

DISTRIBUTION OF BALKAN ENDEMIC *EUPHORBIA SERPENTINI*

SEMIR MASLO¹, ŠEMSO ŠARIĆ² & MARJAN NIKETIĆ^{3,4}

¹Primary School, Lundåkerskolan, Gislaved, Sweden (e-mail: semmas@edu.gislaved.se)

²Jelaške, Olovo, Bosnia and Herzegovina (e-mail: semsosumar@gmail.com)

³Natural History Museum, Njegoševa 51, 11000 Belgrade, Serbia (e-mail: mniketic@nhmbeo.rs)

⁴Serbian Academy of Sciences and Arts, Kneza Mihaila 35, 11000 Belgrade, Serbia

Maslo, S., Šarić, Š. & Niketić, M.: Distribution of Balkan endemic *Euphorbia serpentini*. *Nat. Croat.*, Vol. 31, No. 2, 251-263, Zagreb, 2022.

This paper is a survey of distribution of the Balkan endemic obligate serpetinophyte *Euphorbia serpentini* in Bosnia and Herzegovina and Serbia based on a revision of herbarium specimens from SARA, BEO, BEOU and private collections of the authors, literature data and on field observations. In addition a short morphological description and photographs of the species are presented.

Keywords: Balkans, distribution, endemic species, *Euphorbia serpentini*, morphology, serpentine

Maslo, S., Šarić, Š. & Niketić, M.: Rasprostranjenost balkanskog endema *Euphorbia serpentini*. *Nat. Croat.*, Vol. 31, No. 2, 251-263, Zagreb, 2022.

Rad predstavlja pregled rasprostranjenosti balkanskog endema, obligatnog serpetinofita *Euphorbia serpentini* u Bosni i Hercegovini i Srbiji, na temelju revizije herbarijskih primjeraka iz herbara SARA, BEO, BEOU i privatnih zbirki autora, podataka iz literature i terenskih opažanja. Dodatno su prikazani kratak morfološki opis i fotografije vrste.

Ključne riječi: Balkan, rasprostranjenost, endemi, *Euphorbia serpentini*, morfologija, serpentin

INTRODUCTION

Euphorbia L. (Euphorbiaceae) is a genus of almost worldwide distribution, including over 2150 species and is thus one of the largest genera of flowering plants (FRAJMAN & SCHÖNSWETTER, 2011). Approximately 40 species of the genus *Euphorbia* are mentioned in the flora of Bosnia and Herzegovina (BECK-MANNAGETTA, 1920).

Within the *Euphorbia verrucosa* alliance three species are recorded for the flora of Bosnia and Herzegovina: *E. montenegrina* (Bald.) K. Malý, *E. serpentini* Novák and *E. verrucosa* L. (ČAKOVIĆ *et al.*, 2021). *Euphorbia montenegrina* and *E. serpentini* are Balkan endemic species, whereas *E. verrucosa* is distributed in western and central Europe and in the western part of the Balkan Peninsula (Slovenia, Croatia and Bosnia and Herzegovina; ČAKOVIĆ *et al.*, 2021; NIKETIĆ *et al.*, 2021). *Euphorbia montenegrina* grows in subalpine or low-alpine vegetation on limestone, from 1200 to 2250 m s.m. It is restricted to the mountains of the western and southern Balkan Peninsula (Bosnia and Herzegovina, Montenegro, Kosovo, Albania, North Macedonia and Greece.). *Euphorbia serpentini* is distributed in serpentine areas in north-central Bosnia and western Serbia. It is a characteristic species of naturally forest-free serpentine outcrops, scrublands or open pine forests over serpentine below the timberline, from 250 to 1350 m s.m. (ČAKOVIĆ *et al.*, 2021).

Euphorbia serpentini was collected for the first time by MALÝ (1920) on serpentines in central Bosnia, in the valley of the stream Gostović, but under the name *E. montenegrina*. Soon after it was described as a new species by Novák (1924) from serpentine outcrops on the Zlatibor plateau in western Serbia. It was reported for several localities (Crni Rzav, Kraljeva voda, Tornik), but later also from Murtenica Mountain (Novák, 1927). In addition, it was reported by SIGUNOV (1979) and TATIĆ (1984) further east from the serpentines in central Serbia, but those records have not yet been confirmed. Outside Serbia, the species was collected from serpentines in central Bosnia, but considered to be *E. montenegrina*. MALÝ (1920) noted "Glede ove je biljke do sada bilo samo poznato, da se nalazi u alpskom i višem predalpskom stepenu" (With respect to this species it was up till now only known, that it occurs in the alpine and upper montane/subalpine belt). Consequently, MALÝ (1920, 1923, 1928) and RITER-STUDNIČKA (1952, 1970) treated the Bosnian populations of *E. serpentini* as *E. montenegrina* and recorded it from 40 localities on serpentines in north-central Bosnia, from 160 to 1230 m (Tab. 1).

Tab. 1. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Bosnia and Herzegovina (literature data).

