

## MAIN CHARACTERISTICS OF THE BEECH FORESTS FROM BUCEGI MOUNTAINS (ROMANIAN CARPATHIANS)

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**Abstract:** Two types of beech forest in Bucegi Mountains were analysed: *Hieracio rotundati-Fagetum* (Vida 1963) Täuber 1987 and *Symphyto cordati-Fagetum* Vida 1959. In order to make a comparison of these two plant associations it were taken into account the main characteristics of relief, soil and altitude.

In the beech forests of the Bucegi Mountains three sampling plots were delimited: Talea, Moroieni and Brădet. During three growing seasons, different measurements concerning the green and dry biomass as well as the frequency, density and water content of the herbaceous species occurring in the *Hieracio rotundati - Fagetum* communities of Talea locality was done. A comparison between green and dry biomass of the plant communities of Talea, Moroieni and Brădet was done.

The dendrogram of similarity based on Jaccard index was performed for both plant associations.

### Introduction

The Carpathian chain is situated at the intersection of continental, subatlantic and central-european climate influences, while, its southern part is exposed to submediterranean influences. Therefore, the mountain vegetation is the result of the climatic conditions determined by the mountain position.

The Bucegi Mountains still keeps the vestiges of a rich autochthonous floristic base, which seems to be of tertiary age, but this ancestral base so homogenous at its origin has been very early subjected to allochthonous immigrations of the most different geographic origins.

For the forest zone spread in the Bucegi Mountains the beech subzone has large altitudinal limits between 500-1400 m. On vertical line, there are delimited two vegetation levels: inferior mountain and middle mountain level. The inferior limits define pure beech forest or mixed beech and deciduous forest. The coniferous species are absent or there have sporadic presence in the forest. The inferior mountain level is not very well represented in comparison with other vegetation belt. It is covering especially the area between Ialomița Valley and Ialomicioara Valley. The altitude is 600-700 m and the forest is pure or mixed with *Acer* species.

The middle level has a larger coverage and the majority of the forests are located on the exterior side of the massive. The limits of the forest are between the inferior and superior vegetation limit for the fir, up to this limit, the beech is mixed with coniferous species, especially *Picea abies*.

The forest vegetation from middle mountain level is predominated by beech and fir, beech, fir and spruce fir or by beech and spruce fir combinations. The species proportion is variable and it is considerate to be between 10 and 90%. The pure beech forest is situated into the mixed forests, especially at the superior level, up to the fir vegetation limits. At the high altitude are mentioned the pure beech forest situated up to the mixed forest, like a belt on the rocky zone of the Caraiman and Coștila Mountains.

The superior limits of the middle mountain level are corresponding with the superior vegetation beech limit, on the average altitude between 1350-1450 m.

The comparative study of the beech phytocoenoses from Bucegi Mountains [1, 4] and others mountains chain of the South-eastern Carpathians [2, 6, 7, 8, 9] has aimed two aspects:

- the main particularities of the phytocoenosis which were taken into account,

- the integration of these phytocoenosis in category “ 41.1D Dacian beech forests” of Palearctic Habitat Classification [3].

### Material and Methods

It were analyzed two types of beech forest in Bucegi Mountains: *Hieracio rotundati - Fagetum* (Vida 1963) Täuber 1987 and *Symphyto cordati-Fagetum* Vida 1959. In order to make a study of these two plant association it were taken into account the main characteristics of relief, soil and altitude.

It were selected two plots for *Hieracio rotundati - Fagetum* association: Talea and Moroieni and for *Symphyto cordati - Fagetum* association was selected one plot, Brădet.

During three seasons of vegetation, a comparison was done between green and dry biomass and also frequency, density and water content of the herbaceous species included in the *Hieracio rotundati-Fagetum* association of Talea locality.

The comparison between plant communities points out the similarity of vegetation and is based upon the calculation of the Jaccard similarity index and it was obtained the similarity dendrograms based on cladistics method [5]. It was used the quality index of similarity, Jaccard (based on presence/absence criteria), which allowed a close examination of data and relèves from the vegetation tables.

### Results and Discussion

The acidophilous beech forest grouped in *Hieracio rotundati – Fagetum* (Vida, 1959) Täuber 1987 association (Tab.1) have been analysed and characteristics gathered by investigations made on the beech forest on Talea and Moroieni, placed at altitudes varying between 730-820m. It lies on acid brown-yellowish soils (pH=5,05), podsol type, rich in skeleton and poor in humus.

The trees layer is dominated by *Fagus sylvatica* with few rare insiders as *Abies alba* and *Picea abies*, which can reach heights of 20-27m, small tree having a consistency of 0.5-0.6, mainly due to the fact in the last decades were massive cuts.

The shrub layer is made from rare samples of *Rosa canina*, *Rubus idaeus* and *Sambucus nigra*. It lies on different inclinations (15-25°) and sun exposure.

The edaphic characteristics in special gives a specific floristic structure of herbaceous sinusia, made of a small number of species, most of them being acidophilous. The elements characteristic for suballiance *Calamgrostio-Fagenion* as: *Calamogrostis arundinacea*, *Hieracium rotundatum*, *Luzula luzuloides*, *Veronica officinalis* are dominating. Species belonging to *Symphyto-Fagion*, even though are present, are in small number.

