Genus Euphorbia L. (Euphorbiaceae juss.) in Serbia based on herbarium data from the collections BEO and BEOU

Article *in* Bulletin of the Natural History Museum · December 2022

DOI: 10.5937/bnhmb2215097D

5 authors, including:

Sanja Đurović
University of Niš
38 PUBLICATIONS **158** CITATIONS
SEE PROFILE

Milana Ranimirović
University of Belgrade
3 PUBLICATIONS **5** CITATIONS
SEE PROFILE

Gordana Tomović
Faculty of Biology University of Belgrade
109 PUBLICATIONS **1,121** CITATIONS
SEE PROFILE

Marjan Niketic
Natural History Museum, Belgrade, Serbia
131 PUBLICATIONS **1,454** CITATIONS
SEE PROFILE

Bulletin of the Natural History Museum, 2022, 15: 97-120.
Received 30 May 2022; Accepted 03 Sep 2022.

doi:10.5937/bnhmb2215097D
UDC: 582.681.5.082.5(497.11)
Original scientific paper

GENUS *EUPHORBIA* L. (EUPHORBIACEAE JUSS.) IN SERBIA BASED ON HERBARIUM DATA FROM THE COLLECTIONS BEO AND BEOU

SANJA ĐUROVIĆ[1*], MILANA RANIMIROVIĆ[2], GORDANA TOMOVIĆ[2], GORANA PETKOVSKI[3], MARJAN NIKETIĆ[3,4]

[1] University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia
e-mail: djurovic.sanja@ni.ac.rs
[2] University of Belgrade, Faculty of Biology, 11000 Belgrade, Serbia,
e-mails: milana.ranimirovic@bio.bg.ac.rs, gtomovic@bio.bg.ac.rs
[3] Natural History Museum, 11000 Belgrade, Serbia,
e-mails: gorana.petkovski@nhmbeo.rs, mniketic@nhmbeo.rs
[4] Serbian Academy of Sciences and Arts, Belgrade, Serbia

This paper contains information on specimens of the genus *Euphorbia* L. collected in Serbia and deposited in the Herbarium of the Natural History Museum in Belgrade (BEO) and in the Herbarium of the University of Belgrade (BEOU). A total of 2199 herbarium sheets were examined, of which 915 are deposited in BEO and 1284 in BEOU. The catalogue with herbarium data on 37 taxa of the genus *Euphorbia* distributed in Serbia is presented as well as distribution maps for all recorded taxa.

Key words: *Euphorbia*, distribution, herbarium collections, Serbia.

INTRODUCTION

The genus *Euphorbia* L. belongs to the family Euphorbiaceae Juss. and is one of the most numerous genera among the angiosperms, with over

2000 species (Govaerts *et al.* 2000). Species are native to temperate and tropical regions and occur in a variety of different habitats, ranging from dry to humid and at altitudes from sea level to over 4000 m (Riina & Berry 2021). Members of the genus are characterized by a unique morphological feature - the cyathium, a pseudanthium ("false flower"), which is technically an inflorescence and was a very important feature in establishing a classification system (Lamarck 1786, Victor *et al.* 2002, Dorsey *et al.* 2013).

There are 105 *Euphorbia* species listed in the *Flora Europaea* (Smith & Tutin 1968), while 35 species are listed in the *Flora of SR Serbia* (Janković & Nikolić 1972, Nikolić 1977, Janković 1986, Nikolić & Diklić 1986, Bože & Vasić 1986, Butorac 1986): *E. agraria* M. Bieb., *E. amygdaloides* L., *E. angulata* Jacq., *E. barrelieri* Savi, *E. carniolica* Jacq., *E. chamaesyce* L., *E. cyparissias* L., *E. exigua* L., *E. esula* L., *E. falcata* L., *E. fragifera* Jan., *E. glabriflora* Vis., *E. glareosa* Pall. ex M. Bieb., *E. graeca* Boiss. & Spruner, *E. helioscopia* L., *E. humifusa* Willd., *E. lathyris* L., *E. lingulata* Heuff., *E. lucida* Waldst. & Kit., *E. maculata* L., *E. montenegrina* (Bald.) K. Maly, *E. myrsinites* L., *E. nutans* Lag., *E. palustris* L., *E. pancicii* Beck, *E. peplus* L., *E. platyphyllos* L., *E. polychroma* A. Kern., *E. salicifolia* Host., *E. seguieriana* Neck., *E. serpentini* Novák, *E. stricta* L., *E. verrucosa* L., *E. villosa* Waldst. & Kit. ex Willd., and *E. virgata* Waldst. & Kit. The occurrence of *E. nuda* Velen. in Serbia was reported by Urumov (1935) and confirmed by Zlatković & Bogosavljević (2014). Findings of 12 additional taxa distributed in Serbia not listed in the Flora of SR Serbia were published: *E.* ×*angustata* (Rochel) Simonk. (Simkovics 1882), *E.* ×*angustifrons* Borbás (Bernátsky 1908), *E.* ×*peisonis* Rechinger (Rechinger 1935), *E. aleppica* L. (Jurišić 1901), *E. davidii* Subils (Purger *et al.* 2015), *E. gregersenii* K. Malý ex Beck (Blečić 1957), *E. heterophylla* L. (Jovanović 1970), *E. lamarckii* Sweet (Prodanović *et al.* 2011), *E. orjeni* Beck (Caković & Frajman 2020), *E. paradoxa* (Schur) Simonk. (Obradović & Panjković 1980), *E. prostrata* Aiton (Veljić *et al.* 2017), and *E. segetalis* L. (Obradović 1966).

Euphorbia graeca should be considered a synonym of *E. taurinensis* All.; *E. lingulata* and *E. polychroma* should be considered synonyms of *E. epithymoides* L., while *E. villosa* should be considered a synonym of *E. illirica* Lam. (Govaerts *et al.* 2000). Recently, Frajman *et al.* (2019) proposed a revised taxonomic treatment of *E. seguieriana* s. l., recognizing two clearly separate species: *E. niciciana* Borbás and *E. seguieriana* Neck., using genetic, genome size, environmental and morphological data. Niketić *et al.* (2020) published that *E. pancicii* should be treated as synonym of *E. maglicensis* Rohlena and that all previous records of *E. glareosa* refer to *E.*

pannonica Host, while *E. glareosa* occurs in Serbia, but is known only for Mt Rujan. Moreover, these authors indicated that the occurrence of *E. agraria* in Serbia is doubtful and that the name refers either to the specimens of *E. subhastata* Vis. & Pančić or *E. lucida*. Using genetic, genome size and morphological data Stevanoski *et al.* (2020) concluded that *E. glabriflora* should be treated as a subspecies (*E. spinosa* subsp. *glabriflora* (Vis.) Frajman). In addition, Niketić *et al.* (2021) published that *E. verrucosa* and *E. fragifera* were incorrectly listed as present in the flora of Serbia. In the case of *E. paradoxa*, despite its undoubted hybrid origin (*E. esula – E. salicifolia*) (POWO 2023, GBIF 2023), on this occasion the taxon is treated as an independent and stabilized species because its population in Deliblato sands (Banat) is much larger than that of the parental species. This is also in accordance with the original treatment of the species (Simkovics 1892a), and the author of the original nomenclatural combination later noticed that in Romania (Banat) *E. paradoxa* replaces *E. esula* in the process of natural succession (Simonkai 1893).

The aims of this paper are: (1) to determine the number of taxa of the genus *Euphorbia* distributed in Serbia based on data from two herbarium collections: Herbarium of the Natural History Museum in Belgrade (BEO) and Herbarium of the University of Belgrade (BEOU) and (2) to present their distributions.

MATERIAL AND METHODS

The data used to determine the distribution of the genus *Euphorbia* in Serbia were obtained from herbarium specimens deposited in the Herbarium of the Natural History Museum in Belgrade (BEO) and in the Herbarium of the University of Belgrade (BEOU) (Thiers 2023). In addition, the BEOU collection consists of three sub-collections: the general collection (BEOU), the collection of the Department of Plant Ecology and Geography (BEOU-KEGB) and the collection of Josif Pančić - *Herbarium Pancicianum* (BEOU-Herb Panc).

Identification and revision of the herbarium material were made according to the national and regional floras (Janković & Nikolić 1972, Kuzmanov 1979, Nikolić 1977, Janković 1986, Nikolić & Diklić 1986, Boža & Vasić 1986, Butorac 1986, Smith & Tutin 1968). The nomenclature follows *Flora Europaea* (Smith & Tutin 1968), as well as some new data sources such as POWO (2022) and GBIF (2022). Division of subgen. *Esula* Pers. into sections is according to Frajman & Schönswetter (2011).

The obtained data on the distribution of *Euphorbia* species are presented on a grid map with 10×10 km squares, based on the Military Grid Reference System and the Universal Transverse Mercator (UTM) projection (Lampinen 2001). On the distribution maps, imprecise records related to wider localities that encompassed two or more UTM 10×10 km squares were marked with the ◌ sign, while allochthonous taxa/records were presented with the "x" mark.

