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THE ECOLOGICAL ANALYSIS OF THE CORTICOLOUS MACROLICHENS FROM THE PĂDUREA CRAIULUI MOUNTAINS (BIHOR DEPARTAMENT)

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Abstract: The studies of corticolous lichen flora of the Pădurea Craiului Mountains had carried out to the identification of 59 foliose and fruticose lichen species, 8 species are rarest (*Hypocenomyces scalaris, Melanelia elegantula, M. subargentifera, Physcia dubia, Lepraria lobificans, Phlyctis agelaea, P. argena, Xanthoria fallax*) and 1 species *Parmelina pastilifera* (Harm.) Hale is new for the Romanian lichen flora.

The corticolous foliose and fruticose lichen species from the Pădurea Craiului Mountains were characterised using the ecological indexes (light, humidity, temperature and chemical reaction of the substrate) published by *Ellenberg, H.* et al. (1992) and *Wirth, V*. (1995).

According to their preferences toward light, the predominance of the moderate photophilous species (47.45%) could be explained by their development on the trunks of all the investigated tree species. The analysis of the humidity figure reveals the predominance of xero-mesophilous species (44.06%) developed on sunny exposed parts of the tree trunks. Considering the preferences toward the temperature, the climate characteristic to the low mountain zone, specific for the Pădurea Craiului Mountains, determine the preponderance of the micro-mesothermal species (45.76%). Regarding the chemical reaction of the substrate, the aproximatively equal percents of moderate acidophilous (23.92%), acidophilous (22.03%) and subneutrophilous (20.38%) lichen categories is corelated with the bark pH of the trees where the lichen were identified.

Introduction

The Pădurea Craiului Mountains are located in the north-western part of the Apuseni Mountains. They occupy a space between the Iadului Valley (East), the Beiuşului Depression (South) and the Vadului Depression (North).

The relief forms, in connection with the geological substratum, are built on impermeable (lime free) rocks and one limestone. The hydro-grapy is related to the two main water courses in the area, Crişul Repede in north and Crişul Negru in south. The climate has a piedmont and mountain character.

The greatest part of the Pădurea Craiului Mountains is covered with leafy forests (*Fagus sylvatica* forests, *Carpinus betulus* and *Fagus sylvatica* mixed forests and *Quercus petraea* forests). Woods accounting for 57% of the area, the most widespread category of lichens is the corticolous species.

Material and Method

The analysis of flora was carried out on the basis of foliose and fruticose lichen specimens collected and determined between 1992-1998. The rare and new species for the Romanian lichen flora are kept in the Herbarium of the "Al. Borza" Botanical Garden in Cluj-Napoca. For a more complete analysis of lichen flora we have used chorological data from Moruzi, Petria, Mantu, (1967), *Catalogue of the lichens from Romania* as well as the specimens from the Liége University's Herbarium, the Herbarium of the Botany Institute of Uppsala's University and the Herbarium of the "Al. Borza" Botanical Garden.

The lichen flora was analyzed in relation with the ecological preferences of the species toward light (Fig. 1), humidity (Fig. 2), temperature (Fig. 3) and chemical reaction of the

substrate (Fig. 4). Indicator values for the lichens that we have used are those published by Ellenberg et al. (1992) and Wirth (1995)

Results and Discussion

The 59 corticolous lichen species identified in the area belong to 6 orders (Graphidales, Lecanorales, Opegraphales, Pertusariales, Pyrenulales, Teloschistales), 14 families (Graphidaceae, Thelotremataceae, Alectoriaceae, Candelariaceae, Lecanoraceae, Lecideaceae, Parmeliaceae, Physciaceae, Ramalinaceae, Opegraphaceae, Pertusariaceae, Pyrenulaceae, Teloschistaceae and Phlyctidaceae) and 33 genera, all from the class Ascomycotina. The order Lecanorales is the most wide represented with 47 species, 23 species belonging to the family Parmeliaceae. Among the corticolous species identified in the studied area, 8 are rarest (*Hypocenomyces scalaris, Melanelia elegantula, M. subargentifera, Physcia dubia, Lepraria lobificans, Phlyctis agelaea, P. argena, Xanthoria fallax)* and one, *Parmelina pastilifera* (Harm.) Hale, is new for the Romanian lichen flora.

