

TYPES OF HABITATS ON LIMESTONE AND SCHIST (METAMORPHIC CRYSTALLINE SCHISTS) GEOLOGICAL SUBSTRATUM IN LEAOTA MOUNTAINS, SOUTHERN CARPATHIANS (ROMANIA)

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INTRODUCTION

Leaota Mountains, located in the Southern Carpathians, Bucegi Group (Romania), have a diversified geological composure, in spite of the fact that their surface is not that large, namely 336 sq.km (Murătoreanu, 2009). However, within this surface, we can meet a multitude of rocks, belonging to the three categories: sedimentary, metamorphic and magmatic rocks, as we can observe from the any geological map of the area (Mutihac & Mutihac, 2010). The geomorphological portrait of Leaota Mountains is featured by a relief on a substratum consisting of 25% sedimentary rocks, of which 4% limestone and 21% detritic rocks; on a substratum of metamorphic rocks (crystalline schists) 74% and only 1% on a magmatic substratum (Murătoreanu, 2009).

This paper analyses the types of habitats develops on limestone and schists geological substratum. We are interested whether there are differences regarding the role of the geological components. It only represents a piece from a wider ensemble, which proposes the analysis of the connection between the type of geological substratum from the ecosystems installed in lithosols and scree - *mesovoid shallow substratum* (MSS), also called *shallow subterranean habitats* (SSHs) and the main ecologic factors of relative humidity and temperature on one side, and the distribution of some invertebrate species on the other side.

MATERIALS AND METHODS

During the studies, we had established nine ecological stationeries on limestone or mesometamorphic crystalline schists' geological substratum. We wanted that these stationeries would not be influenced by anthropic factors; studied scree had a natural origin. The ecological stationeries no. 2, 3, 4, 7 and 8 were placed on limestone substratum (no. 4 and 7 on lithosols and no. 2, 3 and 8 on the scree - MSS); the others stationeries (no. 1, 5, 6 and 9) were placed on the schist substratum (no.1, 6 and 9 on the lithosols and no. 5 on the scree). Their

positioning and the calculation of the elevation was made using a GPSMAP® 76CSx device.

We have made evaluations of the humidity, pH and the temperature at the level of the soil in all stationeries. We have used two types of hygro-pH-meters: Tecpel PH 707 and ETP300C, with a precision of 0.1 units in the case of the pH and 1% in the case of relative humidity. The determination of the position of the stationeries, of the samplings and of the outcrops, where we collected the samples from, was made using the same device GPSMAP® 76CSx device; the precision of the measurements depended on the reception mode of the satellite signal.

The measurements were made on a repeated basis. The altitude and the distances were indicated with a tolerance of several meters. We also used compasses in order to determine the orientation of the slopes on which we have placed the stationeries. To identify the botanical material and the vegetal associations, we used the relevés method (vegetation plot data); the botanical material was collected for subsequent laboratory analyses and determinations. To determine the features of the types of rocks we used macroscopic analysis, as well as the microscopic one, using a *Carl Zeiss Jena Amplitval Pol • U* mineralogical microscope.

RESULTS AND DISCUSSIONS

The ecological stationary no. 1 was placed at the foot of the southern slope of Zăbava Mountain, at its limit with Berbece's Creek (the tributary on the right of Ghimbav) Fig. 1.

The position was determined by the N 45°22'18.1"; E 25°15'57.2" GPS coordinates; elevation = 1060 meters. The geological substratum consists of limestone scree which was covered by soil (lithosol) and which is covered by a layer of litter, with the thickness of the soil and litter layers of approximately 10 - 11 cm. The average of the pH values of the soil was 6.8 in all ecological stationeries with schists and 6.8 in the others stationary with limestone.



Fig. 1. Location of the ecological stationary # 1 ÷ 8 (in red digits the stationary with limestone substratum and in blue digits those with the schists) (After: <http://www.carpati.org>, modified)

Subsequently to the macroscopic analysis and to the microscopic one, we can conclude that crystalline schists are mesometamorphic schists.

