UDK 581.9(234.422 KONJUH)
DOI 10.54652/RSF.2023.V53.I1.554

ORIGINAL SCIENTIFIC PAPER

Balkan endemic vascular flora of the Konjuh Mountain

Balkanska endemska vaskularna flora planine Konjuh

Jasmina Kamberović[1,*], Šemso Šarić[2], Nermina Sarajlić[3], Edin Hadžimustafić[1]

[1] University of Tuzla, Faculty of Natural Sciences and Mathematics, Urfeta Vejzagića 4, 75 000 Tuzla, Bosnia and Herzegovina
[2] Jelaške, 71340 Olovo, Bosnia and Herzegovina
[3] Ornithological Society "Naše ptice", Semira Frašte 6, 71000 Sarajevo, Bosnia and Herzegovina

ABSTRACT

This paper presents data on the diversity and distribution of Balkan endemic vascular plants on Konjuh Mountain in northeastern Bosnia and Herzegovina. Konjuh is characterized by geological heterogeneity and a significant proportion of ophiolitic substrate, which supports the development of endemic-relict serpentinophytes. A total of 31 endemic and four subendemic taxa were recorded in the surveyed area. Among these, *Caryophyllaceae*, with five recorded endemic taxa, is the most abundant family. The analysis of life forms and chorological spectra showed a dominance of hemicryptophytes and taxa from the South European and Mediterranean-Sub-Mediterranean chorological groups. The majority of endemic and relict taxa in the surveyed area are serpentinophytes. A total of 18 recorded taxa are listed as threatened according to the Red List of Flora of the Federation of Bosnia and Herzegovina. The species findings are presented with a distribution map. The distribution range of endemic and endangered taxa in Konjuh extends beyond the protected area. The results provide a list of locations of particular interest for further research and potential protection due to the diversity of endemic taxa.

Key words: *endemics, serpentinophytes, threatened taxa, flora, Konjuh*

INTRODUCTION – *Uvod*

The term "endemism" can be defined in many ways, and in most cases, it refers to the limitation of a species' range to a geographical area, type of ecosystem or habitat, biogeographical region, or a specific country (Nikolić et al., 2015). In the biological context, endemics are taxonomic units (populations, subspecies, species, genera) whose distribution is restricted to a certain area (Šilić, 1990). Depending on the size of their range, endemics can be divided into two groups: subendemic, or endemics in a broader sense, which inhabit larger geographical areas (e.g., the entire Balkan Peninsula), and steno-endemics, or endemics in the narrower sense, which are distributed in smaller areas (individual mountains, canyons, island groups, a single country). Additionally, the term "local endemics" is used to describe taxa limited to a narrow area of up to several hectares. The definition of Balkan endemic species has remained unchanged since Turill (1929), who defined them as species with a range limited to the Balkan Peninsula (Tomović et al., 2014). According to the available data, the vascular flora of the Balkan Peninsula contains approximately 8000 taxa, including 2600-2700 endemic taxa at the species or subspecies level (Stevanović, 2005).

* Corresponding author: Jasmina Kamberović, jasmina.kamberovic@untz.ba

The unique processes of forming the geological base, soil types, relief, ecoclimate, and water regime in the past have led to the development of a unique flora in the Dinarides of Bosnia and Herzegovina. It is characterized by the presence of numerous paleo- and neo-endemics, as well as tertiary and glacial relics that survived in refugia such as gorges, canyons, and mountain cirques. The first National report for the Convention on Biodiversity (Redžić et al., 2008) states that the flora of Bosnia and Herzegovina contains 450 endemics, which is one-tenth of the total number of vascular taxa registered in the country. According to Lubarda et al. (2014; 2019), the flora of Bosnia and Herzegovina contains 309 Balkan endemic taxa at the species and subspecies level, classified into five chorological groups.

The parts of Konjuh Mountain consist of serpentine (ophiolitic, ultramafic) rocks, characterized by a low silicon content (less than 45%), calcium deficiency, high concentrations of aluminum, iron, magnesium, nickel, cobalt, and chromium, and a low content of plant nutrients (Pustahija, 2011). The serpentine area is rich in basiphilous-calcifugal plants. According to Stevanović et al. (2003), 15–16% of Balkan endemics have been recorded on serpentine, while 123 (6%) endemic taxa are obligate serpentinophytes.

The first extensive floristic research of Konjuh was conducted in the western part of the mountain by Ritter-Studnička (1958; 1963; 1970) as part of a broader study of the serpentine flora and continued for the purpose of an exhaustive study of genome size in plants growing on serpentine (Pustahija et al., 2013). The diversity of algae and aquatic plants in crenic communities of the Konjuh Mountain was described by Kamberović (2015; 2020) and Kamberović et al. (2019). Several endangered and endemic taxa were listed in the paper on the diversity of Paučko Lake (Kamberović et al., 2020). Recent publications include remarks on the distribution of endemic plants *Polygonum albanicum* (Maslo and Šarić, 2021) and *Euphorbia serpentini* (Maslo et al., 2022), as well as data on the distribution of the threatened species *Adenophora liliifolia* (Ballian and Šarić, 2015).

A part of Konjuh Mountain is legally protected as a fifth-category protected area - a Protected Landscape, and recent biological surveys have mainly focused on this area. A study conducted by a group of authors contracted by "Enova" in 2017, in order to create a baseline of the state of biodiversity of the Konjuh Protected Landscape, lists a total of 11 endemics and 10 sub-endemics out of a total of 326 plant taxa registered in the area of the Protected Landscape. Additionally, a study on species and ecosystem diversity in the Protected Landscape Konjuh, published as part of a project realized by the non-governmental organization CISP (2019), lists about 500 plant taxa but excludes the endemism analysis.

The aim of this paper is to survey and present qualitative data on the taxonomy, distribution, chorological groups, floristic elements, and conservation status of Balkan endemic plant taxa in the entire area of Konjuh Mountain, including parts outside of the present Protected Landscape for which recent data were not available.

MATERIALS AND METHODS – *Materijal i metode*

Study area

The Konjuh Mountain is part of the central Dinarides. It is located between northeastern and central Bosnia and is topographically classified as a hilly-mountainous area, with absolute altitudes ranging from 300 to 1326 m a.s.l. (Ristić et al., 1967). The geological structure consists of a complex of magmatic, metamorphic, and sedimentary formations. Konjuh is part of a large ultrabasic massif, the Krivaja-Konjuh ophiolite complex, which is one of the largest complexes in the Dinaric ophiolite zone. Ultramafic rocks (ultrabasic, serpentine, peridotite) predominate in the geological structure of Konjuh Mountain, especially in the west and northwest. The central parts of the mountain consist of igneous rocks, mostly diabase, and the eastern part is mostly composed of sedimentary rocks of Middle Triassic limestone. An undissociated formation of ophiolitic mélange is found along the eastern and southern parts of the Konjuh peridotite-serpentine massif. It includes various clays (sometimes schistose), sandstones, less often conglomerates, marls, marly limestones, and cherts (Babajić, 2009).

Automorphic soils, namely eutric cambisols, are the most widespread soil types in the area of Konjuh Mountain. Ranker-cambisol and cambisol-luvisol layers on peridotites and serpentinites, and distric cambisol on acid silicate rocks, are also common, while chalcocambisols are far less represented. The area of Konjuh is situated in a moderately continental climate zone and is characterized by harsh winters and warm summers, with a continental pluviometrical precipitation regime (Kudumović Dostović et al., 2019).

According to CISP (2019), the vegetation types present in Konjuh Mountain include acidophilic beech forests (*Luzulo-Fagion sylvaticae*), Illyrian beech forests (*Aremonio-Fagion*), black pine and Scots pine forests on serpentine and peridotite (*Erico-Fraxinion orni*) with relict asso-

ciations *Seslerio serbicae-Pinetum nigrae* and *Erico-Pinetum sylvestris*, acidophilic mountain spruce forests (*Vaccinio-Picenion*) including *Luzulo sylvaticae-Piceetum* association, oak-hornbeam forests (*Erythronio-Carpinion betuli* and *Quercion petraeae*) with *Epimedio-Carpinetum betuli* and *Erico-Quercetum petraeae* associations, alluvial forests on fluvisols (*Alnion glutinosae*), serpentine rocky grassland of the order *Halacsyetalia sendtneri*, mountain and lowland hay meadows, limestone and silicate rocks with chasmophytic vegetation, and partially developed limestone screes. The flora and vegetation on the peridotites and serpentinites of Konjuh Mountain have a tertiary-relict character and have been preserved in refugium-type habitats, especially in the ecosystems of black pine and Scots pine forests, serpentine rocky grasslands, and rock crevices. Kamberović (2015) also described the *Platyhypnidion rusciformis*, *Cratoneurion commutati*, and *Caricion remotae* alliances in spring ecosystems on the Konjuh Mountain.

