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CONTRIBUTION TO THE KNOWLEDGE OF SERPENTINE FLORA IN WESTERN KOSOVO, WITH COMPARISONS OF THE WESTERN, CENTRAL AND NORTHERN SERPENTINE MASSIFS

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This article presents the results of a floristic survey conducted between 2011 and 2021 on Mt. Kaznik, western Kosovo. In all, 361 plant taxa belonging to 75 families and 147 genera of vascular flora were recorded. These areas are dominated by serpentine soils, which are known for the increased occurrence of endemic plant taxa. Detailed analysis of chorological and biological data in conjunction with general vegetation data has highlighted the distinctive nature of Mt. Kaznik, making it a floristically important area. Of the taxa identified, 15 were classified as threatened plant taxa at the national level, while a total of 17 taxa are endemic plants. For each plant taxon, data on floristic element, habitat characteristics, life form, and general vegetation data are provided. A syntaxonomic analysis of the recorded taxa showed that they belong to nine vegetation classes, with the pubescent oak and mixed deciduous forest class *Quercetea pubescentis* being dominant. In addition, a floristic comparison was made between the serpentines of Kaznik and those in central and northern Kosovo. Considering the floristic importance and the high degree of diversity exhibited by the serpentines, the data presented are of particular importance to a better understanding of the floristic composition of Kosovo.

Key words: vascular plants, chorology, syntaxonomy, plant diversity, serpentine

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Rad donosi rezultate floističkog istraživanja provedenog između 2011. i 2021. na planini Kaznik, zapadno Kosovo. Zabilježena je ukupno 361 biljna svojta iz 75 porodica i 147 rodova. Područjem dominiraju serpentinska tla, poznata po povećanom broju endemskih svojti. Detaljna analiza horoloških i bioloških podataka, zajedno s općim vegetacijskim podacima, naglasila je osobitosti planine Kaznik i njegovu floističku važnost. Petnaest svojti pripada ugroženim svojtama na nacionalnoj razini, a 17 svojti su endemi. Za svaku svojtu daju se podaci o flornom elementu, staništu, životnom obliku i vegetaciji. Sintaksonomska analiza zabilježenih svojti pokazala je da pripadaju u devet vegetacijskih razreda, s tim da je dominantan razred šumske vegetacije *Quercetea pubescentis*, s hrastom meduncem. Također je napravljena usporedba serpentinske flore planine Kaznik i središnjeg te sjevernog Kosova. Što se tiče floističke važnosti, i visokog stupnja bioraznolikosti na serpentinima ovi podaci su od posebne važnosti za bolje razumijevanje floističkog sastava Kosova.

Ključne riječi: vaskularne biljke, horologija, sintaksonomija, biljna raznolikost, serpentinski

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INTRODUCTION

Serpentinite soils are known to provide a very unfavourable environment for plants to thrive in. This is due to serious insufficiencies in their chemical and physical properties, including nutrient deficiencies, phytotoxic nickel concentrations, ultrabasic pH, and other unsui le factors (Brooks, 1987). In addition, the chemical composition of these environments makes them susceptible to drought and rapid moisture loss. These factors, in combination, are important drivers of plant evolution (Kruckeberg & Rabinowitz, 1985). In fact, only a small portion of the regional flora is adapted to thrive under these conditions, and these are known as 'serpentinophytes'.

One of the most interesting parts of the European continent is the Balkan Peninsula, which is characterized by the increased presence of ultramafic substrates, predominantly concentrated in its part, i.e. in Greece, Bulgaria, North Macedonia, Albania, Kosovo, Montenegro, Bosnia and Serbia (Turrill, 1929; Rechinger, 1957; Tatić & Veljović, 1992; Stevanović *et al*., 2003; Pavlova, 2010; Bani *et al*., 2013).

Serpentine soils represent an edaphic factor of great importance in the context of diversity of plants, offering them local patterns of adaptation and distribution, consequently playing a significant role in the evolution of terrestrial plants (Rajakaruna, 2004; Mota *et al*., 2017). The total serpentine areas in Kosovo are relatively small, they are scattered in plates, with largest serpentine bodies being concentrated in the northern and western Kosovo, as well as with smaller areas extending in the central and south-eastern Kosovo. Intense studies concerned with serpentine flora in Kosovo started in the late 70s, and in the course of several years, the number of publications and the available data concerning this issue and other related aspects such as ecology, general characteristics, flora, vegetation, etc. increased proportionately (Rexhepi, 1979; Tatić *et al*., 1981; Berisha *et al*., 2014; Millaku *et al*., 2008; 2017; Prodanović *et al*., 2020; Ahmeti *et al*., 2021, etc.).

The floristic investigation of the serpentine massifs in the Kazniku mountains has been carried out over a long period of time, starting from 1996 and onwards, with some occasional pauses, resulting in a large number of successful expeditions. The current study has the following objectives: ***i***. to provide a verified checklist of the Mt. Kaznik vascular plant taxa, ***ii***. analyze, describe, and comment on the relationship between the flora of the investigated serpentine areas and its life forms and chorological spectrums; ***iii***. to provide direct comparisons with the floristic data from other serpentine areas of Kosovo and properly compare their taxonomic and endemic spectra and ***iv***. provide some short synecological notes for the recorded taxa.

MATERIAL AND METHODS

Study site

Mt Kaznik. is an ultramafic massif located in the western part of Kosovo. It stretches from the Malisheva-Rahovec highway in the east to the Drini i Bardhë valley in the west; in the north it passes into the Mirusha basin, while in the south it stretches to the tectonic cliff with the Dukagjini Plain, extending in a southeast-northwest direction (Ahmetaj, 1988).

This mountain massif has for a long time been relatively well preserved and undisturbed by human influences, but in recent years there has been an extension of new

roads and a rural settlement expansion has been observed. It is located within the municipalities of Rahovec and Malishevë. It stretches over several settlements in the area: Kaznik, Zatriq, Mrasor, Kramovik, Petkoviq, Pastasellë, Senoc, Drenoc, Rahovec, Panorc and Llapçevë (Fig. 1). In the geological-tectonic aspects, Mt Kaznik belongs to the Ophiolitic geological-tectonic zone, which in Kosovo includes most of the Dukagjini plain (Pruthi, 1986). These mountains generally have a homogeneous lithological structure, where magmatic rocks are encountered, with pronounced ultrabasic composition. Due to various exogenous processes, apart from serpentinized peridotites and harzburgites, deluvions also occur, mainly in the south of Kaznik and Mrasor.

The Kaznik mountains as a whole belong to the horsts of Dukagjini (Ahmetaj 1988), which is located between Mirusha in the north and the Dukagjini plain in the south. In the hypsometric aspects, the massif is predominantly a hilly-mountainous terrain, with small hypsometric differences.

The lowest parts of the massif are located at an altitude of about 450 m, while the highest point is Gradishta (1,038 m). In the western and southern parts, the terrain slope is smaller, while the steepest slopes are encountered at the foot of the Bajrak peak, up to 30°. The slopes of the massif have mainly southern and northern exposures. According to the Air and Rainfall Temperature Map (Anonymous, 1983), an average annual isotherm of 10° C (approximately at an absolute altitude of 500 m) and 9° C (at an altitude of 700-800 m) passes through the Kaznik Mountains. The average annual rainfall fluctuates between 700-750 mm, according to the available data in the nearest

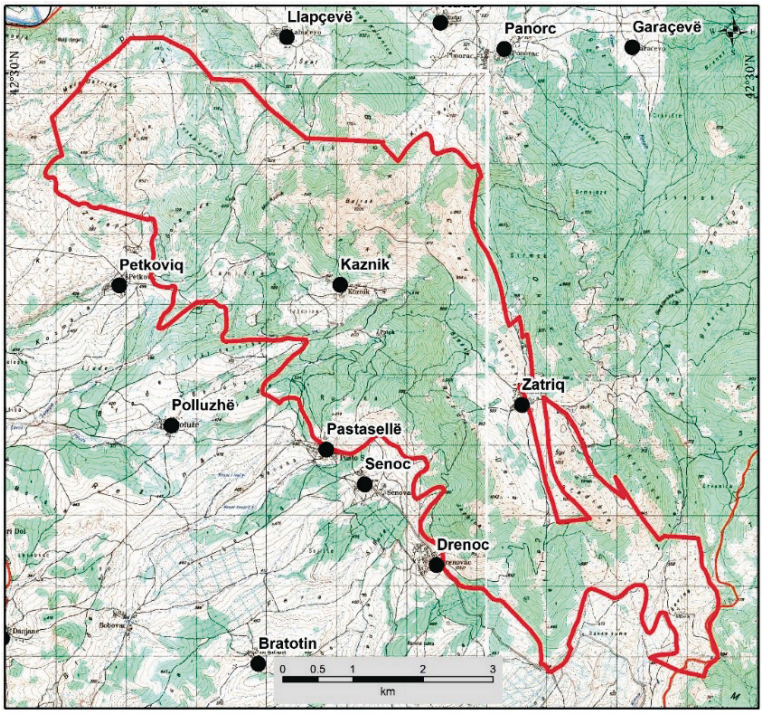

Fig. 1. Topographic map of the Kazniku Mts.

rainfall station is Rahovec, which is in close proximity to the Kaznik Mountains. Precipitation in Rahovec has two maximums and two minimums. The first maximum is in May (68 mm), while the second is in November (84 mm). The first minimum is presented in February (54 mm), while the second in August (43 mm). Most rainfall falls in the winter season (about 196 mm), while in the summer there is less rainfall (156 mm) (Fig. 2).

