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TOM 61-62

ZBORNIK RADOVA
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THE SITE CHARACTERISTICS, FLORISTIC COMPOSITION AND STRUCTURE OF THE SPRUCE FOREST (ASS. *PICEETUM EXCELSAE MONTANUM SERBICUM* GREBENŠČIKOV 1950.) IN PESHTER PLATEAU

Ljubinko RAKONJAC[1], Zagorka TOMIC[2], Aleksandar VASILJEVIC[3], Mihailo RATKNIC[1], Milorad VESELINOVIC[1]

Abstract: *This paper presents the results of the research of the remains of sprouce forests in Peshter Plateau, i.e. on the mountain branches which extend well into Peshter area. The position, range, site conditions, floristic composition and structure, layers, etc. were determined in the observed area. The biological spectrum of the association and the spectrum of the floral elements are presented within the floristic composition.*

Key words: site, spruce forests, Peshter, floristic composition

1. INTRODUCTION

Spruce forests of Peshter Plateau are the remains of the previous coniferous forests of Giljeva, Ozren and the remains of the forests of the branches of Golija and Javor which extend well into the plateau itself. In almost all higher mountains in Serbia the spruce forests, which are preserved to a greater or lesser extent, and described by Grebenshchikov (G r e b e n s h c h i k o v, O., 1950) as the unique complex of spruce forests in Serbia under the name *Piceetum excelsae serbicum*. The montane types of spruce forests were marked by Blechic and Tatic (B l e c h i c, V., T a t i c, B., 1962) as *Picetum montanum.* The climate-regional zone at the altitudes ranging from 1,500 to 1,700 meters is made of the mono-dominant spruce

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forests. The zone is particularly well-developed in Kopaonik, Golija, Zlatar and Stara planina. The spruce forest is the dominant type of forests in Zlatar and is the climate-regional association (O b r a t o v, D., 1992). It spread in a mosaic pattern, alternating with the other forest types at the altitudes ranging from 1,290 to 1,790, mainly on the limestone at the different exposures and slopes. By its population size and crown cover, the spruce is absolutely dominant in the forest layer, so all spruce forests are of mono-dominant character. It is very similar to the spruce forest in Golija. According to Blechic and Tatic (Blechic, V., Tatic, B., 1962), spruce forest in Golija is by its floristic composition more similar to the spruce forests of Montenegro and Croatia than to the spruce forests which have been described in Serbia. According to Obratov (O b r a t o v, D., 1992), the same observation holds true to the spruce forests in Zlatar, which by their characteristics are similar to the spruce forest in Golija.

2. METHODS

The recent forest vegetation was studied by using the principles and methodology of the French-Swiss school by Braun-Blanquet (1928, 1921), which is usual and generally accepted in the phytocoenological researches in this country. As the starting point for the study of the phytocoenological characteristics of spruce forests, the collection of the phytocoenological records, which encompassed the basic characteristics of stands, floristic composition and construction and site conditions, was used. The spectra of the floral elements (percent of the groups of floral elements and the percent of the individual floral elements) per associations were made in accord with the systematization of the plant-geographical elements of Gajic (1984). The biological spectra (percent of some life forms) of the plants were made by using the results obtained by Kojic et al. (1994), based on the classification of the types of the life forms by R a u n k i a e r's method.

3. THE IMPORTANCE AND AIM OF THE RESEARCH

The ultimate aim of the study of the forest vegetation and spruce forests, as well as the suitable sites, is helping the regeneration and re-estastablishment of the forest cover in this devasted and to a great extent deforested plateaus, mainly in order to regenerate spruce in this optimal site of it, where it used to be considerably more present.

The current condition of forests and forest sites in Peshter Plateau is the result of its natural development over the previous periods.Its current condition is one of the important keys to solving the problem regarding the origin, succession, and degradation of forest vegetation of this area. The natural spruce forests in the form of the remains of the previous poly-dominant associations occupy only small areas.These associations, which are similar by the type of the micro-climate area or the mountain zone, by the site and floristic composition, and which originate from the same association, composes one ecological-floristic historic series, which implies that in such similar conditions, the indicators of which are the ecological-

vegetation-historic series, the forest vegetation can be efficiently re-established on the site on which it has been previously destroyed.

