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DISTRIBUTION AND ECOLOGY OF *ALCHEMILLA* SPECIES IN OSOGOVO MT. AND WEST BALKAN MT. IN BULGARIA

Anna GAVRILOVA[1] & Antonina VITKOVA[1]

Abstract
The present study aims to determine some common species of genus *Alchemilla* (*Rosaceae*) in Osogovo Mt. and West Balkan Mt. in Bulgaria. The ecological conditions in seven habitat types according to EUNIS with detected presence of *Alchemilla* species are compared. According to this classification, the habitats that were found belong to six general types: Transition mires and quaking bogs (D 2.3), Mountain hay meadows (E 2.3), Moist or wet eutrophic and mesotrophic grassland (E 3.4), Acid alpine and subalpine grassland (E 4.3), Subalpine moist or wet tall-herb and fern stands (E 5.5), Evergreen alpine and subalpine heath and scrub (F 2.2). Seven species were reported in the investigated regions: *A. crinita* Buser, *A. erythropoda* Juz., *A. flabellata* Buser, *A. glabra* Neygenf., *A. glaucescens* Wallr., *A. monticola* Opiz and *A. viridiflora* Rothm. In the paper are submitted some new reports for the presence of *A. crinita*, *A. erythropoda* and *A. glabra* in the investigated areas. Some preliminary results concerning the resources of the examined species are obtained.
Key words: *Alchemilla* spp., West Balkan Mountain, Osogovo Mountain, EUNIS, resources.

Izvleček
V raziskavi smo predstavili nekaj vrst rodu *Alchemilla* (*Rosaceae*) na gorovjih Osogovo in Zahodni Balkan (Stara Planina) v Bolgariji. Primerjali smo rastiščne razmere v sedmih habitatnih tipih po razvrstitvi EUNIS, v katerih smo ugotovili prisotnost vrst *Alchemilla*. Po tej razvrstitvi najdene habitate uvrščamo v šest glavnih tipov: prehodna barja (D 2.3), gorski gojeni travniki (E 2.3), mokrotni mezotrofni in eutrofni travniki ali pašniki (E 3.4), alpinska in subalpinska travišča na kisli podlagi (E 4.3), subalpinska in alpinska visoka steblikovja (E 5.5), arktično-alpinske in borealne resave (F 2.2). V raziskovanem območju smo našli sedem vrst: *A. crinita* Buser, *A. erythropoda* Juz., *A. flabellata* Buser, *A. glabra* Neygenf., *A. glaucescens* Wallr., *A. monticola* Opiz and *A. viridiflora* Rothm. V članku so prikazana nova nahajališča vrst *A. crinita*, *A. erythropoda* in *A. glabra* na raziskovanem območju. Prikazali smo tudi predhodne rezultate koristne uporabe proučevanih vrst rodu *Alchemilla*.
Ključne besede: *Alchemilla* spp., gorovje Zahodni Balkan, gorovje Osogovo, EUNIS, ekonomska uporaba naravnih virov.

1. INTRODUCTION

Genus *Alchemilla* in Bulgaria consists of 35 species according to Flora of PR Bulgaria, vol. 5 (Assenov 1973), 26 of these species are presented in Flora Europaea, Vol. 2 (Walters & Pawlowski 1968), and in Atlas Flora Europaea (Kurtt et al. 2007) the number of the species given for the country is 36.

The representatives of the genus are perennial herbaceous plants, most frequently with creeping rootage and erect to raised stems. The basal leaves have long petioles, brought together in a rosette, the outlines of the leaf lamina are orbicular to reniform, lobed to various extend. The flowers have a doubled calyx, corolla-absented, brought together in botryoid inflorescences. The species reproduce by seeds through facultative

[1] Department of "Applied botany", Institute of Botany – BAS, Georgi Bonchev Str. 23, 1113 Sofia, Bulgaria, any_gavrilova@abv.bg

apomixes, though hybridization does occasionally take place (Glazunova 1987, Izmailow 1994) and also vegetative, forming clone-populations. Some authors consider the species within the group to be a microspecies with wide genetic polymorphism (Sepp et al. 2000).

The *Alchemilla* species are poorly studied in the Bulgarian flora from the taxonomical and chorological aspect, as well as regarding their biological characteristics. In the Herbaria of the Institute of Botany-BAS (SOM) and the Biological faculty of Sofia University "St. Kliment Ohridski" (SO) there is an insufficient number of specimens, as the localities of some species remain not vouched for over the last 3–4 decades. Because of the highly valued medicinal properties of the larger part of the *Alchemilla* species, their resources are intensely exploited for personal needs as well as in the pharmaceutical industry. According to the Bulgarian legislation *Alchemilla* spp. are placed under special regime for harvesting with annual quotas (Medicinal Plants Act 2000). The sustainable utilization of the *Alchemilla* resources appears to be a problematic issue in Bulgaria because of the lack of scientific data on economically valued localities.

The present study is part of a larger one, regarding the perspective from the economic point of view of the *Alchemilla* species in Bulgaria. The aim is to determine the species diversity within genus *Alchemilla* and its relation with the habitat types in the investigated regions, which may prove useful for the sustainable utilization and preservation of the resources. The determination of the habitat types, combined with the respective species abundance, can become essential for the selection of plots for commercial exploitation. This approach closely relates to the sustainable use and preservation of the resources of *Alchemilla* spp.

2. STUDY AREA

The present study was conducted on the territory of Osogovo Mt. (without the north-western slopes) and part of the territory of West Balkan Mt. in the section of Varshetc town – Todorini kukli peak – Petrohan pass. The investigated regions were situated in West Bulgaria: Osogovo Mt. in south-western Bulgaria, and West Balkan Mt. in north-western Bulgaria.

According to the literature there is a certain resemblance in the geomorphologic structure in both investigated regions – West Balkan Mt. and Osogovo Mt. The mountain slopes are comparatively steep and have on the ridges well differentiated denudation plates. However, West Balkan Mt. has more highly varied relief than Osogovo Mt., because of the numerous river valleys and watershed hills of second and upper order (Vaptzarov et al. 1989, Penchev et al. 1989).

Both mountains come under different climatic regions – West Balkan Mt. under the temperate continental zone and Osogovo Mt. under the transitional continental zone; however, they have some similarities in with regard to climate. This is conditioned by the similar elevation range investigated in both mountains, and by the fact that Balkan Mt. and the mountains of the Macedono-Thracian Massif (with Osogovo Mt. as a part) gather the precipitations respectively from north-west and south-east enterings of moist air currents. However the winter on Osogovo Mt. is milder than the one on West Balkan Mt., and the humidity at a same elevation is lower as well in this comparison (Velev 2002). The water flow of the rivers in both mountains has a temperate continental influence and considerable snow melting supply, although Osogovo Mt. is perceptibly dryer in comparison with West Balkan Mt. (Jordanova 2002).

