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CONTRIBUTIONS TO THE KNOWLEDGE OF THE ASSOCIATION OF *FESTUCO DRYMEJAE-FAGETUM* FROM LĂZĂRENI HILLS (NORTH-WESTERN ROMANIA)

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Abstract: The importance and relevance of the present study emerges from the analysis and characterization for the first time of an association of Festuco drymejae-Fagetum (Morariu et al., 1968) in an unchartered territory from this point of view. The very existence of this association that is specific to the mountain area adds something new. Human impact on vegetation from this space took various types and forms, among which stands out: burning of vegetation, overgrazing, deforestation and not at least air and waters pollution. Deciduous forests in general in Piedmont Lăzăreni suffered in recent years (1990 - 2008) because of the economic degradation that caused serious damage to the exploitation of timber.

Key words: association, phytocoenologic study, ecological factors, floristic elements

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INTRODUCTION

The area studied (Lăzăreni Hills), is located in terms of space in the central southern part of Bihor County, between Crişul Repede River to the north and Crişul Negru River to the south (figure 1). From the geographic point of view this area represents a subsystem of the orographic system of the Western Hills. In its turn, this subsystem behaves as a system consisting of several physical and geographical units among which we mention: Tăşad Hills, Betfiei Hills, Hidişel Hills, Calea Mare Hills etc. Over time, Lăzăreni Hills were treated in the specialized literature from the following points of view: orographic (Pop, 2005), geological (Ţicleanu, 2008), climatic (Dragotă, 2006; Dumiter, 2007), pedological (Sabău et al., 2002) and biogeographic (Burescu and Cheregji, 2002; Burescu et al., 2002; Burescu and Lacatoş, 2010; Lacatoş and Burescu, 2010; Lacatoş, 2010a; Lacatoş, 2010b) etc. And in our country, this association has been described in North-Western Romania (Ardelean, 2002; Groza, 2008; Păşcuţ and Burescu, 2010; Pop et al., 2002), in Oltenia (Răduţoiu, 2006), in Moldova (Gurău, 2004), in South Western Romania (Nicolim and Imrea, 2009) etc

In a careful analysis of the specialized bibliographic literature focused on this area, it is noted the absence of scientific gaps aimed at various components of the environment. This study comes in completing and improving information about an anthropic area, in full process of degradation due to the actions and activities of man.

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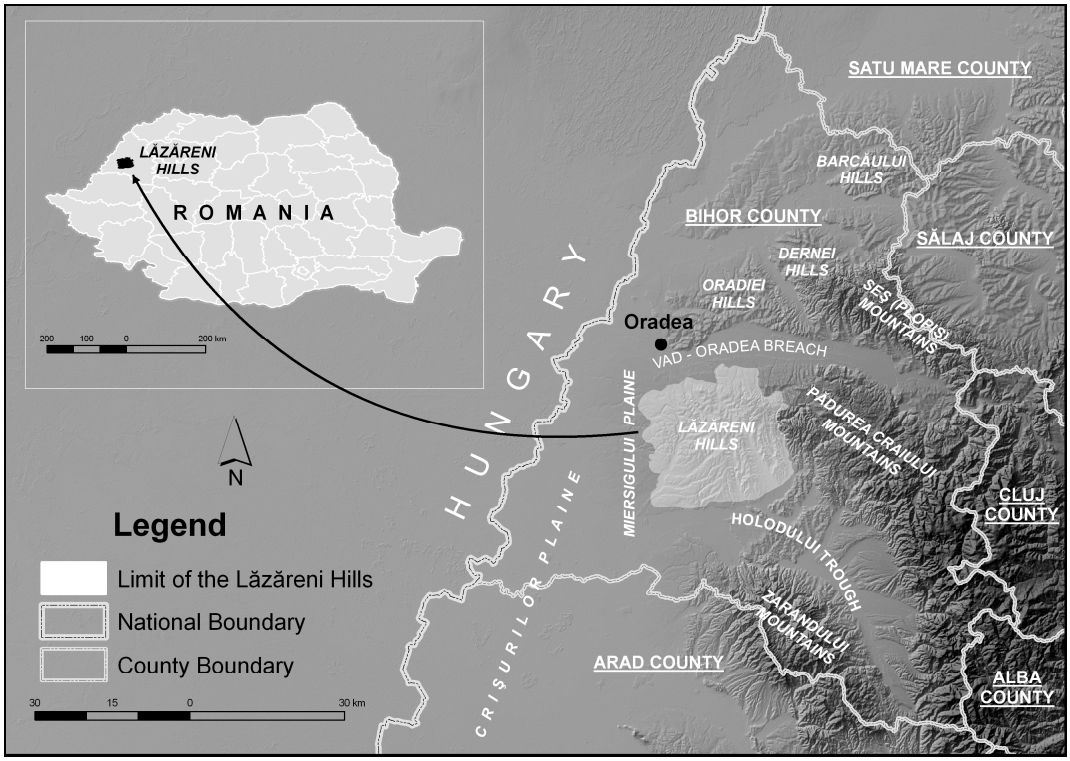

