PHYTOCOENOLOGIC STUDY OF THE EUROPEAN BEECH STAND FOREST FROM ORMANU VALLEY SPRINGS (CODRU-MOMA MOUNTAINS)

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Abstract

This work represents a phytocoenologic study of european beech forests, carried out in the year 2015 at Orman Valley springs, on Santalpar Hill and Măgura Hill in Codru-Moma Mountains.

There were made a number of 7 phytocoenological relevées and as a result there were identified a number of 2 plant associations: Festuco drymejae-Fagetum Morariu et al. 1968 and Luzulo albidae-Fagetum sylvaticae Zólyomi 1955.

For the two associations identified synthetic tables have been drawn up in which information regarding the species from the floristic composition of phytocoenoses, life form, floristic element and ecological indices was introduced. I made for each association in part a graphical interpretation of the spectrum of life forms and floristic elements, as well as a diagram of the ecological indices.

Key words: phytocoenoses, association, vegetation, floristic elements, life forms, ecological indices.

INTRODUCTION

The study is located at Ormanu Valley springs, a left tributary of the Crişul Negru River, in the northern part of Codru-Moma Mountains (Fig. 1).

Fig. 1. Geographical location of Ormanu Valley

The hydrographic network of Ormanu Valley consists of the following main tributaries: Pragului Brook and Urît Brook. These brooks have a permanent flow throughout the year, being fueled by nival and rainwater.

The main types of soil in the studied area are districambosol and eutricambosol. Vegetation conditions from the the upper third of Ormanu Valley are favourable for the development of european beech forests.

In our country the *Festuco drymejae-Fagetum* association Morariu et al. 1968, is described by Pop I. et al. (2002), Groza G. (2008), Păşcuţ C., Burescu P. (2010), Karácsonyi C. (2011), Niculescu M. (2006), Păşcuţ C. (2012), Chifu T. (2014). From our country the *Luzulo albidae-Fagetum sylvaticae* association Zólyomi 1955, is referred to by Coldea G. (1990), Marian M. (1998), Pop I. et al. (2002), Răduţoiu D. (2006), Păşcuţ C., Burescu P. (2010), Păşcuţ C. (2012).

MATERIAL AND METHODS

For the determination of the species in the field we used specialised works developed by Ciocârlan V. (2009) and Sârbu I. et al. (2013). With regard to the use of associations names, I have complied with the recommendations of ''Code of phytosociological nomenclature'' (Barkman J.J. et al., 1986).

The sample surfaces were selected in the characteristic phytocoenoses, their size being 400 m² (Cristea V. et al, 2004). In the phytocoenological and ecological study of the two associations, we have paid particular attention to the analysis of life forms, floristic elements and ecological indices (humidity, temperature, chemical reaction of the soil). The results obtained were analysed and rendered in the form of graphics, in spectres and diagrams.

RESULTS AND DISCUSSION

1. The european beech phytocoenoses belonging to the ***Festuco drymejae-Fagetum*** association Morariu et al. 1968, develops at the top of the slopes (at altitudes between 733-805 m), with slope of 5-25º degree, usually on sunny exhibitions (Table 1). This phytocoenoses are dominated by *Fagus sylvatica*, to which the following types of trees are associated: *Acer pseudoplatanus*, *Ulmus glabra*, *Betula pendula*, *Populus tremula*, *Quercus petraea*, *Sorbus torminalis*, *Picea abies*.

The lithological substrate consists of limestone, crystalline schists, conglomerates, sandstones and igneous rocks. Soils on which the association is situated are of the districambosoil and eutricambosoil type, medium depth, moderately acidic and moist. Shrub layer has a low coverage, being directly influenced by the shading of the canopy, consisting

of *Ligustrum vulgare*, *Cornus mas*, *Corylus avellana*, *Crataegus monogyna*, *Prunus spinosa*, *Sambucus nigra*, *Viburnum lantana*.