Regarding the soil type, the two regions belong to different soil sub-regions; however, at the same elevation, in both mountains brown mountain-forest soils prevail, well drained and damp due to the clayey-sandy structure (Ninov 2002).

3. METHODS

The analyzed data were obtained through the period 30.05.2008–14.08.2008. The investigations in the two mountain regions included a similar altitude range: for Osogovo Mt. from 1459 to 1791 m a.s.l., and for West Balkan Mt. from 1382 to 1711 m a.s.l. The species status was determined according to Flora of R Bulgaria (vol. I-X), Guidebook of vascular plants in Bulgaria (Kodzuharov 1992), and Guidebook of higher plants in Bulgaria (Delipavlov & Cheschmedziev 2003). The data about the species distribution in phytogeographical regions is in conformity with Conspectus of the Bulgarian Vascular Flora (Assjov & Petrova 2006), the available herbarium specimens in the Herbaria from the Institute of Botany (SOM) and Biological Faculty of Sofia University "St.

Kliment Ohridski" (SO), and were synchronized with the latest development of genus *Alchemilla* in Atlas Florae Europaeae (Kurtto et al. 2007).

For the data collection the track method was applied. The experimental plots suitable for population investigations were chosen according to the natural ecological prerequisites of the *Alchemilla* species. These requirements excluded the forest massifs for their unfavorable light regime regarding the investigated species, as well as the herbaceous communities located under 1200 m a.s.l. for their most often xerophyle characteristics. The list of the floristic composition of the communities with presence of *Alchemilla* species was made with the support of quantitative estimations following the Braun-Blanquet method (1964) (Table 1), GPS locations and data on the elevation, inclination, exposition and humidity in certain localities were also collected. The set size of the experimental plots was at an average of 100 m^2. The determination of the habitat types was completed on the basis of EUNIS (European Nature Information System) habitat classification (http://eunis.eea.europa.eu/habitats.jsp). The average area of the populations was estimated in decares (da), and the joint project coverage of the *Alchemilla* species for every locality was given in percents.

In the Herbarium of the Institute of Botany, BAS (SOM) were deposed specimens from the investigated regions for the new and confirmed species.

4. RESULTS AND DISCUSSION

4.1 Floristic results

Altogether, 191 species belonging to 40 families and 121 genera were found in the surveyed plot areas from both mountains.

As a result of the conducted study, seven species of genus *Alchemilla* L. were reported on the territory of the investigated regions of Osogovo Mt. and West Balkan Mt. (Table 1). Six of these species are common for both mountains: *A. crinita* Buser, *A. erythropoda* Juz., *A. flabellata* Buser, *A. glabra* Neygenf., *A. glaucescens* Wallr. and *A. monticola* Opiz. They are part of Sect. *Alchemilla* (*Brevicaulon* Rothm.) of genus *Alchemilla*, Subsect. *Heliodrozium* Rothm. From Subsect. *Calycanthum* Rothm. of the same section only one species is reported: *A. viridiflora* Rothm. from Osogovo Mt., where it is known to occur (Assyov & Petrova 2006).

In the present study *A. crinita* was submitted for the first time for the territory of Osogovo Mt. and West Balkan Mt. This species partakes in all floristic descriptions from Osogovo Mt., the major part of those being from West Balkan Mt.

A. erythropoda was reported for the first time for Osogovo Mt. and was confirmed its presence for West Balkan Mt., where herbarium specimens have not been collected since 1949. It was also the first report for the presence of *A. glabra* for West Balkan Mt.

4.2 Distribution analysis

All the localities found in both mountains are situated in the range of beech belt, out of the forest canopy or in the subalpine belt. The specified *Alchemilla* species occur in mesophile herbaceous, wetland and ericoid communities. These plant communities are distinguished by not more than 3 herbaceous sublevels (the third one lies directly on the ground, and where it is presented consists mainly of mosses) and also perennial herbaceous species (usually grasses) or small ericoid species (e.g. *Vaccinium* spp.) as dominant biological types.

As a result, from the comparison of the phytogeographic elements characterizing the species diversity in the investigated regions (Table l, Figure 4), it is clear that in both regions there predominate European (Eur), boreal (Boreal), Euro-Asian (Eur-As) and sub-boreal (subBoreal) floristic elements. Figuratively, these elements amount to 53 % of all elements presented in Osogovo Mt., and 62 % for West Balkan Mt. The distribution by life forms and biological types shows that all the described localities are dominated by perennial species (Figure 1) belonging to the group of hemicryptophytes (Figure 2) and are characteristic for territories with a moderate to cool climate. From the analysis regarding the humidity, it follows that in the investigated regions of both mountains the group of species bonded to more or less humid habitats (xeromeso-, meso-, mesohygro-, hygromeso- and hygrophytes) exceeds 70 % (Figure 3). All these results show that in both regions the climate is distinguished by higher humidity and lower average temperatures. It is likely that this circumstance in some degree counter-balances the difference between the moderate-

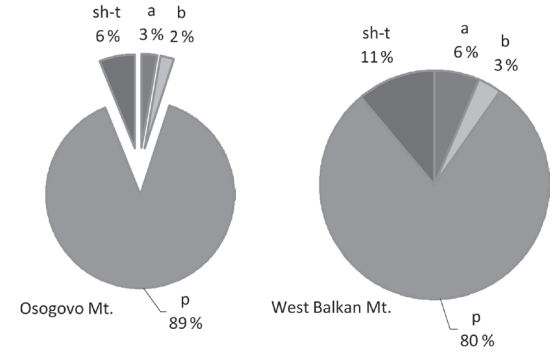

Figure 1: Distribution of the biological types in the investigated regions of Osogovo Mt. and West Balkan Mt. (a – annual; b – biennial; p – perennial; sh – shrub; t – tree).
Slika 1: Razporeditev bioloških tipov na gorovju Osogovo in Stara Planina (a – enoletnice; b – dvoletnice; p - trajnice; sh – grm; t – drevo).

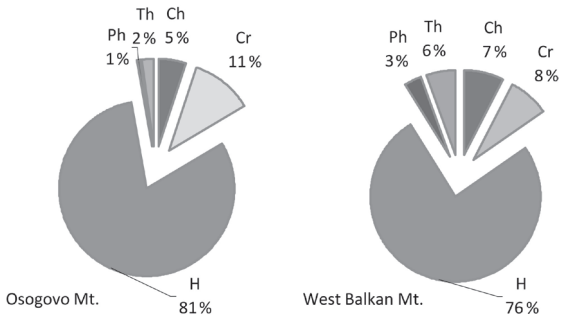

Figure 2: Distribution of the life form types in the investigated regions of Osogovo Mt. and West Balkan Mt. (Raunkiaer, 1937) (Ph – phanerophytes; Ch – chamephytes; H – hemicryptophytes; Cr – criptophytes; Th – therophytes).
Slika 2: Razporeditev življenskih oblik na gorovju Osogovo in Stara Planina (Raunkiaer 1937) (Ph – fanerofiti; Ch – hamefiti; H – hemikriptofiti; Cr – kriptofiti; Th – terofiti).

