UDC (UDK) 582.32(497.16Podgorica)

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BRYOPHYTE FLORA OF "FOREST PARK GORICA" (PODGORICA, MONTENEGRO)

SUMMARY

With the aim of supplementation recent knowledge about the floristic diversity in urban area of Podgorica city, bryological investigation of the "Forest Park Gorica" was conducted during 2008. In this paper, 50 bryophyte species (including the literature data) were presented, as representative of classes *Bryopsida* and *Marchantiopsida* (46 mosses and 4 hepatics); 28 species are new for the investigated area. The most numerous family is *Pottiaceae* with 9 genera and 16 species, while the most numerous genus is *Bryum*, with 6 species. Taxonomic, phytogeographic and ecological analyses of study area are given.

Keywords: Bryoflora, forest park Gorica, Podgorica, Montenegro

INTRODUCTION

During the last 10 years in Montenegro, bryological research has intensified, so that the total number of registered taxa has significantly increased (Dragićević and Veljić, 2006; Sabovljević and Natcheva, 2006; Ros et al., 2007; Sabovljević et al., 2008; Erzberger and Papp, 2007; Erzberger et al., 2008; Papp and Erzberger 2007, 2008). However, the bryoflora of urban areas are still unknown. Forest park Gorica is located in the core of Podgorica (42º27'0.09"N, 19º16'39,7"E) and it is an area of 144.24 ha. The geological substrate consists of limestone on which a basic type of soil formed *terra rossa* (Knežević, 2000). Forest park Gorica ranks as a floristically rich locality with more than 400 species of vascular plant (Stešević, 2002; 2009). Before the large fires in 2011 and 2012 the vegetation of the Park Forest was mainly represented by planted pine-cypress forest, and natural forest with Trojan oak (ass. *Quercetum trojanae montenegrinum*). Now days, dominant are open communities typical for karstic terrain, while forest is left only in fragments. Literature data about bryophyte flora of the Forest Park Gorica is poor and rather old, and it contains 21 species (1 hepatics and 20 mosses) (Pulević and Pavletić, 1980). That was the key reason in the selection of the site for bryological research.

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MATERIAL AND METHODS

Main habitat types in the investigated area are forest and rock formations, with some different substrates: tree bark, soil, exposed and shaded rocks. Taxa is listed alphabetically according to nomenclature used in Hill *et al.* (2006) for mosses and Grolle and Long (2000) for hepatics. Ecological data is given by Soó (1964), Boros (1964) and Boros & Járai-Komlódi (1975); phytogeographic analyses and distribution are discussed by Duell *et al.* (1999). Literature data which were not confirmed in the field are marked with minus (-). The materials are preserved in the Herbarium of the Faculty of Natural Sciences and Mathematics, University of Montenegro (TGU) and the Natural History Museum of Montenegro.

RESULTS AND DISCUSSION

The list of bryophytes of "Forest Park Gorica" consists of 50 species, 4 hepatics and 46 mosses. Among them 22 species, 1 hepatic and 21 mosses were already known for the area (Pavletić and Pulević, 1980), therefore, 28 species (3 hepatics, 25 mosses) presents new records. Due to habitat loss, 14 species cited in the literature (Pavletić and Pulević, 1980) were not confirmed in out field investigations.

List of recorded Bryophyte taxa with substrates:

HEPATICS

Frullania dilatata (L.) Dumort. – bark of *Cupressus semprevirens*.
Preissia qudrata (Scop.) Ness. - the stone wall.
Radula complanata (L.) Dumort. – bark of *Ailanthus altissima*.
(-) ***Targionia hypophylla*** L. – limestone rock.
* In sod of hepatic *Frullania dilatata* we registered **only one individua** of *Frullania jackii* (conf. B. Papp); this is a first data about *F. jackii* for the bryophyte flora of Montenegro; research will be continued.