Figure 1. Geographical location of Lăzăreni Hills
(Source: processing after Pop, 2005)

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MATERIALS AND METHODS

In the study of vegetation cover a total of 52 phytocoenologic lifts were made, during 2008 - 2010, of which 10 more representative surveys entered into the composition of the phytocoenologic table (table 1), according to the methodology used in scientific research work by Borza and Boșcaiu (1954), Borhodi (1996), Braun-Blanquet and Pavillard (1928), Marian (2008), Pott (1995) and Sanda (2008). Flora inventoried in the 10 surveys comprise a total of 54 species which are grouped in the phytocoenologic table on probative and characteristic species, differential or of recognition, which are subordinated to the sub-alliance, alliance, order and class.

The synthetic table contains information about the species included in the floristic composition of the association, biological form, floristic elements, ecological indices (humidity, temperature, soil chemical reaction), karyotype, serial number of the survey, altitude (m.s.m.), exposition, slope, tree height (m), diameter of the trees (cm), canopy, grassy layer cover (%), surface (sqm).

Overall coverage of each species participating in the association table was made with the index of abundance-dominance and besides it was calculated and noted the constancy (K) according to its evaluation system Braun-Blanquet. At the bottom of the table there were listed the species occurring in a single survey, place and the date of the surveys.

Data from the phytocoenologic and environmental study of the association *Festuco drymejae-Fagetum* were plotted as a spectrum of biological shapes, of floristic elements, ecological indices and karyotype.

RESULTS

Beech forests studied are located along some streams, the valley and extend to the coast slopes with gradients ranging from 8º - 25º. Above them, on the plateau, there is a mixture of hornbeam and beech *(Carpino-Fagetum)*, oak with hornbeam *(Querceto petraeae-Cărpinetum)*,

holm with hornbeam *(Carpino-Quercetum cerris)*, holm with Turkey oak *(Querco petraeae-cerris)*, etc. They love moisture and are mostly located in the northern, north-western slopes.

The association *Festuco drymejae-Fagetum* (figure 2) was identified in the following places: Miheleu, Gepiş, Lăzăreni, Holod, Sititelec, Oşand, Mierlău, Chijic and Copăcel, places whose pedological substrate is characterized by profound and intense moist soils up to damp - wet soils where air humidity is sufficient for the beech to find conditions favorable to life.

Figure 2. *Festuco drymejae-Fagetum* Biţişagului Valley (Lăzăreni village-Bihor County)

The flora of the phytocoenoses studied in this area is rich summing up a total of 54 species (table 1), including a beautiful forest orchid *Cephalanthera damassonium* (Oprea, 2005), as well as the species *Fagus sylvatica* and *Festuca drymejae* which are species characteristic and dominant for the association analyzed.

Tree layer is well represented by *Fagus sylvatica* having a general coverage of 75%, a maximum consistency (K=V), and the herbaceous layer is given by *Festuca drymeja* with an average coverage of 36.5%, a maximum consistency (K=V).

Among the species identifying the sub-aliance ***Symphyto-Fagenion,*** alliance ***Symphyto cordati-Fagion*** and order ***Fagetalia sylvaticae*** we mention: *Cardamine glanduligera, Euphorbia amygdaloides, Lamium galeobdolon, Asarum europaeum, Carex digitata*, etc. And of the class ***Querco-Fagetea***: *Anemone nemorosa, Aposeris foetida, Athyrium filix–femina, Brachypodium sylvaticum, Campanula persicifolia* etc.