The corticolous macrolichens were identified on 18 tree species. The most populate tree species with corticolous lichens were *Fagus silvatica* with 43 species, *Quercus petraea* with 28 species, *Q. cerris* with 26 species and *Carpinus betulus* with 24 species. On *Populus tremula* were identified 18 lichen species, on *Abies alba* 10 species and on *Sorbus torminalis* 7 species. On *Malus silvestris* and *Alnus glutinosa* 4 lichen species were found, 3 lichen species on *Acer platanoides*, *A. pseudoplatanus, Betula pendula* and *Crataegus monogyna*, 2 lichen species on *Acer tataricum, Pyrus piraster* and *Tilia cordata* and only one corticolous lichen on *Prunus avium.*

The analysis of the lichens flora in relation with the preferences of the species toward **light** (Fig. 1) shows the predominance (47.45%) of the moderate photophilous (*Bryoria fuscescens, Lecanora conizaeoides, Evernia prunastri, Hypogymnia tubulosa, Melanelia exasperatula, M. elegantula, M. subargentifera, M. subaurifera, Parmelia sulcata, Parmelina tiliacea, Platismatia glauca, Pleurosticta acetabulum, Punctelia subrudecta, Usnea hirta, U. filipendula, Anaptychia ciliaris, Phaeophyscia orbicularis, Physcia adscendens, Ph. aipolia, Ph. stellaris, Ph. tenella, Physconia distorta, Ramalina fastigiata, R. pollinaria, Xanthoria fallax, X. parietina, Caloplaca cerina, Lecanora allophana)* followed by the moderate photophilous - photo-ombrophilous (18.64%; *Lecanora carpinea, Lecidella elaeochroma, Hypocenomyce scalaris, Flavoparmelia caperata, Parmelia saxatilis, Parmelina pastilifera, Parmeliopsis ambigua, Vulpicida pinastri, Rmalina farinacea, Pertusaraia albescens, P. amara*) The moderate photophilous lichen species were identified on all the investigated tree species, while the moderate photophilous - photo-ombrophilous lichen species were missing on *Sorbus torminalis, Acer platanoides* and *Quercus robur.* Less represented are the photo-ombrophilous categories (11.86%; *Lecanora albella, L. argentata, L. intumescens, Melanelia fuliginosa, Phlyctis agelaea, P. argena, Hypotrachyna laevigata*), the photophilous species (10.16%; *Candelariella vitellina, Melanelia exasperata, Parmelia quercina, Pseudevernia furfuracea, Physcia dubia, Ramalina obtusata*). The photo - ombrophilous lichen species were missing on *Abies alba, Alnus glutinosa, Acer pseudoplatanus, A. platanoides, Crataegus monogyna, Quercus robur.* With the lowest percent were present the moderate ombrophilous - photo-ombrophilous species (5.08%; *Thelotrema lepadinum, Lepraria lobificans, Opegrapha atra*) and the moderate ombrophilous (5.08%; *Graphis scripta, Opegrapha viridis, Pyrenula nitida*), one species being strong photophilous (*Hypogymnia physodes*). We have noticed that at the tree species with a treetop density from moderate to low, as *Alnus glutinosa, Quercus robur* and *Crataegus monogyna* are missing the moderate ombrophilous and moderate ombrophilous - photo-ombrophilous lichen species. Those lichens were instead identified on the trees with a shadowy treetop (mainly on isolated exemplaries) as *Fagus sylvatica* and *Carpinus betulus*.

