INPUTS TO KNOWLEDGE OF ROCKS VEGETATION WITHIN CODRU MOMA MOUNTAINS (NW ROMANIA)

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Abstract. This work represents a phytocoenologic, ecological, bioeconomic and ecoprotectiv study on the vegetation of rocky formations from the class ***Asplenietea trichomanis*** (Br.-Bl. in Meier et Br.-Bl. 1934) Oberdorfer 1957.

After conducting a 70 phytocoenologic relevées on limestones and silicate rocks from the Codru-Moma Mountains there have been identified a number of five vegetal associations from which only two are examined in this work: *Asplenietum trichomano-rutae-murariae* R. Tx. 1937 and *Asplenietum septentrionali-adianti-nigri* E. Oberdorfer 1938.

The saxicol-sciadophilous phytocoenoses (shady) and sciadophilous-helsciadophilous phytocoenoses (shady-semishady) belonging to groups that we are reffering to were studied in terms of the ecological factors (moisture, temperature and chemical reaction of the soil) and of the distribution of species in the spectrum of life forms and in the spectrum of floristic elements.

Keywords: phytocoenoses, vegetal association, rocky, ecological factors, life forms, floristic elements.

INTRODUCTION

Codru-Moma Mountains are limited in the north and east by Crişul Negru River, in the south by Crişului Alb Plain, in the west by the hills that end in Tisa Plain and are located in North-West of Romania. Codru-Moma Mountains cover an area of about 1200 km², with an altitude of 300-1112 m (Fig. 1) [12].

Figure 1. Localization of Codru-Moma Mountains [17].

The major areas of these mountains are in Bihor county, and only the south-western corner is part of Arad county. Unlike the Pădurea Craiului Mountains and Zărandului Mountains that are strongly bound to the large mass of the Apuseni Mountains, Vlădeasa Mountains and Metaliferi Mountains, Codru-Moma Mountains have an extremely weak link, a kind of narrow bridge that links them to Bihor Mountains [12]. This makes them to be well outlined by the strong limits and almost detached from the central part of the Apuseni Mountains, appearing as an island-like mountainous mass surrounded by depressions.

In higher regions the Codru-Moma Mountains are formed of (900-1112 m) permocarbonifere siliceous rocks, eruptive rocks from upper Paleozoic and Neogene age who present a high resistance to erosion [12]. Lower regions (300-700 m) are composed of limestone and Mesozoic Marne [12].

Specific to these mountains are the brown acid oligotrophic soils, highly unsaturated in bases on siliceous and brown rocks mostly humiferous and saturated in bases on limestone rocks [12].

The climate of Codru-Moma Mountains is influenced by direct contact with the Bihor Mountains on a small portion in the south, by their neighborhood in the east with the rest of the Bihor Mountains massif which separates the narrow depression Beiuş-Vaşcău and to a small extent by their neighborhood with plain Tisa in the west. Since the studied region has an average altitude of over 500 m and maximum of 1112 m and knowing the fact that at an increase of 100 m in altitude the temperature decreases with 0.55ºC, it appears that at an altitude of 800 meters they register an average annual temperature of 7.2ºC and at 1000 m altitude they prefigure an average annual temperature of 6.1ºC. Directly proportional to altitude the quantity of rainfall grows, so that in the studied region it reaches 800-1000 mm annually. Climatic data are favorable to the development of mesophilic deciduous forests and in particular those of european beech (*Fagus sylvatica*).

Codru-Moma Mountains are mostly (85%) covered with forests and only to a small extent (15%) they are deforestated and cultivated. The forests with the highest range are the hornbeam-beech forests (*Carpino-Fagetum*), which form the wooded massifs in Codru-Moma Mountains.

The mixture in equal shares of beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) varies depending on substratum, with beech dominance on calcareous rocks while hornbeam accompanied by evergreen oak is dominant on siliceous substratum. At the edge of these woods, by the streams, in narrow valleys with rocky surface, on skeletal soils (rendzinas, pseudorendzinas) rich in humus, on the northern, shady slopes, with plenty of moisture one can occasionally meet beech with deer-tongue (*Phyllitidi-Fagetum*) that also include the mountain maple (*Acer pseudoplatanus*), the field maple (*Acer platanoides*), the maple (*Acer campestre*) and the ash (*Fraxinus excelsior*).

Virgin European beech forests are met on humid locations, valley floors on relatively restricted areas, on altitudes varying from 600 m up to 1000 m, on both

moderate slopes and sharply inclined (10-35º); virgin European beech forests with roadside fescue (*Festuco drymejae-Fagetum*) growing on calcareous substratum, and *Luzulo albidae-Fagetum* growing on siliceous substratum.

The sessile oak stands (*Quercus petraea*) are spread on semiskeletal, oligotrophic, acid soils on a siliceous substrate only at altitudes of 350-500 m, colonizing the sunny slopes with moderate to strong tilt (15-38º). The only stands that can withstand dry conditions and the impoverishment of the soil are the acidophilous sessile oak stands with *Genista tinctoria* (*Genisto tinctoriae-Quercetum petraeae*) and sessile oak stands with *Cytisus nigricans* (*Cytiso nigricantis-Quercetum petraeae*).