The average height of herbaceous layer is 40-60 cm and presents a decreased degree of covering of 20-30%.

From the herbaceous elements found as characteristics we can mention for the *Hieracio rotundati-Fagetum* association following species: *Athyrium filix-femina*, *Cardamine bulbifera*, *Cardamine glanduligera*, *Carex sylvatica*, *Circaea lutetiana*, *Epilobium montanum*, *Galium odoratum*, *Gymnocarpium dryopteris*, *Impatiens noli-tangere*, *Luzula luzuloides*, *Mycelis muralis*, *Veronica montana*, *V. urticifolia*.

The various soils, with a great exposure to water flow in the rain period, especially the spring ones, lead to a development in herbaceous sinusia of a great number of meso-hygrophilous species as *Ajuga reptans*, *Allium ursinum*, *Carex sylvatica*, *Circaea lutetiana*, *Dryopteris filix-mas*, *Moehringia trinervia*, *Pulmonaria rubra*, *Ranunculus repens*, *Stachys sylvatica*.

Among acidophilous species characteristics there is *Luzula luzuloides* with a frequency of 18,3% and an average density of 13.3 ind./sqm, green biomass of 11.54g/sqm and dry biomass of 2.98g/sqm. Same values for *Gallium odoratum* are 25%, 12.3/sqm, 14.3 g/sqm and 2.91 g/sqm.

**Table 1: *Hieracio rotundati* – *Fagetum* (Vida 1963) Täuber 1987**

No. of relèves		1	2	3	4	5	6	7	8	9	10	11	12	K	
AREA (sqm)		500	500	500	500	500	500	500	500	500	500	500	500		
HEIGHT OF VEGETATION	tree	20	23	25	20	24	26	22	23	20	25	27	22		
	shrub	5	5	5	6	4	5	5	5	7	5	5	5		
	herbs	45	40	35	30	35	40	45	50	60	50	50	45		
COVERAGE (%)	tree	80	85	75	85	90	80	75	75	80	85	75	80		
	shrub	5	2	5	5	3	5	2	5	6	7	10	8		
	herbs	20	25	30	25	35	30	30	25	20	25	30	35		
EXPOSURE		NE	NE	NE	NE	NE	NE	NE	S	S	S	S	S		
INCLINATION (degree)		15	10	15	20	25	15	20	25	25	10	15	15		
LOCALITY		T	T	T	T	T	T	T	M	M	M	M	M		
<b>Characteristics species</b>															
<i>Hieracium rotundatum</i>		+	-	+1	1	+	+	-	+1	-	+1	+1	1	IV	
<i>Fagus sylvatica</i>		4	5	5	5	4	3	4	5	4	4	5	5	V	
<b><i>Calamagrostio-Fagenion</i></b>															
<i>Luzula luzuloides</i>		2	1	3	2	4	3	2	2	1	+1	3	3	V	
<i>Calamagrostis arundinacea</i>		-	-	+	-	1	-	-	-	+	-	+	+	III	
<i>Veronica officinalis</i>		+	-	+	+	-	+	-	+	-	-	+	+	III	
<b><i>Symphyto-Fagenion</i></b>															
<i>Cardamine glanduligera</i>		+	-	+	+	+	-	-	+	+	-	+	+	IV	
<i>Veronica urticifolia</i>		-	+	-	+1	-	+	-	-	+	+	-	+	III	
<i>Pyrola secunda</i>		-	+	-	-	+	-	-	+	-	-	+	-	II	
<i>Gymnocarpium dryopteris</i>		+	-	+	-	-	+	+	-	+	-	-	+	III	
<i>Abies alba</i>		-	+	-	+	-	-	-	-	-	+	-	-	II	
<i>Festuca altissima</i>		-	+	-	-	+	-	-	+	-	-	-	+	II	
<i>Festuca drymeia</i>		-	+	-	-	+	-	-	+	-	-	-	+	II	
<b><i>Fagetalia</i></b>															
<i>Cardamine bulbifera</i>		+	-	+	-	-	+	-	-	+	+	-	+	III	
<i>Euphorbia amygdaloides</i>		-	+	-	+	+	-	+	+	-	-	-	+	III	
<i>Mercurialis perennis</i>		+	-	+	-	-	+	-	+	-	+	-	+	III	
<i>Pulmonaria rubra</i>		+	-	+	-	-	+	-	+	-	+	-	-	III	
<i>Salvia glutinosa</i>		+	+	-	-	+	-	+	-	-	+	+	+	III	
<i>Viola reichenbachiana</i>		+	-	+	-	-	+	-	+	-	-	-	-	II	
<i>Epilobium montanum</i>		-	+	-	+	-	-	+	+	+1	-	+	-	III	
<i>Carex sylvatica</i>		+1	-	-	+	-	+1	-	-	-	+1	-	+	III	
<i>Athyrium filix-femina</i>		+	-	-	+	-	-	+	-	-	+	-	+1	III	

