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## **DATA UPON THE MACROLICHENS IN BOCULUI MOUNTAIN, CLUJ COUNTY**

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**Abstract:** A first inventory of the foliose and fruticose lichens in Bocului Mountain (Cluj district) is made, a number of 30 species being identified. Were found 10 rare species (37%) (*Cladonia cornuta*, *Parmelia caperata*, *P. exasperata*, *Parmotrema chinense*, *Usnea filipendula*, *U. florida*, *U. glabrescens*, *U. subfloridana*, *Physconia distorta*, *Ramalina fastigiata*) according to the chorology of lichens in central Europe.

The lichen species were characterised using the ecological indexes (light, humidity, temperature and chemical reaction of the substrate) published by *Ellenberg* et al. (1992) and *Wirth* (1995) and the geographical elements. The predominant categories are moderate photophilous (60%), xero-mesophilous (37%), micro-mesothermal (40%) and moderate acidophilous (23%). Prdominate also the boreal-mediterranean geographical elements (8 species) and the *Parmelia* (43%) and *Caldonia* (27%) type bioforms.

**Key words:** lichens, fruticose, foliose, lichenflora, ecological analysis, geographical elements, bioforms, Bocului Mountain, Romania

### **Introduction**

Boc Mountain is situated in the proximity of three well-known tourist areas in Cluj county, that is Băișoara Mountain, Fili Mountain and Iara Valley. Just like Băișoara Mountain, Boc Mountain has a subalpine character. Although this region is not a tourist resort and the only access way is on a forest road, it is a very popular recreation area. In Boc hamlet there live only a few families and the number of population barely reaches 43 inhabitants, mostly elderly people. The place is obviously undergoing an accelerated demographic decline caused by the low birth rate, but mostly by young people's migration to the town.

Although this area has an extraordinary potential from the aesthetic, tourist, educational and scientific point of view, it is not very known to the public and the science community. Moreover, due to the local authorities' ignorance, who closed their eyes to the tree cutting in the past, a very suitable location for ecotourism and scientific tourism is about to be lost.

Boc Mountain is situated in the east of the massif Muntele Mare, at 46°34'4,8" north latitude and 23°19'52,68" east longitude. Boc Mountain is crossed by the following streams: Roșala, Jneapănu, Huda Mare, Scoruş, Bocu [4].

The researched area is characterized by a variety of forests, but mostly by forms of coniferous trees. The ecology of the vegetation in Boc Mountain is strongly influenced by the anthropogenic factor which manifests through tree cutting, inappropriate household refuse storage and animal grazing. Because of these factors the respective area needs protection and conservation measures in order to be able to keep research it in proper conditions [13].

### **Material and Methods**

The foliose and fruticose lichens were collected and determined during 2005-2007. We have used for the identification of the lichen species several scientific works [1, 5, 6, 8, 10, 11, 14], the nomenclature was established according to the professional literature [7, 9]. The lichens

ecological preferences toward light, humidity, temperature, chemical reaction of the substrate, and the chorology were analysed, comparing with other works [2] and using the indicator values of Ellenberg et al. [3] and Wirth [12].

### Results and Discussion

There have been identified 30 species of macro lichens, classified in 6 families: *Cladoniaceae*, *Parmeliaceae*, *Physciaceae*, *Ramalinaceae*, *Teloschistaceae*. The best represented type is *Cladonia*, with 7 species, followed by *Parmelia* and *Usnea* with 5 items each.