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
1 Vrbanja, Banja Luka, Riter-Studnička, H. 1952	44°45'53" N, 17°14'41" E	160 m	XK75
2 Tedin Han, Teslić, Riter-Studnička, H. 1970	44°44'56" N, 17°46'53" E	168 m	YK25
3 Ččava, Teslić, Riter-Studnička, H. 1970	44°42'07" N, 17°43'47" E	292 m	YK15
4 Debelo Brdo, Teslić, Riter-Studnička, H. 1970	44°37'32" N, 17°52'20" E	353 m	YK24
5 Dolovi, Teslić, Riter-Studnička, H. 1970	44°36'37" N, 17°41'55" E	359 m	YK14
6 Kakmuž, Ozren, Riter-Studnička, H. 1970	44°38'05" N, 18°18'24" E	259 m	BQ84
7 Bornata Kosa, Ozren, Riter-Studnička, H. 1952	44°37'02" N, 18°17'12" E	457 m	BQ84
8 Oštra Glava, Tešanj, Riter-Studnička, H. 1970	44°33'19" N, 17°59'27" E	450 m	YK33
9 Crno Brdo, Tešanj, Riter-Studnička, H. 1970	44°33'54" N, 17°59'11" E	669 m	YK33
10 Visoki Bor, Slatina, Riter-Studnička, H. 1970	44°29'27" N, 17°52'49" E	700 m	YK23
11 Vitlaci, Žepče, Riter-Studnička, H. 1970	44°27'08" N, 17°59'12" E	614 m	YK32
12 Smolin, Teslić, Riter-Studnička, H. 1970	44°27'50" N, 17°53'29" E	1105 m	YK22
13 Markovo Brdo, Žepče, Riter-Studnička, H. 1970	44°26'11" N, 17°59'00" E	515 m	YK32
14 Boljak, Žepče, Riter-Studnička, H. 1970	44°24'39" N, 17°58'33" E	725 m	YK32
15 Orlovik, Žepče, Riter-Studnička, H. 1970	44°24'10" N, 18°01'46" E	556 m	BQ62
16 Ljeskovic, Žepče, Riter-Studnička, H. 1970	44°25'09" N, 18°06'49" E	260 m	BQ72
17 Trbušnica, Velež, Malý, K. 1923	44°19'23" N, 18°09'50" E	850 m	BQ71
18 Gostović and Kamenica, Malý, K. 1920	44°20'46" N, 18°11'38" E	370 m	BQ71
19 Žedni Vrh, Riter-Studnička, H. 1970	44°20'21" N, 18°17'16" E	1017 m	BQ81
20 Vresina Kosa, Tajan, Malý, K. 1923	44°17'33" N, 18°11'22" E	1230 m	BQ70
21 Botanj, Malý, K. 1923	44°19'14" N, 18°13'36" E	449 m	BQ71
22 Botašnica, Malý, K. 1923	44°18'39" N, 18°13'32" E	644 m	BQ71
23 Djedovo Brdo, Riter-Studnička, H. 1970	44°18'56" N, 18°17'53" E	1167 m	BQ81
24 Svatovac, Lukavac, Riter-Studnička, H. 1952	44°27'41" N, 18°26'46" E	350 m	BQ92
25 Vijenac, Riter-Studnička, H. 1970	44°26'56" N, 18°27'37" E	537 m	BQ92
26 Dubrava, Riter-Studnička, H. 1970	44°29'36" N, 18°42'19" E	311 m	CQ12
27 Donja Višća, Riter-Studnička, H. 1970	44°22'36" N, 18°37'37" E	543 m	CQ11
28 Lipik, Riter-Studnička, H. 1970	44°19'39" N, 18°30'03" E	1087 m	CQ01
29 Stipin Han, Malý, K. 1928	44°19'18" N, 18°25'29" E	354 m	BQ91

Tab. 1. Continued

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
30 Mala Maoča, Riter-Studnička, H. 1970	44°18'56" N, 18°17'53" E	455 m	BQ81
31 Modra Ploča, Riter-Studnička, H. 1970	44°18'18" N, 18°27'59" E	950 m	BQ90
32 Zaskok, Riter-Studnička, H. 1970	44°18'56" N, 18°17'53" E	691 m	BQ81
33 Župeljeva, Riter-Studnička, H. 1970	44°16'57" N, 18°29'48" E	787 m	CQ00
34 Prelijev potok, Riter-Studnička, H. 1970	44°17'30" N, 18°27'36" E	491 m	BQ90
35 Velika Maoča, Riter-Studnička, H. 1970	44°16'10" N, 18°28'10" E	739 m	BQ90
36 Duboštica, Olovo, Malý, K. 1928	44°14'31" N, 18°23'22" E	579 m	BQ90
37 Careva Čuprija, Olovo, Malý, K. 1928	44°16'45" N, 18°25'48" E	387 m	BQ90
38 Zakolje, Riter-Studnička, H. 1970	44°16'04" N, 18°23'31" E	856 m	BQ90
39 Donja Vijaka, Olovo, Malý, K. 1928	44°12'22" N, 18°27'20" E	917 m	BP99
40 Kozjača, Magulica, Riter-Studnička, H. 1970	44°14'02" N, 18°26'03" E	597 m	BQ90
41 Grabovački potok, Olovo, Riter-Studnička, H. 1970	44°09'50" N, 18°36'28" E	769 m	CP09
42 Gostović potok near Borovnica, Caković <i>et al.</i> 2021	44°21'47"N, 18°10'48"E	310 m	BQ71
43 between Čardak i Kamenica, Zavidovići, Caković <i>et al.</i> 2021	44°21'18"N, 18°11'27"E	347 m	BQ71
44 Tajan, Caković <i>et al.</i> 2021	44°17'19"N, 18°11'25"E	1300 m	BQ70
45 Oskova, Banovići, Caković <i>et al.</i> 2021	44°25'19"N, 18°33'57"E	290 m	CQ02
46 Grgiči, Ribnica, Caković <i>et al.</i> 2021	44°19'25"N, 18°25'23"E	335 m	BQ91
47 Duboštica, Caković <i>et al.</i> 2021	44°14'19"N, 18°19'01"E	1042 m	BQ80
48 Olovske Luke, Olovo, Caković <i>et al.</i> 2021	44°08'18"N, 18°37'32"E	590 m	CP18

However, based on the recent study by ČAKOVIĆ *et al.* (2021), all these as well as additional populations from serpentines below the timberline in north-central Bosnia and Herzegovina should be treated as *E. serpentini*.

In addition, according to NIKETIĆ *et al.* (2021) all reports of *E. fragifera* Jan ex Link and some of *E. verrucosa* in Serbia actually correspond to *E. serpentini*. Given the unclear distribution of this recently resurrected species, we here revise its distribution based on literature data, herbarium revision and personal field observations.

MATERIAL AND METHODS

We analysed herbarium material of *E. serpentini* deposited at SARA, BEO and BEOU (herbarium acronyms according to HOLMGREN *et al.* (1990) and gathered locality data from literature (BECK-MANNAGETTA, 1920; MALÝ, 1920, 1923, 1928; RITER-STUDNIČKA, 1952, 1970; ČAKOVIĆ *et al.*, 2021). In addition twelve specimens from various localities in north-central Bosnia were collected and stored in (SARA) (Tab. 2). Digital photographs were taken and 47 localities of *E. serpentini* were recorded in the field. The nomenclature follows the Euro-Med checklist (EURO+MED 2006). The distribution of the species shown on the map using the standard UTM grid 10×10 km is based on the Military Grid Reference System (MGRS) projection (LAMPINEN, 2001) in zones 33T and 34 T. A list of all localities representing the distribution of *E. serpentini* in Bosnia and Herzegovina (Tab. 1, Tab. 2, Tab. 3) and Serbia (Tab. 4, Tab. 5, Tab. 6) is given. For literature records, herbarium records as well as new records, the WGS1984 coordinates are given.

Tab. 2. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Bosnia and Herzegovina (herbarium data).