MOSSES

Brachythecium rutabulum (Hedw.) Schimp. – soil and decaying branch; hill Gorica (Pavletić & Pulević, 1980).
(-) ***Brachythecium salebrosum*** (Hoffm. ex F. Weber & D. Mohr) Schimp.
Bryum argenteum Hedw. – on soil.
Bryum capillare Hedw. – on soil.
Bryum caespiticium Hedw. – on soil; hill Gorica (Pavletić and Pulević, 1980).
(-) ***Bryum funckii*** Schwägr.
(-) ***Bryum intermedium*** (Brid.) Blandow
Bryum pseudotriquetrum (Hedw.) P. Gaertn. *et al.* – limestone rock.
(-) ***Calliergonella lindbergii*** (Mitt.) Hedenäs (*Breidleria arcuata* Loeske)

Cinclidotus fontinaloides (Hedw.) P.Beauv. – limestone rock and bark of *Cupressus sempreviren***s.**
Cirriphyllum crassinervum (Taylor) Loeske & M. Fleisch. – bark of *Cupressus sempreviren*s.
Dialytrichia mucronata (Brid.) Broth. - wet limestone rock.
(-) ***Dicranum spurium*** Hedw.
(-) ***Didymodon rigidulus*** Hedw. (*Barbula rigidula* (Hedw.) Milde)
Didymodon luridus Hornsch. – limestone rock.
Eucladium verticillatum (With.) Bruch & Schimp. - wet limestone rock.
Fabronia pussilla Raddi - bark of *Cupressus sempreviren*s.
(-) ***Fissidens dubius*** P.Beauv. (*Fissidens cristatus* Wils.)
Fisidens taxifolius Hedw. – on soil.
Grimmia pulvinata (Hedw.) Sm. - limestone rock; hill Gorica (Pavletić and Pulević, 1980).
Grimmia spp. - limestone rock.
Homalothecium lutescens (Hedw.) H.Rob. - on soil; hill Gorica (Pavletić and Pulević, 1980).
(-) ***Homalothecium philippeanum*** (Spruce) Schimp. (*Campthothecium philippeanum* B.S.G.)
Homalothecium sericeum (Hedw.) Schimp. – limestone rock.
***Hypnum cupressiforme* Hedw.** - bark of *Cupressus sempreviren*s.
Leptodon smithii (Hedw.) F.Weber & D.Mohr - bark of *Cupressus sempreviren*s.
Leucodon sciuroides (Hedw.) Schwärg. – bark of *Pinus halepensis*.
Orthotrichum anomalum Hedw. – limestone rock.
Orthotrichum cupulatum Hoffm. ex Brid. – limestone rock.
(-) ***Orthotrichum speciosum*** Nees
(-) ***Plagiobryum zieri*** (Hedw.) Lindb.
Plagiomnium affine (Blandow ex Funck) T. J. Kop. – on soil.
Platyhypnidium riparioides (Hedw.) Dixon – wet limestone rock.
Pleurochaete squarrosa (Brid.) Lindb. – on soil; hill Gorica (Pavletić and Pulević, 1980).
Rhynchostegium confertum (Dicks.) Schimp. – limestone rock.
Schistidium sp. - limestone rock.
Scorpiurium circinatum (Bruch) M. Fleisch. et Loeske – bark of *Pinus halepensis*.
Syntrichia laevipila Brid. - bark of *Cupressus sempreviren*s.
Syntrichia ruralis (Hedw.) F.Weber & D.Mohr – limestone rock; hill Gorica (Pavletić and Pulević, 1980).
Tortula muralis Hedw. – limestone rock; hill Gorica (Pavletić and Pulević, 1980).
Tortella flavovirens (Bruch) Broth. – on soil.
Totella inclinata (R.Hedw.) Limpr. – limestone rock; hill Gorica (Pavletić and Pulević, 1980).
Tortella tortuosa (Hedw.) Limpr. – on soil.

(-) ***Weissia brachycarpa*** (Nees & Hornsch.) Jur. (*Weissia microstoma* C. Müll.)
(-) ***Weissia controversa*** Hedw. (*Weissia viridula* Hedw.)
(-) ***Weissia condensa*** (Voit) Lindb. (*Weissia tortilis* (Schwägr.) Müll. Hal.)

At the Gorica site was noted the presence of two mosses classes: *Marchantiopsida* (4 species ili 8%) and *Bryopsida* (46 species ili 92%). Class *Machantiopsida* is represented by 4 families and 4 genera, and class *Bryopsida* represented by 12 families and 28 genera (Figure 1).