### Systematic arrangement

#### EUMYCOTA

##### ASCOMYCOTINA

##### DISCOMYCETES

##### LECANORALES

##### CLADONIACEAE

1. *Cladonia arbuscula* (Wallr.) Flot. - identified at „Șes”, among *Vaccinium myrtillus*; L<sub>8</sub>U<sub>0</sub>T<sub>0</sub>R<sub>0</sub>; arkt-mieur (smed-mo); Ch Cl; common.
2. *Cladonia chlorophaea* (Flörke ex Sommerf.) Spreng. - identified at „Zmeuriș”; L<sub>5</sub>U<sub>0</sub>T<sub>0</sub>R<sub>0</sub>; arkt - med; Ch Cl ; in expans.
3. *Cladonia coniocraea* (Flörke) Spreng. - identified at „Zmeuriș”; L<sub>5</sub>U<sub>0</sub>T<sub>0</sub>R<sub>4</sub>; bor - med; Ch Cl; in expans.
4. *Cladonia cornuta* (L.) Hoffm. - identified at „Zmeuriș”, Dealul Huzii and Grâu Căzut; L<sub>8</sub>U<sub>5</sub>T<sub>4</sub>R<sub>3</sub>; (arkt)bor – mieur-mo; Ch Cl; rare, critically endangered.
5. *Cladonia digitata* (L.) Hoffm. - identified at „Șes” and Grâu Căzut; L<sub>5</sub>U<sub>0</sub>T<sub>4</sub>R<sub>2</sub>; bor - med; Ch Cl; common.
6. *Cladonia fimbriata* (L.) Fr. - identified at „Zmeuriș” and „Șes”; L<sub>7</sub>U<sub>0</sub>T<sub>3</sub>R<sub>4</sub>; bor - med; Ch Cl; common.
7. *Cladonia macilenta* Hoffm. - identified at „Zmeuriș”; L<sub>7</sub>U<sub>0</sub>T<sub>3</sub>R<sub>2</sub>; s'bor – smed (med); Ch Cl; common.

##### PARMELIACEAE

8. *Evernia prunastri* (L.) Ach. - identified at „Șes”, Roșala and Grâu Căzut; L<sub>7</sub>U<sub>3</sub>T<sub>5</sub>R<sub>3</sub>; bor - med; H E Ra; common.
9. *Hypogymnia physodes* (L.) Nyl. - was identified everywhere; L<sub>7</sub>U<sub>3</sub>T<sub>0</sub>R<sub>3</sub>; arkt - med; H E Pa; in expans.
10. *Neofuscelia pulla* (Ach.) Essl. - identified at Roșala; L<sub>9</sub>U<sub>3</sub>T<sub>3</sub>R<sub>4</sub>; s'bor - med; H E Pa; in expans.
11. *Parmelia acetabulum* (Neck.) Elix & Lumbsch in Lumbsch, Kothe & Elix - identified in the experimental spruce forest from Boc hamlet; L<sub>7</sub>U<sub>3</sub>T<sub>6</sub>R<sub>7</sub>; (s'bor)mieur-med; H E Pa; common.
12. *Flavoparmelia caperata* (L.) Hale - from *Prunus avium* rithidome in Boc hamlet; L<sub>6</sub>U<sub>4</sub>T<sub>6</sub>R<sub>4</sub>; mieur(subatl)-med; H E Pa; rare.
13. *Melanelia exasperata* (De Not.) Essl. - identified at Roșala; L<sub>8</sub>U<sub>6</sub>T<sub>3</sub>R<sub>6</sub>; bor - med; H E Pa; rare.
14. *Parmelia sulcata* Taylor - identified at Roșala, Dealul Huzii spruce rithidome and ash rithidome from a yard in Boc hamlet; L<sub>7</sub>U<sub>3</sub>T<sub>0</sub>R<sub>5</sub>; arkt - med; H E Pa; in expans.
15. *Parmotrema chinense* (Osbeck) Hale & Ahti - identified at Grâu Căzut; L<sub>7</sub>U<sub>5</sub>T<sub>6</sub>R<sub>5</sub>; mieur - subatl – med (mo/subatl); H E Pa; rare.
16. *Pseudevernia furfuracea* (L.) Zopf. - was identified ewerywhere; L<sub>8</sub>U<sub>3</sub>T<sub>4</sub>R<sub>2</sub>; bor - med - mo; H E Pa; in expans.