<i>Galium odoratum</i>		+	-	+	+1	-	+	+	-	+	+	-	+	IV
<i>Dryopteris filix-mas</i>		-	+	-	-	+	-	+	-	+	-	+	-	III
<i>Geranium robertianum</i>		-	+	-	-	-	+	-	+	-	+	-	-	II
<i>Stachys sylvatica</i>		+	-	-	+	+	-	-	+	-	-	+	+	III
<i>Veronica montana</i>		+	-	-	-	-	+	-	+	-	+	-	+	III
<i>Impatiens noli-tangere</i>		+	-	-	+	-	-	+	-	-	+	-	+	III
<i>Galeopsis speciosa</i>		-	+	-	-	+	-	-	-	+	-	-	+	II
<i>Ajuga reptans</i>		-	+	-	-	-	+	-	-	+	-	-	+	II
<i>Allium ursinum</i>		-	+	-	+	+	-	-	+	-	+	-	+	III
<i>Acer pseudoplatanus</i>		-	+	-	-	+	-	-	-	+	-	-	+	II
<i>Myosotis sylvatica</i>		-	+	-	+	-	-	-	-	+	-	-	-	II
<i>Cardamine impatiens</i>		-	+	-	-	+	-	-	-	-	+	-	-	II
<i>Galeobdolon luteum</i>		+	-	+	-	-	+	-	-	+	-	-	+	III
<i>Ranunculus carpaticus</i>		-	+	-	-	-	-	-	-	+	+	-	-	II
<i>Rubus idaeus</i>		+	-	+	+	-	+	+	-	-	-	-	-	III
<i>Sambucus nigra</i>		-	+	-	+	-	+	+	+	-	-	-	-	III
<b>Quercu-Fagetea</b>														
<i>Moehringia trinervia</i>		+	-	-	+	+1	-	-	-	-	-	+	-	II
<i>Mycelis muralis</i>		+	-	+	-	-	+	-	-	+	-	+	+	III
<i>Rubus hirtus</i>		+	-	+	+	+	-	-	+	-	+	-	+	III
<i>Rosa canina</i>		+	-	+	+	+	-	+	-	-	-	-	-	III
<i>Fragaria vesca</i>		-	+	-	+	-	-	+	-	-	+	-	-	II
<i>Galium schultesii</i>		-	+	-	-	-	+	-	-	+	-	-	+	II
<i>Poa nemoralis</i>		+	-	+	+1	-	-	-	+	-	-	-	-	II
<i>Geum urbanum</i>		+	-	+	-	-	-	+	-	-	+	-	-	II
<i>Glechoma hirsuta</i>		-	+	-	-	+	-	-	-	-	+	-	+	II
<b>Alno-Ulmion</b>														
<i>Circaea lutetiana</i>		+	+	-	+	-	-	-	+	+	+	-	+	III
<b>Vaccinio-Piceetea</b>														
<i>Picea abies</i>		+	-	-	-	+	-	-	-	+	-	-	+	II
<i>Oxalis acetosella</i>		-	+1	-	+1	-	-	1	-	-	1	-	+	III
<i>Campanula patula</i> ssp. <i>abietina</i>		-	+	-	-	-	+	-	-	+	-	-	+	II
<b>Varia</b>														
<i>Tussilago farfara</i>		+	-	-	-	+	-	-	-	-	+	+	-	II
<i>Ranunculus repens</i>		-	+	-	-	+1	-	+	-	-	+	-	+1	III

Species present in one releve: *Anemone nemorosa* (3), *Vaccinium myrtillus* (7), *Gentiana asclepiadea* (9), *Prenanthes purpurea* (10), *Polystichum aculeatum* (5), *Epipactis helleborine* (6), *Monotropa hypopitys* (10), *Pulmonaria obscura* (12), *Urtica dioica* (8), *Scopolia carniolica* (5); T=Talea; M=Moroeni

Date: 1-3 relèves, 15. 06. 1996; 4-5 relèves, 20. 08. 1996; 6-7 relèves, 17. 09. 1996; 8-10 relèves, 20. 06. 1999; 11-12 relèves, 25. 09. 1999.

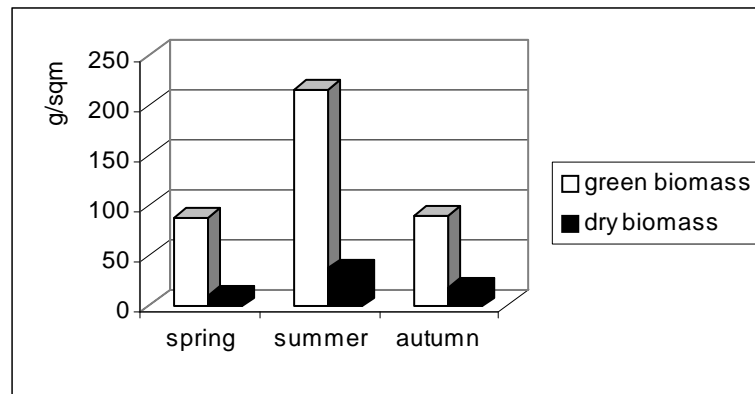
**Table 2: Frequency, density, biomass and water contain of the herbs species included in *Hieracio rotundati*-*Fagetum* (Vida 1963) Täuber 1987 (locality Talea, 1996)**

