DIGITAL DATABASE REGARDING THE MEGAFORBS OF THE SOUTHERN CARPATHIANS

CHIRIȚOIU Magdalena

Abstract. The database for megaforbs in the Southern Carpathians represents 317 taxa, taken from 225 phytosociological relevees, grouped in 11 associations. The species in different coenotaxa of the class Mulgedio-Aconitetea, gathered in a base of data indicate the bioform of the floristic element, of the ecological indexes for humidity (U), temperature (T), soil reaction (R).

Keywords: database, megaforbs, Mulgedio-Aconitetea class.

Rezumat. **Bază de date digitale privind megaforbietele din Carpații Meridionali.** Baza de date pentru megaforbietele din Carpații Meridionali însumează 317 taxoni, prelevați din 225 relevee, grupate în 11 asociații. Speciile încadrate în diferiți cenotaxoni ai clasei Mulgedio-Aconitetea, adunate într-o bază de date, precizează bioforma, elementul floristic, indicii ecologici pentru umiditate (U), temperatură (T), reacția solului (R).

Cuvinte cheie: bază de date, megaforbiete, clasa Mulgedio-Aconitetea.

INTRODUCTION

The database represents a method of gathering pieces of information that work in o system of management (Excel, Acces, and Oracle etc.). This database gathers the pieces of information taken from the field samples of the area representing a source of synthesis for the floristic and vegetation research or for the studies of syndynamic vegetation. The actual work has as a target the appreciation of the similarity of different coenotaxa in some massifs in the Southern Carpathians chain, based on the graphical representation of the ecological indexes specific for the taxons presented in the database made of the phytosociological relevees, by different authors: BOȘCAIU (1971), COLDEA (1993), SANDA et al. (2005), ALEXIU (1998), MIHĂILESCU (2001), DRĂGULESCU (1996), NEBLEA (2006), STANCU (2005), CHIRIȚOIU (2005a, 2005b, 2008a, 2008b).

MATERIAL AND METHODS

For the study or the vegetal carpet we have used methods of phytosociological research characteristic to the Central European phytosociological School. The associations were identified and distinguished according to the characteristic, edifying, dominant and differential species. The syntaxonomical nomenclature is conformable to the stipulations of the International Code of the Phytosociological Nomenclature (WEBER et al., 2000). We gave a special attention to the calculation of the quantitative index Bray-Curtis and to performing the dendrograms, by using the Group-Average method in the program Biodiv.

Ecologic characterization: significance of the indexes U T R used in the paper in order to simplify the carrying out of the spectra when studying vegetation (SANDA et al., 2003). The description of the taxa was performed on the basis of specialty literature: The Illustrated Flora of Romania (CIOCÂRLAN, 2000).

RESULTS AND DISCUSSIONS

In Romania, the science of vegetation (Phytosociology) is a botanical discipline that studies the vegetal communities, based on floristic lists (the floristic conspect). The comparative analyse of the vegetal groups allows the definition of abstract categories (for example the vegetal association). It defines the ecological and botanical function of the vegetal communities at different levels (from the synusia to the zonal biomes), the relations of the plants between them and their environmental (climate, soil etc.), and their geographical distribution (CRISTEA et al., 2004). Romania belongs to the Montpellier school of phytosociology (SIGMA - Station Internationale de Géobotanique Mediterranéene et Alpine) funded by the Swiss botanist Josias Braun-Blanquet at Montpellier.

We gathered pieces of information of the phytosociological relevees realised by different botanists in seven mountain massifs in the Southern Carpathians: Țarcu, Godeanu, Cernei (BOȘCAIU, 1971), Valea Sadului, Cindrel (DRĂGULESCU, 1996; CHIRIȚOIU unpublished data), Retezat (COLDEA, 1993; CHIRIȚOIU, 2005b), Râiosu-Buda (STANCU, 2005), Iezer-Păpușa (ALEXIU, 1998), Piatra Craiului (MIHĂILESCU, 2001), Leaota (NEBLEA, 2006), Bucegi (SANDA, 2005; CHIRIȚOIU, 2008a).

The database that we have done is useful because of the information taken from a number of 317 phytosociological relevees (Table 1), grouped in 11 associations taken from different public works, thesis, monographs, and also from the personal investigations (CHIRIȚOIU, 2005a, 2005b, 2008a, 2008b). These relevees have been taken in the massifs: Iezer-Păpuşa (35 relevees), Godeanu (35), Valea Sadului (38), Piatra Craiului (43), Leaota (10), Bucegi (52) and Râiosu-Buda (12), (Table 2).

Table 1. The number of species presented in different mountain massifs groups.
Tabel 1. Numărul de specii prezente în diferite grupuri de masive muntoase.

Mountain massifs groups	No. species
7 mountain massifs	7
6 mountain massifs	14
5 mountain massifs	18
4 mountain massifs	26
3 mountain massifs	37
2 mountain massifs	64
1 mountain massifs	151
Total species	317

Table 2. The associations, number of relevees by mountain massifs and authors.
Tabel 2. Asociațiile, număr de relevee pe masive muntoase și autori.