4. RESULTS

4.1. Position and distribution in the observed area

This tree species, which used to be well-spread, is not in the favourable position according to its range. It is limited to small forest preserves, scarce canopies and individual trees. Krstic (Krstic, O., 1956) reported that in the 1950s he was not able to find as three spruce in the same place, let alone spruce forests. He found only about twenty trees which sprouted from common hazel and common juniper scrubs at Zilindar, at the altitudes ranging from 1,460 to 1,600 meters above the sea level, above the very Potkrsh spring. In Bare the spruce association is in its range at the altitudes ranging from 1,200 to 1,400 meters, from the left bank of Dubochica to the meeting place of Babov Do and Crvachka Gorge. In this area its stands with the dense crowns were scattered. The last preserved forests burnt in 1947, between Treshnjevica and Vishnjevo. The previous spruce forest is quickly replaced by beeches and different sprouts, weak pastures, common hazelnuts, aspens and birches.The villagers still grow it in the forest preserves, but there is an increasing presence of the beech, apsen and Scots pine in them. The spruce in the Bare is in the regression. The third site is Karishici (from 1,200 to 1,400 meters above the sea level), in the forest preserves of the scattered pasture canopy. It is not found on the serpentinite although Krstic reported that it was present at the bend between Ozren and Jadovnik, but the sites reported by him did not have the serpentinite as the bedrock. On the slopes of Jadovnik it occurs individually on the limestone, in the complete regression. The distribution of the spruce on the surrounding area can be divided into two units. One of them spreads from Miloshev do to Uvac, and the second one from Uvac to Bojev do in Golija. On the first site it is found only in the small groups in the forest preserves in Gorachici, but the spruce also disappears on these sites. From Zlatarsko brdo to Derventa the spruce has been suppressed to the border line of Zlatar. Its best sites are now occupied by the common hazel bushes. With the little attention and tending, it could have been saved from the final destruction, at least in the form of the pasture forests and groves, so typical forms of the Stari Vlah forest-pasture landscape. It occurs in the vicinity of Sugubin and Papic, on the silicate terrains, between the massive limestones of Zlatar and Javor. In these places it is found in the preserved forest preserves, such as Papica gaj and Omar. From Omar, Papica gaj, towards Javor, via Radevska River towards its flat crest, the every trace of the spruce seems to lose in the huge range of deciduous forests of the foot of the Javor mountain (Krstic, 1956). It has preserved in the form of several small groups above Prashovici in the recent meeting places in Studenichka reka, below Ogorijevac and around Jevik, in the very vicinity of village, on the barren limestone karst (Krstic, 1956). At the western side of Leskovac (at 1,326 meters above the sea level) only one spruce, in the privately-owned forest preserve has been preserved. It has not been found on the slopes of Javor towards Golija in Sjenica area any more. The

scattered spruce crests are found on the dacite in Bojevo brdo, where its highest site is located at Peshter-Sjenicka Plateau. From Bojevo brdo via all Golija in the Ljutska reka gravity, there are no whole spruce stands, except for the individual trees in the beech forest Crvena Voda and in Srchanski Buh.

Regarding the characteristics of spruce stands, their conditions have not altered since Krstic described their sites up to the present, due to the permanent zoo-anthropogenic influences, so the progression is not visible. The spruce is the basic conifer tree of the open karst areas of the mountains of Dinaric type, and the Peshter-Sjenicka Plateau is also like this. In Sjenichka Ravine it is found only in the form of artificial plantations. From the above statements it is seen that the spruce has preserved only in the peripherous plots of the plateau in the forms of last remains.

