PRELIMINARY STUDIES REGARDING THE EPIPHYTIC LICHENS DIVERSITY FROM BĂNEASA FOREST (BUCHAREST MUNICIPALITY, ROMANIA)

VICOL Ioana

Abstract. Within this note the analysis of epiphytic lichens diversity from Băneasa Forest is presented. Within Băneasa Forest, it was identified an extremely reduced number of lichen species, analysed mainly from toxi-tolerance degree and chorology point of view. Also, the lichen species were analysed in relation with their ecological preferences. The analysis has indicated the correlations among critical environment conditions and ecological particularities of lichen species from Băneasa Forest. The comparisons with other similar studies around and within Bucharest Municipality have been pointed out. It was achieved the evaluation of the environmental quality based on the toxitolerance degree and chorology aspects of the identified lichen species.

Keywords: epiphytic, lichens, diversity, ecological conditions, Băneasa Forest.

Rezumat. Studii preliminare privind diversitatea lichenilor epifitici din Pădurea Băneasa (Municipiul Bucureşti, România). În cadrul acestei note este prezentată analiza lichenilor epifitici din Pădurea Băneasa. În Pădurea Băneasa a fost identificat un număr foarte redus de specii de licheni analizate în principal din punct de vedere al gradului de toxitoleranţă şi al corologiei. De asemenea, speciile de licheni au fost analizate în raport cu preferinţele ecologice. Analizele efectuate au indicat corelaţiile dintre condiţiile critice de mediu şi particularităţile ecologice ale speciilor de licheni din Pădurea Băneasa. Au fost evidenţiate comparaţii cu alte studii similare în jurul Municipiului Bucureşti şi din cadrul acestuia. S-a realizat evaluarea calităţii mediului pe baza gradului de toxitoleranţă şi corologiei speciilor de licheni identificate.

Cuvinte cheie: epifitic, licheni, diversitate, condiţii ecologice, Pădurea Băneasa.

INTRODUCTION

The present note is a part of an extensive study within the PhD thesis.

In terms of geographical position, the studied area is located within the East Muntenia Plain, this being the youngest sector of the Romanian Plain. Particularly, the investigated area is a subsidence plain that extends as a continuous strip between the Argeş and the Siret rivers. Within this part of the Romanian Plain the climatic influences are excessive-continental, featuring severe winters and dry summers, frosts, early and late hoar frosts, and violent snowstorms (BĂLTEANU et al., 2006).

From the vegetation point of view, the investigated territory is located within the forest-steppe zone with various oak species (*Quercus cerris, Quercus frainetto, Quercus pubescens*, and occasionally *Quercus robur*), which often occur in association with hornbeam, lime and elm trees (BĂLTEANU et al., 2006). Particularly, the forest around Bucharest Municipality is characterized by the prevailing presence of *Q. cerris* and *Q. farnetto* PAŞCOVSCHI & LEANDRU (1958).

MATERIAL AND METHODS

The research was performed within Băneasa Forest situated from the geographical point of view in the northern part of Bucharest Municipality (Fig. 1).

The samples were collected during March-August 2009. The procedure of collecting lichens species consisted in the random establishment of six sampling units of 4 x 4 m. Corticolous lichens species have been collected beginning from the basis of the trunks to the height of to 2.5 m.

Collected lichen species were determined according to CIURCHEA (2004), MORUZI & TOMA (1971), CIURCHEA (1998). Lichen species were identified on the basis of colour, morphology, aspects of thlline elements, microscopically preparation by using chemical reagents such as KOH, $CaCl_2$, and IIK. The used nomenclature is according to CIURCHEA (2004).

The ecological indices were used according to ELLENBERG et al. (1992), WIRTH (1995), and CIURCHEA (2004).

As a preliminary study within this work, there were additionally presented different analyses regarding the investigated lichen species, future objectives and the expectancy results.

The lichen species are a part of the Lichen Collection of the Institute of Biology from Bucharest.

