



HILL STEPPE VEGETATION OF LESKOVIK

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SYNOPSIS

Leskovik is very rich with flora which has calcified character located in larger number of associations and the pastures of Leskovik are specially interesting, we separated them in two groups: hill pastures (750 m) and mountain pastures (700-1000 m). We establish the presence of two hill pasture associations in the field: *Galio-Festucetum valesiacaef trifolietosum dalmaticae* and *Rhinantho-Filipenduletum*. In the paper, we will give the description, the floristic structure analysis and the analysis of ecologic parameters of this association.

SINOPSIS

BRDSKA STEPSKA VEGETACIJA LESKOVIKA

Leskovik je veoma bogat florom koja ima kalcifilni karakter i ona je locirana u veći broj zajednica od kojih su posebno interesantni pašnjaci Leskovika koji smo podelili na brdske (750 m) i planinske (700-1000 m). Od brdskih pašnjaka na terenu smo utvrdili prisustvo dve zajednice i to: *Galio-Festucetum valesiacaef trifolietosum dalmaticae* i *Rhinantho-Filipenduletum*. U radu će biti dat opis, analiza florističkog sastava i ekoloških parametara pomenutih zajednica.

INTRODUCTION

The Leskovik mountain and its homonymous peak (1174 m) represent outmost southwest part of Carpathian-Balkan Mountains, more familiar as Sokobanja's mountains. These mountains are ranging from Knjazevac, on the east, to the Juzna Morava, on the west. The mountains of this complex are disposed from east to the west in next row: Devica, Ozren and Leskovik. They have interesting compact

structure and line of spreading, similar geologic and pedologic structure. According to new researches, this chain of mountains belongs to Carpathian Mountain system and it is ended with Leskovik on the west.

Leskovik is the most western part of Sokobanja's mountains complex, which descends slopingly to Aleksinac field (Aleksinacko polje) to Juzna Morava. The Leskovik mountain is bordered with Moravica, on the north, Juzna Morava, on the west, on the south it passes into waved area of Svrljiske mountains, and on the east, there is no strict viewable border because it leans to Ozren, and some scientists don't take Leskovik for individual mountain, but they denote it as Ozren, and according to them, Leskovik is just one of its peaks. Otherwise, the Leskovik mountain consists of two parts, Veliki and Mali Leskovik, which are separated by numerous depressions aligned in line and in its complex there is 43 m long and 23 m deep glacier where temperature don't overreach 5°C even in the warmest summer months.

The parts of Leskovik nearby Lipovac, Resnik and Crna Bara are rich with boulders and between them the parts of gorge and spring are situated which represent refugial habitats significant for relic polydominant forest associations developing and preserving where Turkish hazel (*Corylus colurna*) is very important and by its name the massive itself is named. Besides relic, impoverished and modern forest associations, the slopes of Leskovik are rich with forest edges where steppe-like meadow and pasture vegetation is developed.

THE MEADOW-PASTURE VEGETATION OF LESKOVIK

Regarding to altitude, two groups of meadow-pasture phytocenoses from meadow steppe vegetations of Leskovik are separated:

- hilly and
- mountain.

Regarding to vertical distribution, hilly vegetation of pastures outspreads between 300 and 900 m of altitude and it is made by two associations: *Galio-Festucetum valesiaca* and *Rhinantho-Filipenduletum*.

The mountain pasture vegetation is made by two vegetations also: *Potentillo-Caricetum humilis* and *Centaureo-Seslerietum rigidae* situated between 900 and 1174 m of altitude.

In continuation of paper the hilly steppe vegetation and its mentioned phytocenoses will be processed in detail.

ASSOCIATION *GALIO-FESTUCETUM VALESIIACAE* R. JOV. SUBASS. *TRIFOLIETOSUM DALMATICA* SUBASS. NEW

The association *Galio-Festucetum valesiaca trifolietosum dalmaticae* (yellow bedstraw and fescue) (Table 1.) is developing on shallow hilly ground

originated by reddish-bay soil wherein limestone frame dominates, and because of that we can say that, according to texture, this soil belongs to type of changed and degraded skeletoid hill reddish-bay soils.

According to perennial outwork and literature researches it can be concluded that this pasture is widespread on altitude from 300 to 700 m in zone of forest of *Carpinus orientalis* and forest of *Fraxinus ornus* and *Quercus pubescens*, on shallow, frame, limestone ground.