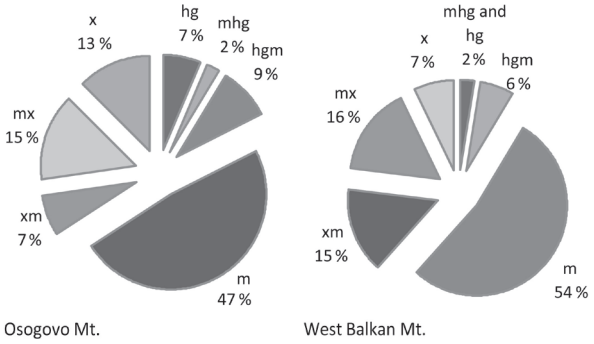

Figure 3: Distribution of the ecological types in relation to humidity in the investigated regions of Osogovo Mt. and West Balkan Mt. (m – mesophytes; xm – xeromesophytes; mx – mesoxerophytes; x – xerophytes; mhg – mesohygrophytes; hgm – hygromesophytes; hg – hygrophytes).
Slika 3: Razporeditev ekoloških tipov v odvisnosti od vlažnosti na gorovju Osogovo in Stara Planina (m – mezofiti; xm – kseromezofiti; mx – mezokserofiti; x – kserofiti; mhg – mezohigrofiti; hgm – higromezofiti; hg – higrofiti).

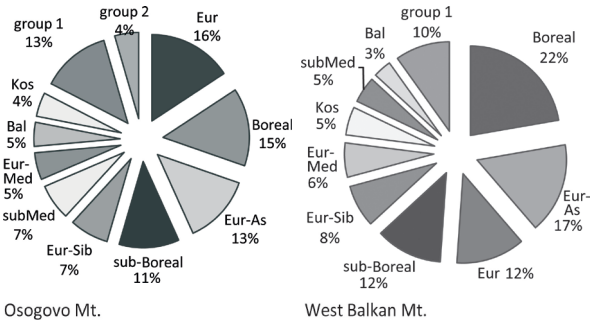

Figure 4: Distribution of the phytogeographic elements in the investigated regions of Osogovo Mt. and West Balkan Mt. (Osogovo Mt.: group 1 – Pont-Med; Arct-Alp; Carp-Bal; Med; Eur-subMed; sMed-Cas, group 2 – other phytogeographic elements. West Balkan Mt.: group 1 – Pont-Med; Arct-Alp; Eur-subMed; Carp-Bal, Alp-Carp-Bal and other phytogeographic elements).
Slika 4: Razporeditev fitogeografskih elementov na gorovju Osogovo in Stara Planina (Osogovo: skupina 1 – Pont-Med; Arct-Alp; Carp-Bal; Med; Eur-subMed; sMed-Cas, skupina 2 – ostali fitogeografski elementi; Stara Planina: skupina 1 – Pont-Med; Arct-Alp; Eur-subMed; Carp-Bal, Alp-Carp-Bal in ostali fitogeografski elementi).

continental (West Balkan Mt.) and transitional-continental climate (Osogovo Mt.), which influence the investigated regions respectively. These conditions offer a favorable environment to the *Alchemilla* species, which are naturally distributed in the mountain and high-mountain zone of Central and East Europe as well as in some other regions with similar features (Fröhner 1995).

Secondly are presented sub-Mediterranean (subMed), Euro-Mediterranean (Eur-Med), Euro-Siberian (Eur-Sib), cosmopolite (Kos) and Balkan (Bal) floristic elements, which are smaller in number, and consequently do not characterize sufficiently the floristic diversity in the investigated regions.

Except for *A. erythropoda*, which is of limited distribution in South-East Europe (Assenov 1973), the remaining five species, common to

both surveyed regions, have European (*A. crinita*, *A. glaucescens*), euro-Siberian (*A. glabra*, *A. monticola*) and Alpic-Carpathian origin (*A. flabellata*) (Assyov & Petrova 2006). The main part of the populations of these species is distributed in the middle and high mountain belt of the Alps and Carpathians, and clearly forms two possible corridors for irradiation and genetic material exchange – one corridor follows the line that connects the Alpo-Carpathian range with Balkan Mt. (in particular West Balkan Mt.) as a natural continuation, and the second corridor stretches from the Central massif of the Alps, to the Dinaric Alps and then through the Serbo-Macedonian Massif to Osogovo Mt., which is the last formation of this massif to the east (Kurtto et al. 2007, Zagorchev 2007). The existence of these two possible corridors for irradiation may explain the exact correspondence in the *Alchemilla* species diversity, reported for the investigated regions of West Balkan Mt. and Osogovo Mt.

Regarding the similar ecological prerequisites of the six species common to both regions, one likely explanation of this fact is that they have very close taxonomic relations: all of them are positioned in Section *Alchemilla*, subsection *Heliodrosium* in two consequent series (series *Pubescentes* – *A. glaucescens*, *A. flabellate*, *A. erythropoda*; series *Vulgares* – *A. monticola*, *A. crinita*, *A. glabra*) of the genus (Walters & Pawlowski 1968). Some authors express the opinion that, in the past, one way of species formation in the genus could be a result of hybridization in combination with introgression, which is common for apomicts groups like *Hieracium*, *Rubus*, *Taraxacum* or *Ranunculus auricomus* complex (Gehrke et al. 2008). This specific kind of species formation allows the descendent new species to share common ecological niches with their parent species, and their area remains sympatric. If we accept this assumption, it gives a reasonable explanation of the similar preferences of the closely related *Alchemilla* species in the borders of the described habitat types.

When comparing the descriptions of the separate phytocoenoses from the summarized habitats, one is impressed by the various number of *Alchemilla* species forming different combinations. This could be explained by the fortuity in the dissemination of the seeds in combination with the possible transference of seeds from adjacent areas with similar ecological conditions. A good example of this is the presence of *A. glaucescens* in the habitat of Balkanic quaking bogs (D 2.3I) in Osogovo Mt. and the mountain hay meadows (E 2.33) from West Balkan Mt. This species is known from the literature to have xeromesophyle to xerophyle characteristics and it appears at considerably drier places (Lovelius 1987). Because of the specific characteristics of the bogs in Osogovo Mt., as a large number of localities compared with very small areas, we can assume that the species penetrated from the nearby acidophylous herbaceous communities for which it is typical. It should be mentioned that, in spite of the presence of *A. glaucescens* in the habitat of Balkan quaking bogs, it takes the peripheral niches of the habitat in the spatial and ecological aspect. Different is the situation with the occurrence of *A. glaucescens* in the Balkan mountain hay meadows from West Balkan Mt. Most likely this species had irradiated from the higher distributed opened acidophilous grasslands. It penetrates the hinder area of the forest belt, with its seeds probably transported along the springs or gullies, and with the water flow most often as a result of the melting snow.

