

# CONTRIBUTIONS TO THE STUDY OF THE FONTINAL VEGETATION FROM THE SUPERIOR BASIN OF THE NEAGRA ȘARULUI RIVER (SUCEAVA COUNTY)

Loredana ASOLTANI\*, Toader CHIFU  
Faculty of Biology, "Al. I. Cuza" University of Iași

\* **Correspondence:** Loredana Asoltani, "Al. I. Cuza" University, Faculty of Biology, Department of Plant Biology, Carol I, 20A, 700505 Iași, România, e-mail: loredanaasoltani@yahoo.com

Received: march 2008; Published: may 2008

**ABSTRACT.** The paper presents two associations from the *Montio-Cardaminetea* Br.-Bl. Et R Tx ex Klika 1948 class identified in the superior basin of the river Neagra Șarului, respectively: the *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959 association and the *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942 association. From the speciality literature consulted it follows that the *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942 association has not been mentioned on the Moldavian territory before. The phytocoenoses identified are described through the phytocoenologic table and analyzed from the viewpoint of the bioforms, of the floristic elements and of the ecologic indices.

**Keywords:** fontinal vegetation, phytocoenosis, bioforms, floristic elements, ecologic indices, river Neagra Șarului

## INTRODUCTION

The Neagra Șarului river basin is the most important hydrographic basin from the Northern side of Călimani Mountains, with an area of 311 square kilometres, including 177 water-courses with a total length of the drainage network of 125,6 kilometers.

The presence of the numerous springs and streams, the large amount of precipitations which fall in the superior area of the basin, the richness of the phreatic waters, the surface outflow, as well as the maintenance of a relatively constant temperature during the entire vegetation period (approximately 5°C) are determinative factors in the installation and development of the fontinal phytocoenoses.

The surface outflow at the alpine layer is controlled by the long periods of frost (6-7 months a year), by the presence of the glacial cirques, due to which only the main stream of the river develops itself on large surfaces, another cause being the water shed effect, where we can notice the absence of a network of permanent outflow rivers, which causes the sporadic emergence of the species specific to this type of vegetation.

But in the lower areas, sub-alpine, the covering mountainside deposits thickens, and the increased pluviometric gain contributes to a more intense fragmentation of the relief. The alteration crust and the fissures of the sublayer rocks contain phreatic waters, more abundant, which ensure a permanent subterranean input even for the small rivers, favouring thus the installation and development of the fontinal vegetation.

## MATERIALS AND METHODS

For the study of the vegetation we used the method of the Zürich – Montpellier school phytocoenology, perfected by J. Braun – Blanquet and J. Pavillart. Taking into consideration a few phytosociological works of nomenclature and classification (Chifu T., Coldea Gh., Sanda V.), the associations taken into the study were framed in the following phytocoenosis system:

Cls. *MONTIO- CARDAMINETEA* Br. – Bl. Et R. Tx ex Klika 1948

Ord. *CARDAMINO-CHRYOSPLENIETALIA* Hinterlang 1992

Al. *CARICION REMOTAE* Kästner 1941

As. *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959

Ord. *MONTIO – CARDAMINETALIA* Pawlowski 1928

Al. *CARDAMINO – MONTION* Br.-Bl. 1926 em. Zechmeister in Grabherr et Mucina 1993

As. *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942

## RESULTS AND DISCUSSION

As. *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959

The association was mentioned under the name of *Cardaminetum amarae* (Rübel 12) Br.-Bl. 26 by M. Toma (1975) in his PhD thesis in the area of the localities Coverca and Șaru Dornei, but without presenting the phytocoenological surveys. The phytocoenoses of this association was described by Gh. Coldea (1973) as well from the southern versants of Călimani massive, at Răchitișul de Sus.

The phytocoenoses identified in the present study occupy reduces surfaces on the northern versants of Călimani massive, respectively in the superior basin of Neagra Sarului river (from the Haita river valley towards the bottom of Pietrosul peak, and also on Rețiș river), at altitudes comprised between 1300-1750 m, on plane lands or with a slightly inclined slope. The association is encountered in the pine forests, on the soils with humidity excess, on the beds of rivers or sources, where the almost horizontal disposal of the land favors the appearance of swamps.