By syntaxonomic meaning, mentioned association belongs to steppe-like vegetation of alliance *Festucion vallesiaceae* Klika 1931, order *Festucetalia vallesiaceae* Br.-Bl et Tx 1943, and class *Festuco brometalia* Br.-Bl et Tx 1943.

Table 1. The association *Galio-Festucetum vallesiaceae trifolietosum dalmaticae*

Plant species	P1	P2	V	K	N	S	T	ŽF	Areal type
<i>Festuca vallesiaca</i> Schl.	4	8	1	3	2	4	4	h	Pont
<i>Asperula purpurea</i> L.	3	7	2	3	2	4	4	h	subMed
<i>Trifolium dalmaticum</i> Vis.	3	7	4	2	2	4	2	th	Bal
<i>Koeleria macrantha</i> (Ledeb) Schult.	2	5	1	4	1	4	3	h	Bal
<i>Petrorhagia saxifraga</i> (L.) Link	2	5	1	4	2	4	4	ch	subMed
<i>Dichantium ischaemum</i> (L.) Rob.	2	5	2	3	2	5	5	h	SMed-As
<i>Teucrium chamaedrys</i> L.	1	3	1	4	1	4	3	ch	subMed
<i>Eryngium campestre</i> L.	1	3	1	4	3	4	4	h	Pont-Med
<i>Galium verum</i> L.	1	3	2	4	2	4	3	g	Eur-Sib
<i>Salvia nemorosa</i> L.	1	3	1	3	3	4	5	h	Eur-OT
<i>Potentilla argentea</i> L.	1	3	1	3	1	4	3	h	SPont
<i>Achillea crithmifolia</i> W. et K.	1	3	3	3	2	4	4	g	Pann-Bal
<i>Fragaria viridis</i> Duch	1	3	2	4	2	3	4	h	Eur-Sib
<i>Satureja kitaibelii</i> Wüerzb. ex Heuff.	1	3	1	4	1	4	4	ch	Pont-Med
<i>Poa angustifolia</i> L.	1	3	1	3	2	4	3	h	Kos
<i>Artemisia alba</i> L.	1	3	1	4	1	4	5	ch	subMed
<i>Medicago falcata</i> L.	1	3	2	4	2	4	4	h	Eur-Sib
<i>Plantago lanceolata</i> L.	+	2	3	3	3	3	3	h	Kos
<i>Helianthemum nummularium</i> (L.) Mill	+	2	2	4	1	4	4	ch	Alp-Med
<i>Inula oculus-christi</i> L.	+	2	2	4	2	4	4	h	Eur-Med
<i>Euphorbia sequeiriana</i> Neck.	+	2	3	3	3	4	4	h	Eur-Sib
<i>Verbascum phlomoides</i> L.	+	2	2	4	3	4	5	th	Eur
<i>Convolvulus arvensis</i> L.	+	2	2	4	3	4	3	g	Kos
Ecoklina:		82	1.78	3.39	1.94	4.00	3.73	h	Bal-Med

Within this phytocenosis, 23 plant species exist which is 5,11% from total number of plant species (450) determined on this mountain.

The dominating species in this association are: *Festuca vallesiaca*, *Asperula purpurea* and *Trifolium dalmaticum*. Except them, the next species take the significant place in this association: *Petrorhagia saxifraga*, *Dichantium ischaemum*, *Teucrium*

chamaedrys, Salvia nemorosa, Potentilla argentea, Euphorbia seguieriana, Achillea crithmifolia, Inula oculus-hristi, Koeleria macrantha, Artemisia alba, Satureja kitaibelii etc.