On cleared lands at altitudes between 400-1000 m the sparse grassland dominates (which in recent years has not been mowed) in alternation with mesophile grassland dominated by *Agrostis capillaris* and *Anthoxanthum odoratum* (*Anthoxantho-Agrostietum capillaris*), by *Festuca rubra* and *Agrostis capillaris* (*Festuco rubrae-Agrostetum capillaris*), by *Nardus stricta* and *Hieracium pilosella* (*Hieracio pilosellae-Nardetum strictae*).

On arid and sunny clearings resulting out of evergreen oak forests' disafforestation or due to their degrading, the xero-mezophyl lawns edified by *Festuca valesiaca* and *Festuca rupicola* (*Festucetum valesiacae-rupicolae*), by *Vulpia myuros* and *Aira elegantissima* (*Vulpio-Airetum elegantissimae*), by *Thymus comosus* and *Festuca rupicola* ssp. *sulcata* (*Thymo comosi-Festucetum sulcatae*).

Contributions to the study of flora and vegetation of these mountains were brought by Paucă (1941) [12] and Ardelean (2002) [1, 2].

MATERIALS AND METHODS

In the study of the rocky vegetation of Codru-Moma Mountains we used phytocoenological research methods of Central European school [3, 6] and adapted to the vegetation particularities of our country [5].

The phytocoenologic relevées including floristic homogeneous and physiognomic surfaces of the sample with a size of 2-16 m², were chosen from herbaceous vegetation of rocks that are the most representative. For this we made seven trips in the field in the following period: August 14, August 16, August 17, August 20, August 27, August 29, September 7 2008, when we made a total of 70 phytocoenologic relevées. The 70 relevées were then grouped in synthetic tables belonging to 5 plant associations from the class ***Asplenietea trichomanis*** (Br.-Bl. in Meier et Br.-Bl. 1934) Oberdorfer 1957.

The synthetic table of association contains information on species from the floristic composition, the life forms, the floristic element, the ecological indices (moisture, temperature, chemical reaction of the soil), the serial number of relevées, altitude (m.s.m.), exposition, slope (degrees), area (m²), the coverage of grass layer (%).

The quantitative assessment of the participation of each species in the tables of associations was made with the index of abundance-dominance [3].

At the end of tables the constance (K) phytocoenotic synthetic index was calculated and noted, whose classes ranging from I-V expresses the degree of coenotic fidelity of each species to the phytocoenoses environment.

In order to sequence and group the species from the table in the corresponding coenotaxa the following works were considered [3, 8, 10, 13, 14, 16]. In the bottom of the table we mentioned the species occurring in a single relevées, the place and date of the relevées.

For the completion of the phytocoenologic and environmental study of the two associations described, we have represented graphically in the form of the spectrum the distribution of life forms, floristic elements, ecological indices.

On the basis of data provided by the biologic formations spectra, flower elements and environment indicators diagram, we have performed the flower-environmental (sigmatic) analysis of vegetal formations, alliance, order, class, association and their ecology (synecology).

RESULTS

After reunificating the relevées in synthetic tables containing the grass phytocoenoses on the rocks of Codru-Moma Mountains, they are within the following 5 associations identified by us, belonging to class ***Asplenietea trichomanis*** (Br.-Bl. in Meier et Br.-Bl. 1934) Oberdorfer 1977:

- *Asplenietum trichomano-rutae-murariae* R. Tx. 1937;
- *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938;
- *Asplenio quadrivalenti-Poëtum nemoralis* Soó ex Gergely et al. 1966;
- *Asplenio trichomani-Poëtum nemoralis* Boşcaiu 1971;
- *Ctenidio moluscae-Polypodietum vulgare* Jurko et Peciar 1963.

In this paper we focus on research conducted in field and in laboratory and we present the results of a phytocoenologic, environmental and ecoprotectiv study on the first two associations, while the analysis and presentation of the research results on the other three associations may be subject of other scientific papers.

Association ***Asplenietum trichomano-rutae-murariae*** R. Tx. 1937

This association is mentioned in several stations in the Romanian Carpathians [4, 7-9, 11, 15].

The phytocoenoses of association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937 (Fig. 2) develop through cracks and on the policies of strongly inclined limestone rocks (60-90°) with a north or north-west expositions where superficial rendzinic lithosols form with weak acid pH up to neutral (7.0-7.8).

The association forms small pioneer clusters on rocks, along valleys and mountain streams between 380-720 m altitude in Codru-Moma Mountains.

Because of the nordic exposition of rocks exposition and their inclusion in beech forest stands a

shady microclimate has formed with moderate humidity throughout the year and a lower temperature in summer. This allowed the installation of briophytes belonging to the *Ctenidium* genus, with a coverage up to 60%.

Figure 2. Association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937 on Râposu Brook - Tărcăiţa Valley.

The phytocoenoses of the association were identified by us on Râposu Brook rocks (Tărcăiţa village) in 3 relevées, on Morilor Valley canyon (Borz village) in 2 relevées, on Izbuc Brook under the Cave (Briheni village) in 2 relevées, Crişului Vărateс Valley (Lunca village) 1 relevées, all from Bihor County.