RESULTS AND DISCUSSIONS

Within the sampling units, there were identified only 7 lichen species as it follows: *Candelaria concolor* (DICKS.) STNR., *Phaeophyscia orbicularis* (NËCK.) MOBERG., *Physcia ascendens* (FR.) OLIV., *Physcia aipolia* (EHRH. ex HUMB.) FÜRNR., *Physcia tenella* (SCOP.) DC. in Lam. & DC., *Lepraria finkii* (B. de LESD. ex HUE) R. HARRIS (1985), and *Xanthoria parietina* (L.) TH. FR. It is known that lichens are very sensitive to pollution, thus their number spectacularly decreased in the proximity of industrialized areas such as towns (BARTOK, 1980).

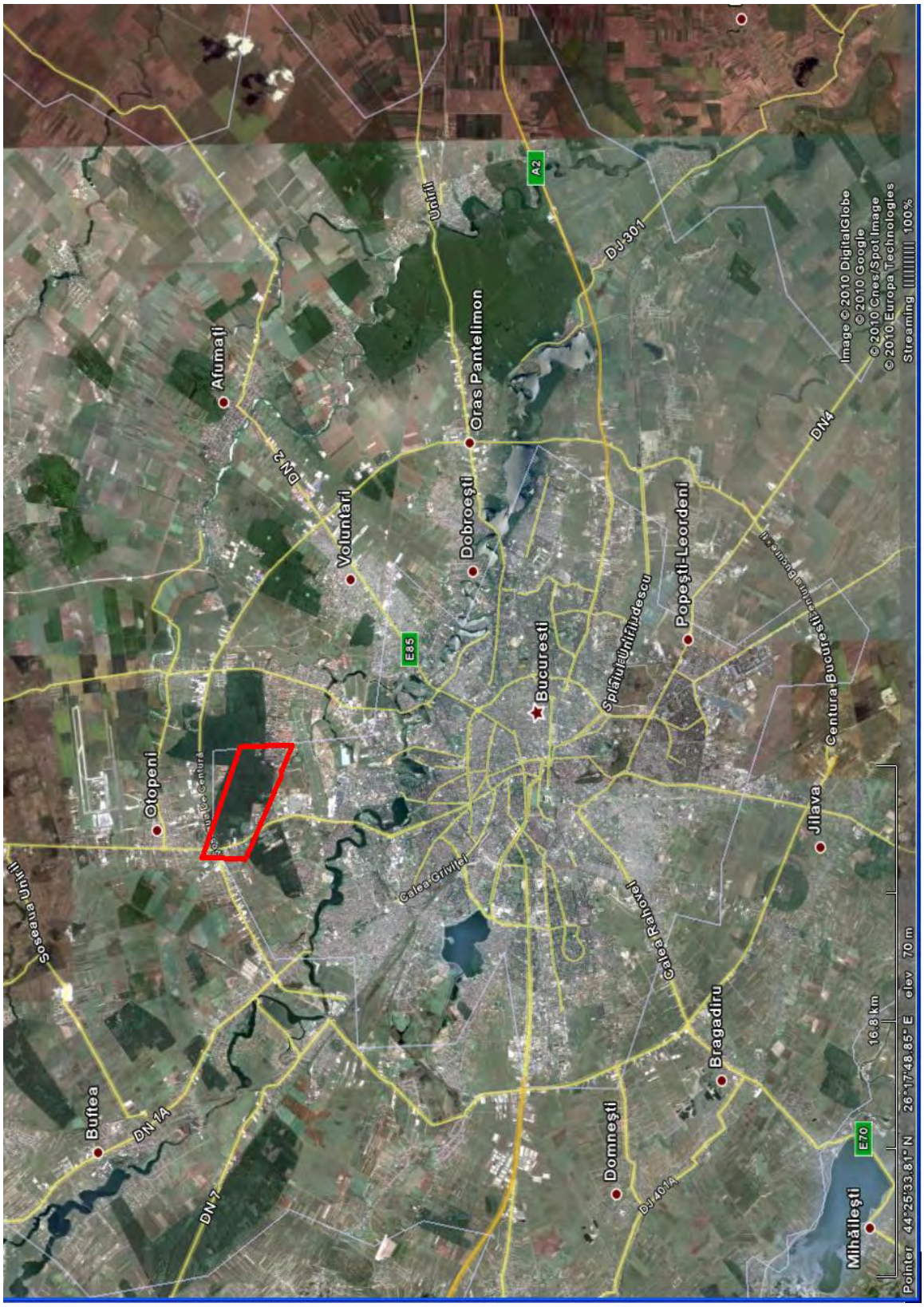

Figure 1. Băneasa Forest (red framed zone). Source: this is an own construct map by Google Earth software.
Figura 1. Pădurea Băneasa (zona roşie). Sursa: hartă după Google Earth.