Species	Spring					Summer					Autumn				
	Biomass					biomass					biomass				
	Freq.	Density	Green biomass	Dry biomass	Water contain	Freq.	Density	Green biomass	Dry biomass	Water contain	Freq.	Density	Green biomass	Dry biomass	Water contain
%	m <sup>-2</sup>	g/m <sup>2</sup>	g/m <sup>2</sup>	%	%	m <sup>-2</sup>	g/m <sup>2</sup>	g/m <sup>2</sup>	%	%	m <sup>-2</sup>	g/m <sup>2</sup>	g/m <sup>2</sup>	%	
<i>Pulmonaria rubra</i>	5.00	0.67	1.803	0.223	87.63	21.67	1.60	5.075	0.923	81.82	5.00	1.40	2.927	0.426	85.46
<i>Luzula luzuloides</i>	3.30	2.07	1.035	0.343	66.86	18.33	13.40	11.570	2.988	74.07	10.00	5.47	3.740	0.918	75.51
<i>Euphorbia amygdaloides</i>	3.30	0.27	0.619	0.088	81.90	13.33	1.67	4.850	0.675	86.08	-	-	-	-	-
<i>Galium odoratum</i>	21.70	8.13	7.662	1.122	85.35	25.00	12.27	14.390	2.910	76.69	25.00	10.13	11.60	2.168	81.31
<i>Dentaria glandulosa</i>	56.70	4.20	5.036	0.499	90.09	15.00	0.73	0.821	0.079	90.42	-	-	-	-	-
<i>Dentaria bulbifera</i>	66.70	5.47	12.510	1.793	85.71	41.67	3.53	6.021	0.816	84.44	1.70	0.33	0.424	0.047	88.91
<i>Dryopteris filix-mas</i>	3.30	0.53	0.837	0.118	85.94	6.67	1.53	3.941	0.498	84.90	-	-	-	-	-
<i>Geranium robertianum</i>	13.30	0.67	2.073	0.157	92.41	43.33	5.00	22.900	2.940	87.17	26.70	2.33	9.290	1.059	88.60
<i>Carex sylvatica</i>	33.30	4.13	4.071	0.645	84.16	46.67	6.80	7.929	2.074	73.84	36.70	3.00	6.460	1.773	72.55
<i>Epilobium montanum</i>	10.00	0.93	0.761	0.097	87.23	16.67	1.20	1.886	0.451	76.05	3.30	0.40	0.382	0.081	79.03
<i>Mycelis muralis</i>	41.67	2.13	3.550	0.348	90.18	46.66	3.53	15.350	2.343	84.74	43.30	3.00	6.468	1.392	78.48
<i>Veronica urticifolia</i>	5.00	0.67	0.350	0.056	86.20	8.33	0.93	0.590	0.089	85.16	-	-	-	-	-
<i>Viola reichenbachiana</i>	38.30	5.27	5.540	0.764	86.18	60.00	8.73	13.190	2.009	84.67	58.30	7.47	9.371	1.538	83.58
<i>Rubus hirtus</i>	23.30	1.93	4.001	0.944	76.30	26.67	2.00	8.718	3.630	58.36	23.30	2.00	10.06	4.152	58.65
<i>Stachys sylvatica</i>	23.30	1.93	4.831	0.794	83.57	25.00	1.80	10.850	2.203	79.60	5.00	0.60	4.530	0.981	78.36
<i>Moehringia trinervia</i>	5.00	0.67	0.567	0.070	87.23	10.00	1.47	1.396	0.198	85.20	-	-	-	-	-
<i>Circaea lutetiana</i>	35.00	1.93	2.902	0.305	89.46	38.33	4.87	13.500	2.214	83.61	25.00	3.13	7.130	1.231	82.73
<i>Veronica montana</i>	15.00	1.80	1.015	0.117	68.47	16.67	2.33	6.109	1.132	81.46	13.30	2.40	5.970	0.977	83.69
<i>Pyrola secunda</i>	-	-	-	-	-	5.00	0.40	0.203	0.105	48.28	3.33	0.27	0.190	0.082	56.95
<i>Fragaria vesca</i>	15.00	1.07	0.529	0.116	78.07	26.67	2.13	1.638	0.459	72.00	20.00	2.27	2.416	0.716	70.41
<i>Athyrium filix-femina</i>	6.70	3.53	6.576	0.774	88.23	10.00	4.07	12.160	1.689	86.11	-	-	-	-	-
<i>Gymnocarpium dryopteris</i>	-	-	-	-	-	26.70	2.70	2.069	0.475	77.04	5.00	0.47	0.296	0.065	78.08
<i>Tussilago farfara</i>	6.70	0.53	0.533	0.132	89.70	6.67	1.60	4.608	0.482	89.50	-	-	-	-	-
<i>Ranunculus repens</i>	41.70	3.73	8.785	0.784	91.08	38.33	7.47	27.070	2.606	89.19	28.30	3.27	8.545	0.905	89.41
<i>Impatiens noli-tangere</i>	10.00	0.87	0.459	0.017	95.11	13.33	2.47	11.400	0.895	92.18	-	-	-	-	-
<i>Galeopsis speciosa</i>	8.40	0.60	1.536	0.199	87.04	11.67	1.33	6.941	0.992	85.71	-	-	-	-	-
<b>Total</b>			<b>88.330</b>	<b>10.750</b>				<b>215.9</b>	<b>37.16</b>				<b>89.79</b>	<b>18.44</b>	

A comparative analysis of green and dry biomass was done during the three seasons of vegetation of the year 1996.