The herbaceous layer, which has a 50-95% coverage is dominated by *Festuca drymeja* in clumps of different sizes. Floristic composition comprise a total of 69 species.

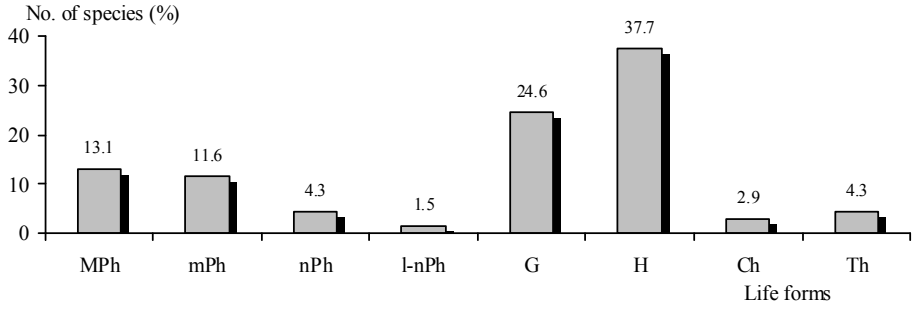

Fig. 2. The life forms spectrum of *Festuco drymejae-Fagetum* association

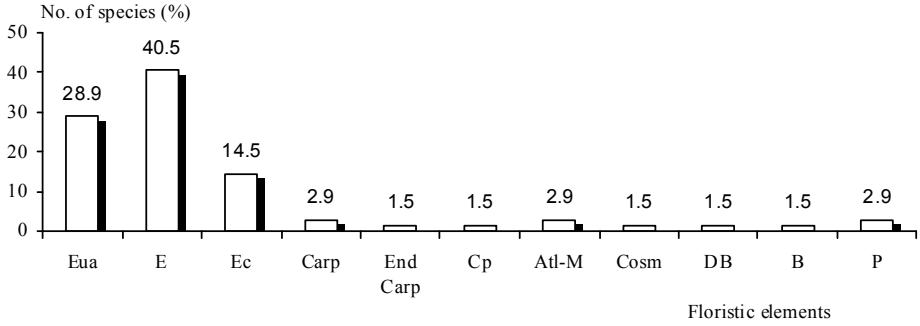

Fig. 3. Spectrum of floristic elements of *Festuco drymejae-Fagetum* association

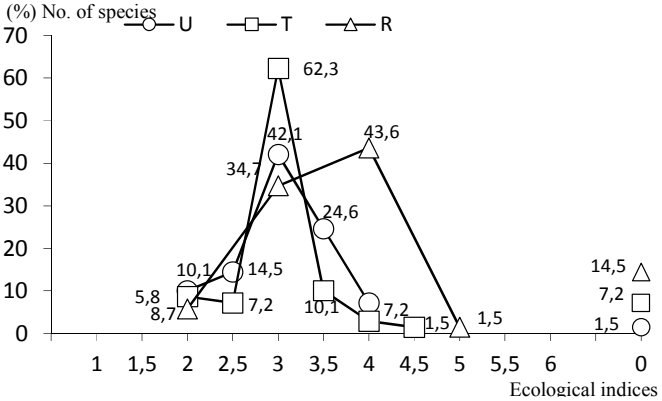

Fig. 4. Diagram of ecological indices for the *Festuco drymejae-Fagetum* association

It can be seen that life forms are represented by a high percentage of hemicryptophytes (H=37.7%), smaller percentages of phanerophytes (Ph=29%) and geophytes (G=24.6%) (Fig. 2).

In this phytocoenoses, the floristic elements with the largest share are the European species (E=40.5%), followed by Eurasian (Eua=28.9%) and Central Europeans (Ec=14.5%) (Fig. 3).

