

The endemic flora of Bosilegrad surroundings (Krajište region) in SE Serbia

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Abstract. Data on the presence, diversity and chorology of the endemic plant taxa of the Bosilegrad surroundings (Krajište region) in southeast Serbia are presented. Fifty-nine endemic taxa (species and subspecies) are recorded in the rich flora of this area. The greatest number of endemics is recorded in the highland, siliceous region of the Vlasina mountain chain. Considerable percentage of endemics, including the local or steno-endemic taxa, occur on the small calcareous plateau of Mt Rudina. The existence of a diverse and rich endemic flora is of great importance in the conservation of biodiversity in this area. Moreover, this fact shows that Bosilegrad surroundings are an important center of the Balkan endemic flora in the area of Serbia and the Balkan peninsula.

Key words: Balkan Peninsula, Bosilegrad surroundings, endemic taxa, flora, SE Serbia

Introduction

The Bosilegrad surroundings, well known under the name Krajište, is a mountain region in the central part of the Balkan Peninsula, situated in the remotest parts of southeast Serbia, and with most of it in west Bulgaria. The boundaries of this region in Serbia follow the line of a mountain ridge, with the following highest peaks: Krvavi Kamik (1737 m), Mt Vardenik (Pandžin Grob 1664 m; Ravnište 1703 m; Golemi Vrh 1753 m; Obršina 1734 m; Golema Ravnica 1744 m), Mt Besna Kobila (Besna Kobila 1923 m; Patarica 1672 m; Majorsko Čukle 1627 m) and Mt Dukat (Skrštena Straža 1666 m; Kolevo Gumno 1715 m; Golemi Vrh 1831 m) (Fig. 1). The massifs of these mountains form the catchment area of river Dragovištica, which is a tributary of river Struma and is one of the few rivers in the Aegean Sea catchment from Serbia. The state border between Serbia and Bulgaria cuts through the region that includes Mt Milevska (1736 m) and Mt Ru-

dina (1240 m), as well as the spacious foothills to the south from the Ribarci border pass. Further south, the border with Bulgaria and FYR Macedonia was determined by the divide of the catchment of Brankovačka River, which is a tributary of Dragovištica River. Along the divide there are some mountain peaks with altitudes of 1000–1786 m. There are also some dominant mountain massifs in the central part of the study area, for example Mt Valozi (1830 m), Mt Gloška (1756), Mt Dukat (Crnook 1881 m), etc. (Fig. 1).

The flora of Bosilegrad surroundings has been studied since the beginning of the 20th century. The first sparse records on the flora of the western, high-mountain region of Krajište (Mt Besna Kobila) were published by Adamović (1901, 1904). The first more serious studies into the flora of this region were performed by the Bulgarian researchers Toshev (1903), Urumov (1935) and Ahtarov (1953), and the Serbian botanist Rajevski (1950). However, the most signifi-