Number and name of the locality, collectors, collection date, Herbarium/Collection number	WGS coordinates	Altitude	MGRS quadrant
1 Debelo Brdo, Pribinići, Teslić, Riter-Studnička, H. 19.06.1958, SARA 48918 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°37'32" N, 17°52'20" E	340 m	YK24
2 Borik, Velež, Malý, K., 05.06. 1921, SARA 23164 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°19'23" N, 18°09'50" E	853 m	BQ71
3 Stolovi near Borovnica-Kamenica, Malý, K., 05.06. 1921, SARA 23158 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°20'46" N, 18°11'38" E	810 m	BQ71
4 Borovnica (Gostović), Malý, K., 07.06. 1920, SARA 23163 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°20'46" N, 18°11'38" E	300 m	BQ71
5 Kamenica (Gostović), Malý, K., 06.06. 1921, SARA 23161 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°20'46" N, 18°11'38" E	580 m	BQ71
6 Popova Luka (Gostović), Malý, K., 01.06. 1920, SARA 23140 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°20'46" N, 18°11'38" E	480 m	BQ71
7 Mt. Tajan, Malý, K., 06.06. 1921, SARA 23160 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°17'33" N, 18°11'22" E	1278 m	BQ70
8 Mt. Tajan, Gostovići, Malý, K., 06.06. 1921, SARA 23162 (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°17'33" N, 18°11'22" E	1278 m	BQ70
9 Svatovac, Lukavac, Riter-Studnička, H., 20.05.1951, SARA 23159, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°27'41" N, 18°26'46" E	389 m	BQ92
10 Duboštica, Vareš, Malý, K., 11.06. 1923, SARA 23175, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°14'31" N, 18°23'22" E	600 m	BQ90
11 Tribija, Vareš, Malý, K., 12.06. 1923, SARA 23178, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°14'31" N, 18°23'22" E	580 m	BQ90
12 Olovo, Šilić, Č., 21.05.1978, SARA 23166, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°08'18" N, 18°37'41" E	605 m	CP18
13 Olovo, Šilić, Č., 21.05.1978, SARA 23167, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°08'18" N, 18°37'41" E	605 m	CP18
14 valley of the stream Gostović S of Borovnica, Frajman, B., 18.05.2018, IB 15079, (as <i>E. verrucosa</i> L.)	44°21'47"N, 18°10'48"E	310 m	BQ71
15 between the villages Čardak and Kamenica E of Zavidovići, Frajman, B., &Schönswetter, P., 23.05.2009, IB 12555, (as <i>E. verrucosa</i> L.)	44°21'18"N, 18°11'27"E	347 m	BQ71
16 summit of the Mt. Tajan, Frajman, B., &Schönswetter, P., 23.05.2009, IB 12564, (as <i>E. montenegrina</i> (Bald.) K. Malý)	44°17'19"N, 18°11'25"E	1300 m	BQ70
17 Oskova NE of Banovići, Frajman, B., 19.05.2018, IB 15083, (as <i>E. verrucosa</i> L.)	44°25'19"N, 18°33'57"E	290 m	CQ02
18 Grgiči SE of Ribnica in the river Krivaja valley, Frajman, B., 19.05.2018, IB15080, (as <i>E. verrucosa</i> L.)	44°19'25"N, 18°25'23"E	335 m	BQ91
19 SE of Duboštica, Kuzmanović, N. &Bogunić, F., 01.05.2018, IB 15159, (as <i>E. verrucosa</i> L.)	44°14'19"N, 18°19'01"E	1042 m	BQ80
20 NE margin of Olovske Luke NE of Olovo, Frajman, B., 19.05.2018, IB 15088, (as <i>E. verrucosa</i> L.)	44°08'18"N, 18°37'32"E	1042 m	CP18
21 Kopaljšta, Vareš, Šarić, Š., 18.05.2020, SARA 52362	44°13'49" N, 18°18'40" E	904 m	BQ80
22 Donja Vijaka, Vareš, Šarić, Š., 18.05.2020, SARA 52363	44°13'29" N, 18°24'43" E	583 m	BQ90
23 Duboštica, Vareš, Šarić, Š., 10.05.2017, SARA 52364	44°14'16" N, 18°20'16" E	661 m	BQ80

Tab. 2. Continued

Number and name of the locality, collectors, collection date, Herbarium/Collection number	WGS coordinates	Altitude	MGRS quadrant
24 Suha, Jela, Jelaške, Olovo, Šarić, Š., 10.05.2015, SARA 52365	44°17'01" N, 18°23'34" E	597 m	BQ90
25 Zidine, Konjuh, Olovo, Šarić, Š., 19.05.2020, SARA 52366	44°19'04" N, 18°31'10" E	1136 m	CQ01
26 Župeljeva, Tovarnica, Konjuh, Šarić, Š., 15.05.2018, SARA 52367	44°17'34" N, 18°28'18" E	550 m	BQ90
27 Velež, Zavidovići, Šarić, Š., 14.04.2018, SARA 52368	44°21'28" N, 18°10'59" E	329 m	BQ71
28 Buk, Olovo, Šarić, Š., 20.05.2018, SARA 52369	44°17'14" N, 18°25'29" E	376 m	BQ90
29 Papratnica, Žepče, Šarić, Š., 19.05.2018, SARA 52370	44°26'53" N, 18°58'32" E	484 m	YK32
30 Velike Ribnice, Banovići, Šarić, Š., 19.05.2018, SARA 52371	44°21'15" N, 18°27'49" E	463 m	BQ91
31 Maoča, Zavidovići, Šarić, Š., 10.05.2020, SARA 52372	44°18'14" N, 18°25'00" E	435 m	BQ90
32 Dištica, Zavidovići, Šarić, Š., 02.05.2018, SARA 52373	44°17'57" N, 18°21'57" E	875 m	BQ80

Tab. 3. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Bosnia and Herzegovina (new records).