17. *Usnea filipendula* Stirt. - identified at Dealul Huzii; L<sub>7</sub>U<sub>6</sub>T<sub>4</sub>R<sub>3</sub>; bor - med - mo; H E Us; rare.
18. *Usnea florida* (L.) Weber ex F. H. Wigg. - identified at Roșala, Dealul Huzii and Grâu Căzut; L<sub>7</sub>U<sub>7</sub>T<sub>5</sub>R<sub>5</sub>; mieur – smed - mo; H E Us; rare, endangered.
19. *Usnea glabrescens* (Nyl. Ex Vain.) Vain. - identified at Dealul Huzii; L<sub>7</sub>U<sub>0</sub>T<sub>5</sub>R<sub>5</sub>; bor – mieur - mo; H E Us; rare.
20. *Usnea hirta* (L.) Weber ex F. H. Wigg. - identified at Grâu Căzut; L<sub>7</sub>U<sub>5</sub>T<sub>4</sub>R<sub>3</sub>; bor-mieur(med – mo); H E Us; common.
21. *Usnea subfloridana* Stirt. - identified at Dealul Huzii; L<sub>7</sub>U<sub>6</sub>T<sub>4</sub>R<sub>5</sub>; (s')bor – mieur (med – mo); H E Us; rare, vulnerable.
22. *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M. J. Lai - identified at Roșala *Sorbus aucuparia* rithidome and at Grâu Căzut on spruce rithidome; L<sub>6</sub>U<sub>7</sub>T<sub>3</sub>R<sub>2</sub>; bor – smed – mo (med – mo); Ch Ce; common.
23. *Xantoparmelia conspersa* (Ach.) Hale - identified at Roșala; L<sub>9</sub>U<sub>3</sub>T<sub>5</sub>R<sub>5</sub>; bor - med; H E Pa; common.

### PHYSICIACEAE

24. *Physcia aipolia* (Ehrh. Ex Humb.) Fürnr. - identified on ash rithidome from a yard in Boc hamlet; L<sub>7</sub>U<sub>3</sub>T<sub>4</sub>R<sub>7</sub>; bor – med(mo); H E Pa; common.
25. *Physcia stellaris* (L.) Nyl. - identified at Roșala; L<sub>7</sub>U<sub>3</sub>T<sub>5</sub>R<sub>6</sub>; bor – med(mo); H E Pa; common.
26. *Physconia distorta* (With.) J. R. Laundon - identified at Grâu Căzut; L<sub>7</sub>U<sub>3</sub>T<sub>5</sub>R<sub>7</sub>;(s')bor - smed - med; H E Pa; rare.

### RAMALINACEAE

27. *Ramalina calicaris* (L.) Fr. - collected at „Șes”; L<sub>7</sub>U<sub>5</sub>T<sub>5</sub>R<sub>6</sub>; bor - med; H E Ra; rare.
28. *Ramalina fastigiata* (Pers.) Ach. – collected in Boc hamlet area; L<sub>7</sub>U<sub>6</sub>T<sub>5</sub>R<sub>6</sub>; (s')bor-mieur-med; H E Ra; rare.

### PELTIGERALES

#### PELTIGERACEAE

29. *Peltigera degenii* Gyeln. - identified in the experimental spruce forest from Boc hamlet; L<sub>5</sub>U<sub>6</sub>T<sub>4</sub>R<sub>5</sub>; bor – mieur – mo(smed – mo); H Pe; common.

### TELOSCHISTALES

#### TELOSCHISTACEAE

30. *Xanthoria polycarpa* (Hoffm.) Th. Fr. Ex Rieber – collected from ash rithidome from a yard in Boc hamlet; L<sub>7</sub>U<sub>3</sub>T<sub>5</sub>R<sub>6</sub>; mieur; H E Pa; common.

The analysis of the lichen flora according to the species preferences to the light shows the predominance of the moderate photophilous species (60%), followed by the photophilous and photo-sciaphilous species, 13% each. Less represented are the strong photophilous and photo-sciaphilous - moderate photophilous species, 7% each.

The analysis according to preferences to humidity ranks on a higher position the xero-mesophilous species (37%) and the euryhigrous ones (23%). They are followed by the mesophilous - mesohygrophilous (17%) and mesophilous (13%) species. The least represented are the mesohygrophilous (7%) and the xero-mesophilous - mesophilous (3%) species.