With the regard to the habitat types where the reported *Alchemilla* species (*A. crinita*, *A. erythropoda*, *A. flabellata*, *A. glabra*, *A. glaucescens* and *A. monticola*) were found, we consider them from the perspective of characterization of their preferred environmental conditions as a projection of their habitats. For the territory of Osogovo Mt. the reported *Alchemilla* species are located in three main types of habitats: E 2.33 Balkan mountain hay meadows, E 4.318 Oro-Moesian mat-grass swards, and D 2.3I Balkanic quaking bogs. With biggest species diversity for genus *Alchemilla* are highlighted the habitat types of Oro-Moesian mat-grass swards (*A. crinita, A. erythropodoides, A. flabellata, A. monticola*) and Balkanic quaking bogs (*A. crinita, A. erythropodoides, A. glabra, A. glaucescens*) (Table 2).

For West Balkan Mt. the reported *Alchemilla* species occur in six types of habitats:E 2.33 Balkan mountain hay meadows, E 3.46 Continental humid meadows, E 4. 318 Oro-Moesian mat-grass swards, E 4.3944 Oro-Moesian [*Sesleria comosa*] grasslands, E 5.572 Moesian scarlet avens tall herb communities, and F 2.2A2 Balkano-Hellenic dwarf bilberry heaths. The biggest species diversity of *Alchemilla* representatives here is found in the communities with dominance of *Vaccinium myrtillus* and *Vaccinium vitis-idaea* (F 2.2A2 – *A. erythropoda, A. flabellata, A. glabra, A. glaucescens*), and in second place come the subalpine acidophilous herbaceous communities of type E 4.3944

(*A. erythropoda, A. glabra, A. glaucescens*) and hay meadows (E 2.33 – *A. crinita, A. glaucescens, A. monticola*) (Table 3).

The bigger number of habitats for West Balkan Mt. compared with Osogovo Mt., where *Alchemilla* species were found, can be explained by the more varied relief as a result to the large number of river valleys and feeders of different order.

The habitat type of E 4.394 Oro-Moesian aeolian grasslands is ascertained for the wide area near Ruen peak in Osogovo Mt., and there are sparsely presented *A. glaucescens* and *A. erythropoda* according to yet unpublished investigations from the Balkan Green Belt – Osogovo project (Bulgarian Biodiversity Foundation). However we did not find any *Alchemilla* species in the *Vaccinium* heaths for this mountain. Their presence in the respective communities from West Balkan Mt. can be explained by the longer hold of the snow-cover in that region, which provides the necessary humidity for the *Alchemilla* species development. At the same time the height of the heath-berries is rather small (30–40 cm), which can be explained by the regular harvesting of fruit on a large scale.

From the six reported species of genus *Alchemilla*, only *A. erythropoda* does not possess proven medicinal properties. The distribution of the species in the particular phytocenoses and habitats is always mosaic, which is conditioned by the dissemination fortuity, the specific features of the reproduction in genus *Alchemilla* and by the competitive interrelations in the plant communities.

Generally, the ascertained abundance of the *Alchemilla* species for both mountains is very low. We used for its characterization the index project coverage of the species which for the different experimental plots varies from 1 to 25 %. Only in 3 localities and on the respective experimental plots from the two mountain regions together, does the project coverage of *Alchemilla* species vary from 15 to 25 %. For the territory of Osogovo Mt. these localities come under the habitat types (D 2.3I) Balkan quaking bogs and (E 4. 318) Oro-Moesian mat-grass swards (Table 4) and for West Balkan Mt. under the habitat (E 3.46) Continental humid meadows (Table 5).

For the territory of Osogovo Mt., with largest areas (0.9–1.6 da), the localities were situated higher on the mountain – 1665–1791 m a.s.l. – and they were also in largest abundance. At lower elevation (within the borders of E 2.33) the localities occupy smaller areas. This pattern can be explained by the better light regime at higher elevation, where the plant communities often are opened, mosaic and consist of short herbaceous representatives throughout. All the localities found in Osogovo Mt. occupy the altitude range of 1459–1791 m a.s.l. The exposition has a prevailing south or east component or a combination of both. The inclination varies from 3º to 15º. The humidity in the separate localities changes at small extent and determines the range of ecological conditions in the localities from hygrophilous (bogs) to mesophile and xeromesophile (grass communities).

The localities in West Balkan Mt. are situated from 1382 m a.s.l. to 1714 m a.s.l., and have expositions with dominant north component. Covering the largest area (5 da) appear to be the localities, found within the boundaries of F 2.2A2 between 1691 m a.s.l. and 1711 m a.s.l., but the *Alchemilla* species there are sparsely distributed. These communities present a complex of heath-berries with grasses. The smallest (0.05–0.5 da) are the localities which are situated within the habitat types E 2.33 and E 3.46, distributed between 1382 and 1429 m a.s.l. The localities of the *Alchemilla* spp. for both mountains are scattered throughout the territory of the investigated regions, which it difficult to utilizef the resources.

5. CONCLUSIONS

Taking into consideration the limited investigation area for both mountains, the seven ascertained *Alchemilla* species show the presence of a comparatively large diversity within the genus for Osogovo Mt. and West Balkan Mt.

A. crinita, which is reported for the first time for the territory of Osogovo Mt. and West Balkan Mt. and appears in the majority of the plots, turns out to be most common species for both regions.

The specified *Alchemilla* species occur in sublevels of the following main habitat types: Transition mires and quaking bogs (D 2.3), Mountain hay meadows (E 2.3), Moist or wet eutrophic and mesotrophic grassland (E 3.4), Acid alpine and subalpine grassland (E 4.3), Subalpine moist or wet tall-herb and fern stands (E 5.5), Evergreen alpine and subalpine heath and scrub (F 2.2). These types of habitats and the related communities meet to a high degree the ecological requirements of the *Alchemilla* species as they provide good light regime, high humidity and well drained soil at the respective elevation.

The low project coverage and relatively small sizes of the localities are conditions for the perceptibly low abundance of the *Alchemilla* species. That is why the resources of *Alchemilla* spp. in West Balkan Mt. and Osogovo Mt. are limited and can be harvested sustainably only for personal needs and under strict monitoring.

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Table 1: Floristic composition of the investigated localities with presence of *Alchemilla* spp. and assessment of the species abundance according to Braun-Blanquet (1964).