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
1 Konjuh, Kladanj, Šarić, Š., 21.06.2015	44°16'23" N, 18°31'28" E	1300 m	CQ00
2 Bjeliš, Olovo, Šarić, Š., 22.06.2015	44°08'24" N, 18°37'31" E	583 m	CP19
3 Buk, Jelaške, Olovo, Šarić, Š., 22.06.2012	44°17'33" N, 18°25'19" E	371 m	BQ90
4 Buk, Olovo, Šarić, Š., 20.05.2018	44°17'14" N, 18°25'29" E	376 m	BQ90
5 Careva Čuprija, Olovo, Šarić, Š., 19.05.2015	44°16'33" N, 18°25'44" E	387 m	BQ90
6 Careva Čuprija, Olovo, Šarić, Š., 30.04.2017	44°16'31" N, 18°25'49" E	395 m	BQ90
7 Duboštica, Vareš, Šarić, Š., 10.05.2017	44°14'16" N, 18°20'16" E	661 m	BQ80
8 Goli brijeg, Konjuh, Banovići, Šarić, Š., 27.05.2018	44°22'09" N, 18°28'40" E	613 m	BQ91
9 Gornja Bočinja, Maglaj, Šarić, Š., 06.05.2017	44°30'32" N, 18°13'40" E	258 m	BQ73
10 Gornja Papratnica, Žepče, Šarić, Š., 06.06.2013	44°25'34" N, 18°58'49" E	495 m	YK32
11 Gornja Višća, Živinice, Šarić, Š., 24.05.2018	44°25'28" N, 18°34'54" E	398 m	CQ02
12 Grabovica, Olovo, Šarić, Š., 21.06.2015	44°10'04" N, 18°36'31" E	775 m	CP09
13 Ivančevo, Vareš, Šarić, Š., 29.06.2019	44°12'08" N, 18°25'04" E	852 m	BP99
14 Suha, Jela, Jelaške, Olovo, Šarić, Š., 10.05.2015	44°17'01" N, 18°23'34" E	597 m	BQ90
15 Kabun, Zavidovići, Šarić, Š., 04.05.2017	44°17'16" N, 17°20'58" E	1131 m	BQ80
16 Kamenica, Olovo, Šarić, Š., 10.06.2017	44°13'14" N, 18°29'21" E	464 m	BP99
17 Dištica, Zavidovići, Šarić, Š., 02.05.2018	44°17'57" N, 18°21'57" E	875 m	BQ80
18 Kopalista, Vareš, Šarić, Š., 18.05.2020	44°13'49" N, 18°18'40" E	904 m	BQ80
19 Lipovac, Zavidovići, Šarić, Š., 30.05.2014	44°21'45" N, 18°22'55" E	300 m	BQ91
20 Ljubna, Žepče, Šarić, Š., 30.06.2021	44°26'47" N, 17°59'22" E	404 m	YK32
21 Maoča, Zavidovići, Šarić, Š., 10.05.2020	44°18'14" N, 18°25'00" E	435 m	BQ90
22 Milanovići, Olovo, Šarić, Š., 10.05.2017	44°12'02" N, 18°33'33" E	893 m	CP09
23 Miljeвица, Konjuh, Kladanj, Šarić, Š., 10.05.2017	44°17'04" N, 18°32'22" E	972 m	CQ00
24 Mladoševac, Olovo, Šarić, Š., 11.05.2017	44°12'08" N, 18°33'48" E	1008 m	CP09
25 Modra Ploča, Konjuh, Šarić, Š., 30.05.2020	44°18'01" N, 18°27'43" E	924 m	BQ90
26 Mujića Kosa, Mala Maoča, Konjuh, Šarić, Š., 22.06.2020	44°18'38" N, 18°26'40" E	528 m	BQ90

Tab. 3. Continued

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
27 Muška Voda, Kladanj, Šarić, Š., 10.05.2017	44°15'57" N, 18°34'37" E	798 m	CQ00
28 Obla Glava, Jelaške, Olovo, Šarić, Š., 08.06.2019	44°17'23" N, 18°22'34" E	961 m	BQ90
29 Odvojak, Župeljeva, Velika Maoča, Konjuh, Šarić, Š., 22.06.2020	44°17'10" N, 18°26'58" E	425 m	BQ90
30 Papratnica, Žepče, Šarić, Š., 19.05.2018	44°26'53" N, 18°58'32" E	484 m	YK32
31 Ravni Bor, Konjuh, Šarić, Š., 10.05.2020	44°19'33" N, 18°30'16" E	972 m	CQ01
32 Sađevica, Zavidovići, Šarić, Š., 15.04.2015	44°17'27" N, 17°19'41" E	1019 m	BQ81
33 Srebrenica, Konjuh, Olovo, Šarić, Š., 27.04.2015	44°14'09" N, 18°34'44" E	786 m	CQ00
34 Stipin Han, Zavidovići, Šarić, Š., 22.06.2020	44°18'57" N, 18°24'37" E	381 m	BQ91
35 Suha, Zavidovići, Šarić, Š., 14.06.2015	44°17'36" N, 18°09'23" E	704 m	BQ70
36 Svatovac, Poljice, Lukavac, Šarić, Š., 25.05.2015	44°28'01" N, 18°28'02" E	332 m	BQ92
37 Župeljeva, Tovarnica, Konjuh, Šarić, Š., 15.05.2018	44°17'34" N, 18°28'18" E	550 m	BQ90
38 Treštenica, Srnica, Banovići, Šarić, Š., 11.06.2013	44°26'57" N, 18°27'40" E	541 m	BQ92
39 Velež, Zavidovići, Šarić, Š., 14.04.2018	44°21'28" N, 18°10'59" E	329 m	BQ71
40 Velike Ribnice, Banovići, Šarić, Š., 19.05.2018	44°21'15" N, 18°27'49" E	463 m	BQ91
41 Donja Vijaka, Vareš, Šarić, Š., 18.05.2020	44°13'29" N, 18°24'43" E	583 m	BQ90
42 Vojnica, Olovo, Šarić, Š., 24.05.2016	44°16'23" N, 18°23'23" E	571 m	BQ90
43 Vukotička Kosa, Olovo, Šarić, Š., 25.05.2016	44°12'55" N, 18°31'45" E	969 m	CP09
44 Zerinska Kosa, Konjuh, Šarić, Š., 10.05.2020	44°18'07" N, 18°26'48" E	868 m	BQ90
45 Zidine, Konjuh, Olovo, Šarić, Š., 19.05.2020	44°19'04" N, 18°31'10" E	1136 m	CQ01
46 Župeljeva, Zaskok, Konjuh, Olovo, Šarić, Š., 04.05.2016	44°17'16" N, 18°30'38" E	758 m	CQ00
47 the village of Jelovača, in the river Jošavka valley, Lubarda, B. & Džombić, D., 2018	44°44'39" N, 17°26'46" E	258 m	XK95

Tab. 4. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Serbia (herbarium data).

Number and name of the locality, collectors, collection date, Herbarium/Collection number	WGS coordinates	Altitude	MGRS quadrant
1 Zlatibor plateau, Crni Rzav, Gmizova Čuprija, Novák, A., 18.07.1923, PRC 455795.	43°41'58" N, 19°40'20" E	950 m	CP93
2 Mokra Gora: Mt Šargan (Zlatibor), Soška, T. 06.1926., s.n. BEOU	43°49'26" N, 19°31'38" E	1017 m	CP85
3 Mokra Gora: Mt Šargan (Zlatibor), Niketić, M. 03.06.2021., s.n. BEOU	43°49'11" N, 19°30'22" E	815 m	CP75
4 Tara Mt., Zborište, Jurišić, Ž.J. 21.06.1912, BEO 3010 (as <i>E. angulata</i> Jacq)	43°50'55" N, 19°27'33" E	1544 m	CP75
5 Tara Mt. Zborište, Stevanović, V., Niketić, M., Tomović, G. 14.07.1998, BEOU-KEGB 12692 (as <i>E. montenegrina</i> (Bald.) K. Malý)	43°50'55" N, 19°27'33" E	1544 m	CP75
6 Zlatibor plateau, Bijele vode, Pavlović, Z. 07.05.1948, s.n. BEO	43°44'36" N, 19°39'54" E	940 m	CP94
7 Zlatibor plateau, Palisad-Zova, 16.05.1931, rev. Niketić, M. 30.05.2020, s.n. BEOU (as <i>E. polychroma</i> A. Kern)	43°44'14" N, 19°43'00" E	1000 m	CP94
8 Zlatibor plateau, Čigota, Niketić, M., Tomović, G., Jakovljević, K., 15.08.2008, BEOU-KEGB 28079	43°38'53" N, 19°46'25" E	1200-1400 m	DP03