Association	Nr.	a	b	c	d	e	f	g	Author
1. *Adenostylo-Doronicetum austriaci*	25		5						BOȘCAIU N.
							9		NEBLEA M.
							10		CHIRIȚOIU M.
		1							CHIRIȚOIU M.
2. *Aconitetum taurici*	24	9							ALEXIU V.
			7						BOȘCAIU N.
					8				STANCU D.
3. *Salici-Alnetum viridis*	47	10							ALEXIU V.
			12						BOȘCAIU N.
						10			NEBLEA M.
							5		SANDA ET AL.
					9				STANCU D.
		1							CHIRIȚOIU M.
4. *Rumicetum alpini*	31	10							ALEXIU V.
				4					DRĂGULESCU C.
								7	MIHĂILESCU S.
					8				STANCU D.
		2							CHIRIȚOIU M.
5. *Cirsio-Heracleetum*	57		5						BOȘCAIU N.
				2					DRĂGULESCU C.
							8		NEBLEA M.
							5		SANDA ET AL.
					10				STANCU D.
				16					CHIRIȚOIU M.
							10		CHIRIȚOIU M.
		1							CHIRIȚOIU M.
6. *Petasito-Cicerbicetum*	8		6						BOȘCAIU N.
				2					DRĂGULESCU C.
7. *Petasitetum albae*	5			5					DRĂGULESCU C.
8. *Calamagrostidetum arundinaceae*	3			3					DRĂGULESCU C.
9. *Astrantio-Delphinietum elati*	5							5	MIHĂILESCU S.
10. *Ligulario sibiricae-Ribetum petraei*	5						5		NEBLEA M.
11. *Phleo-Deschampsietum caespitosae*	15				8				STANCU D.
				6					DRĂGULESCU C.
		1							CHIRIȚOIU M.
		35	35	38	43	10	52	12	
TOTAL relevees	225								

Legend: Iezer-Păpușa (a), Godeanu (b), Valea Sadului (c), Piatra Craiului (d), Leaota (e), Bucegi (f), and Râiosu-Buda (g).

A number of 7 species are present in all the 7 mountain massifs: *Achillea distans* W. et K., *Calamagrostis arundinacea* (L.) ROTH, *Carduus personatus* (L.) JACQ., *Heracleum palmatum* BAUMG., *Leucanthemum waldsteinii* (SCHULTZ BIP.) POUZAR, *Stellaria nemorum* L., *Veratrum album* L.

Using the database, in the synthetic level of any research of the vegetation, using the index of similarity we can realise comparisons between samples, the homogeneity of the relevees can be evaluated, the variability between the coenoses inside the association, harder to notice by classical analysis, the dynamical tendencies of the phytocoenoses can be put into evidence (Table 3).

Using the index of similarity Bray-Curtis we have done the representation of the dendrogram of similarity of the relevees of the seven massifs of the Southern Carpathians chain, based on the presence/absence of the species of these relevees (Fig. 1).

Table 3. Species with high frequency in the database / Tabel 3. Specii cu frecvenţă mare în baza de date.

Species	No. massifs	Species	No. massifs
Achillea distans W. et K.	7	*Chaerophyllum hirsutum* L.	6
Calamagrostis arundinacea (L.) ROTH,	7	*Caltha palustris* L.	5
Carduus personatus (L.) JACQ.	7	*Milium effusum* L.	5
Heracleum palmatum BAUMG.	7	*Polygonatum verticillatum* (L.) ALL.	5
Leucanthemum waldsteinii (SCHULTZ BIP.) POUZAR	7	*Silene vulgaris* (MOENCH) GARCKE	5
Stellaria nemorum L.	7	*Geranium sylvaticum* L.	5
Veratrum album L.	7	*Alnus viridis* (CHAIX) DC.	5
Hypericum maculatum CRANTZ	6	*Cirsium waldsteinii* ROUY	5
Luzula sylvatica (HUDSON) GAUDIN	6	*Myosotis sylvatica* EHRH. EX HOFFM.	5
Rumex alpestris JACQ.	6	*Doronicum austriacum* JACQ.	5
Salix silesiaca WILLD.	6	*Geranium robertianum* L.	5
Viola biflora L.	6	*Athyrium distentifolium* TAUSCH EX OPIZ	5
Deschampsia caespitosa (L.) BEAUV.	6	*Soldanella hungarica* ssp. *major*	5
Aconitum tauricum WULFEN	6	*Angelica archangelica* L.	5
Campanula abietina GRISEB.	6	*Cardamine amara* L.	5
Senecio ovatus (P. GAERTNER, B. MEYER ET SCHERB) WILLD.	6	*Phleum alpinum* L.	5
Epilobium montanum L.	6	*Ranunculus platanifolius* L.	5
Rumex alpinus L.	6	*Valeriana tripteris* L.	5
Spiraea chamaedrifolia L.	6	*Rubus idaeus* L.	5
Urtica dioica L.	6		