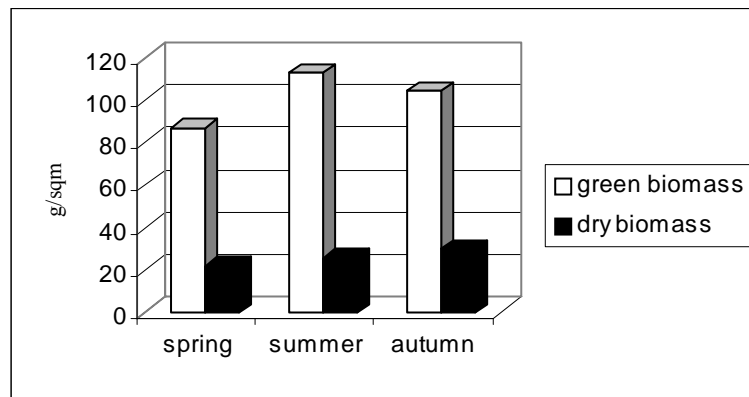
Plot Talea. In the spring seasons, the result of a green biomass was 88.330g/sqm and dry biomass was 10.750 g/sqm (Tab. 2). In the summer season the values for green biomass (215.9 g/sqm) and dry biomass (37.16 g/sqm) are higher due to accumulation in time; in the autumn season there is only 89.79 g/sqm green biomass and 18.44 g/sqm dry biomass (Fig. 1).

The average water content of plants in the period of vegetation seasons varies between 85.18% in spring and 78.34 in autumn.



**Fig. 1: Seasonal dynamic vegetation (Talea)**

Plot Moroieni. The beech forests from Moroieni have the following values for herbaceous biomass: 86.819 g/sqm green biomass and 21.87 g/sqm dry biomass in spring, 112.283g/sqm green biomass and 25.689g/sqm dry biomass in summer and 104.237g/sqm green biomass and 30.099g/sqm dry biomass in autumn (Fig. 2).



**Fig. 2: Seasonal dynamic vegetation (Moroieni)**

#### Plot Brădet.

*Symphyto cordati-Fagetum* Vida 1959 association has a large coverage in the Carpathian. It was considerate pure beech forest in Bucegi Mountains and one plot has been analyzed in the vicinity of Brădet chalet at 1400 m (Tab. 3).

It might be encountered on slight inclined soils, on mollic type soils, with profound pseudo-clay and low skeleton, with varying humidity and reach in humus type mull.

In the small trees layer of these phytocoenoses, which reach a height of 18-25m and coverage of 75-90%, the dominant species is *Fagus sylvatica*. In this layer it could be found also *Acer pseudoplatanus*, *Picea abies* and *Abies alba*.

In the herbaceous layer from pure beeches, it can be found the presence of *Symphytum cordatum* species, having coverage of 20%. It could be also met some species characteristic for *Symphyto-Fagenion* sub-alliance and for order and class. Some species having a coverage of 30% as: *Athyrium filix-femina*, *Galium odoratum*, *Dryopteris filix-mas*, *Oxalis acetosella*, *Mercurialis perennis*, which are dominant in the herbaceous sinuzia, led to creation of numerous sub-associations (7).

The season's dynamic of green biomass in Brădet registered following values: green biomass 316.045g/sqm in spring and 283.080g/sqm in summer and dry biomass 47.637g/sqm in spring and 48.465g/sqm in summer (Fig. 3).

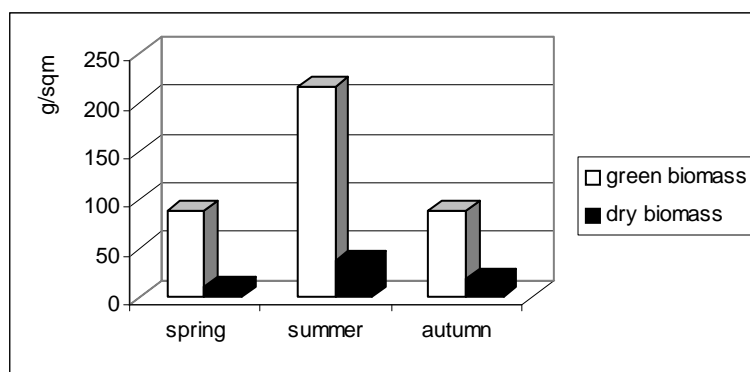


Fig. 3: Seasonal dynamic vegetation (Brădet)

In the month of May a substantial contribution at the green mass is given by the following species: *Allium ursinum*, *Anemone nemorosa*, *Anemone ranunculoides*, *Corydalis solida*, *Isopyrum thalictroides*.