Table 2. The review of life forms of association *Galio-Festucetum valesiacaе trifolietosum dalmaticae*

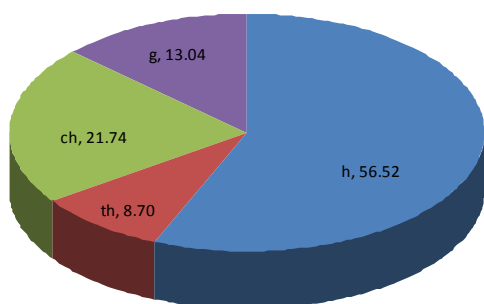
Life form	Number	%
hemicryptophyta (h)	13	56.52
terophyta/hemicryptophyta (th)	2	8.70
chamephyta (ch)	5	21.74
geophyta (g)	3	13.04
Total	23	100.00

Table 3. The review of areal types of association *Galio-Festucetum valesiacaе trifolietosum dalmaticae*

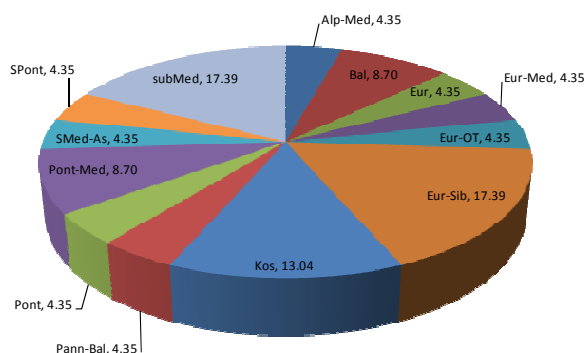
Areal type	Number	%
Mediterranean	8	34.78
European	1	4.35
Oriental-turanian	1	4.35
Siberian	4	17.39
Cosmopolitan	3	13.04
Balkanian	3	13.04
Pontic	2	8.70
Asiatic	1	4.35
Total	23	100.00

The association *Galio-Festucetum valesiacaе trifolietosum dalmaticae* is dominated by hemicryptophyta (h) with 13 taxons or 56.52%, which are followed by chamephyta (ch) with 5 (21.74%) and geophyta (g) with 3 (13.04%). It is interesting that this association almost does not have annual plant species (terophyta) except the crossing form terophyta/hemicryptophyta (th) represented by two species or 8.70%.

According to areal types, Mediterranean areal type dominates with 8 species (37.78%), followed by Siberian with 4 (17.39%), Balkanian and Cosmopolitan with 3 representatives each (13.04%). The least represented types with one representative each are European, Oriental-turanian and Asiatic areal type. So, 78.26 % of total plant species number belongs to four the most numerous areal.



Graph 1. The life form representation in association *Galio-Festucetum valesiacaе trifolietosum dalmaticae*



Graph 2. The areal types representation in association *Galio-Festucetum valesiacaе trifolietosum dalmaticae*

According to analyze of life forms and areal types, we can conclude that this association has characteristics of climate where it is located, and this is continental mountain area with great influence of Mediterranean elements.

This meadows are made by plant species which are curative and have pharmaceutical and medical importance, and because of that, they can be economically valorized. In this case, we select: *Satureja kitaibelii*, *Fragaria viridis*, *Achillea crithmifolia*, *Galium verum*, *Teucrium chamaedrys*, *Artemisia alba* etc. The particular number of species has appliance in stock farming because it is used like stock food.

THE ASSOCIATION *RHINANTHO-FILIPENDULETUM* I-IC 1969

The association *Rhinantho-Filipenduletum* (rattle and dropwort) (Table 4.) is developing on average deep, changed brown forest soil reddish-bay colored, in dips at altitude from 700 to 900 m. This soil type originated on limestone geological foundation. According to syntanomic review, this association belongs to vegetation of alliance *Arrhenatherion* (Br.-Bl. 1925), order *Arrhenatheretalia* Pawl. 1928 and class *Molinio-Arrhenatheretea* Tx. 1937.

On the edge of forest *Paeonio-Quercetum*, in hilly region of Leskovik, the meadow is widespread dominated by: *Rhinanthus rumelicus*, *Lotus corniculatus* and *Salvia pratensis*. From the other species in this association, we separate: *Trifolium incarnatum*, *Salvia nemorosa*, *Vicia cracca*, *Filipendula vulgaris*, *Trifolium montanum*, *Ornithogalum pyrinaicum*, *Thymus marschalianus*, *Carduus candicans*, *Fragaria viridis*, *Ranunculus bulbosus*, *Trifolium alpestre* etc.