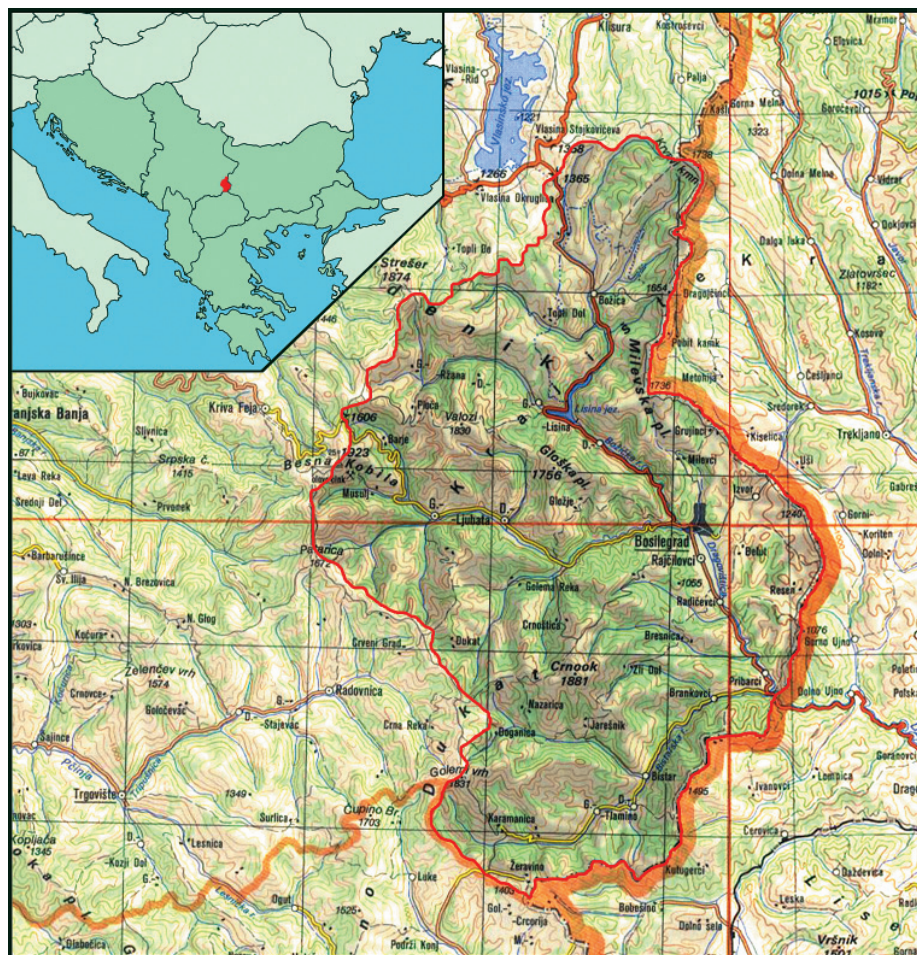


Fig. 1. Topographic map of the Bosilegrad surroundings, Krajište region in Serbia.

cant breakthrough in the studies of the flora and vegetation of the Serbian part of Krajište was made during the last three decades (Randelović 1978; Randelović & Stamenković 1986, 1987; Randelović & al. 1986; Randelović 2002; Niketić & Tomović 2003; Petrović 2004; Milosavljević & al. 2006; Avramović & al. 2006; Milosavljević 2007; Milosavljević & Randelović 2007b), when several new taxa were recorded for the flora of Serbia, as well as numerous new sites in the distribution of important taxa in the flora of Serbia and the Balkan Peninsula, especially the endemics.

Material and methods

The list of endemic taxa of the Bosilegrad surroundings is based on different literature data, herbarium collections (BEO, BEOU, SOM) and continuous field observations carried out between 2000 and 2007. The herbarium specimens are deposited at the Herbarium Moesiacum Niš, Department of Biology and Ecology, Faculty of Sciences, University of Niš, Serbia (HMN)

and the Herbarium Collection of the Randelović Family, Herbarium Moesiacum, Doljevac, Serbia (HMD).

Identification of the collected plants is made according to *Flora Europaea* (Tutin & al. (1964–1980) and the regional Floras relevant for the investigated area (Jordanov 1963–1979; Josifović 1970–1977; Velchev 1982–1989; Sarić & Diklić 1986; Sarić 1992; Kozuharov 1995). The nomenclature follows the *Med-Checklist* (Greuter & al. 1984, 1986, 1989), *Flora Europaea* (Tutin & al. 1964–1980), as well as some new data sources like *Euro+Med Plantbase* (<http://ww2.bg-bm.org/EuroPlusMed/>) and IOPI – International Organization for Plant Information (<http://plantnet.rb-gsyd.nsw.gov.au/iopi/iopihome.htm>). In a few cases the nomenclature follows some other literature sources (Asenov 1973; Stefanova-Gateva 1995; Foggi & al. 2005). For the floristic elements, the classifications of Meusel & al. (1965, 1978), Horvat & al. (1974), Meusel & Jäger (1992) and Stevanović (1992) were used. For the attribution of life forms the criteria proposed by Raunkiaer (1934), Mueller-Dombois & Ellenberg (1974) and Stevanović (1992) were followed.

Results

The analysis of flora at some specified localities in the area of the Bosilegrad surroundings (Mt Besna Kobila, Mt Rudina, Mt Milevska, etc.) showed characteristically a very rich flora composed of diverse elements in origin and age (Milosavljević & Randelović 2002; Petrović 2004; Milosavljević 2007). The endemic plants are among the plant groups important for understanding the florogenetic tendencies and phytogeographic characteristics of each region.

On the basis of the complete list of plant taxa in-

habiting the Bosilegrad surroundings, a list of fifty-nine Balkan endemic taxa was prepared (Table 1), including some local endemics (also known from the eastern part of Krajište in the Republic of Bulgaria). According to the recent phytogeographical analyses, the number of Balkan endemics in Serbian flora is 287, both at specific and subspecific level (Stevanović & al. 1999), while the mountain regions of south Serbia (mountains Besna Kobila and Vardenik) have 11–30 endemic species per 100 km² and, therefore, are cited in literature as an important region of floral endemism in Serbia (Stevanović & al. 1995).

Table 1. The list of Balkan endemic taxa of the Bosilegrad surroundings, Krajište region (abbreviations as given in Fig. 2, and: E – eastern, N – northern, S – southern, W – western).