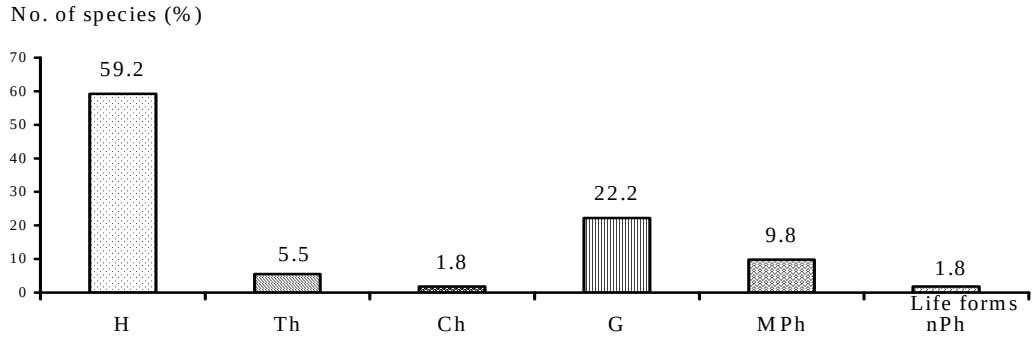

Figure 3. The spectrum of life form in the association *Festuco drymejae-Fagetum*,
where: H = hemicryptophytes; Th =Annual terophytes; Ch= Chamaephytes; G = geophytes; MPh = Megaphanerophytes; nPh = Nanophanerophytes;

The analysis of the spectrum of biological forms (figure 3), highlights the predominance of hemicryptophytes (59.2%), followed at a great distance by geophytes (22.2%) and woody species (11.6%).

In the spectrum of floral elements (figure 4), it is shown that the majority are Eurasian species (46.3%), European (29.6%) and Central European (9.2%).

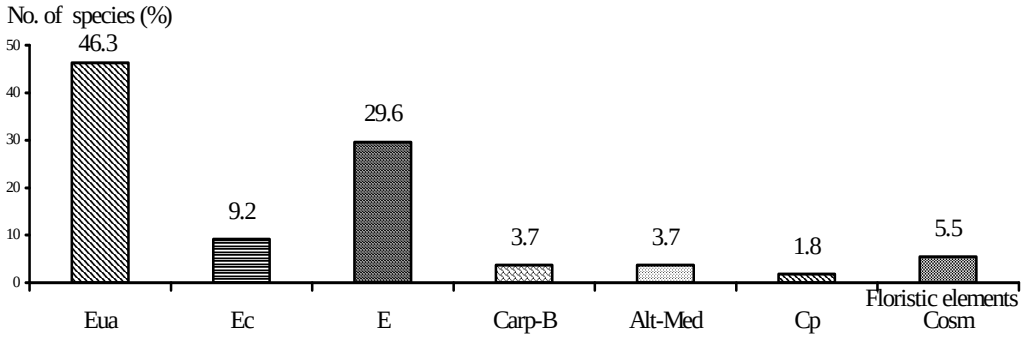

Figure 4. Spectrum of floristic elements of the association *Festuco drymejae-Fagetum*, where: Eua= Eurasian; Ec=Central European; E=European; Carp-B=Carpathian-Balkanic; Atl-Med=Atlantic-Mediterranean; Cp=Circumpolar Cosm=Cosmopolitan;

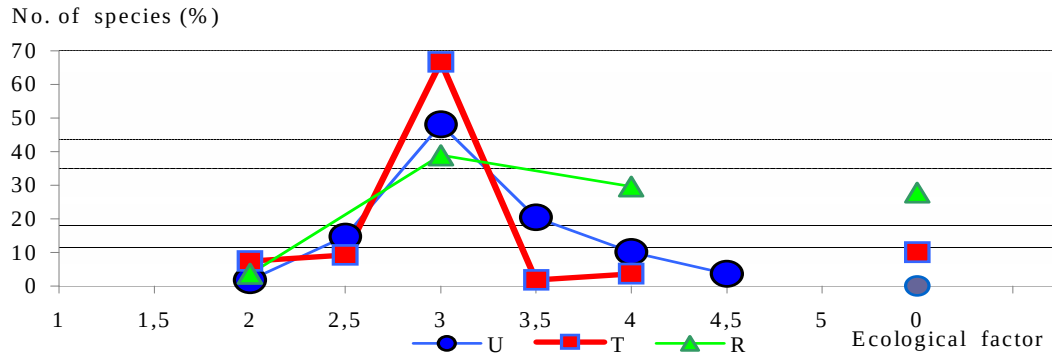

Figure 5. Diagram of ecological factors for the *Festuco drymejae-Fagetum*, where: U= humidity, T= temperature, R= the chemical reaction of the soil.