In the floristic composition of the association a number of 35 saxicole plant species are found (Table 1), of which 11 species are sciadophilous (shadow loving): *Ctenidium moluscum*, *Moehringia muscosa*, *Cystopteris fragilis*, *Geranium robertianum*, *Doronicum columnae*, *Phyllitis scolopendrium*, *Asarum europaeum*, *Hepatica nobilis*, *Lamium galeobdolon*, *Stachys sylvatica*, *Symphytum tuberosum*; 13 species are sciadophilous-helsciadophilous (shadow-hemishadow loving): *Asplenium trichomanis* ssp. *quadrivalens*, *Sedum acre*, *Sedum maximum*, *Poa nemoralis* var. *montana*, *Asplenium adulterinum*, *Polypodium vulgare*, *Hedera helix*, *Mycelis muralis*, *Salvia glutinosa*, *Polygonatum odoratum*.

The groups of species characteristic of the alliance, order and class allow the sintaxomical framing to the association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937.

The physiognomy of the association is given by the characteristic species *Asplenium ruta-muraria* with a coverage of 20% and *Asplenium trichomanes* ssp. *quadrivalens* with a coverage of 35%, both being in a codominance relation.

In addition to these species characteristic to the alliance ***Cymbalario-Asplenion***, order ***Tortulo-Cymbalarietalia*** there are: *Moehringia muscosa*, *Sedum acre*, *Cystopteris fragilis*, *Asplenium septentrionale*, *Ctenidium moluscum*, species characteristic to the class ***Asplenietea trichomanis***: *Sedum maximum*, *Poa nemoralis*, *Thymus comosus*, *Geranium robertianum*, *Asplenium adulterinum*, *Polypodium vulgare*, *Doronicum columnae*.

In addition to the 15 species, in the saxicol pioneer phytocoenoses from the limestone substrate a number of 19 species of class ***Querco-Fagetea*** enter, a phenomenon explained by the fact that the rocky limestone taken in the study are either embedded in the form of small enclaves on steep and wooded slopes or along the mountain valleys and streams occupied by European beech stands.

Analysis of ecological factors (Fig. 3), highlights the dominance of the mesophilous species (U_3=40%) located on wet lithosols on shady rocks, also the dominance of micro-mesothermophilous species (Q_3=62.8%) expressing a temperate continental climate and that of weak acid-neutrophilous species (R_4=40%) with a weak up to acid neutral chemical reaction (pH=6.5-7.0), followed by acid-neutrophilous species (R_3=25.7%) and amphitolerant (R_0=25.75).

Although the substrate is limestone, incompletely degraded organic substances in rendzinic soil type favors the emergence of a mild acidity that allows the development of these plants. Of note, however that the flora has a predominantly calciphilous character.

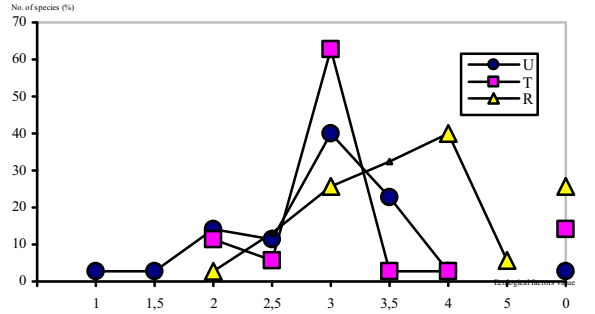

Figure 3. Diagram of ecological factors for the association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937, where: U - humidity, T - temperature, R - the chemical reaction of the soil.

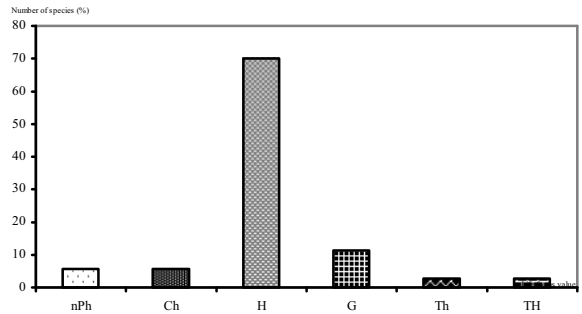

Figure 4. The life forms spectrum of association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937, where: nPh - Nanophanerophytes; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Euterophytes; TH – Hemiterophytes.

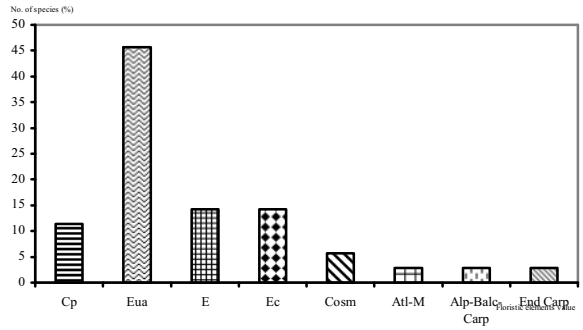

Figure 5. Spectrum of floristic elements of the association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937, where: Cp - Circumpolar; Eua - Eurasian; E - European; Ec - Central European; Cosm - Cosmopolitan; Atl-M - Atlantic-Mediterranean; Alp-Balc-Carp - Alpo-Balkan-Carpathian; End. carp. - Carpathian endemism.