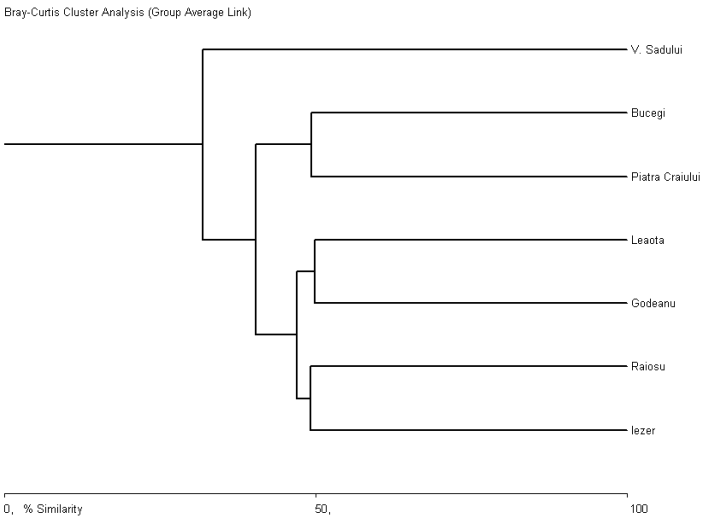

Figure 1. The dendrogram of the coenotic affinity between the species of the Mulgedio-Aconitetea class of the Southern Carpathians. Figura 1. Dendrograma afinităţii cenotice între speciile clasei Mulgedio-Aconitetea din Carpaţii Meridionali.

Table 4. Matrix of similarity of the species of the Mulgedio-Aconitetea class of the Southern Carpathians. Tabel 4. Matricea de similaritate dintre speciile clasei Mulgedio-Aconitetea din Carpaţii Meridionali.

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**		
1	6	50.19157	49.80843	2	5		
2	5	50.63291	49.36709	4	6		
3	4	50.83799	49.16201	1	7		
4	3	52.97208	47.02792	1	2		
5	2	59.6206	40.3794	1	4		
6	1	68.12866	31.87134	1	3		
Similarity Matrix							
	Iezer	Godeanu	V. Sadului	P. Craiului	Leaota	Bucegi	Raiosu
Iezer	*	47.0588	39.7906	36.9048	45.3704	38.5542	49.162
Godeanu	*	*	39.8305	42.2535	49.8084	41.7062	49.1071
V. Sadului	*	*	*	27.3224	35.4978	24.3094	37.1134
P. Craiului	*	*	*	*	38.4615	49.3671	38.5965
Leaota	*	*	*	*	*	42.7184	46.5753
Bucegi	*	*	*	*	*	*	42.6035
Raiosu	*	*	*	*	*	*	*

The index of Bray-Curtis is an index of dissimilarity (GOMOIU & SOLKA, 2001) that takes values 0-1. The coenotic affinities existing among the mountain massifs of the Southern Carpathians allow us to find which are the most characteristic massifs for the relevees of the associations of the Mulgedio-Aconitetea class. We notice the group of seven mountain massifs in 3 categories: Râiosu-Buda and Iezer-Păpuşa, Leaota and Godeanu, Bucegi and Piatra Craiului. Valea Sadului is different from the other massifs. By analysing the dendrogram we notice that the greatest affinity is between the massifs Godeanu and Leaota (49.8084), followed by Piatra Craiului – Bucegi (49.3671) and Iezer-Râiosu (49.162). The smallest affinity is between Piatra Craiului and Valea Sadului (27.3224) (Fig. 1, Table 4).

The corrections of the dendrogram of the coenotic affinity between the mountain massifs of the Southern Carpathians chain is verified by applying the same index Bray-Curtis for bioforms, floristic elements and ecological indexes (U, T, R) (Figs. 2-16, Table 5-9) (DRAGOMIRESCU & DRANE, 2001).

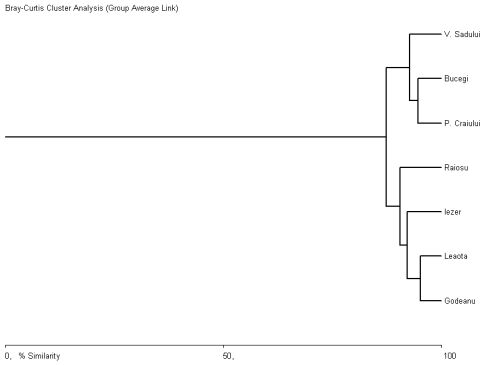

Figure 2. The dendrogram of the coenotic affinity between the weights of the bioforms of the Mulgedio-Aconitetea class in the Southern Carpathians.
Figura 2. Dendrograma afinității cenotice între ponderea procentuală a bioformelor clasei Mulgedio-Aconitetea din Carpații Meridionali.