4.2. Site charateristics

On three sites in the observed area the spruce association is found on the different bedrocks. In the foot of the mountain Javor in the valley of the Radevska River, where the spruce remained in the low-lying areas, the bedrock of the valley are limestone and marly limestone.The spruce is here found in the inversion, in the river ravine, where they descend and keep the cold air masses for a long time, as well as the snowdrifts which melt slowly, owning to which the spruce descended the lower positions. In Aljinovici, on the slopes of Zlatar, the spruce is found on the multi-layer limestone with cherts. In two stands in Bara, the spruce is found on spilite. Regarding the altitudes, the remains of these spruce stands are found at the altitudes ranging from 1,100 to 1,380 meters, at western, west-southwestern, eastern, north-northeastern exposures. The slopes of the terrains on which these spruce stands are located ranging from 15° in Bare, to 40° in the Radevska River. On the limestone of the Radevska River the limestone chernozem and brown limestone soil are developed, and on the cliff metting place the marly limestone and eutric cambisol occur. On the multi-layered limestone with chert at the branches of Zlatar, on the eutric cambisol in Aljinovici one spruce stand was found. In Bare, on the spilite, luvisol occurs in the stands with the dense crowns. The limestone chernozem is 37 cm deep, and by the texture characteristics it belongs to the powdery clay. The soil reaction is alkaline and pH value in water is 7.1, and in KCl it is 6.4. Regarding humus, the soil is rich (6.63%), as well as regarding the total nitrogen (0.65%). The soil is not well-provided with the available forms of phosphorous (0.7 mg/100 g soil), whereas it is well-provided with potassium (30.01 mg/100 g soil). The brown limestone soil is 55 cm deep, and regarding the texture characteristics it ranges from powdery clayey-loam to the powdery clay. The pH value is harmonized along the whole depth of profile and accounts for about 5.0. In the upper layers of the profile the soil is rich in humus and nitrogen, whereas in the lower ones it is poor (0.43%). Regarding the available forms of phosphorous, the soil is poor (0.1–0.3 mg/100 g soil), and regarding the available forms of potassium it ranges from poor-provided to well-provided (from 8.72 to 21.29 mg/100 g soil). Luvisols are deep for the conditions of Peshter, i.e.they are 70 cm deep, and regarding the texture characteristics in the upper parts

loams are present, and in the lower ones clays. In Bare the pH value of luvisols is about 5, and in KCl it is 4.3. The humus-accumulative horizon in this type of soil is rich in humus and nitrogen. Regarding the available forms of phosphorous, the soil is poor, whereas regarding the available forms of potassium it ranges from poor-provided to mid-provided.

4.3. Floristic composition and structure

Floristic composition and structure are presented by the phytocoenologic table 1, which contains 6 records. The phytocoenologic table contains 117 plant species: in the first layer ***Picea abies*** is dominant, and in one record the *Betula pendula, Fagus moesiaca, Pinus nigra* and *Populus tremula* are present. In the second layer more ligneous and bushy species are presented , the total of 22, and 102 species, respectively, occur in the layer of ground flora. Out of the species in the layer of ground flora, two species belong to fens and 100 species to the flowering plants. Individually, phytocoenological records contain very different number of species, from 14 (14b) to 55 plant species (S14), in average 34 species.The majority of records contains more than 30 plant species. The considerable number of plant species is found in only one phytocoenological record (71).

Spectrum of life forms – biological spectrum

The biological spectrum of association is presented in the Table 1. There is a high percent of spruce associations in chemi-cryptophytes (51%), which is much higher than in beech forests, and in beech and fir forests, which points to the cold conditions in it. Phanerophytes account for 20% (10% phanerophytes and 10 nanophanerophytes), which is more than in the spruce association in Zlatar that represents the monodominant association. There is a considerable percent of geophytes, which can be marked as mainly forest plants, i.e. they account for14 %. There is a low percent of the chamaephytes, which are the indicators of the unfavourable site conditions (herbaceous and ligneous chamaephytes, respectively, account for 2%). Terophytes, whose population size is mainly influenced by the Mediterranean, account for only 2%. For their development a lot of light and warmth are necessary, in which the spruce association is poor. Terophytes/chamaephytes account for 4%. Regarding the spectrum of life forms, this association is chemi-cryptophytic-phanerophytic