Tab. 4. Continued

Number and name of the locality, collectors, collection date, Herbarium/Collection number	WGS coordinates	Altitude	MGRS quadrant
9 Zlatibor plateau, Ćirovo brdo, Pavlović, Z., 07.07.1947, s.n. BEO	43°43'41" N, 19°43'51" E	1000 m	CP94
10 Zlatibor plateau, Kraljeva česma, Soška, T., 06.1926, s.n. BEOU	43°43'29" N, 19°42'21" E	960 m	CP94
11 Zlatibor plateau, Partizanske vode, Sigunov, A., 14.06.1976, BEO 81660	43°43'29" N, 19°42'21" E	950 m	CP94
12 Zlatibor plateau, Partizanske vode, Stevanović, V., Jovanović, S., Todorović, B., Jančić, R., 17.06.1990, BEOU-KEGB 1222/90	43°43'29" N, 19°42'21" E	950 m	CP94
13 Zlatibor plateau, Partizanske vode, Niketić, M., Tomović, G., 09.05.2010, BEOU-KEGB 30630	43°43'29" N, 19°42'21" E	950 m	CP94
14 Zlatibor plateau, Partizanske vode, Pavlović, Z., 11.05.1947, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
15 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
16 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
17 Zlatibor plateau, Partizanske vode, Pavlović, Z., 05.06.1948, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
18 Zlatibor plateau, Partizanske vode, Pavlović, Z., 05.06.1948, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
19 Zlatibor plateau, Partizanske vode, Pavlović, Z., 05.06.1948, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
20 Zlatibor plateau, Partizanske vode, Pavlović, Z., 17.05.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
21 Zlatibor plateau, Partizanske vode, Pavlović, Z., 11.05.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
22 Zlatibor plateau, Partizanske vode, Pavlović, Z., 05.05.1948, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
23 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
24 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
25 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
26 Zlatibor plateau, Partizanske vode, Pavlović, Z., 09.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
27 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
28 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
29 Zlatibor plateau, Partizanske vode, Pavlović, Z., 10.07.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
30 Zlatibor plateau, Partizanske vode, Pavlović, Z., 11.05.1949, s.n. BEO	43°43'29" N, 19°42'21" E	950 m	CP94
31 Zlatibor plateau, Partizanske vode/ Semegnjevo, Tomović, G., Jakovljević, K., Đurović, S., / Buzurović, U., 29.05.2014, BEOU-KEGB 40684	43°44'00" N, 19°37'28" E	950 m	CP84
32 Zlatibor plateau, Lakušić, D., Jovanović, S., Glišić, O., Tomović, G., 22.05.1996, BEOU-KEGB 192/96			

Tab. 4. Continued

Number and name of the locality, collectors, collection date, Herbarium/Collection number	WGS coordinates	Altitude	MGRS quadrant
33 Zlatibor plateau, Rajkovača, Pavlović, Z., 10.07.1957, s.n. BEO			
34 Zlatibor plateau, Obudovica, Pavlović, Z., 08.07.1949, s.n. BEO	43°43'08" N, 19°40'20" E	920 m	CP94
35 Zlatibor plateau, Obudovica, Pavlović, Z., 08.07.1948, s.n. BEO	43°43'08" N, 19°40'20" E	920 m	CP94
36 Zlatibor plateau, Obudovica, Pavlović, Z., 08.07.1949, s.n. BEO	43°43'08" N, 19°40'20" E	920 m	CP94
37 Zlatibor plateau, Obudovica, Pavlović, Z., 15.06.1949, s.n. BEO	43°43'08" N, 19°40'20" E	920 m	CP94
38 Zlatibor plateau, Obudovica, Pavlović, Z., 06.05.1948, s.n. BEO	43°43'08" N, 19°40'20" E	920 m	CP94
39 Zlatibor plateau, Ribnica, Pavlović, Z., 10.05.1948, s.n. BEO	43°40'48" N, 19°38'36" E	1010 m	CP93
40 Zlatibor plateau, Ribnica, Pavlović, Z., 10.05.1948, s.n. BEO	43°40'48" N, 19°38'36" E	1010 m	CP93
41 Zlatibor plateau, Ribnica, Diklić, N., Mladenović, S., 05.07.1984, s.n. BEO (as <i>E. fragifera</i> Jan)	43°40'48" N, 19°38'36" E	1010 m	CP93
42 Zlatibor plateau, Semegnjevo, Kabaš, E., Kuzmanović, N., Vukojičić, S., 21.06.2012, BEOU-KEGB 34694	43°44'01" N, 19°37'44" E	828 m	CP84
43 Zlatibor plateau, Šumnato brdo, Pavlović, Z., 15.06.1949, s.n. BEO	43°42'05" N, 19°42'37" E	1100	CP93
44 Zlatibor plateau, Šumnato brdo, Pavlović, Z., 15.06.1949, s.n. BEO	43°42'05" N, 19°42'37" E	1100	CP93
45 Zlatibor plateau, Zlatibor, Viogor - Kozja stena (near Šargan), Ostojić, D., 24.05.2001, s.n. BEOU-KEGB (as <i>E. polychroma</i> A. Kern)	43°47'16" N, 19°32'18" E	950 m	CP84
46 Zlatibor plateau, Pavlović, Z., 25.07.1960, s.n. BEO			
47 Zlatibor plateau, Stevanović, V., Jovanović, S., Lakušić, D., 19.05.1991, BEOU-KEGB 29/91			
48 Zlatibor plateau, Jovanović, S., 01.06.1989, BEOU-KEGB 147/89			
49 Zlatibor plateau, Semegnjevo, Đurović, S., 14.07.2018, IB 15201	43°44'00" N, 19°37'30" E	829 m	CP84
50 Zlatibor plateau, Tornik Mt., Kuzmanović, N., 01.05.2018, IB 15157	43°40'32" N, 19°38'30" E	1048 m	CP93

Tab. 5. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Serbia (literature data).