The data on the distribution of endemic vascular flora in Konjuh were collected from 2002 to 2022. The survey covered the wider area of Konjuh Mountain, which stretches between Olovo, Kladanj, Banovići and Živinice basins and the Krivaja River (Figure 1), and focused on serpentine habitats in Grabovica, Olovo, Župeljeva, Velika Maoča, Velika and Mala Ribnica, Mačkovac, Varda, Zelenboj, Zidine, Veliki Konjuh, Mali Konjuh, and the watersheds of Drinjača. The limestone habitats around Olovo, Crni Potok, Kamensko-Sokolina, Brateljevići, Tuholj, Krabanja, Djedinska planina, and Mačkovac were also surveyed.

Figure 1. The study area of Konjuh Mountain

Slika 1. Područje istraživanja Konjuh planine

Species identification and data analysis

The plant taxa were identified according to Tutin et al. (1964-1993) and Nikolić (2020a; 2020b). Taxonomic status was determined according to the Euro+Med database (http://ww2.bgbm.org/EuroPlusMed/). The endemic status was assigned based on the lists of endemic taxa (Šilić, 1990; Lubarda et al., 2014; Lubarda, 2019). The assessment of the conservation status was done according to the Red List of wild species and subspecies of plants, animals, and fungi of the Federation of Bosnia and Herzegovina (Official Gazette of the Federation of Bosnia and Herzegovina, 07/14; Đug et al., 2013), and the IUCN Red List of Threatened Species (IUCN, 2022). The analysis of the presence of protected taxa was done according to the list from the Rulebook on Protection Measures for Strictly Protected Species and Subspecies (Official Gazette of the Federation of Bosnia and Herzegovina, 21/2020). The relict status was assigned according to Stevanović et al. (2003). The data on floral elements and chorological groups were determined according to Lubarda et al. (2014), and the data on life forms according to Raunkiaer (1934) from Mueller-Dombois & Ellenberg (1974) and Stevanović (1992). Digital photographs were taken for each taxon in the field.

The distribution of the taxa is presented on the map using a standard UTM 10×10 km grid based on the Military Grid Reference System (MGRS) projection (Lampinen, 2001) in zones 33T and 34T. The distribution map of endemic taxa was created using QGIS software version 3.4, based on OSM (https://www.openstreetmap.org).

RESULTS AND DISCUSSION – *Rezultati i diskusija*

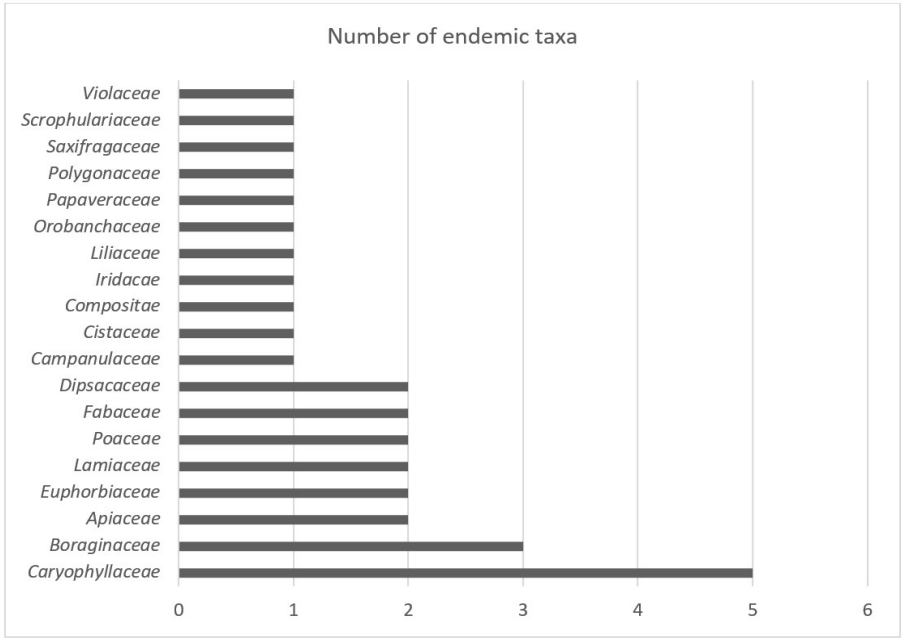
A total of 31 endemic plant taxa, classified into 19 families and 27 genera, were recorded in the area of the Konjuh Mountain (Table 1). This number represents 10% of the total number of plant endemics listed by Lubarda et al. (2019) specific to Bosnia and Herzegovina. Additionally, 4 subendemic taxa were identified: *Dianthus giganteus* D'Urv subsp. *croaticus* (Borbás) Tutin, *Dianthus petraeus* Waldst. et Kit. subsp. petraeus, *Scabiosa cinerea* Lam. subsp. *cinerea*, and *Pilosella pavichii* (Heuff.) Arv.-Touv (synonym of *Hieracium pavichii* Heuff.). The distribution of these taxa extends across a wider area of South-Eastern Europe and therefore they are not included in the list. *Caryophyllaceae* is the most abundant family with 5 taxa, followed by *Boraginaceae* with 3 taxa (Graph 1). Genera *Sesleria, Euphorbia, Knautia*, and *Cerastium* are represented by two taxa each, while all other genera are represented by only one taxon.

Table 1. List of the Balkan endemic taxa of the vascular flora of the Konjuh Mountain

Tabela 1. Popis balkanskih endemskih taksona vaskularne flore planine

Taxon	Chorological group	Chorological subgroup	Floral element	Life form*	Threatened status*	Conservation status*
Apiaceae						
1. *Athamanta turbith* (L.) Brot. subsp. *haynaldii* (Borbás et Uechtr.) Tutin	SEM	Dinar-Balk	Dinar(W-E)-Balk(sc-pind(N))	Ch	**EN**	
2. *Peucedanum aegopodioides* (Boiss.) Vandas	CE	Illyr-Balk	Illyr(C-E)-Balk(sc-pind(N-C)-moes(W-C)	H		
Boraginaceae						
3. *Halacsya sendtneri* (Boiss.) Dörfler.	MED-SUBMED	Balk(subcont)	Illyr(C-E)-Balk(sc-pind(N-C))	Ch	NT	
4. *Myosotis suaveolens* Willd.	CEM	Dinar-Balk	Dinar(W-E)-Balk(sc-pind(N-C)-moes(W-E))	H		
5. *Onosma stellulata* Waldst. et Kit.	MED-SUBMED	Balk(subcont)	Illyr(W-E)-Balk(sc-pind(N))	Ch	**LC**	
Campanulaceae						
6. *Edraianthus graminifolius* (L.) A.DC.	SEM	Dinar-Balk	Dinar(C-E)-Balk(moes(W))	Ch	NT	
Caryophyllaceae						
7. *Cerastium malyi* (Georgiev) Niketić subsp. *serpentinii* (Novak) Niketić.	SEM	Dinar	Dinar(C-E)	Ch		
8. *Cerastium rectum* Friv.	SEM	Dinar-Balk	Dinar(C-E)-Balk(sc-pind(N)-moes(W-E))	T		
9. *Gypsophila spergulifolia Griseb.* var. *serbica* Vis. & Pančić	MED-SUBMED	Balk(subcont)	Illyr(C-E)-Balk(sc-pind(N-C))	Ch		
10. *Heliosperma pusillum* subsp. *monachorum* (Vis. & Pančić) Niketić & Stevanović	SEM	Dinar	Dinar(C-E)	Ch	DD	
11. *Minuartia bosniaca* (G. Beck) K. Maly	SEM	Dinar-Balk	Dinar(C-E)-Balk(sc-pind(N)-moes(W))	H	VU	
Cistaceae						
12. *Fumana bonapartei* Maire & Petitm.	MED-SUBMED	Balk(subcont)	Illyr(C-E)-Balk(sc-pind(N-C))	Ch	**CR**	**SP**
Compositae						
13. *Centaurea nigrescens* subsp. *smoliensis* (Hayek) Dostal.	CE	Illyr	Illyr(C-E)	H	VU	
Dipsacaceae						
14. *Knautia sarajevensis* (Beck) Szabó	CEM	Dinar	Dinar(C-E)	H	LC	
15. *Knautia dinarica* (Murb.) Borbás subsp. *dinarica*	CE	Illyr	Illyr(C-E)	H	LC	
Euphorbiaceae						
16. *Euphorbia gregersenii* K.Maly.	CE	Illyr	Illyr(C-E)	H	NT	
17. *Euphorbia serpentini* Novák	SEM	Dinar		H		