Data collection and work methodology

The field-work was carried out for a rather long and continuous period of time, from 2011 to 2021. Plant taxa were recorded and representative samples were collected from all serpentine sites of the massif. For proper identification of plant taxa, in numerous cases other relevant herbarium (Herbarium of the University of Prishtina) specimens were examined. The two other serpentine massifs of Kosovo: Mt. Golesh (Krasniqi *et al*., 2019) and the Ibër River Valley (Prodanović *et al*., 2020) are also indicated for the sake of comparison. Plant specimens were determined according to Flora Europaea II-V (Tutin, T. G. *et al*., 1968-1980), Flora Europaea I (Tutin, T. G. *et al*., 1993), Flora of SR Serbia I-IX (Josifović (ed.), 1970-1977), Flora of SR Serbia X (Sarić & Diklić (eds.), 1986), Flora of Serbia II (Stevanović (ed.), 2012) as well as Flora of Albania I (Paparisto (ed.), 1988), Flora of Albania II (Qosja (ed.), 1992), Flora of Albania III (Qosja (ed.), 1996), Flora of Albania IV (Vangjeli (ed.), 2000). For all of the registered plant taxa, the nomenclature was finally adjusted according to Euro+Med Plantbase (Euro+Med 2006+). In the floristic list (Annex le 1), family and genera names are alphabetically ordered. There the threatened plant taxa are indicated (▼). Concerning the taxa chorological types, Pignatti (1982) was followed, with additional references concerning some local species to Gajić (1980) and Flora of Greece (Dimopoulos *et al*., 2016). For the classification of taxa life-forms, we have relied on the well-known Raunkiaer system (Raunkiaer, 1934). Each plant taxon was checked for its local protection status according to the Red Book of Vascular Flora of the Republic of Kosovo (Millaku *et al*., 2013). For the analysis of the similarity of the flora in the studied area of the Kazniku mountains, with the Ibër River valley area in northern Kosovo as well as the Mt Golesh region in central Kosovo, the similarity index of Sørensen (1948) was used.

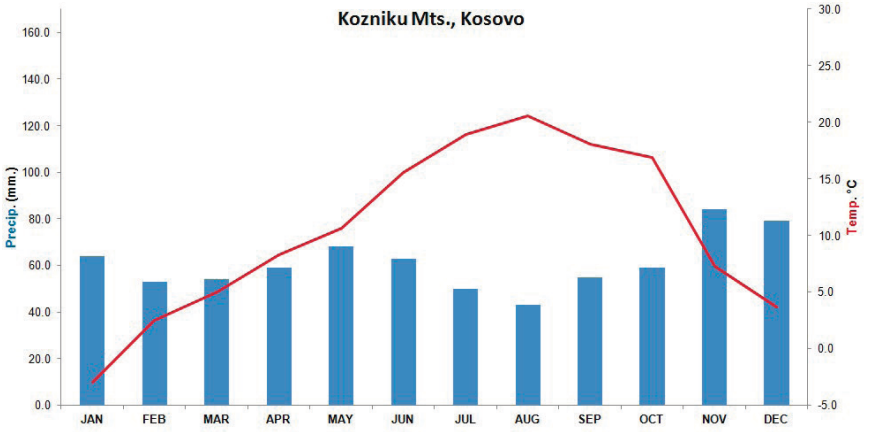

Fig. 2. Weather diagram from the stations located in the proximity of the studied area.

RESULTS AND DISCUSSION

Life form, chorology and floristic richness with comparisons

Due to harsh chemical and physical factors, serpentines are known to be difficult environments for plant development (Baker *et al*., 1992; Adamidis *et al*., 2013). As a result, these habitats often have low species richness (Reddy *et al*., 2008). Because of the inadequate developmental conditions and the need for physiological and morpho-structural adaptations (Van der Meulen *et al*., 2001) by plants for them to survive, serpentine habitats represent floristically important centers of speciation and differentiation (Morrey *et al*., 1989; Stevanović *et al*., 2003; Anacker, 2014).

There are currently 361 plant taxa growing in the serpentines of Mt Kazniku, which we have listed together with their floristic structure and other relevant details in Appendix 1. Of these taxa, 7 species are representatives of the Pteridophyta. Of the spermatophytes, which are the dominant group with 354 taxa, only 3 belong to the gymnosperms, while the remaining 351 belong to the angiosperms. Among the angiosperms, 298 plant taxa were found from the dicotyledon group and 53 plant taxa from the monocotyledon group. Among the angiosperms, the dominant families with relatively numerous plant taxa were Compositae (39 taxa), Fabaceae (26 taxa), Rosaceae (23 taxa), Lamiaceae (22 taxa), Poaceae (19 taxa), Caryophyllaceae (18 taxa), Brassicaceae (12 taxa), and Apiaceae and Boraginaceae with 10 plant taxa each (Fig. 3). In a comparative perspective, on Mt Golesh (central part of Kosovo) according to Krasniqi *et al*. (2019) the dominant plant families are: Compositae, Fabaceae and Rosaceae – exactly the same as on the Mt Kaznik, while in the northern part of Kosovo, according to Prodanović *et al*. (2020), the dominant plant families are: Compositae, Fabaceae, Poaceae and Lamiaceae.

Analysis of life forms by Raunkiaer showed that hemicryptophytes are the most abundant with 184 taxa (50.8%), followed by geophytes with 65 taxa (17.9%), phanerophytes 49 taxa (13.5%), therophytes 40 taxa (11%) and chamaephytes 23 taxa (6.4%) (Fig. 4). While the increased occurrence of hemicryptophytes is a general feature of the Balkan flora (Diklić, 1984; Goranova *et al*., 2013), therophytes are plant life form the

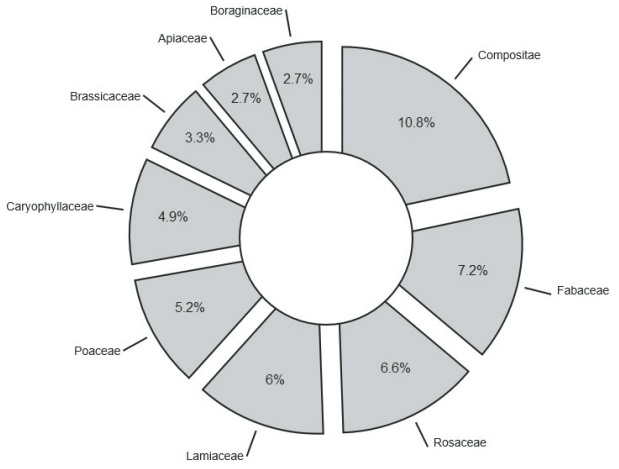

Fig. 3. Pie chart showing the most dominant 11 plant families in the studied flora of Mt Kaznik.

most adapted to serpentines, as they manage to successfully reproduce under stress conditions in a relatively short time (Brooks, 1987). Despite this importance and specificity for serpentines, this life form ranks fourth in the studied area of the Kaznik Mountains, accounting for only 11% of the total flora. Comparatively, a completely similar proportion of plant life forms has been observed in the central Kosovo on Mt. Golesh (Krasniqi *et al*., 2019), while in the northern part of Kosovo (Prodanović *et al*., 2020) after hemicryptophytes (with 48.2%) come therophytes (with 22%), followed by geohypytes (with 10.5%).

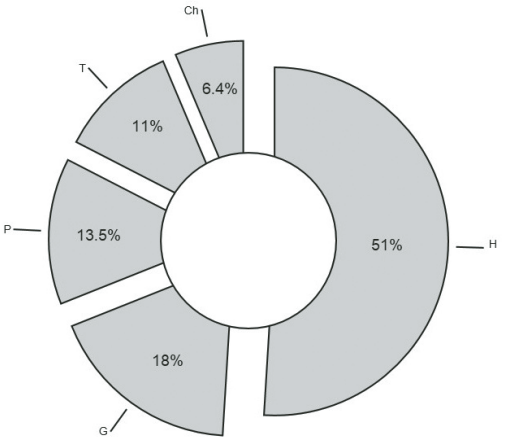

Fig. 4. Pie chart showing the most dominant plant life forms in the studied flora of Mt Kaznik.

From the analysis of floristic elements, it was observed that in the studied serpentine areas of Mt Kaznik, the European (24.6%), Eur-Asian (23.2%) and Balkan (13.5%) plant taxa prevailed, among other nine floristic groups, as shown in Fig. 5. Of particular importance were the endemic plants of the Balkans within the Balkan floristic element, present on the serpentine soils of Mt Kaznik. A total of 17 Balkan endemic taxa (4.7%) were reported in this study (Appendix 1). In classifying the endemic plant taxa, we relied on Tomović *et al*. 2014. The high proportion of European and Eur-Asian floral elements clearly indicates that the area was floristically most influenced by the direction of the Alps, the Carpathians and Asia Minor (Stevanović, 1996). The distinguished presence of the Balkan floristic element is a valuable indicator of the local character of the flora, which is expressed also in terms of (Balkan) endemic plant taxa. Furthermore, it is obvious that different floristic elements meet and overlap in these mountain ranges in the western part of Kosovo. The chorological composition of the serpentine flora of Mt Kaznik can be compared with that of Mt Golesh (in central Kosovo) and that of northern Kosovo (around the Ibër valley), and it is obvious that there is strong similarity between Mt Kaznik and Mt Golesh (European, Eur-Asian, Sub-Mediterranean ⟷ Balkan). These two massifs have similar geological compositions and other shared ecological features, so this similarity is also expected. The chorological compositions of Mt Kaznik and that of the Ibër valley are significantly different. The serpentine flora of northern Kosovo (Prodanović *et al*., 2020) is dominated by Holarctic (41.8%), Mediterranean (29.1%) and Pontic (10.3%) floristic elements. This difference is due to the different geological substrates, since in the Ibër Valley there are serpentines as well as a calcareous substrate, and the climate and humidity are significantly different from those of Mt Kaznik due to the Ibër River.