The spectrum of life forms (Fig. 4) shows the dominance of hemicryptophytes (H=70%) which shows a climate with heat and fluid deficiency in the stations on these rocks, followed by geophytes (G=11.4%) representing species that exploit best the bad edafo-climatical factors of the resort, during a short cycle of development.

The spectrum of floristic elements (Fig. 5), is dominated by Eurasian species (Eua=45.7%) which entered the Codru-Moma Mountains in ancient fitohistorical times and express a drier temperate climate, followed by European species (E=14.2%) and Central European ones (Ec=14.2%) whose genesis was conducted on the European continent in a temperate moderate climate, (E) and in a temperate-humid climate (Ec), followed by Circumpolars (Cp=11.4%) expressing a cool and humid climate and are the reminiscences of the last glaciation.

The economic importance

The phytocoenoses of this association does not present an economic interest in terms of biomass production whose value is negligible, but it is the pedogenetic basis by which rocky plants favor the

Table 1. Association *Asplenietum trichomano-rutae-murariae* R. Tx. 1937 in Codru-Moma Mountains.

L.f.	F.e.	U	T	S.r.	Number	1	2	3	4	5	6	7	8	9	10	K
					Altitude (m.s.m.)	700	680	720	470	480	500	480	490	500	380	
					Exposition	NV	N	N	NV	N	N	N	N	NE	NV	
					Slope (degree) (º)	40	60	90	60	40	40	90	90	70	80	
					Area (m²)	4	4	3	4	4	1	6	4	6	4	
					The coverage of grass layer (%)	60	80	90	60	60	90	70	60	90	30	
H	Cp	1.5	3	5	As. *Asplenium ruta-muraria*	+	1	+	2	+	1	1	+	1	2	V
H	Cosm	3	0	4	As. *Asplenium trichomanes* ssp. *quadrivalens*	2	3	2	1	2	2	3	2	3	1	V
					Cymbalario-Asplenion, Tortulo-Cymbalarietalia											
-	-	-	-	-	*Ctenidium moluscum*	3		4	3	3	4	2	3	4	·	IV
H	Ec	4	2	4	*Moehringia muscosa*	+	+	1	·	·	·	+	·	+	·	III
Ch	Eua	0	3	3	*Sedum acre*	·	·	+	·	·	·	·	·	·	+	I
H	Eua	3.5	2	0	*Cystopteris fragilis*	·	·	·	·	·	1	·	·	·	·	I
					Asplenietea trichomanis											
H	Cp	1	3	2	*Asplenium septentrionale*	·	·	·	·	·	·	·	·	·	+	I
H(G)	Eua-M	2	3	0	*Sedum maximum*	+	+	+	·	·	·	·	·	+	+	III
H	Eua	3	3	0	*Poa nemoralis*	·	+	·	+	·	·	1	·	·	+	II
Ch	End. carp.	2	3.5	4.5	*Thymus comosus*	·	·	·	+	·	·	·	·	+	+	II
H	E	3	0	4	*Asplenium adulterinum*	·	·	·	·	·	·	+	·	·	·	I
G	Cp	3.5	3	4	*Polypodium vulgare*								+			I
H	Ec	3	0	4.5	*Valeriana tripteris*	·	·	·	·	·	·	·	·	+	·	I
H	Alp-Balc-Carp	3.5	2	3.5	*Doronicum columnae*	·	1	·	·	·	·	+	+	+	·	II
					Querco-Fagetea											
nPh	Atl-M	3	3	3	*Hedera helix*	+	3	·	·	+	·	+	+	·	·	III
Th	Cosm.	3.5	3	3	*Geranium robertianum*	·	·	·	·	·	+	+	+	+	·	II
H	Eua-M	3	2	0	*Campanula rapunculoides*	+	+	+	·	·	·	+	+	+	·	III
G	Cp	3.5	3	5	*Phyllitis scolopendrium*	·	+	+	·	·	+	+	+	+	·	III
H	E	3	3	0	*Mycelis muralis*	+	·	+	·	·	·	+	+	·	·	II
H	Eua	3.5	3	4	*Salvia glutinosa*	·	+	·	·	·	·	+	+	+	·	II
H-G	Eua	3.5	3	4	*Asarum europaeum*	·	+	·	·	·	·	+	+	+	·	II
G	E	3	3	4	*Hepatica nobilis*	+	·	·	·	·	·	·	·	·	·	I
H	Ec	3	0	4	*Lamium galeobdolon*	·	·	·	·	·	·	+	+	+	·	II
G	Eua-M	2	3	4	*Polygonatum odoratum*	·	+	·	·	·	·	·	·	·	·	I
H	Eua	3	3	3	*Lathyrus vernus*	·	+	·	·	·	·	·	·	·	·	I
H	Eua	3.5	0	0	*Stachys sylvatica*	·	·	·	+	·	·	·	·	·	·	I
H-G	Ec	3	3	3	*Symphytum tuberosum*	·	·	·	·	+	·	·	·	·	·	I
H	E-M	2	4	4	*Vincetoxicum hirundinaria*	·	+	·	·	·	·	·	·	·	·	I
H	Eua	3	3	0	*Campanula persicifolia*	·	·	·	·	·	·	·	+	+	·	I
H	Eua	3	2.5	0	*Fragaria vesca*	·	·	·	·	·	·	·	·	+	·	I
nPh	E	2	3	3	*Rosa canina*	·	·	·	·	·	·	·	·	+	·	I
					Variae syntaxa											
H	Eua	2.5	2.5	3	*Galium album*	·	1	·	+	·	·	+	+	+	·	III
H	Eua	2.5	3	4	*Agrimonia aupatoria*	·	·	·	+	+	·	·	·	·	·	I
TH-H	Ec	2.5	3	4	*Cardaminopsis arenosa*	·	·	+	·	·	·	+	+	·	·	II
H	Eua	3	3	0	*Hypericum perforatum*	·	·	·	·	·	·	·	·	+	·	I
H	Eua-M	2.5	3	3	*Origanum vulgare*	·	·	·	·	·	·	·	·	+	·	I