Taxon	Distribution in the region	Endemic type	Area group	Geological substrate
<i>Achillea ageratifolia</i> (Sm.) Benth. & Hooker f. subsp. <i>serbica</i> (Nyman) Heimerl	Mt Rudina (Bregovi, Golema Ploča, Pavlovo Padinče)	illyr.(E)-sc.pind.(N)-moes.	JEP	carbonate
<i>Achillea chrysocoma</i> Friv.	Mt Besna Kobila (Prosečenica, Šuplja Padina), Mt Patarica	sc.pind.-moes.(SW)	JEP	silicate
<i>Allium melanantherum</i> Pančić	Mt Besna Kobila, (Prosečenica, Šuplja Padina), Mt Patarica	moes.	JEP	silicate
<i>Anthyllis aurea</i> Welden	Resen, Mt Rudina (Izvor, Golema Ploča)	illyr.(E)-sc.pind.-moes.(SW)	JEP	carbonate
<i>Armeria rumelica</i> Boiss.	Mt Besna Kobila (Šuplja Padina), Mt Dukat (Crnoštica, Jarešnik), Mt Rudina, Mt Vardenik, Mt Žeravinska Čuka (Golemi Kameni)	moes.-sc.pind.-mac.thrac.	JEP	silicate
<i>Asperula purpurea</i> (L.) Ehrend. subsp. <i>apiculata</i> (Sm.) Ehrend.	Musulj, Mt Rudina	moes.-sc.pind.-mac.thrac.	MSM	silicate / carbonate
<i>Astragalus wilmottianus</i> Stoj.	Mt Rudina (Bregovi)	moes.(W)	PONT	carbonate
<i>Bupleurum apiculatum</i> Friv.	Musulj, Mt Rudina (Izvor)	moes.(E)-mac.thrac.	MSM	silicate / carbonate
<i>Campanula sparsa</i> Friv. subsp. <i>sphaerothrix</i> (Griseb.) Hayek	Ljubatska river valley, Mt Besna Kobila (= Mt Musulska), Mt Rudina	moes.-mac.thrac.	MSM	silicate
<i>Carduus kernerii</i> Simonk. subsp. <i>scardicus</i> (Griseb.) Kazmi	Mt Besna Kobila (Šuplja padina)	illyr.(E)-sc.pind.-moes.	SJEP	silicate
<i>Centaurea chrysolepis</i> Vis.	Mt Rudina (Bregovi, Golema Ploča, Pavlovo Padinče)	illyr.(E)-sc.pind.-moes.	JEP	carbonate
<i>Cephalaria flava</i> (Sm.) Szabó	Brankovci (Brankovačka river gorge), Musulj	moes. (SW)-mac.thrac.	MSM	silicate
<i>Chamaecytisus tommasinii</i> (Vis.) Rothm.	Mt Besna Kobila, Mt Dukat, Mt Vardenik	illyr.(E)-sc.pind.(N)-moes.(W)	JEP	silicate
<i>Cirsium appendiculatum</i> Griseb.	Donja Ljubata, Mt Dukat (Jarešnik), Mt Besna Kobila (= Mt Musulska), Mt Vardenik	sc.pind.-moes.	SJEP	silicate
<i>Crocus veluchensis</i> Herb.	Mt Besna Kobila (Prosečenica, Šuplja Padina), Mt Gloška, Mt Dukat (Crnook), Mt Milevska, Mt Vardenik (Pandžin Grob)	illyr.(E)-sc.pind.(N)-moes.	JEP	silicate
<i>Cyanus velenovskyi</i> (Adamović) Wagenitz & Greuter	Mt Besna Kobila (Prosečenica, Šuplja Padina, Uši), Mt Dukat, Mt Patarica, Mt Vardenik (Ravnište)	sc.pind.-moes.	JEP	silicate
<i>Delphinium balcanicum</i> Pawl.	Bosilegrad, Dolnja Ljubata	moes.(SW)-mac.thrac.-ion.aege.	MSM	silicate
<i>Dianthus corymbosus</i> Sm.	Mt Dukat (Crnoštica), Mt Milevska, Mt Rudina (Izvor), Mt Vardenik (Topli Dol)	moes.(SW) -mac.thrac.	MSM	silicate / carbonate
<i>Dianthus cruentus</i> Griseb. subsp. <i>cruentus</i>	Bosilegrad, Mt Dukat (Bele Vode), Mt Besna Kobila, Ljubatska river valley, Mt Rudina (Izvor), Mt Vardenik	illyr.(E)-sc.pind.-moes.	JEP	silicate
<i>Dianthus pelviformis</i> Heuff.	Bosilegrad, Božica, Mt Dukat (Crnoštica), Musulj, Mt Rudina (Izvor), Mt Vardenik (Topli Dol)	sc.pind.-moes.(W)	PONT	silicate / carbonate
<i>Dianthus pinifolius</i> Sm. subsp. <i>pinifolius</i>	Bosilegrad, Mt Dukat (Crnoštica), Gornja Ljubata, Mt Milevska, Mt Rudina, Mt Vardenik (Topli Dol)	moes.-sc.pind.(N)-mac.thrac.	MSM	silicate

Table 1. Continuation.

