New chorological data for some rare plants in Montenegro

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Abstract
In this paper, we will present new chronological data for seven rare species, collected during floristic research in different parts of Montenegro. Besides the distribution data for each taxa. This paper outlines information about habitats, ecology as well as estimation of IUCN category. The following taxes will be analyzed: *Asyneuma canescens* (Waldst. & Kit) Griseb & Schenk, *Epipogium aphyllum* Sw., *Euphrasia minima* DC., *Gymnospermium scipetarum* E. Mayer & Pulević, *Veronica scutellata* L., *Vicia oroboides* Wulfen and *Tragopogon dubius* Scop.

Keywords: chorological data, distribution, rare plants, IUCN threatened status, Montenegro.

Introduction

Despite its small territory, according to its topographic, climatic and geological complexity Montenegro is characterized by a significant number of different habitat types. A larger number of (micro) habitats practically means a larger number of niches exploitable by species with different ecological requirements (Tews et al. 2004). If the richness of the flora of an area is expressed by the ratio of the number of species per square meter, Montenegro has the richest flora of all European countries (Stevanović et al. 1995). The number of species and subspecies of vascular plants in Montenegro exceeds 3600 (Rohlena 1942, Pulević 2005, Stešević et al. 2008). Despite the long tradition of botanical research the floristic data for some area is extremely poor (for example Pljevlja town surrounding) and there are numerous unresolved taxonomic problems. So, the research is ongoing and almost every year new floristic findings for Montenegro are published (Stešević & Bubanja 2017; Stešević & Berg 2015; Caković et al. 2014; Bubanja & Stevanović 2013), new species are described (Janković et al. 2016) as well as long neglected taxa illuminated (Caković et al. 2017; Barina et al. 2017; Caković et al. 2015).

The main challenge affecting plants conservation efforts in Montenegro is the lack of data about distribution and population size of rare and protected species. In this paper we will present new chorological data for seven rare species, collected during floristic research in different parts of Montenegro.

Material and Methods

Material has been collected during floristic research in different parts of Montenegro, mostly in the north and eastern regions, and stored in the Herbarium of Faculty of Natural Sciences and Mathematics, Department of Biology in Podgorica (TGU!). Identifications of plants were conducted according to Pignatii (1982), Turin *et al.* (1964-1980, 1993) and Domac (1973). In addition to field data, we examined all relevant literature for the presented species. In order to conduct estimation of the threatened status of each species on the territory of Montenegro we used the most recent IUCN Red List Categories and Criteria (IUCN 2012a) and Guidelines for application of IUCN Red List Criteria at regional and national levels (IUCN 2012b). NATURA2000 habitats are adjusted according to the Interpretation manual of European Union habitats (European Commission Directorates General 2007).

Results

Asyneuma canescens (Waldst. & Kit) Griseb & Schenk
New chorological data in Montenegro: vicinity of Pljevlja, Kozica village, coordinates: N 43°15'07.4" E 019°31'18.54" and 43°14'38.58" E 019°30'45.04"
Population size: about 20 individuals
IUCN threatened status in Montenegro: VU (Vulnerable) (B2abiii; D2)

***Epipogium aphyllum* Sw.**
New chorological data in Montenegro: National park Prokletije, Grbaje, coordinates: N 42°32'49.89" E 019°47'06.32"
Population size: 4 individuals
IUCN threatened status in Montenegro: CR (Critically endangered) (D1)

***Euphrasia minima* DC.**
New chorological data in Montenegro: Prokletije mountain, closed to Hridsko jezero, coordinates: 42°34'13.13" E 20°02"01.93"
Population size: about 50 individuals

IUCN threatened status in Montenegro: LC (Least concern)

***Gymnospermium scipetarum* E. Mayer & Pulević.**
New chorological data in Montenegro: Garač mountain, Locality: near pond Lera, coordinates: N 42°32'43.84" E 19°1'30.64"
Population size: about 150 individuals

