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The vascular flora of the Valamara mountain range (SE Albania), with three new records for the Albanian flora

Abstract

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As a result of floristic investigations in the Valamara mountain range carried out between 2007 and 2016, 567 taxa belonging to 305 genera and 89 plant families were recorded, of which 307 taxa are reported as new for the area. A phytogeographical analysis showed that the Eurasian chorological type was the most dominant comprising 126 taxa (22.2% of the flora), the second was Balkan with 104 taxa (18.3%). There are 9 endemic and subendemic taxa. *Epilobium alsinifolium*, *Dichoropetalum stridii* and *Taraxacum pindicum* are new for the Albanian flora. Life-form analysis indicates that 56.8% of the species are hemicryptophytes; this high percentage points to the Mediterranean nature of the investigated area. A total of 119 species (20.9 %) are listed as deserving conservation status. Of these, 49 are in the Albanian Red List, 76 species in the IUCN Red List, two in the Habitats Directive, one included in Annex I of the Bern Convention and seven species in Appendix II of CITES.

Key words: floristic investigation, biodiversity, phenology, chorology, conservation.

Introduction

Valamara is a mountain range in south-eastern Albania, located between the districts of Korça, Pogradeci and Gramshi. It has a number of peaks, the highest of which is 'Maja e Valamarës', which reaches 2373 m elevation. The flora of the Valamara Mts is poorly explored and no detailed studies are available. The first floristic records from this region are by Markgraf (1927, 1931) and Demiri (1959). Sporadic floristic records were later published by Paparisto & Qosja (1976), Gölz & Reinhard (1984), Barina & Pifkó (2008, 2011), Shuka & Tan (2009) and Meyer (2011), and some notes on the vegetation of the area were published by Vangjeli (1983) and Buzo (1990). On the basis of these references and the collections deposited in the Tirana herbarium (TIR, 262 taxa are documented for the Valamara Mts).

The geographical location, complex topography, climate characteristics, different rock substrata and soil types and hydrological conditions, are factors contributing to a rich flora

and vegetation and make the Valamara Mts unique. In this study we provide a list of the vascular flora together with an analysis of taxonomy, chorology, phenology, life form and conservation status for each species.

Study area: geology and climate

The three main summits of the Valamara Mts are 'Guri i Topit' (2122 m), 'Lenie' (2013 m) and 'Valamara ' (2373 m); at *ca*. 2100 m there are eight glacial lakes (Fig. 1).

The geology of the study area consists mainly of different sedimentary rocks spanning from early Cretaceous to Oligocene (140–30 million year old), together with some older magmatic Jurassic rocks (170 million years). The two main rock types encountered in the study area are flysch and ophiolite. Serpentine (ophiolithic) substrate covers large areas in the Valamara Mts, whereas limestone and various kinds of acidophilous metamorphic rocks are less prominent (Kabo 1990-1991; Norconsult 2010).

According to the categories of climatic regions in Albania, the Valamara Mts belong to the Southeast Mountain Mediterranean zone. The main characteristics of this climatic zone are dry summers and wet winters. The average annual temperatures vary from 7.5 °C to 14.7 °C and the coldest month of the year is January with an average temperature of -1.9 °C. July is the warmest month with an average temperature between 16.4 °C and 23.6 °C. Snowfall occurs annually and the number of days with snow cover varies from 30–35 days/year in the lower regions, to 80–90 days/year in the highest parts (Kabo 1990-1991; Norconsult 2010).

Vegetation

Due to the variation in altitude (from 700 to 2373 m), complex topography and the different rock substrates, a wide range of vegetation and habitat types are found within the study area. The vegetation of the Valamara Mts occurs in two different belts based on climatic and soil conditions:

1) montane forests are found at altitudes of *ca.* 700–1600 m, and are dominated by *Fagus sylvatica* and *Pinus nigra*; some smaller areas are covered by *Pinus heldreichii*. At lower elevations the vegetation is dominated by *P. nigra*.
2) alpine habitats: timberline is usually at an altitude of 1700 m asl.. The subalpine brushwood consists of low shrubs such as *Juniperus communis* subsp. *nana*, *Daphne oleoides*, *Rosa* spp. and *Chamaecytisus* spp. In many places the timberline has been artificially lowered by humans, and regeneration is prevented by grazing. Summer grazing by sheep and goats is often heavy. Above the timberline a variety of habitats occur, including snowbed meadows, mountain grasslands, screes and rocks; vegetation type and species composition are much influenced by the bedrock. Dry grassy moors cover vast areas above timberline and are dominated by *Carex* sp. pl., *Stipa* sp. pl., *Festuca* sp. pl., *Sesleria* sp. pl., *Nardus stricta*, etc.