The diagram of ecological indices (Fig. 4), highlights in floristic composition the predominance of mezophyles species (U3-3.5=66.7%), followed by xero-mezophyles (U2-2.5=24.6%), in addition, considering temperature, many are micro-mesothermophilous (T3-3.5=72.4%) and microthermophilous (T2-2.5=15.9%). The chemical reaction of the soil favors development of weak acid-neutrophilous species (R4=43.6%), followed by acid-neutrophilous species (R3=34.7%) and amphitolerant species (R0=14.5%).

Table 1

Festuco drymejae-Fagetum association Morariu et al. 1968

L.f.	**F.e.**	**U.**	**T.**	**R.**	**Number**		1	2	3	4
					GPS coordonates	**Altitude (m)**	805	776	733	776
						Lat. N	46.61271	46.61211	46.61011	46.61083
						Long. E	22.20242	22.20389	22.20313	22.20016
					Exposition		SV	SE	S	V
					Consistency of tree layer		0,7	0,7	0,7	0,9
					Hights of the trees (m)		25	20	20	36
					Diameter of the trees (cm)		100	80	120	180
					Herbaceous layer coverage (%)		80	95	50	60
					Slope (degree) (°)		5	25	20	5
					Area (m²)		400	400	400	400
0	*1*	*2*	*3*	*4*	*5*		*6*	*7*	*8*	*9*
G	Carp	4	2	3	As. *Festuca drymeja*		1	2	2	1
MPh	E	3	3	0	As. *Fagus sylvatica*		4	4	4	5
					Symphyto-Fagenion, Symphyto cordati-Fagion					
MPh	Ec	3,5	3	3	*Acer pseudoplatanus*		·	1	·	+
H	Ec	4	2,5	4	*Aconitum vulparia* ssp. *vulparia*		+	·	+	·
H	Ec	3	2,5	3,5	*Aposeris foetida*		+	·	+	·
G	End Carp	4	2,5	4	*Dentaria glandulosa*		+	1	·	1
H	Carp	2,5	3	4	*Helleborus purpurascens*		+	+	+	·
H	Eua	3	3	4	*Primula elatior* ssp. *elatior*		+	·	+	·
					Fagetalia sylvaticae					
MPh	Eua	4	3	3	*Ulmus glabra*		1	+	+	+
nPh	Eua	3,5	3	3	*Daphne mezereum*		+	·	+	·
nPh	E	3	2,5	3	*Rubus hirtus*		+	·	+	·
G	E	3,5	3,5	4	*Allium ursinum*		1	2	·	3
G	E	3,5	3	4	*Anemone ranunculoides*		+	+	·	+
G	Ec	3,5	3,5	4	*Arum maculatum*		+	·	·	·
H	Eua	3,5	3	4	*Asarum europaeum*		·	+	·	·
H	E	3,5	3	4	*Carex sylvatica*		·	·	1	·
G	E	3	3	0	*Corydalis solida*		1	+	·	1
Ch	E	3	3,5	4	*Euphorbia amygdaloides*		·	·	·	+
G	E	3,5	3	4	*Galanthus nivalis*		+	+	·	·
G	Eua	3	3	3	*Galium odoratum*		1	1	+	·