IUCN threatened status in Montenegro: R (rare)

Veronica scutellata L.
New chorological data in Montenegro: vicinity of Pljevlja, Kozica village, coordinates: N 43°15'16.98" E 019°31'39.89"
Population size: 7 individuals
IUCN threatened status in Montenegro: VU (Vulnerable) (D1, D2) (LC)

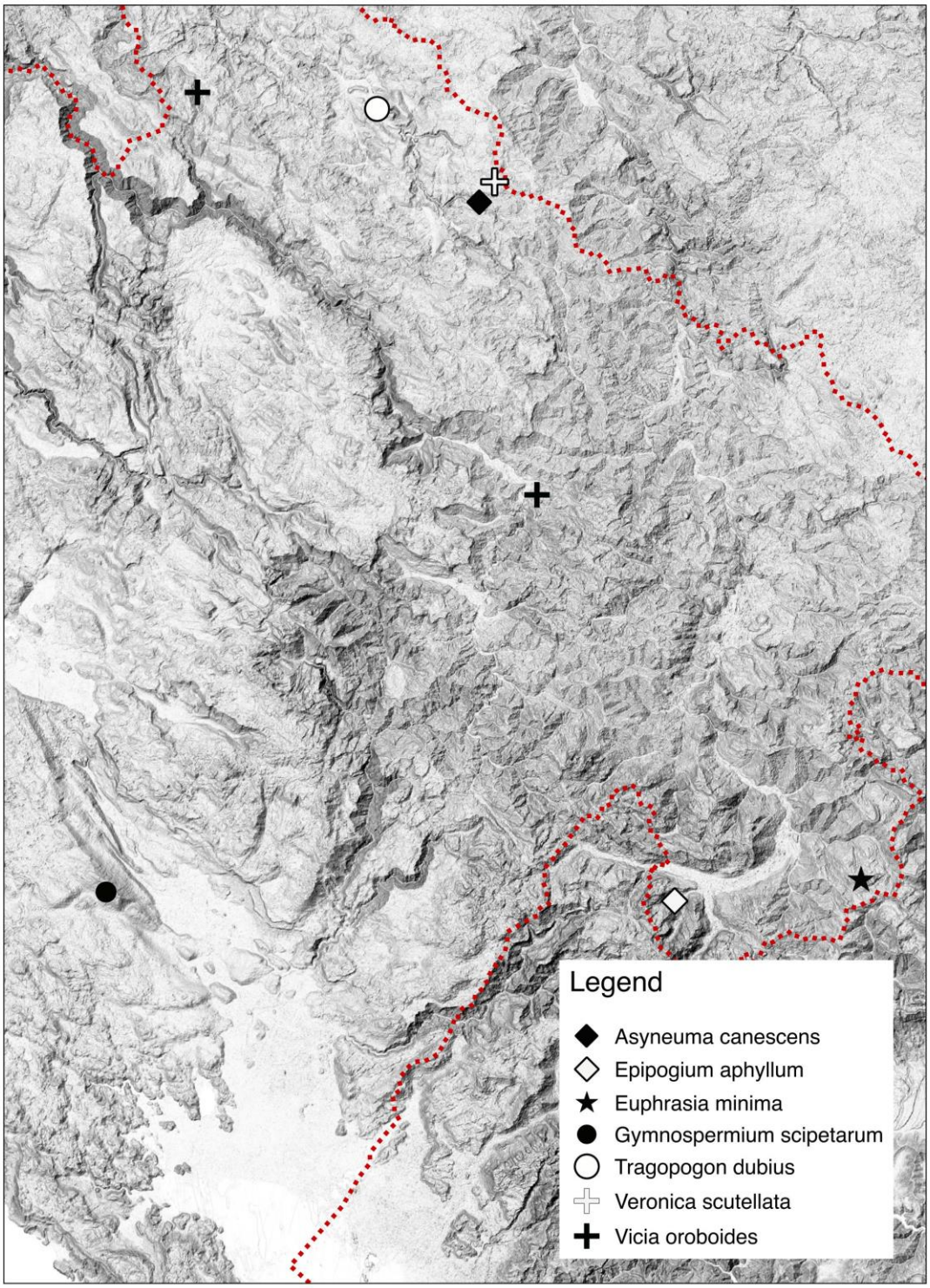


FIGURE 1: MAP OF NEW CHOROLOGICAL DATA FOR SEVEN RARE SPECIES IN MONTENEGRO

Figure 1. Map of the new chorological data for seven rare species in Montenegro

***Tragopogon dubius* Scop.**
New chorological data in Montenegro: vicinity of Pljevlja, Rabitlje, coordinates: N 43°19'28.40" E 019°22'1.02" and N 43°19'20.32" E 019°21'39.21"
Population size: about 50 individuals

IUCN threatened status in Montenegro: VU (Vulnerable) (D1, D2)

Vicia oroboides Wulfen
New chorological data in Montenegro: Bjelasica mountain, National Park Biogradska gora, coordinates: N 42°53'37.72" E 019°36'13.52"; Ljubišnja mountain, coordinates: N 43°18'55" E19°8'33" and N43°19'46" E19°8'29"
Population size: NP Biogradska gora 3 individuals; Ljubišnja mountain 10 individuals and 3 individuals

IUCN threatened status in Montenegro: EN (Endangered) (D)

Discussion

Asyneuma canescens (Waldst. & Kit) Griseb & Schenk. has been recorded so far only from Lovćen mountain (Rohlena 1942; Stanković Tomić 1972), despite the fact that Lovćen National park's quality of habitats is declining due to the construction of tourist facilities and the reduction of livestock production. Also, the construction of the ropeway in this National park is planned. In Kozica village *Asyneuma canescens* was found in the habitat 5130 *Juniperus communis* formations on heaths or calcareous, which presented stage in succession of mesophilic or xerophilic grassland of the Festuco-Brometea class. This habitat is threatened by the abandonment of traditional extensive grazing. Taking into account the above mentioned species are therefore assessed as Vulnerable under criteria B and D. Due to decline of the quality of habitats, regional status should not be changed.

