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VEGETAL ASSOCIATIONS OF THE ORDER FAGETALIA SYLVATICAE PALOWLOWSKI ET AL. 1928 IN BERZUNTI MOUNTAINS, BACĂU COUNTY (2)

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ABSTRACT

In this paper we present two of the forest associations in Berzunţi Mountains area, which belong to the class QUERCO-FAGETEA Br.-Bl et Vlieger in Vlieger 1937. During 2009-2010 we investigated the phytocenoses of the associations : *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987 şi *Galio schultesii-Fagetum* (Burduja et al 1973). The description of these associations in the researched territory is accompanied ny phytocenological tables and the analysis of the bioforms and the floristic elements.

Key words: vegetal associations, forest, Berzunţi Mountains

Introduction

The Berzunţi Mountains are situated in the eastern extremity of the Eastern Carpathians, its borders are: to the North – Tarcău Mountains, to the West – Dărmăneşti Depression, to the East and to the South – Tazlău Subcarpathians.

The researched territory (the Berzunţi Mountains area) has a 140 Km² surface and includes various types of mountain and hill relief, with a great diversity of the biotops. The forest area has deţine 47 % of the researched territory, this paper referring to phytocenoses of the following associations: *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987 and *Galio schultesii-Fagetum* (Burduja et al 1973).

Matherial and method

The species nomenclature complies with the books *Flora ilustrată a României – Pteridophyta et Spermatophyta* (3) cu *Flora ilustrată a plantelor vasculare din Estul României* (14) and *Flora R.P.R.-R.S.R.* (15). The determination of the bioform types and the floristic elements was made according to *Flora cormofitelor spontane şi cultivate din România* (10). The ecological indices for each analyzed species were settled according to the book *Flora şi vegetaţia Moldovei (România), vol. I.* (2)

To study the vegetation in the Berzunţi Mountains area we used the phytocenological survey method of the Zürich-Montpellier Phytocenological-floristic Central-European School.

Results and discussions

Taking into consideration the book *Flora şi vegetaţia Moldovei (România),* vol. II (2) and other phytosociological papers of nomenclature and classification (1.2,4,7-9,11-13), the associations taken into study were classified as follows:

CLASS QUERCO-FAGETEA Br.-Bl et Vlieger in Vlieger 1937
Order *FAGETALIA SYLVATICAE* Palowlowski et al. 1928
Alliance *Symphyto-Fagion* Vida 1963
Suballiance *Symphyto-Fagenion* Boşcaiu et al. 1982
*Association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987: Plaiul Savului, the surroundings of lake Tarniţa
Alliance *Lathyro hallersteinii-Carpinion* Boşcaiu et. al 1982
Suballiance *Galio schultesii-Carpenion* Täuber 1992
*Association *Galio schultesii-Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994 (*Carpino-Fagetum* Paucă 41.- MITITELU D., BARABAŞ N., 1978: Larga-Dofteana), Dealul Pipirigului, Dealul Stogului

The description of the vegetal associations

1. Association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987
Syn.: Chrysanthemo rotundifolio-Piceo-Fagetum Soó 1964; Piceo-Fagetum sensu auct.
Spruce-beech forests

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Corology and stational conditons

The association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987 has not been previously signalled in the research area. During our research we identified spruce-beech associations in the area of Berzunţi Mountains, on Plaiul Savului and in the surroundings of lake Tarniţa. Spruce-beech forests constitute the intermediate forest type between spruce forests and beech forests. The phytocenoses of this association develop at altitudes situated between 800-820 m, occupying inclined terrains (40-45 degrees), with a main northern exposure, on slightly wet acid brown soils.

Floristic composition and phytocenological structure

Besides the edificating species *Fagus sylvatica* and *Picea abies*, with ages situated between 75-100 zears, there can also be found in the tree stratum (with a 70-90% coverage) species such as: *Acer pseudoplatanus*, *Pinus sylvestris* etc. The shrub stratum (with a 2-5 % coverage) is poorly developed, with species such as: *Hedera helix*, *Corylus avellana*, *Crataegus monogyna* etc.