0	1	2	3	4	5	6	7	8	9
G	Ec	3	3,5	3	*Isopyrum thalictroides*	+	+	·	+
H	Eua	3	3	3	*Lathyrus vernus*	+	+	+	·
H	Ec	3	0	4	*Lamium galeobdolon*	·	+	·	+
H	E	3,5	0	4	*Lamium maculatum*	+	+	·	·
G	Eua	3	0	4	*Lilium martagon*	+	·	·	·
H	E	3,5	3	4	*Mercurialis perennis*	2	3	1	·
H	Cp	4	3	3	*Oxalis acetosella*	·	·	·	+
H	Atl-M	3,5	3	4	*Sanicula europaea*	+	·	+	·
H	Ec	3	3	3	*Symphytum tuberosum* ssp. *nodosum*	·	·	+	·
					Querco-Fagetea				
MPh	Eua	3	2	2	*Betula pendula*	+	·	·	+
MPh	Eua	3	2	2	*Populus tremula*	·	·	·	+
mPh	E	2,5	3	3	*Ligustrum vulgare*	+	·	+	·
mPh	E	2	3	4	*Pyrus pyraster*	·	·	+	·
Th	Eua	3	3	4	*Alliaria petiolata*	+	+	·	+
G	E	3,5	4	0	*Anemone nemorosa*	+	+	·	+
H	E	3	3	3	*Carex digitata*	2	+	·	·
H	Eua	3	2	2	*Cruciata glabra*	+	·	+	·
H	Ec	2,5	3	3	*Dactylis polygama*	·	·	+	·
G	Ec	3	3	4	*Dentaria bulbifera*	+	1	1	+
G	Eua	3,5	3,5	4	*Erythronium dens-canis*	+	·	·	+
Th	Cosm	3,5	3	3	*Geranium robertianum*	·	+	·	·
H	Eua	3	3	4	*Geum urbanum*	+	·	+	·
l-nPh	Atl-M	3	3	3	*Hedera helix*	+	·	·	·
G	E	3	3	4	*Hepatica nobilis*	+	·	+	·
H	E	2,5	3	4	*Melica uniflora*	+	·	·	·
H	E	3	3	0	*Mycelis muralis*	+	·	·	·
H	Eua	3,5	3	3	*Ranunculus ficaria*	·	·	·	+
G	E	3,5	3	4	*Scilla bifolia*	+	·	·	+
H	Eua	3	3	0	*Stellaria holostea*	+	+	·	·
H	Eua	3	3	3,5	*Viola reichenbachiana*	+	·	+	·
					Quercetea pubescenti-Petraeae				
MPh	E	2,5	3	0	*Quercus petraea*	+	·	·	·
MPh	E	2,5	3	4	*Sorbus torminalis*	+	·	1	·
mPh	P	2	3,5	4	*Cornus mas*	+	·	+	·
G	B	3	4	5	*Aristolochia lutea*	+	·	+	·
G	P	2	4,5	4	*Paeonia officinalis* ssp. *banatica*	1	·	1	·
H	E	2	4	4	*Vincetoxicum hirundinaria*	+	·	·	·
					Rhamno-Prunetea				
MPh	E	2,5	3	3	*Acer campestre*	+	+	+	·
mPh	E	3	3	3	*Corylus avellana*	+	·	·	+
mPh	E	2,5	3	3	*Crataegus monogyna*	+	·	+	·
mPh	Eua	2	3	3	*Prunus spinosa*	+	·	·	·
mPh	E	3	3	3	*Sambucus nigra*	+	+	+	+
mPh	Ec	2,5	3	4,5	*Viburnum lantana*	+	·	+	·
nPh	E	2	3	3	*Rosa canina*	+	·	+	·
					Variae syntaxa				
MPh	E	0	0	0	*Picea abies*	·	·	·	+
H	E	3,5	0	0	*Ajuga reptans*	·	·	+	·
H	DB	2,5	3,5	4	*Euphorbia lingulata*	+	+	+	·
H	Eua	3	2,5	0	*Fragaria vesca*	·	·	+	·
Th	Eua	3	2	0	*Galeopsis speciosa*	+	+	·	+
Ch	Eua	2	2	2	*Veronica officinalis*	+	+	+	·

Place and date of mapping: 1 – 4 Santalpar Hill – Ormanu Valley (Bihor county) 25.04.2015.

where: L.f. - life forms; MPh - Megaphanerophytes; mPh - Mezophanerophytes; nPh - Nanophanerophytes; l-nPh - Climbing plants; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Annual terophytes; F.e. - floristic elements; Eua-Eurasian; Cp - Circumpolar; E - European; Ec - Central European; Atl-M - Atlantic-

Mediterranean; Cosm - Cosmopolitan; P - Pontic; End Carp - Carpathian endemism; Carp - Carpathian; DB - Daco-Balkan; B - Balkan; U - humidity, T - temperature, R - the chemical reaction of the soil.