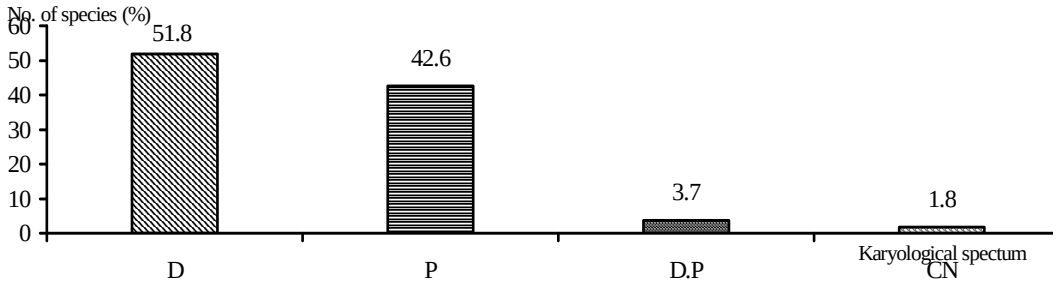

Figure 6. The spectrum of karyological in the association *Festuco drymejae-Fagetum*, where: D=dyploid; P=polyploid; D.P=Dyplo-polyploid; CN= karyotype is not knows.

Ecological factors (figure 5), emphasizes in terms of moisture the high number of mesophilous plants (68.5%), followed by xero-mesophilous (16.6%), which has values close to mezo-higrophyle (13.8%). Compared to the heat factor micro-mesothermal species distinguish (68.4%) as well as micro-thermal (16.6%). Depending on the chemical reaction most species are acid-neutrophilous (38.9%), followed by weak acid-neutrophilous (29.6%), at a very small distance by amphitolerant species (27.8%).

From the karyological analysis (figure 6), the high number of diploid species come off (51.8%), followed at a small difference by polyploids (42.6%). The diplo-polyploid couple (3.7%) is poorly represented in the association, as the species with unknown karyotype (1.8%). Diploids index has a value of 1.2.

DISCUSSIONS

Making a comparison between the work „*Contributions to the phytocoenologic study in pure European beech stand forests in Codru-Moma mountains (North-Western Roman*ia)" and this work from Lăzăreni Hills, we find that the first work comprises a large number of 104 species in Codru-Moma Mountains, while in Lăzăreni Hills we have a halved number of only 54 species, of which 36 species are common in the two areas studied.

Differences in excess of the dominance of biological forms in association, of floristic elements and ecological factors are not too many; comparing them, we note a certain similarity in that:

In Codru-Moma Mountains, live forms are represented by hemicriptophyte (H=50%), geophyte (G=23.6%) and megafanerophyte (MPh=13%), and in Lăzăreni Hills we have hemicriptophyte (H=59.2%), geophyte (G=22.2%) and megafanerophyte (MPh= 9.8%).

In terms of floristic elements Codru-Moma Mountains are dominated by the Eurasian species (Eua=47.7%), European (E=18.7%) and circumpolar (Cp=8.4%), and in Lăzăreni Hills first places are held by the Eurasian (Eua=46.3%), European (E=29.6%) and Central European (Ec=9.2%).

Behavior to environmental factors both in Codru-Moma Mountains and Lăzăreni Hills, phytocoenoses are of mesophilic character (67% in Codru-Moma Mountains, 68.5% in Lăzăreni Hills) and xero-mesophilic (12% in Codru-Moma Mountains, 16.6% in Lăzăreni Hills). Compared to temperature they are micro-mesothermal (75.9% in Codru-Moma Mountains, 68.4% in Lăzăreni Hills) and microthermal (12% in Codru-Moma Mountains, 16.6% in Lăzăreni Hills). Soil chemical reaction capitalized through acid-neutrophil species (37% in Codru-Moma Mountains, 38.9% in Lăzăreni Hills) and low-acid neutrophil (37% in Codru-Moma Mountains, 29.6% in Lăzăreni Hills).