Table 4. The association *Rhinantho-Filipenduletum*

Plant species	P1	P2	V	K	N	S	T	ŽF	Flora element
<i>Rhinanthus rumelicus</i> Vel.	3	7	3	3	2	4	3	t	Med
<i>Salvia pratensis</i> L.	2	5	2	4	3	4	4	h	Eur-Med
<i>Lotus corniculatus</i> L.	4	8	2	4	3	4	3	h	Eur-Med
<i>Sanguisorba minor</i> Scop.	1	3	2	4	2	4	3	h	subMed
<i>Vicia cracca</i> L.	2	5	3	3	3	4	3	h	Eur-As
<i>Anthoxanthum odoratum</i> L.	1	3	3	2	3	4	3	h	Eur-As
<i>Plantago lanceolata</i> L.	1	3	3	3	3	3	3	h	Kos
<i>Salvia nemorosa</i> L.	2	5	2	4	3	4	4	h	Eur-OT
<i>Arrhenatherum elatius</i> (L.) Mert et Koch	1	3	3	3	4	3	3	h	Eur-As
<i>Trifolium montanum</i> L.	1	3	2	4	2	4	3	h	SPont
<i>Filipendula vulgaris</i> Moench.	2	5	2	3	2	4	4	h	Eur-Med
<i>Plantago media</i> L.	1	3	2	4	2	4	3	h	Boreal
<i>Trifolium repens</i> L.	1	3	3	3	4	4	3	ch	Eur-Sib
<i>Potentilla argentea</i> L.	1	3	1	3	1	4	3	h	SPont
<i>Euphorbia cyparissias</i> L.	1	3	2	3	2	4	3	h	Eur
<i>Trifolium incarnatum</i> L.	3	7	2	3	3	4	5	th	subMed
<i>Ranunculus polyenthemus</i> L.	1	3	2	3	2	3	4	h	Eur-subMed
<i>Poa pratensis</i> L.	1	3	3	3	3	3	3	h	Kos
<i>Achillea setacea</i> W.K.	1	3	1	3	1	4	4	h	subMed

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<i>Ornithogalum pyrenaicum</i> L.	2	5	3	3	3	3	5	g	Med
<i>Trifolium alpestre</i> L.	2	5	3	3	2	3	4	h	Eur-Sib
<i>Carduus candicans</i> W. et K.	1	3	3	3	3	4	4	h	Pont
<i>Thymus marschalianus</i> Willd.	3	7	2	3	2	4	4	ch	Eur
<i>Festuca vallesiaca</i> Schl.	2	5	1	3	2	4	4	h	Pont
<i>Stachys germanica</i> L.	1	3	2	4	3	4	4	h	Eur-subMed
<i>Hieracium pilosella</i> L.	1	3	2	3	1	4	3	h	Eur-Med
<i>Rumex acetosa</i> L.	+	2	3	3	3	4	3	h	Boreal
<i>Verbascum banaticum</i> Roch. Schred.	1	3	2	3	3	4	3	th	Bal-Dac
<i>Fragaria viridis</i> Duch.	2	5	2	4	2	3	4	h	Eur-Sib
<i>Trifolium striatum</i> L.	1	3	2	2	2	4	5	th	Eur-Med
<i>Hypericum perforatum</i> L.	1	3	2	3	3	3	3	h	Kos
<i>Silene alba</i> (L.) Kr.	1	3	2	3	4	4	3	th	Eur-Sib
<i>Ranunculus bulbosus</i> L.	1	3	2	4	2	4	3	h	Eur
<i>Origanum vulgare</i> L.	1	3	2	3	2	3	3	g	Eur-As
<i>Cruciata pedemontana</i> (Bell) Ehrend.	1	3	3	3	3	4	3	g	Med-CAs
<i>Convolvulus arvensis</i> L.	+	2	2	4	3	4	3	g	Kos
<i>Tragopogon orientalis</i> L.	1	3	2	3	3	4	3	h	Eur-Med
<i>Haynaldia villosa</i> Schur	1	3	2	3	3	4	4	t	SEur
<i>Galium schultesii</i> Vest	+	2	2	3	3	2	3	g	subMed
<i>Paeonia peregrina</i> Mill.	+	2	3	4	3	3	3	g	subMed
<i>Achillea crithmifolia</i> W.K.	+	2	3	3	2	4	4	g	Pann-Bal
<i>Salvia verticillata</i> L.	1	3	2	5	2	4	5	h	subMed
<i>Geranium molle</i> L.	+	2	2	3	3	4	3	th	Eur-Med
<i>Anthemis arvensis</i> L.	+	2	2	2	3	4	4	t	Eur-Med
<i>Bromus mollis</i> L.	1	3	3	3	3	3	3	t	Boreal
<i>Bromus racemosus</i> L.	1	3	4	3	3	3	3	t	Eur
Ecoklina:		164	2.29	3.24	2.56	3.73	3.56	h	Eur-Med

According to previous researches, this association has 46 plant species, that means it is more various and richer from previous analyzed association.