RESULTS AND DISCUSSION

A total of 2199 herbarium sheets with specimens of taxa belonging to the genus *Euphorbia* distributed in Serbia were examined, of which 915 are deposited in BEO and 1284 in BEOU. We couldn't identify specimens in nine sheets. The study confirmed the presence of 37 taxa, of which three belong to the subgenus *Chamaesyce* Rafin. and 34 belong to the subgenus *Esula.* Representatives of nine sections were recorded. A detailed presentation of the number of exsiccates in the BEO and BEOU collections, sorted by subgenera, sections and species/subspecies, is given in Table 1. The detailed catalogue with herbarium data on specimens of the genus *Euphorbia* collected in Serbia, with the geographical data of each specimen and the following information on the labels of the herbarium specimens is given in Appendix 1.

Out of 37 recorded *Euphorbia* taxa, 34 are native for Serbia, whereas three (*E. maculata*, *E. nutans* and *E. lathyris*) are allochthonous.

No specimens of 12 taxa previously reported for the flora of Serbia were found. Therefore, their occurrence in Serbia could not be confirmed with this study. Those are: *E. agraria*, *E. humifusa*, *E. ×angustata*, *E. ×angustifrons*, *E. ×peisonis*, *E. aleppica*, *E. davidii*, *E. gregersenii*, *E. heterophylla*, *E. lamarckii*, *E. prostrata* and *E. segetalis*.

Subgen. ***CHAMAESYCE*** Rafin.

Sect. ***Anisophyllum*** Roeper

Euphorbia chamaesyce L. is the only native species of sect. *Anisophyllum* in Serbia. It was collected in several localities, in the regions: Bačka, Šumadija, Pomoravlje, NE and E Serbia, in 19 UTM 10×10 km squares (Fig. 1). It probably has a much wider distribution, considering that it is distributed throughout Europe to Asia and North Africa (Govaerts *et al.* 2000).

Table 1. – Number of sheets with specimens of *Euphorbia* species/subspecies deposited in BEO and BEOU.

Subgenus	**Section**	**Taxon**	BEO	BEOU	BEOU KEGB	BEOU Herb. Panc.	Total
Subgen.. *Chamaesyce* Rafin.	Sect. *Anisophyllum* Roeper	*E. chamaesyce* L.	4	3	2	8	17
		E. maculata L.	0	0	18	0	18
		E. nutans Lag.	3	0	1	0	4
Subgen. *Esula* Pers.	Sect. *Helioscopia* Dumort.	*E. angulata* Jacq.	5	0	4	2	11
		E. carniolica Jacq.	6	0	11	3	20
		E. epithymoides L.	80	27	41	18	166
		E. helioscopia L.	19	18	25	0	62
		E. illirica Lam.	24	3	8	6	41
		E. montenegrina (Bald.) K. Malý	2	0	1	0	3
		E. nuda Velen.	0	3	0	0	3
		E. palustris L.	10	5	0	0	15
		E. platyphyllos subsp. *literata* (Jacq.) Holub	0	6	11	1	18
		E. platyphyllos L. subsp. *platyphyllos*	18	25	33	5	81
		E. serpentini Novák	36	4	11	3	54
		E. spinosa subsp. *glabriflora* (Vis.) Frajman	81	17	92	9	199
		E. stricta L.	93	14	52	10	169
	Sect. *Conicocarpae* (Prokh.) Frajman	*E. barrelieri* subsp. *thessala* (Formánek) Bornm.	12	3	6	0	21
		E. falcata L.	23	5	6	11	45
		E. glareosa Pall. ex M. Bieb.	1	0	0	0	1

Subgenus	**Section**	**Taxon**	BEO	BEOU	BEOU KEGB	BEOU Herb. Panc.	Total
Subgen. *Esula* Pers.	Sect. *Conicocarpae* (Prokh.) Frajman	*E. niciciana* Borbás	60	31	40	1	132
		E. pannonica Host	27	16	31	5	79
		E. seguieriana Neck. subsp. *seguieriana*	43	14	28	2	87
	Sect. *Myrsinitae* (Boiss.) Tutin.	*E. myrsinites* L.	35	9	30	3	77
	Sect. *Patellares* (Prokh.) Frajman	*E. amygdaloides* L.	68	58	66	1	193
		E. orjeni Beck	2	0	2	0	4
	Sect. *Aphyllis* Webb & Berthel	*E. exigua* L.	1	0	1	0	1
	Sect. *Esula* (Pers.) Dumort.	*E. subhastata* Vis. & Pančić	21	8	33	3	65
		E. cyparissias L.	55	59	89	0	203
		E. esula L.	3	4	12	5	24
		E. lucida Waldst. & Kit.	21	13	18	1	53
		E. maglicensis Rohlena	3	0	8	4	15
		E. paradoxa (Schur) Simonk.	3	0	5	0	8
		E. salicifolia Host	45	14	14	3	76
		E. virgata Waldst. & Kit.	76	29	32	1	138
	Sect. *Peplus* Lázaro	*E. peplus* L.	0	0	5	4	9
		E. taurinensis All.	35	9	15	11	70
	Sect. *Lathyris* Dumort	*E. lathyris* L.	0	2	4	1	7
		Unidentified	0	2	5	2	9
		Total	915	401	760	123	2199

Euphorbia maculata L. has been recorded on several localities, in the regions: Banat, Šumadija, NE and E Serbia, in 12 UTM 10×10 km squares (Fig. 2), mostly as a ruderal plant. It is an alien species from North America, previously recorded only in Vojvodina province (Janković 1986).

Euphorbia nutans Lag. is recorded only in the Šumadija region, in two UTM 10×10 km squares (Fig. 3), in Belgrade as a ruderal plant. Although it is an alien species from North America, already recorded in Vojvodina province (Janković 1986), we did not find any specimens collected in Vojvodina.

Subgen. ***ESULA*** Pers.

Sect. ***Helioscopia*** Dumort.

Euphorbia angulata Jacq. is recorded only in NW and W Serbia, in eight UTM 10×10 km squares (Fig. 4) which is a somewhat wider distribution than previously reported (Janković & Nikolić 1972).

Euphorbia carniolica Jacq. is recorded only in three regions: NW, W and NE Serbia, in 15 UTM 10×10 km squares (Fig. 5) which is a slightly wider distribution than previously reported (Janković & Nikolić 1972).

Euphorbia epithymoides L. is recorded in almost all regions, except Bačka, SW and S Serbia, in 88 UTM 10×10 km squares (Fig. 6) as expected, since it was previously reported to be widespread in Serbia (Janković & Nikolić 1972).

Euphorbia helioscopia L. is recorded in almost all regions, except W, SE and S Serbia, and Metohija, in 37 UTM 10×10 km squares, of which one was imprecise (Fig. 7) as expected, since the species is widely distributed in Serbia (Janković & Nikolić 1972).

Euphorbia illirica Lam. is recorded in almost all regions south of Vojvodina province, except S Serbia and Kosovo, in 22 UTM 10×10 km squares (Fig. 8). In the *Flora of SR Serbia*, it is listed as *E. villosa* Waldst. & Kit., widely distributed (Nikolić 1977).

Euphorbia montenegrina (Bald.) K. Malý is recorded only in three regions: SW Serbia, Kosovo and Metohija, in three UTM 10×10 km squares (Fig. 9). It was previously reported only from Kosovo (Nikolić 1977).

Euphorbia nuda Velen. is recorded only in E Serbia, in two UTM 10×10 km squares (Fig. 10), although it was previously reported also for SE and S Serbia (Urumov 1935, Zlatković & Bogosavljević 2014).

Euphorbia palustris L. is recorded in eight regions in Serbia, not being recorded in Bačka, W, SW, SE and C Serbia, Kosovo and Metohija, in 15 UTM 10×10 km squares (Fig. 11), implying a slightly wider distribution than previously reported (Janković & Nikolić 1972).

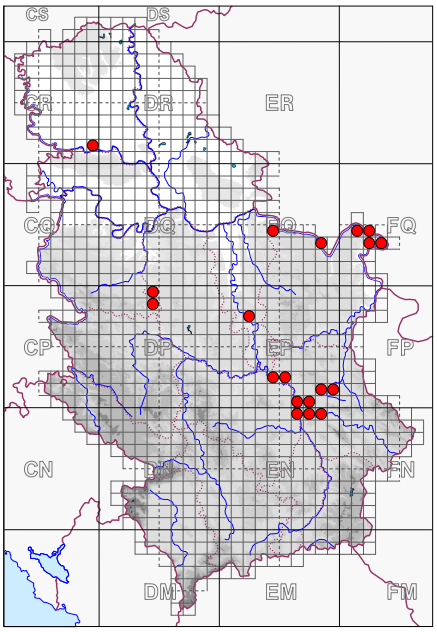

Fig. 1. – Herbarium records of *E. chamaesyce* L. in Serbia.

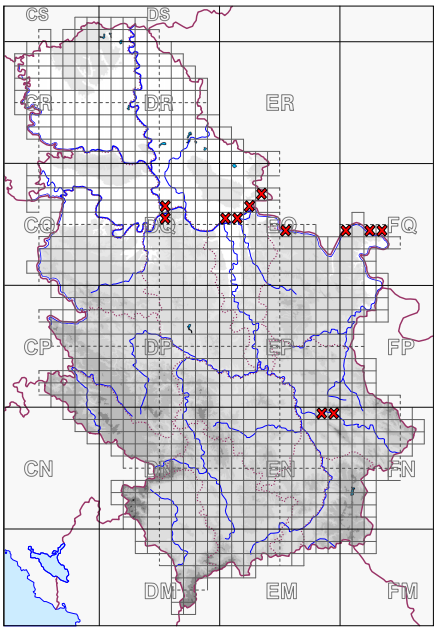

Fig. 2. – Herbarium records of *E. maculata* L. in Serbia.