Comparative analysis with work 11 illustrates the large number of species (70 species) found in similar associations from Pădurea Craiului Mountains for the small number of species (54 species) which are part of the same phytocoenoses from Lăzărenilor Hills. 26 species are common for both situations. After live forms, are dominant hemicryptophytes (H=34% in Pădurea Craiului Mountains, H=59.2% in Lăzărenilor Hills), geophytes (G=23% in Pădurea Craiului Mountains, G=22.2% in Lăzărenilor Hills) and megaphanerophytes (Mph=11% in Pădurea Craiului Mountains, Mph=9.8% in Lăzărenilor Hills). In terms of florist elements found in Pădurea Craiului Mountains, the most representative species are the European species (E=30%), the Eurasian species (Eua=24%) and Central European species (Ec=21%) and, in Lăzărenilor Hills, the most representative are the Eurasian species (Eua=46.3%) and the Central European species (Ec=9.2%).

Compared to ecological factors, species from Pădurea Craiului Mountains and from Lăzărenilor Hills have a mesophilic character (74.2% those from Pădurea Craiului Mountains and 68.5% those from Lăzărenilor Hills).

In terms of temperature, there are 77.1% micro-mesothermal in Pădurea Craiului Mountains and 68.4% in Lăzărenilor Hills. Chemical reaction shows acid-neutrophil species and weak acid-neutrophil species (67.1% in Pădurea Craiului Mountains and 38.9% in Lăzărenilor Hills), followed by euro-ionic species (22.8% in Pădurea Craiului Mountains and 27.8% in Lăzărenilor Hills).

A relatively similar situation is presented by species from *Festuco drymejae-Fagetum* association analyzed in works *„Flora şi vegetaţia din depresiunea Caşin-Oneşti (sectorul Căiuţi-Oituz)”*, *„Flora şi vegetaţia judeţului Satu-Mare”*, *„Vegetaţia Judeţului Cluj. (Studiu fitocenologic, ecologic, bioeconomic şi ecoprotectiv)”* and *„Caracterizarea sinecologică a principalelor fitocenoze lemnoase din Ţara Oaşului (judeţul Satu-Mare)”*. Differences and similarities are generated by their spatial location.

As a conclusion, *Festuco drymejae-Fagetum* association, analyzed in the above-mentioned works, is located, from orographic point of view, in mountain region, while, in this study, it is described in hills region. In the mountain region, the association has a much higher number of species, it is often doubled (for example, in work *„Contributions to the phytocoenologic study in pure European beech stand forests in Codru-Moma mountains (North-Western Romania)*”, compared to Lăzărenilor Hills. Making a comparison between the analysis of live forms, of floristic elements and of ecological factors described in Lăzărenilor Hills, and the works from the mountain region, it appears a certain similitude between them.

Tabel 1. As. *Festuco drymejae-Fagetum* (Morariu et al. 1968)