Table 1. *The spectrum of life forms of plants in Piceetum excelsae montanum serbicum Grebenshchikov 1950 association (sin. Picetum abietis serbicum (Rud. 47) Mish. et Pop. 1980)*

Životni oblici							
Phanerophytes	Nanophanerophytes	Ligneous chamaephytes	Herbaceous chamaephytes	Chemi-cryptophytes	Geophytes	Terophytes	Terophytes/ chamaephytes
p	np	lc	hc	c	g	t	tc
10%	10%	4%	4%	51%	14%	2%	4%
20%		8%					

Spectrum of floral elements

The spectrum of floral elements of the association is presented in the Table 2. The high percent of the individual range types is not visible, particularly regarding the Sub-Mediterranean floral elements, i.e. Balkan and Balkan-Apennine floral elements regarding some other associations of this area. The most dominant total range types are Mid-European floral elements (accounting for 27%), and the second most frequently found are Eurasian floral elements (accounting for 25%). The same ratio of the range types is found in the beech association. There is a low percent of the Sub-Meditteranean floral elements, which account for only 4%. There is a considerable percent of Pontic-Central Asian floral elements (accounting for 12%). The very important group of floral elements of the cold areas are made of frigophilic floral elements of the northen regions (accounting for 7%) and cosmopolitan floral elements (accounting for 11%)

Table 2. *Spectrum of floral elements of Piceetum excelsae montanum serbicum Grebenshchikov 1950. (sin. Picetum abietis serbicum (Rud.47), Mish.. et Pop. 1980) association*

Group of floral elements	Number of plants	Percent		Floral elements	Number of plants
FLORAL ELEMENTS OF NORTHERN REGIONS	5	7%	7%	Boreal European	1
				Sub-Boreal -Eurasian	1
				Sub-Boreal-Sub-Eurasian	1
				Sub-Boreal-Circumpolar	2
MID-EUROPEAN	18	27%	27%	Mid-European	6
				Sub-Mid-European	11
				Alpine-Carpathian	1
SUB-ATLANTIC	5	7%	7%	Sub-Atlantic-Sub-Mediterranean	5
SUB-MEDITERRANEAN	3	4%	11%	Sub-Mediterranean	3
Eastern-Sub-Mediterranean	2	3%		Eastern-Sub-Mediterranean	2
Balkan and Balkan-Apennine	3	4%		Moesian	1
				Sub-Illyrian	2
PONTIC-CENTRAL ASIAN	1	1%	12%	Sub-Pontic-Central Asian	1
Pontic	8	11%		Sub-Pontic	2
				Pontic-Sub-Mediterranean	4
				Pontic-Eastern-Sub-Mediterranean	1
				Sub-Pontic-Sub-Mediterranean	1
EURASIAN FLORAL ELEMENTS	17	25%	25%	Sub-South Siberian	4
				Eurasian	10
				Sub-Eurasian	3
CIRCUMPOLAR AND COSMOPOLITES	7	11%	11%	Circumpolar	5
				Cosmopolites	2
TOTAL:	69	100%	100%	TOTAL:	126

Mesophilic plants (of the Mid-European and Sub-Altantic floral elements) account for 34%, and the plants of the xerophilic character (Pontic, Sub-Mediterranean, Balkan floral elements, and the floral elements of the desert areas) account for 23%, whereas there is a high percent of the plants of the wide ecological amplitude (Eurasian and cosmopolitan floral elements), accounting for 28%. Frigophilic plants account for 14%.

The most dominant individual range types are Sub-Mid-European (11), Eurasian (10), Mid-Europan (6), circumpolar (5), etc. The spectrum of floral

elements of the spruce association in the observed area is very similar to the spruce association in Zlatar.