Table 5. Matrix of similarity of the bioforms species of the Mulgedio-Aconitetea class of the Southern Carpathians.
Tabel 5. Matricea de similaritate dintre bioformele speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali.

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**
1	6	4.9	95.1	1	2
2	5	5.399998	94.6	5	6
3	4	7.329577	92.67042	5	7
4	3	7.900001	92.1	1	3
5	2	9.524999	90.475	1	4
6	1	12.71502	87.28498	1	5

Similarity Matrix

	Godeanu	Leaota	Iezer	Raiosu	P. Craiului	Bucegi	V. Sadului
Godeanu	*	95.1	92.6	91.7	86	87.7	87.4423
Leaota	*	*	91.6	92	83.1	84.7	85.9047
Iezer	*	*	*	89.1	85.9	83.6	89.8001
Raiosu	*	*	*	*	89.2	90.2	91.9528
P. Craiului	*	*	*	*	*	94.6	92.5679
Bucegi	*	*	*	*	*	*	92.7729
V. Sadului	*	*	*	*	*	*	*

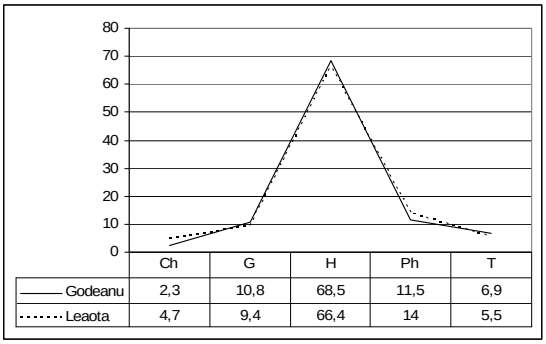

Figure 3. The maximum similarity (95.1) expressed in the spectrum of the bioforms of the Godeanu-Leaota massifs (%).
Figura 3. Similaritatea maximă (95,1) exprimată în spectrul bioformelor masivelor Godeanu-Leaota (%).

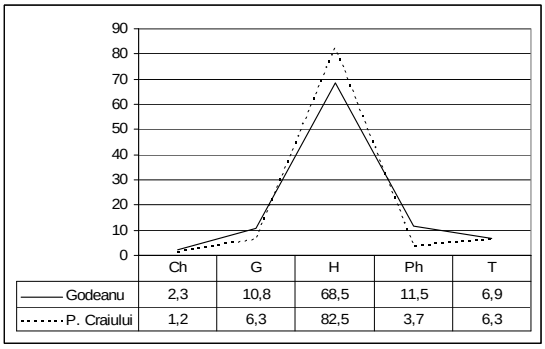

Figure 4. The minimal similarity (86) expressed in the spectrum of the bioforms of the Godeanu-Piatra Craiului massifs (%).
Figura 4. Similaritatea minimă (86) exprimată în spectrul bioformelor masivelor Godeanu-Piatra Craiului (%).

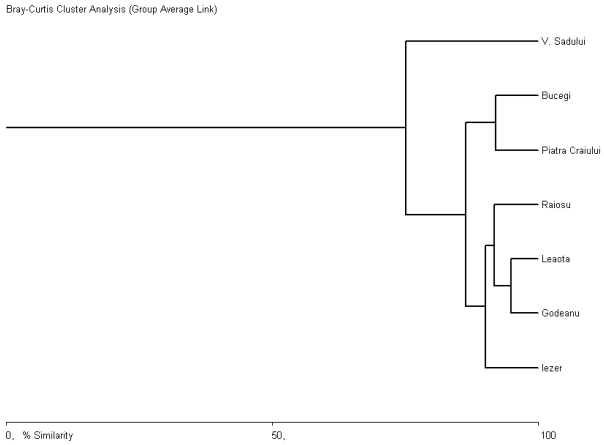

Figure 5. The dendrogram of the coenotic affinity between the weights of the floristic elements in the Mulgedio-Aconitetea class in the Southern Carpathians.
Figura 5. Dendrograma afinității cenotice între ponderea procentuală a geoelementelor clasei Mulgedio-Aconitetea din Carpații Meridionali.

Table 6. Matrix of similarity of the geoelements species of the Mulgedio-Aconitetea class of the Southern Carpathians.
Tabel 6. Matricea de similaritate dintre geoelementele speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali.