where: L.f. - life forms; MPh - Megaphanerophytes;nPh - Nanophanerophytes; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Euterophytes; TH - Hemiterophytes

F.e. - floristic elements; Cp - Circumpolar; Eua - Eurasian; E - European; Ec - Central European; Cosm - Cosmopolitan; Atl-M - Atlantic-Mediterranean; Alp-Balc-Carp – Alpo-Balkan-Carpathian; End. carp. - Carpathian endemism

U - humidity, T - temperature, R - the chemical reaction of the soil.

Species that occur in a single relevees: *Teucrium montanum* (4); *Peucedanum longifolium* (4); *Helianthemum nummularium* (4); *Euphorbia cyparissias* (4); *Calamintha sylvatica* (5); *Brachypodium pinnatum* (5); *Teucrium chamaedrys* (5); *Verbascum phlomoides* (7); *Clinopodium vulgare* (9); *Melampyrum bihariense* (9); *Stachys officinalis* (9); *Achillea millefolium* (9); *Vulpia myuros* (10); *Dianthus carthusianorum* (10).

Place and date of relevees: 1-3. Râposu Brook (Tărcăiţa) 14-16 August 2008; 4-6. Morilor Valley (Borz) 17 August 2008; 7-9. Izbuc Brook (Briheni) 27 August 2008; 10. Crişului Văratec Valley (Briheni) 29 August 2008.

bioaccumulation processes of humus on the rock cracks leading eventually to the formation of organic litosol.

A relatively large number of calciphile species are on calcareous rocks, some of them adorning the geographical landscape: *Asplenium trichomanes*, *Polypodium vulgare*, *Phyllitis scolopendrium*, *Sedum maximum*, *Doronicum columnae*, *Hedera helix*, *Campanula rapunculoides*, *Campanula persicifolia*, *Asarum europaeum*, *Hepatica nobilis*, *Galium album* and some are rare, endangered, vulnerable, endemic species, relicts, natural monuments that need to be protected: *Thymus comosus*, *Asplenium septentrionale*, *Asplenium adulterinum*.

Association ***Asplenietum septentrionali-adianti-nigri*** Oberdorfer 1938

This is a association little known, with a very narrow and fragmented distribution area in the Carpathians (Fig. 6).

In Codru-Moma Mountains the phytocoenoses of this association have been identified by us as increasing at low altitudes (350-390 m) on siliceous rocks along some valleys and streams at the edge of hornbeam-beech forests. They develop on a superficial lithosol, poor in organic substances and acid-neutral up to acid reaction.

In the studied territory there were done 6 phytocoenologic relevées 2 of which on Mic Valley, Briheni village (27 August 2008), and 4 releveess on Crişului Văratec Valley, Lunca village (29 August 2008).

Figure 6. Association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938 on Briheni Valley - Briheni village

The 37 inventoried species, collected then in the association table (Table 2), are subordinated floristically and ecologically to the cenotaxons corresponding to the alliance, order and class that justify the inclusion of these phytocoenoses from silicate shale rocks in the association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938.

The physiognomy of the association is given by the characteristic species *Asplenium adiantum-nigrum* with an average coverage of 20%, with maximum constance (K=V) and *Asplenium septentrionale* with a coverage of 25%, maximum constant (K=V), being in relation of codominance.

With these differential recognition species are developing for the ***Asplenion septentrionalis*** alliance and the ***Androsacetalia vandelii*** order: *Sedum maximum*, *Epilobium collinum*, *Asplenium trichomanes* ssp. *trichomanes*, recognition species for the ***Asplenietea trichomanis*** class: *Poa nemoralis* var. *montana*, *Ctenidium moluscum*, *Thymus comosus*, *Polypodium vulgare*, *Silene nutans* ssp. *dubia*, *Genista januensis*, *Moehringia muscosa*.

In the floristic composition of the association there are also a significant number of transgressive species of ***Querco-Fagetea*** and ***Quercetea pubescenti-petraeae*** classes, which means woody vegetation has a strong effect on rocky vegetation as a result of the fact that their areas cross in some places.