Visual macroscopic analysis shows an emphasized schistosity through an alternance of dark, green or gray parallel microlayers, with other white or gray-white microlayers. Microscopic analysis revealed that the minerals are represented by muscovite and biotite, quartz, feldspars, chlorite, epidote, as well as traces of garnet, calcite, ilmenite, limonite. Sometimes we notice, in the mass of the rocks, crystals that are thinner than a tenth of a millimeter, with vitreous shine, especially on the schistosity planes (possibly epidote). Some samples of rock display micro cracks. As for the existence of feldspars in large volumes within the schists (20-24%), it favors the development of clay minerals, through their chemical decomposition, given the high humidity, especially through the kaolinization process. The faster the clay material is generated and more abundant is, the faster installation of vegetation, the more abundant it is and the scree is faster stabilized; interclastic spaces between the clasts that represent the scree are faster filled with clay material (Dorobăț, 2016).

This type of schists is vulnerable to chemical alteration (Dorobăț, 2012).

The placement of stationary no. 1 is located at the limit with the young forest ecosystems of whose coenosis are specific for the **91V0 Dacian beech forests (Symphyto-Fagion)** habitat. We identified vegetation groups consisting of nemoral and boreal, oligomesotrophic, oligomesothermal and mesophytes. The floral structure consists of both wooden: *Fagus sylvatica*, *Abies alba*, *Picea abies*, *Rubus hirtus*, *Corylus avellana*,) and herbal species as *Salvia glutinosa*, *Glechoma hederacea*, *Oxalis acetosella*, *Aegopodium podagraria*, *Poa nemoralis*, *Luzula sylvatica*, *Athyrium filix-femina*, *Tussilago*

farfara, *Moehringia trinervia*, *Viola reichenbachiana*, *Petasites* spp., *Dryopteris filix-mas*, *Geranium robertianum*, *Stellaria nemorum*, *Fragaria vesca*, *Mycelis muralis*, *Impatiens noli-tangere*, *Pulmonaria rubra*, *Polystichum aculeatum*, *Polygonatum verticillatum*, *Ajuga reptans*. The vegetal association that defines the habitat is ***Pulmonario rubrae-Fagetum sylvaticae* (Soó 1964)** Täuber 1987 (Gafta & Mountford, 2008).

Ecologic stationary no. 2 has functioned on a limestone scree which outcrops on a surface of approximately 80 meters long and approximately 25-30 meters wide from the southern slope of Ghimbav Mountain, continued by a fixed scree, covered with forest and herbal vegetation, which goes down to the basis of the forest road. The slope is located on the right side of Ghimbav River. (Fig.1)

From this slope on which the stationary is placed the river flows approximately 300 meters before entering the gorge.

The central location of this stationary has an altitude of 879 meters, with the N 45°22'43.0"; E 25°13'49.4" GPS coordinates. The highest side of the analyzed area has an altitude of 883 meters, limestone scree being more mobile and nearly nude in here. The lowest area of the delimited area is located on the foot of the slope, in a forest, in fixed scree, covered by a layer of soil and litter of approximately 10 centimeters thickness, the altitude in the location being 860 meters. The inclination of the slope is 40°, southern exposure.

In the superior layer of the scree, we can notice a soilification process generated by the chemical alteration of limestone and the development of residual clay; besides, the soil particles are gravitational transported from the forest which limits the scree on its superior, northern side, thus accelerating the soilification process. In the southern part of the forest margin, we find scree, as it has been

fixed, in the contact area with the forest, through the development of a herbal layer dominated by *Teucrium montanum*, *Thymus comosus*, *Teucrium chamaedrys*, which confirms the belonging of these phytocoenosis to habitat **8120 Limestone and crystalline schists scree from the mountain to the alpine floor (*Thlaspietea rotundifolii*)**.

Alongside the specific species of this scree (*Thymus comosus*, *Teucrium montanum*, *Galium album*, *Teucrium montanum*, *Vincetoxicum hirundinaria*, *Geranium robertianum*) (Gafta & Mountford, 2008), we can also find taxons that are specific to the vegetation of rock cracks, such as *Silene nutans* ssp. *dubia* și *Cardaminopsis arenosa* (Doniță et al., 2005; Alexiu, 2011 b, c).

The presence, in the floral composure, of some species in the Festuco-Brometea (*Stachys recta*, *Salvia verticillata*, *Galium verum*, *Verbascum lychnitis*) Class shows the evolution direction from the phytocoenosis scree towards the xerophile meadows (Alexiu, 2011a).