The taxonomic analysis

All lichen species identified within the studied area are tabulated in Ascomycotina Class, Gymnocarpeae Series belonging only two orders (Lecanorales and Teloschistales), three families (Candelariaceae, Physciaceae, and Teloschistaceae), and five genera *Candelaria*, *Phaeophyscia*, *Physcia*, *Lepraria*, and *Xanthoria* (Table 1).

Table 1. Repartition of the lichen species in classes, orders, families, and genera.
Tabelul 1. Repartiția speciilor de licheni pe clase, ordine, familii şi genuri.

Class	Order	Families	Genera	Species
Ascomycotina Gymnocarpae Series	Lecanorales	Candelariaceae	*Candelaria*	*Candelaria concolor*
		Physciaceae	*Physconia*	*Phaeophyscia orbicularis*
			Physcia	*Physcia adscendens*
				Physcia aipolia
				Physcia tenella
			Lepraria	*Lepraria finkii*
	Teloschistales	Teloschistaceae	*Xanthoria*	*Xanthoria parietina*

Within this preliminary study, it was observed a high frequency of genera correlated with a high degree of the perturbation belt of Bucharest Municipality. The frequency of genera with a high percentage points out a clearly stricken poverty of lichen flora within Băneasa Forest.

The analysis of the lichen genera reflects an equal percentage for a great majority of genera and a different percentage regarding *Physcia* genus. Thus, the last genus has recorded 44% being better represented compared with other genera. There is a close correlation between prevailing lichen species tabulated into *Physcia* genus and of the toxitolerance highest degree of *Physcia adscendens* and *Physcia tenella* (Fig. 2; Table 2).

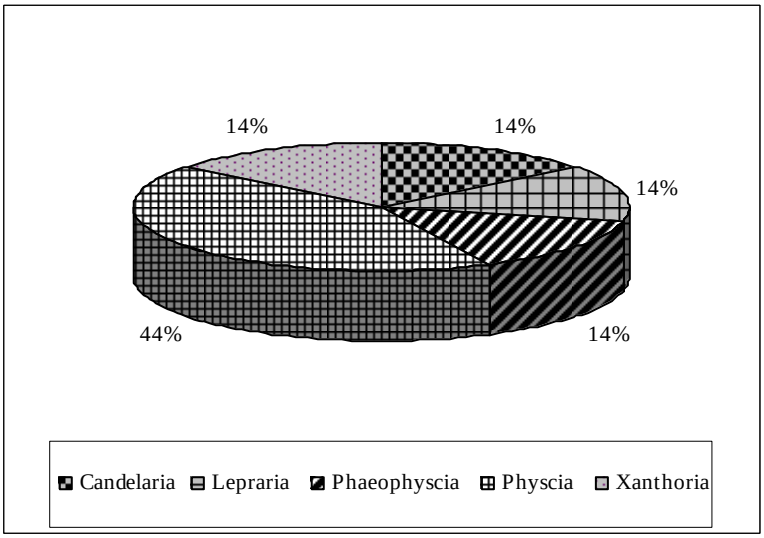

Figure 2. Frequency of the lichens genera within the surveyed sampling units.
Figura 2. Frecvența genurilor de licheni în cadrul unităților de probă investigate.

Table 2. Repartition of the lichens species depending on toxitolerance degree and chorology of species.
Tabel 2. Repartiția speciilor de licheni în funcție de gradul de toxitoleranță şi de corologia speciilor.