Analysis of ecological factors (Fig. 7) shows that the vegetation of rocks composed of crystalline shales is predominantly mesophilous (U_3=29%) of optimal

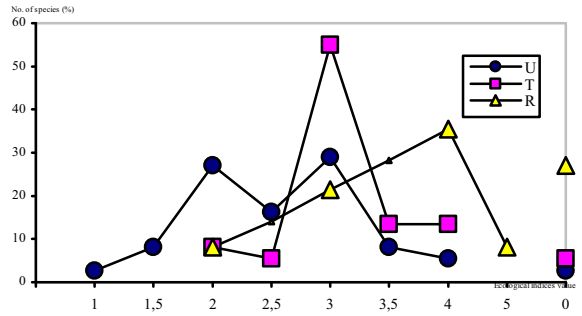

Figure 7. Diagram of ecological factors for the association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938, where: U - humidity, T - temperature, R - the chemical reaction of the soil.

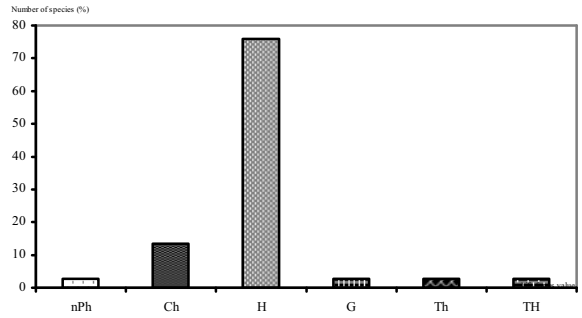

Figure 8. The life forms spectrum of association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938, where: nPh - Nanophanerophytes; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Euterophytes; TH – Hemiterophytes.

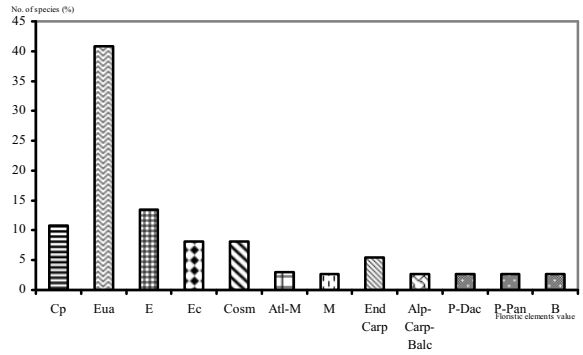

Figure 9. Spectrum of floristic elements of the association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938, where: Cp - Circumpolar; Eua - Eurasian; E - European; Ec - Central European; Cosm - Cosmopolitan; Atl-M - Atlantic-Mediterranean; M - Mediterranean; End. carp. - Carpathian endemism; Alp-Balc-Carp - Alpo-Balkan-Carpathian; P-Dac - Ponto-Dacian; P-Pan – Ponto-Pannonian; B – Balkan.

moist environment, to xero-mesophilous (U2=27%) of dry and arid climate, predominantly micro-mezotherm (T3=55%) showing micro-stationary conditions of continental temperate microclimate, to moderately thermophyle (T4=13.5%) of a mild and dry microclimate.

As for the chemical reaction of the soil, the vegetation is predominantly low acid-neutrophilous (R4=35.4%) of weakly acid to neutral soils to amfitolerant (R0=27%) species with large amplitude in response to the chemical reaction of the soil.

The spectrum of life forms (Fig. 8) illustrates the overwhelming weight in phytocoenoses of the hemicryptophytes species (H=76%) as the expression of coexistence in water deficient spas during summer and with heat deficiency during winter.

The slightly increased percentage of chamaephyte species (Ch=13.5%) on these rocks inform us on some stations marked by cold, snowy winters and summers with dry winds, this fact involving a hydric stress.

The floristic elements spectrum (Fig. 9) suggests the large share of eurasian species (Eua=40.8%) specific to a drier temperate continental climate, followed by European species (E=13.5) moderate and temperate climate and by the southern ones (Mediterranean, Balkan, Ponto-Pannonian, Ponto-Dacian) in 10.8% being the expression of a mild climate without extremes. On the siliceous rocks of Codru-Moma Mountains there are quartered a relatively large number of species.

Table 2. Association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938 in Codru-Moma Mountains.