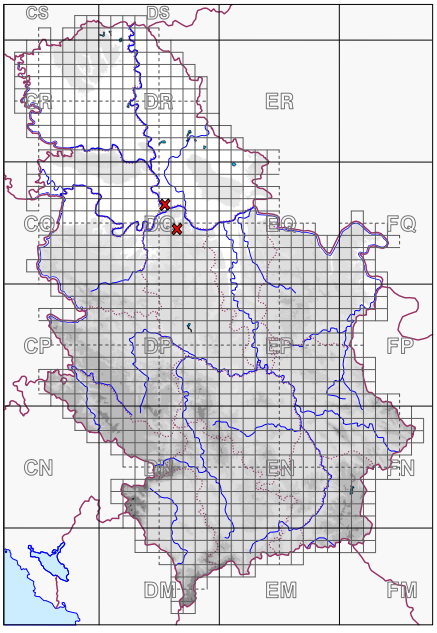

Fig. 3. – Herbarium records of *E. nutans* Lag. in Serbia.

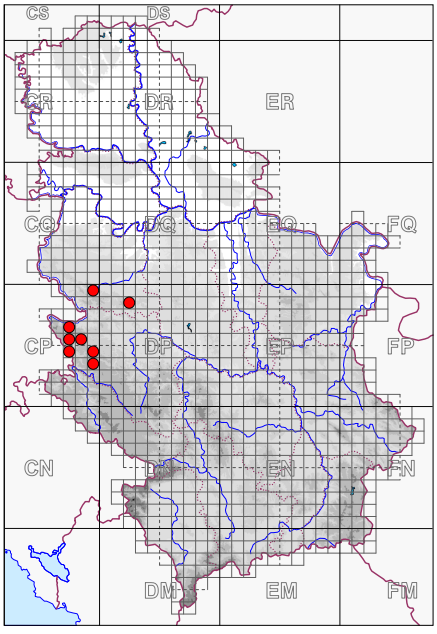

Fig. 4. – Herbarium records of *E. angulata* Jacq. in Serbia.

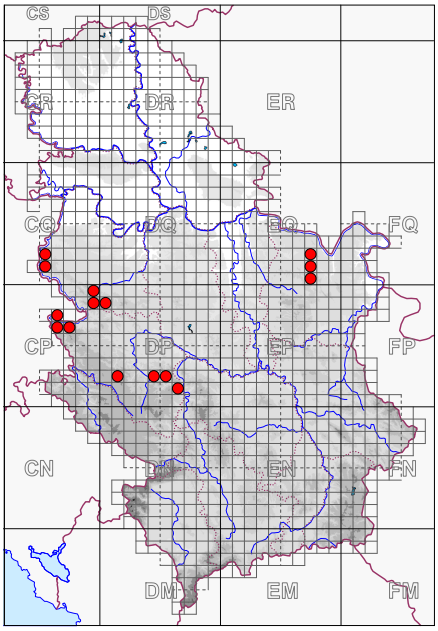

Fig. 5. – Herbarium records of *E. carniolica* Jacq. in Serbia.

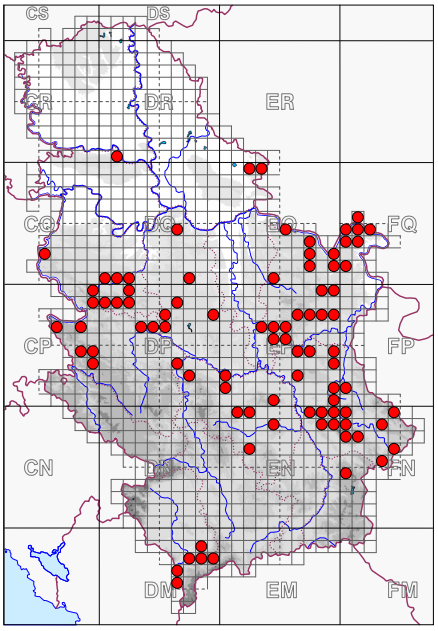

Fig. 6. – Herbarium records of *E. epithymoides* L. in Serbia.

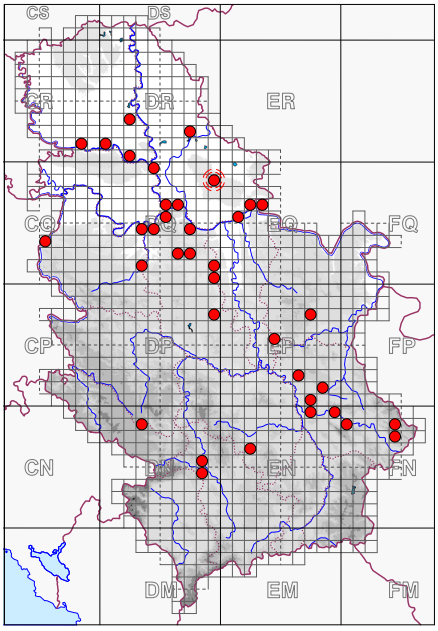

Fig. 7. – Herbarium records of *E. helioscopia* L. in Serbia.

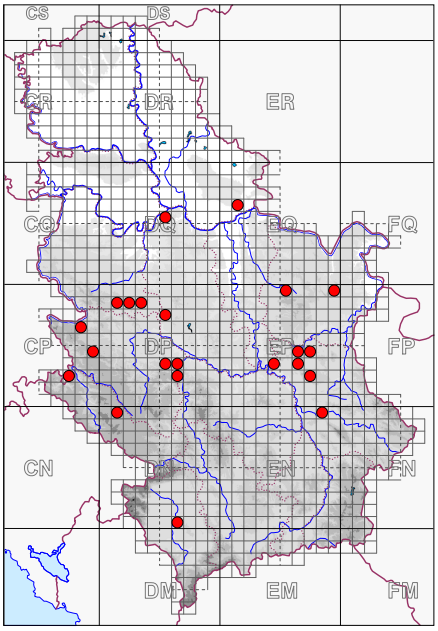

Fig. 8. – Herbarium records of *E. illirica* Lam. in Serbia.

Euphorbia platyphyllos L. is recorded in almost all regions, except in S Serbia (Figs. 12 and 13). Two subspecies are present in Serbia: *E. p.* subsp. *literata* (Jacq.) Holub and *E. p.* subsp. *platyphyllos*. The specimens of the first are collected in five regions: Srem, Banat, Šumadija, NW and NE Serbia, in 16 UTM 10×10 km squares, of which one was imprecise (Fig 12), whereas the specimens of the second are collected in all regions except in S Serbia, in 66 UTM 10×10 km squares, of which two were imprecise (Fig. 13).

Euphorbia serpentini Novák is recorded only in W Serbia, in seven UTM 10×10 km squares (Fig. 14), as previously reported (Nikolić 1977).

Euphorbia spinosa subsp. ***glabriflora*** (Vis.) Frajman is recorded in the following seven regions: NW, W, SW, C and S Serbia, as well as Kosovo and Metohija, in 60 UTM 10×10 km squares, of which one was imprecise (Fig. 15) which is in accordance with previously reported distribution (Janković & Nikolić 1972).

Euphorbia stricta L. is recorded in almost all regions, except in Vojvodina Province, Srem, Banat, and Bačka, in 108 UTM 10×10 km squares, of which two were imprecise (Fig. 16) as expected, since it was reported as a widespread species in Serbia (Janković & Nikolić 1972). Specimens collected in Vojvodina are likely to be found in other Herbaria.

Sect. ***Conicocarpae*** (Prokh.) Frajman

Euphorbia barrelieri Savi is recorded in four regions: SW, E and SE Serbia and Kosovo, in six UTM 10×10 km squares (Fig. 17). Only one subspecies has been recorded: *E. b.* subsp. *thessala* (Formánek) Bornm. It was previously reported only in E Serbia (Janković & Nikolić 1972).

Euphorbia falcata L. is a widespread species in Serbia, as previously reported by Janković & Nikolić (1972). It is recorded in almost all regions except Pomoravlje and SE Serbia, in 37 UTM 10×10 km squares (Fig. 18).

Euphorbia glareosa Pall. ex M. Bieb. is recorded only in one locality, on Mt Rujan in S Serbia (Fig. 19) as published in Niketić *et al.* (2020).

Euphorbia niciciana Borbás is recorded in almost all regions except Banat and Bačka, in 84 UTM 10×10 km squares, of which three are imprecise (Fig. 20), having slightly wider distribution than previously reported (Janković & Nikolić 1972).

Euphorbia pannonica Host is recorded in almost all regions, except: W, SE, C and S Serbia, and Kosovo and Metohija, in 36 UTM 10×10 km squares (Fig. 21). As Niketić *et al.* (2020) stated, *E. glareosa* Pall. ex M. Bieb. previously reported in the *Flora of SR Serbia* (Janković & Nikolić 1972) refers to *E. pannonica* Host (= *E. glareosa* var. *lasiocarpa* Boiss.). In this paper, we provide evidence for a somewhat wider distribution than previously reported for Banat, Šumadija and E Serbia (Janković & Nikolić 1972).