Toxi-tolerance degree	Number and lichens species		Frequency of species	Number and lichens species	
moderately resistance species to pollutions	3	*Candelaria concolor*	Rare species	2	*Candelaria concolor*
		Phaeophyscia orbicularis			*Physcia aiploia*
high resistance species to pollutions	4	*Physcia adscendens*	Common species	5	*Phaeophyscia orbicularis*
					Physcia adscendens
		Physcia tenella			*Physcia tenella*
		Lepraria finkii			*Lepraria finkii*
		Xanthoria parietina			*Xanthoria parietina*

Future objectives: achievement of the gradient studies in a close correlation with an increasing genera number depending on the distance from Băneasa Forest.

The expectancy results: As a function of the distance, the number of lichens genera will decrease and the number of lichens species will increase. The genera with a high degree of toxitolerance will decrease and the genera with a high sensitivity, rare and disappearing species will increase, depending on the distance from Băneasa Forest.

The analysis of toxitolerance degree

The domination of the lichens species with a high toxitolerance degree (57%) from those with a moderate toxi-tolerance degree (43%) reveals the downward tendency of the environment quality. The presence within the releveé of the most tolerant lichen species to air pollution, such as *Physcia ascendens*, *Physcia tenella*, *Lepraria finkii*, and *Xanthoria parietina*, which grow on weakly acid to basic substrata are correlated with climatic conditions of relatively high aridity (LOPPI & FRATI, 2006). This fact is in close relation with the strongly anthropization conditions from Bucharest Municipality (Fig. 3). Lichens are the best indicators of environmental quality, due to their sensitivity, therefore they have a great importance as biological indicators of atmosphere pollution (BARTOK, 1985; BRODEKOVÁ et al., 2006; ASTA et al., 2002). Depending on the quality of air the sensitive lichens species disappear (BARTOK, 1985), this being the explanation of the actual situation pointed out by the lowest number of lichens species, of which a great majority displays the highest resistance to pollutants.

The tolerance of lichens to toxic materials is also a function of the ecological requirements of species (KOVACS, 1992).

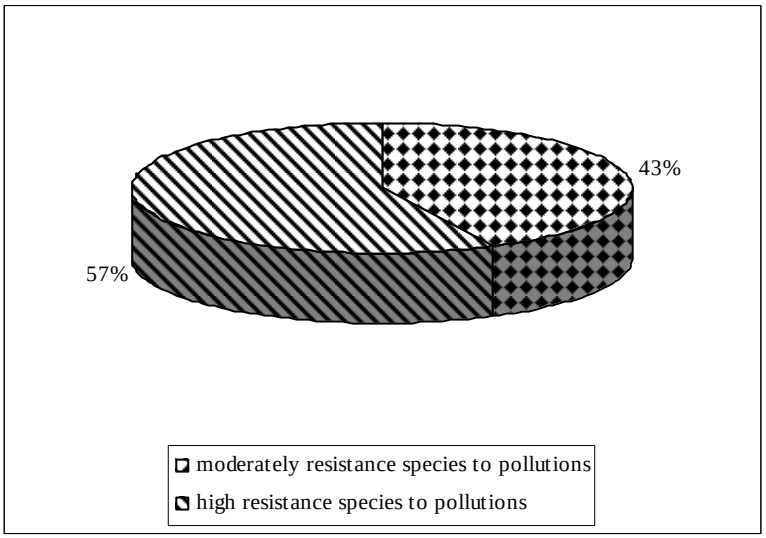

Figure 3. The percentage distribution of lichens species depending on the toxi-tolerance degree.
Figura 3. Distribuția procentuală a specilor de licheni în funcție de gradul de toxitoleranță.

Regarding the behavior of the investigated lichens species towards humidity (Fig. 4), 86% of them are xerophylous and 14% are xero-mesophylous. The domination of the xerophylous species reflect the influence of the sub-Mediterranean climatic trends such as excessive-semi-arid with an annual mean temperature > 11°C and a decrease of the rainfall amount from 550 mm to 450 mm (BĂLTEANU et al., 2006).