Tabela 1: Floristična sestava na raziskovanih ploskvah s prisotnostjo vrst *Alchemilla* spp. in ocena pogostnosti po Braun-Blanquet-u (1964).

Taxon	Floristic element	Biological type	Life form	Humidity	Osogovo Mt.						West Balkan Mt.								
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Apiaceae																			
Angelica pancicii Vandas	Bal	biann-p	H	hgm	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Angelica sylvestris L.	Eur-Sib	biann-p	H	hgm	.	.	.	.	.	.	.	.	2a	.	.	.	.	.	.
Carum carvi L.	Eur-As	biann-p	H	m	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.
Chaerophyllum hirsutum L.	subMed	p	H	hgm	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
Peucedanum austriacum (Jacq.) Koch	Pont	p	H	x	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Peucedanum oligophyllum (Grsb.) Vand.	Bal	p	H	x	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.
Seseli peucedanoides (Bieb.) Kos.-Pol.	Med-OT	p	H	m	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Aspidiaceae																			
Dryopteris filix-mas (L.) Schott	Boreal	p	H	m	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Asteraceae																			
Achillea collina J. Becker ex Reichenb.	Eur-subMed	p	H	xm	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.
Achillea distans Waldst. & Kit. ex Willd. ssp. *tanacetifolia* Janch	Alp-Carp-Bal	p	H	m	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Achillea millefolium L.	Eur-Sib	p	H	m	.	.	.	+	+	.	.	+	.	+	+	+	.	.	+
Anthemis macrantha Heuffel	Carp-Bal	p	H	hgm	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Carduus kerneri Simonkai ssp. *austro-orientalis* Franco	Bal	p	H	m								1							
Cirsium appendiculatum Griseb.	Bal	p	H	hgm	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.
Cirsium vulgare (Savi) Ten.	Eur-Med			xm	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Erigeron annuus (L.) Pers.	Boreal	a	Th	hgm	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Gnaphalium sylvaticum L.	Eur-WAs	p	H	xm	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Hieracium cymosum L. ssp. *sabinum* (Sebastiani & Mauri) Naegeli & Peter	Eur-Sib	p	H	m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hieracium pilosella L.	Eur-Med	p	H	m	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Inula germanica L.	subMed	p	H	m	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.
Leontodon crispus Vill.	Pont-Med	p	H	x	.	.	+	1	.	.	.	.	.	+	.	.	.	.	.
Leucanthemum vulgare Lam.	Eur-Sib	p	H	m	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Senecio nemorensis L.	Boreal	p	H	xm	.	.	.	.	.	.	.	.	.	+	+	.	+	+	+
Senecio papposus (Reichenb.) Less.	Carp-Bal	p	H	m	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Senecio subalpinus Koch	Carp-Bal	p	H	hgm	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Telekia speciosa (Schreber) Baumg.	subMed	p	H	hgm	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Tussilago farfara L.	Eur-As			hgm	.	.	.	.	.		2a		+	.	.	.	.	.	.
Athyriaceae																			
Athyrium filix-femina (L.) Roth	Kos	p	H	m	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Boraginaceae																			
Myosotis scorpioides L.	Eur-Nam	p	H	hgm	1	+	.	.	.	.	.	.	1	.	.	.	.	.	.
Brassicaceae																			
Rorippa pyrenaica (L.) Reichenb.	subMed	p	H	xm	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Thlaspi kovatsii Heuffel	Pont-Med	b	H	x	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Thlaspi praecox Wulfen	subMed	p	H	xm	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Campanullaceae																			
Campanula glomerata L.	Eur-OT	p	H	m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Campanula patula L.	Eur	p	H	m	.	.	+	.	.	.	.	+	.	.	1	.	.	.	.
Campanula scheuchzeri Vill.	Eur	p	H	x	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Campanula sparsa Friv.	Bal	a	Th	m	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.
Campanula trojanensis Kovanda & Ancev	Bul	p	H	m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Jasione heldreichii Boiss. & Orph.	Eur-Med	b	H	x	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.

Taxon	Floristic element	Biological type	Life form	Humidity	Osogovo Mt.						West Balkan Mt.								
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Caryophyllaceae																			
Cerastium alpinum L.	Arct-Alp	p	H	x	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Cerastium petricola Pancic	Bal	ann-b	Th-H	xm	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Dianthus armeria L.	Eur	ann-b	Th-H	m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Dianthus giganteus D'Urv.	subMed	p	H	xm	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Silene otites (L.) Wibel	Eur-Med	p	H	x	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Silene vulgaris (Moench) Garcke	Eur-As	a	Th	xm	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+
Stellaria graminea L.	Eur-As	p	H	m	.	.	+	1	.	+	.	+	.	+	+	+	.	+	+
Viscaria vulgaris Rohling ssp. *atropurpurea* (Griseb.) Stoj.	Eur-Sib	p	H	xm	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cistaceae																			
Helianthemum nummularium (L.) Miller	Alp-Med	p	H	x	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Cupressaceae																			
Juniperus sibirica Burgsd.	Boreal	sh	Ch	x	1	.	.	.	1	+	+	.	.	+	+	.	1	2a	2b
Cyperaceae																			
Carex echinata Murray	Kos	p	H	hg	2a	1	.	.	.	.	.	.	.	.	.	+	.	.	.
Carex hirta L.	Boreal	p	H	mhg	.	.	.	.	.	.	.	.	2a	.	.	.	.	.	.
Carex cinerea Poll.	Boreal	p	H	hg	.	.	.	.	.	.	.	.	2a	.	.	.	.	.	.
Carex nigra (L.) Reichenb.	Alp-Carp	p	H	hg	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex pallescens L.	Boreal	p	H	m	2b	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Eriophorum angustifolium Honckeny	Boreal	p	H	hg	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dipsacaceae																			
Scabiosa columbaria L.	Eur-Med	p	H	m	.	.	.	+	.	.	+	.	.	+	+	.	.	+	.
Succisa pratensis Moench	Eur	p	H	hgm	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Ericaceae																			
Bruckenthalia spiculifolia (Salisb.) Reichenb.	subMed	sh	Ch	mx	.	.	.	.	.	.	.	.	.	.	+	.	2a	.	2a
Vaccinium myrtillus L.	Boreal	sh	Ch	mx	+	.	.	.	+	.	.	.	.	1	+	+	2b	3	2b
Vaccinium vitis-idaea L.	Boreal	sh	Ch	mx	.	.	.	.	.	.	.	.	.	+	.	.	2a	2b	2a
Euphorbiaceae																			
Euphorbia cyparissias L.	Eur	p	H	x	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.
Fabaceae					.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chamaecytisus absinthioides (Janka) Kuzmanov	Bal	sh	Ch	mx	.	.	.	.	1	+	.	.	.	.	.	.	1	.	2a
Chamaespartium sagittale (L.) P. Gibbs	Eur			m	.	.	1	2a	+	1	.	.	.	.	+	.	1	.	.
Genista depressa Bieb.	subMed	sh	H	x	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.
Lathyrus pratensis L.	subBoreal	p	H	m	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.
Lotus corniculatus L.	Eur-Med	p	H	xm	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.
Lupinus albus L.	Med	p	H	xm	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.
Medicago falcata L.	Eur-As	p	H	mx	.	.	.	.	.	.	2a	.	.	.	.	.	.	.	.
Medicago minima (L.) Bartal.	Eur-As	a	Th	mx	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Trifolium alpestre L.	Eur-Sib	p	H	mx	.	.	.	+	+	.	+	.	.	+	.	.	.	.	.
Trifolium dubium Sibth.	Eur-Med	a	Th	mx	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Trifolium patens Schreber	subMed	a	Th	mx	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Trifolium pratense L.	subBoreal	p	H	m	.	.	+	+	+	.	.	+	+	.	+	.	.	.	.
Trifolium repens L.	Eur-Sib	p	H	m	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Gentianaceae																			
Gentiana cruciata L.	Eur-Sib	p	H	mx	.	.	.	.	.	.	.	.	.	+	.	.	.	+	1
Geraniaceae																			
Geranium pyrenaicum Burm.f.	subMed	p	H	xm	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Geranium sylvaticum L.	Boreal	p	H	xm	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Hypericaceae																			
Hypericum maculatum Crantz	Boreal	p	H	m	+	+	2b	2a	+	.	+	.	+	1	1	1	+	+	1
Hypericum perforatum L.	Kos	p	H	mx	.	.	.	.	.	.	.	2a	.	.	.	.	.	.	.