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**
1	6	5.147425	94.85257	2	5
2	5	7.953977	92.04602	4	6
3	4	8.223189	91.77681	2	7
4	3	9.958482	90.04152	1	2
5	2	13.58375	86.41625	1	4
6	1	24.82587	75.17413	1	3

Similarity Matrix

	Iezer	Godeanu	V. Sadului	P. Craiului	Leaota	Bucegi	Raiosu
Iezer	*	91.1456	79.6194	86.3864	87.3874	84.8272	91.5916
Godeanu	*	*	79.8	89.8551	94.8526	87.9	92.7536
V. Sadului	*	*	*	74.3372	82.5413	67.6677	77.3387
P. Craiului	*	*	*	*	88.4	92.046	86.2
Leaota	*	*	*	*	*	85.1426	90.8
Bucegi	*	*	*	*	*	*	86.8434
Raiosu	*	*	*	*	*	*	*

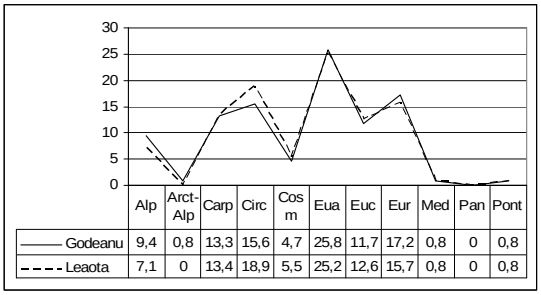

Figure 6. The maximum similarity (94.85) expressed in the spectrum of the floristic elements of the Godeanu-Leaota massifs (%). / Figura 6. Similaritatea maximă (94,85) exprimată în spectrul geoelelementelor masivelor Godeanu-Leaota (%).

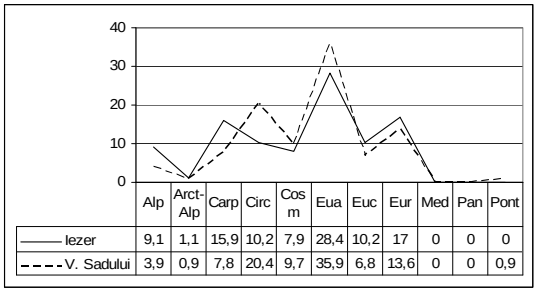

Figure 7. The minimal similarity (75.17) expressed in the spectrum of the floristic elements of the Iezer-Cindrel, Valea Sadului massifs (%). / Figura 7. Similaritatea minimă (75,17) exprimată în spectrul geoelementelor masivelor Iezer-Cindrel, Valea Sadului (%).

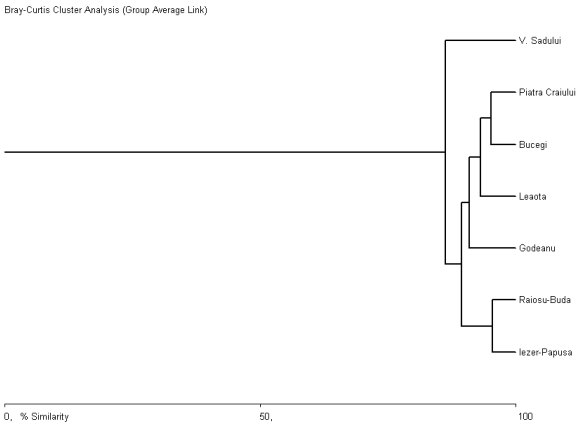

Figure 8. The dendrogram of the coenotic affinity between the weights of the species in the Mulgedio-Aconitetea class in the Southern Carpathians compared to the humidity (U).
Figura 8. Dendrograma afinității cenotice între ponderea procentuală a speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali față de umiditate (U).

Table 7. Matrix of similarity between the weight of the species compared to the humidity (U).
Tabel 7. Matricea de similaritate dintre ponderea speciilor față de umiditate (U).

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**
1	6	4.500002	95.5	1	4
2	5	4.9	95.1	6	7
3	4	6.903451	93.09655	5	6
4	3	9.156731	90.84327	2	5
5	2	10.54209	89.45791	1	2
6	1	13.70441	86.29559	1	3

Similarity Matrix

	Iezer	Godeanu	V.Sadului	Raiosu	Leaota	Bucegi	P.Craiului
Iezer-Papusa	*	90.5453	85.9	95.5	89.5448	91.1	90.9
Godeanu	*	*	85.0425	86.3432	91.3914	89.5448	91.0455
V. Sadului	*	*	*	83.6	85.8429	88.5	93.1
Raiosu-Buda	*	*	*	*	87.4437	92.3	89.5
Leaota	*	*	*	*	*	93.4467	92.7464
Bucegi	*	*	*	*	*	*	95.1
Piatra Craiului	*	*	*	*	*	*	*

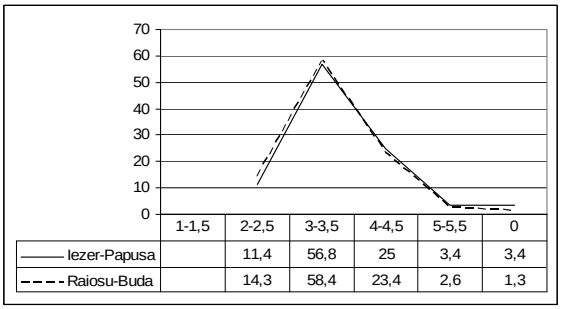

Figure 9. The maximum similarity (95.5) expressed in the spectrum of the humidity (U) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%). / Figura 9. Similaritatea maximă (95,5) exprimată în spectrul umidității (U) speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali (%).