Fabaceae						
18. *Cytisus austriacus* var. *maezius* K.Maly	PONT	Illyr	Illyr(C-E)	P		
19. *Trifolium dalmaticum* Vis.	MED-SUBMED	Balk(med-submed subcont)	Adriat(N-S)-Ion(N-S)-Illyr(W-E)-Balk(sc-pind(N-S)-moes(W-E))	T		
Iridaceae						
20. *Iris reichenbachii* Heuff. var. *bosniaca* G. Beck	SEM	Dinar	Dinar(C-E)	G	LC	
Lamiaceae						
21. *Stachys recta* subsp. *baldaccii* (K. Malý) Hayek	SEM	Dinar	Dinar(W-E)	H	**CR**	
22. *Thymus praecox* subsp. *jankae* (Čelak.) Jalas	MED-SUBMED	Balk(subcont)	Illyr(W-E)-Balk(sc-pind(N-C)-moes(W))	Ch		
Liliaceae						
23. *Lilium carniolicum* Bernh. ex Koch subsp. *bosniacum* (Beck) Asch.et Graebn.	CEM	Dinar-Balk	Dinar(C-E)-Balk(sc-pind(N-C))	G	DD	
Orobanchaceae						
24. *Melampyrum hoermannianum* K. Maly	CE	Illyr	Illyr(C-E)	T	DD	
Papaveraceae						
25. *Pseudofumaria alba* subsp. *leiosperma* (P. Conrath) Lidén	MED-SUBMED	Balk(subcont)	IllyrW-E)-Balk(sc-pind (N)	H	**EN**	**P**
Poaceae						
26. *Sesleria latifolia* (Adamovic) Degen. var. *serpentinica* Deyl.	SEM	Dinar-Balk	Dinar(C-E)-Balk(sc-pind(N-C)-moes(W-E))	H		
27. *Sesleria serbica* (Adamović) Ujhelyi	SEM	Dinar	Dinar(C-E)	H		
Polygonaceae						
28. *Polygonum albanicum* Ják.	PONT	Illyr-Balk	Illyr(C-E)-Balk(sc-pind(N-C))	T		
Saxifragaceae						
29. *Saxifraga blavii* (Engler) Beck	CEM	Dinar-Balk	Dinar(W-E)-Balk(sc-pind(N))	H		
Scrophulariaceae						
30. *Scrophularia canina* L. subsp. *tristis* (K. Maly) Nikolic	MED-SUBMED	Balk(subcont)	Illyr(C-E)-Balk(sc-pind(N))	T-H	**EN**	**P**
Violaceae						
31. *Viola beckiana* Fiala ex Beck.	MED-SUBMED	Balk(subcont)	Illyr(C)	H	NT	



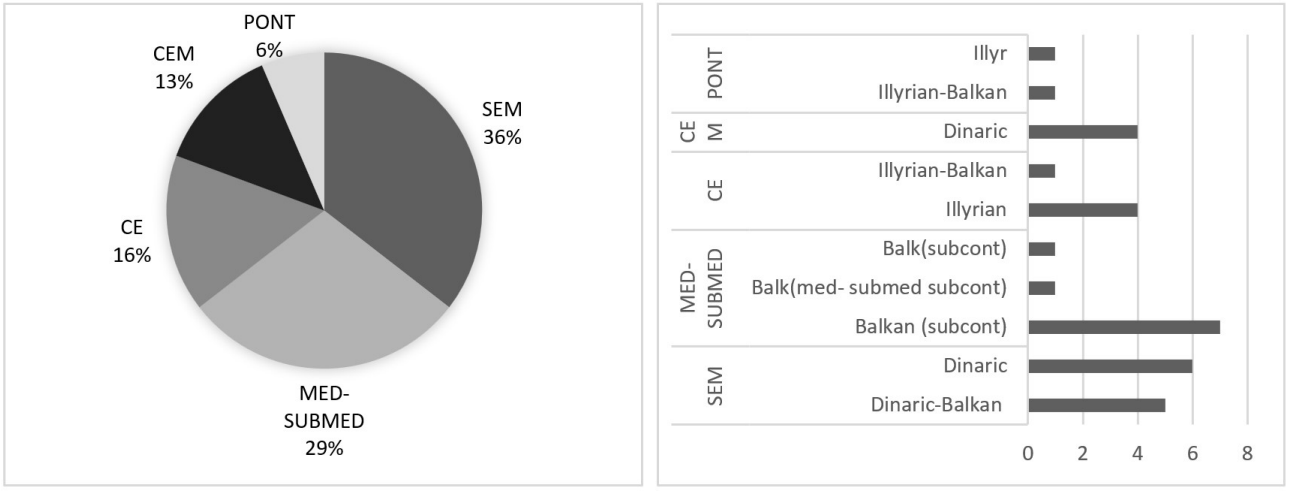
Graph 1. Endemic taxa richness at the family level

Grafikon 1. Bogatstvo endemskih taksona na nivou familije

* SEM - South European mountainous, MED-SUBMED - Mediterranean-Submediterranean, CEM - Central European mountainous; CE - Central European, PONT - Pontic, Chamephyte (Ch), Hemicryprophyte (H), Geophyte (G), Therophyte (T); CR - critically endangered, EN - endangered, NT - near threatened, LC - least concern, DD - data deficient; Conservation status: SP-strictly protected taxa, P – protected taxa.

The endemic taxa of the Konjuh Mountain were recorded in MGRS quadrants 100×100 BP, CP, BQ, and CQ (Figure 2). Most taxa were found in quadrants BQ90, CQOO, CQ01, and BQ91.

The highest number of endemic taxa recorded in the Konjuh Mountain are serpentinophytes. Obligate serpentine endemics in the studied area include *Halacsya sendtneri*, *Fumana bonapartei*, *Gypsophila spergulifolia* var. *serbica*, *Polygonum albanicum*, *Stachys recta* subsp. *baldacci*, *Scrophularia canina* subsp. *tristis*, *Sesleria serbica*, *Euphorbia gregersenii*, *Centaurea nigrescens* subsp. *smoliensis*, and *Euphorbia serpentini*. Within the boundaries of the



a) b)

Graph 2. Spectrum of chorological groups (a) and subgroups (b) of the Balkan endemic vascular flora of Konjuh Mountain: SEM - South European mountainous, MED-SUBMED - Mediterranean-Sub-Mediterranean, CEM - Central European mountainous; CE - Central European, PONT - Pontic.

Grafikon 2. Spektar horoloških grupa (a) i podgrupa (b) balkanske endemske vaskularne flore planine Konjuh. SEM – južno evropsko planinska, MED-SUBMED – mediteransko-submediteranska, CEM – centralno-evropsko planinska, CE – centralno-evropska, PONT- pontska.