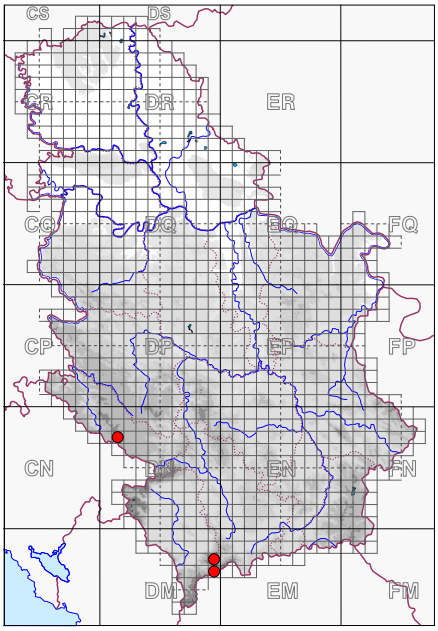

Fig. 9. – Herbarium records of *E. montenegrina* (Bald.) K. Malý in Serbia.

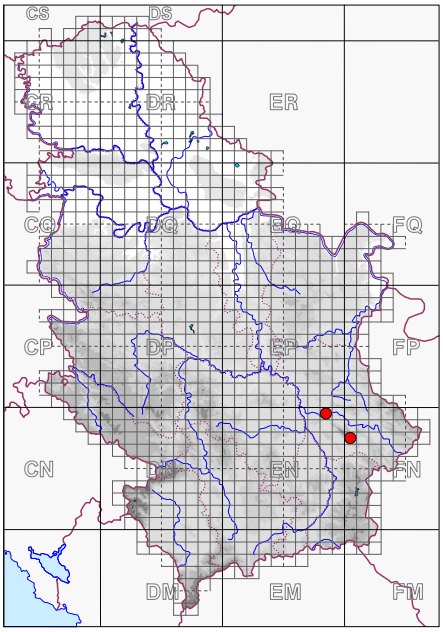

Fig. 10. – Herbarium records of *E. nuda* Velen. in Serbia.

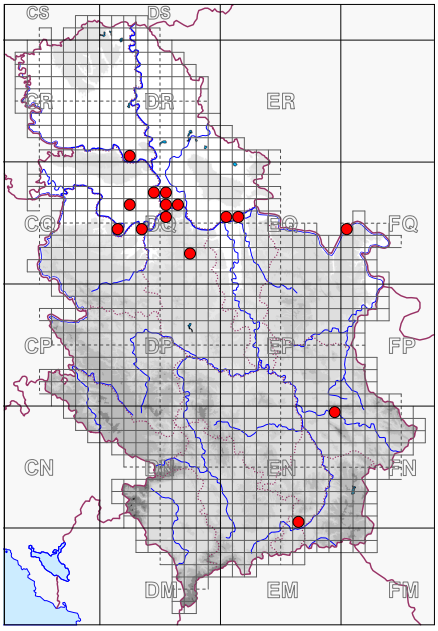

Fig. 11. – Herbarium records of *E. palustris* L. in Serbia.

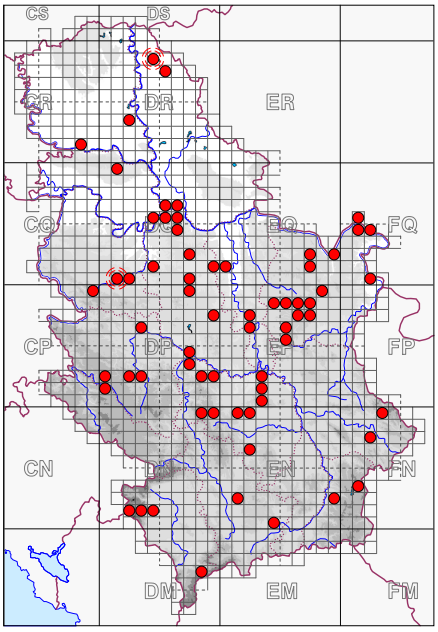

Fig. 12. – Herbarium records of *E. platyphyllos* subsp. *platyphyllos* in Serbia.

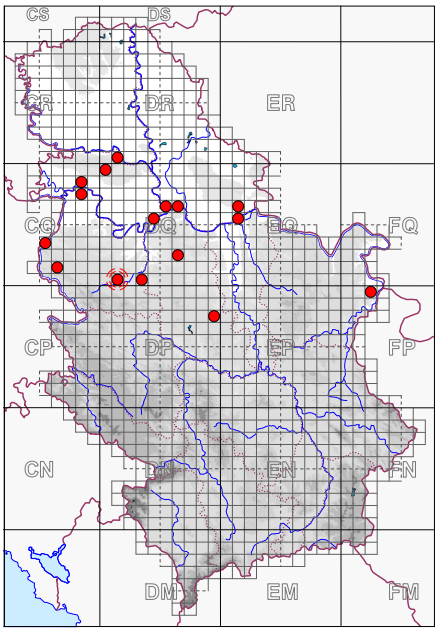

Fig. 13. – Herbarium records of *E. platyphyllos* subsp. *literata* (Jacq.) Holub in Serbia.

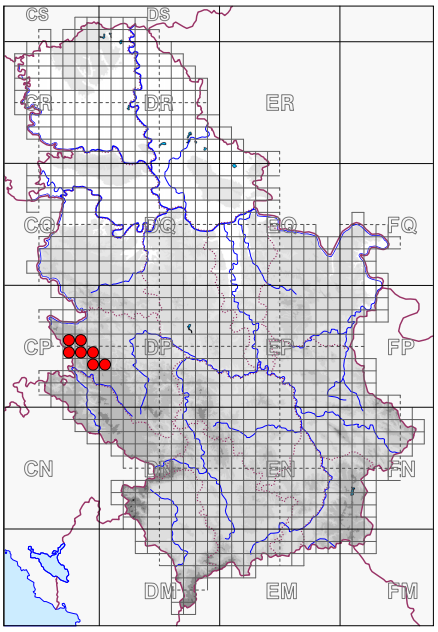

Fig. 14. – Herbarium records of *E. serpentini* Novák in Serbia.

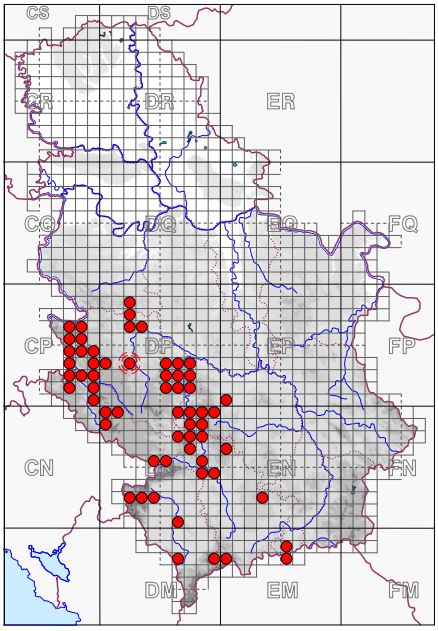

Fig. 15. – Herbarium records of *E. spinosa* subsp. *glabriflora* Vis. in Serbia.

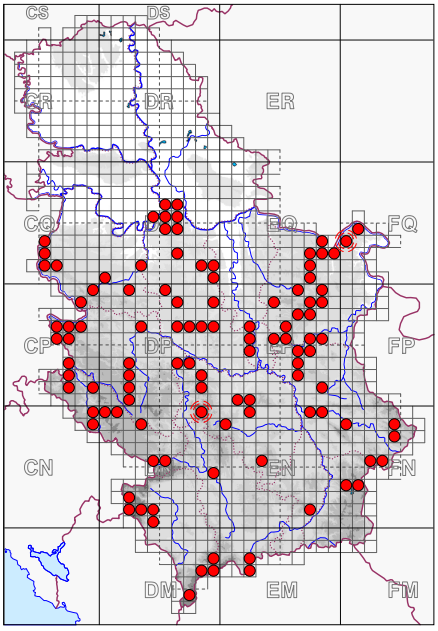

Fig. 16. – Herbarium records of *E. stricta* L. in Serbia.

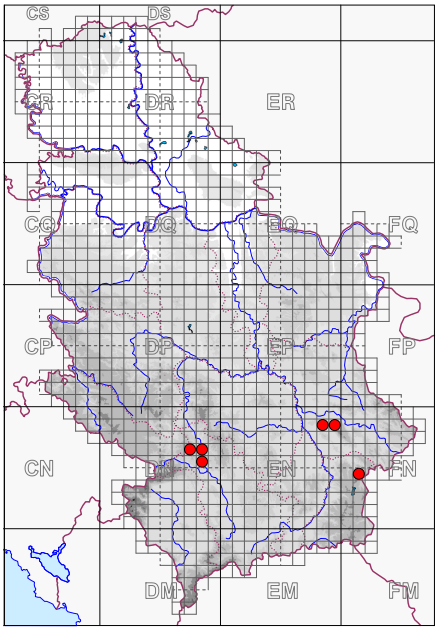

Fig. 17. – Herbarium records of *E. barrelieri* subsp. *thessala* (Formánek) Bornm. in Serbia.