2. The phytocoenoses of ***Luzulo albidae-Fagetum sylvaticae*** association Zólyomi 1955 (Table 2), are located on slopes of 5-20º, at altitudes between 872-894 m, frequently on shaded exposition. Specific rocks are acidic, schist, gneiss granite and silica. Soils on which these associations appear are of districambosoil type, middle deep, acid, fluidly balanced.

European beech dominates the tree layer, *Acer pseudoplatanus* and *Betula pendula* can also be seen, but insignificantly. Shrub layer is poorly represented, due to the high consistency of the stand, the most common species encountered are the *Cytisus nigricans* and *Vaccinium myrtillus*.

In the herbaceous layer the *Luzula luzuloides* can be found, along with which there are a number of acidophilus species such as: *Deschampsia flexuosa*, *Veronica officinalis*, *Cruciata glabra*.

Phytocoenoses floristic inventory of the association include a total of 44 species.

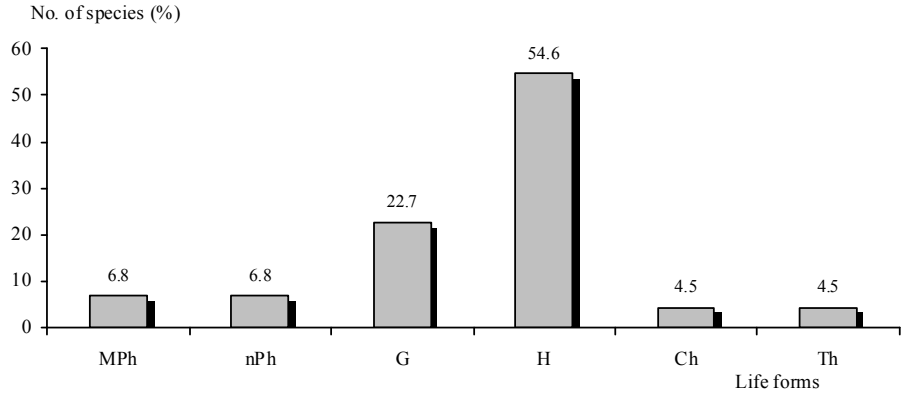

Fig. 5. The life forms spectrum of *Luzulo albidae-Fagetum sylvaticae* association

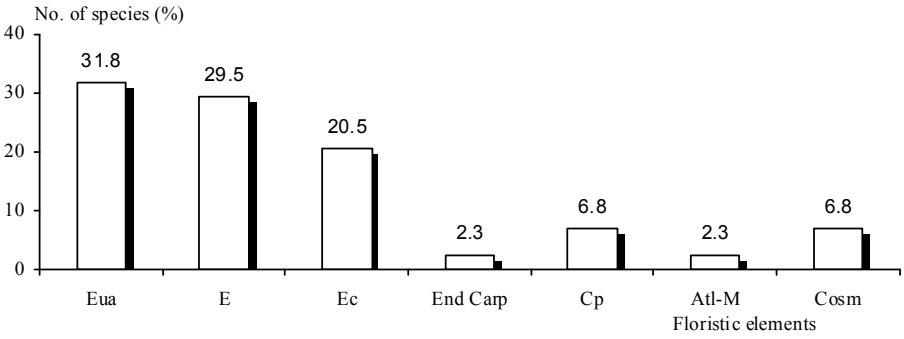

Fig. 6. Spectrum of floristic elements of *Luzulo albidae-Fagetum sylvaticae* association