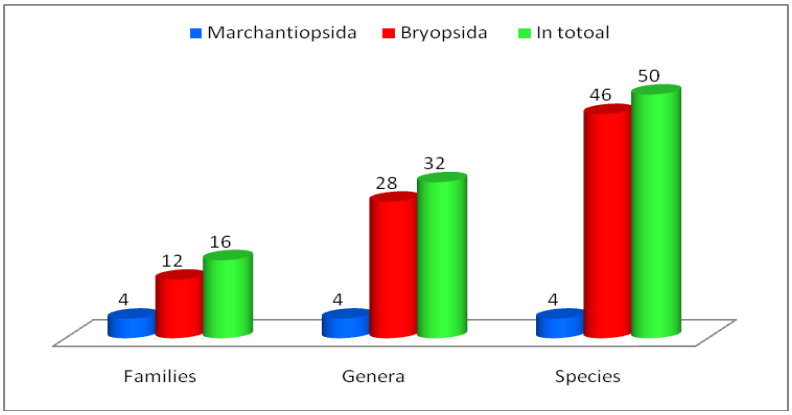

Figure 1: The taxonomic spectrum of moss of the "Forest Park Gorica”.

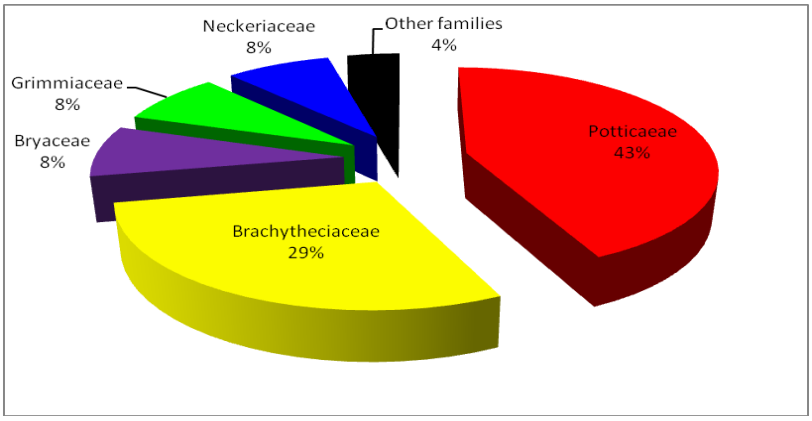

Figure 2: The taxonomic spectrum of families of the "Forest Park Gorica”.

Most numerous family *Pottiaceae* consists of 9 genera (43%). It also dominates the total taxonomic spectrum of bryophtes of Montenegro (Dragićević and Veljić, 2006). Family *Brachytheciaceae* consists of 7 genera (29%), while *Bryaceae*, *Grimmiaceae* and *Neckeraceae* are represented by two genus each (9%). Other families are represented by a single genus (4%) (Figure 2).

Moss found at the "Forest Park Gorica" are classified in 32 genera. The genus with the largest number of representatives is *Bryum* (6 species, 23%);

followed by *Homalothecium*, *Orthotrichum* and *Weissia* with 3 species each (11%) and *Brachythecium*, *Didymodon*, *Fissidens*, *Grimmia*, *Syntrichia* and *Tortella* with 2 species each (8%). Genera presented with only one species are: *Calliergonella*, *Cinclidotus*, *Cirriphyllum*, *Dialytrichia*, *Dicranum*, *Eucladium*, *Fabronia*, *Frullania*, *Hypnum*, *Leptodon*, *Leucodon*, *Plagiobryum*, *Plagiomnium*, *Platyhypnidium*, *Pleurochaete*, *Preissia*, *Radula*, *Rhynchostegium*, *Schistidium*, *Scorpiurium*, *Targionia* and *Tortula* (4%) (Figure 3).

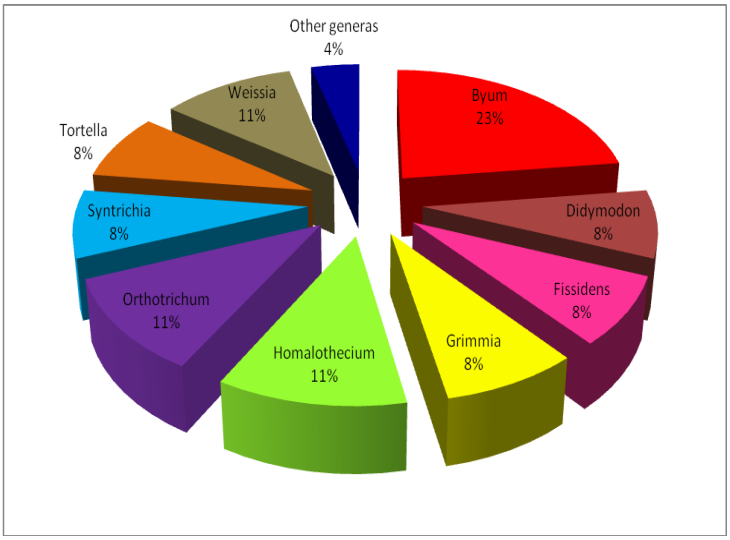

Figure 3: The taxonomic spectrum of genera of the "Forest Park Gorica”.