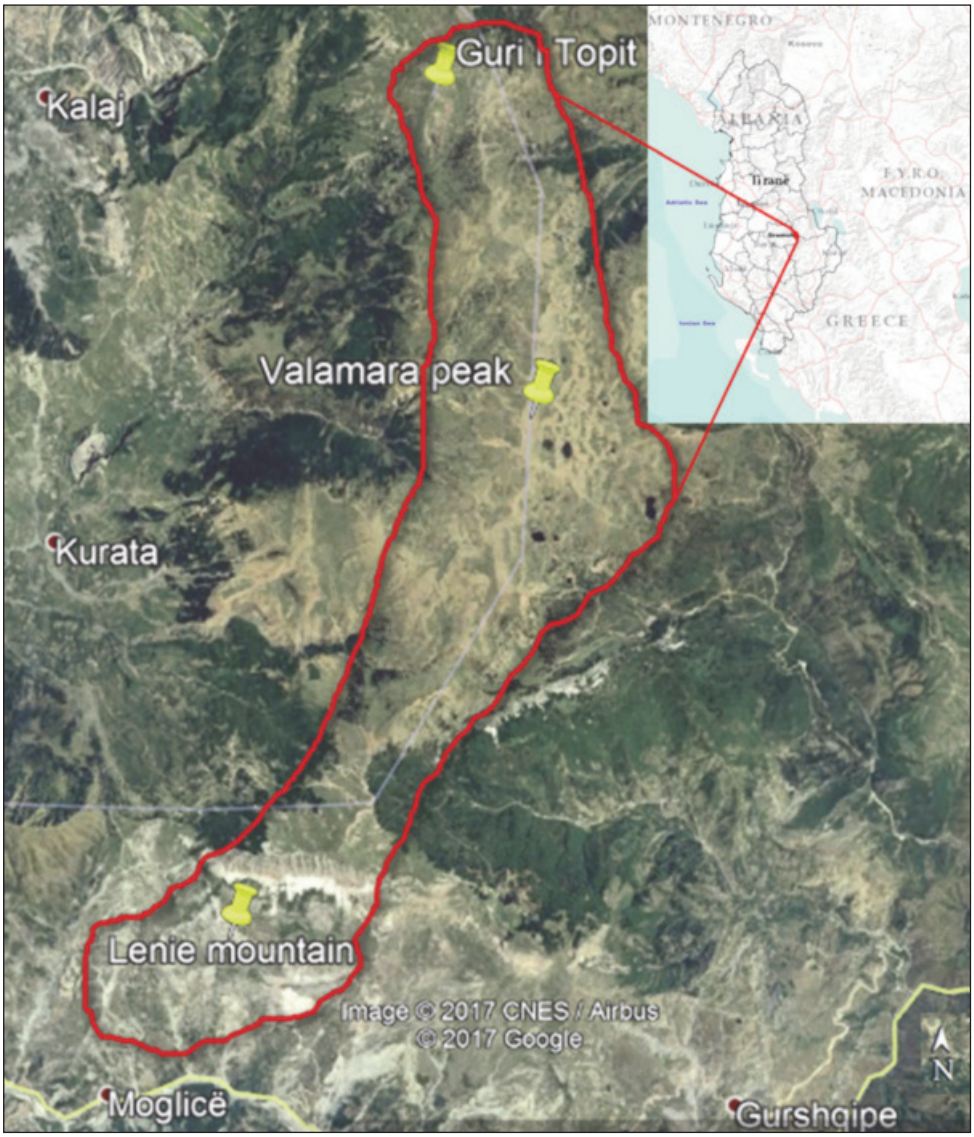

Fig. 1. The Albanian territory where is shown the study area (Valamara Mts).

Materials and Methods

The study is based on the results of field work carried out between 2007 and 2016. Collections of plant material (*ca* 1000 specimens) were made during different seasons of the year from all the representative habitats covered by different vegetation types. Herbarium specimens are deposited at University of Tirana (TIR) and Hungarian Natural

History Museum (HNHM). The species list is based on the authors' own collections, herbarium material at TIR, field observations and published information as provided by Markgraf (1927, 1931), Demiri (1959), Paparisto & Qosja (1976), Gölz & Reinhard (1984), Vangjeli (1983), Buzo (1990), Barina & Pifkó (2008, 2011), Shuka & Tan (2009) and Meyer (2011).

Plant identification follows Flora Europaea (Tutin & al. 1968-1980, 1993), Flora of Albania (Paparisto & al. 1988; Qosja & al. 1992, 1996; Vangjeli & al. 2000), nomenclature is mainly according to Euro+Med Plantbase (2006-). For conservation status we consulted the Albanian Red List of vascular plants (Council of Ministers' decision, 2013), the IUCN Red List of Threatened Species (IUCN 2016), Bern Convention (Council of Europe 1979), Annex II, IV and V of Habitat Directive (Council Directive 92/43/EEC) and Appendix II of CITES Convention (CITES 2011).

The chorology of the taxa is principally based on critical comparison of information provided by Strid & Tan (1997, 2002), Davis (1965-1988), Pignatti (1982), and Tutin & al. (1968-1980, 1993).

Life forms of the taxa are according to the systems of Raunkiaer (1934), Ellenberg (1956) and Ellenberg & Müller-Dombois (1967a, 1967b). The following abbreviations apply: Ph = phanerophyte, NPh = nano-phanerophyte, Ch = chamaephyte, H = hemicryptophyte, G = geophyte, T = therophyte, Hyd = hydrophyte, Lian = liana. The data concerning the flowering period or sporulation period for ferns were taken from Flora of Albania (Paparisto & al. 1988; Qosja & al. 1992, 1996; Vangjeli & al. 2000) and Mountain Flora of Greece (Strid 1986; Strid & Tan 1991). Number of species for each month was counted taking in consideration that for most of the species period of flowering lasts more than one month, and in this way each species was counted in all flowering months. The maps of the study area with indicated locations of species reported here for first time for Albania were prepared in ArcMap 10.1.