The regeneration stratum is formed by the sapling of the tree species, especially beech and spruce. The herbaceous stratum, with various coverage, of 5-15%, shelters species such as: *Luzula luzuloides*, *Pteridium aquilinum*, *Dryopteris filix-mas*, *Geum urbanum*, *Glechoma hederacea*, *Neottia nidus–avis* etc.

From a phytocenological point of view, besides the two dominant species *Fagus sylvatica* and *Picea abies*, there also appear species characteristic to the suballiance *Calamagrostio-Fagenion,* alliance *Symphyto cordati-Fagion*, order *Fagetalia sylvaticae* and class *Querco-Fagetea.* In the phytocenoses of the association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987 can be found other species of the alliances *Acerion pseudoplatani* and *Lathyro hallersteinii-Carpinion* and classes*: Rhamno-Prunetea, Vaccinio-Piceetea* and *Epilobietea angustifolii* (Table 1).

Table 1- CLASS QUERCO-FAGETEA Br.-Bl et Vlieger in Vlieger 1937
Order *FAGETALIA SYLVATICAE* Palowlowski et al. 1928
Alliance *Symphyto-Fagion* Vida 1963
Suballiance *Symphyto-Fagenion* Boşcaiu et al. 1982
1. Association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987

Geoelem.	Biof.	Ecological indices						Number of survey	1	2	3	4
								Altitude (m)	820	810	800	800
								Exposure	NV	N	N	N
								Inclination (º)	40	45	40	45
								Herbaceous stratum coverage (%)	70	75	80	90
		L	T	C	U	R	N	Shrub stratum coverage (%)	5	-	2	-
								Herbaceous stratum coverage (%)	15	10	5	5
								Survey area (m²)	1000	1000	1000	1000
								Number of species	23	18	16	17
								Charact. of as.				
Eur	MM	5	3	6	X	X	X	*Picea abies*	2	3	2	2
Eur	MM (M)	3	5	2	5	X	X	*Fagus sylvatica*	2	2	3	3
								Calamagrostio-Fagenion				
Eur	H	4	X	4	5	3	4	*Luzula luzuloides ssp luzuloides*	-	+	-	-
Cosm	G	6	5	3	5	3	3	*Pteridium aquilinum*	-	1	-	+
Eua	Ch	5	X	3	4	2	3	*Veronica officinalis*	-	-	+	-
								Symphyto cordati-Fagion				
Carp (End)	G	4	4	4	7	7	7	*Dentaria glandulosa*	+	-	+	-
Eua	G	3	5	3	6	7	5	*Epipactis helleborine*	+	-	-	-
Euc (Mont)	H	3	4	4	5	7	X	*Veronica urticifolia*	-	+	-	-
								Acerion pseudoplatani				
Euc	MM	5	X	4	6	X	7	*Acer pseudoplatanus*	-	-	-	+