The **humidity** regime (Fig. 2) shows that the xero-mesophilous species are predominant (44.06%; *Candelariella vitellina, Lecanora carpinea, L. conizaeoides, L. allophana, Lecidella elaeochroma, Hypocenomyce scalaris, Evernia prunastri, Hypogymnia physodes, H. tubulosa, Melanelia exasperatula, M. subaurifera, Parmelia quercina, P. sulcata, Parmelina tiliacea, Pleurosticta acetabulum, Pseudevernia furfuracea, Punctelia subrudecta, Physcia adscendens, Ph. aipolia, Ph. stellaris, Ph. tenella, Physconia distorta, Ramalina obtusata, Pertusaria albescens, Xanthoria fallax, X. parietina),*). Well represented are the xero-mesophilus - mesophilous (18.64%; *Graphis scripta*, *Lecanora albella, L. argentata, Flavoparmelia caperata, Melanelia fuliginosa, Lepraria lobificans, Opegrapha atra, Pertusaria amara, Pyrenula nitida, Phlyctis agelaea, P. argena*) and mesophilous lichen species (18.64%; *Melanelia elegantula, M. subargentifera, Parmelia saxatilis, Parmeliopsis ambigua, Platismatia glauca, Usnea hirta, Anaptychia ciliaris, Ramalina farinacea, R. pollinaria, Opegrapha viridis, Caloplaca cerina*). 8.47% are mesophilous - meso-hygrophilous species (*Bryoria fuscescens, Lecanora intumescens, Melanelia exasperata, Usnea filipendula, Ramalina fastigiata*), 5.08% are meso-hygrophilous (*Thelotrema lepadinum, Parmelina pastilifera, Vulpicida pinastri*). Less represented are the euryhygrous species (3.38%; *Phaeophyscia orbicularis, Physcia dubia*) and one lichen species is hygrophilous (*Hypotrachyna laevigata*).

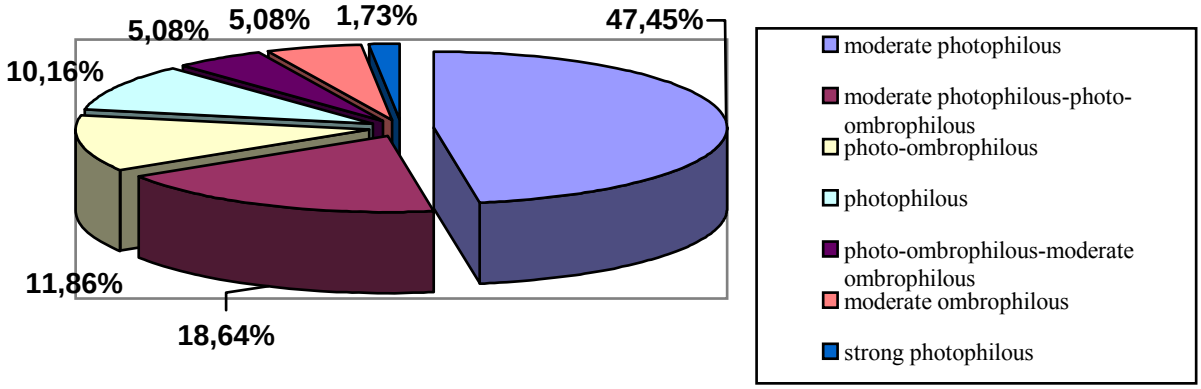

Fig. 1: Percentual repartition of the corticolous lichen species in relation with their preferences toward light