Among the two species characteristic to the association, *Cardamine amara* is the dominant and edificatory species, covering up to 75% , while the species *Chrysosplenium alternifolium* was identified only in four of the five phytocoenological surveys. The floristic composition is made up of species characteristic to the alliance, order and class, a special percentage in the general coverage (up to 25%), being registered by the species *Stellaria nemorum*. We notice the presence of species characteristic to the classes *Vaccinio- Piceetea* and *Mulgedio- Aconitetea*, species which penetrate from neighbor phytocoenoses. In the phytocoenoses analyzed we ascertain the presence of a moss layer, which can cover up to 30% (Table 1).

**The analysis of bioforms** (Fig. 1) emphasizes the net dominance of the hemicryptophytes (H= 88, 24%), followed by camephytes (Ch) and hemiterophytes - hemicryptophyte (HT-H), with 5.88 % each.

**The analysis of floristic elements** (Fig. 2) reveals the fact that, of the total of the 17 species which enter the floristic composition of the association, the

circumpolars are those which dominate the specter with 35.30%, being followed by the Alpine European elements (Alp. Eur = 17.66%), Eurasiatic (Euras. = 11.76% and Euras. Bor. =5.88 %), central European (Eur. Centr.= 11.76%) and European, cosmopolite and Atlantic - Mediterranean central European, each with 5.88 %.

**The analysis of ecological indices** (Fig. 3), confirms the sciophilous and cryophilous character of the analyzed phytocoenoses, indicating the dominance of the sciophilous species (L<sub>4</sub>= 23.53%) and semi-shadow (L<sub>6</sub>= 17,65%), respectively of the cryophilous species (T<sub>4</sub> = 29,41% și T<sub>3</sub> = 23,53%). The hygrophilous character of the association is emphasized by the presence of the hydro-hygrophyle species (U<sub>9</sub> = 17,65%, U<sub>10</sub> = 5,88%) together with the species which prefer the humid soils (29.42%). As regards the reaction and trophicity of the soil, the majority of the species prefer the acid soils (R<sub>2</sub> =1 7,66%, R<sub>3</sub>= 5,88%, R<sub>4</sub>= 5,88%, R<sub>5</sub>= 5,88%, totaling a score of 29,41%) and salted in mineral azoth (29,41%).

Since in the development and succession of different fontinal phytocoenoses the hydric factor and the acidity of the sublayer play a very important role, while alluvial material is also accumulated, the phytocoenoses of the association *Chrysosplenio alternifolii – Cardaminetum amarae* will evolve towards the phytocoenoses of the association *Chrysosplenio alpini – Saxifragetum stellaris* (Coldea, 1973).

Table 1

**ASS. CHRYSOSPLENIO ALTERNIFOLII – CARDAMINETUM AMARAE MAAS 1959**

Relevee number	1	2	3	4	5	
Altitude (m)	1307	1337	1400	1750	1700	
Exposure	NV	-	V	-	-	
Slope (degrees)	15	-	5	-	-	
Vegetation coverage (%)	75	90	80	70	75	K
Moss layer coverage (%)	30	10	10	20	20	
Survey area (m <sup>2</sup> )	15	20	15	20	20	
Number of species	13	11	10	7	9	
<b>Association's characteristics:</b>						
<i>Chrysosplenium alternifolium</i>	+	-	+	+	+	IV
<b>Caricion remotae et Cardamino – Chrysopogonetalia</b>						
<i>Athyrium filix - femina</i>	+	+	+	-	-	III
<i>Oxalis acetosella</i>	+	+	+	-	-	V
<i>Stellaria nemorum</i>	2	1	+1	+1	2	
<b>Montio - Cardaminetea</b>						
<i>Caltha palustris</i>	+	+	+	+	+	V
<i>Cardamine amara</i>	3	4	4	4	3	V
<i>Epilobium nutans</i>	+	+	+	+	+	V
<i>Veronica beccabunga</i>	-	-	+	+	+	III
<b>Vaccinio – Piceetea s.l.</b>						
<i>Homogyne alpina</i>	+	+	+	-	-	III
<i>Luzula sylvatica</i>	+	-	-	-	-	I
<i>Vaccinium myrtillus</i>	-	+	-	-	-	I
<i>Valeriana tripteris</i>	+	+	+	-	-	III
<b>Mulgedio – Aconitetea s.l.</b>						
<i>Angelica archangelica</i>	-	+	-	-	-	I
<i>Deschampsia flexuosa</i>	-	-	-	+	+	II
<i>Rumex alpinus</i>	+	-	-	-	+	II
<i>Viola biflora</i>	+	-	-	-	+	II
<b>Variae syntaxa:</b>						
<i>Chaerophyllum hirsutum</i>	+	+1	-	-	-	II

**Place and date of surveys:** 1 - 3. valley river of Haita – Pietrosul (11.07.2007, 9.08.2007), 4, 5. Rețiș (18.07.2007).