Eua	G	4	4	2	5	4	X	*Polygonatum verticillatum*	1	-	-	-
								Lathyro hallersteinii-Carpinion				
Euc	G	5	5	5	4	7	4	*Galium schultesii*	-	+	-	-
Eua	H	4	7	4	4	7	X	*Lathyrus vernus*	-	-	-	+
								Fagetalia sylvaticae				
Eur	G	3	6	4	6	8	8	*Anemone ranunculoides*	+	-	-	-
Eua	H	3	5	5	6	8	6	*Asarum europaeum*	+	-	1	-
Eur (Med)	Ch	4	5	2	5	7	6	*Euphorbia amygdaloides*	+	-	+	-
Euc	H-Ch	3	5	2	5	7	5	*Lamium galeobdolon*	+	-	+	-
Eua	G	5	X	5	4	7	5	*Lilium martagon*	-	-	-	+
Eua (Cont)	G	3	X	6	X	3	3	*Majanthemum bifolium*	-	-	-	+
Circ	H-G	1	X	3	6	X	7	*Oxalis acetosella*	+	+	-	+
Eua	H	3	X	X	6	7	6	*Paris quadrifolia*	+	-	-	-
Eua (Mont)	H	4	5	4	6	7	7	*Salvia glutinosa*	-	+	-	-
Eua	H	4	5	3	5	8	6	*Sanicula europaea*	-	+	-	-
								Alnion incanae et Alno-Fraxinetalia				
Eua (Med)	G	4	5	3	6	7	7	*Circaea lutetiana*	-	+	-	-
Circ	G	3	4	X	6	3	4	*Equisetum sylvaticum*	-	+	-	-
Eua	Th	4	5	5	7	7	6	*Impatiens noli-tangere*	-	+	-	+
Eua (Med)	Ch-N	7	5	X	8	X	8	*Solanum dulcamara*	-	-	-	+
Eua	H	4	X	3	7	7	7	*Stachys sylvatica*	-	-	-	+
								Querco-Fagetea				
Eua	H	6	X	2	6	X	6	*Ajuga reptans*	-	-	+	-
Circ	G	X	X	3	X	5	X	*Anemone nemorosa ssp. nemorosa*	-	-	+	-
Cosm	H	4	X	3	7	X	6	*Athyrium filix-femina*	+	-	-	-
Eua	H	3	5	4	4	X	3	*Carex digitata*	-	+	-	-
Euc	G	3	5	4	5	7	6	*Dentaria bulbifera*	+	-	-	-
Cosm	H	3	X	3	5	5	6	*Dryopteris filix-mas*	+	+	+	-
Med (Circ)	H	4	5	5	5	X	7	*Geum urbanum*	-	-	+	-
Alt-Med	N-E	4	5	2	5	X	X	*Hedera helix*	+	+	-	-
Euc-Med	H (G)	3	5	2	5	6	X	*Melica uniflora*	+	-	-	-
								Rhamno-Prunetea				
Balc	M	6	5	3	X	X	X	*Corylus avellana*	+	-	-	-
Eua	M	7	5	3	4	8	3	*Crataegus monogyna*	+	-	-	-
Circ	N	7	X	X	5	X	8	*Rubus idaeus*	-	-	+	-
Eua	H	7	5	5	5	7	7	*Verbascum nigrum ssp. nigrum*	-	-	-	+
								Vaccinio-Piceetea				
Carp-Balc	TH	7	4	4	6	4	3	*Campanula abietina*	-	+	-	-
Cosm	Ch	4	3	3	6	3	5	*Lycopodium selago*	-	+	-	-
Euc	H	4	4	2	6	2	5	*Luzula sylvatica*	-	+	-	+
Eua (Mont)	Th	4	X	5	5	2	2	*Melampyrum sylvaticum*	-	-	-	+
Eur	MM-M	6	X	X	X	X	X	*Sorbus aucuparia*	+	-	-	-
								Epilobietea angustifolii				
Eua	H	5	X	5	5	X	6	*Fragaria vesca*	+	-	+	-
Circ	H	5	X	X	5	X	5	*Solidago virgaurea ssp. virgaurea*	-	-	-	+
								Variae syntaxa				
Euc	MM	3	5	4	X	X	X	*Abies alba*	-	-	-	+
Cosm	Th-TH	4	X	3	X	X	7	*Geranium robertianum*	-	-	+	-
Eua	H-Ch	6	5	3	6	X	7	*Glechoma hederacea*	+	-	-	-
Eua (Cont)	H-Ch	8	7	5	4	7	7	*Nepeta nuda*	-	-	-	+
Eua	G	2	5	3	5	7	5	*Neottia nidus -avis*	+	-	-	-

Eur	H	5	6	5	5	8	6	*Pulmonaria officinalis*	-	-	+	-
Eua	MM	7	X	7	X	X	X	*Pinus sylvestris*	-	-	+	-
Circ	M	6	5	3	7	7	6	*Viburnum opulus*	+	-	-	-