According to the temperature factor, the highest position is held by the micro-mesothermal species (40%), followed by the microthermal ones (33%). Less represented are the eurythermic (17%) and moderate thermophilous (10%) species.

From the point of view of the chemical nature of the substrate, 23% represents the moderate acidophilous species, 17% represents the moderate acidophilous - subneotrophilous

species as well as the acidophilous ones. They are followed by the strong acidophilous and acidophilous - moderate acidophilous species, 13% each. Less represented are the euryonic species (7%).

The chorology analysis of the lichen flora concludes that 43% of the inventoried lichens are common, 37% are rare species and 20% are species with an increasing spreading area.

The analysis of the lichens from the point of view of bioforms on the premises around Boc hamlet emphasizes the predominance of *Parmelia* type (H E Pa) in a percentage of 43%. The *Cladonia* type (Ch Cl) has an percentage of 27%, followed by the *Usnea* type (H E Us) in a percentage of 17%. The *Ramalina* type (H E Ra) has an percentage of 10% and the *Peltigera* type (H Pe) has low representation in a percentage of only 3%.

**Table 1.** *The distribution of species in relation with the geographical elements\**

	<b>Geographical element</b>	<b>Number of species</b>
	Arkt-med	3
	Arkt-mieur (smed-mo)	1
	(Arkt)bor – mieur-mo	1
	Bor-med	8
	Bor-med-mo	1
	Bor-med-(mo)	2
	Bor – mieur - mo	1
	Bor – mieur – mo(smed – mo)	1
	Bor-mieur(med – mo)	1
	Bor – smed – mo (med – mo)	1
	Mieur	1
	Mieur(subatl)-med	1
	Mieur-subatl-med (mo/subatl)	1
	Mieur – smed - mo	1
	S'bor - med	1
	S'bor-smed (med)	1
	(S')bor-smed-med	1
	(s')bor – mieur (med – mo)	1
	(S')bor-mieur-med	2
	<b>TOTAL</b>	<b>30</b>

\*The shortcuts used for the geographical elements are corresponding to Wirth (21).

From the fitogeographic point of view (Table 1) we can notice the preponderance of the boreal elements, the boreal - mediterranean ones being best represented (8 items). Also, in the researched area there has been noticed the interference of the arcto-mediterranean elements.

### **Conclusions**

The field analysis took place between 2005 and 2007 in the surrounding area of Boc hamlet, in Boc Mountain. There were identified 30 species of macro lichens, classified into 6

families: *Cladoniaceae*, *Parmeliaceae*, *Physciaceae*, *Ramalinaceae*, *Peltigeraceae*, *Teloscistaceae*. The best represented is *Cladonia*, with 7 species, followed by *Parmelia* and *Usnea* with 5 species each. Among the rare species inventoried on Boc mountain we can mention: *Cladonia cornuta*, *Parmelia caperata*, *Parmelia exasperata*, *Parmotrema chinense*, *Usnea filipendula*, *Usnea florida*, *Usnea glabrescens*, *Usnea subfloridana*, *Physconia distorta*.

As far as light is concerned lichen species do not develop restrictive behaviors. The best represented are the moderate photophilous species (60%), followed by the photophilous species and by the photo-sciaphilous species, each equaling 13%. We shall mention as less represented the strong photophilous and photo-sciaphilous - moderate photophilous species, with 7% each. The latter have found their niche in open places, where trees have been cut, on knots or on sunny parts of the trees.

The analysis according to preferences to humidity underlines a significant percent of the xero-mesophilous species (37%) which equally tolerate stations poor in rainfalls and more humid as well. It is one of the features determined by the shelter land climate, to the foehn effects and to the wide spread of lime stones in Apuseni Mountains. The euryhigrous species are well represented as well, in a percentage of 23%. They are followed by the mesophilous - mesohygrophilous (17%) and mesophilous (13%) species which prefer the humid habitats. The mesohygrophilous species are less represented (7%), as they prefer stations poor in rainfalls, nevertheless with high atmospheric humidity.