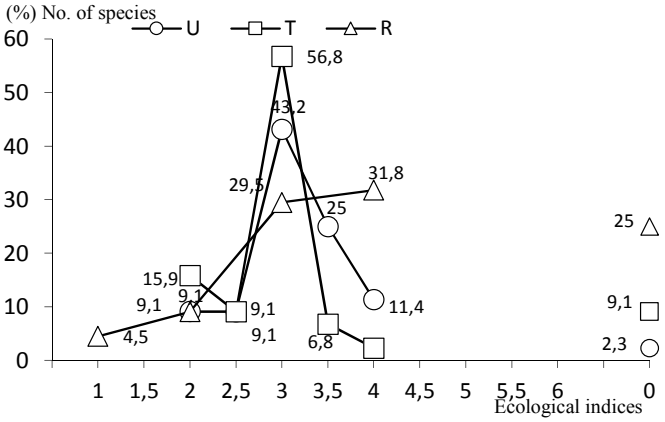

Fig. 7. Diagram of ecological indices for the *Luzulo albidae-Fagetum sylvaticae* association

In terms of life forms (Fig. 5), the association is built in a high percentage of hemicryptophytes species (H=54.6%), followed in smaller numbers by geophytes (G=22.7%), the rest having a lower weight.

The floristic elements spectrum (Fig. 6), indicates the dominance of Eurasian species (Eua=31.8%), together with Europeans (E=25%) and Central Europeans (Ec=20.5%).

The stationary conditions in which the association develops reveal, in terms of moisture, the predominance of mezophyle species (U3-3.5=68.2%), followed by xero-mezophyles (U2-2.5=18.2%) and mezo-higrophyles (U4-4.5=11.4%). Depending on the temperature, a large number of micro-mesothermophilous species can be seen (T3-3.5=63.6%), and depending on the chemical reaction of the soil the predominat species are weakly acid-neutrophyles (R4=31.8%), followed by acid-neutrophyles (R3=29.5%) and amphitolerant species (R0=25%) (Fig. 7).

Table 2

Luzulo albidae-Fagetum sylvaticae association Zólyomi 1955

L.f.	**F.e.**	**U.**	**T.**	**R.**	**Number**		1	2	3
					GPS coordonates	**Altitude (m)**	894	893	872
						Lat. N	46.60468	46.60345	46.60524
						Long. E	22.19127	22.19154	22.19023
					Exposition		N	SV	NV
					Consistency of tree layer		0,9	0,7	0,9
					Hights of the trees (m)		20	26	24
					Diameter of the trees (cm)		60	100	140
					Herbaceous layer coverage (%)		55	50	40
					Slope (degree) (°)		10	5	20
					Area (m²)		400	400	400
0	*1*	*2*	*3*	*4*	*5*		*6*	*7*	*8*
H	E	2,5	2,5	2	As. *Luzula luzuloides*		1	2	2
MPh	E	3	3	0	As. *Fagus sylvatica*		5	4	5
					Calamagrostio-Fagenion,				

					Symphyto cordati-Fagion			
MPh	Ec	3,5	3	3	*Acer pseudoplatanus*	+	1	·
H	Eua	2	3	0	*Calamagrostis arundinacea*	·	1	·