Place and time of survey: 1,2. Rocky places and lake Tarniţa (06.06.2010) (03.07.2010), 3,4. Plaiul Savului (06.06.2010) (03.07.2010)

The bioform spectrum states the dominance of hemicryptophytes (H) with 43,89%, then geophytes (G) with 22,80%, phanerophytes (Ph) with 19,27%, annual terophytes (Th) with 5,25%, camephytes (Ch) with 7,07% and biannual terophytes (TH) with 1,75% (Fig. 1).

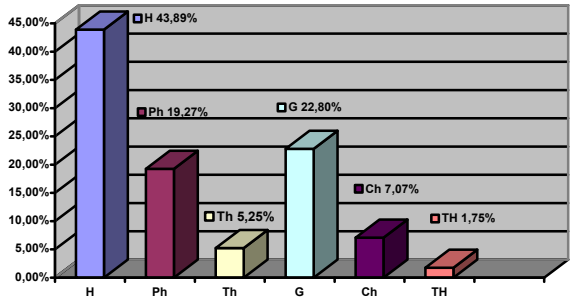

Fig. 1 – Bioform spectrum of the association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987

The spectrum of floristic elements: shows the dominance of Eurasian species (Eua) with 43,83%, then European (Eur) and Central-European species (Euc) with 14,03% each, circumpolar (Circ) with 10,52%, cosmopolitan (Cosm) with 8,77%. The Carpathian, Mediterranean, Atlantic-Mediterranean, Balkanic and Carpathian-Balkanic species have 1,75% each (Fig. 2).

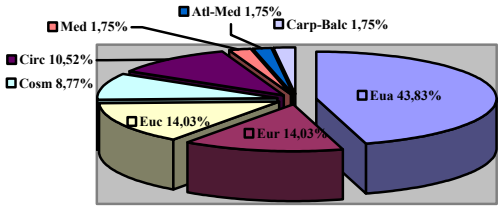

Fig. 2 – Floristic element spectrum of the association *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987

2. Association *Galio schultesii-Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994
Syn.: Carpino-Fagetum moldavicum Burduja, Mihai et Sârbu 1973 şi 1974, Carpino-Fagetum sensu auct. mold.
Hornbeam-beech forests

Corology and stational conditions

The association *Galio schultesii-Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994 has been previously identified in the western side of the researched area, i.e. in the village localitatea Larga-Dofteana (MITITELU D., BARABAŞ N., 1978) under the name *Carpino-Fagetum* Paucă 41. In the Berzunţi Mountains area this association sporadically appears on smaller areas, we identified it on Dealul Pipirigului and on Dealul Stogului in the basin of streams Butucari and Plopul. The phytocenoses of hornbeam and beech have ages between 40-45 years and can be found at an average altitude of 300 m, on slightly inclined slopes, with a north-eastern and north-western exposure.

Floristic composition and phytocenological structure:

The tree stratum edified by *Fagus sylvatica* and *Carpinus betulus,* but also by *Tilia cordata*, *Betula pendula* etc. makes 75-90 % coverage. The shrub stratum makes up to 5% coverage, isolated specimens of *Viburnum opulus, Rubus idaeus* etc. can be also found. The regeneration stratum is poor, due to the 10 cm-thick litter, being formed by the beech and hornbeam saplings. The herbaceous stratum has an average coverage of over 15%, with numerous species characteristic to the class *Querco-Fagetea.* From a phytocenological point of view, besides the species edifying for the association, within the surveys we identified species characteristic to cenotaxa superior to the association, i.e. the alliances *Lathyro hallersteinii-Carpinion* and *Symphyto-Fagion,* the order *Fagetalia sylvaticae* and the class *Querco-Fagetea.* (Table 2).