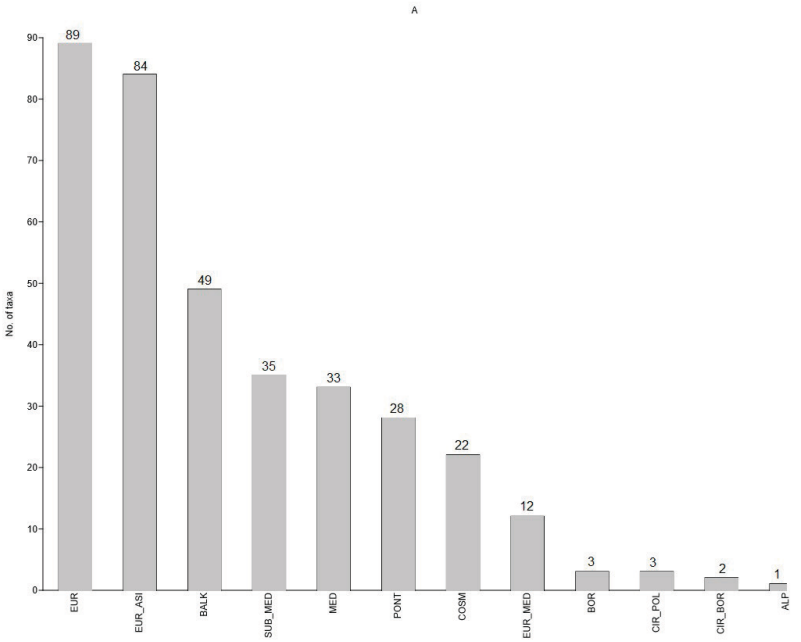

Fig. 5. Floristic elements in the studied area of Mt Kaznik in W Kosovo. EUR (European), EUR_ASI (Eur-Asian), BALK (Balkan), SUB_MED (Sub-Mediterranean), MED (Mediterranean), PONT (Pontic), COSM (Cosmopolitan), EUR_MED (Euri-Mediterranean), BOR (Boreal), CIR_POL (Circum-Polar), CIR_BOR (Circum-Boreal), ALP (Alpine).

Within the surveyed flora of Kaznik Mt., 119 taxa were identified with known medical and aromatic effects, marked by the symbol (+) in Appendix 1. In addition to this, a group of a 26 poisonous plant taxa (Fig. 6) were identified and they have been marked with the ☠ icon in the Appendix 1.

As for the general floristic diversity, we were able to register and identify a total of 361 plant taxa on Mt Kaznik over a period of 10 years. Taking into account the total surveyed area (30.7 km^2), habitat diversity and geographical extent of Mt Kaznik, it is certain that the number of taxa is relatively low regarding plain floristic diversity. There is a general indication that serpentine soils are mostly inhabited by a lower number of plant taxa, and this low α-diversity is due in part to the extreme and unsui le conditions and lack of nutrients compared to other geological substrates (Marin & Tatić, 2001; Stevanović *et al*., 2003). For example, Krasniqi *et al*. (2019) reported 295 plant taxa for Mt. Golesh – in a studied area of 22.2 km^2 – of which 228 matched those of Mt Kaznik (63.1%). In the calculated Sørensen similarity index (. 1), it turned out that Mt Kaznik had the highest similarity values with Mt Golesh (0.69). This demonstrated floristic similarity between Mt Kaznik and Mt Golesh, as with the previous parameters, is evident from the fact that these two dominant serpentine massifs have relatively similar conditions, approximate average elevations (1038 m Mt Kaznik – 1019 m Mt Golesh), and are under the influence of similar climatic conditions. Comparatively, in northern Kosovo, in the valley of the Ibër River Prodanović *et al*. (2020) reports a very high floristic diversity for this area of serpentine substrate. In a >50 km long way

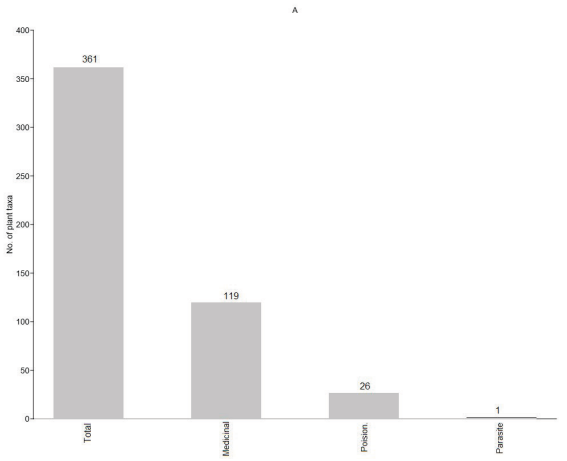

Fig. 6. Grouping of the studied plant taxa from Mt Kaznik with medicinal properties, and those that are poisonous, endemic and parasitic.

valley along the Ibër River those authors reported in total 882 plant taxa. The high number of recorded plant taxa can be explained, first of all, by the large area studied (due to the fact that most of the serpentine soils of Kosovo are located in this area) and by the fact that in these areas, as explained by Prodanović *et al*. (2020), in addition to the serpentine soils, there are mosaics of other soils (including peridotite and unmodified ultramafic rocks) that have resulted with a much higher floristic diversity.

In the Ibër River valley, 233 out of 361 plant taxa from Mt Kaznik were a match (64.5%). By using the Sørensen similarity index (Tab. 1), it turned out that Mt Kaznik had very low similarity values with the Ibër River valley (0.37).

Endangered and endemic taxa

Tab. 1. The Sørensen similarity index calculated for the serpentine floras of Mt Kaznik (western Kosovo), Mt Golesh (central Kosovo) and Ibër River Valley (northern Kosovo).

	Mt Kaznik	Mt Golesh	Ibër valley
Mt Kaznik	1	0.69	0.37
Mt Golesh	0.69	1	0.39
Ibër valley	0.37	0.39	1

Endemic plant taxa tend to be more vulnerable to natural changes and human-induced threats, and therefore have a higher risk of extinction (Millaku *et al*., 2013; Coelho *et al*., 2020). Serpentine habitats on the other hand are considered highly valuable regions with respect to endemic flora (Tondi *et al*., 2003; Kurt *et al*., 2013). This was confirmed in Kosovo, where a large number of endangered plant taxa (Millaku *et al*., 2013) belonging to different threatened and lower risk categories (according to IUCN criteria) were recorded on serpentine soils. In a study conducted about the quantitative analysis of endemic and endangered plants in Kosovo (Berisha *et al*., 2020), the studied area of Mt Kaznik belongs to the E6 region, which has been evaluated as belonging to the high Conservation Importance group (high CI = 0.1250) in Kosovo. In

total, there are 15 plant species registered on Mt Kaznik that are classified as threatened (Tab. 2) – based on the Red Book of Vascular Flora of the Republic of Kosovo (Millaku *et al*., 2013). Of these species, five belong to the category CR (critically endangered), five to the category EN (endangered), and five to the category VU (vulnerable). Of these 15 species, four were also recorded on Mt Golesh by Krasniqi *et al*. (2019): *Centaurea albertii* Rexhepi., *Galatella albanica* Degen, *Haplophyllum boissierianum* Vis. & Pančić, and *Klasea radiata* (Waldst. & Kit.) Á. Löve & D. Löve, and three were recorded in the Ibër River valley in the northern part of Kosovo by Prodanović *et al*. (2020): *Haplophyllum boissierianum* Vis. & Pančić., *Klasea radiata* (Waldst. & Kit.) Á. Löve & D. Löve and *Malus florentina* (Zuccagni) C. K. Schneid. *Aristolochia merxmuelleri* Greuter & E. Mayer, is a critically endangered plant species in Kosovo in the areas of Mt Kaznik (*locus classicus*) – stenoendemic of Kosovo and N-Albania. The species population is very fragile with only a few adult individuals; there is no other known natural habitat in Kosovo where this plant grows. According to Shuka *et al*. (2011), this species grows in the northern part of Albania in the village of Surroj. In accordance with the assessments of the Red Book of Vascular Flora of the Republic of Kosovo (Millaku *et al*., 2013), this species deserves special treatment and an applicable conservation program. Additionally, *Cytisus purpureus* Scop. – as a Critically Endangered species from Mt Kaznik, the only known habitat of the species in Kosovo, deserves additional care and a concrete conservation program since it is threatened by grazing and fires.

Tab. 2. The list of threatened plant taxa recorded in Mt Kaznik.

No.	Plant taxa	Red Book*	C.XK	N. XK
1	*Aristolochia merxmuelleri* Greuter & E. Mayer.	CR		
2	*Centaurea albertii* Rexhepi	VU	●	
3	*Cytisus purpureus* Scop.	CR		
4	*Dioscorea balcanica* Košanin.	EN		
5	*Galatella albanica* Degen	VU	●	
6	*Genista hassertiana* (Bald.) Buchegger.	EN		
7	*Gladiolus illyricus* W. D. J. Koch.	EN		
8	*Haplophyllum boissierianum* Vis. & Pančić	EN	●	●
9	*Klasea radiata* (Waldst. & Kit.) Á. Löve & D. Löve	CR	●	●
10	*Linum elegans* Boiss.	VU		
11	*Lysimachia atropurpurea* L.	CR		
12	*Malus florentina* (Zuccagni) C. K. Schneid.	VU		●
13	*Onosma echioides* (L.) L.	VU		
14	*Sanguisorba albanica* András. & Jáv.	EN		
15	*Tulipa kosovarica* Shuka, L., Tan., K. & Krasniqi, E.	CR		

* Plant species threat category in Kosovo according to Millaku et al. (2013); C.XK – Central Kosovo (Krasniqi et al., 2019); N.XK – North Kosovo (Prodanović et al., 2020).