Results

567 taxa belonging to 305 genera and 89 families were identified within the study area. *Taraxacum pindicum, Dichoropetalum stridii* and *Epilobium alsinifolium* are new records for Albania and 306 taxa are new for the study area (Electronic Supplementary File 1). Hemicryptophytes are the most frequent followed by geophytes, therophytes, phanerophytes, chamaephytes, hydrophytes, and lianas. The taxa belong to 58 floristic elements (Table 2), of which the Eurasian and European with 127 and 104 taxa, respectively, are the largest. One Albanian endemic species, *Festucopsis serpentini*, and eight sub-endemic taxa were also identified. A total of 119 taxa have some conservation status (Table 3). Forty-nine are included in the Albanian Red List, 76 are part of the IUCN Red List, two species belong to annexes II, IV and V of the Habitats Directive (Council of Ministers' decision, 2013; IUCN 2016; Council Directive 92/43/EEC). *Centranthus longiflorus* is included in annex I of Bern Convention and seven species are listed in Appendix II of CITES.

Taxonomic analysis

Of the 567 vascular plant taxa observed in the Valamara Mts 95.9 % (544 taxa) of them are angiosperms and 4.1 % (23 taxa) pteridophytes. The flora comprises 15.6 % of the total Albanian flora, with 31.7 % of the genera and 50.8 % of the families (Meço & Mullaj 2015).

In table 1 families with the greatest number of the species are shown (ten or more species), that represent 64.1 % of all taxa and 62.9 % of the genera. In monocots, the *Poaceae* has the greatest number, 10 % of all taxa and 9.2 % of all genera. In Albanian flora, *Poaceae* is the third family with the highest number of taxa. In our study area, species of this family are dominant because the upper part of Valamara Mts is dominated by grasslands and rocky treeless terrains. Family with highest number of species is *Asteraceae*. It represent 10.2 % of total number or 58 taxa and 9.8 % or 30 genera. The high number of the species of Asteraceae comes by the fact that this is the biggest family of the flora of Albania (Meço & Mullaj 2015) and from a high presence of Circumboreal species, Orofil and Eurosiberic species, about 29.3 % of all *Asteraceae* grow in the upper part of Valamara Mts. Other families with greatest number of the taxa and genera are: *Caryophyllaceae* (5.8%), *Rosaceae* (5.6%), *Fabaceae* (5.4%), *Lamiaceae* (5.3%), *Brassicaceae* (4%), etc. (Table 1). Genera with five or more species are 24, such are *Carex* (11 species), *Campanula* (10 species), *Silene* (9 species), *Galium* (8 species), *Trifolium* (8 species), *Geranium* (7 species), *Hieracium* (6 species), *Plantago* (6 species), *Poa* (6 species), *Allium* (5 species), etc.

Table 1. Largest families in the flora of Valamara Mts.

Family	Genera No. (%)	Species and subspecies No. (%)
Apiaceae	14 (4.6)	15 (2.6)
Asteraceae	30 (9.8)	58 (10.2)
Boraginaceae	7 (2.3)	10 (1.8)
Brassicaceae	14 (4.6)	23 (4.0)
Campanulaceae	3 (1)	12 (2.1)
Caryophyllaceae	14 (4.6)	33(5.8)
Cyperaceae	5 (1.6)	21 (3.5)
Fabaceae	14 (4.6)	31 (5.4)
Lamiacea	18 (5.9)	30 (5.3)
Orchidaceae	8 (2.6)	10 (1.8)
Poaceae	28 (9.2)	57 (10)
Ranunculaceae	12 (3.9)	18 (3.2)
Plantaginaceae	2 (0.7)	10 (1.8)
Rosaceae	17 (5.6)	32 (5.6)
Scrophulariaceae	9 (3)	15 (2.6)

New records for the Albanian flora

1) *Taraxacum pindicum* Kirschner & Štěpánek [*Asteraceae*]

SE Albania. Valamara Mts, at the western foot of Guri i Topit' mountain, c. 900 m west-northwest of the peak and c. 5.9 km north-northeast of village Grabovë, 40.8425 N, 20.443889 E, in mountain pasture, 1862 m a.s.l., 18.08.2007, coll. Z. Barina & D. Pifkó (BP769285), det.: J. Štěpánek & J. Kirschner.

T. pindicum belongs to *Taraxacum* sect. *Piesis* (DC.) Kirschner & Štěpánek, which is unique in the genus and comprises only a few species. So far, it is known only from the N Pindos, Greece, described from the Katara Pass (Kirschner & Štěpánek 1998). In the Valamara Mts it is restricted to mountain pastures on serpentine substrate, between 1800–1900 m a.s.l. (Fig. 2). However, *Taraxacum* is a taxonomically difficult genus and the species might thus be overlooked and present also at other localities. *T. pindicola* belongs to *T.* sect. *Erythrocarpa*. We have observed that the species is rare in the rocky grasslands of Northeastern Albania from 2000 to 2700 m a.s.l.