Taxon	Distribution in the region	Endemic type	Area group	Geological substrate
<i>Digitalis viridiflora</i> Lindl.	Mt Besna Kobila (Prosečenica, Šuplja Padina), Mt Dukat (Crnoštica), Mt Vardenik (Ravnište)	illyr.-sc.pind.-moes.	SE	silicate
<i>Edraianthus serbicus</i> Petrović	Mt Rudina (Golema Ploča)	moes.(W)	JEP	carbonate
<i>Eryngium palmatum</i> Pančić & Vis.	Bosilegrad, Musulj, Mt Rudina (Slavče)	illyr.(E)-sc.pind.-moes.	MSM	carbonate
<i>Festuca stajanovii</i> (Acht.) Kozuharov ex Foggi & Petrova	Mt Rudina	moes.(W)	JEP	carbonate
<i>Festuca valida</i> (Uechtr.) Péntzes subsp. <i>valida</i>	Mt Besna Kobila (Šuplja Padina), Mt Dukat, Mt Vardenik	moes.(W)-mac.thrac.	JEP	silicate
<i>Genista subcapitata</i> Pančić	Mt Rudina (Bregovi, Golema Ploča, Ezero, Pavlovo Padinče)	illyr.(E)-sc.pind.-moes.(W)-mac.thrac.	JEP	carbonate
<i>Geum rhodopeum</i> Stoj. & Stef.	Božica, Mt Dukat, Mt Vardenik (Dejanova river valley, Ravnište)	moes.(E)	SJEP	silicate
<i>Hieracium pannosum</i> Boiss.	Mt Rudina, Mt Besna Kobila (= Mt Musulska)	illyr.-sc.pind.-moes.	JEP	carbonate
<i>Hypericum rumeliacum</i> Boiss.	Mt Besna Kobila, Mt Dukat (Crnoštica), Mt Rudina (Izvor)	moes.-sc.pind.-mac.thrac.	MSM	silicate / carbonate
<i>Knautia macedonica</i> Griseb.	Mt Dukat (Jarešnik), Mt Rudina (Izvor)	moes.-sc.pind.-mac.thrac.	MSM	silicate / carbonate
<i>Knautia midzorensis</i> Form. [<i>Knautia magnifica</i> auct. non Boiss. & Orph.: Toshev (1903); Randelović (1978, 2002); Randelović & Stamenković (1986)]	Mt Besna Kobila (Prosečenica, Šuplja Padina, Uši), Mt Patarica, Mt Vardenik (Ravnište)	sc.pind. (N)-moes.	SJEP	silicate
<i>Linum capitatum</i> Kit. ex Schult.	Mt Besna Kobila (= Mt Musulska), Mt Dukat (Crnook, Crnoštica), Mt Vardenik (Pandžin Grob, Ravnište)	illyr.-sc.pind.-moes.	SJEP	silicate
<i>Minuartia bulgarica</i> (Velen.) Graebn.	Mt Besna Kobila (Prosečenica), Mt Žeravska Čuka (Golemi Kameni)	moes.(E)	JEP	silicate
<i>Pastinaca hirsuta</i> Pančić	Mt Duka (Crnoštica, Jarešnik), Musulj, Mt Rudina, Mt Vardenik	moes.-mac.thrac.(N)	SJEP	silicate
<i>Peucedanum aegopodioides</i> (Boiss.) Vandas	Mt Besna Kobila (Uši)	illyr.-sc.pind.-moes.	SE	silicate
<i>Peucedanum olygophyllum</i> (Griseb.) Vandas subsp. <i>aequiradium</i> (Velen.) Tutin	Mt Besna Kobila (Prosečenica), Mt Dukat, Gornja Lubata, Musulj, Mt Vardenik (Pandžin Grob, Ravnište)	moes.(W)	SJEP	silicate
<i>Rumex balcanicus</i> Rech. f.	Mt Besna Kobila	illyr.(E)-sc.pind.(N)-moes.	SJEP	silicate
<i>Satureja kitaibelii</i> Wierzb.	Mt Rudina (Belut, Bregovi, Golema Ploča, Miovci)	moes.	MSM	carbonate
<i>Scabiosa fumarioides</i> Vis. & Pančić	Mt Rudina, Mt Dukat (Crnoštica), Mt Žeravska Čuka (Golemi Kameni)	illyr.-sc.pind.-moes.	MSM	silicate / carbonate
<i>Sesleria comosa</i> Velen.	Mt Besna Kobila (Šuplja Padina)	illyr.(E)-sc.pind.-moes.	JEP	silicate
<i>Silene asterias</i> Griseb.	Mt Besna Kobila, Donja Ržana	illyr.(E)-sc.pind.(N)-moes.	SJEP	silicate
<i>Silene fabarioides</i> Hausskn.	Mt Besna Kobila (= Mt Musulska)	moes.(SW)-sc.pind.-mac.thrac. (N)	MSM	silicate
<i>Silene flos-cuculi</i> (L.) Greuter & Burdet subsp. <i>subintegra</i> Hayek	Mt Rudina (Miovci)	moes.-sc.pind.-mac.thrac.	MSM	silicate
<i>Silene frivaldszkyana</i> Hampe	Bosilegrad, Božica, Mt Vardenik (Topli Dol)	moes.-mac.thrac.	MSM	silicate
<i>Silene roemerii</i> Friv. subsp. <i>roemerii</i>	Mt Besna Kobila (Šuplja Padina), Mt Dukat, Mt Gloška, Ljubatska river valley, Mt Vardenik (Pandžin Grob, Topli Dol)	moes.	JEP	silicate
<i>Silene sendtneri</i> Boiss.	Mt Besna Kobila, Mt Dukat (Bele Vode, Crnook), Mt Vardenik	illyr.(E)-sc.pind.(N)-moes.	JEP	silicate
<i>Stachys plumosa</i> Griseb.	Mt Dukat (Jarešnik), Rajčilovci, Ribarci, Mt Rudina (Izvor), Mt Milevska, Musulj	moes.(W)-mac.thrac.	MSM	silicate
<i>Stachys scardica</i> (Griseb.) Hayek	Mt Rudina, Mt Dukat (Crnoštica)	illyr.(E)-sc.pind.-moes.-mac.thrac.	JEP	silicate
<i>Thymus praecox</i> Opiz subsp. <i>jankaе</i> (Čelak.) Jalas	Mt Besna Kobila, Mt Dukat, Mt Vardenik (Ravnište), Mt Rudina, Mt Žeravska Čuka (Golemi Kameni)	illyr.(E)-sc.pind.-moes.	JEP	silicate / carbonate
<i>Thymus tosevii</i> Velen.	Mt Rudina	moes.	MSM	carbonate
<i>Tragopogon pterodes</i> Petrović	Mt Rudina (Golema Ploča)	moes.(W)-mac.thrac.	MSM	carbonate