Endemic plant taxa are characteristic plants with clear elements of local biodiversity (Behroozian *et al*., 2020). They are known to be restricted to narrow distributional ranges, with a rarity that is due to specific environmental conditions. In the studied area of Mt Kaznik, in total 17 (4.6%) Balkan endemic plant taxa have been recorded. These endemic plant taxa are the following: *Aristolochia merxmuelleri* Greuter & E. Mayer., *Halacsya sendtneri* (Boiss.) Dörfl., *Paramoltkia doerfleri* (Wettst.) Greuter & Burdet, *Odontarrhena markgrafii* (O. E. Schulz) Španiel et al., *Centaurea albertii* Rexhepi., *Centau-*

rea kosaninii Hayek., *Galatella albanica* Degen, *Sedum serpentini* Janchen., *Scabiosa fumarioides* Vis. & Pančić, *Genista hassertiana* (Bald.) Buchegger., *Stachys scardica* (Griseb). Hayek, *Linum elegans* Boiss., *Veronica barrelieri* Roem. & Schult., *Polygala doerfleri* Hayek., *Sanguisorba albanica* András. & Jáv., *Dioscorea balcanica* Košanin. and *Tulipa kosovarica* Shuka, L., Tan., K. & Krasniqi, E.

Synecological features of the studied area of Mt Kaznik

Based on the occurrence of certain plant taxa that are diagnostic or characteristic of the known vegetation classes, we also analyzed the occurrence of the main vegetation classes in the studied area in Mt Kaznik. As shown in Fig. 7, most of the plant taxa present on Mt Kaznik (148 – 40.8%), belonged to the class of oak and mixed deciduous forests of Central and Southern Europe [*Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959]. Although the forests of this class do not cover the entire area of Mt Kaznik, whether as a whole or as fragments of this class, they still represent the dominant vegetation type in this mountain massif. The second class in terms of the number of diagnostic taxa (79 – 21.8%) on this mountain massif was *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947 – the class of calcareous and ultramafic (even secondary) dry grasslands of the mountain range. The third class in terms of the number of diagnostic taxa (25 – 6.9%) in this mountain massif was *Alnetea glutinosae* Br.-Bl. et Tx. ex Westhoff et al. 1946 – the class of mesotrophic alder carr and birch forests of Europe. Based on analyses and comparisons of the presence of certain characteristic taxa, it was possible to identify six additional vegetation classes in addition to the three mentioned, using available

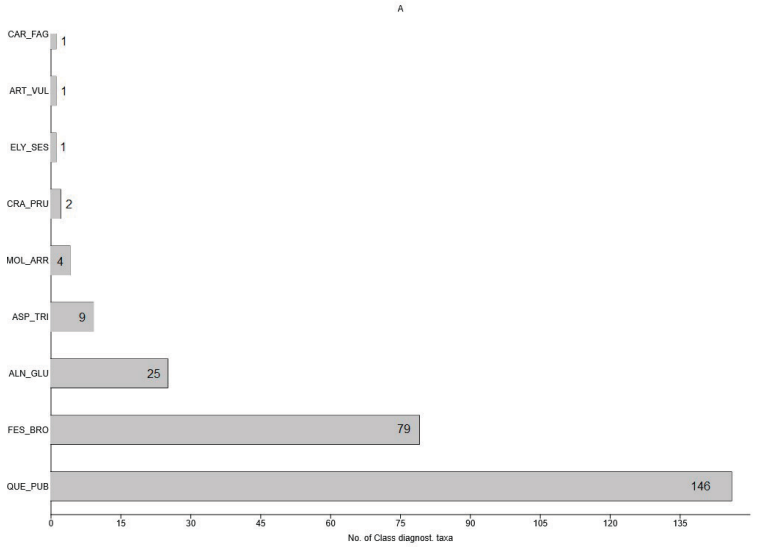

Fig. 7. Main syntaxonomical classes derived from the diagnostic and characteristic plant taxa in the surveyed area. QUE_PUB = *Quercetea pubescentis* Doing-Kraft ex Scamoni et Passarge 1959; FES_BRO = *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947; ALN_GLU = *Alnetea glutinosae* Br.-Bl. et Tx. ex Westhoff et al. 1946; ASP_TRI = *Asplenietea trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977; MOL_ARR = *Molinio-Arrhenatheretea* Tx. 1937; CRA_PRU = *Crataego-Prunetea* Tx. 1962 nom. conserv. propos.; ELY_SES = *Elyno-Seslerietea* Br.-Bl. 1948; ART_VUL = *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951; CAR_FAG = *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968.

data from Vegetation of Europe (Mucina *et al*., 2016). These other six classes were: *Asplenietea trichomanis* (Br.-Bl. in Meier et Br.-Bl. 1934) Oberd. 1977; *Molinio-Arrhenatheretea* Tx. 1937; *Crataego-Prunetea* Tx. 1962 nom. conserv. propos.; *Elyno-Seslerietea* Br.-Bl. 1948; *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951 and *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968. Each plant taxon was determined in terms of the vegetation class it belonged to (described in Appendix 1 with appropriate abbreviations). However, there were also many plant taxa that did not belong to any vegetation class, and in addition, plants from the ruderal vegetation group were not included in this study.

CONCLUSIONS

The main results of this study indicate that the serpentine massifs are generally rich in rare and endemic plant taxa, but have low floristic diversity. This is particularly evident in the case of comparison of diversity patterns between serpentine and non-serpentine habitats in Kosovo. Comparisons between the serpentine flora of Mt Kaznik and that of Mt Golesh and the Ibër valley in northern Kosovo revealed an expected similarity between Mt Golesh and Mt Kaznik, while the difference with the Ibër valley in the north was obvious. This is due to the fact that in the northern part there are other additional substrates (other then serpentines) and the studied area is larger than the first two. The presence of 15 endangered plant taxa, as well as the presence of 17 endemic plant species of the Balkans, gives this massif a special importance for biodiversity and nature conservation. In view of these data, the state nature protection authorities are strongly recommended to monitor the area carefully and to prepare concrete protection plans for the rare plant taxa.

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Appendix 1. Catalogue of the recorded vascular plants in the Koznik Mt, with syntaxonomical notes, comparative distribution data for Kosovo, life forms and corresponding chorological data.

				PTERIDOPHYTA			
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
ASPLENIACEAE							
1.	*Asplenium adiantum-nigrum* L.	H	EUR_ASI	CL=QUE_PUB	●	●	
2.	*Asplenium ceterach* L.	H	EUR_ASI	CL=QUE_PUB	●	●	+
3.	*Asplenium septentrionale* (L.) Hoffm.	Ch	EUR_ASI	----------	●		
4.	*Asplenium trichomanes* L.	H	COSM	----------	●	●	
DENNSTAEDTIACEAE							
5.	*Pteridium aquilinum* (L.) Kuhn	G	COSM	CL=QUE_PUB		●	+ ☠
EQUISETACEAE							
6.	*Equisetum palustre* L.	G	EUR_ASI	CL=ALN_GLU		●	+ ☠
PTERIDACEAE							
7.	*Paragymnopteris marantae* (L.) K. H. Shing	H	EUR_ASI	----------			
SPERMATOPHYTA							
GYMNOSPERMAE							
CUPRESSACEAE							
8.	*Juniperus communis* L.	P	CIR_BOR	CL=QUE_PUB	●	●	+
9.	*Juniperus oxycedrus* L.	P	EUR_MED	CL=QUE_PUB	●	●	+ / Characteristic species of the Association: *Astero-Junipere-tum oxycedri* Rexhepi 1990
PINACEAE							
10.	*Pinus sylvestris* L.	P	EUR_ASI	CL=QUE_PUB			Cultivated, almost naturalized
ANGIOPSERMAE							
Dicotyledoneae							
ACANTHACEAE							
11.	*Acanthus hungaricus* (Borbás) Baen.	H	EUR_MED	CL=QUE_PUB			+
ANACARDIACEAE							
12.	*Cotinus coggygria* Scop.	P	EUR_ASI	CL=QUE_PUB	●	●	+
APIACEAE							
13.	*Angelica sylvestris* L.	H	EUR_ASI	CL=QUE_PUB			+
14.	*Bupleurum flavicans* Boiss. & Heldr.	T	BALK	----------	●		
15.	*Daucus carota* L.	T	COSM	----------	●	●	+
16.	*Eryngium campestre* L.	H	PONT	CL=QUE_PUB		●	+

Appendix 1. Continued

PTERIDOPHYTA							
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
17.	*Laserpitium krapfii* Crantz.	H	EUR	CL=ASP_TRI			
18.	*Orlaya grandiflora* (L.) Hoffm.	T	EUR	----------	●	●	
19.	*Physospermum cornubiense* (L.) DC.	H	MEDIT	CL=QUE_PUB	●	●	
20.	*Seseli montanum* L.	H	MEDIT	CL=ASP_TRI			
21.	*Smyrnium perfoliatum* L.	H	EUR_MED	CL=ALN_GLU	●	●	
22.	*Trinia glauca* (L.) Daumort.	T	BALK	CL=ASP_TRI	●	●	
APOCYNACEAE							
23.	*Vincetoxicum huteri* Vis. & Asch.	H	EUR_ASI	CL=QUE_PUB	●		+
ARALIACEAE							
24.	*Hedera helix* L.	P	SUB_MED	CL=ALN_GLU CL=QUE_PUB	●	●	+ ☠
ARISTOLOCHIACEAE							
25.	*Aristolochia clematitis* L.	G	SUB_MED	CL=ALN_GLU		●	+ ☠
26.	*Aristolochia merxmuelleri* Greuter & E. Mayer.	G	BALK	CL=QUE_PUB CL=ASP_TRI			▼ END
BETULACEAE							
27.	*Alnus glutinosa* (L.) Gaertn.	P	EUR_ASI	CL=ALN_GLU		●	+ / Characteristic species of the Association: *Alnetum glutinosae* Ilić & Vukičević 1956
BORAGINACEAE							
28.	*Aegonychon purpurocaeruleum* (L.) Holub.	Ch	PONT	CL=QUE_PUB			
29.	*Buglossoides arvensis* (L.) I. M. Johnst.	T	EUR_ASI	----------		●	
30.	*Halacsya sendtneri* (Boiss.) Dörfl.	H	BALK	CL=FES_BRO	●		Characteristic species of the Association: *Polygalo-Genistetum hassertianae* Blečič et al. 1969 / END
31.	*Heliotropium europaeum* L.	T	MEDIT	----------			☠
32.	*Myosotis sylvatica* Hoffm.	H	EUR_ASI	CL=QUE_PUB	●		
33.	*Onosma echioides* (L.) L.	H	EUR	CL=FES_BRO			Characteristic species of the Association: *Onosmato-Scabiosetum fumarioides* Rexhepi 1978 ▼
34.	*Paramoltkia doerfleri* (Wettst.) Greuter & Burdet	Ch	BALK	CL=QUE_PUB	●		END
35.	*Pontechium maculatum* (L.) Böhle & Hilger	H	PONT	CL=FES_BRO			
36.	*Pulmonaria mollis* Hornem.	H	EUR	CL=QUE_PUB			
37.	*Symphytum tuberosum* L.	G	PONT	CL=QUE_PUB	●		☠
BRASSICACAE							
38.	*Aethionema saxatile* (L.) W. T. Aiton.	T	SUB_MED	CL=ASP_TRI	●	●	