L.f.	F. e.	U.	T.	R.	2n	Nr. Land Surveys	1	2	3	4	5	6	7	8	9	10	K	AD m
						Altitude (m.s.m.)	250	290	260	280	240	260	280	210	230	220		
						Exposition	N	NV	N	E	NE	NV	N	V	NV	SE		
						Slope (º)	20	25	20	20	25	18	20	9	10	8		
						Trees high (sqm)	19	20	22	21	17	20	18	23	21	22		
						Trunk diam. (cm)	35	40	50	45	30	40	50	55	45	60		
						Consistency of tree layer	0.8	0.95	0.7	0.8	1	0.7	0.8	0.9	1	0.9		
						The grass layer (%)	60	55	35	75	45	95	60	55	35	80		
						Surface (sqm)	400	400	400	400	400	400	400	400	400	400		
MPh	E	3	3	0	D	*Fagus sylvatica*	4	5	4	4	5	4	4	5	5	5	V	75
G	Carp-B	4	2	3	D	*Festuca drymeja*	3	3	2	3	2	4	3	3	2	4	V	36,5
						Symphyto-Fagenion; Symphyto cordati-Fagion; Fagetalia sylvaticae												
G	Carp-B	4	2.5	4	P	*Cardamine glanduligera*	+	+	.	.	.	+	.	+	+	+	III	0,3
Ch	E	3	3.5	4	D	*Euphorbia amygdaloides*	+	+	+	+	+	.	+	+	+	+	V	0,45
H	Ec	3	0	4	D	*Lamium galeobdolon*	+	+	+	1	.	+	+	+	+	+	V	0,9
H	Eua	3.5	3	4	D	*Asarum europaeum*	+	+	+	.	.	+	+	+	+	.	IV	0,35
H	E	3	3	3	P	*Carex digitata*	+	+	+	+	.	.	+	+	+	+	IV	0,4
H	E	3.5	3	4	P	*Carex sylvatica*	+	+	.	+	1	+	+	.	+	+	IV	0,85
G	Eua	3.5	3	4	D	*Circaea lutetiana*	+	+	+	1	+	.	+	.	+	.	IV	0,8
G	Ec	2.5	3	3	P	*Galium schultezii*	+	+	+	+	+	+	.	.	+	+	IV	0,4
H	Eua	3	3	3	D	*Lathyrus vernus*	+	.	+	+	+	+	.	+	.	+	IV	0,35
H	Eua	3.5	3	3	DP	*Myosotis sylvatica*	+	+	+	.	+	+	.	+	.	+	IV	0,35
H	Cp	4	3	3	D	*Oxalis acetosella*	+	.	+	+	.	+	+	.	+	+	IV	0,35
H	E	3.5	3	3	D	*Pulmonaria officinalis*	+	.	+	+	+	+	.	+	+	+	IV	0,4
H	E	3	2.5	3	P	*Rubus hirtus*	+	+	+	.	+	.	+	.	+	+	IV	0,35
H	Atl-Med	3.5	3	4	D	*Sanicula europaea*	.	+	+	+	.	+	.	+	+	+	IV	0,35
H	Eua	3	3	0	P	*Symphytum tuberosum*	+	+	.	+	+	.	+	+	.	+	IV	0,35
G	Ec	3	3	4	P	*Cardamine bulbifera*	+	.	+	+	.	.	+	+	.	+	III	0,3
G	Eua	3	3	3	P	*Galium odoratum*	+	.	+	.	+	+	1	+	.	.	III	0,75
G	Eua	3	3	0	P	*Maianthemum bifolium*	.	+	.	+	+	.	+	+	+	.	III	0,3
H	Eua	3.5	0	4	P	*Paris quatrifolia*	.	+	.	+	+	+	+	+	.	.	III	0,3
						Querco-Fagetea												
G	E	3.5	4	0	P	*Anemone nemorosa*	+	+	.	+	+	.	+	.	+	+	IV	0,35
H	Ec	3	2.5	3	D	*Aposeris foetida*	+	+	+	.	+	.	+	+	+	.	IV	0,35
H	Cosm	4	2.5	0	P	*Athyrium filix–femina*	+	+	.	+	+	.	.	+	+	+	IV	0,35
H	Eua(Med)	2.5	4	4	D	*Brachypodium sylvaticum*	.	+	+	.	+	+	+	.	+	+	IV	0,35
H	Eua	3	3	0	D	*Campanula persicifolia*	+	+	+	.	+	.	+	+	+	+	IV	0,4
H	E	4.5	3	3	P	*Carex remota*	+	.	+	.	+	.	+	+	+	+	IV	0,35
H	Eua	3	2	2	DP	*Cruciata glabra*	.	+	.	+	+	+	.	+	+	+	IV	0,35
H	Cosm	4	3	0	P	*Dryopteris fili–mas*	+	.	+	1	1	2	+	+	+	.	IV	3
H	Eua	4	3	2	P	*Festuca gigantea*	.	+	+	+	+	+	.	.	+	+	IV	0,35
H	Eua	3	2.5	0	D	*Fragaria vesca*	+	+	.	+	+	.	+	.	+	+	IV	0,35
Th	Eua	3	2	0	D	*Galeopsis speciosa*	+	.	+	.	.	+	+	+	+	+	IV	0,35
H	Eua(Med)	3	3	4	P	*Geum urbanum*	+	+	.	+	.	+	+	+	+	.	IV	0,35
nPh	Atl-Med	3	3	3	P	*Hedera helix*	+	+	+	1	+	.	+	+	.	+	IV	0,85
Th	Eua(Med)	2.5	3	3	D	*Lapsana communis*	.	.	+	+	+	+	+	+	.	+	IV	0,35
H	Eua	3	0	4	D	*Melica nutans*	+	+	+	.	.	+	+	+	+	+	IV	0,4
H	E	2.5	3	4	D	*Melica uniflora*	+	.	+	+	+	+	+	.	+	.	IV	0,35
H	E	3	3	0	D	*Mycelis muralis*	+	+	+	+	+	.	.	+	+	+	IV	0,4