Table 1. Continuation.

Taxon	Distribution in the region	Endemic type	Area group	Geological substrate
<i>Trifolium dalmaticum</i> Vis.	Mt Rudina (Izvor)	illyr.-sc.pind.-moes.-mac.thrac.	MSM	carbonate
<i>Trifolium medium</i> L. subsp. <i>balcanicum</i> Velen.	Mt Dukat (Crnoštica), Gornja Ljubata, Mt Rudina (Izvor)	illyr.(E)-sc.pind.-moes.	SE	silicate / carbonate
<i>Trifolium trichopterum</i> Pančić	Mt Rudina, Mt Javorska Čuka, Mt Vardenik, Mt Žeravska Čuka (Golemi Kameni)	moes.-mac.thrac.	JEP	silicate
<i>Trifolium velenovskyi</i> Vandas	Mt Besna Kobila, Mt Dukat (Crnoštica), Mt Rudina, Mt Milevska	illyr.(E)-sc.pind.-moes.-mac.thrac.	SE	silicate
<i>Verbascum adamovicii</i> Velen.	Mt Vardenik, Mt Besna Kobila, Mt Dukat	moes.(W)	JEP	silicate
<i>Verbascum anisophyllum</i> Murb.	Mt Rudina (Golema Ploča)	moes.(SW)	MSM	carbonate
<i>Viola tricolor</i> L. subsp. <i>macedonica</i> (Boiss. & Heldr.) A. Schmidt.	Mt Besna Kobila, Bosilegrad, Mt Dukat (Bele Vode), Radičevci, Mt Rudina, Mt Vardenik	illyr.(E)-sc.pind.-moes.	MSM	silicate / carbonate

Discussion

The flora of the Bosilegrad surroundings includes fifty-nine endemic taxa (46 species and 13 subspecies). The list of identified taxa mostly includes endemics with ranges that overlap with the territory of the Balkan floristic subregion, or just with some of its provinces. However, some of the enumerated taxa are not strictly Balkan endemics, but mainly slightly encroaching on the territory near, or close to the Danube in southeast Romania, or West Anatolia in Asiatic Turkey (*Knautia macedonica*, *Dianthus pinifolius* subsp. *pinifolius*), etc. These taxa are also given in Table 1 and are considered as endemics in the article.

The presence of an imposing number of endemic taxa has a great significance from the aspect of biodiversity and conservation of the area, emphasizing the fact that the region of Bosilegrad surroundings represents an important center of the endemic Balkan flora in Serbia.