2) *Dichoropetalum stridii* (Hartvig) Pimenov & Kljuykov [*Apiaceae*]

SE Albania. Northern slope of Mount of Valamarë, c. 2.4 km south of the summit, c. 3.7 km northwest of village Shalës and c. 5.8 km east of village Shënepremte, (district of Korçë), 40.77285 N, 20.46428 E; in open grassland, on serpentine, 2092 m a.s.l., 16.08.2007, coll. Z. Barina & D. Pifkó, Nr. 12647 (BP750303).

First described as *P. lavrentiadis* subsp. *multicaulis* Strid & Papanicolau (Strid & Papanicolau 1980), later considered a separate species differing in numerous characteristics from *P. lavrentiadis* (Hartvig 1986) and with different habitat preferences. So far known only from a fairly small area in Northern Pindos (N Greece) from the Katara Pass to the Gramos mountains at the Albanian border, It occurs on the following mountains: Aftia, Avgo, Gramos, Mavrovouni, Milea, and Smolikas (Hartvig 1986). Our new record extends the area of the species more to the North (Fig. 2). Our record confirms that *D. stridii* is a species of ophiolithic substrates. Further records for the border area with can be expected in the Gramos Mts.

3) *Epilobium alsinifolium* Vill. [*Onagraceae*]

SE Albania. Valamara Mts, Gramsh district: a small mountain lake below lake 'Guri i Topit', c. 750 m northwest of the peak of Mount "Guri i Topit" and c. 6.0 km north-northeast of village Grabovë, 40.842222 N, 20.447778 E, at the shore of a small mountain lake, 1838 m a.s.l., 18.08.2007, coll. Z. Barina (BP761674).

Other localities outside the study area:

District of Librazhd, Jablanica Mt. (Mali i Jablanices); on the western slope of Mt. "Varri i Marises" (2022 m), c. 6.7 km south-southeast of village Steblevë; 41.27968N, 20.50093E, in flysh, on gravel-conglomerate., 1887 m a.s.l.; 03.07.2008, coll. Z. Barina, D. Pifkó & A. Vojtkó, Nr. 13926 (BP).

Malësi e Madhe District (Rrethi i Malësisë së Madhe); above village Lëpushë, 42.50204 N, 19.74179 E, on limestone rocks, cliffs, 1861 m; 02.08.2011, coll. Z. Barina & G. Somogyi, Nr. 19683 (BP) (Fig. 2).

Not so rare in the mountains of Central Europe and also at lower altitudes northwards, but very scattered in the Balkan Peninsula. Rare in the mountains of Bulgaria between 1400–1800 m a.s.l. (Assyov & Petrova 2006) and in the Greek Mainland (Pindos Mts, Sterea Ellas and North Central; Dimopoulos & al. 2013), but absent from Montenegro (Pulević 2005) and without confirmed records from Croatia (Strgulc Krajšek & al. 2009).