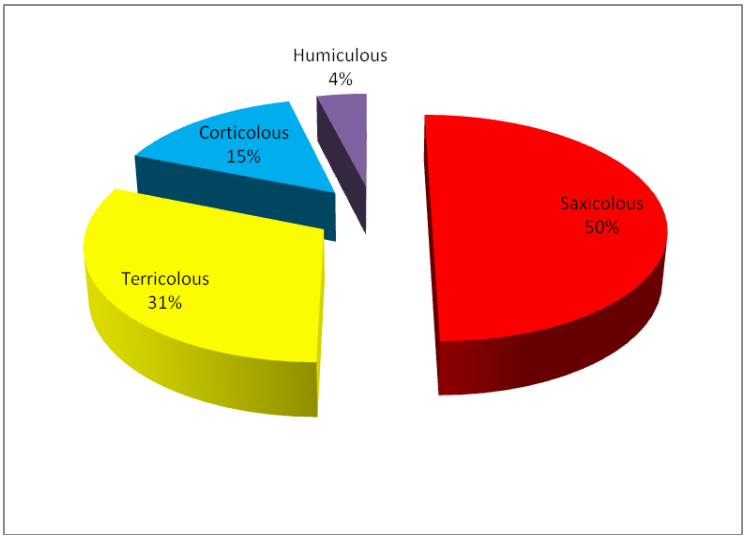

Figure 4: Number and percentage of taxa in relation to substratum type.

In the studied area, mosses were collected from different substrates: soil, bark, rocks, walls. Most of the recorded ones are saxicolous moss (23 species or 50%), then terricolous (14 species or 31%), corticolous (7 species, 15%) and humiculous (2 species, 4%) (Figure 4).

In relation to the ecological parameters of humidity dominant are xerophilous life forms (23 species or about 50%), then mesophilous (17 species or 37%), while hygrophilous forms are significantly less presented (6 species or 12%) (Figure 5).

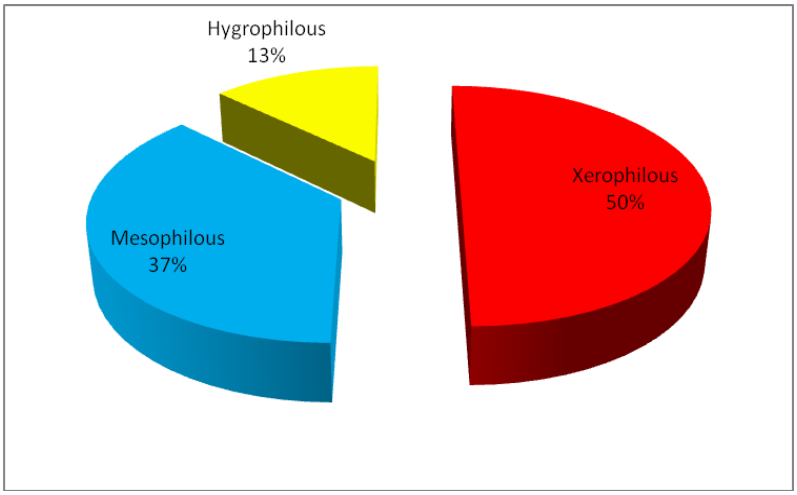

Figure 5: Number and percentage of taxa in relation to ecological parameter humidity.

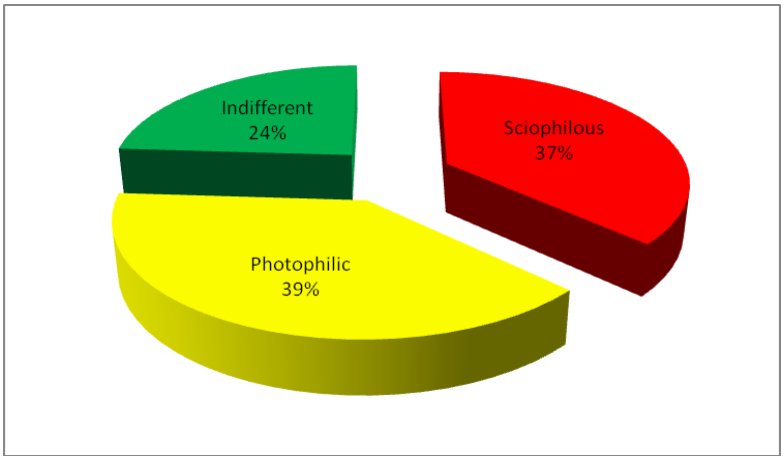

Figure 6: Number and percentage of taxa in relation to ecological parameter light.