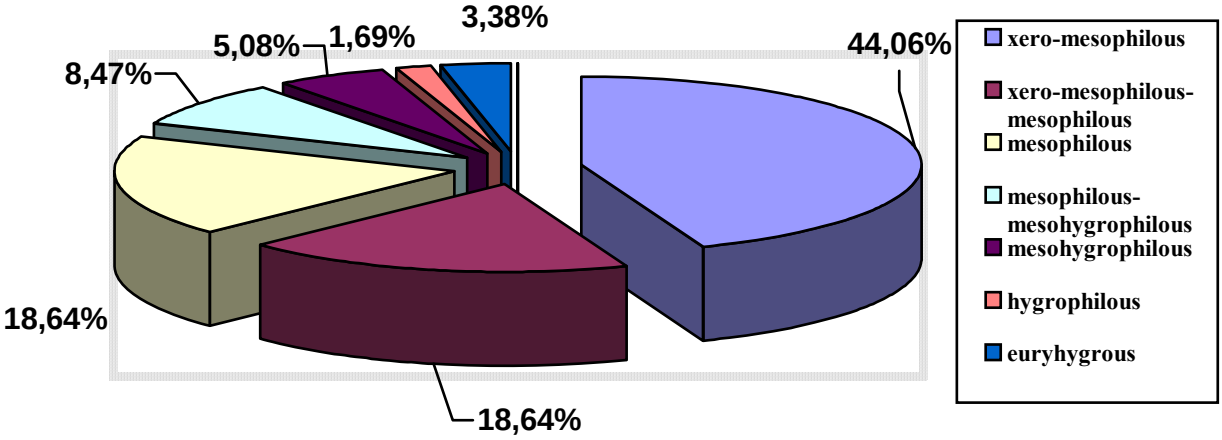

Fig. 2: Percentual distribution of the corticolous lichen species in relation with their preferences toward the humidity

The **temperature** figure (Fig. 3) indicate the dominance of the micro-mesothermal lichen species (45.76%; *Graphis scripta, Lecanora albella, L. argentata, L. carpinea, L. allophana, Lecidella elaeochroma, Hypocenomyce scalaris, Evernia prunastri, Melanelia exasperatula, M. fuliginosa, M. subargentifera, Parmelina quercina, Anaptychia ciliaris, Physcia adscendens, Ph. aipolia, Ph. stellaris, Physconia distorta, Ramalina farinacea, R. fastigiata, R. obtusata, Lepraria lobificans, Pertusaria albescens, P. amara, Xanthoria fallax, X. parietina, Phlyctis argena, Hypotrachyna laevigata*) as a consquence of the low altitude of the Pădurea Craiului Mountains. The percent of microthermal lichen species (25.41%; *Thelotrema lepadinum, Bryoria fuscescens, Lecanora intumescens, Hypogymnia tubulosa, Parmelia saxatilis, Parmelina pastilifera, Parmeliopsis ambigua, Platismatia glauca, Pseudevernia furfuracea, Usnrea hirta, U. filipendula, Lecanora conizaeoides, Melanelia exasperata, Vulpicida pinastri, Ramalina pollinaria*) is probably the result of the influence of the highest Bihorului - Vlădeasa Mountains. The moderate termophilous lichen species (16.94%; *Flavoparmelia caperata, Parmelina tiliacea, Pleurosticta acetabulum, Opegrapha atra, Pyrenula nitida*, *Melanelia elegantula, M. subaurifera, Punctelia subrudecta, Opegrapha viridis, Phlyctis agelaea*), are in relation with the influence of Dealurile Vestice and Câmpia Crişurilor formations which have a low altitude. There were also identified eurythermic lichen species (11.86%; *Candelariella vitellina, Hypogymnia physodes, Parmelia sulcata, Phaeophyscia orbicularis, Physcia dubia, Ph. tenella, Caloplaca cerina*).