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
1 Zlatibor plateau, Murtenica, Novák, A., 1927	43°35'14" N, 19°47'40" E	1400 m	DP02
2 Zlatibor plateau, Šumnato brdo, Novák, A., 1927	43°42'05" N, 19°42'37" E	1100	CP93
3 Zlatibor plateau, Mešćema Gora, Ribnica, Novák, A., 1927	43°40'48" N, 19°38'36" E	1025 m	CP93
4 Zlatibor plateau, Tornik Mt., Novák, A., 1924	44°39'30" N, 19°38'38" E	1250-1400 m	CP93

Tab. 5. Continued

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
5 Zlatibor plateau, Kraljeva Voda, Novák, A., 1924	43°43'29" N, 19°42'21" E	950 m	CP94
6 Zlatibor plateau, Crni Rzav, Novák, A., 1924	43°40'01" N, 19°38'47" E	1250 m	CP93
7 Zlatibor plateau, Gmizova Čuprija, Novák, A., 1927	43°41'58" N, 19°40'20" E	1050 m	CP93
8 Studena Planina near Kraljevo, Tatić, B., 1984	43°31'32" N, 20°40'48" E	1355 m	DP71
9 Zlatibor plateau, Tornik Mt., Pavlović, Z., 1951	43°40'32" N, 19°38'30" E	1100 m	CP93
10 Zlatibor plateau, Partizanske Vode, Pavlović, Z., 1951	43°43'29" N, 19°42'21" E	950 m	CP94
11 Zlatibor plateau, Pjevčevo Brdo, Pavlović, Z., 1951	43°43'12.80"N, 19°43'27.79"E	1072 m	CP94
12 Zlatibor plateau, Kriva Breza, Pavlović, Z., 1951	43°41'50.98"N, 19°42'7.09"E	1100 m	CP93
13 Zlatibor plateau, Bijele vode, Pavlović, Z., 1951	43°44'36" N, 19°39'54" E	940 m	CP94
14 Zlatibor plateau, Rajčevina, Pavlović, Z., 1951	43°42'40.02"N, 19°38'9.62"E	1110 m	CP94
15 Zlatibor plateau, Džamija, Pavlović, Z., 1951	43°41'39.96"N, 19°37'51.64"E	1110 m	CP83
16 Goč Mt., Ravnine, Sigunov, A., 1979	43°34'3.12"N, 20°43'43.86"E	740 m	DP72
17 Čemerno Mt., Lopatnica river valley, Odajište, Sigunov, A., 1979	43°39'9.29"N, 20°26'16.65"E	500 m	DP53
18 Zlatibor plateau, Semegnjevo, Caković <i>et al.</i> 2021	43°44'00" N, 19°37'30" E	829 m	CP84
19 Zlatibor plateau, Tornik Mt., Caković <i>et al.</i> 2021	43°40'32" N, 19°38'30" E	1048 m	CP93
20 Zlatibor plateau, coll. & det. Pančić, J., BEOU (as <i>E. verrucosa</i> L.), Niketić <i>et al.</i> 2021			
21 Tara Mt., Zborište, coll. Jurišić, Ž.J., Niketić, M. <i>et al.</i> 2021	43°50'55" N, 19°27'33" E	1544 m	CP75

Tab. 6. Georeferenced data of the distribution of *Euphorbia serpentini* Novák in Serbia (new records).

Number and name of the locality, observers (collectors) and dates for the observations	WGS coordinates	Altitude	MGRS quadrant
1 Mokra Gora: Mt Šargan (Zlatibor), Niketić, M. 03.06.2021., s.n. BEOU	43°49'11" N, 19°30'22" E	815 m	CP75
2 Zlatibor plateau, Čigota Mt., Niketić, M., Tomović, G., Jakovljević, K., 15.08.2008, BEOU-KEGB 28079	43°38'53" N, 19°46'25" E	1200-1400 m	DP03

RESULTS AND DISCUSSION

The occurrence of *E. serpentini* in the flora of Bosnia and Herzegovina was firstly noted by MALÝ (1920) in the area of Gostović near the town of Zavidovići under the name *E. montenegrina*. Although known from several localities mentioned in older botanical literature under the same name (MALÝ, 1923, 1928; RITER-STUDNIČKA, 1952, 1970), records of *E. serpentini* in Bosnia and Herzegovina in the last 50 years have been very rare. The first records under the current name were recently provided by LUBARDA & DŽOMBIĆ (2018) and ČAKOVIĆ *et al.* (2021) (Tab. 1). In the Herbarium of the National Museum of Bosnia and Herzegovina (SARA), twenty-six specimens originally identified as *E. montenegrina* were deposited. Thirteen of these specimens were collected from limestone in the high mountains of south-eastern Bosnia and Herzegovina, and were correctly identified as *E. montenegrina*. On the other hand, thirteen specimens

were collected on serpentine substrates in north-central Bosnia, which indicates that the species in question is *E. serpentini*. Most of the herbarium specimens of *E. serpentini* were collected by Malý between 1920 and 1921 (Tab. 2).

On the territory of Bosnia and Herzegovina *E. serpentini* was thus recorded in 30 UTM squares 10×10 km, from Banja Luka in the west to Olovo in the east (Fig. 2). During floristic research in north-central Bosnia between 2016 and 2020 the presence of *E. serpentini* could be confirmed in 13 UTM squares. The species was found in 46 micro localities in the vicinity of the towns of Banovići, Kladanj, Lukavac, Maglaj, Olovo, Vareš, Zavidovići, Žepče and Živinice (Tab. 3) at altitudes between 258 and 1300 m s.m. Some populations were numerous, with high seed production. Since neither literature nor herbarium data could confirm the presence of *E. serpentini* in the serpentine complex in eastern Bosnia near Višegrad, a new field survey is needed to confirm the possible presence of the species in the current area. On the other hand, in neighbouring Serbia, the species was reported for ten 10×10 km UTM squares (NOVÁK, 1924, 1927; PAVLOVIĆ, 1951; SIGUNOV, 1979; TATIĆ, 1984; ČAKOVIĆ *et al.*, 2021; NIKETIĆ *et al.*, 2021, Fig. 2), of which four were confirmed by herbarium material, and we here report two additional new records (Tab. 6). In Serbia the species occurs from 500 to 1544 m s.m.

The serpentine areas in Bosnia and Herzegovina exist as localised outcrops separated from other geological formations in north-central Bosnia. In addition, in eastern Bosnia, serpentinite areas are located north of the town of Višegrad on both banks of the Drina River, and are connected to those in western Serbia (RITER-STUDNIČKA, 1963). Whereas *E. serpentini* is quite common on the thermophilous rocky serpentine habitats of north-central Bosnia, it seems to be lacking in the serpentine areas of eastern Bosnia. This leads to the conclusion that the centre of distribution of this species is located in north-central Bosnia while the sites from Serbia are located on the south-east border of the species- distribution. The species should be added to the list of 298 Balkan endemic taxa reported in the territory of Bosnia and Herzegovina (LUBARDA *et al.*, 2014). This species belongs to Balkan obligate serpentine endemic plants distributed only in Bosnia and Serbia (STEVANOVIĆ *et al.*, 2003; TOMOVIĆ *et al.*, 2014; ČAKOVIĆ *et al.*, 2021).