In relation to ecological parameter of light, predominant are photophilic (18 species, 39%) and sciophilous (17 species, 37%) forms of moss, while a smaller number represented indifferent taxa (11 species, 24%) (Figure 6).

With chorological analysis we found that the most of the represented species belong to temporal floristic element (22 species, 47%), followed by Sub-Mediterranean one with 11 representatives (23%) (Figure 7).

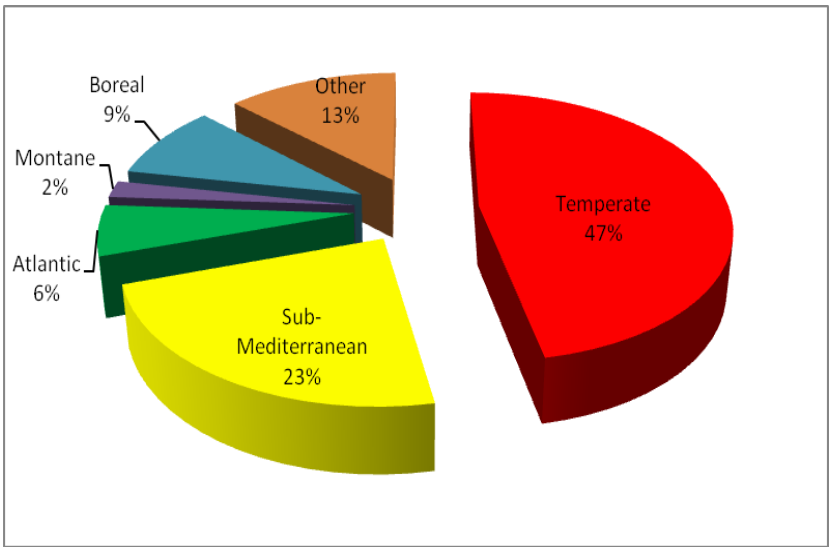

Figure 7: Number and percentage of taxa in relation to chorology.

CONCLUSIONS

This paper presents the results of moss survey at the "Forest Park Gorica" in Podgorica. The list of bryophytes consists of 50 species, 4 hepatics and 46 mosses. Among them 22 species, 1 hepatic and 21 mosses were already known for the area (Pavletić and Pulević, 1980), therefore, 28 species (3 hepatics, 25 mosses) presents new records. Due to habitat loss, 14 species cited in the literature were not confirmed in out field investigations. According to taxonomical analysis registered taxa belongs to the classes *Bryopsida* (12 families, 28 genera and 46 species) and *Marchantiopsida* (4 families, 4 genera and 4 species). The dominant family is *Pottiaceae* with 9 genera, and the most numerous genus is *Bryum* with 6 species. Ecological analysis was performed in relation to ecological parameters of humidity, light and substrate type. The most numerous are mosses of dry habitats- xerophilous life forms (23 species or 50%), while compared to the light, dominant are photophilic mosses (18 taxa or 39%) and by the type of substrate saxicolous one (23 or 50%). Chorological analysis showed that almost half of the recorded taxa belongs to temporal floristic element (22 species or 47%).

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FLORA MAHOVINA "PARK ŠUME GORICA" (PODGORICA, CRNA GORA)

SAŽETAK

Sa ciljem dopune dosadašnjih saznanja o florističkom diverzitetu urbanog područja Podgorice, u toku 2008. godine sprovedena su briološka istraživanja "Park šume Gorice". U radu je predstavljeno 50 vrsta mahovina (uključujući i literaturne podatke), predstavnika klasa *Bryopsida* i *Marchantiopsida* (46 pravih mahovina i 4 jetrenjače); 28 vrsta su nove za istraživano područje. Najbrojnija porodica je *Pottiaceae*, koja obuhvata 9 rodova i 16 vrsta. Najbrojniji rod je *Bryum*, sa 6 vrsta. U radu je data taksonomska, fitogeografska i ekološka analiza mahovina istraživanog područja.

Ključne riječi: brioflora, "Park šuma Gorica", Podgorica, Crna Gora.