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
PTERIDOPHYTA							
39.	*Alyssum montanum* L.	H	SUB_MED	CL=FES_BRO	•	•	
40.	*Bunias erucago* L.	T	MEDIT	----------			
41.	*Capsella bursa-pastoris* (L.) Medik.	H	COSM	CL=QUE_PUB	•	•	✚
42.	*Cardamine bulbifera* (L.) Crantz	G	EUR	CL=QUE_PUB		•	
43.	*Draba verna* L.	T	BOR	----------			
44.	*Erysimum sylvestre* (Crantz) Scop.	H	ALP	CL=QUE_PUB	•	•	
45.	*Noccaea praecox* (Wulfen) F. K. Mey	H	SUB_MED	CL=QUE_PUB			
46.	*Odontarrhena markgrafii* (O. E. Schulz) Španiel & al.	H	BALK	CL=FES_BRO			Characteristic species of the Association: *Onosmato-Scabiosetum fumarioides* Rexhepi 1978 / END
47.	*Odontarrhena muralis* (Waldst. & Kit.) Endl.	H	SUB_MED	CL=FES_BRO	•		
48.	*Peltaria alliacea* Jacq.	H	EUR	CL=QUE_PUB			
49.	*Rorippa lippizensis* (Wulfen) Rchb.	H	BALK	CL=FES_BRO	•	•	
CAMPANULACEAE							
50.	*Asyneuma limonifolium* (L.) Janch.	H	MEDIT	CL=QUE_PUB	•	•	Characteristic species of the Association: *Polygalo-Genistetum hassertianae* Blečič et al. 1969
51.	*Campanula glomerata* L.	H	EUR_ASI	CL=ASP_TRI	•		
52.	*Campanula persicifolia* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
53.	*Campanula rapunculus* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
54.	*Campanula trachelium* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
CANNABACEAE							
55.	*Humulus lupulus* L.	H	CIR_POL	CL=ALN_GLU		•	✚
CAPRIFOLIACEAE							
56.	*Lonicera caprifolium* L.	P	EUR	CL=ALN_GLU	•	•	✚
CARYOPHYLLACEAE							
57.	*Cerastium arvense* L.	Ch	CIR_POL	CL=ELY_SES	•		
58.	*Cerastium pumilum* Curtis.	T	EUR	----------	•	•	
59.	*Dianthus carthusianorum* L.	H	SUB_MED	----------	•	•	
60.	*Dianthus pinifolius* Sm.	H	BALK	----------		•	
61.	*Dianthus sylvestris* Wulfen.	H	EUR	----------		•	
62.	*Herniaria glabra* L.	H	BOR	----------		•	✚
63.	*Minuartia verna* (L.) Hiern.	H	CIR_POL	CL=FES_BRO	•	•	
64.	*Paronychia kapela* (Hacq.) A. Kern.	H	EUR	CL=FES_BRO	•		
65.	*Petrorhagia prolifera* (L.) P. W. Ball & Heywood.	H	EUR	----------		•	

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
	PTERIDOPHYTA						
66.	*Petrorhagia saxifraga* (L.) Link.	H	SUB_MED	CL=ASP_TRI	•	•	
67.	*Scleranthus annuus* L.	H	EUR_ASI	----------	•		
68.	*Silene bupleuroides* L.	H	EUR	CL=FES_BRO		•	
69.	*Silene coronaria* (L.) Clairv.	H	SUB_MED	CL=QUE_PUB	•	•	
70.	*Silene otites* (L.) Wibel	H	EUR	----------	•	•	
71.	*Silene paradoxa* L.	H	EUR	CL=FES_BRO	•		
72.	*Silene viscaria* (L.) Jess.	H	COSM	CL=QUE_PUB	•	•	
73.	*Silene vulgaris* (Moench) Garcke.	H	EUR_ASI	CL=QUE_PUB	•	•	✚
74.	*Stellaria holostea* L.	H	EUR	CL=QUE_PUB	•	•	
CELASTRACEAE							
75.	*Euonymus europaeus* L.	P	EUR	CL=QUE_PUB CL=ALN_GLU		•	✚ ☠
76.	*Euonymus verrucosus* Scop.	P	EUR	CL=QUE_PUB	•	•	
CISTACEAE							
77.	*Fumana bonapartei* Maire & Petitm.	Ch	BALK	CL=ASP_TRI	•	•	
78.	*Helianthemum nummularium* (L.) Mill.	Ch	EUR_ASI	CL=QUE_PUB	•	•	
CLUSIACEAE							
79.	*Hypericum barbatum* Jacq.	H	BALK	CL=FES_BRO	•	•	
80.	*Hypericum perforatum* L.	H	COSM	CL=FES_BRO	•	•	✚ ☠
81.	*Hypericum rumeliacum* Boiss.	H	BALK	CL=FES_BRO	•	•	
COMPOSITAE							
82.	*Achillea coarctata* Poir.	H	PONT	CL=FES_BRO		•	
83.	*Achillea millefolium* L.	H	EUR_ASI	CL=ALN_GLU CL=FES_BRO	•	•	✚
84.	*Anthemis cretica* L.	H	MED_MON	CL=FES_BRO	•		
85.	*Artemisia alba* Turra	Ch	SUB_MED	CL=FES_BRO	•	•	
86.	*Bellis perennis* L. f. *villosa* (Prahl.) Borza.	H	EUR	CL=QUE_PUB	•	•	✚
87.	*Carduus nutans* L.	H	EUR_ASI	CL=QUE_PUB		•	
88.	*Centaurea albertii* Rexhepi.	H	BALK	CL=FES_BRO	•		In forest clearings, along with *Forsythia europaea* Degen & Bald. ▼ / END
89.	*Centaurea kosaninii* Hayek.	H	BALK	CL=QUE_PUB CL=FES_BRO			END
90.	*Centaurea stoebe* L.	H	EUR_ASI	CL=FES_BRO	•	•	
91.	*Cichorium intybus* L.	H	COSM	----------	•	•	✚

Appendix 1. Continued

	PTERIDOPHYTA						
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
92.	*Cota tinctoria* (L.) J. Gay	H	PONT	CL=QUE_PUB	•	•	
93.	*Crepis sancta* (L.) Bornm.	T	EUR_MED	CL=QUE_PUB		•	
94.	*Crupina vulgaris* Cass.	T	PONT	CL=FES_BRO	•	•	
95.	*Cyanus triumfettii* (All.) Á. Löve & D. Löve.	H	EUR	CL=QUE_PUB		•	
96.	*Eupatorium cannabinum* L.	H	EUR_ASI	----------		•	✚
97.	*Filago pyramidata* L.	T	EUR_MED	----------	•		
98.	*Galatella albanica* Degen	H	BALK	CL=CRA_PRU	•		Characterisitc species of the Ass.: *Astero-Juniperetum oxycedri* Rexhepi 1990. ▼ / END
99.	*Galatella linosyris* (L.) Rchb.	H	PONT	CL=QUE_PUB	•		✚
100.	*Inula ensifolia* L.	G	PONT	----------	•	•	
101.	*Inula hirta* L.	H	EUR_ASI	----------	•	•	
102.	*Inula salicina* L.	G	PONT	CL=QUE_PUB	•	•	
103.	*Jacobaea vulgaris* Gaertn.	H	EUR_ASI	----------	•		
104.	*Jurinea mollis* (L.) Rchb.	H	PONT	CL=FES_BRO			
105.	*Klasea radiata* (Waldst. & Kit.) Á. Löve & D. Löve	H	PONT	CL=FES_BRO	•	•	▼
106.	*Leontodon crispus* Vill.	H	BALK	CL=QUE_PUB	•		
107.	*Leontodon hispidus* L.	H	EUR_ASI	----------		•	
108.	*Leucanthemum vulgare* Lam.	H	EUR_ASI	CL=QUE_PUB	•	•	
109.	*Pilosella bauhini* (Schult.) Arv.-Touv.	H	EUR_ASI	CL=FES_BRO		•	
110.	*Pilosella officinarum* Vaill.	H	EUR_ASI	CL=FES_BRO			✚
111.	*Pilosella piloselloides* (Vill.) Soják	H	EUR_ASI	CL=FES_BRO	•	•	
112.	*Scorzonera austriaca* Willd.	H	PONT	CL=FES_BRO	•	•	
113.	*Scorzonera doriae* Degen & Bald.	H	BALK	----------			
114.	*Scorzonera hispanica* L.	H	PONT	CL=FES_BRO	•	•	
115.	*Senecio leucanthemifolius* subsp. *vernalis* (Waldst. & Kit.) Greuter	T	EUR_ASI	----------	•		
116.	*Tanacetum corymbosum* (L.) Sch. Bip.	H	EUR_MED	CL=QUE_PUB	•	•	
117.	*Taraxacum officinale* F. H. Wigg	H	EUR_ASI	CL=QUE_PUB	•		✚
118.	*Tussilago farfara* L.	G	EUR_ASI	CL=QUE_PUB		•	✚ ☠
119.	*Xeranthemum annuum* L.	T	SUB_MED	----------	•	•	
120.	*Xeranthemum cylindraceum* Sm.	T	EUR_MED	----------	•		