Habitat and ecology: This species inhabits dry grasslands, subalpine meadows, stony places. In Kozica village it was recorded on the NATURA 2000 habitat 5130 *Juniperus communis* formations on heaths or calcareous.

General distribution: It is native to eastern Central Europe, Eastern Europe and Balkan Peninsula.

***Epipogium aphyllum* Sw.** is one of the rarest orchid species in Montenegro. The first record of the presence of *E. aphyllum* in Montenegro was published by Beck and Szyszkowicz (1888), who reported it from Montis Mojan close to the Albanian border. After almost a hundred years Lakušić (1983) indicated the existence of given taxon on the Durmitor mountain. The same site was reported in Höllhuber (2013). There are no data about population size for mentioning localities, but *E. aphyllum* usually occurs in small populations composed of a few individuals (Vičko et al. 2003; Šegota & Alegro 2011; Cole 2014). Due to this fact, as well as that we found only 4occurances of this specie, according to criteria D1 the IUCN threat category is CR (Critically endangered). Although all three findings are within the boundaries of national parks, forest cutting also present a threat to habitat quality.

An orchid is rare in neighboring countries: in Croatia it is strictly protected by low (Šegota & Alegro 2011), IUCN threatened status in Serbia is CR (DD) (Tomović et al. 2007), this specie is reported only in one locality on the territory of Albania (Ermelinda et al. 2015) and IUCN status in Bosnia is DD (Đug et al. 2013). Since the species is

sparsely scattered in a neighboring area, the regional Red List Category need not to be changed.