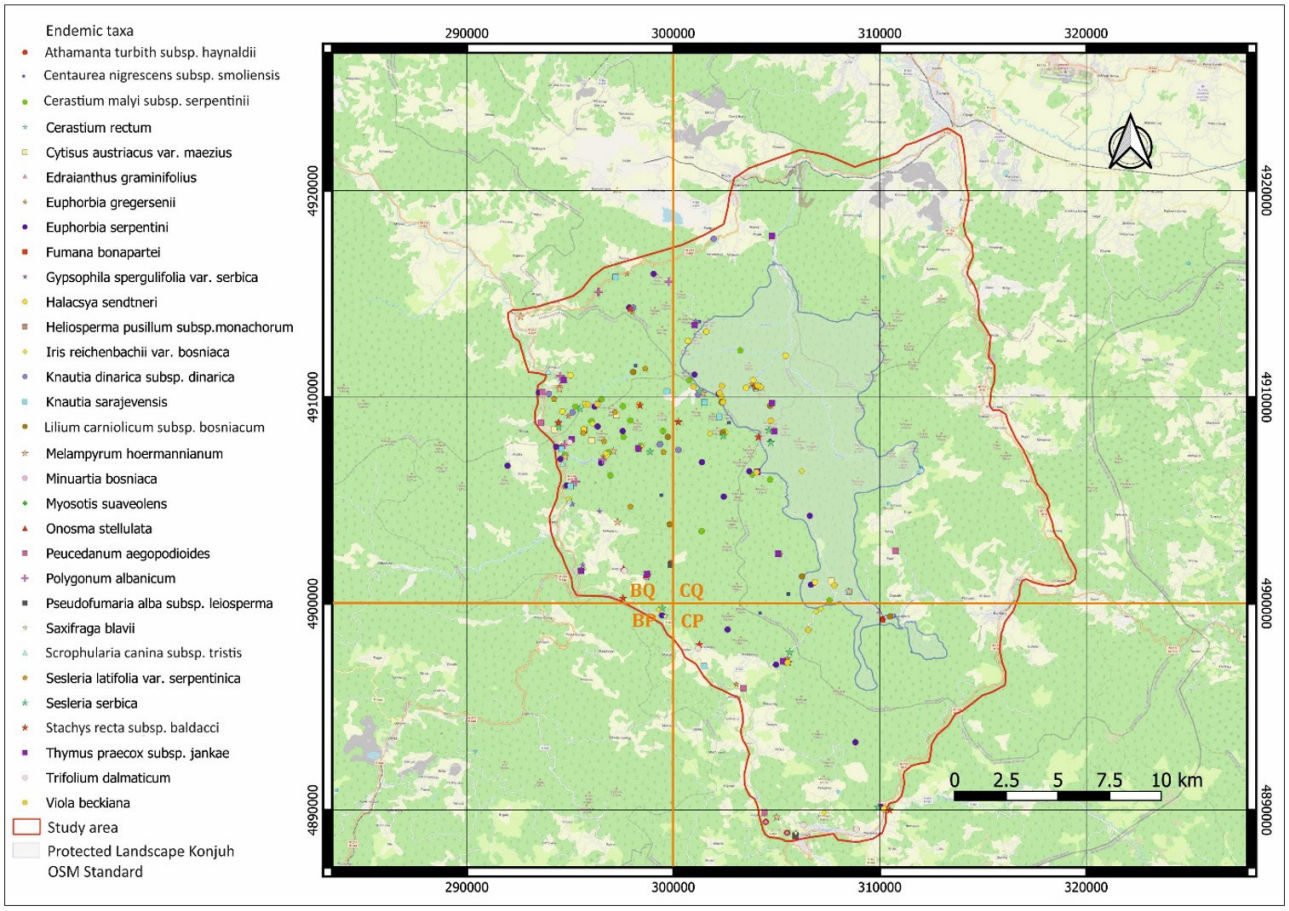


Figure 2. The distribution of endemic taxa on the Konjuh Mountain per MGRS 10×10 km square

Slika 2. Distribucija endemskih taksona na planini Konjuh po MRGR kvadrantima 10×10 km

Konjuh Protected Landscape, the locations of Varda, Zidine, Zelenboj, Mali Konjuh, Miljevica, and Borovnica are of special interest for stricter preservation due to the richness of endemic flora. A large number of endemic taxa were registered outside the boundaries of the Konjuh Protected Landscape, which administratively belongs to the Zenica-Doboj canton. The locations of Zerinska kosa, Modra ploča, Mladoševac, Smolin, the catchment area of the upper reaches of Župeljeva, and Mala Maoča are of particular interest for more detailed ecosystem research and further protection of relict serpentine endemic taxa.

In comparison to the above-mentioned taxa, a lower number of endemic taxa occur exclusively on limestone rocks: *Athamanta turbith* subsp. *haynaldii*, *Pseudofumaria alba* subsp. *leiosperma*, *Edraianthus graminifolius*, *Minuartia bosniaca*, and *Onosma stellulata*. The locations of Sokolina, Kamensko, Magulica, Olovski krševi, and the limestone area around the Drinjača river are important for detailed research and potential protection of habitats for carbophilic endemic taxa of the Konjuh mountain.

The chorological analysis of the Balkan endemics on the Konjuh Mountain reveals the dominance of Dinaric and Dinaric-Balkan floral elements, which belong to the South European Mountain (SEM) and Mediterranean-Sub-Mediterranean chorological groups (MED-SUBMED) (Graphs 2a and 2b).

The South European Mountain chorological group is the most numerous group of endemics in Bosnia and Herzegovina and neighboring Serbia (Tomović et al., 2014). The related taxa are widespread in the mountains of southern Europe. The representatives of this chorological group in the flora of Konjuh Mountain include *Cerastium malyi* subsp. *serpentinii, Cerastium rectum*, *Edraianthus graminifolius*, *Euphorbia serpentini*, *Iris reichenbachii* var. *bosniaca*, *Heliosperma pusillum* subsp. *monachorum*, *Sesleria latifolia* var. *serpentinica*, and *S. serbica* (*Figure 3*).

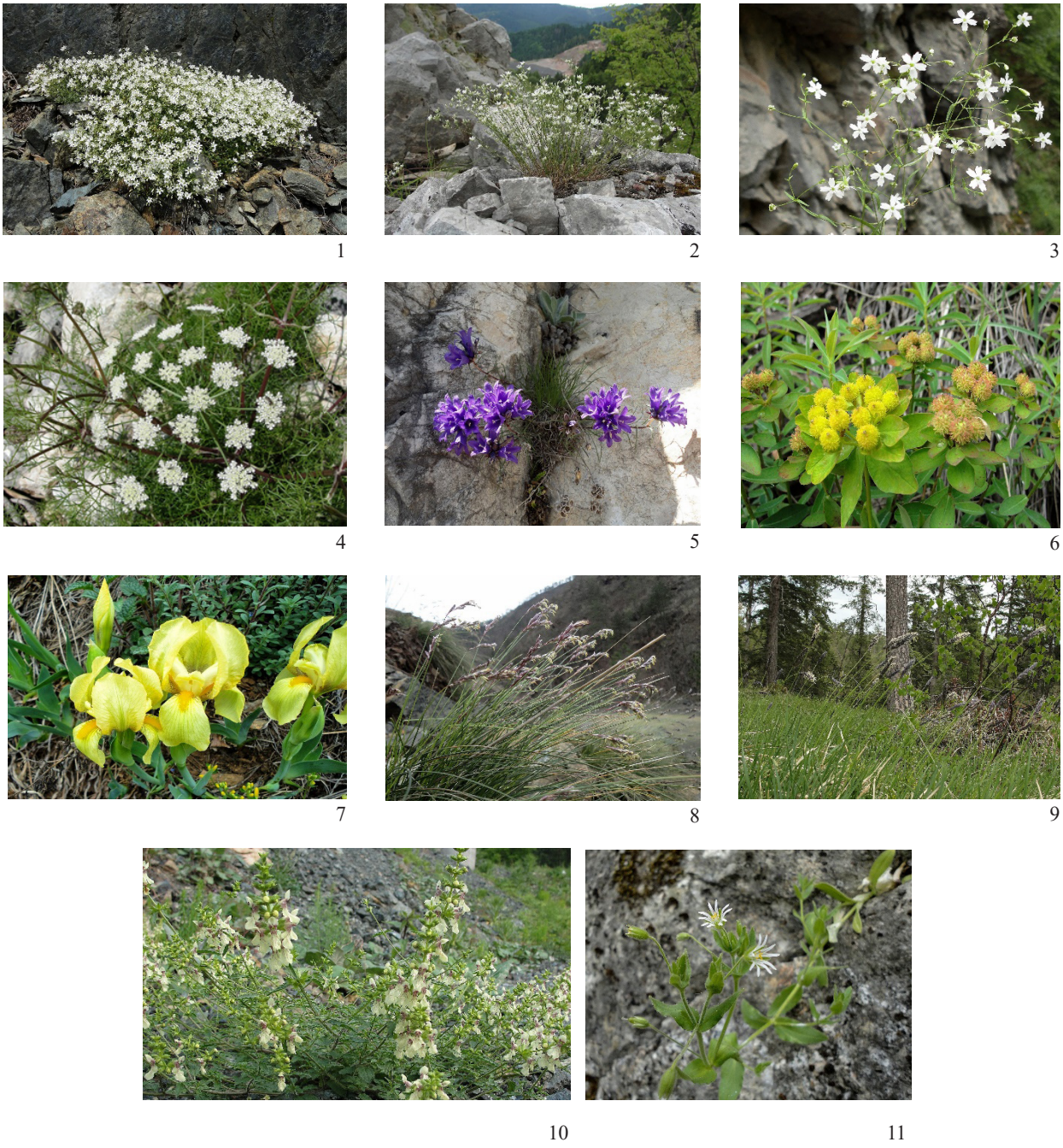


Figure 3. Endemic taxa of the Konjuh Mountain from the SEM chorological group: 1 *Cerastium malyi* subsp. *serpentinii*, 2 *Minuartia bosniaca*, 3 *Heliosperma pusillum* subsp. *monachorum*, 4 *Athamanta turbith* subsp. *haynaldii*, 5 *Edraianthus graminifolius*, 6 *Euphorbia serpentini*, 7 *Iris reichenbachii* var. *bosniaca*, 8 *Sesleria serbica*, 9 *Sesleria latifolia* var. *serpentinica*, 10 *Stachys recta* subsp. *baldacci,* 11 *Cerastium rectum* (Photos: Š. Šarić)

Slika 3. Predstavnici endemskih biljnih taksona planine Konjuh iz SEM horološke grupe: 1. Cerastium malyi subsp. serpentinii, 2. Minuartia bosniaca, 3. Heliosperma pusillum subsp. monachorum, 4. Athamanta turbith subsp. haynaldii, 5. Edraianthus graminifolius, 6. Euphorbia serpentini, 7. Iris reichenbachii var. bosniaca, 8. Sesleria serbica, 9. Sesleria latifolia var. serpentinica, 10. Stachys recta subsp. baldacci, 11. Cerastium rectum (Foto: Š. Šarić)

The second most numerous chorological group is the Mediterranean-Sub-Mediterranean (MED-SMED), with the Balkan subcontinental subgroup, which includes old Mediterranean taxa typical for the continental thermophilic habitats on limestone or serpentine of the Balkan Peninsula. Most taxa of this chorological group were registered in serpentine habitats at Konjuh: *Fumana bonapartei*, *Gypsophila spergulifolia*, *Halacsya sendtneri*, *Scrophularia canina* subsp. *tristis*, *Thymus praecox* subsp. *jankae*, *Trifolium dalmaticum*, and *Viola beckiana* (Figure 4). The high share of SEM and MED/SMED chorological groups in Konjuh and northeastern Bosnia can be explained by the fact that serpentine habitats are scarce in water and provide conditions for the growth of thermophilic plant taxa.