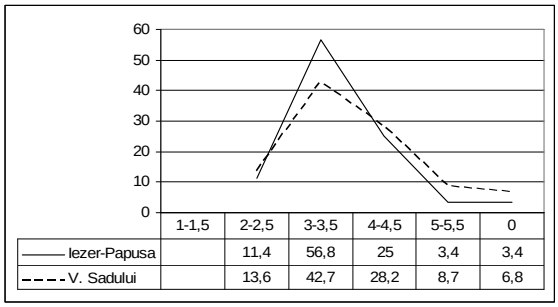

Figure 10. The minimal similarity (86.29) expressed in the spectrum of the humidity (U) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%). / Figura 10. Similaritatea minimă (86,29) exprimată în spectrul umidității (U) speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali (%).

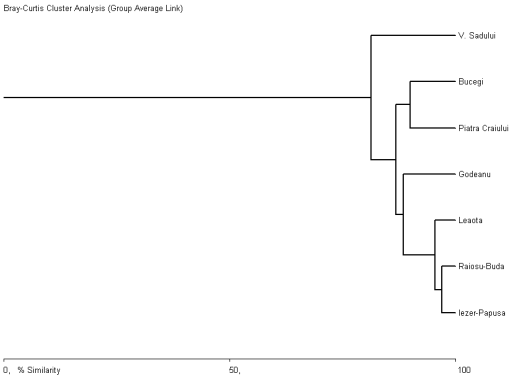

Figure 11. The dendrogram of the coenotic affinity between the weights of the species in the Mulgedio-Aconitetea class in the Southern Carpathians compared to the temperature (T). Figura 11. Dendrograma afinității cenotice între ponderea procentuală a speciilor clasei Mulgedio-Aconitetea din Carpații Meridionali față de temperatură (T).

Table 8. Matrix of similarity between the weight of the species compared to the temperature (T).
Tabel 8. Matricea de similaritate dintre ponderea speciilor față de temperatură (T).

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**
1	6	3.00300431	96.997	1	2
2	5	4.55455541	95.4454	1	4
3	4	10.0999984	89.9	5	6
4	3	11.6366367	88.3633	1	7
5	2	13.1471996	86.8528	1	5
6	1	18.6578826	81.3421	1	3

Similarity Matrix

	Iezer	Raiosu	V. Sadului	Leaota	P. Craiului	Bucegi	Godeanu
Iezer-Papusa	*	96.997	86.8869	94.8949	88.2441	89.7449	88.1882
Raiosu-Buda	*	*	88.989	95.996	87.3437	87.944	86.0861
V. Sadului	*	*	*	85.0851	85.2426	78.5393	75.0751
Leaota	*	*	*	*	84.2421	87.4437	89.5896
Piatra Craiului	*	*	*	*	*	89.9	83.942
Bucegi	*	*	*	*	*	*	88.2441
Godeanu	*	*	*	*	*	*	*

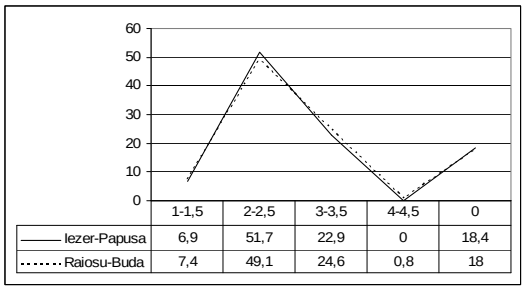

Figure 12. The maximum similarity (96.99) expressed in the spectrum of the temperature (T) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%). Figura 12. Similaritatea maximă (96,99) exprimată în spectrul temperaturii (T) speciilor din clasa Mulgedio-Aconitetea în Carpații Meridionali (%).

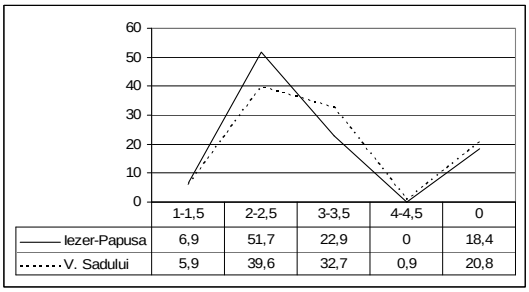

Figure 13. The minimal similarity (81.34) expressed in the spectrum of the temperature (T) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%). / Figura 13. Similaritatea minimă (81,34) exprimată în spectrul temperaturii (T) speciilor din clasa Mulgedio-Aconitetea în Carpații Meridionali (%).