Taxon	Floristic element	Biological type	Life form	Humidity	Osogovo Mt.						West Balkan Mt.								
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Juncaceae																			
Juncus atratus Krocker	subMed	p	H	hg	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus conglomeratus L.	Eur	p	H	hg	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus effusus L.	subBoreal	p	H	hg	2a	1	.	.	.	.	.	.	.	.	.	1	.	.	.
Juncus inflexus L.	subBoreal	p	H	hg	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Luzula campestris (L.) DC.	subBoreal	p	H	x	+	.	.	+		+	.	.	.	+	.	.	.	.	.
Luzula luzuloides (Lam.) Dandy & Wilmott	Eur	p	H	m	+	.	.	+	1	.	.	.	.	1	2a	+	1	+	1
Lamiaceae																			
Acinos alpinus (L.) Moench	Alp-Carp	p	H	mx	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Ajuga genevensis L.	sPont	p	H	m	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Clinopodium vulgare L.	subBoreal	p	H	x	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Galeopsis tetrachit L.	Eur-As	a	Th	x	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Lamiastrum galeobdolon (L.) Ehrend. & Polatschek	Med	p	H	m	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Mentha arvensis L.	Eur-As	p	H	m	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Mentha longifolia (L.) Hudson	Eur-Sib	p	H	hgm	+	+	.	.	.	.	.	.	3	.	.	.	.	.	.
Mentha pulegium L.	Eur-As	p	H	hgm	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Prunella laciniata (L.) L.	Eur	p	H	m	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Prunella vulgaris L.	Kos	p	H	xm	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Stachis sylvatica L.	Eur-As	p	H	m	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Theucrium chamaedrys L.	subMed	p	H	x	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Thymus sp. div.		p	H	mx	.	.	.	.	+	1	.	.	.	.	+	1	1	+	+
Lentibulariaceae																			
Pinguicula balcanica Casper	Bal	p	H	mhg	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Liliaceae																			
Allium carinatum L.	Pont-Med	p	Cr	mx	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Allium cirrhosum Vandelli		p	Cr	mx	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Ornithogalum nutans L.	Eur	p	Cr	m	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.
Veratrum album L. ssp. *lobelianum* (Bernh.) Reichenb.	Eur-As	p	Cr	m	2a	.	1	.	+	.	.	.	.	.	.	+	.	.	.
Onagraceae																			
Chamaenerion angustifolium (L.) Scop.	subBoreal	p	H	m	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.
Epilobium collinum C.C.Gmelin	Eur-Med	p	H	m	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Epilobium palustre L.	subBoreal	p	H	hgm	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Ophioglossaceae																			
Botrychium lunaria (L.) Swartz	**Boreal**	p	H	m	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Orchidaceae																			
Dactylorhiza cordigera (Fries) Soo	Carp-Bal	p	Cr	hgm	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gymnadenia conopsea (L.) R.Br.	Eur-As	p	Cr	m	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Parnassiaceae																			
Parnassia palustris L.	subBoreal	p	H	mhg	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.
Pinaceae																			
Pinus sylvestris L.	subBoreal	shrub-t	Ch	mx	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.
Plantaginaceae																			
Plantago subulata L.	Med	p	H	x	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Plantago lanceolata L.	Kos	p	H	x	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
Poaceae																			
Agrostis capillaris L.	Boreal	p	H	xm	.	+	3	.	.	+	2a	2b	2a	2b	.	2b	2a	.	.
Anthoxanthum odoratum L.	Eur-As	p	H	xm	.	.	1	1	2a	.	1	.	.	2a	2a	+	1	2a	+
Arrhenatherum elatius (L.) Beauv. ex J.&C.Presl	Eur-As	p	H	xm	.	.	.	.	.	.	2a	.	.	.	.	.	.	.	.
Bellardiochloa variegata (Lam.) Kerguelen	subMed-Anat	p	H	m	.	.	.	.	2b	.	.	.	.	+	.	.	.	.	.
Briza media L.	Eur	p	H	m	.	.	.	+	.	.	2b	.	.	.	.	.	.	.	.
Calamagrostis arundinacea (L.) Roth	subBoreal	p	H	xm	.	.	.	.	.	.	.	.	.	.	1	.	.	1	2a