The Central-European (CE) group with Illyrian and Illyrian-Balkan subgroups, and the Central-European Mountain group (CEM) with the Dinaric subgroup, are each represented by four taxa. Relatives of the CEM group are spread across the mountains of Central Europe, the Alps, and a smaller part of the Carpathians. The taxa from this group registered at Konjuh Mountain include *Knautia sarajevensis*, *Lilium carniolicum* subsp. *bosniacum*, *Myosotis suaveolens*, and *Saxifraga blavii*. The Central European chorological group consists of species distributed in forest and meadow habitats of hilly and mountainous continental areas. In Konjuh, this group mostly consists of taxa from the Illyrian chorological subgroup: *Euphorbia gregersenii*, *Centaurea nigrescens* subsp. *smoliensis*, *Melampyrum hoermannianum*, *Knautia dinarica* subsp. *dinarica*, and *Peucedanum aegopodioides*. Two

Figure 4. Endemic taxa of the Konjuh Mountain of the MED-SMED chorological group: 1 *Halacsya sendtneri*, 2 *Fumana bonapartei*, 3 *Scrophularia canina* subsp. *tristis*, 4 *Viola beckiana*, 5 *Thymus praecox* subsp. *jankae*, 6 *Gypsophila spergulifolia*, 7 *Onosma stellulata*, 8 *Pseudofumaria alba* subsp. *leiosperma*, 9 *Trifolium dalmaticum* (Photos: Š. Šarić)

Slika 4. Predstavnici endemskih biljnih taksona planine Konjuh iz MED-SMED horološke grupe: 1. Halacsya sendtneri, 2. Fumana bonapartei, 3. Scrophularia canina L. subsp. tristis, 4. Viola beckiana, 5. Thymus praecox subsp. jankae, 6. Gypsophila spergulifolia, 7. Onosma stellulata, 8. Pseudofumaria alba subsp. leiosperma, 9. Trifolium dalmaticum (Foto: Š. Šarić)

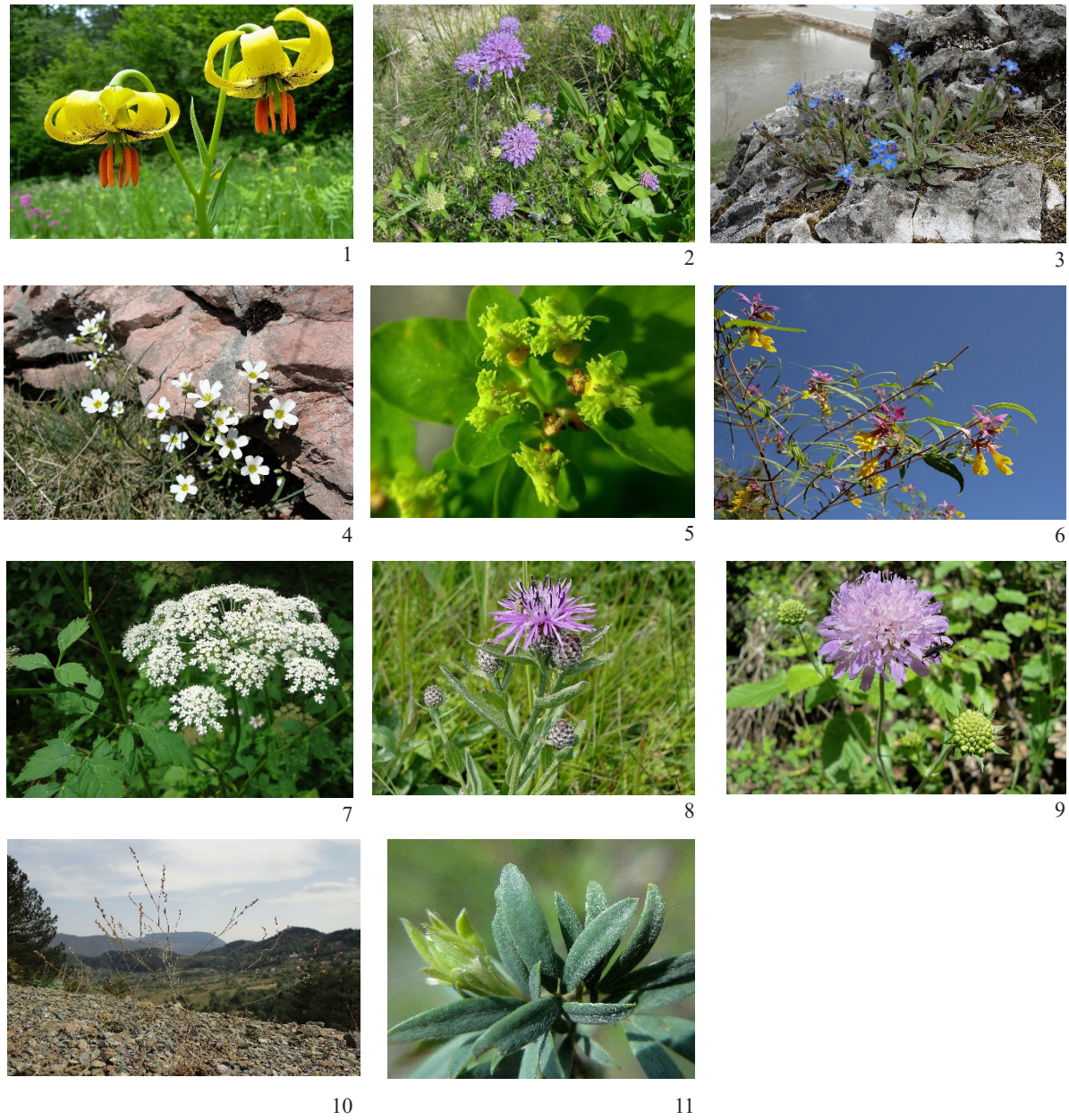
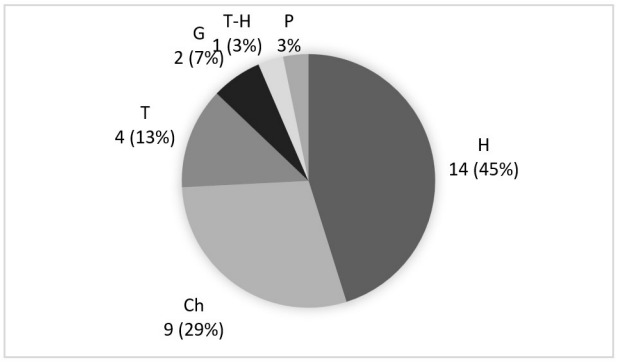


Figure 5. Endemic taxa of the Konjuh Mountain from the CEM, CE and PONT chorological groups: 1 *Lilium carniolicum* subsp. *bosniacum*, 2 *Knautia sarajevensis*, 3 *Myosotis suaveolens*, 4 *Saxifraga blavii*, 5 *Euphorbia gregersenii*, 6 *Melampyrum hoermannianum*, 7 *Peucedanum aegopodioides*, 8 *Centaurea nigrescens* subsp. *smoliensis*, 9 *Knautia dinarica* subsp. *dinarica, 10 Polygonum albanicum, 11 Cytisus austriacus* var. *maezius* (Photos: Š. Šarić)

Slika 5. Predstavnici endemskih biljnih taksona planine Konjuh iz CEM, CE i PONT horoloških grupa: 1. Lilium carniolicum subsp. bosniacum, 2. Knautia sarajevensis, 3. Myosotis suaveolens, 4. Saxifraga blavii, 5. Euphorbia gregersenii, 6. Melampyrum hoermannianum, 7. Peucedanum aegopodioides, 8. Centaurea nigrescens subsp. smoliensis, 9. Knautia dinarica subsp. dinarica, 10. Polygonum albanicum, 11. Cytisus austriacus var. *maezius (Foto: Š. Šarić)*

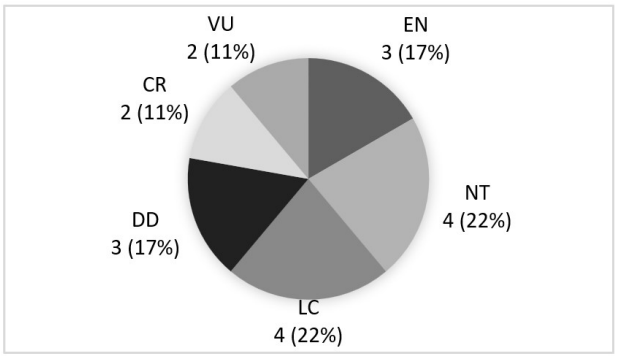
taxa (*Polygonum albanicum* and *Cytisus austriacus* var. *maezius*) belong to the Pontic chorological group and inhabit extremely thermophilic serpentine habitats.