The floral structure of the herbal layer is also completed by other species, such as: *Polygala vulgaris*, *Scabiosa lucida*, *Scabiosa ochroleuca*, *Digitalis grandiflora*, *Bupleurum falcatum*, *Dianthus tenuifolius*, *Cuscuta* sp., *Achillea millefolium*, *Potentilla thuringiaca*, *Seseli libanotis*, *Helianthemum nummularium*, *Veronica chamaedrys*, *Aster amellus*. Locally, we can meet *Corylus avellana*, *Picea abies*, *Acer pseudoplatanus* juv., *Cytisus nigricans*, *Rhamnus saxatilis* ssp. *Tinctorius*; individuals on mobile scree, the herbal layer is low developed with rare examples of *Galium album*, *Geranium robertianum*, *Mycelis muralis*, *Silene pusilla*, *Campanula rapunculoides*, *Chelidonium majus*, *Cytisus nigricans*, *Cardaminopsis arenosa*, (Neblea, 2005).

At the basis of the scree, in the forest phytocoenosis, we can find saxicol vegetation, with the following species: *Mycelis muralis*, *Urtica dioica*, *Picea abies*, *Lamium maculatum*, *Acer pseudoplatanus*, *Geranium robertianum*, *Corylus avellana*, *Silene pusilla*, *Fragaria vesca*, *Poa nemoralis*, *Galium album*, *Salvia glutinosa*, *Silene nutans* ssp. *dubia*, *Erysimum witmannii*, *Gymnocarpium dryopteris* (*Thymo comosi*-*Galietum albi* Association Sanda et Popescu 1999).

Ecologic stationary no. 3 – Rudărița, was placed on the south-eastern slope of Căpățâna Mountain, located in the north-western sector of Leaota Mountains (Fig.1). The exposure is southern, the grade of the slope is 50 degrees. The slopes is on the right side of Rudărița Creek.

The average altitude is 1085 meters, and, in the central area of the studied surface, the measured GPS coordinates were: N 45°24'39.2"; E 25°16'12.3". Here, in the center, the scree is mobile, with rare herbal plants. At the limit of the lower side of the areal, we find a nemoral forest, in fixed scree,

covered with an approximately 10 centimeter soil and litter layer.

Within this stationary, there is a mobile scree which, in the middle part is stabilized through the development of xeric herbal phytocoenosis, which belongs to *Melico-Phleetum montani* Association Boșcaiu 1966. The herb synusia specific to this group consists of taxons, such as: *Bupleurum falcatum*, *Viola tricolor*, *Digitalis grandiflora*, *Thymus comosus*, *Festuca rupicola*, *Melica ciliata*, *Calamintha clinopodium*, *Origanum vulgare*, *Galium album*, *Silene nutans* ssp. *dubia*, *Verbascum lychnitis*, *Achillea millefolium*, *Vincetoxicum hirundinaria*, *Geranium robertianum*, *Phleum montanu*, *Arabis turrata*, *Cirsium erisithales*, *Scabiosa lucida*, *Verbascum phlomoides*, *Sedum maximum*, *Campanula persicifolia*, (Neblea, 2007, 2008 a, b).

We can find, towards the forest, in the floral composure, species with different coenotic featur, which also happens due to the contact with the vegetal groups specific to beech forest, both wooden species (*Picea abies*, *Acer pseudoplatanus*, *Corylus avellana*, *Fraxinus excelsior*, *Euonymus verrucosus*, *Ulmus glabra*, *Spiraea chamaedryfolia*), and herbal ones (*Origanum vulgare*, *Peltaria alliacea*, *Sedum maximum*, *Campanula carpatica*, *Urtica dioica*, *Verbascum phlomoides*, *Coronilla varia*, *Mycelis muralis*, *Arabis turrata*, *Geranium robertianum*, *Euphorbia amygdaloides*, *Mercurialis perennis*, *Lamium maculatum*, *Aconitum toxicum*, *Lamium maculatum*, *Cirsium erisithales*, *Calamintha clinopodium*, *Poa nemoralis*, *Cardaminopsis arenosa*, *Bromus riparius*, *Digitalis grandiflora*, *Galium album*, *Polygonatum verticillatum*, *Scabiosa lucida*, *Salvia glutinosa*, *Dactylis glomerata*, *Vincetoxicum hirundinaria*, *Silene nutans* ssp. *dubia*, *Erysimum witmannii*, *Anthemis tinctoria*, *Melica ciliata*, *Valeriana sambucifolia*).