The total list of the endemic flora of Bosilegrad surroundings can be divided into five area-groups (Fig. 2). However, the geomorphological characteristics of the area that include the presence of high mountains have enabled a strong influence of the Eurasian mountainous chorion on florogenesis. The consequence of this influence is the presence of most endemics belonging to the South European mountainous (JEP) and Central South European mountainous (SJEP) area group. The most dominant South European mountainous area group is represented by 23 endemic taxa. They are distributed into six floristic elements, where Illyrian-Scardo-Pindho-Moesian element is represented by 10 taxa, while Moesian is represented by six taxa and is the most numerous. The Central South Euro-

pean mountainous area group is represented by nine taxa divided into four floristic elements. The Illyrian-Scardo-Pindho-Moesian is the dominant element and is represented by four taxa. From the other side, the strong influence of the Mediterranean-submediterranean floristic chorion, which advances through the Struma valley, is observable in the area-spectrum of the endemic flora. A large number of endemics (21 taxa) belong to the Mediterranean-submediterranean area group (MSM), particularly to the Moesian-Macedonio-Tracian (7 taxa) and Moesian-Scardo-Pindho-Macedonio-Tracian (6 taxa) floristic elements. The Central European (SE) group includes four, and the Pontian (PONT) area group only two taxa.

Except for the prevailing Illyrian-Scardo-Pindho-Moesian endemic taxa (20), it should be noted that the Moesian endemics (12 taxa), regardless of the area group, represent one of the dominant group in the endemic flora of the Bosilegrad surroundings. In the broader sense of the term, this floristic element brings together the taxa distributed at the eastern part of the Balkan Peninsula, which presently includes the eastern part of Serbia proper, northeastern Macedonia and most of Bulgaria (excluding the southeastern parts). This completely supports the placement of the flora of this region in the Moesian province of the Balkan floristic subregion. However, a certain number of Moesian endemics included in Table 1, such as *Astragalus wilmottianus*, *Verbascum anisophyllum* and *Festuca stojanovii*, belong to the group of rare taxa in Serbia, as well as in the adjacent countries. Some of them (*Geum rhodopeum*, *Minuartia bulgarica*) are representatives of the East Moesian [moes. (E)] endemic taxa. This fact defines precisely the position of the flora of Bosilegrad surroundings,

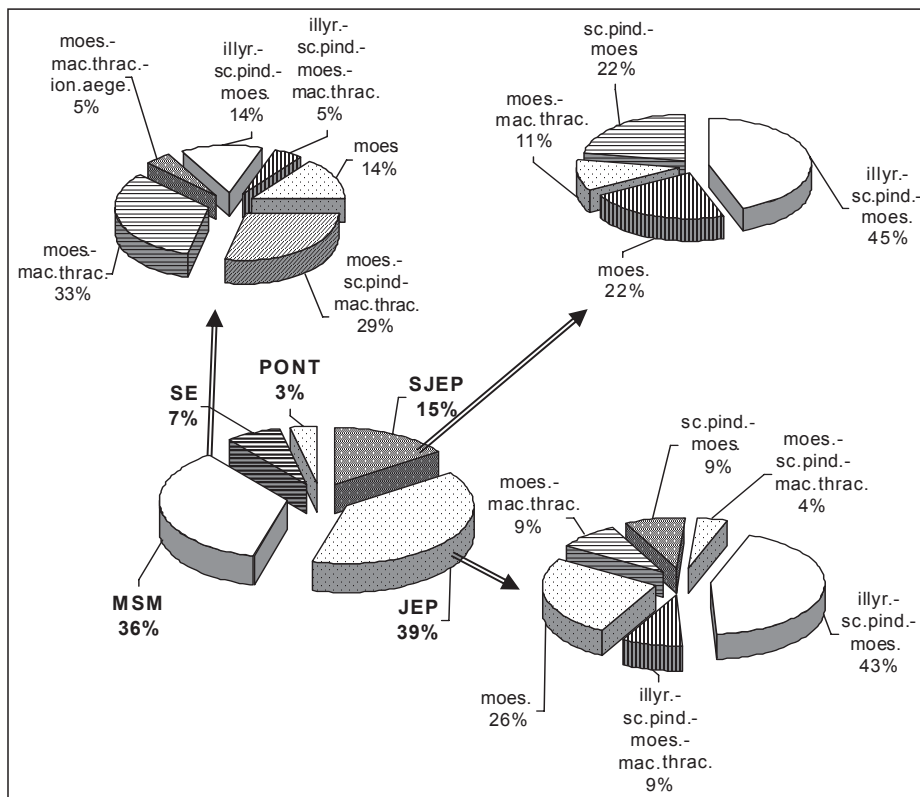


Fig. 2. Area-spectra of the endemic flora of the Bosilegrad surroundings, Krajište region.

Area groups: JEP – South European mountainous; MSM – Mediterranean-submediterranean; PONT – Pontian; SE – Central European; SJEP – Central South European mountainous.