The life form analysis of endemic plant taxa shows the domination of hemicryptophytes (14 taxa, 45%) and chamaephytes (9 taxa, 29%), which is in accordance with the data on the endemic flora of Central Serbia, Kosovo, and Montenegro (Tomović et al., 2014; Vuksanović et al., 2016; Halilaj et al., 2021). Therophytes are more numerous than geophytes, while endemic phanerophytes include only one taxon - *Cytisus austriacus* var. *maezius* (Graph 3).



Graph 3. The life form spectrum of the Balkan endemic flora of the Konjuh Mountain: Ch – chamaephytes; H – hemicryptophytes; G – geophytes; T – therophytes; T-H – therophytes and hemicryptophytes

Grafikon 3. Spektar životnih formi balkanske endemske flore Konjuh planine: Ch – hamefite; H – hemikriptofite; G – geofite; T – terofite; T-H – terofite i hemikriptofite.



Graph 4. The spectrum of threatened status of endemic taxa of Konjuh Mountain: CR – critically endangered, EN – endangered, NT – near threatened, VU – vulnerable, LC – least concern, DD – data deficient

Grafikon 4. Spektar statusa ugroženosti endemskih taksona planine Konjuh: CR – kritično ugrožene, EN – ugrožene, NT – gotovo ugrožene, VU – ranjive, LC – najmanje zabrinjavajuće, DD – nedovoljno podataka

The analysis of the threatened status of endemic taxa of Konjuh indicates that 18 taxa are classified in one of the categories according to the Red List of Flora of the Federation of Bosnia and Herzegovina (Graph 4). Two taxa (*Fumana bonapartei* and *Stachys recta* subsp. *baldacci*) are critically endangered (CR). *F. bonapartei* is an endemic relict, a strictly protected species in the Federation of Bosnia and Herzegovina, and an obligate serpentinophyte found in extremely thermophilic, rocky steppic grasslands over shallow soils on ultramafic bedrocks. This species was recorded in only a few locations in previous research in Bosnia and Herzegovina, mostly inhabiting the serpentines around Višegrad and Rudo Mountain (Ritter-Studnička, 1970). The small populations were observed in only two locations on Konjuh Mt: Varda and Zerinska kosa, implying the need for stricter protection measures. On the contrary, *Stachys recta* subsp. *baldacci* has been observed in several locations on Konjuh Mt.

Three endemic taxa present at Konjuh are listed as endangered (EN): *Athamanta turbith* subsp. *haynaldii*, *Pseudofumaria alba* subsp. *acaulis*, and *Scrophularia canina* subsp. *tristis*. The last two taxa are also protected in the Federation of Bosnia and Herzegovina. *A. turbith* ssp. *haynaldii* has been found on three locations (Olovski krševi, Brateljevići i Sokolina), whilst *P. alba* subsp. *acaulis* inhabits two locations Olovo and Sokolina. Both species are associated with exposed carbonate habitats. *S. canina* subsp. *tristis* has been identified exclusively in serpentine habitats in several locations (Varda, Careva Ćuprija, Buk, Grgići).

The endemic plant richness of Konjuh, which includes 31 endemic taxa and four subendemic taxa, is not negligible in comparison with the high Dinaric mountains (Bjelčić et al., 1969; Bjelčić & Šilić, 1971; Lakušić & Redžić, 1989; Šilić & Abadžić, 1986, 1991; Stevanović, 1996), considering the overall height of the mountain and its geographical position. After analyzing and synthesizing the previous results on Balkan endemic flora in Bosnia and Herzegovina, published by numerous botanists over the last 150 years, Lubarda et al. (2014) concluded that the greatest diversity of endemic plant species is recorded in the Herzegovinian mountains (Prenj, Čvrsnica, Čabulja), where about 125 taxa are present, followed by the mountains of Bjelašnica, Treskavica, Ivan, and the canyon of the Rakitnica river (109 taxa), and the mountains on the border with Montenegro, Maglić and Volujak, with the Sutjeska river canyon (99 taxa). The richest endemic mountain flora was recorded on Prenj (99 taxa), Čvrsnica (78), Orjen (74), Velež (70), Treskavica (63), Maglić (58), and Dinara (52). The largest number of endemic species of the Konjuh Mountain is found on the ophiolitic substrate in rocky steppic grasslands over shallow soils on ultramafic bedrock, vegetation order *Halacsyetalia sendtneri*, or relic-refuge black pine and Scots pine forests of the alliance *Erico-Fraxinion orni*, which are of significant natural and conservation value in this area. Serpentine endemics participate with 335-350 endemic taxa (or 15-16%) in the Balkan endemic flora (Stevanović et al., 2003). Identified taxa *Polygonum albanicum*, *Gypsophila spergulifolia*, *Fumana bonapartei, Halacsya sendtneri*, and *S. canina* subsp. *tristis* are transregional serpentine Balkan endemics, distributed in the wider serpentine areas in the Balkans. The genus *Halacsya*, with the only species *H. sendtneri*, is a monotypic

endemic-relict genus found in the investigated area. It occurs in well-developed populations and is numerous on exposed ophiolite substrates.

In the group of regional serpentine endemic taxa restricted to a single floristic subregion or province, the species *Sesleria serbica* has been identified. This species is typical for Central and Eastern Bosnia and Serbia (Stevanović et al., 2003). The area of Konjuh Mountain is considered to be the northernmost distribution point of endemic serpentinophytes in the Balkans for locally distributed serpentinophytes: *Centaurea nigrescens* subsp. *smoliensis*, *Euphorbia gregersenii*, and *Cytisus austriacus* var. *maezius* (Stevanović et al., 2003). The taxon *Cytisus austriacus var. maezius* is listed as *Chamaecytisus maezeius* K. Malý in Lubarda et al. (2014) and Stevanović et al. (2003), but according to Pifkó (2015), the name *Chamaecytisus maezeius* in these papers is mistakenly used, since this combination has never been validly published. In addition to the above-mentioned local endemics, *Viola beckiana* can also be classified in the steno-endemic group according to the First Report for the Convention on Biodiversity of Bosnia and Herzegovina (Redžić et al., 2008). The locus classicus for the description of this species is on Smolin (which is included in this research), and according to the aggregated distribution data presented by Đug et al. (2013), in addition to the Konjuh area, the species is also present in Kupres, Stolovac, near Bugojno and Han Koprivnica. *V. beckiana* has well-developed populations in Konjuh, especially in the locations of Zidine, Zelenboj, Smolin and Mala Maoča. *Euphorbia gregersenii* as steno-endemic taxa for Boasnia and Herzegovina has been described for the first time on Gostović (Tajan). It inhabits humid habitats on serpentine and often comes near streams, especially in the southwestern part of Konjuh Mt.

Previous research on the biodiversity of Konjuh Mt., published in the "Report on the baseline state of the biodiversity of the Konjuh protected landscape" (Enova, 2017), indicates the presence of a total of 11 endemic and 10 subendemic taxa. The report does not note the presence of the following taxa, which were confirmed by our survey: *Athamanta turbith* (L.) Brot. subsp. *haynaldii* (Borbás et Uechtr.) Tutin, *Cerastium rectum* Friv., *Euphorbia serpentini*, *Heliosperma pusillum subsp. monachorum* (Vis. & Pančić) Niketić & Stevanović, *Myosotis suaveolens* Willd, *Polygonum albanicum* Jáv., *Pseudofumaria alba* subsp. *leiosperma* (P. Conrath) Lidén, and *Saxifraga blavii* (Engler) Beck, but it does list *Cardamine plumierii* and *Cytisus pseudoprocimnes* as sub-endemics. During our field research, *Cardamine plumierii* was observed on the serpentine substrate on Konjuh Mt., but its map of distribution indicates a wider distribution area, which does not fit into the sub-endemic term applied in this study. We did note the presence of *Cytisus procumbens* in the surveyed area, which is morphologically quite similar to the endemic *C. pseudoprocumbens*, but the presence of the endemic species *C. pseudoprocumbens* was not confirmed.