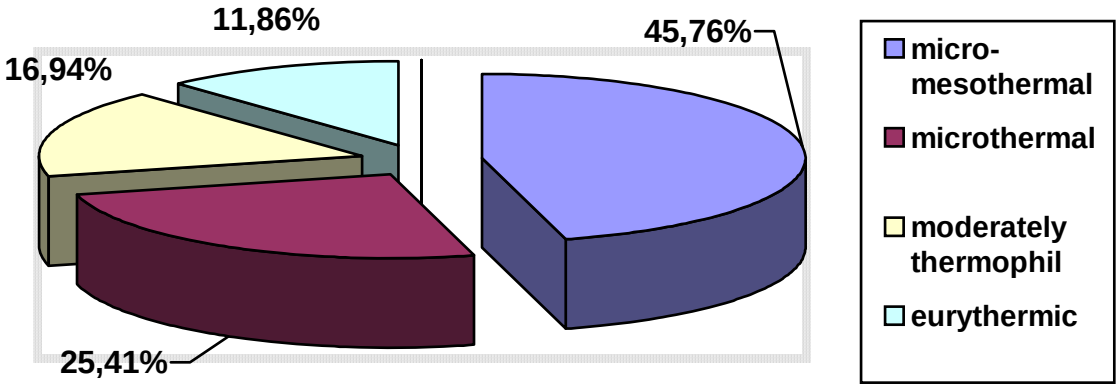

Fig. 3: Percentual distribution of the corticolous lichen species in relation with their preferences toward the temperature.

Regarding the **chemical reaction of the substrate** (Fig. 4) we notify the predominance of the moderate acidophilous species (23.92%; *Graphis scripta, Candelariella vitellina, Lecanora albella, L. carpinea, L. intumescens, Melanelia exasperatula, Parmelia sulcata, Parmelina pastilifera, P. tiliacea, Ramalina farinacea, R. obtusata, Pyrenula nitida, Phlyctis argena*), instaled especially on *Fagus silvatica, Carpinus betulus, Acer tataricum, Quercus petraea* and acidophilous lichen species (22.03%; *Hypocenomyce scalaris, Evernia prunastri, Hypogymnia physodes, H. tubulosa, Usnea hirta, U. filipendula, Vulpicida pinastri, Pertusaria amara, Hypotrachyna laevigata).* The moderate acidophilous lichen species were identified mainly on *Fagus silvatica, Carpinus betulus, Acer tataricum, Quercus petraea* and the acidophilous on *Abies alba, Betula pendula, Crataegus monogyna.* The subneutrophilous lichen species (20.38%; *Melanelia subargentifera, M. subaurifera, Parmelia quercina, Pleurosticta acetabulum, Anaptychia ciliaris, Phaeophyscia orbicularis, Physcia adscendens, Ph. aipolia, Ph. dubia,*

Xanthoria fallax, X. parietina, Caloplaca cerina) were found mainly on *Tilia cordata, Acer platanoides, Quercus cerris, Populus tremula*.

The subneutrophilous - moderate acidophilous lichen species (16.94%; *Lecanora allophana, Lecidella elaeochroma, Melanelia exasperata, Physcia stellaris, Physcia tenella, Physconia distorta, Ramalina fastigiata, Opegrapha viridis, Phlyctis agelaea, Pertusaria albescens*) were identified on *Fagus silvatica, Populus tremula, Carpinus betulus, Sorbus torminalis*. Less represented were the moderate acidophilous-acidophilous lichen species (10.16%; *Thelotrema lepadinum, Flavoparmelia caperata, Melanelia elegantula, Punctelia subrudecta, Ramalina pollinaria, Opegrapha atra*) developed mainly on *Alnus glutinosa* and *Fagus silvatica* and the strong acidophilous species (6.97%; *Lecanora conizaeoides, Parmeliopsis ambigua, Platismatia glauca, Pseudevernia furfuracea*) wich were identified on *Abies alba, Crataegus monogyna, Fagus silvatica, Pyrus piraster, Malus silvestris*.