The dominant species in summer are: *Athyrium filix-femina*, *Chaerophyllum hirsutum*, *Euphorbia amygdaloides*, *Helleborus purpurascens*, *Sanicula europaea*.

In the autumn it is registered only a 191.479 g/sqm green biomass and 41.697g/sqm dry biomass. Among the species with a high contribution at production of green biomass in autumn season it could be mentioned: *Galeobdolon luteum*, *Geranium robertianum*, *Pulmonaria rubra*, *Rubus hirtus*, *Stellaria nemorum*.

The comparison between *Hieracio rotundati-Fagetum* (Vida 1963) Täuber 1987 and *Symphyto cordati-Fagetum* Vida 1959 associations, points out the similarity of vegetation and is based upon the calculation of the Jaccard similarity index and it was obtained the similarity dendrograms (Fig. 4, 5) based on cladistics method [5]. The index values for *Hieracio rotundati-Fagetum* association ranged between 0.25 and 0.44. The index values for *Symphyto cordati-Fagetum* association ranged between 0.17 and 0.42.

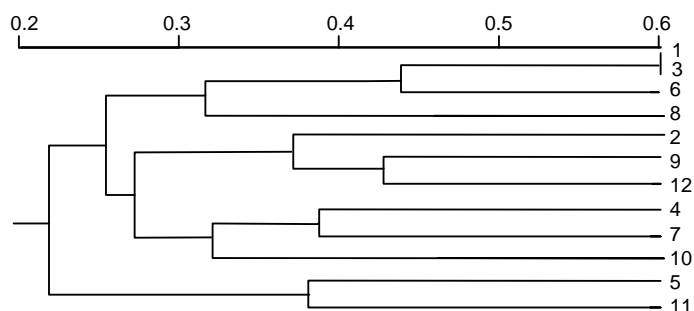


Fig. 4: Dendrogram of *Hieracio rotundati* – *Fagetum* (Vida 1963) Täuber 1987 association

Table 3: *Symphyto cordati-Fagetum* Vida 1959

No. of relèves		1	2	3	4	5	6	7	8	9	10	11	12	13	14	K	
AREA (m <sup>2</sup> )		500	500	500	500	500	500	500	500	500	500	500	500	500	500		
HEIGHT OF VEGETATION	tree	20	25	20	18	21	20	22	20	22	25	20	21	20	25		
	shrub	2	5	5	5	5	2	5	5	5	5	5	5	5	2		
	herbs	20	35	30	40	25	35	40	45	25	50	50	40	35	30		
COVERAGE (%)	tree	85	80	75	70	85	80	80	85	80	75	80	90	85	80		
	shrub	5	3	2	5	5	3	2	5	5	5	3	7	5	5		
	herbs	45	50	40	60	60	50	45	30	45	45	50	55	60	65		
EXPOSITION		E	NE	E	NE	E	NE	E	NE	NE	E	E	E	NE	NE		
INCLINATION (degree)		10	5	10	10	10	5	15	10	15	10	10	15	10	10		
LOCALITY		B	B	B	B	B	B	B	B	B	B	B	B	B	B		
<b>Characteristics species</b>																	
<i>Symphytum cordatum</i>		1	+1	2	1	+1	-	+1	2	3	+1	2	2	+1	1		V
<i>Fagus sylvatica</i>		4	5	5	4	4	5	5	4	4	3	4	5	5	5		V
<i>Festuca drymeia</i>		-	+	-	+	-	+	-	-	-	+	-	+	+	-	IV	
<b><i>Symphyto-Fagenion</i></b>																	
<i>Euphorbia carniolica</i>		+	-	-	-	-	+	+	-	-	+	-	-	-	+	III	
<i>Cardamine glanduligera</i>		+	+	+1	+	-	-	-	+	-	-	-	-	-	-	II	
<i>Pulmonaria rubra</i>		-	+	+	-	-	+	+	+	+	+	-	+	+	+	IV	
<i>Hepatica transsilvanica</i>		-	-	-	-	+	-	-	-	+	-	-	+	-	+	II	
<i>Ranunculus carpaticus</i>		+	+	+	-	-	+	-	-	-	-	-	-	-	-	II	
<i>Rubus hirtus</i>		+	-	+	-	+	-	-	+	-	-	+	-	-	-	II	
<i>Helleborus purpurascens</i>		-	-	+	+	+	-	-	+	-	-	+	-	+	-	III	
<i>Polygonatum verticillatum</i>		+	+1	-	-	-	-	-	-	-	+	-	-	-	-	II	
<b><i>Fagetalia</i></b>																	
<i>Galium odoratum</i>		-	+	+	-	+	+	+1	-	+	+	+	+	-	+	IV	
<i>Salvia glutinosa</i>		-	+	+	-	-	+	-	+	-	-	+	-	-	+	III	
<i>Mycelis muralis</i>		-	-	+	-	+	-	-	-	+	-	-	-	-	-	II	
<i>Adoxa moschatellina</i>		+	+	-	+	+	-	-	-	-	-	-	-	-	-	II	
<i>Galeobdolon luteum</i>		-	+	+	-	-	-	+	-	+	+	-	+	-	+	III	
<i>Polystichum aculeatum</i>		-	+	+	-	-	-	-	-	-	-	-	-	-	-	I	
<i>Lamium maculatum</i>		-	+	+	-	-	-	-	-	-	-	-	-	-	-	I	
<i>Geranium robertianum</i>		-	-	-	-	+	+	-	-	-	-	-	+	-	-	II	
<i>Cardamine bulbifera</i>		-	-	-	+	-	+	-	-	+	-	-	-	-	+	II	