Table 2- CLASS QUERCO-FAGETEA Br.-Bl et Vlieger in Vlieger 1937
Order *FAGETALIA SYLVATICAE* Palowlowski et al. 1928
Alliance *Lathyro hallersteinii – Carpinion* Boşcaiu et al.1982
Suballiance *Galio schultesii-Carpinenion* Täuber 1992
2. Association *Galio schultesii-Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994

Geoelem.	Biof.	Ecological indices						Number of survey	1	2
								Altitude (m)	300	300
								Exposure	NV	NE
								Inclination (º)	10	5
								Tree stratum coverage (%)	90	75
		L	T	C	U	R	N	Shrub and juvenile stratum coverage (%)	-	5
								Herbaceous stratum coverage (%)	15	20
								Survey area (m²)	400	400
								Number of species	18	25
								Charact. of as.		
Euc	G	5	5	5	4	7	4	*Galium schultesii*	+	-
Eur	MM (M)	3	5	2	5	x	x	*Fagus sylvatica*	3	3
								Fagus sylvatica (juv.)	-	+
								Lathyro hallersteinii – Carpinion et Galio schultesii-Carpinenion		
Eur	MM-M	4	6	4	x	x	x	*Carpinus betulus*	2	1
								Carpinus betulus (juv.)	-	+
Eua	H	5	6	3	5	6	5	*Stellaria holostea*	-	+
Eur	MM	4	5	4	x	x	5	*Tilia cordata*	+	-
								Symphyto-Fagion		
Cosm	G	6	5	3	5	3	3	*Pteridium aquilinum*	-	1
								Tilio platyphyllae – Acerion pseudoplatani		
Euc	MM	5	x	4	6	x	7	*Acer pseudoplatanus*	+	-
Cosm	Th-TH	4	x	3	x	x	7	*Geranium robertianum*	-	+
Eua	G	4	4	2	5	4	x	*Polygonatum verticillatum*	+	+
								Alnion incanae		
Atl-Med	H	5	5	2	8	6	5	*Carex pendula*	-	+
Eua (Med)	G	4	5	3	6	7	7	*Circaea lutetiana*	-	+
Eua	H-Ch	6	5	3	6	x	7	*Glechoma hederacea*	-	+
Eua	Th	4	5	5	7	7	6	*Impatiens noli-tangere*	+	+
Eua	H	4	x	3	7	7	7	*Stachys sylvatica*	+	-
Circ	M	6	5	3	7	7	6	*Viburnum opulus*	-	+
								Fagetalia sylvaticae		
Eua	H	3	5	5	6	8	6	*Asarum europaeum*	+	-
Eur (Med)	Ch	4	5	2	5	7	6	*Euphorbia amygdaloides*	+	-
Eua	G	2	5	2	5	x	5	*Galium odoratum*	-	+
Eua	H	4	7	4	4	7	x	*Lathyrus vernus*	-	+
Eur	H	5	x	3	6	x	7	*Myosotis sylvatica*	-	+
Eua	H	4	5	3	5	8	6	*Sanicula europaea*	+	-
								Querco-Fagetea		
Eur	MM-M	5	7	4	5	7	6	*Acer campestre*	+	-
Eua	H	6	x	2	6	x	6	*Ajuga reptans*	-	+
Eua (Med)	H	4	5	3	5	6	6	*Brachypodium sylvaticum*	-	+
Eur	G	5	x	3	4	x	4	*Convallaria majalis*	-	+
Cosm	H	3	x	3	5	5	6	*Dryopteris filix-mas*	+	+
Atl-Med	N-E	4	5	2	5	x	x	*Hedera helix*	-	+
Eur	H	5	6	2	4	7	3	*Melittis melissophyllum*	+	-
Circ	H	5	x	5	5	5	5	*Poa nemoralis*	+	-
Eua	H	4	5	4	5	7	6	*Viola reichenbachiana*	-	+