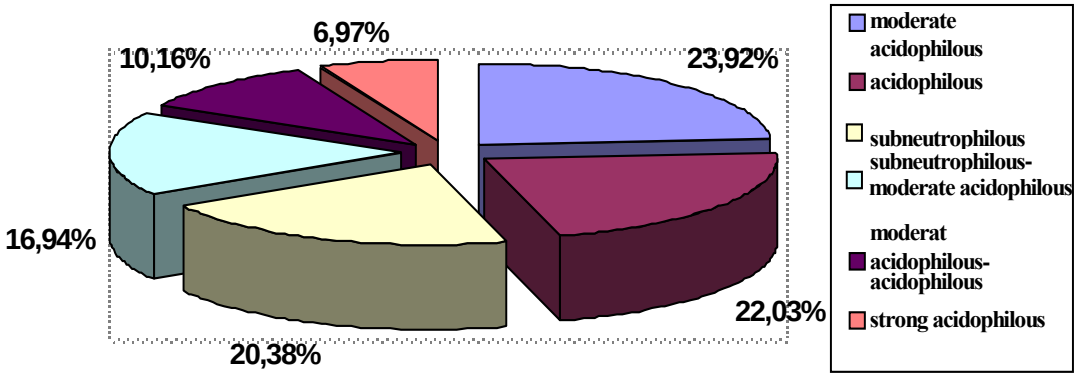

Fig. 4: Percentual distribution of the corticolous lichen species in relation with their preferences toward the chemical reaction of the substrate.

Conclusions

The studies of corticolous lichen flora of the Pădurea Craiului Mountains had carried out to the identification of 59 foliose and fruticose lichen species, 8 species are rarest and 1 species is new for the Romanian lichen flora.

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). According to their preferences toward light, the predominance of the moderate photophilous species (47.45%) could be explained by their development on the trunks of all the investigated tree species, the other lichen categories showing some preferences toward different tree species, according to their treetop characteristics. The analysis of the humidity figure reveals the predominance of xero-mesophilous species (44.06%) developed on sunny exposed parts of the tree trunks. Considering the preferences toward the temperature, the climate characteristic to the low mountain zone, specific for the Pădurea Craiului Mountains, determine the preponderance of the micro-mesothermal species (45.76%). The presence of a relatively large number of microthermal species (25.41%) is probably under the influence of the highest Bihorului - Vlădeasa Mountains. The percent of moderate termophilous species (16.94%) is corelated with the vicinity of Dealurile Vestice and Câmpia Crişurilor, formations with a low altitude. Regarding the chemical reaction of the substrate, the aproximatively equal percents of moderate acidophilous (23.92%), acidophilous (22.03%) and subneutrophilous (20.38%) lichen categories is corelated with the bark pH of the trees where the lichen were identified.

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ANALIZA ECOLOGICĂ A LICHENILOR CORTICOLI FOLIACEI ŞI FRUTICULOŞI DIN MUNŢII PĂDUREA CRAIULUI (JUD. BIHOR)

(Rezumat)

Studiul asupra florei corticole de macrolicheni din Munţii Pădurea Craiului a dus la identificarea a 59 de specii de licheni foliacei şi fruticuloşi, dintre care 8 specii sunt rare (*Hypocenomyces scalaris, Melanelia elegantula, M. subargentifera, Physcia dubia, Lepraria lobificans, Phlyctis agelaea, P. argena, Xanthoria fallax*) şi o specie nouă pentru lichenoflora României - *Parmelina pastilifera* (Harm.) Hale. Lichenii identificaţi au fost analizaţi pe baza indicilor ecologici (lumină, umiditate, temperatură, reacţia chimică a substratului) publicaţi de Ellenberg et al. (1992) şi Wirth (1995).

Analiza preferinţelor faţă de lumină a evidenţiat predominanţa speciilor moderat fotofile (47,45%), explicată prin prezenţa lichenilor din această categorie pe toate speciile de arbore suport investigate. Preferinţele faţă de factorul umiditate indică procentul ridicat (47,45%) de specii xeromezofile, care se dezvoltă pe porţiunile însorite ale trunchiurilor. Preponderenţa speciilor micro-mezoterme (45,76%) este consecinţa climatului caracteristic etajului montan inferior în care se încadrează zona luată în studiu, prezenţa speciilor microterme fiind probabil indusă de vecinătatea masivului Bihor-Vlădeasa, iar a speciilor moderat termofile de formaţiunile joase ale Dealurilor Vestice şi Câmpiei Crişurilor. Procentele aproximativ egale ale speciilor moderat acidofile (23,92%), acidofile (22,03%) şi subneutrofile (20,38%) sunt în corelaţie cu pH-ul ritidomului arborilor suport.