Euphorbia montenegrina (Bald.) K. Malý was also mentioned as an endemic plant in earlier studies of this region (Public Institution Protected Landscape Konjuh, 2017), but its presence was not confirmed during our research. A recently published work on the distribution of *Euphorbia s*erpenini in the area of Konjuh (Maslo et al., 2022) indicates the frequent confusion of these two species in the literature. According to the above-mentioned authors, *E. serpentini* was mistakenly referred to as *E. montenegrina* in surveys of serpentine sites in Bosnia and Herzegovina and on Konjuh in many cases, despite the different ecology of *E. montenegrina*, which prefers the alpine and subalpine habitats and limestone substrate, unlike the obligate serpentinophyte *E. serpentini*.

When comparing the results, we found similarities in the presence of endemic species with the areas around the city of Banja Luka investigated by Stupar et al. (2011): *Minuartia bosniaca, Dianthus giganteus* subsp. *croaticus*, *Pseudofumaria alba* subsp. *leiosperma*, *Onosma stellulata, Iris reichenbachii* var. *bosniaca.*

Recent studies on biodiversity have mostly focused on the Protected Landscape area. Our research indicates the presence of numerous endemic species outside the boundaries of the Protected Landscape, especially in the southwest area of Mt. Konjuh on the ophiolite bedrock and limestone habitats around Olovo, Sokolina, and the Drinjača River. The process of declaring protected areas in the Federation of Bosnia and Herzegovina below the second level of protection is given to the cantonal government. Since Konjuh mountain is the border of the canton, this area is only partially protected. According to the Federation's plans for B&H, the entire area is designated as a potential Natura 2000 habitat, which would certainly be a solution for the long-term preservation of species and ecosystems in this area.

CONCLUSIONS – *Zaključak*

The flora of Konjuh Mountain includes 31 endemic and four subendemic taxa. The largest number of endemic taxa occurs on the ophiolite substratum and consists of endemic-relict forms of serpentinophytes. The chorological spectrum is characterized by the dominance of South-European and Mediterranean-Sub-Mediterranean taxa.

A total of 18 identified endemic taxa are classified as threatened. The presence of strictly protected, critically endangered endemic-relict serpentinophytes such as *Fumana bonapartei* indicates the importance of Konjuh Mountain for the preservation of this and other stenoendemic and relict taxa. Most endemic taxa also inhabit areas outside of the Protected Landscape, particularly serpentine habitats that gravitate toward the Krivaja River basin and exposed limestone habitats. The results of this study can be useful in the preparation of studies for the integrative protection of this area as a Natura 2000 site, regardless of cantonal borders.

REFERENCES – *Literatura*

Babajić, E. (2009). Petrološko-geohemijska i geotektonska obilježja mafitnih magmatskih stijena Krivajsko-konjuškog ofiolitnog kompleksa. Doktorska disertacija. Rudarsko-geološko-građevinski fakultet Univerziteta u Tuzli.

Ballian, D., Šarić, Š. (2015). A new site for the Lilyleaf Ladybells (Adenophora liliifolia (L.) A.DC.) in Bosnia and Herzegovina. Glasnik Zemaljskog muzeja Bosne i Hercegovine u Sarajevu, 35: 61-64.

Bjelčić, Ž., Šilić, Č., Lakušić, R., Kutleša, Lj., Mišić, Lj. Grgić, P. (1969). Neke rijetke i interesantne vrste biljaka sa područja planina Maglića, Volujka i Zelengore. Posebna izdanja Odjeljenja prirodnih i matematičkih nauka ANU-BiH, Sarajevo, 3: 91-106.

Bjelčić, Ž., Šilić, Č. (1971). Karakteristične cvjetnice za hercegovački endemni centar - planina Prenj, Čvrsnica i Čabulja. Glasnik Zemaljskog muzeja u Sarajevu, Prirodne nauke, 10: 39-57.

Comitato internazionale per lo sviluppo dei popoli (CISP). (2019). Scientifico sulla biodiversità del paesaggio protetto Konjuh. Bosna i Hercegovina.

Đug, S., Muratović, E., Drešković, N., Boškailo, A., & Dudević, S. (2013). Crvena lista flore Federacije Bosne i Hercegovine. EU "Greenway", Sarajevo.

Euro+Med. (2006). Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. Published on the Internet http://ww2.bgbm.org/EuroPlusMed/ [accessed 28th December 2022].

Enova. (2017). Izvještaj o polaznoj osnovi stanja biodiverziteta zaštićenog pejzaža "Konjuh". Public Institution Protected Landscape Konjuh. Bosnia and Herzegovina.

Franković, M., Kosec, D., Obratil, S., Đedović, R. (2002). Elaborat o proglašenju dijela područja planine Konjuh zaštićenim područjem. Zavod za zaštitu i korišćenje kulturno-istorijskog i prirodnog nasljeđa Tuzla.

Hafner, D., Cantonati, M. (2019). Algal assemblages in springs of different lithologies (ophiolites vs. limestone) of the Konjuh Mountain (Bosnia and Herzegovina). Acta Botanica Croatica, 78(1): 66-81.

Halilaj, H., Kupe, L., Bajrami, A., Icka, P., Mala, X., & Damo, R. (2021). Endemic plants in the flora of Shutman (Sharri Mountain), Kosovo–an analysis of phytogeographical elements and life forms. Natura Croatica: Periodicum Musei Historiae Naturalis Croatici, 30(1), 1-11.

IUCN. (2022). The IUCN Red List of Threatened Species. Version 2022-2. https://www.iucnredlist.org. [accessed on 6 January, 2023].

Kamberović, J., Plenković-Moraj, A., Kralj Borojević, K., Gligora Udovič, M., Žutinić, P.,

Kamberović, J. (2015). Struktura i sezonska dinamika krenonskih zajednica algi i vodenog bilja na području planine Konjuh. Doktorska disertacija. Univerzitet u Tuzli, Tuzla.

Kamberović, J. (2020). Ekosistemi izvora planine Konjuh. OFF-SET Štamparija Tuzla.

Kamberović, J., Adrović, A., Modrić, E., Lukić, Z., Nešković, R. (2020). The macrophyte flora and vegetation of the Paučko lake (mt. Konjuh). Works of the Faculty of Forestry University of Sarajevo, 50(1): 4-11.

Kudumović Dostović, F. Ahmetbegović, S., Stjepić Srkalović, Ž. (2019). Climate as a development factor of recreational tourism in north-eastern Bosnia, Acta geographica Bosniae et Herzegovinae, 6 (11): 23-34.

Lampinen, R. (2001). Universal Transverse Mercator (UTM) and Military Grid Reference System (MGRS) [http://www.luomus.fi/english/botany/ afe/map/utm.htm]

Lakušić, R., Redžić, S. (1989). Flora i vegetacija vaskularnih biljaka u refugijalno-reliktnim ekosistemima kanjona rijeke Drine i njenih pritoka. Glasnik Odjeljenja prirodnih nauka Crnogorske akademije nauka i umjetnosti, Titograd, 7: 107-205.

Lubarda, B., Stupar, V., Milanović, Đ., Stevanović, V. (2014). Chorological characterization and distribution of the Balkan endemic vascular flora in Bosnia and Herzegovina. Botanica Serbica, 38(1): 167-1842.

Lubarda, B. (2019). Balkanski endemi u flori Bosne i Hercegovine. Univerzitet u Banjoj Luci. Prirodno-matematički fakultet, Banja Luka.

Maslo, S., Šarić, Š. (2021). Remarks on recent distribution of Polygonum albanicum Ják. in Bosnia and Herzegovina. Glasilo Future, 4 (5-6): 01–09.

Maslo, S., Šarić, Š., Niketić, M. (2022). Distribution of Balkan endemic Euphorbia serpentini. Natura Croatica, 31(2): 251-263.

Nikolić T. (2020a). Flora Croatica – vaskularna flora Republike Hrvatske, Volumen 2. Ključevi za determinaciju s pratećim podatcima: Equisetidae, Lycopodiidae, Ophyoglossidae, Polypodidae, Cycadidae, Ginkgooidae, Gnetidae, Pinidae, Magnoliidae – porodice A – FAB. Alfa d. d., Zagreb.