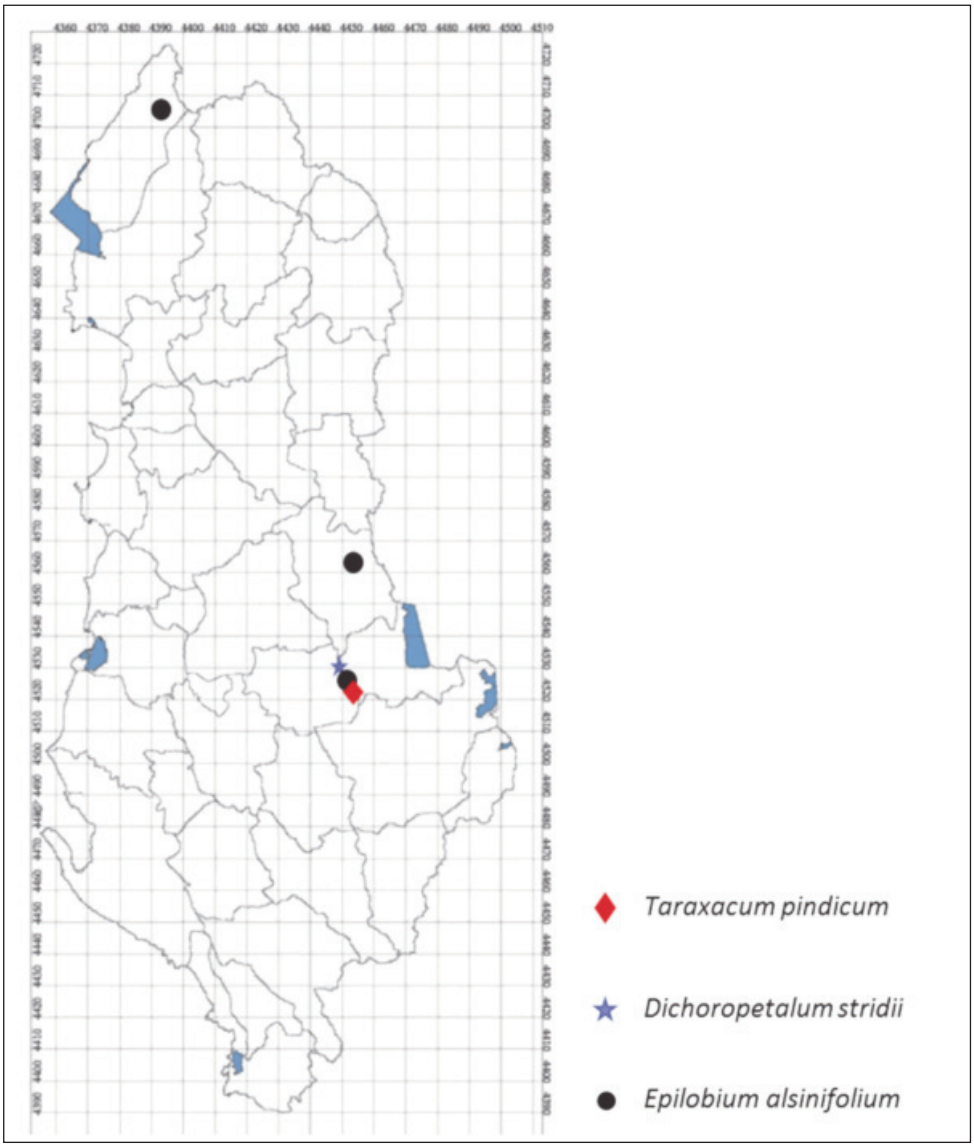

Fig. 2. Albanian map where is shown the location of new species reported for first time in territory of Albania.

Very rare in the mountains of Albania, so far known from altitudes between 1800 and 2000 m, where it occurs in wet places, along streams, at edge of mountain lakes, in flushes, exceptionally on shady, damp rocks on various substrates. Further localities can be expected in mountain habitats, especially in Northern and Eastern Albania.

Biological spectrum

Hemicryptophytes represent 57.0% of all species, followed by geophytes (13.8%), therophytes (11.8 %), phanerophytes (7.8%), chamaephytes (8.8 %) and hydrophytes (0.9%). In general, herbaceous species dominate (83.2%) as compared with trees and shrubs (16.8%). Hydrophytes were found in glacial lakes of Valamara and are represented mostly by *Potamogeton crispus, P. natans, P. pusillus, Nymphaea alba* and *Myriophyllum spicatum*, which, according to Pignatti (1982), belong to rooting hydrophytes. Lianas are represented only by *Clematis vitalba*. The high proportion of hemicryptophytes is determined by the fact that Balkan flora is dominated by hemicryptophytes (Stojanov 1924, 1950; Stojanoff 1941; Goranova & al. 2013) and their center of distribution is regarded Central Europe. The geographical position of Valamara mountain range and its high altitude, creates climatic conditions which favor these life forms (Cain 1950; Begon & al. 2006; Forseth 2012). The high influence of Mediterranean climate in the low altitude and the eroded areas with shallow soils have created favorable conditions even for a large number of therophytes (Stojanoff 1941; Stojanov 1950). High presence of geophytes is related to forest vegetation, which is dominant on the lower slopes of Valamara Mts as well as with the influence of human activity, especially with pastural activities (Tomović & al. 2005). More than 69% or 53 species of this life form were found in herbaceous layer of these forests. Due to the high altitude, where most of the surface is dominated by grassland vegetation, proportion of phanerophytes in the study area compared with the flora of Albania, is a bit lower, respectively 7.8% and 9.3%. A considerable area is destroyed and degraded and replaced by scrublands mainly dominated by *Juniperus communis, J. oxycedrus*, *Daphne oleoides,* etc.

Phytogeographical elements

The vascular plants belong to 57 chorological groups which are indicated in Table 2. After being grouped in ten larger centers, the analysis of chorological spectra showed that the highest number of the species originate from Eurasia (21.7%, 123 taxa), followed by Europe (18.3%, 104 taxa), Balkan (16.2%, 92 taxa), Mediterranean (11.5%, 65 taxa), boreal (10.6%, 60 taxa), Euro-Mediterranean (7.9%, 45 taxa), temperate (6.3%, 36 taxa), cosmopolitan / subcosmopolitan (5.1%, 29 taxa), endemic/sub-endemic (1.6%, 9 taxa); 0.7 % or 4 taxa originat from three other centers of distribution. The high number of species with southern centre of distribution like south Europe, Mediterranean, Euro-Mediterranean and Balkan species, are typical for xerothermic and xeromesophytic grassland communities (Pedashenko & Vassilev 2014), which are predominant in the Valamara Mts. The presence of a high number of boreal taxa (60 taxa, 10.6%), of which 9.1% belong to circumboreal taxa, 1.0% artic-alpine and 0.4% alpine, is quite high within the flora of

Albania (4.2%) and shows that the high altitude of Valamara Mts somewhat negates the effect of the Mediterranean climate and creates conditions which favor the growth of circumboreal species, mostly in its upper region.

The endemic and sub-endemic group comprise 9 species which represent 1.6% of the Valamara flora. *Festucopsis serpentini* is the only endemic species while sub-endemic species are represented by *Bornmuellera baldaccii, Campanula hawkinsiana, Cerastium smolikanum, Cistus albanicus, Onosma mattirolii, Taraxacum pindicum, Dichoropetalum stridii* and *Viola dukadjinica*. All these species occur in both Albania and Greece.

Table 2. Centre of distribution of vascular flora of Valamara Mts and number of species belonging to each chorological group.