Taxon	Floristic element	Biological type	Life form	Humidity	Osogovo Mt.						West Balkan Mt.								
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cynosurus cristatus L.	Eur	p	H	xm	+	+	.	.	.	.	.	.	1	.	.	+	.	.	.
Cynosurus echinatus L.	subMed	a	Th	mx	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylis glomerata L.	Eur-As	p	H	mx	.	.	+	.	1	.	2a	2b	.	.	.	.	.	.	.
Deschampsia caespitosa (L.) Beauv.	Boreal	p	H	m	1	1	.	.	.	.	.	.	2b	.	.	+	.	.	.
Deschampsia flexuosa (L.) Trin.	Boreal	p	H	m	.	.	.	.	.	2b	.	.	.	.	2a	+	1	2a	2a
Elymus repens (L.) Gould.	Boreal	p	H	m	.	.	.	.	.	.	.	.	2a	.	.	.	.	.	.
Festuca dalmatica (Hackel) K.Richter	subMed	p	H	m	.	.	2b	3	.	.	.	.	.	.	.	.	.	.	.
Festuca nigrescens Lam.	Eur	p	H	m	1	1	.	.	3	3	.	.	.	2b	+	.	+	2a	+
Festuca pratensis Hudson	Boreal	p	H	m	.	.	+	3	.	.	2a	1	1	.	.	.	.	.	.
Festuca rubra L.	Boreal	p	H	m	.	.	.	.	.	3	1	.	.	.	.	1	.	.	.
Holcus mollis L.	Eur	p	H	m	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Molinia coerulea (L.) Moench	Boreal	p	H	hgm	1	+	.	.	.	.	.	.	.	.	2a	.	.	.	.
Nardus stricta L.	Arct-Alp	p	H	mx	.	.	.	2b	2a	3	.	.	.	2a	.	.	2a	.	.
Phleum alpinum L.	Arct-Alp	p	H	m	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Phleum phleoides (L.) Karsten	Eur-As	p	H	xm	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Phleum pratense L.	Eur-subMed	p	H	m	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.
Poa pratensis L.	Kos	p	H	m	.	.	+	.	.	.	.	1	.	1	.	.	+	.	.
Sesleria comosa Velen.	Bal	p	H	mx	.	.	.	.	.	.	.	.	.	.	2b	.	.	.	.
Trisetum flavescens (L.) Beauv.	Boreal	p	H	xm	.	.	2b	.	.	.	.	1	.	.	.	.	.	.	.
Polygonaceae																			
Bistorta major S.F.Gray	Eur-As	p	H	hgm	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex acetosa L.	Boreal	p	H	m	.	.	.	.	.	.	.	1	.	.	.	2a	.	+	.
Rumex acetosella L.	Eur-subMed	p	H	mx	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Rumex alpinus L.	Alp-Carp-Bal	p	H	hgm	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Primulaceae																			
Primula veris L.	Eur-Med	p	H	m	.	.	.	1	.	.	+	.	.	.	.	.	.	.	.
Ranunculaceae																			
Caltha palustris L.	Eur	p	H	hg	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.
Ranunculus acris L.	Kos	p	H	m	2b	+	.	.	+	.	.	1	.	+	+	+	+	.	.
Ranunculus bulbosus L. ssp. *aleae* (Willk.) Rouy & Fouc.	Eur	p	H	mx	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Ranunculus polyanthemos L.	Eur-subMed	p	H	mx	2b	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus repens L.	subMed	p	H	m	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus serbicus Vis.	Ap-Bal	p	H	hgm	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Rosaceae																			
Agrimonia eupatoria L.	Eur-Med	p	H	xm	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Alchemilla crinita Buser	Eur	p	Cr	m	1	2a	+	2a	+	.	.	+	2b	.	.	1	.	.	.
Alchemilla erythropodoides Pawl		p	Cr	m	.	+	.	.	+	.	.	.	.	+	1	.	+	.	+
Alchemilla flabellata Buser	Alp-Carp	p	Cr	m	.	.	.	.	.	2a	.	.	.	.	.	.	.	.	+
Alchemilla glabra Neygenf.	Eur-Sib	p	Cr	m	.	2a	.	.	.	.	.	.	.	.	+	1	.	+	+
Alchemilla glaucescens Wallr.	Eur	p	Cr	m	1	.	.	.	.	.	+	.	.	.	+	.	+	.	+
Alchemilla monticola Opiz	Eur-Sib	p	Cr	m	.	.	+	+	.	2a	.	+	+	.	.	.	.	.	.
Filipendula ulmaria (L.) Maxim.	subBoreal	p	H	hg	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Fragaria vesca L.	subBoreal	p	H	m	.	.	.	.	+	.	1	.	.	+	.	+	.	+	.
Geum coccineum Sibth. & Sm.	subMed	p	H	hgm	2a	.	.	.	.	.	.	.	.	.	.	2a	.	.	.
Geum urbanum L.	subBoreal	p	H	m	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Potentilla erecta (L.) Rauschel	subBoreal	p	H	m	2a	+	.	.	.	.	.	.	+	+	+	1	.	+	+
Potentilla micrantha Ramond ex DC	Eur-subMed	p	H	m	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Potentilla ternata C.Koch	Carp-Bal	p	H	m	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Rosa canina L.	subMed	sh	Ph	x	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Rosa vosagiaca Desportes	subMed	sh	Ph	x	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Rubus idaeus L.	subBoreal	sh	Ph	mx	.	.	.	.	1	.	.	1	+	.	+	+	.	.	+
Sanguisorba officinalis L.	subBoreal	p	H	m	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.

Taxon	Floristic element	Biological type	Life form	Humidity	Osogovo Mt.						West Balkan Mt.								
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rubiaceae																			
Asperula aristata L.f. ssp. *longiflora* (Waldst. & Kit.) Hayek	subMed	p	H	xm	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Asperula cynanchica L.	Eur-Sib	p	H	x	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Cruciata glabra (L.) Ehrend.	sMed-CAs	p	H	m	.	.	.	+	.	+	+	.	.	+	+	.	+	.	+
Cruciata laevipes Opiz	sMed-CAs	p	H	m	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.
Galium album Miller	Eur-As	p	H	m	.	+	.	.	+	.	.	.	.	+	.	.	.	.	+
Galium aparine L.	Eur-As	p	H	xm	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Galium uliginosum L.	Eur-As	p	H	hgm	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Galium verum L.	Eur-As	p	H	m	.	.	+	2a	.	.	2a	+	.	+	.	.	.	.	.
Salicaceae																			
Salix caprea L.	subBoreal	shrub-t	Ph	hgm	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Scrophulariaceae																			
Euphrasia hirtella Jordan ex Reuter	Eur-As	a	Th	m	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Linaria dalmatica (L.) Miller	Med	p	H	xm	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Melampyrum sylvaticum L.	Eur	a	Th	m	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Rhinanthus alpinus Baumg.	Alp-Carp-Bal	a	Th	m	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Rhinanthus rumelicus Velen.	Eur-Med	a	Th	mx	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.
Scrophularia nodosa L.	subBoreal	p	Cr	m	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Verbascum longifolium Ten ssp. *pannosum* (Vis.) Murb.	Eur-Med	b	H	mx	.	.	+	.	+	.	.	.	.	+	.	+	+	+	+
Veronica chamaedrys L.	Eur-As	p	H	m	.	.	.	+	+	.	.	.	.	+	+	+	.	+	+
Veronica jaquinii Baumg.		p	H	xm	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Veronica vindobonensis (M.Fischer) M.Fischer	Eur	p	H	m	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.
Thymelaeaceae																			
Daphne mezereum L.	Eur-Sib	sh	Ph	m	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Urticaceae																			
Urtica dioica L.	Boreal	p	H	m	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.
Violaceae																			
Viola aetolica Boiss. & Heldr.	Bal	ann-b	Th-H	xm	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Viola dacica Borbas	Pont-Med	p	H	m	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+
Viola tricolor L.	Eur-As	a	Th	m	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.
Sphagnaceae																			
Sphagnum spp.					+	+	.	.	.	.	.	.	.	.	.	+	.	.	.