<i>Epilobium montanum</i>		-	+	-	-	-	-	-	-	-	+	+	-	+	-	II
<i>Isopyrum thalictroides</i>		+	+	+	-	-	+	-	-	-	-	-	-	-	+	II
<i>Euphorbia amygdaloides</i>		+	+	+	-	+	-	-	+	-	-	-	-	-	-	II
<i>Myosotis sylvatica</i>		-	-	-	+	-	+	+	-	-	+	-	+	-	+	III
<i>Sanicula europaea</i>		-	-	+	-	-	+	+	-	-	+	-	+	-	-	II
<i>Actaea spicata</i>		-	+	-	+	-	-	-	+	+	-	-	+	-	+	III
<i>Luzula luzuloides</i>		+	+	+	-	-	+	+	-	+	+	+	-	-	-	III
<i>Mercurialis perennis</i>		+	+	+	-	-	-	+	-	-	+	+	-	+	+	III
<i>Paris quadrifolia</i>		-	-	-	-	+	-	-	-	-	-	+	-	-	-	I
<i>Veronica montana</i>		+	+	-	-	-	-	-	-	+	-	-	-	-	+	II
<i>Polystichum setiferum</i>		+	-	-	-	+	-	-	-	-	-	-	-	+	-	II
<i>Senecio fuchsii</i>		+	+	-	-	-	+	-	-	-	-	+	-	-	+	II
<b>Alno-Ulmion</b>																
<i>Chrysosplenium alternifolium</i>		+	-	-	-	+	-	-	-	-	-	-	-	-	-	I
<i>Circaea lutetiana</i>		-	+	+	-	-	+	-	+	-	-	-	-	-	-	II
<i>Impatiens noli-tangere</i>		-	+	+	-	-	-	-	-	-	-	-	-	-	+	II
<i>Carex remota</i>		-	-	+	-	-	-	-	+	-	-	-	+	-	-	II
<i>Dryopteris carthusiana</i>		-	+	-	-	-	+	-	-	-	-	-	+	-	-	II
<i>Sambucus nigra</i>		-	+	-	-	-	-	-	+	-	-	-	+	-	-	II
<i>Stellaria nemorosa</i>		+	-	+	-	+1	-	-	-	-	-	-	-	-	+	II
<b>Tilio-Acerion</b>																
<i>Acer pseudoplatanus</i>		+	-	-	-	-	-	-	+	-	+	-	-	-	+	II
<i>Gymnocarpium robertianum</i>		-	+	-	-	+	-	-	-	+	-	-	-	-	-	II
<b>Quercu-Fagetea</b>																
<i>Glechoma hirsuta</i>		+	-	-	-	-	-	+	-	-	+	-	+	-	-	II
<i>Moehringia trinervia</i>		-	+	-	+	-	-	-	+	-	-	-	-	-	+	II
<i>Athyrium filix-femina</i>		-	+	-	+	-	+	-	-	+	-	-	+	-	+	III
<i>Poa nemoralis</i>		-	-	-	-	+	-	-	-	-	-	-	-	+	-	I
<i>Anemone ranunculoides</i>		+	-	+	+	-	-	+	-	-	-	-	-	-	-	II
<i>Geum urbanum</i>		-	+	-	-	-	-	-	+	-	-	+	-	-	+	II
<i>Dryopteris filix-mas</i>		+	-	+	-	-	+	-	-	-	-	+	-	-	-	II
<i>Ficaria verna</i>		-	+	+	+	-	-	-	+	-	-	-	-	-	-	II
<i>Scilla bifolia</i>		+	-	+	-	-	+	-	-	-	-	-	-	-	-	II
<i>Scrophularia nodosa</i>		-	+	-	-	-	-	+	-	-	-	-	-	+	-	II
<b>Vaccinio-Piceetalia</b>																
<i>Abies alba</i>		-	-	+	+	-	-	+	-	+	-	+	-	+	+	III
<i>Oxalis acetosella</i>		+	+	-	+1	-	-	-	+1	-	-	-	-	-	+	II