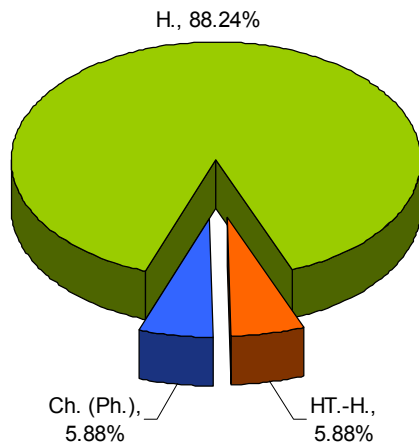


Fig. 1. Bioform spectrum of Ass. *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959

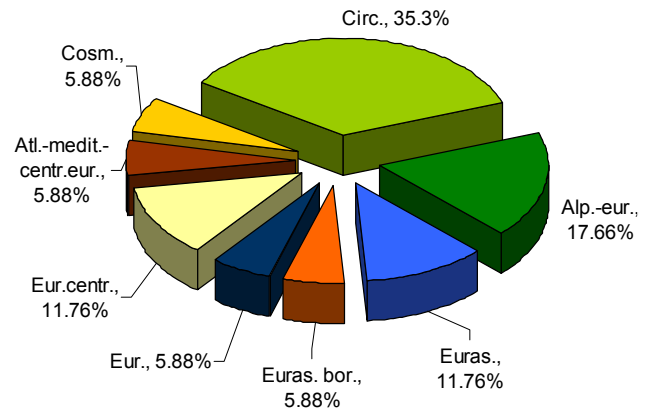


Fig. 2. Floristic elements spectrum of Ass. *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959

As. *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942

As in the previous association, this association was described from the southern versants of Călimani massive (Răchitișul de Sus) by Gh. Coldea (1973) under the name of *Philonotido – Saxifragetum stellaris* Horv. 49.

In the present study, the phytocoenoses of this association were identified on Rețiș peak, around the sources and on the valley of Tarnița river, under Pietrosul peak, at altitudes comprised between 1560-1700 m on plane lands or slightly inclined, with predominantly north exposure.

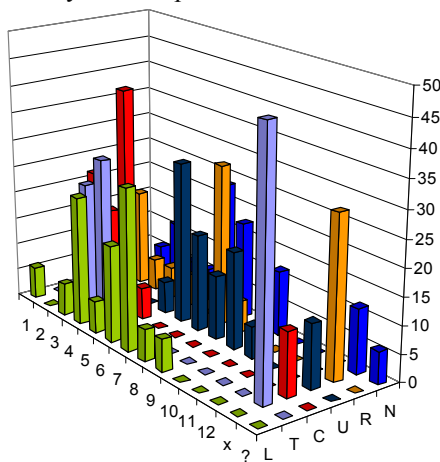


Fig. 3. Ecological indices spectrum of Ass. *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959

The association from the territory of Neagra Șarului river basin has not been described anymore, and based on the literature consulted we conclude the fact that the association is new on the territory of Moldavia.

The alpine element *Saxifraga stellaris* ssp. *Robusta* represents the edificatory species of the association, achieving in the interior of the phytocoenoses coverings up to 90% (Fig. 4, table 2). The other species characteristic to the association, the east-Carpathian

endemits *Chrysosplenium alpinum*, has not been identified in the five phytocoenological surveys. We also notice the presence in a high percentage of the species *Philonotis seriata*, which in some phytocoenoses contributes to edifying a moss layer with a coverage up to 25%. Together with the species characteristic to the alliance, order and class, in the floristic composition we notice the presence of some species characteristic to the classes *Phragmiti – Magnocaricetea*, which characterize the hydrophilic vegetation, *Vaccinio – Piceetea* and *Mulgedio – Aconitetea*, the latter penetrating from the phytocoenoses that the fontinal vegetation comes into contact with (Table 2).