	Phytogeographical elements	**Taxa No. (%)**
1	**Eurasian**	**123 (21.7)**
	1. Euro-caucasian	71 (12.5)
	2. Europ. - Siber (Euro-Siberian)	29 (5.1)
	3. Europ. - Asia (Eurasian)	10 (1.8)
	4. Orof. Europ. - Caucas. (Euro-caucasian orofil)	3 (0.5)
	5. S Europ-S Siber. (south European- south Siberian)	3 (0.5)
	6. S Europ - Subsiber (south European- sub Siberian)	2 (0.4)
	7. S Europ. - CaucAsia. (south European- asiatic Caucasian)	2 (0.4)
	8. Orof. Europ. - Asia (Eurasian orofil)	1 (0.2)
	9. Pontic	1 (0.2)
	10. Subpont. (sub Pontic)	1 (0.2)
2	**European**	**104 (18.3)**
	1. S Europ. (south European)	40 (7.0)
	2. Orof. - S Europ. (south European orofil)	22 (3.9)
	3. C Europ. (central European)	19 (3.3)
	4. Europ. (European)	11 (1.9)
	5. SE Europ. (southeast European)	6 (1.0)
	6. S Europ. - Pont. (south European- Pontic)	3 (0.5)
	7. Pontic-Europ. (Pontic-European)	1 (0.2)
	8. E Europ. (east European)	1 (0.2)
	9. Europ. - Balk (European-Balkan)	1 (0.2)
3	**Balkan**	**92 (16.2)**
	1. Balk. (Balkan)	53 (9.3)
	2. SubBalk (sub Balkan)	30 (5.4)
	3. Amphiadriatic	4 (0.7)
	4. StenoBalk. (steno Balkan)	3 (0.5)
	5. S Balk (south Balkan)	1 (0.2)
	6. Illir. (Anfiadriat.) (Anfiadriatic- Illiric)	1 (0.2)
4	**Mediterranean**	**65 (11.5)**
	1. Medit. (Mediterranean)	12 (2.1)
	2. Stenomedit. (steno Mediterranean)	10 (1.8)
	3. Orof-Medit. (Mediterranean orofil)	10 (1.8)
	4. NE Medit. (north east mediterranean)	6 (1.0)
	5. Medit.-Atlant. (Mediterranean atlantic)	5 (0.9)
	6. Orof. NE Medit. (north east Mediterranean orofil)	4 (0.7)

Table 2. continued.

	7. SubMedit. (Submediterranean)	3 (0.5)
	8. E Medit. (East Mediterranean)	2 (0.4)
	9. Medit.- Mont. (Mediterranean mountains)	2 (0.4)
	10. Medit.-Turan. (Mediterranean-Turanian)	2 (0.4)
	11. N Medit. (north Mediterranean)	2 (0.4)
	12. S Medit. (south Mediterranean)	2 (0.4)
	13. Stenomedit-N Orient. (steno Mediterranean- north Oriental)	2 (0.4)
	14. Orof. W Medit. (west Mediterranean orofil)	1 (0.2)
	15. NE Medit.-Pontic (north Mediterranean-Pontic)	1 (0.2)
	16. Stenomedit.-Turan. (steno Mediterranean- Turanian)	1 (0.2)
5	**Boreal**	**60 (10.6)**
	1. Circum.-Boreal (Circumboreal)	52 (9.1)
	2. Artico-Alpine (Artico-Alpine)	6 (1.0)
	3. Alpine	2 (0.4)
6	**Euro-Mediterranean**	**45 (7.9)**
	1. Europ. - Medit. (Euro-Mediterranean)	44 (7.7)
	2. Europ. - Medit.Occid. (Euro-Mediterranean occidental)	1 (0.2)
7	**Temperate**	**36 (6.3)**
	1. Pan-temperate	30 (5.3)
	2. Pan.subtrop. (pan-subtropical)	5 (0.9)
	3. Pantrop. (Pantropical)	1 (0.2)
8	**Cosmopolitan / sub cosmopolitan**	**29 (5.1)**
	1. Cosmop. (Cosmopolitian)	9 (1.6)
	2. Subcosmop. (sub Cosmopolitian)	20 (3.5)
9	**Endemic/Subendem. (Sub-Endemic)**	**9 (1.6)**
	1. Endem. (Endemic)	1 (0.2)
	2. Subendem. (Sub-Endemic)	8 (1.4)
10	**other**	**4 (0.8)**
	1. S Am (south Americ)	1 (0.2)
	2. C Asia (center Asia)	1 (0.2)
	3. Asia	1 (0.2)
	4. E Asia (east Asia)	1 (0.2)

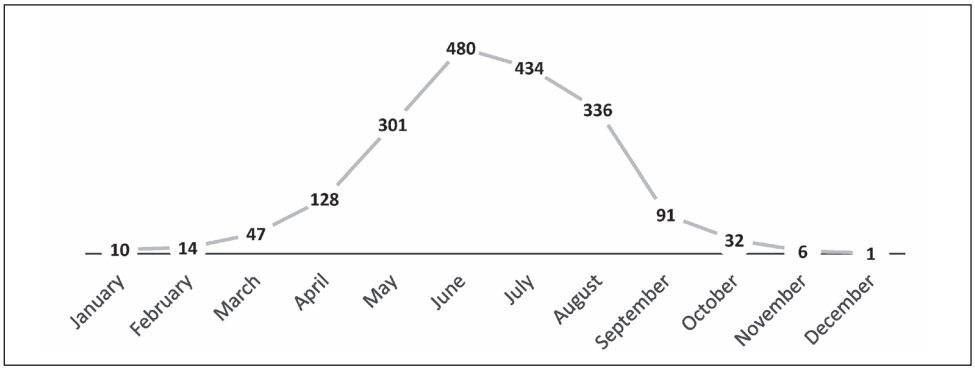

Fig. 3. Number of species in flowering by month.