G	Eua	3.5	0	3	CN	*Platanthera bifolia*	+	.	.	+	+	+	+	+	.	+	IV	0,35
H	Eua	3	3	0	D	*Stellaria holostea*	+	+	+	+	+	.	.	+	.	+	IV	0,35
H	Eua	3	3	4	D	*Astragalus glycyphyllos*	.	+	+	+	.	+	+	+	.	.	III	0,3
G	E(Med)	2.5	3	4	P	*Cephalanthera damassonium*	+	.	+	.	+	.	+	+	.	.	III	0,25
G	E	2.5	3	3	D	*Convallaria majalis*	+	.	+	.	+	+	+	.	+	.	III	0,3
Th	Cosm	3.5	3	3	P	*Geranium robertianum*	.	.	+	.	+	.	+	.	+	+	III	0,25
H	Eua	3	3	0	P	*Poa nemoralis*	.	+	+	.	.	+	+	.	+	+	III	0,3
G	Eua(Med)	2	3	4	D	*Polygonatum odoratum*	+	+	.	+	.	.	+	+	+	.	III	0,3
MPh	E	3	3	3	D	*Prunus avium*	.	+	+	.	.	+	+	+	.	+	III	0,3
MPh	E	2.5	3	0	D	*Quercus petraea*	+	.	.	+	+	.	.	+	.	+	III	0,25
H	Eua	3.5	0	0	P	*Stachys sylvatica*	.	+	+	+	.	+	.	+	+	.	III	0,3
H	Eua	3	3	3	P	*Viola reichembachiana*	+	+	.	+	.	+	.	+	+	.	III	0,3
MPh	E	2.5	3	3	D	*Acer campestre*	.	.	+	.	+	+	.	+	.	.	II	0,2
MPh	E	3	3	3	P	*Carpinus betulus*	.	+	.	+	.	+	.	.	+	.	II	0,2
						Accompanying												
H	Eua	3	0	3	D	*Galium molugo*	+	+	+	.	.	+	+	.	+	+	IV	0,35
H	Ec	4.5	2	0	D	*Chaerophyllum hirsutum*	.	.	.	+	.	.	+	+	+	.	II	0,2

L.f. = life forms; H = hemicryptophytes; Th = Annual terophytes; Ch = Chamaephytes; G = geophytes; MPh = Megaphanerophytes; nPh = Nanophanerophytes; F.e.= floristic elements; Eua = Eurasian; Ec = Central European; E = European; Carp-B = Carpathian-Balkanic; Atl-Med = Atlantic-Mediterranean; Cp = Circumpolar Cosm = Cosmopolitan; U = humidity, T = temperature, R = the chemical reaction of the soil; 2n = karyological spectrum; D = dyploid; P = polyploid; D, P = Dyplo-polyploid; CN = karyotype is not knows.

Species that occur in a single releve: *Cruciata laevipes, Equisetum maximum.*

Place and date of mapping: 1. Briciu Valley - Miheleu village, 25.07.2009; 2. Gepişanului Valley - Gepiş village, 31.05.2009; 3. Luncile Valley - Lăzăreni village, 02.06.2009; 4. Biţişagului Valley - Lăzăreni village, 02.06.2009; 5. Hodişel Valley - Holod village, 28.06.2009; 6. Şumugiului Valley – Sititelec village, 28.05.2009; 7. Surupa Valley - Oşand village, 22.08.2009; 8. Forest Şumugiu - Mierlău village, 22.08.2009; 9. Forest Dumbrava - Mierlău village, 25.07.2009; 10. Forest Gruiului - Copăcel village, 07.06.2009.

The presence of *Festuco drymejae-Fagetum* association in these hills was conditioned by local specific topoclimatic conditions, generated by the existence of some orographic thermal inversions.

The explanation for the existence of beech in Lăzăreni Hills is closely linked to physical and geographical conditions encountered in this area. Although beech vegetates at altitudes above 1200 m in the latitudinal range of conditions between 40º - 45º, we will see that here it is an exception to the rule mentioned above. The scientific explanation of this is attributed to thermal inversions occurring at the level of topoclimate along the valleys such as: Gepişanului Valley, Luncile Valley, Biţişagului Valley, Şumugiului Valley, Surupa Valley etc., cold air masses taking refuge along them generating conditions conducive to the emergence and development of beech.

Deciduous forests in general in Piedmont Lăzăreni suffered in recent years (1990 - 2008) because of the economic degradation that caused serious damage to the exploitation of timber.

The result of human impact is that a large number of species, some of them having endemic value, disappeared or will disappear.

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