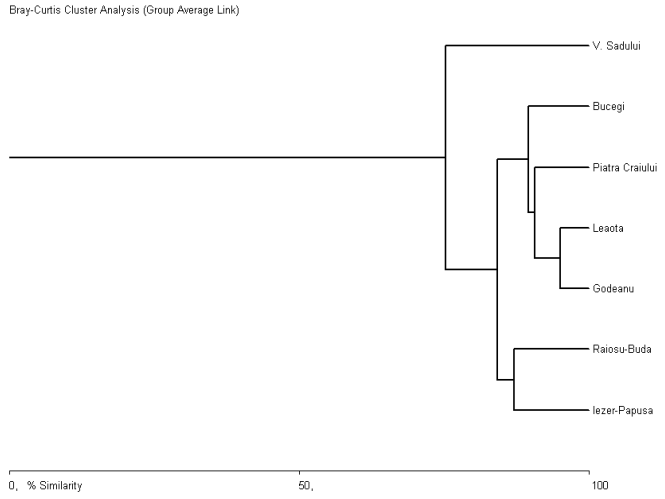

Figure 14. The dendrogram of the coenotic affinity between the weights of the species in the Mulgedio-Aconitetea class in the Southern Carpathians compared to the soil reaction (R).

Figura 14. Dendrograma afinităţii cenotice dintre ponderea procentuală a speciilor din clasa Mulgedio-Aconitetea în Carpaţii Meridionali faţă de reacţia solului (R).

Table 9. Matrix of similarity between the weight of the species compared to the soil reaction (R).
Tabel 9. Matricea de similaritate dintre ponderea speciilor faţă de reacţia solului (R).

Step	**Clusters**	**Distance**	**Similarity**	**Joined 1**	**Joined 2**
1	6	5.005005	94.995	2	5
2	5	9.40941	90.59059	2	4
3	4	10.46046	89.53954	2	6
4	3	12.91291	87.08709	1	7
5	2	15.8033	84.1967	1	2
6	1	24.80481	75.19519	1	3

Similarity Matrix

	Iezer	Godeanu	V. Sadului	P. Craiului	Leaota	Bucegi	Raiosu
Iezer	*	87.0871	82.8829	76.7768	84.6847	78.7788	87.0871
Godeanu	*	*	82.5826	89.0891	94.995	87.2873	87.6877
V. Sadului	*	*	*	75.5756	78.3784	70.0701	76.6767
P.Craiului	*	*	*	*	92.0921	89.5896	83.6837
Leaota	*	*	*	*	*	91.6917	88.2883
Bucegi	*	*	*	*	*	*	87.2873
Raiosu	*	*	*	*	*	*	*

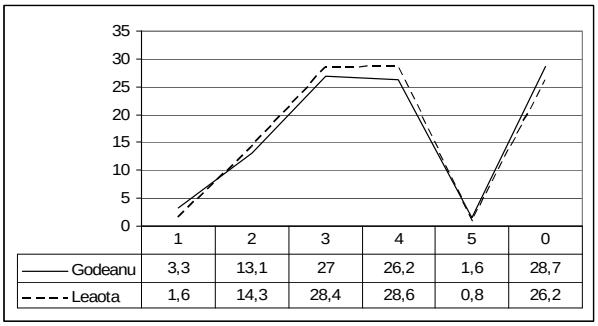

Figure 15. The maximum similarity (94.99) expressed in the spectrum of the soil reaction (R) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%).

Figura 15. Similaritatea maximă (94,99) exprimată în spectrul reacţiei solului (R) speciilor din clasa Mulgedio-Aconitetea din Carpaţii Meridionali (%).

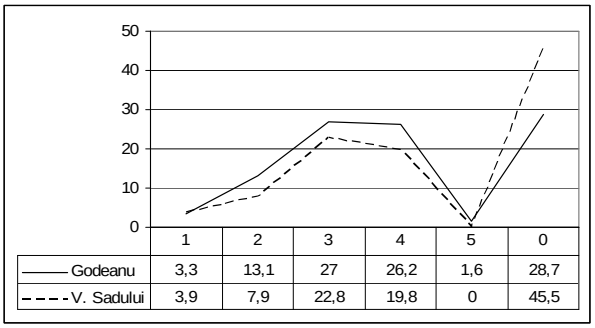

Figure 16. The minimal similarity (75.19) expressed in the spectrum of the soil reaction (R) of the species in the Mulgedio-Aconitetea class in the Southern Carpathians (%).

Figura 16. Similaritatea minimă (75,19) exprimată în spectrul reacţiei solului (R) speciilor clasei Mulgedio-Aconitetea în Carpaţii Meridionali (%).

CONCLUSIONS

We have done a database by a number of 317 taxa, taken from 225 of relevees, every species presenting pieces of information about the affiliation at a certain bioform, geoelement or ecological indexes (U, T, and R).