Appendix 1. Continued

PTERIDOPHYTA							
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
CONVOLVULACEAE							
121.	*Calystegia sepium* (L.) R. Br.	G	COSM	CL=QUE_PUB	•	•	✚
122.	*Convolvulus althaeoides* L.	H	MED	----------			✚
123.	*Convolvulus arvensis* L.	G	COSM	----------		•	
124.	*Convolvulus can rica* L.	H	SUB_MED	CL=FES_BRO	•	•	
125.	*Cuscuta europaea* L.	T	COSM	----------	•	•	Parasite species. ✚
CORNACEAE							
126.	*Cornus mas* L.	P	EUR_ASI	CL=QUE_PUB	•	•	✚
127.	*Cornus sanguinea* L.	P	BALK	CL=QUE_PUB	•	•	
CORYLACEAE							
128.	*Carpinus betulus* L.	P	EUR_ASI	CL=QUE_PUB	•	•	Characteristic species of the Association: *Quercetum montanum* (B. Jovanović 1948) Černjavski et B. Jovanović 1953
129.	*Carpinus orientalis* Mill.	P	EUR_ASI	CL=QUE_PUB	•	•	
130.	*Corylus avellana* L.	P	EUR	CL=QUE_PUB	•	•	✚
131.	*Ostrya carpinifolia* Scop.	P	EUR	CL=QUE_PUB		•	
CRASSULACEAE							
132.	*Hylotelephium telephium* (L.) H. Ohba	H	EUR_ASI	CL=MOL_ARR		•	✚
133.	*Sedum acre* L.	H	EUR_ASI	----------	•	•	✚
134.	*Sedum hispanicum* L.	T	BALK	CL=ASP_TRI	•	•	
135.	*Sedum ochroleucum* Chaix.	H	SUB_MED	----------	•	•	
136.	*Sedum serpentini* Janchen.	H	BALK	----------			END
137.	*Sempervivum tectorum* L.	H	EUR	CL=FES_BRO			✚
DIPSACACEAE							
138.	*Cephalaria leucantha* (L.) Roem. & Schult.	H	EUR_MED	----------		•	
139.	*Dipsacus laciniatus* L.	H	EUR_ASI	CL=ART_VUL			✚
140.	*Knautia drymeia* Heuff.	H	BALK	CL=CAR_FAG	•		
141.	*Scabiosa fumarioides* Vis. & Pančić.	H	BALK	----------			END
142.	*Scabiosa taygetea* subsp. *portae* (Huter) Kokkini	H	EUR	----------			
EUPHORBIACEAE							
143.	*Euphorbia barrelieri* Savi var. *thesala* (Ferm.) K. Maly.	H	BALK	CL=FES_BRO	•	•	
144.	*Euphorbia cyparissias* L.	H	EUR_ASI	CL=FES_BRO	•	•	✚ ☠

Appendix 1. Continued

PTERIDOPHYTA							
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
145.	*Euphorbia glabriflora* Vis.	H	BALK	CL=FES_BRO	●	●	
146.	*Euphorbia myrsinites* L.	G	EUR_MED	CL=QUE_PUB		●	✚
147.	*Euphorbia nicaeensis* All. subsp. *nicaeensis*	H	EUR	CL=QUE_PUB			✚ ❀
148.	*Mercurialis ovata* Sternb. & Hoppe	G	EUR	CL=QUE_PUB	●	●	
FABACEAE							
149.	*Anthyllis vulneraria* subsp. *polyphylla* (DC.) Nyman.	Ch	SUB_MED	CL=FES_BRO			✚
150.	*Astragalus glycyphyllos* L.	H	SUB_MED	CL=QUE_PUB	●	●	
151.	*Astragalus onobrychis* L.	H	EUR	----------	●	●	
152.	*Colutea arborescens* L.	P	MED	CL=QUE_PUB	●	●	✚
153.	*Cytisus hirsutus* L.	Ch	SUB_MED	CL=FES_BRO	●	●	
154.	*Cytisus purpureus* Scop.	Ch	BALK	CL=QUE_PUB			▼
155.	*Dorycnium pentaphyllum* Scop.	Ch	SUB_MED	CL=FES_BRO	●		
156.	*Genista hassertiana* (Bald.) Buchegger.	P	BALK	----------			Characteristic species of the Association: *Polygalo-Genistetum hassertianae* Blečič et al.1969. ▼ / END
157.	*Genista pilosa* L.	Ch	EUR	----------	●		
158.	*Genista sagittalis* L.	Ch	EUR	CL=QUE_PUB	●	●	
159.	*Genista tinctoria* L.	Ch	EUR_ASI	CL=QUE_PUB	●	●	✚
160.	*Hippocrepis emerus* (L.) Lassen.	P	EUR	CL=QUE_PUB	●	●	✚
161.	*Hippocrepis comosa* L.	H	SUB_MED	CL=FES_BRO	●	●	
162.	*Lathyrus niger* (L.) Bernh.	G	PONT	CL=QUE_PUB	●	●	
163.	*Lathyrus venetus* (Mill.) Wohlf.	G	PONT	CL=QUE_PUB	●	●	
164.	*Lembotropis nigricans* (L.) Griseb.	P	SUB_MED	CL=QUE_PUB	●	●	
165.	*Lotus corniculatus* L.	H	EUR_ASI	CL=MOL_ARR	●	●	
166.	*Onobrychis alba* (Waldst. & Kit.) Desv.	H	EUR	CL=FES_BRO	●	●	
167.	*Ononis spinosa* L.	Ch	EUR	----------	●		✚
168.	*Trifolium alpestre* L.	G	EUR	----------	●		
169.	*Trifolium arvense* L.	T	EUR	----------	●	●	
170.	*Trifolium campestre* Schreb.	T	EUR	----------	●		
171.	*Trifolium montanum* L.	H	PONT	CL=QUE_PUB	●	●	
172.	*Trifolium ochroleucon* Huds.	H	PONT	----------		●	
173.	*Trifolium pignantii* Fauché & Chaub.	G	BALK	CL=QUE_PUB	●	●	

Appendix 1. Continued

		PTERIDOPHYTA					
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
174.	*Vicia cracca* L.	H	EUR_ASI	CL=MOL_ARR	•	•	Characteristic species of the Association: *Quercetum montanum* (B. Jovanović 1948) Černjavski et B. Jovanović 1953
FAGACEAE							
175.	*Quercus cerris* L.	P	EUR	CL=QUE_PUB	•	•	✚
176.	*Quercus frainetto* Ten.	P	EUR	CL=QUE_PUB	•	•	
177.	*Quercus petraea* (Matt.) Liebl.	P	EUR	CL=QUE_PUB		•	✚ – Characteristic species of the Association: *Quercetum montanum* (B. Jovanović 1948) Černjavski et B. Jovanović 1953
178.	*Quercus pubescens* Willd.	P	SUB_MED	CL=QUE_PUB	•	•	
GENTIANACEAE							
179.	*Centaurium erythraea* Ranfn. subsp. *erythraea*	H	EUR	CL=FES_BRO	•	•	✚
180.	*Centaurium pulchellum* (Sw.) Druce	T	EUR_ASI	----------	•		✚
GERANIACEAE							
181.	*Erodium cicutarium* (L.) L'Hér.	T	EUR_ASI	CL=ALN_GLU	•	•	✚
182.	*Geranium pyrenaicum* Burm.	H	EUR_ASI	CL=QUE_PUB		•	
183.	*Geranium sanguineum* L.	H	EUR	----------	•	•	✚
LAMIACEAE							
184.	*Ajuga genevensis* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
185.	*Ajuga laxmannii* (Murray) Benth.	G	EUR	CL=FES_BRO		•	
186.	*Clinopodium acinos* (L.) Kuntze	T	EUR_MED	----------		•	
187.	*Clinopodium vulgare* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
188.	*Lamium purpureum* L.	T	EUR_ASI	----------		•	✚
189.	*Marrubium peregrinum* L.	G	MED	CL=FES_BRO		•	✚
190.	*Melittis melissophyllum* L.	H	EUR	CL=QUE_PUB		•	✚
191.	*Mentha aquatica* L.	G	COSM	CL=ALN_GLU		•	✚
192.	*Mentha pulegium* L.	G	COSM	CL=ALN_GLU			✚
193.	*Origanum vulgare* L.	H	EUR	CL=QUE_PUB	•	•	✚
194.	*Prunella laciniata* (L.) L.	H	MED	CL=QUE_PUB	•	•	
195.	*Prunella vulgaris* L.	H	COSM	CL=MOL_ARR		•	✚
196.	*Satureja montana* L.	Ch	MED	CL=FES_BRO	•		✚
197.	*Scutellaria altissima* L.	G	PONT	CL=QUE_PUB		•	
198.	*Sideritis montana* L.	T	EUR_ASI	----------	•	•	✚