The association *Rhinantho-Filipenduletum* is dominated by hemicryptopyta (h) with 27 taxons, or 58.70%, then followed by geophyta (g) with 7 (15.22%), terophyta (t) and terophyta/chemicryptophyta (th) with 5 representatives each (10.87%) and in the end, the chamephyta (ch) with 2 (4.35%).

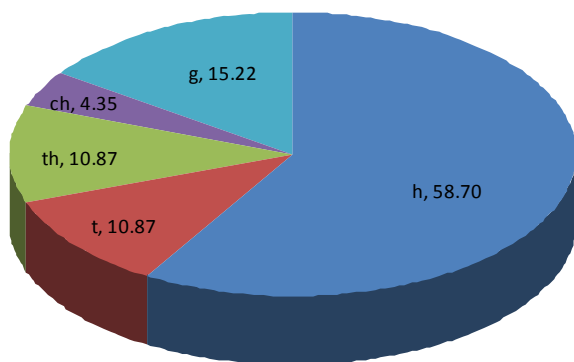
According to areal types, Mediterranean dominates with 18 (39.13%), followed by European and Asiatic with 5 representatives (10.87%) each, Siberian, Pontic and Cosmopolitan with 4 (8.70%) each and Boreal 3 (6.52%). The first three areal types are represented with even 60.87% of total plant species number.

Table 5. The review of life forms of association *Rhinantho-Filipenduletum*

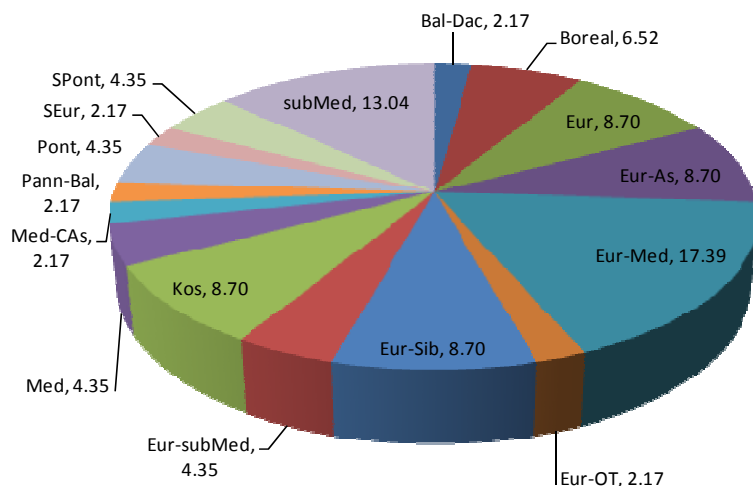
Life form	Number	%
hemicryptophyta (h)	27	58.70
terophytes (t)	5	10.87
terophytes/hemicryptophyta (th)	5	10.87
chamephyta (ch)	2	4.35
geophyta (g)	7	15.22
Total	46	100.00

Table 6. The review of areal types of association *Rhinantho-Filipenduletum*

Areal type	Number	%
Mediterranean	18	39.13
European	5	10.87
Balkanian	1	2.17
Siberian	4	8.70
Pontic	4	8.70
Cosmopolitan	4	8.70
Dacian	1	2.17
Oriental-turanian	1	2.17
Asiatic	5	10.87
Boreal	3	6.52
Total	46	100.00



Graph 3. The life form representation in association *Rhinantho-Filipenduletum*



Graph 4. The areal types representation in association *Rhinantho-Filipenduletum*

According to analyze of life forms and areal types, we can conclude that this association has characteristics of European-Mediterranea flora, because submediterranean elements are 30.43% from total number.

ECOLOGIC INDEXES

In phytocenological tables, we cite ecologic indexes for each plant species and calculate ecologic indexes for analyzed plant associations. On the basis of that, we got the next cognitions represented in following tables (Tables 7. i 8.)