Quercetea pubescentis										
Eua	G	7	5	5	3	7	3	*Polygonatum odoratum*	-	+
Rhamno-Prunetea										
Eua	MM (M)	7	x	x	x	x	x	*Betula pendula*	+	-
Circ	N	7	x	x	5	x	8	*Rubus idaeus*	-	+
Vaccinio –Piceetea										
Euc	MM	3	5	4	x	x	x	*Abies alba*	+	-
Trifolio-Geranietea										
Eua	H	7	6	4	4	8	4	*Agrimonia eupatoria*	-	+
Eua	H	7	x	3	3	x	3	*Origanum vulgare*	-	+
Galio-Urticetea										
Eua (Med)	H	8	6	3	5	8	7	*Sambucus ebulus*	-	+
Cosm	H	x	x	x	6	x	8	*Urtica dioica*	+	-

Place and time of survey: 1. Plaiul Stogului (05.08.2009), 2. Dealul Pipirigului (23.07.2010)

Bioform spectrum: the best numerical representation is held by the hemicryptophyte species (H – 47,36%) of the total identified species. Phanerophytes (ph) are well represented with 28,93%, followed by geophytes with 18,42%. Annual terophytes (Th) have 5,26% and camephytes are poorly represented with 2,63% (Fig. 3).

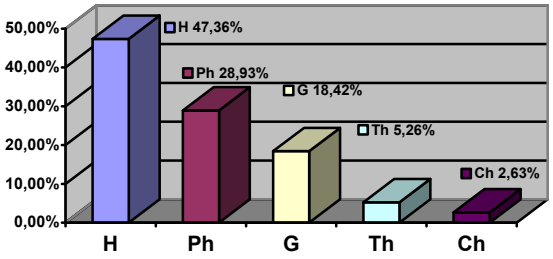

Fig. 3 – The bioform spectrum of the association *Galio schultesii-Fagetum* (Burduja et al. 1973) Chifu et Ştefan 1994.

The floristic element spectrum states the dominance, within the analyzed phytocenoses, of Eurasian species (Eua) with 47,36%, then European species (Eur) with 21,05%, cosmopolitan (Cosm) with 10,52%, Central-European (Euc) and circumpolar (Circ) wih 7,89% each, then Atlantic-Mediterranean (Atl-Med) with 5,26% (Fig. 4).

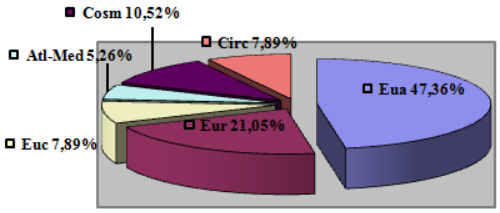

Fig. 4 – The floristic element spectrum of the association Galio schultesii-Fagetum (Burduja et al. 1973) Chifu et Ştefan 1994.

Conclusions

4. The forest vegetation (class QUERCO-FAGETEA) can be included in the nemoral stratum (deciduous forests), i.e. in the substratum of the beech and mixed forests. The main forest group in the mentioned substratum is the fir-beech group (*Pulmonario rubrae-Fagetum*), also sporadically appear spruce-beech forests (*Leucanthemo waldsteinii-Fagetum*), pure beech forests (*Symphyto cordati-Fagetum*) and hornbeam-beech forests (*Galio schultesii-Fagetum*);
5. The floristic composition of the phytocenoses of the two researched associations is diverse.
6. The bioform spectrum and the geoelement spectrum of the two researched associations confirms the data in the specialty literature.

Rezumat

În această lucrare sunt prezentate două dintre asociaţiile de pădure din zona Munţiilor Berzunţi, încadrate în clasa QUERCO-FAGETEA Br.-Bl et Vlieger in Vlieger 1937. În perioada anilor 2009-2010 au fost investigate fitocenozele asociaţiilor: *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Taüber 1987 şi *Galio schultesii-Fagetum* (Burduja et al 1973) . Descrierea acestor asociaţii din teritoriul investigat este însoţită de tabele

fitocenologice, precum şi de analiza bioformelor şi a elementelor floristice

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