4.4. Layers

In the vertical structure of this association the following layers are present: trees, bushes and ground flora. It is a mono-dominant species; in the layers of trees and bushes the spruce is dominant. The degree of crown cover in the **first layer** is different and ranges from 0.5 to 0.9, but mainly it exceeds 0.7. The height of the trees is different, depending on the age of the stands, degree of the preservation of the stand range from 20 to 30m, and mainly it is 22 m. The mean diameter of the trees of the first layer of the observed stands is very similar and ranges from 30 to 35 cm, except for in one record (s31), where there is a wide range of volumes, from 12 to 35 cm. The highest values are reported at the western slope and in the valley of the Radevska River, where the significant dimensions, regarding the diameter and height, are reported, i.e. the diameter of the trees is up to 50 cm, and trees are taller than 25 m. It can be said that the distances between the trees are typical for such a condition of the spruce stands and range from 1 to 5 meters. The assessments of the spruce regarding the population size, crown cover and closure range from 3.3 to 5. 5, which leads to the conclusion that the stands are highly homogenous, since they mainly got the mark 4.4.

In the canopy of **bush layer** there are many species, even 22, in spite of the fact that the stands with the favourable canopy closure are found in the first layer. Regarding the degree of presence, *Picea abies* is dominant, but there are also significant percent of *Corylus avellana, Juniperus communis, Rosa arvensis*. The **layer of ground flora** is not abundant and the degree of land cover ranges from 0.15 to 0.4. The lower degree of land cover is reported in the stands with the dense canopy and found on the steep slopes, so the ground flora is not well-rooted. In the third layer the most frequently found are the following species: *Aremonia agrimonioides, Anemone nemorosa, Vaccinium myrtillus*, whereas *Brachypodium silvaticum, Fragaria vesca* are less frequent. In considerable part of the stands of this association the following species occur: *Daphne blagayana, Deschampsia flexuosa, Festuca ovina, Glechoma hirsuta,* and *Veronica officinalis*.

Table 3. *Phytocoenologic table – Association Piceetum exelsae montanum serbicum Grebenshchikov 1950*

Cardinal number of the record	**1**	**2**	**3**	**4**	**5**	**6**	**Degree of presence**
Number of record (field code)	s29	s29A	s31	A6	s14	14b	
Date of record	24.6.96	24.6.96	24.6.96	19.7.97	19.6.96	2.7.96	
Site	Radevska River			Aljinovići	Bare		
Area (m2)	900						
Altitude (m)	1190	1170	1100	1340	1370	1380	
Exposure	Z		S-SI	Z-JZ	I		
Slope(°)	40	25	20	15			
Bedrock	Limestones and marly limestones			Marly limestones with cherts	spilites		
Soil	Limestone chernozem	Brown limestone	Eutric cambisol		luvisol		

Cardinal number of the record	1	2	3	4	5	6	Degree of presence
I LAYER							
Canopy	**0.6**	**0.7**	**0.9**	**0.5**	**0.8**	**0.8**	
Height- mean (m)	**28**	**30**	**20**	**20**	**22**	**25**	
Diameter -mean (cm)	**38**	**35**	**12-35**	**30**	**30**	**35**	
Distance – mean (m)	**1-5**	**4**	**4**	**1-5**	**3-5**	**1-3**	
Picea abies	4.4	4.4	5.5	3.3	4.4	4.4	V
Betula pendula		+.1					I
Fagus moesiaca					+1		I
Pinus nigra				+.1			I
Populus tremula			+.1				I
II LAYER							
Canopy	**0.3**	**0.2**	**0.1**	**0.2**	**0.2**	**0.3**	
Mean height (m)	**1.5**	**1.5**	**1.5**	**1**	**1.5**	**1.5**	
Picea abies	1.2	2.1	1.1	1.1	+.1	3.3	V
Corylus avellana	1.2			+.1	+.1		III
Juniperus communis	+.1			+.1	+.1		III
Rosa arvensis	+.1		+.1		+.1		III
Rubus idaeus		+.1	+.1		1.1		III
Betula pendula		+.1	+.1				II
Populus tremula		1.1	1.1				II
Clematis vitalba	+.1						I
Cotoneaster tomentosus		+.1					I
Crataegus monogyna	1.1						I
Daphne laureola		+.1					I
Daphne mezereum					+.1		I
Lonicera nigra						+.1	I
Lonicera xylosteum	+.1						I
Prunus spinosa	+.1						I
Pyrus pyraster	+.1						I
Rhamnus catharticus	+.1						I
Rosa agrestis					+.1		I
Rosa canina	+.1						I
Salix capreae					+.1		I
Sorbus austriacus				+.1			I
Viburnum lantana	+.1						I
III LAYER							
Land cover	**0.3**	**0.4**	**0.15**	**0.3**	**0.3**	**0.4**	
Anemone nemorosa	+.1	2.2	1.2		+.1	1.2	V
Aremonia agrimonoides	+.1	+.1		+.1	+.1	+.1	V
Vaccinium myrtillus		+.1	+.2	2.2	3.3	3.3	V
Brachypodium silvaticum	+.1		1.2	+.1	2.2		IV
Fragaria vesca	+.1	+.1		+.1	+.1		IV
Daphne blagayana	+.1				+.1	+.1	III
Deschampsia flexuosa			1.1	1.1	+.1		III
Festuca ovina	+.1			+.1	+.1		III
Glechoma hirsuta	+.1	+.1				+.1	III
Potentilla heptaphylla		1.1		+.1	1.1		III
Veronica officinalis		+.1		+.1	+.1		III
Ajuga reptans					+.1	+.1	II
Asarum europaeum	+.1	+.1					II
Campanula persicifolia		+.1			+.1		II
Chamaecytisus hirsutus				+.1	1.1		II
Dactylis glomerata	1.2	1.1					II
Epilobium montanum		+.1	+.1				II
Euphorbia amygdaloides					+.1	+.1	II