Appendix 1. Continued

	PTERIDOPHYTA						
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
199.	*Salvia ringens* Sm.	H	BALK	----------			
200.	*Stachys germanica* L.	H	EUR	----------		•	
201.	*Stachys recta* L.	H	PONT	CL=FES_BRO	•	•	✚
202.	*Stachys scardica* (Griseb). Hayek	H	BALK	----------	•	•	END
203.	*Teucrium chamaedrys* L.	Ch	MED	CL=FES_BRO	•	•	✚
204.	*Teucrium montanum* L.	H	EUR	CL=FES_BRO	•	•	✚
205.	*Thymus longicaulis* C. Persl subsp. *longicaulis*	Ch	BALK	CL=FES_BRO	•	•	✚
LENTIBULARIACEAE							
206.	*Pinguicula hirtiflora* Ten.	H	MED	----------			▼
LINACEAE							
207.	*Linum elegans* Boiss.	Ch	BALK	----------			▼ / END
208.	*Linum flavum* L.	H	PONT	CL=FES_BRO	•	•	
209.	*Linum perenne* L.	H	EUR	----------	•		
210.	*Linum tauricum* Willd.	H	EUR	CL=FES_BRO	•		
211.	*Linum tenuifolium* L.	H	EUR	CL=FES_BRO	•	•	
LORANTHACEAE							
212.	*Arceuthobium oxycedri* (DC.) M. Bieb.	T	MED	CL=QUE_PUB		•	
LYTHRACEAE							
213.	*Lythrum salicaria* L.	H	COSM	CL=ALN_GLU	•	•	✚
MALVACEAE							
214.	*Tilia platyphyllos* Scop.	P	EUR	CL=QUE_PUB	•		✚
OLEACEAE							
215.	*Forsythia europaea* Deg. et Bald.	P	BALK	CL=QUE_PUB	•		
216.	*Fraxinus ornus* L.	P	EUR	CL=QUE_PUB	•	•	✚
217.	*Ligustrum vulgare* L.	P	EUR	CL=QUE_PUB	•	•	✚
OROBANCHACEAE							
218.	*Euphrasia pectinata* Ten.	T	EUR_ASI	CL=FES_BRO	•		
219.	*Odontites glutinosa* (M. Bieb.) Benth.	T	BALK	CL=FES_BRO			
220.	*Orobanche alba* Willd.	T	EUR_ASI	CL=FES_BRO	•	•	
221.	*Orobanche gracilis* Sm.	T	MED	CL=FES_BRO	•		
222.	*Melampyrum cristatum* L.	T	EUR	CL=QUE_PUB	•	•	
223.	*Parentucellia latifolia* (L.) Caruel	T	MED	----------	•	•	

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
	PTERIDOPHYTA						
224.	*Rhinanthus rumelicus* Velen.	T	EUR	----------	•	•	
PAPAVERACEAE							
225.	*Corydalis solida* (L.) Clairv.	G	SUB_MED	CL=QUE_PUB	•	•	✚ ❀
PLANTAGINACEAE							
226.	*Digitalis lanata* Ehrh.	G	EUR	CL=QUE_PUB	•	•	✚ ❀
227.	*Plantago argentea* Chaix.	H	EUR	CL=FES_BRO	•	•	
228.	*Plantago lanceolata* L.	H	COSM	----------	•	•	✚
229.	*Plantago media* L.	H	EUR_ASI	CL=QUE_PUB	•	•	✚
230.	*Plantago subulata* L.	H	EUR	CL=FES_BRO	•	•	
231.	*Veronica austriaca* subsp. *jacquinii* (Baumg.) Eb. Fisch.	H	PONT	CL=FES_BRO	•		
232.	*Veronica barrelieri* Roem. & Schult.	H	BALK	CL=QUE_PUB			END
233.	*Veronica beccabunga* L.	H	EUR_ASI	CL=ALN_GLU		•	
234.	*Veronica chamaedrys* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
POLYGALACEAE							
235.	*Polygala comosa* Schkuhr.	H	EUR_ASI	CL=QUE_PUB			
236.	*Polygala doerfleri* Hayek.	H	BALK	CL=CRA_PRU	•		Characteristic species of the Asociation: *Polygalo-Forsythietum europaeae* Blečič et Krasniqi 1972. / END
POLYGONACEAE							
237.	*Rumex acetosella* L.	H	COSM	CL=FES_BRO	•	•	✚ ❀
PLUMBAGINACEAE							
238.	*Armeria rumelica* Boiss.	H	BALK	CL=FES_BRO			
239.	*Goniolimon tataricum* (L.) Boiss.	H	EUR_MED	CL=FES_BRO	•	•	
PRIMULACEAE							
240.	*Cyclamen hederifolium* Aiton.	G	SUB_MED	CL=QUE_PUB	•		✚
241.	*Lysimachia atropurpurea* L.	H	BALK	CL=QUE_PUB			▾
242.	*Lysimachia punctata* L.	H	PONT	CL=QUE_PUB			
243.	*Primula acaulis* (L.) L.	H	EUR_ASI	CL=QUE_PUB		•	✚ – Characteristic species of the Association: *Quercetum montanum* (B. Jovanović 1948) Černjavski et B. Jovanović 1953
244.	*Primula veris* L.	H	EUR	CL=FES_BRO	•	•	✚
RANUNCULACEAE							
245.	*Anemone apennina* L.	G	SUB_MED	CL=QUE_PUB		•	✚
246.	*Clematis vitalba* L.	P	EUR	CL=QUE_PUB			✚ ❀

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
PTERIDOPHYTA							
247.	*Consolida regalis* Gray.	T	EUR	----------	•	•	✚ ☠
248.	*Ficaria verna* Huds.	G	EUR	CL=QUE_PUB	•	•	✚
249.	*Helleborus odorus* Willd.	H	EUR	CL=ALN_GLU	•	•	✚ ☠
250.	*Isopyrum thalictroides* L.	G	PONT	CL=QUE_PUB	•		
251.	*Ranunculus millefoliatus* Vahl.	H	BALK	----------	•	•	
252.	*Ranunculus psilostachys* Griseb.	G	BALK	CL=QUE_PUB	•	•	
253.	*Thalictrum aquilegiifolium* L.	H	EUR	CL=QUE_PUB	•		
RHAMNACEAE							
254.	*Frangula alnus* Mill.	P	EUR_ASI	CL=QUE_PUB	•	•	✚
ROSACEAE							
255.	*Agrimonia eupatoria* L.	H	COSM	CL=QUE_PUB		•	✚
256.	*Aremonia agrimonoides* (L.) DC.	H	SUB_MED	CL=QUE_PUB		•	
257.	*Crataegus monogyna* Jacq.	P	EUR	CL=ALN_GLU	•	•	✚
258.	*Filipendula vulgaris* Moench.	H	BOR	CL=FES_BRO	•	•	✚
259.	*Fragaria vesca* L.	H	EUR	CL=QUE_PUB	•	•	✚
260.	*Geum urbanum* L.	H	CIR_BOR	CL=QUE_PUB	•	•	✚
261.	*Malus florentina* (Zuccagni) C. K. Schneid.	P	MED	CL=QUE_PUB		•	▾
262.	*Malus sylvestris* (L.) Mill.	P	EUR	----------	•	•	✚
263.	*Potentilla argentea* L.	H	PONT	CL=FES_BRO	•	•	
264.	*Potentilla australis* Krašan [non Verl.].	H	MED	CL=FES_BRO	•		
265.	*Potentilla hirta* L.	H	PONT	CL=FES_BRO		•	
266.	*Potentilla micrantha* DC.	H	SUB_MED	CL=QUE_PUB	•	•	
267.	*Potentilla visianii* Pančić.	H	BALK	CL=FES_BRO	•	•	
268.	*Prunus spinosa* L.	P	EUR_ASI	----------	•	•	✚
269.	*Pyrus communis* subsp. *pyraster* (L.) Ehrh.	P	MED	CL=QUE_PUB	•		✚
270.	*Pyrus elaeagrifolia* Pall. subsp. *elaeagrifolia*	P	EUR_ASI	CL=QUE_PUB	•		
271.	*Rosa canina* L.	P	EUR	CL=QUE_PUB	•	•	✚
272.	*Rosa spinosissima* L.	P	SUB_MED	CL=QUE_PUB	•	•	
273.	*Rubus canescens* DC.	P	EUR	CL=ALN_GLU	•		
274.	*Sanguisorba albanica* András. & Jáv.	H	BALK	CL=FES_BRO			Characteristic species of the Asociation: *Polygalo-Forsythietum europaeae* Blečič et Krasniqi 1972. ▾ / END

Appendix 1. Continued

		PTERIDOPHYTA					
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
275.	*Sanguisorba minor* Scop.	H	EUR_ASI	CL=FES_BRO	•	•	✚
276.	*Sanguisorba officinalis* L.	H	COSM	CL=QUE_PUB	•	•	✚
277.	*Sorbus torminalis* (L.) Crantz.	P	EUR	CL=QUE_PUB	•		✚
RUBIACEAE							
278.	*Asperula cynanchica* L.	H	SUB_MED	CL=FES_BRO	•	•	
279.	*Cruciata laevipes* Opiz	G	EUR	CL=QUE_PUB		•	✚
280.	*Galium lucidum* All.	H	EUR	CL=FES_BRO			
281.	*Galium verum* L.	G	EUR_ASI	----------	•	•	✚
RUTACEAE							
282.	*Dictamnus albus* L.	Ch	EUR_ASI	CL=QUE_PUB	•	•	✚
283.	*Haplophyllum boissierianum* Vis. & Pančić.	Ch	BALK	----------		•	▼
284.	*Haplophyllum suaveolens* (DC.) G. Don.	H	PONT	CL=QUE_PUB			
SALICACEAE							
285.	*Populus tremula* L.	P	EUR_ASI	----------		•	✚
286.	*Salix alba* L.	P	EUR_ASI	CL=ALN_GLU		•	✚
287.	*Salix amplexicaulis* Bory.	P	EUR	CL=ALN_GLU			
SANTALACEAE							
288.	*Comandra umbellata* subsp. *elegans* (Spreng.) Piehl.	Ch	BALK	CL=QUE_PUB	•		
289.	*Thesium ramosum* Hayne.	H	EUR_ASI	----------	•		
SAPINDACEAE							
290.	*Acer campestre* L.	P	PONT	CL=ALN_GLU	•	•	
291.	*Acer monspessulanum* L.	P	EUR	CL=QUE_PUB	•		
292.	*Acer obtusatum* Willd.	P	BALK	----------	•		
293.	*Acer pseudoplatanus* L.	P	EUR	CL=QUE_PUB		•	
294.	*Acer tataricum* L	P	EUR_ASI	CL=QUE_PUB	•	•	
SAXIFRAGACEAE							
295.	*Saxifraga bulbifera* L.	H	EUR	CL=QUE_PUB	•	•	
SCROPHULARIACEAE							
296.	*Scrophularia canina* L.	H	EUR	----------		•	
297.	*Verbascum phoeniceum* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
SOLANACEAE							

