I., STOJANOVIĆ V., LAZAREVIĆ P., PEĆINAR I. & ĐORĐEVIĆ V. (2010): Floristic characteristics of the area NP 'Đerdap' and its immediate surroundings. – Zaštita Priro. **61**: 35–59. [In Serbian]
- PETROVIĆ S. (1882): Flora of the vicinity of Niš. – Belgrade: Državna Štamparija. [In Serbian]
- PETROVIĆ S. (1885): Additions to the flora of the vicinity of Niš. – Belgrade: Državna Štamparija. [In Serbian]
- PONERT J. (2014): Contribution to the orchids of Republic of Macedonia and Serbia. – J. Eur. Orch. **46**: 561–577.
- PRODANOVIĆ D. (2006): Serpentine flora of the Kosovo's part of the Ibar river valley. – Dissertation, Faculty of Science, Department of Biology, University of Kosovska Mitrovica. [In Serbian]
- RANĐELOVIĆ V. (2002): Flora and vegetation of Vlasina plateau. – Dissertation, Faculty of Biology, University of Belgrade. [In Serbian]
- RANĐELOVIĆ V., ZLATKOVIĆ B. & AMIDŽIĆ L. (1998): Flora and vegetation of high-mountain fens of Mt Šar planina. – Zaštita Priro. **50**: 377–387. [In Serbian]
- RANĐELOVIĆ V., ZLATKOVIĆ B., JUŠKOVIĆ M. & ŽIVOJINOVIĆ LJ. (2000): Endangered of flora of Mt. Suva planina. – Sokobanja, Serbia: Proceedings of the 6th Symposium on flora of Southeastern Serbia: 303–323.
- RANKOU H. (2011): *Epipactis purpurata*. The IUCN Red List of threatened species 2011: – Published at: <http://dx.doi.org/10.2305/IUCN.UK.2011-2.RLTS.T175965A7156460.en>. [Accessed 14 Mar 2016]
- RATKNIĆ M., BRAUNOVIĆ S. & RATKNIĆ T. (2011): Diversity of the vascular flora in Rogozna Mountain in south-west Serbia. – Žabljak, Montenegro: Proceedings of the conference (Book 2), Nature protection in 21st century: 433–441.
- REXHEPI F. (1986): Flora of high mountains of Kosovo. – Pristina: ETMM. [In Albanian]
- REXHEPI F. (2013): *Gymnadenia frivaldii* Rchb. – In: MILLAKU F. [ed.]: The red book of vascular flora of the republic of Kosovo: 202. – Pristina: Ministry of Environment and spatial planning. [In Albanian]
- REXHEPI F. & RUŽIĆ M. (1985): Plant community *Ostryo-Quercetum cerris*, new association on Mt. Paštrik. – Niš, Serbia: Centenary symposium of the 'The Flora around Niš': 81–87 [In Serbian]

- RUŽIĆ M. (1983): Flora of Pasjača and Vidojevica mountains. – Acta Biol. Exp. **8**: 29–39.
- SARIĆ M. R. & DIKLIĆ N. [eds] (1986): Flora of SR Serbia 10 (Appendix 2). – Belgrade: SASA – Department of Mathematics and Natural Sciences. [In Serbian]
- SAVIĆ D. (1998): Ecology, distribution and conservation of the species of the family Orchidaceae on Mt. Fruska Gora. – Master's Thesis, Faculty of Biology, University of Belgrade. [In Serbian]
- SAVIĆ D., ANAČKOV G. & BOŽA P. (2008): New chorological data for flora of the Pannonian region of Serbia. – Cent. Eur. J. Biol. **3**: 461–470.
- SCHULER A. (2007): Contribution to the flora of northern and central Greece. – Willdenowia **37**: 229–241.
- SIGUNOV A. (1977): The second contribution to the knowledge of distribution of forest plant species in Serbia. – Bull. Nat. Hist. Mus. Belgrade **10**: 5–25. [In Serbian]
- STEVANOVIĆ V., NIKETIĆ M. & LAKUŠIĆ D. (1991): Chorological additions to the flora of eastern Yugoslavia. – Fl. Medit. **1**: 121–142.
- STEVANOVIĆ V. [ed.] (1999): The Red Data Book of Flora of Serbia 1: Extinct and critically endangered taxa. – Belgrade: Ministry of Environment of the Republic of Serbia, Faculty of Biology, University of Belgrade, Institution for Protection of Nature of the Republic of Serbia.
- TAYLOR L. & ROBERTS D. L. (2011): Biological flora of the British Isles: *Epipogium aphyllum* Sw. – J. Ecol. **99**: 878–890.
- TOMIĆ-STANKOVIĆ K. (1967): Contribution to the knowledge of the flora of Ibarski Kolašin. – Zborn. Filoz. Fak. Priština **4**: 69–83. [In Serbian]
- TOMOVIĆ G., VUKOJIČIĆ S., NIKETIĆ M. & LAKUŠIĆ D. (2007): New chorological data on some threatened and rare plants in Serbia. – Arch. Biol. Sci. **59**: 63–73.
- TRIČKOVIĆ D. (2001): Flora of the Predejanska river. – Diploma Thesis, Faculty of Sciences, University of Priština. [In Serbian]
- TSIFTSIS S., TSIRIPIDIS I. & PAPAIOANNOU A. (2012): Ecology of orchid *Goodyera repens* in its southern distribution limits. – Pl. Biosyst. **146**: 857–866.
- UROŠEVIĆ K. (1949): Zlatibor: A phytogeographical and floristic study. – Bull. Mus. Hist. Nat. Belgrade **24**: 1–36. [In Serbian]
- VELJKOVIĆ B., PRELJEVIĆ N. & KRIVOŠEJ Z. (2016): *Epipactis palustris* (L.) Crantz (Orchidaceae), the new locality on Serbian territory. – Kopaonik Mt, Serbia: Proceedings of the 12th Symposium on the flora of Southeastern Serbia and neighboring regions.
- WCSP (2016): World Checklist of Selected Plant Families. – Kew: Royal Botanic Gardens. <http://apps.kew.org/wcsp/>
- ZLATKOVIĆ B. (1999): Flora of Sićevo gorge. – Diploma Thesis, Faculty of Sciences, Institute of Biology, University of Novi Sad. [In Serbian]
- ZLATKOVIĆ B. (2011): Flora and phytogeographic affiliation of Pčinja river valley in southeast Serbia. – Dissertation, Faculty of Biology, University of Belgrade. [In Serbian]
- ZLATKOVIĆ B., RANĐELOVIĆ V., JUŠKOVIĆ M. & MARKOVIĆ M. (2005): New floristic records in Serbia and Northern Macedonia. – Niš, Serbia: Proceedings of the 8th Symposium on the flora of Southeastern Serbia and neighboring regions: 1–4.
- ZLATKOVIĆ B., RANĐELOVIĆ V. & RANĐELOVIĆ N. (1993): Contribution to the flora of southeastern Serbia. – Pirot, Serbia: Proceedings of the 3rd Symposium on the flora of Southeastern Serbia and neighboring regions: 95–110.
- ZORKÓCZY L. (1896): Novi Sad and its surrounding flora. – Újvidék: Popovits M. Testvérek Könyvnyomdája. [In Hungarian]
- ZZPS (2006): Studija zaštite Nacionalni park „Šar-planina”, knj. 1. – Beograd: Zavod za zaštitu prirode Srbije. [In Serbian]

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