<b>Epilobietea</b>																
<i>Rubus idaeus</i>		+	-	-	-	+	-	-	-	-	+	-	-	-	+	II
<i>Fragaria vesca</i>		+	-	-	+	-	-	+	-	-	-	-	-	+	-	II
<i>Galeopsis speciosa</i>		-	-	-	+	-	-	-	-	-	-	-	-	+	-	I
<i>Sambucus racemosa</i>		-	+	-	+	-	-	-	-	-	-	-	-	-	+	II
<b>Filipendulo-Petasition</b>																
<i>Chaerophyllum hirsutum</i>		-	-	-	+	-	-	-	-	-	+	-	-	+	-	II
<i>Stachys sylvatica</i>		-	-	-	-	+	-	-	-	-	-	+	-	-	+	II
<b>Varia</b>																
<i>Stellaria media</i>		-	-	+	-	-	+	-	-	-	-	-	-	-	+	II
<i>Poa annua</i>		+	-	-	-	+	-	-	+	-	-	+	-	-	-	II
<i>Juncus effusus</i>		-	-	-	+	-	-	-	-	+	-	-	-	-	-	II
<i>Veronica chamaedrys</i>		-	+	-	-	+	-	-	-	-	+	-	-	-	-	II
<i>Alliaria petiolata</i>		+	-	-	-	-	+	-	-	-	-	+	-	-	+	II

Species present in one relèves: *Arctium minus* (3), *Chelidonium majus* (5), *Cirsium palustre* (6), *Festuca rubra* (7), *Prunella vulgaris* (9), *Ranunculus repens* (11), *Tussilago farfara* (11), *Veratrum album* (13), *Veronica serpyllifolia* (14), *Corydalis cava* (3), *Aegopodium podagraria* (11), *Paris quadrifolia* (7), *Anemone nemorosa* (1), *Allium ursinum* (7), *Urtica dioica* (10), *Petasites albus* (7), *Picea abies* (6)

Date and place: 1-4 relèves, 15. 06. 1996; 5-8 relèves, 20. 08. 1996; 9-14 relèves, 25. 09. 1996; B=Brădet (Cota 1400).

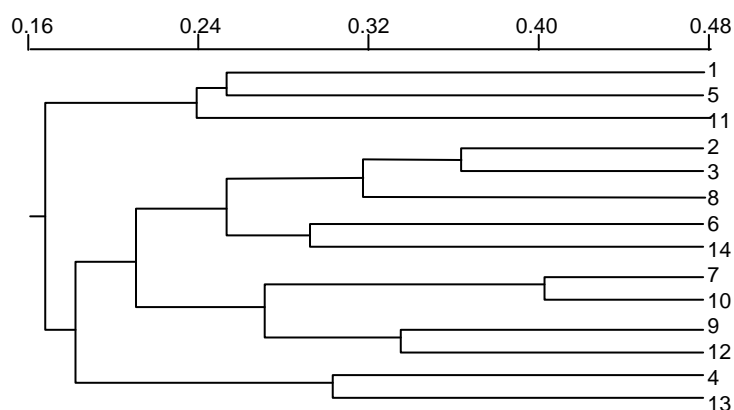


Fig. 5: Dendrogram of *Symphyto cordati-Fagetum* Vida 1959 association

### Conclusions

- For *Hieracio rotundati-Fagetum* association the values of the green biomass are close in both stations Talea and Moroieni. The differences between values of green biomass for *Hieracio rotundati-Fagetum* and *Symphyto cordati-Fagetum* are distinct and that was showed in the graphics.
- A detailed analysis of the materials gathered in this association *Symphyto cordati-Fagetum*, shows that these sub-associations are in fact facies, due to the fact the species have a spread in all beeches analyzed.
- Data analysis has lead to the above diagram. The differences shown in the picture, between relevés from associations are due to the increase of the altitude and are influenced by the appearance within the association of the species that are usually spread at the subalpin level.
- At the same time the increase of the altitude up to 1450 m, in relevés of the beech tree level appears plants specific to the spruce fir level explaining the difference between the index values. In another order the differences between relevés on the forest coenosis are including an important number of *Calamagrostio-Fagenion* characteristic species: *Calamagrostis arundinacea*, *Luzula luzuloides*, *Hieracium rotundatum*, *Veronica officinalis* and species that are characteristic for *Symphyto-Fagenion*.
- It has been shown that the flora remains unitarian and the differences between relevés it could be possible determined by the relief and the edafic factors.

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### PRINCIPALELE CARACTERISTICI ALE FĂGETELOR DIN MUNȚII BUCEGI (CARPAȚII ROMÂNEȘTI)

#### (Rezumat)

Pentru Munții Bucegi au fost analizate două tipuri de făgete *Hieracio rotundati-Fagetum* (Vida 1963) Täuber 1987 și *Symphyto cordati-Fagetum* Vida 1959. Pentru a realiza o comparație între aceste două tipuri de asociații vegetale au fost luate în considerație principalele caracteristici ale reliefului și solului.

Pentru făgetele din Munții Bucegi au fost desemnate trei suprafețe de probă: Talea, Moroieni și Brădet. Pentru suprafața de probă Talea, de-a lungul a trei sezoane de vegetație, au fost efectuate măsurători pentru biomasa verde, biomasa uscată, dar și pentru frecvență, densitate și conținutul în apă la speciile din stratul ierbos de la asociația *Hieracio rotundati-Fagetum*. Pe de altă parte, s-a realizat o comparație între biomasa verde și uscată, de-a lungul a trei sezoane, pentru toate cele trei suprafețe de probă.

Pentru ambele asociații au fost făcute dendrogramele de similaritate bazate pe indicele calitativ Jaccard, calculat în funcție de compoziția floristică redată în tabelele 1 și 3.