Nikolić T. (2020b). Flora Croatica – vaskularna flora Republike Hrvatske, Volumen 3. Ključevi za determinaciju s pratećim podatcima: Magnoliidae – porodice FAG-ZYG. Alfa d. d., Zagreb

Nikolić, T., Milović, M., Bogdanović, S., Jasprica, N. (2015). Endemi u Hrvatskoj flori. Alfa d.d. Zagreb. Hrvatska.

Mueller-Dombois, D., Ellenberg, H. (1974). Aims and methods of vegetation ecology. New York, NY: John Wiley & Sons.

Pifkó, D. (2015). Index of scientific names of Chamaecytisus (Leguminosae) taxa. Studia botanica hungarica, 46(2), 175-203.

Pustahija, F. (2011). Odgovor genoma na abioticki stres : primjer serpentinofita u centralnoj Bosni. Agricultural sciences. Université Paris Sud - Paris XI; Univerzitet u Sarajevu, Bosnian. ffNNT: 2011PA112187

Pustahija, F., Brown, S.C., Bogunić, F., Bašić, N., Muratović, E., Ollier, S., Hidalgo, O.,

Bourge, M., Stevanović, V., Siljak-Yakovlev, S. (2013). Small genomes dominate in plants growing on serpentine soils in West Balkans, an exhaustive study of 8 habitats covering 308 taxa. Plant Soil 373, 427–453. https://doi.org/10.1007/s11104-013-1794-x.

Raunkiaer, C. (1934). The life forms of plants and statistical plant geography. London: Clarendon Press.

Redžić, S., Barudanović, S. Radević, M. (2008). Bosna i Herecgovina zemlja raznolikosti – pregled i stanje biološke i pejzažne raznolikosti BiH. Prvi izvještaj BiH za konvenciju o biološkoj raznolikosti. Federalno ministarstvo okoliša i turizma. Sarajevo.

Riter-Studnička, H. (1963). Biljni pokrov na serpentinama u Bosni. Godišnjak Biološkog Instituta Univerziteta Sarajevo, 14 (1–2): 91–204.

Ritter-Studnička, H. (1958). Bemerkenswerte Pflanzenfundeaus Bosnien und der Herzegowina. Plant systematics and evolution, 105: 285-292

Ritter-Studnička, H. (1970). Die vegetation der Serpentinvorkommen in Bosnien. Vegetatio, 21(1/3), 75-156.

Ristić, P., Panić, Mudrinić, Likić (1967). Magmatizam i geohemizam planine Konjuh, Arhiv za tehnologiju, V, 3-4.

Official Gazette of the Federation of Bosnia and Herzegovina 07/14. (2014). Crvena lista divljih vrsta i podvrsta biljaka, životinja i gljiva.

Stevanović, V. (1996). Analysis of the Central European and Mediterranean orophytic element on the mountains of the W. and Central Balkan Peninsula, with special reference to endemics. Bocconea, 5: 77-97.

Stevanović, V. (2005). Biodiversity estimation – from interpretation to conservation, example of endemic vascular flora of the Balkans. In: M. Anđelković (ed.) Biodiversity at the onset of the millennium, Scientific Meetings, BookCXI, Dept. of the Chemical and Biological Sciences, SASA, Book 2: 53-73.

Stevanović, V., Tan, K., Iatrou G. (2003). Distribution of the endemic Balkan flora on serpentine. I. Obligate serpentine endemics. Plant Systematics and Evolution, 242: 149-170.

Stevanović V. (1992). Floristička podela teritorije Srbije sa pregledom viših horiona i odgovarajućih flornih elemenata. In: Sarić, M.R., (ed.) Flora Srbije, 1. Srpska akademija nauka i umetnosti, Beograd, 47–56.

Stupar, V., Milanović, Đ., Brujić, J., Buzadžija, S., Travar, J. (2011). Ugroženi, rijetki i endemični taksoni područja Banja Luke. Skup 4 – Zbornik radova Drugog simpozijuma biologa i prvog simpozijum ekologa RS, 165-179. Prirodno-matematički fakultet. Banja Luka.

Šilić, Č. (1990). Endemične biljke. SP "SVJETLOST", Zavod za udžbenike i nastavna sredstva, Sarajevo; Zavod za udžbenike i nastavna sredstva, Beograd.

Šilić, Č., Abadžić, S. (1986). Endemične biljne vrste u ekosistemima planina oko Sutjeske. Godišnjak Biološkog instituta Univerziteta u Sarajevu, 39: 151-160.

Šilić, Č., Abadžić, S. (1991). Endemične biljne vrste Dinarida i mogućnost primjene nekih vrsta u hortikulturi. Glasnik Zemaljskog muzeja Bosne i Hercegovine u Sarajevu, Prirodne Nauke, 30: 47-127.

Tomović, G., Niketić, M., Lakušić, D., Ranđelović, V., & Stevanović, V. (2014). Balkan endemic plants in Central Serbia and Kosovo regions: Distribution patterns, ecological characteristics, and centres of diversity. Botanical Journal of the Linnean Society, 176, 173– 202.

Turrill, W.B. (1929). The plant life of the Balkan peninsula. A phytogeographical study. Oxford: Clarendon Press.

Tutin, T.G., Heywood, V.H., Burges, N.A., Valentine D.H., Walters, S.M., Webb, D.A. /ed./ (1964-1993). Flora Europaea 1-5, Cambridge University Press, Cambridge.

Vuksanović S., Tomović G., Niketić M. & Stevanović V. (2016). Balkan endemic vascular plants of Montenegro – critical inventory with chorological and life-form analyses. – Willdenowia, 46: 387 – 397. doi: http://dx.doi.org/10.3372/wi.46.46307

SAŽETAK

Područje planine Konjuh je floristički interesantno zbog specifičnog ofiolitskog ili ultramafitnog supstrata kojeg nastanjuju serpentinofite. Već su prva detaljnija floristička istraživanja ovog područja, koja je objavila Ritter-Studnička (1955; 1963; 1970) ukazala na posebnosti ovog područja. Flora i vegetacija na peridotitima i serpentinitima planine Konjuh ima tercijarno-reliktni karakter, koji se do danas očuvao na ovim staništima tipa refugijuma, posebno u ekosistemima šuma crnog i bijelog bora, serpentinskih kamenjara i pukotina stijena. Tokom istraživanja endemske vaskularne flore, koje je vršeno u periodu od deset godina (2002–2022), obuhvaćen je širi prostor planine Konjuh, sa fokusom na serpentinska i krečnjačka staništa. Ustanovljeno je da endemsku floru planine Konjuh čini 31 takson, što je 10% od ukupnog broja biljnih endema specifičnih za područje Bosne i Hercegovine (Tabela 1). Endemska vaskularna flora planine Konjuh je svrstana u 19 familija od kojih su najbrojnije Caryophyllaceae (Grafikon 1). Najveći broj vrsta pripada serpentinofitama. Lokacije vrsta su kartografski prikazane (Slika 2). U rezultatima su navedene lokacije od posebnog interesa za dalje istraživanje i potencijalnu zaštitu zbog diverziteta endemskih taksona. Najzastupljeniji su dinarski i dinarsko-balkanski elementi iz južno-evropsko planinske horološke grupe (SEM) (Grafikon 2), što je posljedica činjenice da planinu Konjuh najvećim dijelom grade ofioliti, i da su serpentinska staništa oskudna vodom, što osigurava uslove za rast termofilnih biljnih vrsta. U endemskoj vaskularnoj glori Konjuha dominiraju hemikriptofite (Grafikon 3). Analiza kategorija ugroženosti endemičnih biljnih vrsta ukazuje da je 18 taksona svrstano u neku od kategorija ugroženosti prema Crvenoj listi flore Federacije BiH, od čega je četiri sa oznakom EN i NT, po tri u kategorijama LC, DD, i po dva sa oznakom CR i VU (Grafikon 4). Najveći broj endemskih vrsta planine Konjuh naseljava ofiolitski supstrat, odnosno vezan je za osunčana kamenjarska staništa serpentinita i peridotita, ili reliktno-refugijalne šume crnog i bijelog bora, koji predstavljaju značajnu prirodnu i konzervacijsku vrijednost ovog područja (Slike 3, 4, 5). Kritično ugrožena endemo-reliktna serpentinofita *Fumana bonapartei* raste u manjim populacijama, što ukazuje na potrebu dugoročnog očuvanja ovog područja. Areal endemičnih biljaka obuhvata širi prostor od onog koji je pod zaštitom i posebno se vezuje za serpentinska staništa koja gravitiraju prema slivu rijeke Krivaje i krečnjačka izložena staništa. Rezultati ovog rada mogu biti primjenjivi u izradi studija za integrativnu zaštitu ovog područja u vidu NATURA 2000 područja.

Received: 31 January 2023; Accepted: 9 June 2023; Published: 31 July 2023

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.