Habitat and ecology: *E. aphyllum* is myco-heterotrophic species completely devoid of chlorophyll, feeding on decomposing organic substances acquired from fungi (Delforge 2006). This orchid can flower, and often create fruit under the ground, consequently, the specie is not easy to spot. At one locality which we exhamined it s blossoming has been observed every few years. It inhabits shadowy broadleaved, coniferous and mixed forests, in submountain and the mountain latitudinal zone (Vičko et al. 2003). In the National park Prokletije species was noticed within fir and beech dominated forest (ass. *Abieto-Fagetum moesiacae* Bleč. et Lkšić. 70; NATURA 2000 habitat - 91B0 Moesian silver fir forests), near the forest spring. Herb layer is poor, covering about 10 % and dominant species are: *Prenanthes purpurea, Galium sylvaticum, Polypodium vulgare, Hepatica triloba, Saxifrga rotundifolia, Cardamine bulbifera, Veronica urticifolia, Sanicula europea.*
General distribution: Northern Scandinavia, Central and Southeast Europe, Caucasus, Siberia.

***Euphrasia minima* DC.** Up to date data on the distribution of *Euphrasia minima* in Montenegro indicate that this specie is present on the wider Kolašin theritory (Kučki Kom, mountain Pej, Kolašin, Rohlena 1942). Despite it, The Med-Check list did not include the territory of Montenegro in the distribution area. The new finding of species is located in the strictly protected zone of the National Park Prokletije. Also, the habitat of the species, Kolašin, is not endangered. Keeping this in mind, as well as area of occupancy and area of occurrence, IUCN threatened status of species is LC (Least concern).

Habitat and ecology: It inhabits alpine and subalpine calcareous grassland. In the National Park Prokletije species was noted on the NATURA 2000 habitat 4060 Alpine and boreal heaths. On this locality vegetation covers almost 100 % with dominant species: *Vaccinium myrtillus, Juniperus nana, Vaccinium uliginosum, Bruckenthalia spiculifolia, Rosa pendulina, Daphne mezereum.*
General distribution: South and central Europe, from south and central France and Carpathians, towards the south of Pirineus, Apennines and Bulgaria.

Gymnospermium scipetarum E. Mayer & Pulević. *Gymnospermium shqipëtarum was described from Albania (Kruja and Elbasan region) in 1976. by K. Paparisto and Xh. Qosja.* Because Paparisto & Qosja did not designate a type, invalidating the name, Mayer and Pulević (1983) validated it with *G.scipetarum* [Paparisto & Qosja] E.Mayer & Pulević and typified it based on materials collected on the Vrsuta mountain in Montenegro (Tan et al. 2011). Later *G.scipetarum* treated as a subspecies of the wider spread *G. altaicum* (Pallas) Spach (Stearn & Webb 1993; Tan & Mulaj 2001). However, the last taxonomic revision of European taxa of *Gymnospermium* showed that *G.scipetarum* is „good" species (Barina et al. 2017).

Due to early flowering and underground persistence over most of the year, distribution of species remains insufficiently known and many populations were discovered only in the last decade (Barina et al. 2017). For years we suspected that Vrsuta is not the only site on which the specie is growing. On March 16th of 2017 another population was discovered on Mount Garač at 1140 m above sea level in the dried part of this rocky mountain near the pond Lera. Ca. 150 individuals were distributed over an area of 500 m^2. Individuals were in full bloom. The intreguing fact is that this population showed an opposite phonological pattern as reported by Tan et al. (2011). According to the author the basal leaves develop and emerge before

the flowering in more than 75% of the plants observed. In the population from Garač basal leaves emerged postfloral. During the second visit to this site, on April 3rd 2017, the basal leaves were fully developed, 30% of the individuals were flowering and the others had already developed fruits.

The new record of the species did not change the IUCN threatened status in Montenegro (R, Petrović & Stešević 2010).

Habitat and ecology: In oak and mixed beech forests on limestone rocks, forest clearings and deforested hollows, 750 - 1400 m. In Montenegro it was recorded in degraded forest of *Seslerio-Ostryetum carpinifoliae*.