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
G	End Carp	4	2,5	4	*Dentaria glandulosa*	·	+	·
H	Cp	2	0	1	*Deschampsia flexuosa*	+	·	+
Ch	Eua	2	2	2	*Veronica officinalis*	+	·	+
					Fagetalia sylvaticae			
nPh	E	3	2,5	3	*Rubus hirtus*	+	+	1
G	Ec	3,5	3,5	4	*Arum maculatum*	·	+	·
H	Eua	3,5	3	4	*Asarum europaeum*	·	+	+
H	Cosm	4	2,5	0	*Athyrium filix-femina*	·	·	+
H	Eua	3	2	0	*Campanula rapunculoides*	·	·	+
G	E	3	3	0	*Corydalis solida*	·	+	·
Ch	E	3	3,5	4	*Euphorbia amygdaloides*	+	·	·
G	Eua	3	3	3	*Galium odoratum*	+	·	·
H	Ec	3	0	4	*Lamium galeobdolon*	+	+	1
H	Eua	3	3	3	*Lathyrus vernus*	+	·	·
H	E	3,5	3	4	*Mercurialis perennis*	·	+	·
H	Cp	4	3	3	*Oxalis acetosella*	·	+	·
H	Atl-M	3,5	3	4	*Sanicula europaea*	·	·	+
H	Ec	3	3	3	*Symphytum tuberosum* ssp. *nodosum*	+	·	+
					Querco-Fagetea			
MPh	Eua	3	2	2	*Betula pendula*	+	+	·
G	E	3,5	4	0	*Anemone nemorosa*	+	2	·
H	Ec	3	2,5	3,5	*Aposeris foetida*	+	+	·
H	E	3	3	3	*Carex digitata*	+	·	+
H	Eua	3	2	2	*Cruciata glabra*	·	+	·
G	Ec	3	3	4	*Dentaria bulbifera*	+	+	1
H	Cosm	4	3	0	*Dryopteris filix-mas*	·	+	+
G	Eua	3,5	3,5	4	*Erythronium dens-canis*	+	·	·
Th	Cosm	3,5	3	3	*Geranium robertianum*	+	·	·
G	E	3	3	4	*Hepatica nobilis*	·	+	·
H	Eua	3	0	3	*Hieracium murorum*	+	·	+
H	E	2,5	3	4	*Melica uniflora*	·	+	+
Th	Eua	2,5	3	3	*Moehringia trinervia*	·	·	+
H	E	3	3	0	*Mycelis muralis*	+	·	+
G	Eua	2	3	4	*Polygonatum odoratum*	·	+	·
G	E	3,5	3	4	*Scilla bifolia*	+	+	·
H	Eua	3	3	0	*Stellaria holostea*	·	+	+
H	Eua	3	3	3,5	*Viola reichenbachiana*	+	+	·
					Variae syntaxa			
nPh	Ec	2,5	3	0	*Cytisus nigricans*	+	·	·
nPh	Cp	0	2	1	*Vaccinium myrtillus*	3	·	·
H	E	3,5	0	0	*Ajuga reptans*	·	+	·
H	Ec	3,5	2	3	*Doronicum austriacum*	+	+	·
H	Ec	4	2	4	*Gentiana asclepiadea*	+	·	·

Place and date of mapping: 1 – 3 Măgura Hill – Ormanu Valley (Bihor county) 25.04.2015.

where: L.f. - life forms; MPh - Megaphanerophytes; nPh - Nanophanerophytes; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Annual terophytes; F.e. - floristic elements; Eua-Eurasian; Cp - Circumpolar; E - European; Ec - Central European; Atl-M - Atlantic-Mediterranean; Cosm - Cosmopolitan; End Carp - Carpathian endemism; U - humidity, T - temperature, R - the chemical reaction of the soil.

CONCLUSIONS

In european beech phytocoenoses with *Festuca drymeja* there have been identified a number of rare plants, Carpathian endemisms like: *Paeonia officinalis* ssp. *banatica*, *Dentaria glandulosa*, *Lilium martagon*. Scientific novelty is the presence of *Paeonia officinalis* ssp. *banatica*, which was not cited in this place until now. This species grows in european beech forests with *Festuca drymeja*, 0,7 consistency values, on eutricambosol soil type, with sunny exposition and mountainsides with slope between 5-20º. From field observations it was found that *Paeonia officinalis* ssp. *banatica* has a good medium density (in the gaps stand), estimated to 2 ex./m². The population of this species is expanding in stands of the area with less consistency.

The life forms spectrums for the two associations analyzed highlights the largest share of hemicryptophyte species, followed by geophyte species. The European, Central European and Eurasian floristic elements have considerable significance in the phytocoenoses analyzed. Ecological indices show the dominance of mezophyles, micro-mesothermophilous and weak acid-neutrophilous species.

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