As for the temperature, we shall underline the presence of micro-mesothermal species (40%). A high percent is given by the microthermal ones (33%), feature determined by the location of the area subject of the study on the mountain layer with cold climate, characterized by the low temperatures and by the influence of the cold air masses coming from the north.

The preference analysis toward the chemical nature of the substrate underlines the preference of the lichen species object of the study for sub layers more or less acid, fact determined by the specific of the spruce forest. Therefore, 23% of the lichen species collected are moderate acidophilous, whereas the moderate acidophilous-subneotrophilous species and the acidophilous species are represented in a 17% percentage. They are followed by the strong acidophilous and acidophilous-moderate acidophilous species, each with 13%; species which can be found on the spruce ritidome, for the epiphytes, within the coniferous litter, for the tericole species. The euryonic species are less represented (7%).

Referring to the fitogeographic elements we shall mention the predominance of the boreal elements, the boreal - mediterranean species being the most powerfully represented (8). The medium - European species are well represented themselves, with various influences (mediterranean, sub mediterranean and sub atlantic). We shall therefore notice the presence of the arctic elements, represented by arctic - mediterranean elements (3) and arctic - medium European (1). We shall notice the phyto-geographical influence of the boreal elements, with the mediterranean, sub atlantic and arctic. This fact suggests a belonging to the biotome of the temperate coniferous forests, with a powerful European tone. The lichen vegetation reflects the climatic features of this mountain area, with elements of mediterranean origin, together with the intermediary continental. It is determined by the winds bringing masses of humid air, on one hand, and, on the other hand, to the dry air coming from Bihor Mountains, which explains the maintenance of species specific to warmer regions, together with the species from circumpolar regions.

Analyzing the distribution of the macrolichens species within the area subject of the study, according to the bioform category we shall underline a predominance of the *Parmelia* type (43%) – epiphytes hemi cryptophytes, followed by the camephytes of the *Cladonia* form (27%) and by the hemi cryptophyte species of the *Usnea* form (17%).

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## DATE ASUPRA FLOREI DE MACROLICHENI DIN ZONA MUNTELE BOCULUI, JUDEȚUL CLUJ

## (Rezumat)

Muntele Bocului este situat în cadrul Munților Apuseni, în partea estică a masivului Muntele Mare. Cercetările desfășurate în perioada 2005 – 2007 au dus la identificarea unui număr de 30 de specii de licheni foliacei și fruticuloși. Dintre speciile identificate numeroase sunt rare, din această categorie făcând parte: *Cladonia cornuta*, *Flavoparmelia caperata*, *Melanelia exasperata*, *Parmotrema chinense*, *Usnea filipendula*, *U. florida*, *U. glabrescens*, *U. subfloridana*, *Physconia distorta*.

Analiza comportamentului ecologic al speciilor identificate s-a realizat pe baza factorilor care determină distribuția acestora, respectiv lumina, temperatura, umiditatea și reacția chimică a substratului. Prin corelarea datelor obținute cu particularitățile cadrului natural al zonei studiate, s-a evidențiat caracterul lichenilor de indicatori fideli ai microstațiunilor în care se dezvoltă.

Predominanța molidișelor în zona studiată se reflectă în preferințele lichenilor față de lumină, cel mai bine reprezentate fiind speciile moderat fotofile (60%), urmate de fotosciafile și fotofile cu câte 13% fiecare. În privința umidității, se remarcă procentul ridicat de specii xeromezofile (37%), fapt datorat situării zonei într-o “umbră” de precipitații, cu fenomene evidente de vânturi calde și uscate. Situația zonei studiate în etajul montan inferior determină predominanța speciilor micro-mezoterme (40%) și microterme (33%). Molidișele imprimă și preferințele lichenilor față de reacția chimică a substratului, predominând speciile care preferă diferite grade de aciditate.

Din punct de vedere al analizei elementelor floristice se observă interferența elementelor boreale cu cele mediteraneene, subatlantice și arctice, fapt care sugerează încadrarea în biomuul pădurilor temperate de conifere, cu o notă puternic europeană.