General distribution: Until recently, the species was treated as an Illyrian endemic (Albania, Montenegro), but 2014. one population was found in Italy (Rosati et al., 2014). Finding on the Garač is the most northern point of the distribution area.

***Veronica scutellata* L.** There are only a few old published data on the distribution of this species in Montenegro. It was recorded by Pantoczek: near the Crno jezero and Riblje jezero (Durmitor), in the Rijeka Crnojevića and Danilovgrad (Pantoczek 1874). Including our data recorded localities are quite scattered. Thus, it is evident that the distribution of this plant in the territory of Montenegro is still poorly known.

According to D1 and D2 the IUCN threat category at regional level is VU (vulnerable). But, taking account the possibility of immigration from the neighboring area, the regional Red List Category should be changed to LC (Least Concern).

Habitat and ecology: This perennial herb grows in a wide range of wetland habitats: river banks, marshes, bogs, margins of streams. We recorded it near the small pond located in the clearing in the fir forest, as a constituent of ass. *Typho angustifoliae-Phragmitetum australis* (*Tüxen et Preising 1942*) *Rivas* Martínez.

General distribution: It occurs more or less throughout Europe, as well as throughout most of northern North America.

Vicia oroboides Wulfen. The first finding of this species in Montenegro belongs to Aalto et al. (1972), who found it on the Durmitor mountain, west of the Crno jezero. During our research it was recorded in the mountains Bjelasica (NP Biogradska Gora) and Ljubišnja.

Vicia oroboides has relatively restricted spread, but populations appear to be stable throughout its range. Therefore, on the global level, it is assessed as LC (Least Concern) (Osborne 2011). However, only for small populations have been recorded in Montenegro and IUCN threatened status on the regional level is EN (Endangered) under the criteria D.

Habitat and ecology: Species grows in decidious, coniferous and mixed forests from mountain to subapline zone, on fresh and nutrient-rich soil. It is reported for different associations of an order *Fagetalia sylvaticae* Pawlowski 1928 (Šilić 1990). Also, it can be found in pasture (Maxted 1995). In the National park Biogradska gora the species grows in association *Fagetum moesiacae montanum* Blečić & Lakušić 1970 (NATURA 2000 91W0 Moesian beech forest). The forest is absolutely pure and composed only of beech trees. In the herb layer dominates: *Allium ursinum, Saxifraga rotundifolia, Cardamine eneaphyllos, Cardamine bulbifera, Dryopteris filix-mas.*

On the Ljubišnja mountain the species is reported in two NATURA 2000 habitat types:

i) 91WO Moesian beach forest, and ii) 91BA Moesian silver fit forest. The Moesian beech is not absolutelly pure, but with participation of sparse fir and spruce trees. Herb layer is rather lush and composed of: *Asperula odorata, Dryopteris filix-ms,*

Poylstichum aculeatum, Saxifraga rotundifolia, Dentaria enneaphyllos, Dentaria bulbifera, Asarum europaeum, Lamium luteum etc. In the Moesian silver fir forest the fir is accompanied by spruce and beech. Herb layer is lush and composed of: *Vaccinium myrtilus, Asperula odorata, Galium rotundifolium, Dryopteris filix-mas, Sanicula europaea, Asarum europaeum, Mycelis muralis, Lamium luteum, Milium effusum*.

General distribution: Balkan Peninsula, Apennine peninsula, Slovenia, Austria,

***Tragopogon dubius* Scop.** Until now, this specie has been known only from one locality in Montenegro. Stevanović et al. (1990-1991(1993)) and Jovanović et al. (2013) were recorded its presence on the ruderal habitat in the Žabljak town. We found it at the territory of Pljevlja municipality, at several nearby localities (Rabitlje vilage). Area of occupancy is about 10 km².

Habitat and ecology: Species grows in meadows, fields, disturbed habitats from lowland to montane level. It is reported on the montane rocky pastures.

General distribution: Most of Europe (excluding Atlantic islands and northern part) to west Asia (EURO+MED, 2006-).

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