Species with conservation values

Of the 567 taxa identified in the Valamara Mts, about 20.9% (119 taxa) have a conservation status as classified in the Albanian Red list or the IUCN Red list (Table 3). Forty-nine of them (41.2 % of the taxa with conservation status) are included in Albanian Red List, approved by the Decision of Council of Ministers in 2013. These species represent 12.2 % of the Albanian Red List of vascular plants. According to this national

Table 3. Species with a conservation status according IUCN red list (IUCN 2016) and Albanian red list (ARL) (Council of Ministers' decision 2013)

no.	Taxa	IUCN	ARL	no.	Taxa	IUCN	ARL
1.	*Abies alba*	LC		61.	*Festucopsis serpentini*		NE
2.	*Achillea millefolium*	LC		62.	*Gentiana lutea*		EN
3.	*Aconitum lamarckii*		VU	63.	*Gladiolus palustris*	DD	LR
4.	*Adiantum capillus-veneris*	LC	VU	64.	*Halacsya sendtneri*		EN
5.	*Agrimonia eupatoria*	LR		65.	*Herniaria parnassica*		EN
6.	*Agrostis canina*	LC		66.	*Hippocrepis comosa*	LC	
7.	*Alchemilla xanthochlora*	LC		67.	*Hordeum bulbosum*	LC	
8.	*Alkanna scardica*		LR	68.	*Hypericum perforatum*		EN
9.	*Allium schoenoprasum*	LC		69.	*Isatis tinctoria*	DD	
10.	*Alyssoides utriculata*		LR	70.	*Juncus conglomeratus*	LC	
11.	*Alyssum bertolonii*		LR	71.	*Juniperus communis*	LC	VU
12.	*Anthyllis vulneraria*	DD		72.	*Juniperus oxycedrus*	LC	VU
13.	*Aquilegia vulgaris*	DD		73.	*Lilium albanicum*		EN
14.	*Arabis hirsuta*	DD		74.	*Luzula forsteri*	DD	
15.	*Aster albanicus*		EN	75.	*Lythrum portula*	LC	
16.	*Athamanta turbith*		EN	76.	*Mentha longifolia*	LC	
17.	*Atropa bella-donna*		CR	77.	*Myriophyllum spicatum*	LC	
18.	*Berula erecta*	LC		78.	*Narthecium scardicum*		VU
19.	*Betula pendula*	LC	CR	79.	*Nasturtium officinale*	LC	
20.	*Blysmus compressus*	LC	CR	80.	*Neottia nidus-avis*	LC	
21.	*Bornmuellera baldaccii*		EN	81.	*Nymphaea alba*	LC	VU
22.	*Botrychium lunaria*		EN	82.	*Onosma mattirolii*		VU
23.	*Brachypodium retusum*	LC		83.	*Origanium vulgare*		EN
24.	*Calamagrostis pseudophragmites*	LC		84.	*Ostrya carpinifolia*	LC	
25.	*Caltha palustris*	LC	VU	85.	*Parnassia palustris*	LC	
26.	*Campanula hawkinsiana*		LR	86.	*Platanthera chlorantha*		
27.	*Campanula tymphaea*		LR	87.	*Phleum alpinum*	LC	
28.	*Carex digitata*	LC		88.	*Pinus heldreichii*	LC	
29.	*Carex distans*	LC		89.	*Pinus nigra*	LC	
30.	*Carex flava*	LC		90.	*Pinus peuce*	NT	EN
31.	*Carex nigra*	LC		91.	*Poa pratensis*	LC	
32.	*Carex paniculata*	LC		92.	*Polygonum amphibium*	LC	
33.	*Centaurea pindicola*		EN	93.	*Polygonum hydropiper*	LC	
34.	*Cerastium smolikanum*		CR	94.	*Populus nigra*	LC	
35.	*Chamaecytisus tommasinii*		EN	95.	*Potamogeton crispus*	LC	
36.	*Chamaespartium sagittale*	LC		96.	*Potamogeton natans*	LC	
37.	*Cephalanthera longifolia*			97.	*Rhus coriaria*	VU	
38.	*Cephalanthera rubra*			98.	*Salvia officinalis*	LC	VU

Table 3. continued.