The analysis of bioforms (Fig. 5) shows the clear prevalence of the hemicryptophytes (H = 66.67%), followed by the camephyte (Ch = 25%) and pterophytes – hemiterophytes (T-Ht = 8.33%).

The analysis of floristic elements (Fig. 6) justifies the Northern character of the phytocoenoses through the prevalence of the circumpolar (circumference = 41.68%) and European alpine species (Eur. Alpine = 16.67%). The floristic elements' spectrum is completed by the Eurasian elements, respectively Eurasian properly speaking (Euras.), Eurasian European arctic-alpine (Euras.-arct.-alp. Eur.) And Eurasian arctic-alpine Euro American (Euras.-arct.-alp. Euram.) Which totalize a percentage of 24.99% as well as the cosmopolite and the Central-European atlantico-mediterranean elements, each with 8.33%.

The analysis of ecological indices (Fig. 7) indicates the following preferences as regards the ecological factors : we determined the presence of a nucleus of species which love the light, which total a percentage of 41.67%, the majority of species are cryophilic (58,33%) and hydro-hygrophilous (50%), all these justifying the fontinal character of the phytocoenoses taken in the study. As regards the reaction and trophicity of the soil, the majority register the ecologic optimum on the acid (41,67%) and poor in mineral azoth (50%).

Table 2

ASS. CHRYSOSPLENIO ALPINI – SAXIFRAGETUM STELLARIS PAWLOWSKI ET WALAS 1942						
Relevee number	1	2	3	4	5	
Altitude (m)	1650	1700	1560	1600	1700	
Exposure	-	-	NNV	NNV	-	
Slope (degrees)	-	-	5	5	-	
Vegetation coverage (%)	65	70	90	80	75	K
Moss layer coverage (%)	5	3	25	15	10	
Survey area (m <sup>2</sup> )	5	6	5	4	4	
Number of species	8	10	10	7	9	
<b>Association's characteristics:</b>						
Saxifraga stellaris ssp. robusta	4	4	5	5	4	V
<b>Cardamino – Montion et Montio – Cardaminetalia</b>						
Epilobium nutans	+	+	+	+	+	V
<b>Montio – Cardaminetea</b>						
Cardamine amara	+	+	+	+	+	V
Chrysosplenium alternifolium	+	+	+	-	+	IV
Philonotis seriata	+1	-	2	1	1	IV
Saxifraga aizoides	-	+	-	-	-	I
Stellaria uliginosa	+	+	-	+	-	III
<b>Phragmiti – Magnocaricetea s.l.</b>						
Myosotis caespitosa	-	+	+	-	+	III
<b>Mulgedio – Aconitetea s.l.</b>						
Viola biflora	+	-	+	-	+	III
<b>Vaccinio – Piceetea s.l.</b>						
Homogyne alpina	-	+	+	-	+	III
Luzula sylvatica	-	-	+	+	-	II
Vaccinium myrtillus	-	+	-	-	+	II
<b>Variae syntaxa</b>						
Deschampsia caespitosa	+	+	+	+	-	IV

Place and date of surveys: 1, 2 - Rejițiș (18.07.2007, 16.07.2006), Tarnița rivulet – below the Pietrosul peak (14.07.2006, 9.08.2007)

**CONCLUSIONS**

The association *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942 is signaled for the first time on the territory of Neagra Șarului river basin (Suceava county), and based on the consulted specialty literature, it is new for Moldavia's vegetation.

The hemicyptophytes, the circumpolars and the Alpine European elements dominate the phytocoenoses of the two associations taken into the study.

As regards the ecological factors: the association *Chrysosplenio alternifolii* – *Cardaminetum amarae* Maas 1959 has a sciophilous character, and the association *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942 has a strongly heliophilous character; both associations have a cryophilic character, hydro-hygrophilous which confirms their fontinal character, preferring the acid soil with a low content of mineral azoth.