By analyzing the forest phytocoenosis located at the contact with this semi-mobile scree, we have noticed that the tree layer is well emphasized, with a consistency of 0.8 – 0.9, being strengthened by *Picea abies*, *Fagus sylvatica* and *Abies alba* with rare examples of *Fraxinus excelsior* și *Acer pseudoplatanus*.

These vegetal coenosis belong to the **91V0 Dacian beech forests (Symphyto-Fagion)** habitat (Gafta & Mountford, 2008; Doniță, 2005). In the tree synusia, we can find species such as: *Daphne mezereum*, *Corylus avellana*, *Clematis alpina*, *Lonicera xylosteum*, *Euonymus verrucosus*. Herbal species are specific to the Symphyto-Fagion alliance, Fagetalia Order (*Hepatica transsilvanica*, *Euphorbia amygdaloides*, *Mycelis muralis*, *Mercurialis perennis*, *Lilium martagon*, *Salvia glutinosa*,) and the Querco-Fagetea (*Dryopteris filix-mas*, *Campanula rapunculoides*, *Galium schultesii*, *Poa nemoralis*, *Solidago virgaurea*) Class. Other identified species in the floral composition: *Asplenium trichomanes*,

Dactylis glomerata, *Campanula carpatica*, *Cirsium erisithales*, *Campanula persicifolia*, *Polypodium vulgare*, *Aconitum toxicum*, *Stellaria holostea*, *Lapsana communis*.

Below, the herbal structure is poorer, with rare examples of: *Peltaria alliacea*, *Campanula carpatica*, *Mycelis muralis*, *Sambucus racemosa*, *Urtica dioica*, *Sedum maximum*, *Melica ciliata*, *Arabis turrata*, *Coronilla varia*, *Thymus comosus*, *Phleum montanum*, *Digitalis grandiflora*, *Geranium robertianum*. (*Melico-Phleetum montani* Boşcaiu 1966).

The ecological stationary no. 4 – Rudărița was installed on the left bank of Rudărița Creek (Fig.1), at the margin of a forest dominated by broad-leaf and rare examples of evergreen trees. Under the soil (lithosol) and litter stratum of approximately 10 centimeter thickness, we can find limestone scree, clearly fixed. The stationary is located at the foot of the northern limit of the Muchia Zacotelor slope, between the creek and the nearly vertical rocks of the slope. The GPS coordinates which define the stationary are: N 45° 24' 29.4"; E 25° 15' 50.2", at an altitude of 985 meters.

The placement of the stationary is at the contact with the forest phytocoenosis which belong to **91V0 Dacian beech forests (Symphyto-Fagion) habitat** (Gafta & Mountford, 2008). These vegetal associations develop on areas with northern exposure, 40-50° degree of inclination, on low acid soils, with medium humidity. The structure of the vegetal layer is specific to the association *Pulmonario rubrae-Fagetum sylvaticae* (Soó 1964) Täuber 1987 being edified through *Fagus sylvatica*, *Picea abies* și *Abies alba* (Doniță, 2005). Alături de aceștia, compoziția floristică este întregită de: *Geranium robertianum*, *Acer pseudoplatanus*, *Euphorbia amygdaloides*, *Athyrium filix-femina*, *Salvia glutinosa*, *Pulmonaria rubra*, *Urtica dioica*, *Ulmus glabra*, *Polystichum aculeatum*, *Oxalis acetosella*, *Geranium robertianum*, *Glechoma hederacea*, *Actaea spicata*, *Euonymus verrucosus*, *Polypodium vulgare*, *Mercurialis perennis*, *Asplenium viride*, *Fragaria vesca*, *Senecio ovatus*, *Dryopteris filix-mas*, (Gafta & Mountford, 2008).

The ecological stationary no. 5 Popii Valley was installed in schist scree on the both banks of Popii Creek, left tributary of Ghimbav, 600 meter upstream from the Andolia forest canton (Fig. 1). On a surface on the right bank of Popii Valley River, we find a recently created colluvial schist scree, nearly nude, mobile, gravitationally accumulated at the basis of the western slope of Cumpărata Mare Mountain, with the N 45°21'41.6"; E 25°16'38.8" GPS coordinates, at an altitude of 1076 meters. On the left side of the stationary, a schist scree develops, which frequently emerges as several meters patches, in a mixed forest, on the left side of Popii Creek. The GPS positioning of the middle part of the area is N 45°21'42.4"; E 25°16'36.9". The altitude of the

stationary is between 1070 and 1081 meters. In the area of the left bank, the chemical alteration of the rocks in the scree is extremely frequent.