39.	*Cistus albanicus*		EN	99.	*Sanguisorba officinalis*	LC	
40.	*Corylus avellana*	LC		100.	*Satureja montana* subsp. *montana*		VU
41.	*Crepis geracioides*		VU	101.	*Sedum serpentini*		LR
42.	*Crocus dalmaticus*		LR	102.	*Sesleria coerulans*	LC	
43.	*Cyperus difformis*	LC		103.	*Sideritis raeseri*	NT	
44.	*Cyperus flavescens*	LC		104.	*Silene vulgaris*	LC	
45.	*Cyperus fuscus*	LC		105.	*Silene caesia*		DD
46.	*Cyperus glaber*	LC		106.	*Silene tommasini*		EN
47.	*Cyperus longus*	LC		107.	*Sorbus aucuparia*	CR	
48.	*Dactylorhiza saccifera*			108.	*Stipa pulcherrima*	VU	
49.	*Dactylorhiza cordigera*	LC		109.	*Taxus baccata*	LC	VU
50.	*Dictamnus albus*		VU	110.	*Thymus teucroides*		DD
51.	*Centranthus longiflorus*		LR	111.	*Trifolium pratense*	LC	
52.	*Dryopteris filix-mas*			112.	*Trifolium pilczii*		LR
53.	*Eleocharis palustris*	LC		113.	*Trollius europaeus*		VU
54.	*Epilobium angustifolium*	LC		114.	*Urtica dioica*	LC	
55.	*Epilobium parviflorum*	LC		115.	*Vaccinium myrtillus*		VU
56.	*Epipactis palustris*	LC		116.	*Veronica beccabunga*	LC	
57.	*Equisetum palustre*	LC		117.	*Veronica serpyllifolia*	LC	
58.	*Equisetum telmateia*	LC		118.	*Viola dukadjinica*		LR
59.	*Eriophorum angustifolium*	LC		119.	*Viscum album*		VU
60.	*Euphrasia minima*	EX					

conservation status, 15 species (30.6%) are extinct (EX), 15 species (30.6%) vulnerable (VU), 11 species (22.4 %) of least concern (LC), five species (10.2 %) critically endangered (CR), four species (4.2 %) DD (deficient data), and one species (2.1 %) NE (not evaluated). According to the IUCN Red List 76 species were evaluated, which represent 13.4 % of all vascular flora of the study area. Conservation status for about 84 % is categorized as least concern (LC), 8 % deficient data (DD), 3 % vulnerable (VU), 3 % near threatened (NT), 1 % extinct category (EX), 1 % critically endangered (CR). *Gentiana lutea* and *Gladiolus palustris* are two species which are part of the Habitats Directive, respectively in Annexes V and II, IV. *Centranthus longiflorus* is listed in Annex I of Bern Convention and seven species of orchids are listed in Appendix II of CITES viz., *Cephalanthera longifolia*, *Cephalanthera rubra*, *Dactylorhiza saccifera*, *D. cordigera*, *Epipactis palustris*, *Neottia nidus-avis*, *Platanthera chlorantha*.

Analysis of flowering period

The flowering period and flowering state are important for plant identification and choice of time for the field trips. June is the month with the greatest number of species in flower (481 species), while the month with the fewest species in flower is December, only *Taraxacum haussknechtii* (September to December).

About 52.7% (299 species) of taxa flower from January to July. Of these 221 species or 73.6% belong to hemicryptophytes, geophytes and therophytes, which finish flowering before the environmental conditions which characterize serpentine substrate (high temper-

ature and low humidity) reach the extreme values.

During the warmest months of July and August, only 41 species begin flowering., and of these 10 species arecircumboreal and, Euro-Siberian. In Valamara Mts these species occur at high altitudes. Fig. 3 shows the number of species in flower every month.

Discussion and conclusions

The predominance of *Asteraceae* is clear; other families (e.g., *Brassicaceae*, *Caryophyllaceae*, *Cyperaceae*, *Fabaceae*, *Lamiaceae*, and *Rosaceae*) have only half the number of species.

In Valamara Mts hemicryptophytes are the dominant life form, however, geophytes, therophytes, phanerophytes and chamaephytes, all are represented by a high number of species. The high dominance of hemicryptophytes even in Valamara Mts, as other Balkans territory such as Bulgaria, Sokolovica Mt in Serbia and Montenegro (Uzunov & Gussev 2003; Tomović & al. 2005; Vuksanović & al. 2016), support the fact that flora of Balkan is dominated by this life form (Goranova & al. 2013). Though Bulgaria is more continental and less mediterranean as compared with Albanian, the high altitude of Valamara reduce the influence of the Mediterranean climate and make its climate more continental so that both these areas have similarities in their percentage of life forms. The high number of geophytes in the upper regions of Valamara Mts is related to the extreme conditions of cold winters and summer drought, and as influenced by pastural activities, such is overgrazing (Tomović & al. 2005). In the flora of Montenegro where the average altitude is lower and climatic conditions not so extreme and pastural activities less abundant, the number of geophytes is lower and after hemicryptophytes, the second life form with the greatest number of the species is represented by chamaephytes. In general, herbaceous species dominate (83.2%).

The high percentages of Euro-Caucasian, circumboreal, Euro-Siberian, south European and central European species are related to the high elevation of the Valamara Mts. A considerable number of species which are Mediterranean, Balkan, Euro-Mediterranean, south European and sub-Mediterranean, reflect a modified-Mediterranean to moderate climateas characteristic oft the lower parts of the range.

Taking into consideration the study area as compared to other Albanian territorities, the presence of 119 plant taxa with a conservation status, representing 20.9% of the vascular flora, makes this mountain range of some importancefor nature conservation. Eight subendemics occur in the Valamara Mts. In the Balkans, Greece possibly the country with the highest number of endemic taxa, ca. less than 900 (Kit Tan, pers. comm. 2017). The discoveries of *Taraxacum pindicum, Dichoropetalum stridii* and *Cerastium smolikanum*, the latter reported by Shuka & Tan (2009), in the Valamara Mts reduced them as endemics to Greece, and the Valamara Mts are now the northernmost localities for these species.

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