Table 7. The parallel review of number values of ecologic indexes for researched associations

The association	V (humidity)	K (acidity)	N (azote)	S (illuminance)	T (temperature)
<i>Galio-Festucetum</i>	1.78	3.39	1.94	4.00	3.73
<i>Rhinantho-Filipenduletum</i>	2.29	3.24	2.56	3.73	3.56

Table 8. The parallel review of indicator values for researched associations

The association	V (humidity)	K (acidity)	N (azote)	S (illuminance)	T (temperature)
<i>Galio-Festucetum</i>	subxerophyt	neutrophyl-basephyl	oligotroph-mezotroph	polisciophyl-heliophyt	mezoterm-termophyl
<i>Rhinantho-Filipenduletum</i>	submezophyl	neutrophyl-basephyl	mezotroph	polisciophyl-heliophyt	mezoterm-termophyl

According to three important ecologic indexes: acidity (K), illuminance (S) and temperature (T), both of associations belong to: neutrophyl-basephyl (K), polisciophyl-heliophyt (S) and mezoterm-termophyl (V) associations. However, there is difference between them according to humidity (V) because *Galio-Festucetum* is subxerophyl and belongs to steppe vegetation *Festuco-Brometea*, and *Rhinantho-Filipenduletum* is submezophyl and belong to mezophyl vegetation of mountain areas *Arrhenatheretalia*.

CONCLUSION

Based on previous researches, we can conclude that mountain Leskovik, located on far west of Carpathian-Balkanian massif, and represents the significant nature object because the different areal types can be found there.

The vegetation of Leskovik is various: forest (relic, impoverished and modern), meadow-pasture (hill and mountain) and vegetation of boulders (poorly covered).

The hilly-steppe vegetation belongs to associations: *Galio-Festucetum valesiaceae* R.Jov. *trifoliosum dalmatici* subass. *nova* and *Rhinantho-Filipenduletum* l-ić.

The association *Galio-Festucetum valesiaceae* alliance to class *Festuco-Brometea*, order *Festucetalia valesiaceae*, alliance *Festucion valesiaceae*, and association *Rhinantho-Filipenduletum* belongs to class *Molinio-Arrhenatheretea*, to order *Arrhenatheretalia* and to alliance *Arrhenatherion*.

Because of progradation of association *Galio-Festucetum* underwoods, shrubberies and low forests *Carpinetum orientalis serbicum* arise there, and *Rhinantho-Filipenduletum* overgrows into shrubberies, underwoods and forest *Poenio-Quercetum*.

REFERENCES

- CVIJIĆ, J. (1924): Geomorfologija, Knjiga I, Beograd.
- DIKLIĆ, N. (1962): Prilog poznavanju šumskih i livadskih fitocenoza Ozrena, Device i Leskovika kod Sokobanje, Glasnik Prirodjačkog muzeja, Knjiga 18, Serija B, Beograd.
- ĐORĐEVIĆ, V., AVRAMOVIĆ, D., LILIĆ, A., RANĐELOVIĆ, N. (2007): Značajne biljne vrste Leskovika, Ekološka istina 2007, XV Naučno-stručni skup o prirodnim vrednostima i zaštiti životne sredine, Sokobanja. pp: 69 - 73
- ĐORĐEVIĆ, V., RANĐELOVIĆ, N., AVRAMOVIĆ, D., LILIĆ, A. (2006): Prilog vegetaciji Leskovika. Ekološka istina 2006, XIV Naučno-stručni skup o prirodnim vrednostima i zaštiti životne sredine. Sokobanja. pp: 34 - 38
- JOVANOVIĆ, B. (1956): Šibljak asocijacija *Artemisio-Amigdaletum nanae* na Rtnju, Šumarstvo br. 6, Beograd.
- JOVANOVIĆ, R., (1956): Tipovi pašnjaka i livada na Rtnju, Zbornik radova Instituta za ekologiju i biogeografiju SANU, Knjiga 6, br. 2, Beograd.
- RANĐELOVIĆ, N., AVRAMOVIĆ, D., ĐORĐEVIĆ, V., LILIĆ A. (2006): Herbal Associations of mountain Leskovik, Proceedings of Symposium, II Internacionalni Symposium of ecologists of Montenegro, Kotor. pp: 77 - 81.