Euphorbia serpentini and *E. montenegrina* are very similar and belong to the group of *E. verrucosa*. According to Novák, *E. serpentini* is somewhat shorter, has relatively elongated leaves (in *E. montenegrina* they can also be oblong), a smaller number of flowers and fruits in the inflorescence, the involucre of cyathium is somewhat deeper divided into five parts during fruiting, and the bracts and bracteoles are less serrated. However, transitions between these traits are possible, but there is one constant differential characteristic, and that is the seed structure. In *E. serpentini* the seeds are larger, chestnut- or cinnamon-colored and have a worm-wrinkled surface (Fig. 1 d), while in *E. montenegrina* they are lead-colored and dotted-rough (NOVÁK, 1924).

However, it is easiest to distinguish these two species by ecology. *E. serpentini* grows only on serpentine substrates in mountainous areas, while *E. montenegrina* is present on limestone and silicate mostly in the subalpine zone. Detailed description of the species as well as an identification key can be found in ČAKOVIĆ *et al.* (2021).

CONCLUSIONS

The first record of *E. serpentini* in Bosnia and Herzegovina dates from 1920, when it was discovered in the valley of the stream Gostović, but under the name *E. montene-*

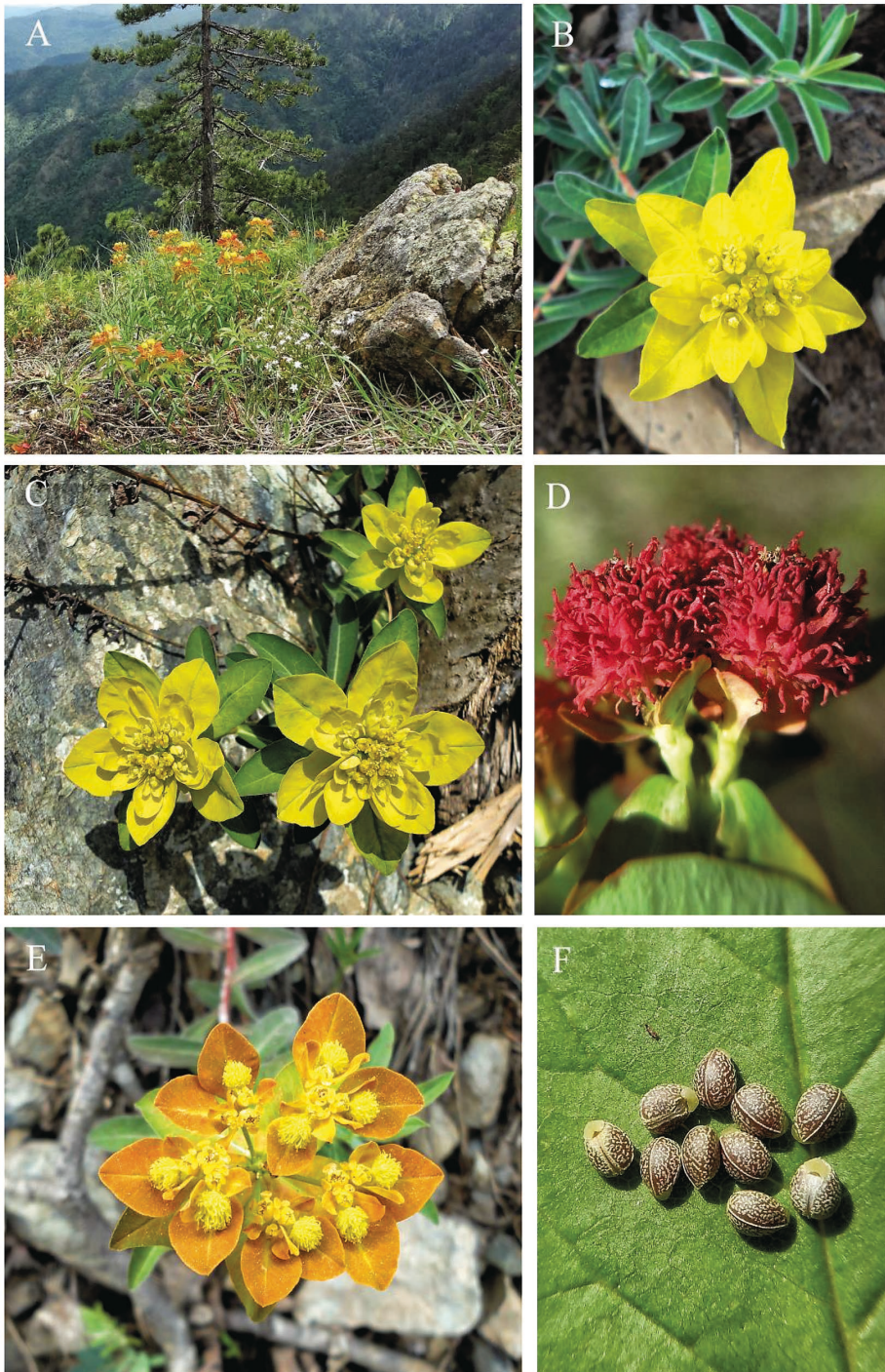


Fig. 1. *Euphorbia serpentini* near Mala Maoča, Mt. Konjuh; A, habitat, B, C, inflorescence details, D, E, capsules, F, seeds (Photos by Šemso Šarić).