Cardinal number of the record	1	2	3	4	5	6	Degree of presence
Festuca vallesiaca				1.1	2.2		II
Gentiana asclepiadea			1.1		+.1		II
Hypericum montanum			+.1		1.1		II
Luzula campestris		+.1		+.1			II
Melica nutans		1.2		+.1			II
Oxalis acetosella	+.1					+.1	II
Plantago media	+.1				+.1		II
Polygonatum verticillatum			+.1	+.1			II
Pteridium aquilinum	+.1				+.1		II
Stachys officinalis		+.1		+.1			II
Teucrium chamaedrys	+.1	+.1					II
Trifolium montanum	+.1			+.1			II
Viola sylvestris					1.1	+.1	II
Drvenaste u III spratu							
Picea abies	+.1	+.1	+.1		+.1		IV

The following species were reported in one phytocoenological record:
Agrimonia eupatoria +.1 (s29A), Alchemilla vulgaris +.1 (s29A), Astrantia major +.1 (A6), Ballota nigra +.1 (s29A), Bellis perennis +.1 (s29A), Campanula patula +.1 (s29A), Carduus personata +.1 (s29), Carex hirta +.1 (A6), Carex montana +.1 (A6), Centaurea montana +.1 (s29A), Centaurea nyssana +.1 (s14), Cephalanthera alba +.1 (s29), Chamaespartium sagittale +.1 (A6), Chamenerion angustifolium +.1 (s31), Crepis conyzifolia +.1 (A6), Cynosurus cristatus +.1 (s29A), Cytisus procumbens +.1 (s14), Dentaria bulbifera +.1 (14b), Digitalis ambigua +.1 (s14), Digitalis lanata +.1 (s29), Dryopteris filix-mas 1.1 (s14), Festuca pratensis +.1 (s14), Festuca rubra +.1 (s14), Filipendula hexapetala +.1 (s14), Galium aparine +.1 (s31), Galium corrudifolium +.1 (s14), Galium cruciata +.1 (A6), Galium mollugo +.1 (s29A), Galium silvaticum +.1 (s14), Galium uliginosum +.1 (s29A), Geum urbanum +.1 (s29A), Helianthemum nummularium +.1 (s14), Helleborus odorus +.1 (s29), Hieracium bauhini +.1 (A6), Hieracium cymosum 1.1 (s14), Hieracium guthnicianum +.1 (s31), Hieracium murorum 1.1 (s14), Hieracium pilosella +.1 (s14), Hypericum maculatum +.1 (s29A), Knautia magnifica +.1 (s14), Lamium galeobdolon +.1 (s29), Leontodon crispus +.1 (s29A), Leontodon hispidus +.1 (s31), Luzula luzulina 1.1 (s14), Luzula luzuloides 1.2 (s31), Luzula pilosa 1.1 (s29A), Majanthemum bifolium +.1 (s31), Melampyrum silvaticum +.1 (A6), Melittis melissophyllum +.1 (s29), Musco sp. 4.4 (14b), Nardus stricta 1.1 (A6), Pastinaca hirsuta 1.2 (14b), Plantago lanceolata +.1 (s14), Poa violacea 1.1 (s29A), Polygala comosa +.1 (s14), Polygala major 1.1 (s29A), Potentilla erecta +.1 (s14), Prenanthes purpurea +.1 (14b), Primula acaulis +.1 (s14), Prunella vulgaris +.1 (s29A), Prunus avium +.1 (A6), Sanguisorba minor +.1 (s14), Sanicula europaea +.1 (s14), Silene armeria +.1 (s14), Silene vulgaris +.1 (s14), Solanum dulcamara +.1 (s29), Stellaria graminea +.1 (s31), Thelypteris palustris +.1 (A6), Thymus serpyllum 1.2 (s14), Trifolium hybridum +.1 (s14), Veratrum nigrum +.1 (s31), Viburnum lantana +.1 (s29).