Fig. 4 Phytocoenosis of Ass. *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942 (Tarnița rivulet, below the Pietrosul peak)

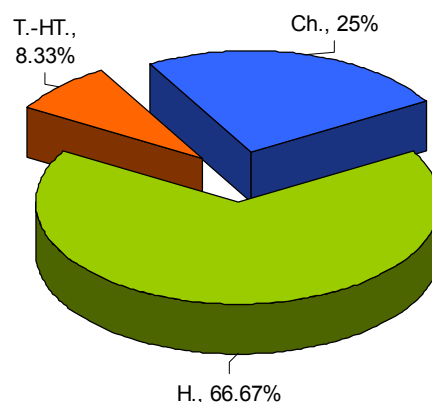


Fig. 5 Bioform spectrum of *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942

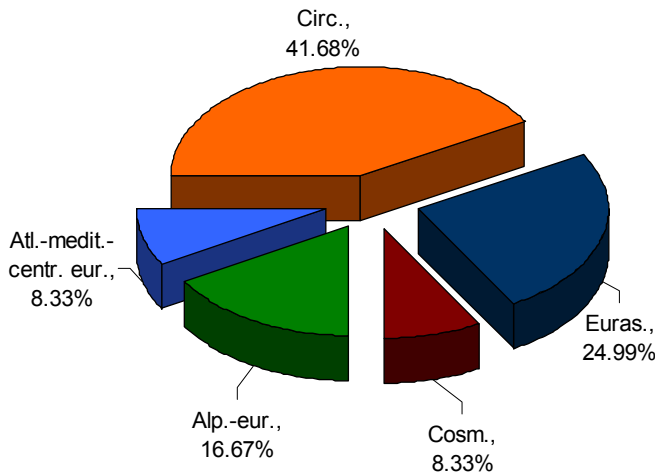


Fig. 6. Floristic elements spectrum of Ass. *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942

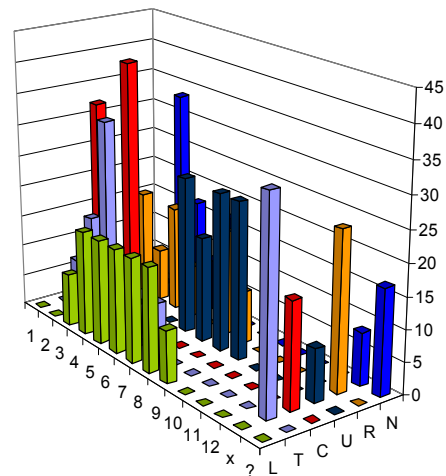


Fig. 7. Ecological indices spectrum of Ass. *Chrysosplenio alpini* – *Saxifragetum stellaris* Pawlowski et Walas 1942

REFERENCES

Chifu T., Mânzu C., Zamfirescu Oana, Flora și vegetația Moldovei II, Iași, Ed. Univ. „Al. I. Cuza”, 698 p., 2006

Ciocârlan V., Flora ilustrată a României – Pteridophyta et Spermatophyta, Edit. Ceres, București: 1138 p., 2000

Coldea Gh., Considerații fitocenologice și sindinamice asupra vegetației mlaștinilor din Munții Călimani, St. Com. Ocrot. Nat., Suceava, 3: 53-63, 1973

Coldea Gh., Prodrome des associations végétales des Carpates du Sud-Est (Carpates Roumaines), Docum. Phytosoc., Camerino, 13: 317-359, 1991

Coldea Gh., Sanda V., Popescu A., Ștefan N., Les associations végétales de Roumanie, 1 – Les associations herbacées naturelles, Presses Universitaire de Cluj : 261 p., 1997

Ellenberg H., Indicator values of vascular plants in Central Europe, Scripta Geobotanica, IX, Verlag Erich Goltze K.G., Göttingen: 1-97, 1974

Sanda V., Vademeccum ceno-structural privind covorul vegetal din România, Edit. Vergiliu, București: 331 p., 2002

Sanda V., Popescu A., Arcuș Mariana, Revizia critică a comunităților de plante din România, Edit. Tilia Press International, Constanța: 142 p., 1999

Sanda V., Popescu A., Barabaș N., Cenotaxonomia și caracterizarea grupărilor vegetale din România. St. Și Com. Muz. Șt. Nat. Bacău, Biol. Veget., 14: 365 p., 1997

Sanda V., Popescu A., Stancu Daniela Ileana, Structura cenotică și caracterizarea ecologică a fitocenozelor din România, Edit. Conphis, București: 359 p., 2001

Stoica D. L., Cercetări de geografie fizică pe versantul Nordic al Masivului Călimani, teză de doctorat, Facultatea de Geografie – Geologie, Departamentul de Geografie, Univ. “Al. I. Cuza” Iași: 253 p., 2007