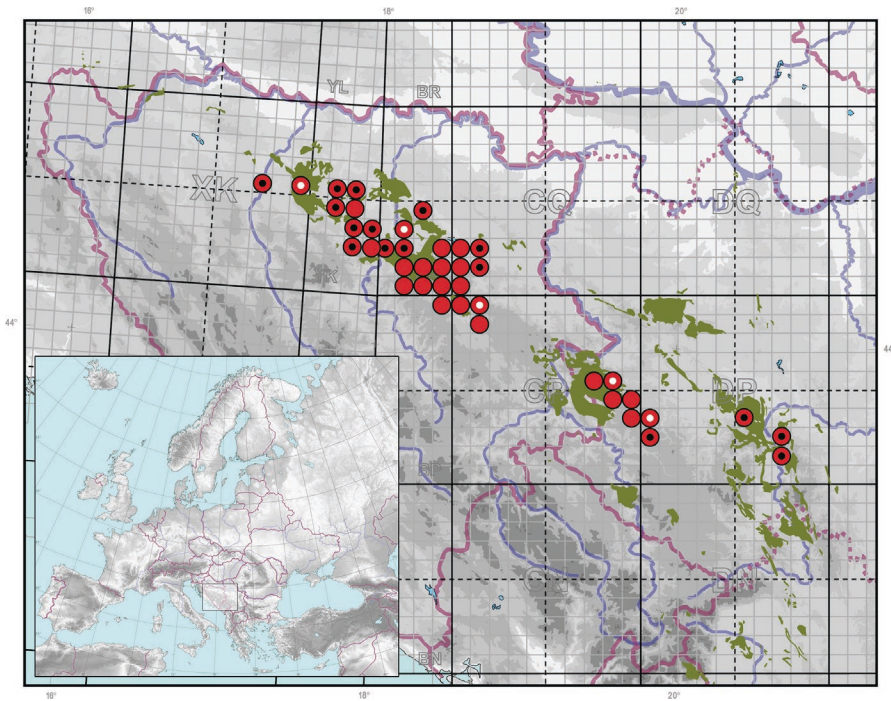


Fig. 2. The distribution of *Euphorbia serpentini* in Balkans. Green colour – serpentinite areas. Full circles – literature and herbarium (confirmed) records; small black circle within circle – literature records only; small white circle within circle – new herbarium data (so far not mentioned for the given UTM square).

grina. It was described as a new species by Novák (1924) from serpentinite outcrops on the Zlatibor plateau in western Serbia. According to literature data and herbarium material (SARA, BEO, BEOU), as well as to our own field study, we could conclude that *E. serpentini* is a widely distributed species on serpentinite in Bosnia and western Serbia. Literature data from central Serbia have not been confirmed yet.

ACKNOWLEDGEMENTS

The authors would like to thank Ermana Lagumdžija and Nermina Sarajlić for the help during studying of the SARA collection, as well as Lanna Maslo for improving the English of this paper.

Received December 9, 2021

REFERENCES

- BECK-MANNAGETTA, G., 1920: Flora Bosne, Hercegovine i bivšeg Sandžaka Novog Pazara 2(9). Glasnik Zemaljskog Muzeja Bosne i Hercegovine u Sarajevu, Prirodne Nauke, **32**, 395–410.
- ČAKOVIĆ, D., CRESTI, L., STEŠEVIĆ, D., SCHÖNSWETTER, P., & FRAJMAN, B., 2021: High genetic and morphological diversification of the *Euphorbia verrucosa* alliance (Euphorbiaceae) in the Balkan and Iberian peninsulas. *Taxon*, **70**(2), 286–307.
- Euro+Med 2006+: Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. - Published at <http://ww2.bgbm.org/EuroPlusMed> (accessed August 2021).

- FRAJMAN, B. & SCHÖNSWETTER, P., 2011: Giants and dwarfs: molecular phylogenies reveal multiple origins of annual spurges within *Euphorbia* subg. *Esula*. *Molecular Phylogentic and Evolution*, **61**, 413–424.
- HOLMGREN, P. K., HOLMGREN, N. H. & BARNETT, L. C., 1990: *Index Herbariorum*. Part I: the herbaria of the world. 8th edn. *Regnum Vegetabile*, **120**, 1–693.
- LAMPINEN, R., 2001: Universal Transverse Mercator (UTM) and Military Grid Reference System (MGRS). [<http://www.luomus.fi/english/botany/afe/map/utm.htm>]
- 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), 167–184.
- LUBARDA, B. & DŽOMBIĆ, D., 2018: Contribution to the flora on serpentine in the valley Jošavka river. In: *Skup 9* (1) 2018, 13–23. PMF Banja Luka, Faculty of Natural Sciences and Mathematics, Banja Luka.
- MALÝ, K., 1920: Prilozi za floru Bosne i Hercegovine 7.8. *Glasnik Zemaljskog muzeja u Bosni i Hercegovini*, **32**, 129–154.
- MALÝ, K., 1923: Prilozi za floru Bosne i Hercegovine 9. *Glasnik Zemaljskog muzeja u Bosni i Hercegovini*, **35**, 123–162.
- MALÝ, K., 1928: Prilozi za floru Bosne i Hercegovine 10. *Glasnik zemaljskog muzeja u Bosni i Hercegovini*, **40**, 107–166.
- NIKETIĆ, M., TOMOVIĆ, G., BOKIĆ, B., BUZUROVIĆ, U., DURAKI, Š., ĐORĐEVIĆ, V., ĐUROVIĆ, S., KRIVOŠEJ, Z., LAZAREVIĆ, P., PERIĆ, R., PRODANOVIĆ, D., RADAČ, B., RAT, M., RANIMIROVIĆ, M. & STEVANOVIĆ, V., 2021: Material on the Annotated Checklist of Vascular Flora of Serbia. Nomenclatural, taxonomic and floristic notes III. *Bulletin of the Natural History Museum in Belgrade*, **14**, 77–132.
- NIKOLIĆ, V., 1977: Euphorbiaceae. In: M. JOSIFOVIĆ (eds.): *Flore de la Republique Socialiste de Serbie 9* (suppl.). Srpska Akademija nauka i umetnosti, Belgrade, 88–95.
- NOVÁK, F. A., 1924: Generi Euphorbiae species nova Balcanica. *Acta Botanica Bohemica*, **3**, 35–40.
- NOVÁK, F. A., 1927: Ad floras Serbiae cognitionem additamentum alterum, *Preslia*, **5**, 37–56.
- PAVLOVIĆ, Z., 1951: Vegetacija planine Zlatibora. *Zbornik radova Instituta za Ekologiju i Biogeografiju, Srpske Akademije Nauka*, **2**, 115–182.
- RITER-STUDNIČKA, H., 1952: Prilozi za floru Bosne i Hercegovine. *Godišnjak Biološkog instituta Univerziteta u Sarajevu*, **5**(1-2), 278–286.
- RITER-STUDNIČKA, H., 1963: Biljni pokrov na serpentinima u Bosni. *Godišnjak Biološkog instituta Univerziteta u Sarajevu*, **16**, 91–204.
- RITER-STUDNIČKA, H., 1970: Die Flora der Serpentinorkommen in Bosnien. *Bibliotheca Botanica*, **130**, 1–100.
- SIGUNOV, A., 1979: Treći prilog poznavanju rasprostranjenja nekih šumskih vrsta biljaka u SR Srbiji. *Glasnik Prirodnjackog Muzeja B* **34**, 71–88.
- 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.
- TATIĆ, B., 1984: A new locality of the serpentine species *Euphorbia serpentini* Nov. in SR Serbia. *Glasnik Instituta za botaniku i botaničke bašte Univerziteta u Beogradu*, Tom XVIII, 55–58.
- TOMOVIĆ, G., NIKETIĆ, M., LAKUŠIĆ, D., RANDELOVIĆ, 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.