Table 2: Habitat types with presence of *Alchemilla* spp. in Osogovo Mt.

Table 2: Habitatni tipi s prisotnostjo *Alchemilla* spp. na gorovju Osogovo.

	GPS locations	*Alchemilla* spp.	EUNIS habitat type	Habitat diagnostic species from the descriptions
1	N 42 11.302 E 22 37.059	*A. crinita, A. erythropodoides, A. glabra, A. glaucescens*	D 2.3I Balkanic quaking bogs	*Sphagnum* spp., *Pinguicula balcanica, Carex echinata, Potentilla erecta, Eriophorum angustifolium, Parnassia palustris*
2	N 42 11.840 E 22 37.471			
3	N 42 10.247 E 22 37.939	*A. crinita, A. monticola*	E 2.33 Balkan mountain hay meadows	*Trisetum flavescens, Festuca pratensis, Rhinanthus rumelicus*
4	N 42 08.672 E 22 39.325			
5	N 42 11.834 E 22 37.447	*A. crinita, A. erythropodoides, A. flabellata, A. monticola*	E 4.318 Oro-Moesian mat-grass swards	*Festuca nigrescens, Festuca rubra, Anthoxantum odoratum, Nardus stricta*
6	N 42 11.401 E 22 35.362			

Table 3: Habitat types with presence of *Alchemilla* spp. in West Balkan Mt.
Tabela 3: Habitatni tipi s prisotnostjo *Alchemilla* spp. na gorovju Stara Planina.

	GPS locations	*Alchemilla* spp.	EUNIS habitat type	Habitat diagnostic species from the descriptions
1	N 43 06.335 E 23 07.354	*A. crinita, A. glaucescens, A. monticola*	E 2.33 Balkan mountain hay meadows	*Festuca pratensis, Trisetum flavescens, Rhinanthus rumelicus*
2	N 43 07.024 E 23 07.567			
3	N 43 06.373 E 23 08.808	*A. crinita, A. monticola*	E 3.46 Continental humid meadows	*Festuca pratensis, Mentha longifolia, Deschampsia caespitosa, Juncus inflexus*
4	N 43 08.913 E 23 11.830	*A. erythropodoides*	E 4.318 Oro-Moesian mat-grass swards	*Anthoxanthum odoratum, Nardus stricta, Festuca nigrescens, Bellardiochloa violacea*
5	N 43 08.391 E 23 11.541	*A. erythropodoides, A. glabra, A. glaucescens*	E 4.3944 Oro-Moesian [*Sesleria comosa*] grasslands	*Sesleria comosa*
6	N 43 07.059 E 23 07.725	*A. crinita, A. glabra*	E 5.572 Moesian scarlet avens tall herb communities	*Geum coccineum, Alchemilla* spp.
7	N 43 08.164 E 23 11.540	*A. erythropodoides, A. flabellata, A. glabra, A. glaucescens*	F 2.2A2 Balkano-Hellenic dwarf bilberry heaths	*Vaccinium myrthilus, Vaccinium vitis-idaea*
8	N 43 08.251 E 23 11.523			
9	N 43 08.339 E 23 11.506			

Table 4: Habitat types with presence of *Alchemilla* spp. and characteristics of the localities in Osogovo Mt.
Tabela 4: Habitatni tipi s prisotnostjo *Alchemilla* spp. in značilnosti rastišč na gorovju Osogovo.

	GPS locations	EUNIS habitat type	Locality area	Project coverage	Exposition	Slope	Humidity	Altitude
1	N 42 11.302 E 22 37.059	D 2.3I Balkanic quaking bogs	0.9 dka	7 %	south-west	5°	meso-hygrophile, hygrophile	1665 m
2	N 42 11.840 E 22 37.471		0.2 dka	15 %	south	15°	meso-hygrophile, hygrophile	1669 m
3	N 42 10.247 E 22 37.939	E 2.33 Balkan mountain hay meadows	0.1 dka	2 %	east	10 °	mesophile	1564 m
4	N 42 08.672 E 22 39.325		0.1 dka	10 %	east	5°	mesophile	1459 m
5	N 42 11.834 E 22 37.447	E 4.318 Oro-Moesian mat-grass swards	0.05 dka	2 %	souht-east	15°	mesophile, xero-mesophile	1565 m
6	N 42 11.401 E 22 35.362		1.6 dka	15 %	south-east	3°	mesophile, xero-mesophile	1791 m

Table 5: Habitat types with presence of *Alchemilla* spp. and characteristics of the localities in West Balkan Mt.
Tabela 5: Habitatni tipi s prisotnostjo *Alchemilla* spp. in značilnosti rastišč na gorovju Stara Planina.

	GPS locations	EUNIS habitat type	Locality area	Project coverage	Exposition	Slope	Humidity	Altitude
1	N 43 06.335 E 23 07.354	E 2.33 Balkan mountain hay meadows	0.05 dka	1 %	south-west	3°	xero-mesophile, mesophile	1415 m
2	N 43 07.024 E 23 07.567		0.1 dka	2 %	north	5°	xero-mesophile, mesophile	1429 m
3	N 43 06.373 E 23 08.808	E 3.46 Continental humid meadows	0.5 dka	25 %	-	-	hygro-mesophile	1382 m
4	N 43 08.913 E 23 11.830	E 4.318 Oro-Moesian mat-grass swards	1,5 dka	1 %	north-east	5°	xero-mesophile, mesophile	1467 m
5	N 43 08.391 E 23 11.541	E 4.3944 Oro-Moesian [*Sesleria comosa*] grasslands	2.0 dka	7 %	north	5°	xero-mesophile, mesophile	1714 m
6	N 43 07.059 E 23 07.725	E 5.5724 Moesian scarlet avens tall herb communities	1.0 dka	10 %	north	5°	hygro-mesophile, mesophile	1418 m
7	N 43 08.164 E 23 11.540	F 2.2A2 Balkano-Hellenic dwarf bilberry heaths	5.0 dka	2 %	north-east	5°	mesophile, xero-mesophile	1691 m
8	N 43 08.251 E 23 11.523		0,5 dka	1 %	south-west	30°	mesophile	1704 m
9	N 43 08.339 E 23 11.506		5.0 dka	4 %	north	30°	mesophile	1711 m