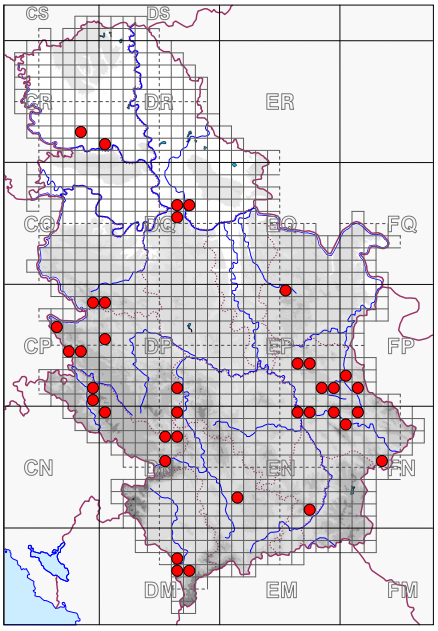

Fig. 18. – Herbarium records of *E. falcata* L. in Serbia.

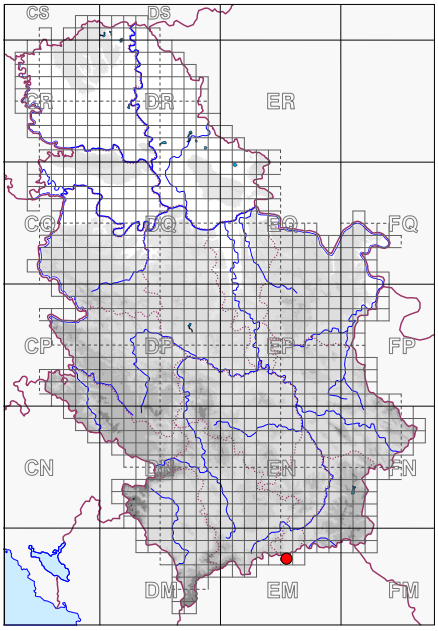

Fig. 19. – Herbarium records of *E. glareosa* Pall. ex M. Bieb. in Serbia.

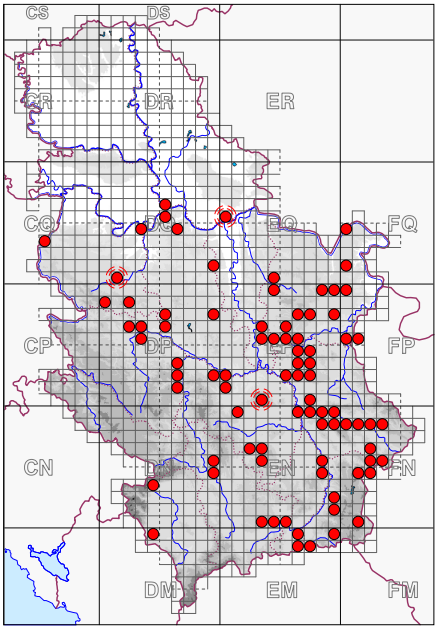

Fig. 20. – Herbarium records of *E. niciciana* Borbás in Serbia.

Euphorbia seguieriana Neck. subsp. ***seguieriana*** is recorded only in the northern regions: Srem, Banat, Bačka, Šumadija, Pomoravlje and NE Serbia, in 31 UTM 10×10 km squares (Fig. 22), having slightly wider distribution than previously reported (Janković & Nikolić 1972).

Sect. ***Myrsinitae*** (Boiss.) Tutin.

Euphorbia myrsinites L. is sporadically distributed in eight regions: Bačka, W, SW, NE, E and C Serbia, as well as Kosovo and Metohija, in 48 UTM 10×10 km squares, of which two were imprecise (Fig. 23) which represents a somewhat wider distribution than previously reported (Janković & Nikolić 1972).

Sect. ***Patellares*** (Prokh.) Frajman

Euphorbia amygdaloides L. is recorded, as expected, in almost all regions, except Banat and Bačka, in 116 UTM 10×10 km squares (Fig. 24), since it was previously considered a widespread plant in Serbia (Janković & Nikolić 1972).

Euphorbia orjeni Beck is recorded in only one UTM 10×10 km square, in Šumadija region (Fig. 25). This locality, in Belgrade, is one of only two known localities for this species, the other being Mt Orjen in Montenegro, where it was first described in 1920 (Caković & Frajman 2020).

Sect. ***Aphyllis*** Webb & Berthel

Euphorbia exigua L. has been recorded only at two localities in E Serbia, and therefore in only two UTM 10×10 km squares (Fig 26). Previously, its distribution was described as rare (Janković & Nikolić 1972) with exact localities given only for Vojvodina (Boža & Vasić 1986).

Sect. *Esula* (Pers.) Dumort.

Euphorbia subhastata Vis. & Pančić is recorded only in W and SW Serbia, and Metohija, in 24 UTM 10×10 km squares (Fig. 27). In the *Flora of SR Serbia*, it is listed as *E. agraria* var. *subhastata* (Vis. & Pančić) Griseb. which is also reported to be distributed in Kosovo (Janković & Nikolić 1972).

Euphorbia cyparissias L. has been recorded in all regions, in 121 UTM 10×10 km squares, of which one is imprecise (Fig. 28). This kind of distribution was expected since it was already reported as widespread in Serbia (Janković & Nikolić 1972).

Euphorbia esula L. has been recorded in almost all regions, except Bačka, W, SW, and SE Serbia, as well as Kosovo and Metohija, in 31 UTM 10×10 km squares (Fig. 29) which means it has a much wider distribution than that previously reported for Srem, Banat, and Šumadija (Janković & Nikolić 1972).

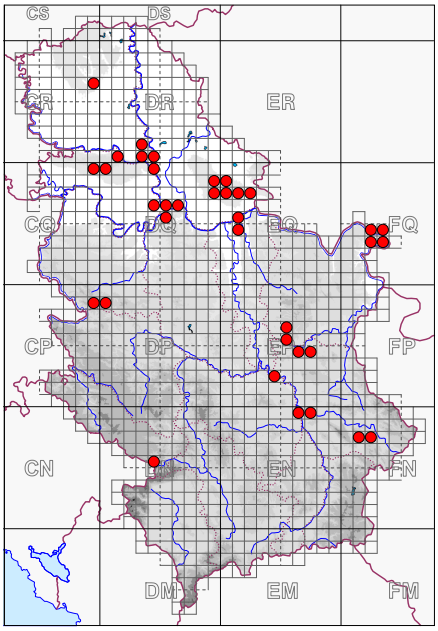

Fig. 21. – Herbarium records of *E. pannonica* Host in Serbia.

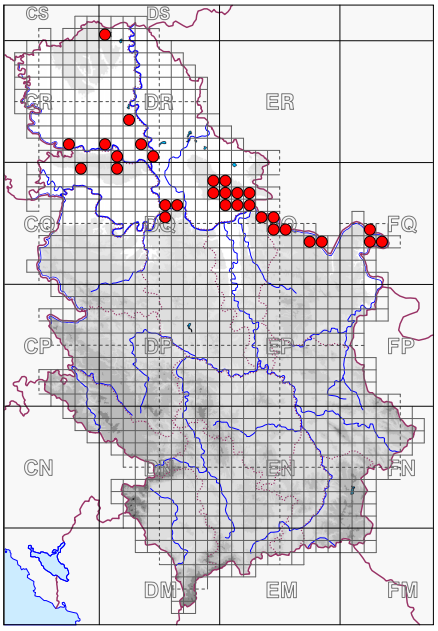

Fig. 22. – Herbarium records of *E. seguieriana* Neck. subsp. *seguieriana* in Serbia.

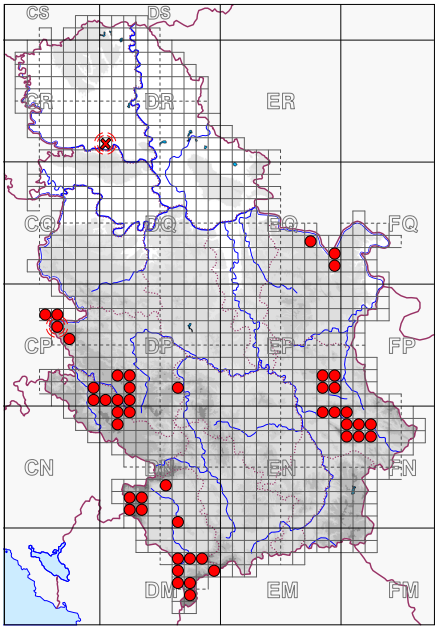

Fig. 23. – Herbarium records of *E. myrsinites* L. in Serbia.

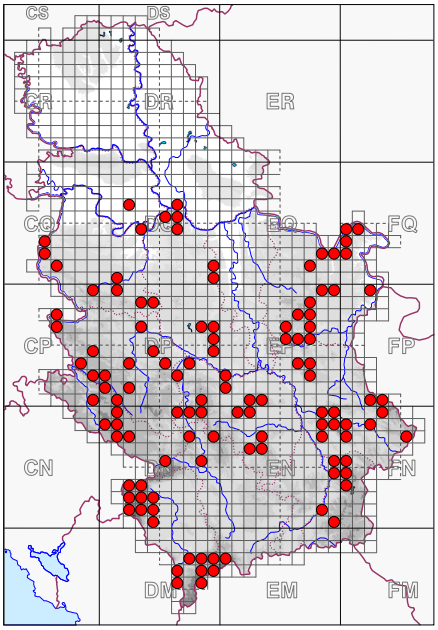

Fig. 24. – Herbarium records of *E. amygdaloides* Host in Serbia.