This scree is located in a mixed forest of beech and spruce, included in the **91V0 Dacian beech forests (Symphyto-Fagion) habitat** (Gafta & Mountford, 2008) in which the layer of three, with a canopy curdling of 0.8, is represented by the *Fagus sylvatica*, *Picea abies*, *Salix silesiaca* and rare individuals of *Alnus incana* at the foot of the slope, given the proximity to 91E0* habitat. Alongside, there are other wooden species, such as: *Corylus avellana*, *Rubus idaeus*, *Spiraea chamaedryfolia*.

The herbal layer covers 40% of the surface, including species such as: *Hieracium transylvanicum*, *Pulmonaria rubra*, *Fragaria vesca*, *Salvia glutinosa*, *Mycelis muralis*, *Athyrium filix-femina*, *Geranium robertianum*, *Gymnocarpium dryopteris*, *Gentiana asclepiadea*, *Luzula luzuloides*, *Epilobium montanum*, *Senecio ovatus*, *Veronica urticifolia*, *Petasites* sp. (*Pulmonario rubrae-Fagetum sylvaticae* (Soó 1964) Täuber 1987).

The ecological stationary no. 6 – Valea Popii (Fig. 1) was installed on schist lithosol on a flat surface, on the right bank of Popii Creek, with the GPS coordinates of N 45° 21'41.2"; E 25°16'37.9", 1079 meters altitude.

The geological substratum also consists of crystalline schists of the same type as in the previous cases, covered by soil and litter of approximately 10-12 cm thick. The rock pieces in the lithosol higher than the litter reach 10-20 cm height.

Alder phytocoenosis identified in this point vegetate on variable inclination angles surfaces (5° in the analyzed sample), on wet soils, with excessive humidity.

This is not a very stable alder forest; it has several individual older of *Alnus incana*, as we noticed branches, decomposing alder trunks, probably resulted from the flash floods or brought down by wind. The floral composition consists of specific species of the **91E0* Alluvial forests of Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) habitat** (Gafta & Mountford, 2008; Mihăilescu *et al.*, 2015).

The Phanerophytes that vegetate in the coenotic ambiance specific to this habitat are represented by megaphanerophytes (*Alnus incana*, *Picea abies*), mesophanerophytes (*Salix silesiaca*, *Sorbus aucuparia*, *Sambucus nigra*, *Corylus avellana*, *Lonicera nigra*,) and nano phanerophytes (*Spiraea chamaedryfolia*, *Rubus idaeus*) (Doniță, 2005; Gafta & Mountford, 2008), with a canopy curdling of 0.5 – 0.6. The herbal layer is very well developed (70% covering), with a *Salvia glutinosa* covering of approximately 30%. The habitat includes, in its floral composure, a core of species specific to the Alno-Ulmion alliance (*Stellaria nemorum*, *Lamium maculatum*, *Impatiens noli-tangere*, *Thalictrum aquilegifolium*, *Deschampsia*

caespitosa), together with the ones specific to Fagetalia Order (*Salvia glutinosa*, *Lamium galeobdolon*, *Epilobium montanum*, *Geranium robertianum*, *Luzula luzuloides*, *Myosotis sylvatica*, *Oxalis acetosella*, *Mycelis muralis*,) and the ones in Querco-Fagetea Class (*Corylus avellana*, *Dryopteris filix-mas*, *Athyrium filix-femina*).

The floral spectrum is completed by other taxons too, such as: *Pulmonaria rubra*, *Fragaria vesca*, *Ranunculus repens*, *Urtica dioica*, *Polystichum aculeatum*, *Prunella vulgaris*, *Cirsium waldsteinii*, *Aegopodium podagraria*, *Calamagrostis arundinacea*, *Luzula sylvatica*, *Tussilago farfara*, *Senecio ovatus*, *Galeopsis speciosa*, *Campanula abietina*, *Gentiana asclepiadea*, *Cardamine pratensis*, *Polygonatum verticillatum*,. The muscinal layer covers 5% [*Telekio speciosae-Alnetum incanae* Coldea (1986) 1990].