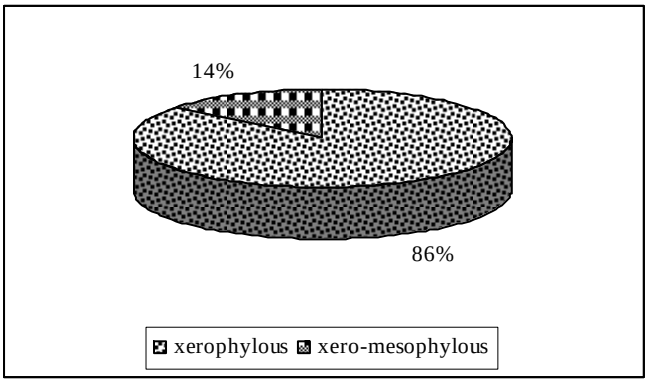

Figure 4. Percentage distribution of the lichens species depending on their preferences towards humidity.
Figura 4. Distribuția procentuală a speciilor de licheni în funcție de preferințele față de umiditate.

Concerning the preferences towards light (Fig. 5), the investigated lichens species are predominantly photophylous (62%); the other lichens species are represented by sciaphylous with 13% and photo indifferent species with 25% respectively. The illumination varies according to the type of forest, of wood bark etc., and it influences the lichen flora. Thus, there is a close correlation among the tree species on which the lichens species grow and their light ecological index. It has been observed that the phytophilous lichens species grow on trees species, which have a weakly canopy, for instant: *Candelaria concolor* growing on *Acer campestre* in the investigated area; *Phaeophyscia orbicularis* growing on *Fraxinus excelsior* and *Physcia tenella* growing on *Acer campestre*. Of all investigated lichens species *Lepraria finkii* is one of the sciaphylous lichens species which grow in the investigated area on *Quercus cerris* with a closeness canopy. Two other investigated lichens species are photo indifferent, growing both on a weakly canopy trees and on a closeness canopy trees, for instant: *Physcia adscendens* and *Physcia aipolia*.

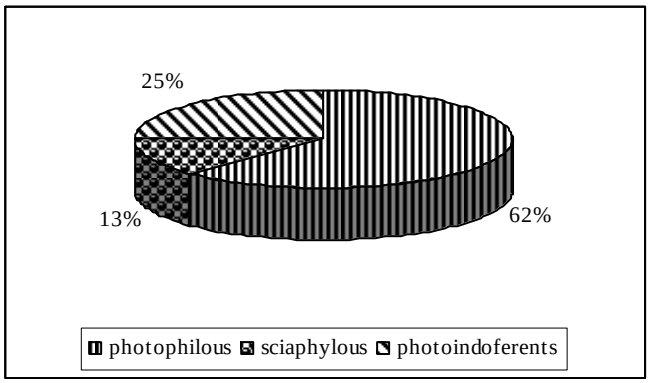

Figure 5. Percentage repartition of the lichens species depending on their preferences towards light.
Figura 5 . Repartiția procentuală a speciilor de licheni în funcție de preferințele față de lumină.

From temperature point of view (Fig. 6), there is a correlation between the great majority of lichen species, which are mesothermal (72%), and the climatic conditions that are excessive-continental in the east and south-east part of Romania. Regarding the eurythermic (*Physcia tenella*) and microthermic (*Physcia aipolia*) lichens species, it might be a strongly correlation between ecological conditions and resistance to pollution.

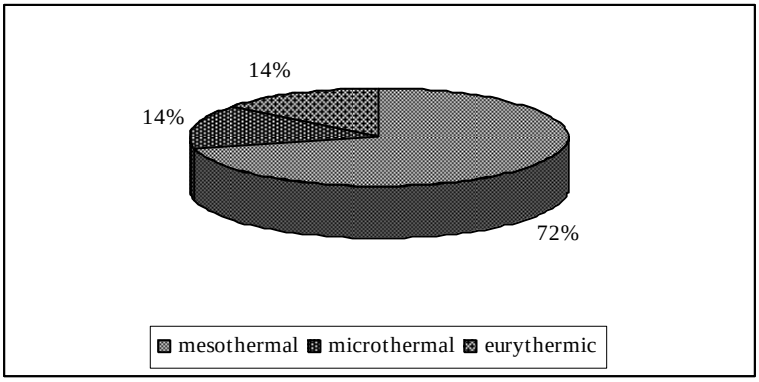

Figure 6. Percentage distribution of the lichens species depending on their preferences towards temperature.
Figura 6. Distribuția procentuală a speciilor de licheni în funcție de preferințele față de temperatură.