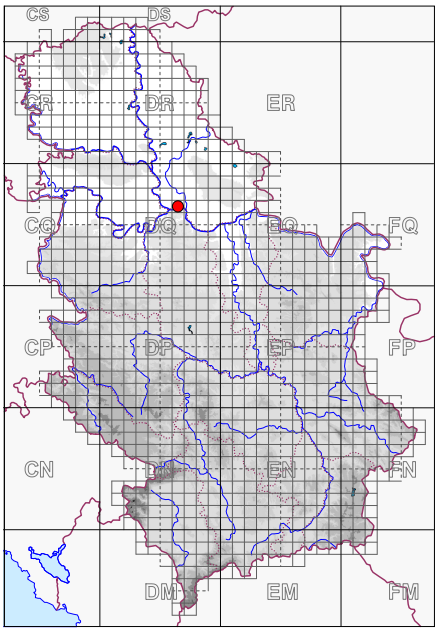

Fig. 25. – Herbarium records of *E. orjeni* Beck in Serbia.

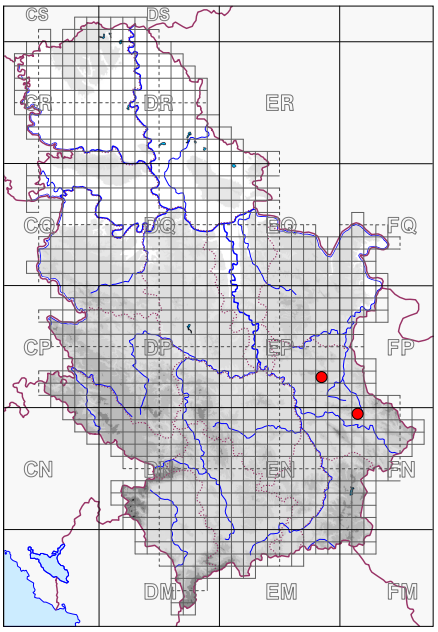

Fig. 26. – Herbarium records of *E. exigua* L. in Serbia.

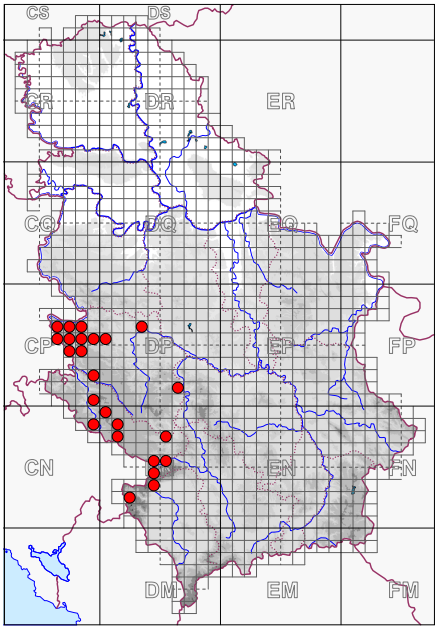

Fig. 27. – Herbarium records of *E. subhastata* Vis. & Pančić in Serbia.

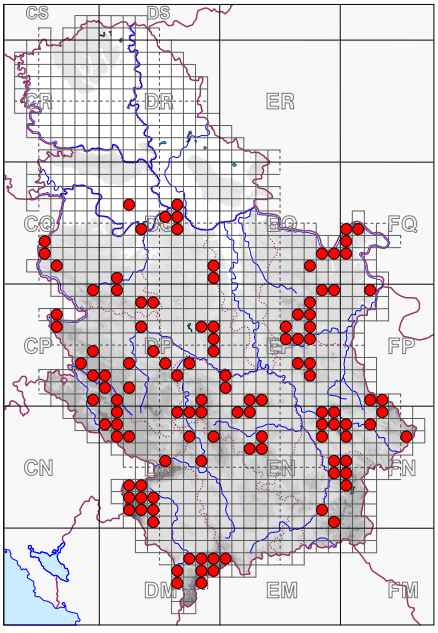

Fig. 28. – Herbarium records of *E. cyparissias* L. in Serbia.

Euphorbia lucida Waldst. & Kit. has been recorded in almost all regions, except W, SW, and S Serbia, as well as Kosovo and Metohija, in 31 UTM 10×10 km squares (Fig. 30). which is a much wider distribution than previously reported for Srem and Šumadija regions (Janković & Nikolić 1972). Since it inhabits wetlands and riverbanks, it would be expected that it is also distributed in the regions with missing data.

Euphorbia maglicensis Rohlena is recorded only in W and SW Serbia, in five UTM 10×10 km squares (Fig. 31). In the *Flora of SR Serbia*, it is listed as *E. pancicii* Beck, distributed only in SW Serbia (Janković & Nikolić 1972).

Euphorbia paradoxa (Schur) Simonk. is recorded only in two regions: Banat and Šumadija, in five UTM 10×10 km squares (Fig. 32), which represents a wider range than previously reported only for Banat (Obradović & Panjković 1980).

Euphorbia salicifolia Host is recorded in almost all regions, except in SE and S Serbia, and Metohija, in 43 UTM 10×10 km squares (Fig. 33) as expected, since it was previously reported as widespread in Serbia (Janković & Nikolić 1972).

Euphorbia virgata Waldst. & Kit. is recorded, as expected, in almost all regions, except W and SE Serbia, and Kosovo and Metohija, in 82 UTM 10×10 km squares, of which one was imprecise (Fig. 34), since it was previously reported as widely distributed in Serbia (Janković & Nikolić 1972).

Sect. ***Peplus*** Lázaro

Euphorbia peplus L. is recorded in several localities in the regions: Šumadija, NE, E and SW Serbia, in six UTM 10×10 km squares (Fig. 35). It is a widespread weed (Janković & Nikolić 1972) and is therefore probably rarely collected by botanists.

Euphorbia taurinensis All. has been recorded in almost all regions south of Vojvodina province, except Pomoravlje, NW, W and NE Serbia, in 49 UTM 10×10 km squares (Fig. 36). In the *Flora of SR Serbia*, it is listed as *E. graeca* Boiss. & Spruner, distributed in E, SE and S Serbia (Janković & Nikolić 1972).

Sect. ***Lathyris*** Dumort

Euphorbia lathyris L. is sporadically recorded in five regions: W and E Serbia, Šumadija and Kosovo, in seven UTM 10×10 km squares (Fig. 37). It has already been reported as an alien species that probably escaped from gardens, but only in East Serbia (Janković & Nikolić 1972).

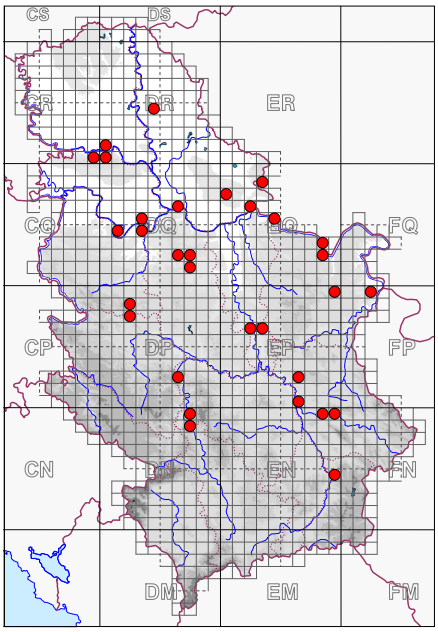

Fig. 29. – Herbarium records of *E. esula* L. in Serbia.

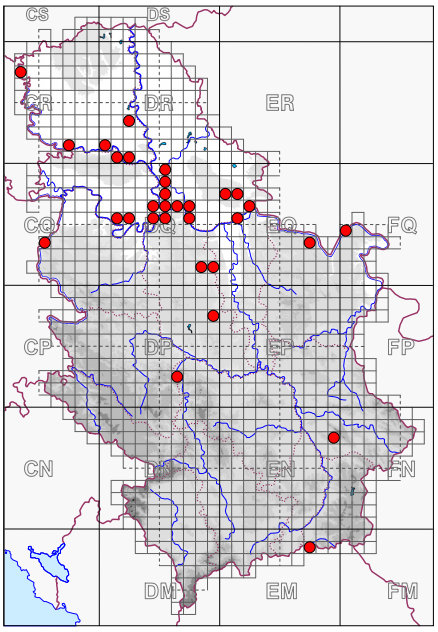

Fig. 30. – Herbarium records of *E. lucida* Waldst. & Kit. in Serbia.