The ecological stationary no. 7 was placed near stationary no. 2 but at a lower altitude, in the same type of habitat which we have already described, namely **8120 Limestone and crystalline schist scree from the mountain to the alpine floor (Thlaspietea rotundifolii)** (Gafta & Mountford, 2008). The scree has a limestone origin and is placed on the foot of the slope, next to the path that leads to the Ghimbav Gorge (Fig. 1). The surface measures approximately 200 sqm.

The position of the stationary is given by the N45°22'42.9" E 25° 13'55.2" GPS coordinates, and the altitude is 802 meters.

The ecological stationary no. 8 – Cheii Valley was also placed in limestone scree, in the Colțul Surpat area (Fig. 1).

The scree is mixed with rocks that also originate in limestone. The inclination degree of the slope is 40°, southern exposure. GPS coordinates that define the central position of the stationary are: N45° 24'12.1"; E 25° 15' 08.3", with an elevation between 911 and 924 meters.

On the basis of the scree, we have identified vegetal communities that belong to habitat **8120 Limestone and crystalline schist scree from the mountain to the alpine floor (Thlaspietea rotundifolii)** (Gafta & Mountford, 2008), with specific species such as *Teucrium montanum*, *Thymus comosus*, *Galium album*. These groups vegetate on west-exposed slopes and inclination degrees of 20-30°, with an herbal covering percentage of 35%, while bryophytes only cover 10% of the analyzed surface.

The floral composure is very heterogeneous, including elements that are specific to xerophyte meadows from the Festuco-Brometea Class (*Melica ciliata*, *Pimpinella saxifraga*, *Bupleurum falcatum*, *Seseli annuum*, *Echium vulgare*), and also taxons that are specific to sub-alpine and alpine meadows from the limestone substratum from the Seslerietalia Order (*Euphrasia salisburgensis*, *Seseli libanotis*, *Scabiosa lucida*).

Other species identified within this habitat are: *Picea abies* juv., *Salix silesiaca*, *Koeleria splendens*, *Solidago virgaurea* ssp. *virgaurea*, *Gymnocarpium robertianum*, *Galium lucidum*, *Campanula cochlearifolia*, *Rhamnus saxatilis* ssp. *tinctorius*, *Scabiosa ochroleuca*, *Pinus sylvestris*, *Campanula carpatica*, *Teucrium chamaedrys*, *Cytisus nigricans*, *Spiraea chamaedryfolia*, *Acer campestre* juv., *Geranium robertianum*, *Betula pendula* (*Thymo comosi-Galietum albi* Sanda et Popescu 1999).

In the upper layer of the scree, at approximately 50-60 meters from the samples, on average and small rocks that are little stable, on small surfaces of several sqm, strong vegetal groups of *Gymnocarpium robertianum* are spreading, belonging to the **8160* habitat Medio-European calcareous scree of hill and montane levels** (Gafta & Mountford, 2008; Mihăilescu *et al.*, 2015).

These coenosis are poorly developed, featured by the presence of the following species: *Phleum montanum*, *Campanula carpatica*, *Thymus comosus*, *Galium album*, *Dianthus spiculifolius*, *Pinus sylvestris*, *Teucrium montanum* *Bupleurum falcatum*, *Salix silesiaca*, *Aster amellus* (*Gymnocarpium robertianae* Kaiser 1926).

The ecological stationary no. 9 (Fig. 2) on the Bădenilor Valley, GPS coordinates: GPS: N 45° 17' 52.4", E 25° 14' 47.9", 863 meters altitude, on the right side of the forest road (from Leota Peak towards the village), parallel to Bădenilor Valley, has a substratum of metamorphic rocks (covered with lithosol).