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
PTERIDOPHYTA							
298.	*Hyoscyamus niger* L.	T	EUR_ASI	CL=ALN_GLU		•	✚ ☠
299.	*Solanum dulcamara* L.	Ch	EUR_ASI	CL=ALN_GLU		•	✚ ☠
THYMELAEACEAE							
300.	*Thymelaea passerina* (L.) Coss. & Germ.	T	EUR	----------	•	•	
ULMACEAE							
301.	*Ulmus campestris* L.	P	EUR_ASI	CL=ALN_GLU	•		✚
URTICACEAE							
302.	*Urtica dioica* L.	H	COSM	----------		•	✚ ☠
VALERIANACEAE							
303.	*Valerianella locusta* (L.) Laterr.	T	EUR_MED	----------		•	
304.	*Valeriana tuberosa* L.	G	EUR_MED	----------		•	
VIBURNACEAE							
305.	*Sambucus ebulus* L.	G	EUR_ASI	----------		•	✚
306.	*Sambucus nigra* L.	P	EUR	CL=ALN_GLU		•	✚
VIOLACEAE							
307.	*Viola odorata* L.	H	SUB_MED	CL=QUE_PUB	•		✚
308.	*Viola riviniana* Rchb.	H	EUR_ASI	CL=QUE_PUB	•		
Moncotyledoneae							
AMARYLLIDACEAE							
309.	*Allium flavum* L.	G	EUR_ASI	----------	•	•	
310.	*Allium moschatum* L.	G	EUR	----------	•	•	
311.	*Allium sphaerocephalon* L	G	EUR_ASI	----------	•		
312.	*Galanthus nivalis* L.	G	MED	CL=QUE_PUB		•	✚
ASPARAGACEAE							
313.	*Asparagus tenuifolius* Lam.	G	MED	CL=QUE_PUB	•	•	✚
314.	*Convallaria majalis* L.	G	SUB_MED	CL=QUE_PUB		•	✚ ☠
315.	*Muscari botryoides* (L.) Mill.	G	SUB_MED	----------	•		
316.	*Ornithogalum umbellatum* L.	G	EUR	CL=QUE_PUB			☠
317.	*Polygonatum odoratum* (Mill.) Druce	G	EUR_ASI	CL=QUE_PUB	•	•	✚ ☠
318.	*Prospero autumnale* (L.) Speta.	G	MED	CL=FES_BRO	•		
319.	*Ruscus aculeatus* L.	G	MED	CL=QUE_PUB			✚ ☠

Appendix 1. Continued

		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
	PTERIDOPHYTA						
320.	*Scilla bifolia* L. var *bifolia*.	G	MED	CL=QUE_PUB	•	•	
COLCHICACEAE							
321.	*Colchicum autumnale* L.	G	EUR	CL=QUE_PUB	•	•	✚ ❀
CYPERICAEAE							
322.	*Carex caryophyllea* Latuorr.	H	EUR_ASI	CL=FES_BRO	•	•	
323.	*Scirpoides holoschoenus* (L.) Soják	G	MED	CL=ALN_GLU	•		
DIOSCOREACEAE							
324.	*Dioscorea balcanica* Košanin.	G	BALK	CL=QUE_PUB			▾ / END
325.	*Dioscorea communis* (L.) Caddick & Wilkin.	G	MED	CL=QUE_PUB			✚ ❀
IRIDACEAE							
326.	*Crocus biflorus* subsp. *weldenii* (Hoppe & Fürnr.) K. Richt.	G	BALK	----------	•		
327.	*Crocus chrysanthus* (Herb.) Herb.	G	BALK	CL=QUE_PUB		•	
328.	*Crocus tommasinianus* Herb.	H	BALK	CL=QUE_PUB			
329.	*Gladiolus illyricus* W. D. J. Koch.	G	EUR	----------			▾
330.	*Iris graminea* L.	G	MED	CL=QUE_PUB	•	•	
331.	*Iris pumila* L.	G	EUR	----------	•		
332.	*Iris reichenbachii* Heuff.	G	BALK	CL=FES_BRO	•	•	
JUNCACEAE							
333.	*Luzula forsteri* (Sm.) DC.	H	MED	CL=QUE_PUB	•	•	
334.	*Luzula multiflora* (Ehrh.) Lej.	H	COSM	CL=QUE_PUB	•		
LILIACEAE							
335.	*Erythronium dens-canis* L.	G	EUR	CL=QUE_PUB	•	•	
336.	*Fritillaria messanensis* Raf.	G	EUR	----------			
337.	*Lilium martagon* L.	G	SUB_MED	CL=QUE_PUB		•	✚
338.	*Tulipa kosovarica* Shuka, L., Tan., K. & Krasniqi, E.	G	BALK	CL=QUE_PUB			▾ / END
339.	*Tulipa sylvestris* L.	G	MED	----------	•	•	
ORCHIDACEAE							
340.	*Anacamptis morio* (L.) R. M. Bateman.	G	MED	----------	•	•	✚
341.	*Platanthera bifolia* (L.) Rich.	G	EUR_ASI	----------		•	✚
POACEAE							
342.	*Aegilops triuncialis* L.	T	EUR	----------	•		

Appendix 1. Continued

PTERIDOPHYTA							
		Life f.	Flor. El.	SYNTAX.	C. XK	N. XK	Add. data & comments
343.	*Agropyron cristatum* subsp. *pectinatum* (M. Bieb.) Tzvelev.	H	EUR	CL=FES_BRO	•	•	
344.	*Brachypodium sylvaticum* (Huds.) P. Beauv.	H	EUR_ASI	CL=FES_BRO	•		
345.	*Briza media* L.	H	EUR_ASI	CL=QUE_PUB	•	•	
346.	*Bromopsis erecta* (Huds.) Fourr.	H	SUB_MED	----------			
347.	*Bromopsis riparia* subsp. *fibrosa* (Hack.) Tzvelev.	H	SUB_MED	CL=FES_BRO			
348.	*Bromus squarrosus* L.	T	MED	----------	•	•	
349.	*Chrysopogon gryllus* (L.) Trin.	H	MED	----------	•	•	
350.	*Cynodon dactylon* (L.) Pers.	G	COSM	----------	•	•	✚
351.	*Dactylis glomerata* L.	H	EUR_ASI	----------	•	•	✚
352.	*Koeleria macrantha* (Ledeb.) Schult.	H	EUR_ASI	----------	•	•	
353.	*Melica ciliata* L.	H	EUR	CL=FES_BRO	•	•	
354.	*Melica uniflora* Retz.	G	EUR	CL=QUE_PUB	•	•	
355.	*Phleum pratense* L.	H	EUR_ASI	----------			
356.	*Poa badensis* Willd.	H	EUR	CL=FES_BRO			
357.	*Poa bulbosa* L.	H	EUR_ASI	----------			
358.	*Schlerochloa dura* (L.) P. Beauv.	T	MED	----------	•		
359.	*Sesleria autumnalis* (Scop.) F. W. Schultz.	H	BALK	----------			
360.	*Stipa pulcherrima* K. Koch.	H	EUR	CL=FES_BRO	•		
TYPHACEAE							
361.	*Typha latifolia* L.	G	COSM	----------			

Explanatory notes on the abbreviations and icons used in the le. Life f. = Life form, Flor. El. = Floral element, H = Hemicryptophytes, Ch = Chamaephytes, P = Phanerophytes, G = Geophytes, T = Therophytes, EUR_ASI = Euro-Asiatic, EUR = European, BALK = Balkan, SUB_MED = Sub-Mediterranean, MED = Mediterranean, PONT = Pontic, COSM = Cosmopolitan, EUR_MED = Euro-Mediterranean, BOR = Boreal, CIR_POL = Circum-Polar, CIR_BOR = Circum-Boreal, ALP = Alpine, SYNTAX. = Syntaxonomic affiliation of the given taxa, CL=QUE_PUB = Class: *Quercetea pubescentis*, CL=FES_BRO = Class: *Festuco-Brometea*, CL=ALN_GLU = Class: *Alnetea glutinosae*, CL=ASP_TRI = Class: *Asplenietea trichomanis*, CL=MOL_ARR = Class: *Molinio-Arrhenatheretea*, CL=CRA_PRU = Class: *Crataego-Prunetea*, CL=ELY_SES = Class: *Elyno-Seslerietea*, CL=ART_VUL = Class: *Artemisietea vulgaris*, CL=CAR_FAG = Class: *Carpino-Fagetea sylvaticae*, C.XK = Central Kosovo (data from Krasniqi et al. 2019), N.XK = North Kosovo (data from Prodanović *et al*., 2020), ✚ = Medicinal plant, ☠ = Poisinous plant, END = Endemic plant taxa; ▼ = Threatened plant in one the IUCN based threat categories in Kosovo (according to Millaku *et al*. 2013).