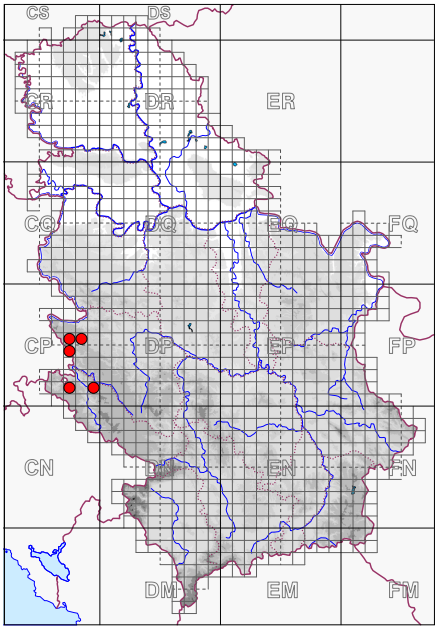

Fig. 31. – Herbarium records of *E. maglicensis* Rohlena in Serbia.

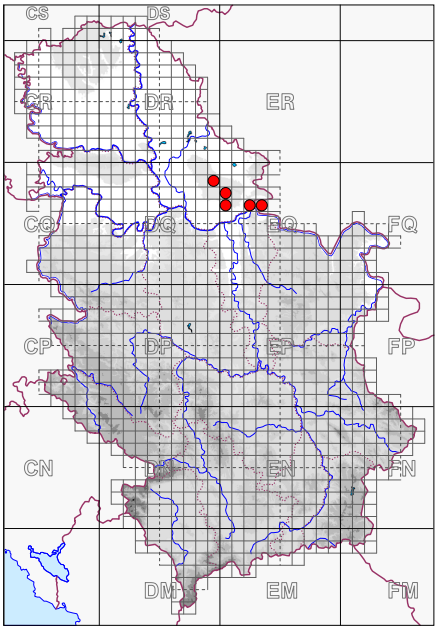

Fig. 32. – Herbarium records of *E. paradoxa* (Schur) Simonk. in Serbia.

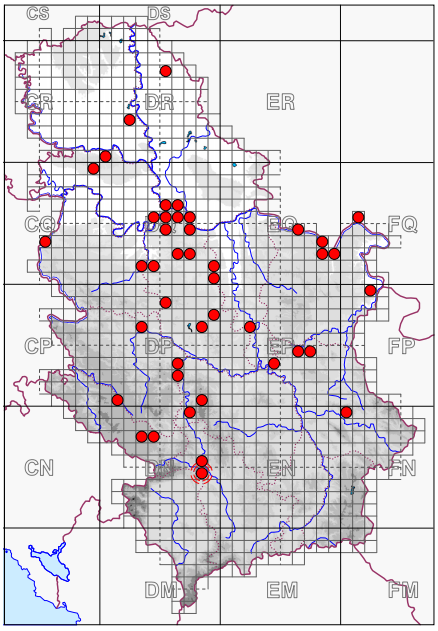

Fig. 33. – Herbarium records of *E. salicifolia* Host. in Serbia.

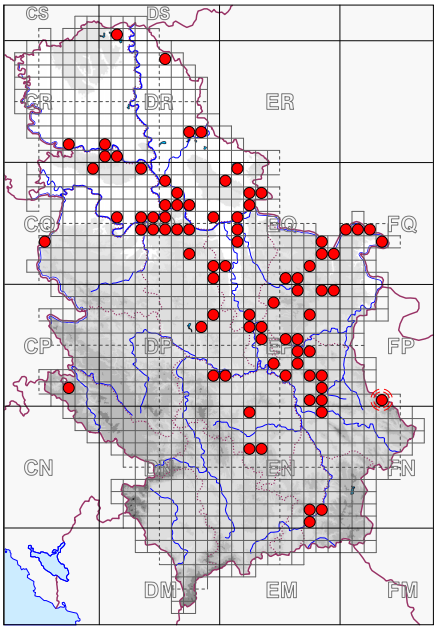

Fig. 34. – Herbarium records of *E. virgata* Waldst. & Kit. in Serbia.

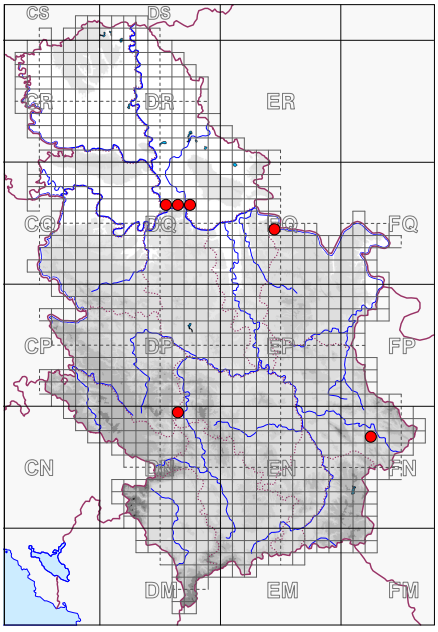

Fig. 35. – Herbarium records of *E. peplus* L. in Serbia.

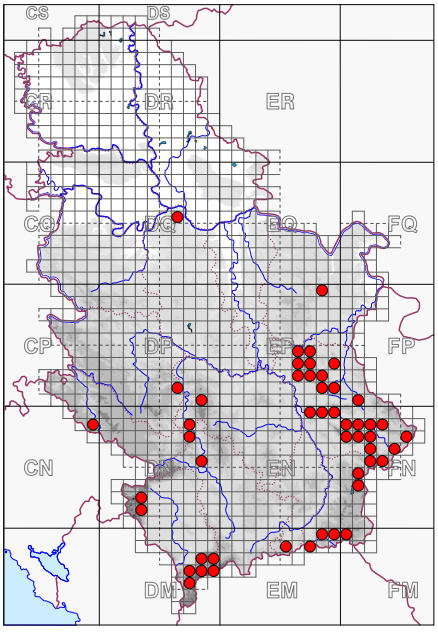

Fig. 36. – Herbarium records of *E. taurinensis* All. in Serbia.

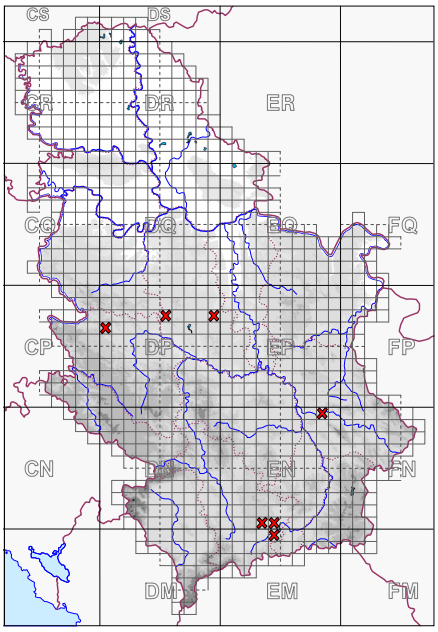

Fig. 37. – Herbarium records of *E. lathyris* L. in Serbia.

Analysis of specimens and taxa

The fewest herbarium sheets, less than five, were found for *E. exigua*, *E. glareosa*, *E. orjeni, E. montenegrina*, *E. nuda* and *E. nutans*, which is expected given their known range in Serbia. However, it is expected that for all of these species additional specimens, from other localities, will be found in other Herbaria. The studied material suggests that another seven taxa may be very rare in Serbia, distributed in less than 10 UTM 10×10 km squares: *E. angulata*, *E. barrelieri* subsp. *thessala*, *E. lathyris*, *E. maglicensis*, *E. peplus*, *E. serpentini* and *E. paradoxa*. However, *E. peplus* most probably has a much wider distribution than evidenced by the collected specimens. Six taxa were recorded in less than 20 UTM 10×10 km squares and can be considered rare in Serbia: *E. carniolica*, *E. chamaesyce*, *E. maculata*, *E. palustris*, *E. platyphyllos* subsp. *literata* and *E. subhastata*. The taxa with the largest distributions, recorded in more than 100 UTM 10×10 km squares are: *E. amygdaloides*, *E. cyparissias* and *E. stricta*.

CONCLUSIONS

The study and analysis of the herbarium specimens deposited in BEO and BEOU provided more accurate data on the distribution of taxa of the genus *Euphorbia* in Serbia. Herbarium specimens of 37 taxa belonging to the genus *Euphorbia* were recorded, of which three belong to subgen. *Chamaesyce* and 34 to subgen. *Esula*. Within the subgen. *Chamaesyce* specimens of taxa belonging to only one section were found, while in subgen. *Esula* specimens of taxa belonging to eight sections were found in BEO and BEOU. Twenty taxa can be considered rare, as they are distributed in less than 20 UTM 10×10 km squares, while three taxa are widely distributed in all or almost all regions of Serbia, in more than 100 UTM 10×10 km squares.

No specimens of *E. agraria*, *E. humifusa*, *E.* ×*angustata*, *E.* ×*angustifrons*, *E.* ×*peisonis*, *E. aleppica*, *E. davidii*, *E. gregersenii*, *E. hetero-*

phylla, *E. lamarckii*, *E. prostrata* and *E. segetalis* were found, so their occurrence in Serbia could not be confirmed with this study.

Acknowledgements

This study was supported by the Ministry of Science and Technological Development of the Republic of Serbia through Grants 451-03-47/2023-01/200383 and 451-03-47/2023-01/ 200178, as well as Science Fund of the Republic of Serbia through Grant 7750112 "Balkan biodiversity across spatial and temporal scales - patterns and mechanisms driving vascular plant diversity".