L.f.	F.e.	U	T	S.r.	Number	1	2	3	4	5	6	K
					Altitude (m.s.m.)	380	380	370	360	350	350	
					Exposition	NV	NV	N	V	NV	NV	
					Slope (degree) (º)	80	75	80	80	90	90	
					Area (m²)	4	4	6	9	8	6	
					The coverage of grass layer (%)	70	50	80	80	80	30	
H	E	2.5	3	3	As. *Asplenium adiantum-nigrum*	1	3	1	3	2	+	V
H	Cp	1	3	2	As. *Asplenium septentrionale*	3	+	3	2	3	2	V
					Asplenion septentrionalis. Androsacetalia vandelii							
H(G)	Eua-M	2	3	0	*Sedum maximum*	1	+	1	+	1	+	V
H	E	3	3	3	*Epilobium collinum*	·	·	·	·	+	+	II
H	Cosm	3	0	4	*Asplenium trichomanes* ssp. *trichomanes*	1	+	2	3	1	+	V
					Asplenietea trichomanis							
H	Eua	3	3	0	*Poa nemoralis* var. *montana*	1	1	+	1	+	+	V
					Ctenidium moluscum	1		2	2	3		IV
Ch	End. carp.	2	3.5	4.5	*Thymus comosus*	·	·	+	+	+	·	III
G	Cp	3.5	3	4	*Polypodium vulgare*	·	·	+	·	+	·	II
H	End. carp.	2	3	0	*Silene nutans* ssp. *dubia*	+	·	·	+	·	·	II
H	Ec (R)	4	2	4	*Genista januensis*	+	+	·	·	·	·	II
H	Ec	4	2	4	*Moehringia muscosa*	+	+	·	·	·	·	II
H	Cp	1.5	3	5	*Asplenium ruta-muraria*	·	·	·	·	·	+	I
					Querco-Fagetea							
H	E	3	3	0	*Mycelis muralis*	+	+	·	·	+	·	III
H	Eua	3	2.5	0	*Fragaria vesca*	+	+	·	+	·	·	III
H	Eua	3.5	3	4	*Salvia glutinosa*	+	+	·	·	·	·	II
H	Eua	3	2	2	*Cruciata glabra*	+	+	·	·	·	·	II
H	E	3	3	3	*Carex digitata*	+	+	·	·	·	·	II
H	Eua	3	2	5	*Primula veris*	+	+	·	·	·	·	II
H	Eua	3	3	0	*Campanula persicifolia*	+	·	·	·	·	·	I
Th	Cosm	3.5	3	3	*Geranium robertianum*	+	+	·	·	·	·	II
H	Cp	2	3	3	*Clinopodium vulgare*	+	·	·	·	·	·	I
H	Cosm	4	3	0	*Dryopteris filix-mas*	·	+	·	·	·	·	I
					Quercetea pubescenti-petraeae							
nPh	Ec-M	2	3.5	4	*Chamaecytisus hirsutus* ssp. *leucotrichus*	+	·	·	·	·	·	I
H	Eua-C	1.5	3	3.5	*Hieracium bauhini*	+	+	·	·	·	·	II
H	Eua-M	2.5	4	4	*Brachypodium pinnatum*	+	·	·	·	·	·	I
H	Ec-M	2.5	3.5	5	*Calamintha sylvatica*	·	+	·	·	·	·	I
Ch	M-E	2	3.5	4	*Teucrium chamaedrys*	+	·	+	·	·	+	III
					Festuco-Brometea							
H	P-Dac	1.5	4	4	*Seseli osseum*	+	+	·	·	·	·	II
Ch	P-Pan	2	4	0	*Thymus glabrescens*	·	·	+	+	+	+	IV
Ch	Eua	0	3	3	*Sedum acre*	·	·	+	+	·	+	III
H	Eua	2	4	2	*Potentilla argentea*	·	·	+	·	·	·	I
H	Eua	3	3	0	*Hypericum perforatum*	·	·	·	+	·	·	I
					Variae syntaxa							
H-Ch	Eua	3	0	0	*Veronica chamaedrys*	+	+	·	·	·	·	II
H	Eua	2.5	2.5	3	*Galium erectum*	+	+	·	·	·	·	II
H	B	2.5	3	4	*Dianthus giganteus*	·	·	+	+	·	+	III
H(G)	Eua	2	3	4	*Euphorbia cyparisias*	·	·	+	+	+	·	III
TH	E	2.5	3.5	4	*Verbascum phlomoides*	·	·	·	+	·	+	II

Species that occur in a single relevees: *Trifolium alpestre* (4); *Vulpia myuros* (6); *Ventenata dubia* (6); *Dichanthium ischaemum* (6).
Place and date of relevees: 1-2 Mic Valley (Briheni) 27 August 2008; 3-6 Crişului Văratec Valley (Lunca) 29 August 2008.

The economic importance

The phytocoenoses of this association present no economic interest either, except that they too favor the bioaccumulation processes of humus contributing to the formation of a thin film of soil which, by successive stratification in time, becomes an organic litosol. On such a substrate the chamaephyte species will install later, the undergrowth and shrub species changing thus the composition of rocky vegetation too. The phytocoenoses of these rocks are interesting to be studied because some plants are rare, endangered, vulnerable, endemism, which must be protected: *Asplenium adiantum nigrum*, *Asplenium septentrionale*, *Thymus comosus*, *Silene nutans* ssp. *dubia*, *Genista januensis*, *Seseli osseum*, *Dianthus giganteus* and others have a decorative character: *Sedum maximum*, *Asplenium trichomanes*, *Polypodium vulgare*, *Asplenium ruta-muraria*, *Primula veris*, *Campanula persicifolia*, *Thymus glabrescens*.

DISCUSSIONS

Summary descriptions of the rocky vegetation of Codru-Moma Mountains can be found in the book belonging of botanist Paucă (1941) [12].

In her travel on the rocky valleys of Codru-Moma Mountains, the author describes 3 relevées which she considers to be fragments of associations much influenced by the neighbouring associations and which are not homogeneous enough and tha's why she could not assemble them in a pool table.

The first relevées performed at Briheni on Şopotesei Valley on a limestone rock near the cave at an altitude of 400 m, contains a list of 12 species of which *Asplenium trichomanis* is the characteristic species of class ***Asplenietea rupestria*** Br.-Bl. 1934, today an obsolete and invalid cenotaxon name and *Asplenium ruta-muraria* as a species characteristic of the order ***Potentilletalia caulescentis*** Br.-Bl. 1926 also an obsolete and ineffective name today.