The analysis of the preferences towards the substrate (Fig. 7), a high percent (43%) is attributed to moderately acidophilous-basicphilous lichens species such as *Phaeophyscia orbicularis*, *Physcia adscendens*, and *Physcia tenella*, followed by moderately acidophilous-subneutrophilous lichens species (29%), and acidophilous lichens species (14%). Subneutrophilous-moderately basicphilous (14%) lichens species such as *Xanthoria parietina* occur in dry, warm, and rich in nutrients habitats (KOVÁCS, 1992).

Future objectives: it will be performed a study on toxitolerance degree, in relation with the distance, which aims to reveals a correlation between the lichens species number, which are extremely sensitive, and sensitive to pollutions and those which are tolerant to pollutions.

The expectancy results: as a function of the distance in a gradient study, from Băneasa Forest to certain distances, the number of sensitive species to pollutions will increase and the number of tolerant lichens species to pollution will decrease.

The chorology of investigated lichens species

Within this study, two species are rare and local disappearing because of atmospheric pollution (*Candelaria concolor* and *Physcia aipolia*) and the others are very common lichens species (*Phaeophyscia orbicularis*, *Physcia ascendens*, *Physcia tenella*, *Lepraria finkii*, *Xanthoria parietina*). The presence of rare and in danger of extinction lichens species might be explained in correlation with the prevailing winds DONICA (2007); BARTOK (1985), which blow from the North and North-East part of Bucharest Municipality. The prevailing winds carry a large quantity of pollutants from North - East part of Bucharest Municipality to its South-West part.

Comparisons with the other similar studies

The forests around Bucharest Municipality were studied from species diversity point of view by some lichenologists. Thus, MORUZI & MANTU (1965) were studied corticolous lichen from Mogoşoaia Forest (Ilfov County) with a total of 53 lichens species. Within Brăneşti Forest, MORUZI & KLOHS (1970) identified a total of 29 lichens species. In Bucharest Municipality area MORUZI & PETRIA (1961), there were performed research studies concerning corticolous and saxicolous lichens species from the Botanical Garden. They was identified a total of 29 lichens species. Within this study the lower number of lichens species was correlated with the ecological conditions of the city. A study performed by MANTU (1965) within Snagov Forest at a great distance from Bucharest Municipality has indicated a large number of lichens species, namely 107 species. Sporadic data regarding the lichens species within Băneasa Forest were cited by CRETZOIU (1933). Within this study, there were mentioned the following lichens species in Băneasa Forest: *Ramalina fastigiata* (LILJEBL.) ACH., *Xanthoria parietina* (L.) TH. FR., *Physcia aipolia* (EHRH. ex HUMB.) FÜRNR, and *Physcia tenella* (SCOP.) DC. in Lam. & DC. Taking into account the aforementioned information, it can be noticed that there occurs an increase of the number of lichens species as the distance from Bucharest area increases.

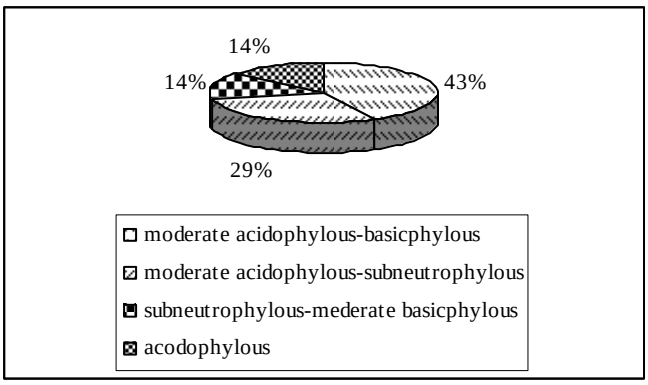

Figure 7. Percentage distribution of lichens species depending on their preference towards the chemical reaction of the substrate. / Figura 7. Distribuția procentuală a speciilor de licheni în funcție de preferințele față de substrat.

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Vicol Ioana
Romanian Academy, Institute of Biology
296, Splaiul Independentei 060031, Bucharest, Romania
E-mail: ioana_vicol@yahoo.com, ioana.vicol@ibiol.ro

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