REFERENCES

Bernátsky, J. (1908): A magyar Alföld befásitása érdekében I-III. – Erdészeti Lapok 47: 4–14. [in Hungarian]

Blečić, V. (1957): Endemične i retke biljke u Srbiji. – **Zaštita prirode 9:** 1–6. [in Serbian]

Boža, P., Vasić, O. (1986): Euphorbiaceae. In: Josifović, M. (*ed.*): Flora SR Srbije 10: 78. – Srpska akademija nauka i umetnosti, Beograd. [in Serbian]

Butorac, B. (1986): Euphorbiaceae. In: Josifović, M. (*ed.*): Flora SR Srbije 10: 78. – Srpska akademija nauka i umetnosti, Beograd. [in Serbian]

Caković, D., Frajman, B. (2020): Three Tertiary *Euphorbia* species persisted in the forests of the Balkan Peninsula. – **Plant Systematics and Evolution 306(3):** 50.

Dorsey, B. L., Haevermans, T., Aubriot, X., Morawetz, J. J., Riina, R., Steinmann, V. W., Berry, P. E. (2013): Phylogenetics, morphological evolution, and classification of *Euphorbia* subgenus *Euphorbia*. – **Taxon 62(2):** 291–315.

Frajman, B., Schönswetter, P. (2011): Giants and dwarfs: Molecular phylogenies reveal multiple origins of annual spurges within *Euphorbia* subg. *Esula*. – **Molecular Phylogenetics and Evolution 61(2):** 413–424.

Frajman, B., Záveská, E., Gamisch, A., Moser, T., Schönswetter, P., STEPPE Consortium. (2019): Integrating phylogenomics, phylogenetics, morphometrics, relative genome size and ecological niche modelling disentangles the diversification of Eurasian *Euphorbia seguieriana* s.l. (Euphorbiaceae). – **Molecular Phylogenetics and Evolution 134:** 238–252.

GBIF (2023): GBIF Home Page (via GBIF API). [https://www.gbif.org] (accessed: September 28th 2022)

Govaerts, R., Frodin, D. G., Radcliffe-Smith, A., Carter, S. (2000): World Checklist and Bibliography of Euphorbiaceae (and Pandaceae). Royal Botanic Gardens, Kew.

Hadžiablahović, S. (2006): Floristic and chorological addition of the vascular flora of Montenegro. In: Pešić V., Hadžiablahović S. (*eds*): II International Symposium of Ecologists of the Republic of Montenegro: 93–101. – Book of Proceedings, Kotor.

Janković, M. (1986): Euphorbiaceae. In: Josifović, M. (*ed.*): Flora SR Srbije 10: 80. – Srpska akademija nauka i umetnosti, Beograd. [in Serbian]

Janković, M., Nikolić, V. (1972): Euphorbiaceae. In: Josifović, M. (*ed.*): Flora SR Srbije 3: 537–566. – Srpska akademija nauka i umetnosti, Beograd. [in Serbian]

Jovanović, S. (1970): Reoniranje nekih hibridnih topola na aluvijumu važnijih reka u SR Srbiji. – **Glasnik Šumarskog fakulteta 36:** 1–176. [in Serbian]

Jurišić, Ž. (1901): Prinove za floru Kraljevine Srbije. – **Prosvetni glasnik 22:** 612–624, 719–729, 857–866. [in Serbian]

Lamarck, J. B. (1786): Encyclopédie méthodique. Botanique 2: 411–413. – Paris and Plomteux, Liege.

Lampinen R. (2001): Universal Transverse Mercator (UTM) and Military Grid Reference System (MGRS). [http://www.luomus.fi/english/botany/ afe/map/ utm.htm] (accessed: September 26th 2022)

Maslo, S., Šarić, Š. (2018): *Euphorbia marginata* (Euphorbiaceae): new alien species in the flora of Bosnia and Herzegovina. – **Thaiszia 28(2):** 145–149.

Niketić, M., Tomović, G., Anačkov, G., Bartula, M., Đorđević, S., Đorđević, V., Đorđević-Milošević, S., Duraki, E., Gavrilović, M., Janaćković, P., Kabaš, E., Kuzmanović, N., Lakušić, D., Lazarević, P., Perić, R., Ranđelović, V., Savić, D., Stanković, M., Stevanoski, I., Stojanović, V., Vasić, O., Vukojičić, S., Zlatković, B., Stevanović, V. (2020): Material on the annotated checklist of vascular flora of Serbia: Nomenclatural, taxonomic and floristic notes II. – **Bulletin of the Natural History Museum 13:** 87–169.

Niketić, M., Tomović, G., Bokić, B., Buzurović, U., Duraki, E., Đorđević, V., Đurović, S., Krivošej, Z., Lazarević, P., Perić, R., Prodanović, D., Radak, 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 14:** 77–132.

Nikolić, V. (1977): Euphorbiaceae. In: Josifović, M. (*ed.*): Flora SR Srbije 9: 90–94. – Srpska akademija nauka i umetnosti, Beograd. [in Serbian]

Obradović, M. (1966): Biljnogeografska analiza flore Fruške gore. – Matica srpska, odeljenje za prirodne nauke, Novi Sad. [in Serbian]

Obradović, M., Panjković, V. (1980): Prodromus flore papratnica i semenica Deliblatske peščare. – **Zbornik radova Prirodno-matematičkog fakulteta, Serija za biologiju 10:** 323–327. [in Serbian]

POWO (2023): Plants of the world online. – The Royal Botanic Gardens, Kew. [http://www.plant softh eworl donli ne.org/] (accessed: September 28th 2022)

Prodanović, D., Krivošej, Z., Amidžić, L. (2011): Ecological features of steppe flora on the Ibar valley serpentine, northern Kosovo. - **Natura Montenegrina 11(3):** 405–424

Purger, D., Vajgand, D., Mićić, N., Vajgand, K. (2015): *Euphorbia davidii* Subils (Euphorbiaceae), a new alien species in the Flora of SR Serbia. – **Botanica Serbica 39(1):** 49–52.

Riina, R., Berry, P.E. (2021): *Euphorbia* planetary biodiversity inventory database. [http://app. tolkin. org/projects/72/taxa] (accessed: September 25th 2022)

Rechinger, K. H. (1935): Ergebnisse einer botanischen Reise in den Bertiscus (Nordalbanische Alpen). – **Feddes Repertorium specierum novarum regni vegetabilis 38(13–25):** 138–152; 319–389.

Simkovics, L. (1882): Pancsova vidékének növényzete. – **Magyar Növénytani Lapok 6(64–65):** 50. [in Hungarian]

Smith, A. R., Tutin, T. G. (1968): *Euphorbia* L. In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M., Webb, D. A. (*eds*): Flora Europaea 2: 213–226. – University Press, Cambridge.

Steinmann, V. W., Porter, J. M. (2002): Phylogenetic Relationships in Euphorbieae (Euphorbiaceae) Based on ITS and *ndh*F Sequence Data. – **Annals of the Missouri Botanical Garden 89(4):** 453–490.

Stevanoski, I., Kuzmanović, N., Koce, J. D., Schönswetter, P., Frajman, B. (2020): Disentangling relationships between the amphi-Adriatic *Euphorbia spinosa* and Balkan endemic *E. glabriflora* (Euphorbiaceae). – **Botanical Journal of the Linnean Society 194(3):** 358–374.

Urumov, I. (1935): Florata na Kostendilska okruža. – **Sbornik na Bălgarskata akademija na nauki 30:** 1–235. [in Bulgarian]

Veljić, M. M., Rajčević, N. F., Bukvički, D. R. (2017): *Euphorbia prostrata* Aiton (Euphorbiaceae)–an adventive species new in Serbia. – **Botanica Serbica 41(1):** 95–98.

Zahariev, D., Ivanova, N., Nasuf, A. (2021): Invasive alien plant species distributed as weeds in arable land in Bulgaria. – **Acta Scientifica Naturalis 8(3):** 41–54.

Zlatković, B., Bogosavljević, S. (2014): Report on the new floristic data from Serbia. – **Biologica Nyssana 5(2):** 123–129.

SUPPORTING INFORMATION

Online Appendix:

Appendix 1. – Catalogue with herbarium data on 37 taxa of the genus *Euphorbia* L. in Serbia: herbarium number, region, localities, UTM 10×10 km square, habitat, geological substrate, altitude, exposition, collectors, collection date, and herbarium sub-collection.

РОД *EUPHORBIA* L. (EUPHORBIACEAE JUSS.) У СРБИЈИ – ХЕРБАРИЈУМСКИ ПОДАЦИ У ЗБИРКАМА BEO И BEOU

САЊА ЂУРОВИЋ, МИЛАНА РАНИМИРОВИЋ, ГОРДАНА ТОМОВИЋ, ГОРАНА ПЕТКОВСКИ, МАРЈАН НИКЕТИЋ

Овај рад садржи информације о примерцима рода *Euphorbia* L. сакупљеним у Србији и депонованим у Хербаријуму Природњачког музеја у Београду (BEO) и у Хербаријуму Универзитета у Београду (BEOU). Испитано је укупно 2199 хербаријумских табака, од којих је 915 депоновано у BEO, а 1284 у BEOU. Дат је каталог хербарских података о примерцима 37 таксона у оквиру рода *Euphorbia* распрострањених у Србији, као и карте распрострањења за све забележене таксоне.