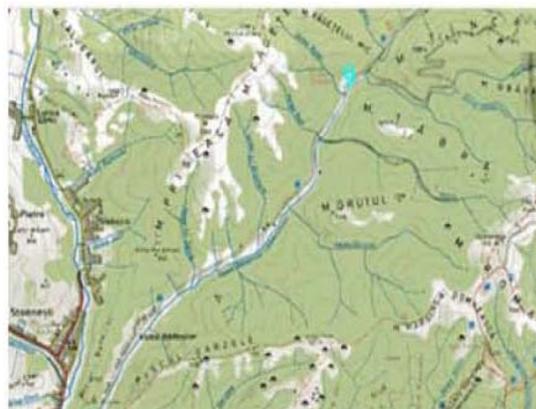


Fig. 2. Location of the ecological stationary # 9 (after http://www.carpati.org/harti_harta/harta_harti/muntii/leota-26/, modified)

This stationary is located at the margin of the vegetal coenosis that can be grouped in Habitat **91V0 Dacian Beech forests (Symphyto-Fagion)** (Gafta & Mountford, 2008). Beech tree, pine tree and spruce that belong to this habitat vegetate at altitude of more than 850 meters, on slopes with eastern exposure and 20-30° inclination degrees. Within this layer, we meet *Picea abies*, *Fagus sylvatica*, *Ulmus glabra*,

Acer pseudoplatanus, *Abies alba*, with a canopy tree of 0.8 – 0.9. Alongside the nemoral species specific to the Fagetalia order (*Rubus hirtus*, *Lamium galeobdolon*, *Euphorbia amygdaloides*, *Mycelis muralis*, *Salvia glutinosa*, *Veronica urticifolia*, *Neottia nidus-avis*, *Epilobium montanum*) and the Querco-Fagetea Class (*Corylus avellana*, *Athyrium filix-femina*, *Pulmonaria rubra*, *Dryopteris filix-mas*, *Solidago virgaurea*, *Geranium robertianum*), we also find species specific to spruce, from the Vaccinio-Piceetalia Order (*Pyrola rotundifolia*, *Oxalis acetosella*, *Sorbus aucuparia*, *Luzula luzuloides*). Other identified species: *Fragaria vesca*, *Carpinus betulus*, *Veronica officinalis*, *Rubus idaeus*, *Spiraea chamaedryfolia*, *Campanula persicifolia*, *Glechoma hederacea*, *Senecio ovatus*, *Urtica dioica*, *Polypodium vulgare*, *Sedum maximum*, *Sambucus nigra*, *Equisetum telmateia*, *Asplenium trichomanes*, *Stachys sylvatica*. The muscinal stratum has a covering of 25-30%.

CONCLUSIONS

The phytocoenosis type of habitat featured by the **91V0 association Dacian Beech forests (Symphyto-Fagion)** is the most frequent, being the most versatile, growing both on limestone substratum (stationeries 3, 4), as well as on schist substratum (stationeries 1, 5, 9). Moreover, this type of habitat covers both areas with lithosoil (stationeries 1, 4, 9) and scree: stationeries 3 and 5.

The type of habitat **8120 featured by the vegetal association calcareous and calcschist screes of the montane to alpine levels (Thlaspietia rotundifolii)** is present on the areas that we have only studied on limestone substratum and only covering scree (MSS) in stationeries 2, 7 and 8.

Medio-European calcareous scree of hill and montane levels 8160* type of habitat (Gafta & Mountford, 2008; Mihăilescu et al., 2015) only appears in one of the studied stationeries (stationary 8, on limestone MSS) at its superior margin, where scree is already fixed by the interclastic clay, formed based on the kaolinization processes which are stronger here reported to the rest of the researched area.

Alluvial forests with. *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, *Alnion incanae*, *Salicion albae*) 91E0 habitat was also identified in a single location (stationary 6, on schist lithosoil) where the environment is wetter and the area is sometimes floodable, compared to stationary 1 – Berbece's Creek, also on schist lithosol, but placed in a non-floodable area.

Considering that we have only analyzed a relatively small area of the North-Western sector of Leaota Mountains and we have found 4 types of habitats and that they condition the presence of various fauna species (especially invertebrates), we can conclude that there are premises that future

research would identify other types of habitats and confirm the presence of a large biodiversity in this geographical space, at least regarding the invertebrates.

ABSTRACT

In this paper are described several types of habitats installed on two different types of geological substrate, crystalline and limestone shale, all of which are located in the Leaota Massif, in the Southern Carpathian, Romania. One of this type of habitat seems to be indifferent to the type of the geological substrate, being encountered on both limestones and crystalline shale, both in lithosol and stabilized or semistabilized scree. Other types of habitats are more selective, more demanding than the geological substrate.

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