Floristic elements: illyr. – Illyrian; ion. aege. – Ionian-Aegean; mac.thrac. – Macedonio-Thracian; moes. – Moesian; sc.pind. – Scardo-Pindhian.

placed close to the boundary of the eastern and the western part of Moesian province, and underlines the influence of its eastern parts on the florogenesis of this area. The area of Krajište also hosts several steno-endemic hybrids such as *Centaurea stojanovii* Acht. (= *C. chrysolepis* x *C. spinulosa*) and *C. spinochrysolepis* Acht. (= *C. spinulosa* x *C. chrysolepis*) described from Mt Rudina (Achtarov 1953), which were not included in this analysis due to their hybrid nature. Also, some findings of endemic taxa given by different authors, such as *Centaurea ognjanoffii* Urum., *C. nyssana* Petrović, *C. mannagettae* Podp. and *Thymus bulgaricus* (Domin & Podp.) Ronniger (Randelović & Stamenković 1986; Randelović & al. 1986; Randelović & al. 1988), are regarded as erroneous, while *Astragalus spruneri* Boiss., *Crucianella graeca* Boiss., *Orobancha pancicii* G. Beck, *O. serbica* G. Beck & Petrović and *Silene skorpilii* Velen. (Urumov 1935) have not been confirmed during our field investigations.

The flora of the Bosilegrad surroundings includes a huge number of taxa ranging not only across the Balkan peninsula, but also across some parts (either large or small within the distribution area) of the neighbouring geographic regions, considering them as sub-endemics. Many authors consider these taxa to be en-

demics *sensu lato* (Randelović 1987; Milosavljević 2007). Although they represent a group of important and often rare taxa, they were not included in this analysis. Out of the richly represented group of sub-endemic taxa from the Bosilegrad surroundings, we will mention the following: *Lilium jankae* A. Kern., *Cirsium candelabrum* Griseb., *Silene lerchenfeldiana* Baumg., *Achillea lingulata* Waldst. & Kit., *Tragopogon balcanicus* Velen., *Ranunculus serbicus* Velen., *Lamium garganicum* L. subsp. *laevigatum* Arcang., *Jasione heldreichii* Boiss. & Orph., etc.

The life forms spectrum of the endemic flora of the Bosilegrad surroundings can be divided into four main types. Their number and percentage participation are presented in Fig. 3. The biological spectrum of the endemic flora shows a pronounced hemicryptophyte character of this area. Hemicryptophytes represent 63% of the total number of endemics. This situation almost completely matches the representation of hemicryptophytes in the endemic flora of the adjacent Vlasina upland plain (Randelović 2002). Domination of hemicryptophytes in the biological spectrum of the endemic flora of the Bosilegrad surroundings completely matches the influences of the cold mountain climate. Within this life form, the best represented type is that of stem hemicryptophytes (*hemicryp-*

tophyta scaposa). On the other hand, in the region of lower mountains and hills, especially in the habitats with warm limestone substrate, the herbaceous (*chamaephyta herbosa*) and semi-woody (*chamaephyta suffrutescens*) forms of chamaephytes become more important; as a group they represent 20% of the whole endemic flora. The group of therophytes is quite frequent in appearance, as they grow in similarly dry habitats, together with the various species of chamaephytes.

More than half of the endemic taxa (35) develop mostly on silicate substrates (Fig. 4), where they are present within various types of vegetation. Most endemic taxa, such as *Sesleria comosa*, *Cyanus velenovskyi* (Fig. 5), *Allium melanantherum*, *Armeria rumelica*, *Achillea chrysocoma*, *Carduus kernerii* subsp. *scardicus*, *Dianthus cruentus* subsp. *cruentus*, *Digitalis viridiflora*, *Festuca valida*, *Knautia midzorensis*, *Silene sendtneri*, *Verbascum adamovicii*, and *Viola tricolor* subsp. *macedonica* are recorded in the herbaceous vegetation of the high-mountain pastures from the alliances *Poion violaceae* and *Festucion valido-paniculatae* (*Seslerietalia comosae*, *Juncetea trifidi*), in the silicate heathlands from the alliances *Bruckenthalion spiculifoliae* and *Vaccinion uliginosi* (*Vaccinietaalia*, *Vaccinio-Piceetea*), and in the mountain meadows from the

alliances *Chrysopogoni-Danthonion calycinae* (*Brometalia erecti*, *Festuco-Brometea*) and *Armerio-Potentillion* (*Armerietalia rumelicae*, *Festuco-Brometea*). A smaller number of endemics, such as *Minuartia bulgarica*, are recorded in the rock-dwelling vegetation from the Carpathian-Balkan alliance *Silenion lerchenfeldiana* (*Asplenietalia septentrionalis*, *Asplenietea trichomanis*), which inhabits the high mountain tops of the region.