We collected pieces of information from the relevees were taken by different botanists from 7 mountain massifs in the Southern Carpathians: Ţarcu, Godeanu, Cernei, Valea Sadului, M. Cindrel, Râiosu-Buda, Iezer-Păpuşa, Piatra Craiului, Leaota, and Bucegi.

Out of the analysis of the Bray-Curtis dendrogram and also of the bioforms spectrum, of the geoelements and ecological indexes, expressed in weights, we can notice the grouping of the massifs of the Southern Carpathians chain, based on the affinity of different species in the relevees of the identified associations in some distinct groups, fact that

demonstrate the correctness of the dendrogram of the coenotic affinity between the species of the Mulgedio-Aconitetea class in the Southern Carpathians.

The grouping of the massifs respects the weights of different species that constitute the 225 relevees taken in the Southern Carpathians.

REFERENCES

ALEXIU V. 1998. *Vegetația Masivului Iezer-Păpușa*. Edit. Cultura. Pitești: 242-262.

BOȘCAIU N. 1971. *Flora şi vegetația Munților Țarcu, Godeanu şi Cernei.* Edit. Academiei R.S.R. Bucureşti: 364-375, 376-377, 384, 386, 380-381.

CHIRIȚOIU MAGDALENA. 2005. *Particularități ecologice ale megaforbietelor din județul Argeş.* Acta Universitatis Cibiniensis. Seria Ştiințe Agricole. Edit. Universității Lucian Blaga. Sibiu. **1**(5): 77-86.

CHIRIȚOIU MAGDALENA. 2005. *Considerații privind megaforbietele din Munții Retezat.* Argessis. Studii şi comunicări. Seria Ştiințele Naturii. Piteşti. **13**: 43-47.

CHIRIȚOIU MAGDALENA. 2008. *Coenotaxonomical characterization of the megaforbs from Horoaba Valley (Bucegi Mountains).* Jurnal of Plant Development. Edit. Universității „Alexandru Ioan Cuza". Iaşi. **15**: 117-123.

CHIRIȚOIU MAGDALENA. 2008. *Adenostylo-Doronicetum austriaci Horvat 1956 in the Meridional Carpathians.* Drobeta. Seria Ştiințele Naturii. Edit. Universitaria. Craiova. **18**: 81-86.

CIOCÂRLAN V. 2000. *Flora ilustrată a României. Pteridophyta et Spermatophyta.* Edit. Ceres. Bucureşti: 1139 pp.

COLDEA G. 1993. *Cormofite. Sintaxonomia şi descrierea asociațiilor vegetale.* In: Popovici Iuliana (Ed.) Parcul Național Retezat. Studii ecologice. Edit. West Side. Braşov: 31-48.

CRISTEA V., GAFTA D., PEDROTTI F. 2004. *Fitosociologie.* Edit. Presa Universitară Clujeană. Cluj-Napoca: 7-31.

DRAGOMIRESCU L. & DRANE J. W. 2001. *Biostatistică pentru începători. I: Biostatistică descriptivă*. Edit. Ars Docenti. Bucureşti: 210 pp.

DRĂGULESCU C. 1996. *Flora şi vegetația Văii Sadului*. Edit. Constant. Sibiu: 271-272, 268-269.

GOMOIU M. T. & SKOLKA M. 2001. *Ecologie (Metode pentru studii ecologice).* Ovidius University Press. Constanța: 190 pp.

MIHĂILESCU SIMONA. 2001. *Flora şi vegetația Masivului Piatra Craiului.* Edit. Vergiliu. Bucureşti: 271, 267-268.

NEBLEA MONICA. 2006. *Flora şi vegetația Munților Leaota şi a sectorului vestic al Munților Bucegi.* Ph.D. Thesis, Institutul de Biologie al Academiei Române Bucureşti. Romania: 12-20.

SANDA V., BIȚĂ-NICOLAE CLAUDIA, BARABAŞ N. 2003. *Flora cormofitelor spontane şi cultivate din România.* Edit. "Ion Borcea". Bacău: 316 pp.

SANDA V., BARABAŞ N., BIȚĂ-NICOLAE CLAUDIA. 2005. *Breviar privind parametrii structurali şi caracteristicile ecologice ale fitocenozelor din România*. Edit. "Ion Borcea". Bacău: 101, 105.

STANCU DANIELA ILEANA. 2005. *Flora şi vegetația Munților Râiosu şi Buda, Masivul Făgăraş.* Edit. Universității din Piteşti: 166-167, 169-170, 176-177, 179, 173-174.

WEBER H. E., MORAVEC J., THEURILLAT J. P. 2000. *International Code of Phytosociological Nomenclature*. Journal of Vegetation Science. 3rd edition. Opulus Press Uppsala. Sweden. **11**: 739-768.

Chirițoiu Magdalena
The Argeş County Museum, Armand Călinescu, 44, 110047, Piteşti, Argeş, Romania
E-mail: magda_chiritoiu@yahoo.com

Received May 10, 2010
Accepted July 17, 2010