5. CONCLUSIONS

1. **Mono-dominant spruce forest - *Piceetum excelsae montanum serbicum* Greb. 1950, is found only in the peripheral parts of the region, occupying small areas or in the form of the small groups and individual trees. The association is preserved on the low-lying areas on the limestone and marly limestone, on the multi-layered limestone with cherts and spilities. The spruce stands are found at the altitudes ranging from 1,100 to 1,380 meters, at the western, western-southwestern, eastern, northern-northeastern exposures on the slopes of terrains ranging from 15 to 40°. The soils reported in the spruce forests are limestone chernozem, brown limestone, eutric cambisol and luvisol.**
2. **he spruce association contains 117 plant species: in the first layer *Picea abies* is dominant, and in one record *Betula pendula, Fagus moesiaca, Pinus nigra* and *Populus tremula* are present. In the second layer more ligneous and bushy species are present, the total of 22 and 102 species, respectively, occur in the layer of ground flora.**
3. **In the spruce association a high percent of chemi-cryptophytes (accounting for 51%) is reported, which is considerably higher than in the beech and fir forests, which points up to the cold conditions in it. Phanerophyte account for 20% (phanerophytes and nanophanerophytes account for 10%, respectively), more than in the spruce association in Zlatar, which is a mono-dominant association.**
4. **The association does not have many individual range types, particularly regarding the Sub-Mediterranean floral elements, i.e. Balkan and Balkan-Apennine, regarding some other associations of this area. The most frequently found total range types are Mid-European floral elements (accounting for 27%).**

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THE SITE CHARACTERISTICS, FLORISTIC COMPOSITION AND STRUCTURE OF SPRUCE FOREST (ASS. *PICEETUM EXCELSAE MONTANUM SERBICUM* GREBENŠČIKOV 1950.) IN PESHTER PLATEAU

Ljubinko RAKONJAC, Zagorka TOMIC, Aleksandar VASILJEVIC, Mihailo RATKNIC, Milorad VESELINOVIC

Summary

Mono-dominant spruce forest - *Piceetum excelsae montanum serbicum* Greb. 1950, is found only in the peripheral parts of the region, occupying small areas or in the form of the small groups and individual trees. The association is preserved on the low-lying soils on the limestone and marly limestone, on the multi-layered limestone with cherts and spilities. The spruce stands are found at the altitudes ranging from 1,100 to 1,380 meters, at the western, western-southwestern, eastern, northern-northeastern exposures on the slopes of terrains ranging from 15 to 40°. The soils reported in the spruce forests are limestone chernozem, brown limestone, eutric cambisol and luvisol.

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Reviewer: **Ph. D. Zoran Miletić**