The second relevées showing a fragmented association again is made on 13 June 1937 to north of village Coleşti on limestone cliffs with an eastern exhibition at an altitude of 390 m, it contains a list of 16 plant species that fall within the same class and order.

The third relevées is done at 16 June 1937 on permiene siliceous shale rocks on the northern end of the village Briheni at an altitude of 280 m on the roadside including a list of 16 plant species.

This second association also fragmentary presents two species *Asplenium septentrionale* and *Sedum maximum* which characterizes the order ***Androsacetalia multiflorae*** Br.-Bl. 1926 and *Asplenium trichomanes* which is characteristic to class ***Asplenietea rupestria*** Br.-Bl. 1934, without identifying in the land the true characteristic species namely *Asplenium adiantum-nigrum*.

As regards the first association *Asplenietum ruta-murariae-trichomanis* identified and analyzed by us compared with the text described and with the floristic composition of the 2 relevées made by Paucă (1941) [12], one can obseve that she failed to put the two local populations with the two characteristic species *Asplenium ruta-muraria* and *Asplenium trichomanis* ssp. *quadrivalens* in valid association throughout Europe, *Asplenietum trichomano-rutae-murariae* R. Tx. 1937, and did not identify the groups of differential and recognition species which subordinate the ceno-taxa association hierarchically superior to alliance ***Cymbalario-Asplenion*** Segal 1969 em. Mucina 1993, to order ***Tortulo-Cymbalarietalia*** Segal 1969, to class ***Asplenietea trichomanis*** (Be.-Bl. in Meier et Br. -Bl. 1934) Oberdorfer 1977.

The association which we refer to described by Paucă is based on 2 relevées from a single location bringing together a small number of species (12) without making a table of association.

As regards the second association *Asplenietum septentrionali-adianti-nigri* Oberdorfer 1938, in her work Paucă made a single relevées with 16 species from a single location, without making an association table that is which she could have separated and subordinated the species as being characteristic and of recognition for association, alliance, order and class.

The association described by us focuses on 6 relevées made in six mountain resorts in Codru-Moma Mountains on siliceous rocks from two locations: Mic Valley Briheni village 2 releveess (27 August 2008) and Crişului Văratec Valley, Lunca village 4 relevées (29 August 2008).

The phytocoenologic environmental and bioeconomical study of vegetation on siliceous rocks focuses on a pool table comprising 37 species on which we have separated the species characteristic of the association, *Asplenium adiantum-nigrum* and *Asplenium septentrionale* and we named the association, we separate the differential and recognition species for the ***Asplenion septentrionalis*** alliance, for the ***Androsacetalia vandelii*** order, for the ***Asplenietea trichomanis*** class.

In some places over the limestone plateaus and dolines a 2-3 m thick layer of gravel overlapped, brought there due to erosion from the Permien quartz peaks. This explains why on such areas we find a mixture of calciphilous and acidophilous plant associations [12].

The vegetation of rocks explored in Codru-Moma Mountains includs 5 associations, of which the phytocoenoses of three associations, *Asplenietum ruta-murariae-trichomanis* R. Tüxen 1937 *Asplenietum quadrivalenti-Poetum nemoralis* Soó ex Gergely et al. [14] and *Ctenidio moluscae-Polypodietum vulgare* Jurko et Peciar [14], develop on a limestone bedrock with a slightly acidic to neutral or slightly basic pH and the phytocoenoses of two associations *Asplenio trichomani-Poetum nemoralis* Boşcaiu [14] and *Asplenietum septentrionali-adianti-nigra* Oberdorfer [14] develop on a crystalline substrate with a siliceous-shales with acid to neutral pH.

The floristic composition of the two associations *Asplenietum rutae-murariae-trichomanis* and *Asplenietum septentrionali-adianti-nigra*, discussed in this paper is relatively poor, bringing together 35 species in the first association and 37 species in the second association and the coverage of vegetation

being only 60-70%.

Regarding the influence of ecological factors (humidity, temperature, chemical reaction of the soil), present in the resort, the phytocoenoses of the rocks from the two associations are dominated by mesophilous species, reflecting a substratum with a negative water deficit during summer, generated by a relatively dry and arid climate, followed by xero-mesophilous species showing a substrate with negative water scarcity during summer resulting from a relatively dry and barren climate.

Compared to the chemical reaction of the soil (organic lithosol) the phytocoenoses are dominated by weak acid species followed by acid-neutrophilous ones.

The spectrum of life forms is marked by a high percentage of hemicryptophytes in both associations as a result of cohabitation of phytocoenoses in resorts with a fluid deficiancy of water in summer and deficiency of heat in winter.

The spectrum of floristic elements suggests the dominance of Eurasian species adapted to a temperate continental drier climate, followed by Europeans species of moderate-temperate climate and in a smaller number by the southern species (Mediterranean, Balkan, Ponto-Pannonian) as the expression of a gentle climate with no extremes.

Taking into account the current flower structures corroborated with stationary conditions alteration, one may suppose that the two above described phytocoenoses develop, in a first stage, towards more coagulated xero-mezophyl lawns belonging to class ***Festuco-Brometea*** associations which, currently, represent only small enclaves included in quercinea forests subordinated to association ***Cytiso Quercetum***.

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