A certain number of extremely rare, mostly Moeisian endemics, is characteristic of the vegetation developing around streams and springs, which belongs to the syntaxonomic alliances *Cardamino-Montion* (*Montio-Cardaminetalia*, *Montio-Cardaminetea*), *Rumicion balcanici*, *Geion coccinei*, and *Cirsion apendiculati* (*Cirsietalia appendiculati*, *Mulgedio-Aconitetea*). This type of vegetation is a characteristic trait of the high siliceous mountains of Krajište and includes such species as *Rumex balcanicus*, *Geum rhodopeum*, *Silene asterias*, and other endemics.

Important habitats of the endemic flora in this region are bare rocks and stony ground, screes and pastures on limestone, as well as dry pastures on narrow silicate beds (Milosavljević & al. 2005). Such areas are situated in the hilly and low-mountain region in the southeastern part of the Bosilegrad surround-

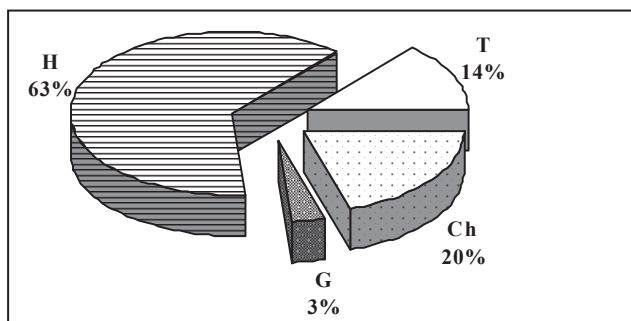


Fig. 3. Life-form spectrum of the endemic flora of the Bosilegrad surroundings, Krajište region: H – hemicryptophytes; G – geophytes; Ch – chamaephytes; T – therophytes.

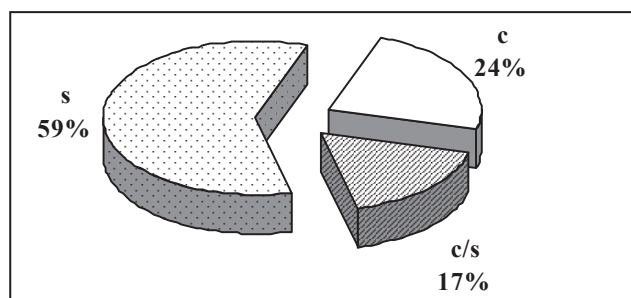


Fig. 4. Endemic flora of the Bosilegrad surroundings, Krajište region: substrate preference: s – silicate; c – carbonate; c/s – carbonate/silicate.



Fig. 5. *Cyanus velenovskyi* (Mt Besna Kobila) (photo B. Zlatković).

ings in Serbia (Mt Rudina and its foothills), which is distinct in geomorphological and geological sense, and is under the influence of a warmer climate from the Aegean Mediterranean. Finally, numerous reports (Randelović 1987; Randelović & Milosavljević 2006; Milosavljević 2007; Milosavljević & Randelović 2007a) have recorded 33 endemic species on the Rudina massif, including 14 species that appear exclusively on carbonate substrate. Most endemic taxa from this area are recorded in the vegetation of xerophilous pastures and steppe-like vegetation, belonging to the alliances *Seslerion rigidae* (*Seslerietalia juncifoliae*, *Festuco-Seslerietea*) developing on limestone, *Armerio-Potentillion* (*Armerietalia rumelicae*, *Festuco-Brometea*) developing on limestone and/or silicate, and *Scabioso-Trifolion dalmatici* (*Astragalopotentilletalia*, *Festucetea vaginatae*) developing on siliceous substrate. In terms of appearance in this region's endemic flora, another important alliance is *Edraiantho graminifolii-Erysimion comatae* (*Potentilletalia caulescentis*, *Asplenietea trichomanis*) and its association *Edraiantho serbici-Anthylletum aureae* that grows in the cracks of limestone rocks. The role of edicator species in this association is played by the endemic species *Edraianthus serbicus* and *Anthyllis aurea*.

Conclusion

The endemic flora of Bosilegrad surroundings includes fifty-nine taxa (46 species and 13 subspecies) sorted out between seven different types from the group of Balkan endemics. The results of the analyses have shown that most (33.9%) endemic flora in the Bosilegrad surroundings is represented by the Illyrian-Scardo-Pindho-Moesian endemics. Another well reported group of endemic taxa (20.3%) overlaps in range with the Moesian floristic province. The endemic flora of the Bosilegrad surroundings can be divided into four main types of life forms. Hemicryptophytes are represented by 63% of the total number of endemic species. Over half the endemic taxa from the flora of Bosilegrad surroundings is recorded in habitats where the mother rock is composed of various types of silicates. The affinity of the endemic flora towards specific types of geological substrate is a well-developed phenomenon in this region.

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