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CONTRIBUTIONS TO THE STUDY OF FORESTS VEGETATION FROM THE SUPERIOR MOUNTAIN LEVEL OF HĂŞMAŞUL MARE MASSIF (EASTERN CARPATHIANS)

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Abstract: The ecological conditions specific to the researched territory have favoured installation of a wooden vegetation represented by mountain beech forests, beech and resinous mixed forests and pure spruce-fir forests. Locally, on limited areas and superficial soils, relict pine phytocoenosis have been identified. Two plant communities from *Vaccinio – Piceetea* Br.-Bl. 1939 and *Erico – Pinetea* Horv. 1959 classes are presented and analysed in this paper from the bioforms, floristic elements and ecological requests perspectives.

Key words: vegetation, Hăşmaşul Mare.

Introduction

Besides Cheile Bicazului, Lacu Roşu and Cheile Şugăului, Hăşmaşul Mare Massif represents a territory integrated in structure of the national park having the same name, region presenting a great geological and biological importance. It is situated in the central part of the Eastern Carpathians and is constituted in its most part from mezozoic calcareous rocks which are permanently attacked by an active erosion process. This mountain massif presents middle altitudes (1792 – Hăşmaşul Mare peak, 1774 – Hăşmaşul Negru peak, 1587 m – Piatra Singuratică peak) and following ecological conditions (specific to middle and superior mountain vegetation levels): brown eu – mezobazic and brown acid soils, average values of atmospheric precipitations by 800 – 1000 mm/m^2/year and average values of temperature between 4 – 7ºC. All these abiotic factors have contributed to the installation of a wooden vegetation represented by:

- mountain beech forests and mixed beech with fir and spruce-fir forests from **Querco – Fagetea** vegetation class (Symphyto – Fagion alliance): *Symphyto cordati – Fagetum* Vida 1959, *Leucanthemo waldsteinii – Fagetum* (Soó 1964) Tauber 1987 and *Pulmonario rubrae – Fagetum* (Soó 1964) Tauber 1987. Also, from the same vegetation class (Alno – Ulmion alliance) mezohygrophilous phytocoenosis belonging to *Telekio speciosae – Alnetum incanae* Coldea (1986) 1990 have been identified;
- coniferous forests from **Vaccinio – Piceetea** class represented by the most spread association: *Hieracio transsilvanici – Piceetum* Pawl. Et Br.-Bl. 1939;
- relict phytocoenosis edified by Pinus sylvestris from **Erico – Pinetea** class, installed on smaller areas and superficial soils: *Seslerio rigidae – Pinetum sylvestris* (Csürös et Sparchez 1963) Csürös et al. 1988.

Material and methods

The phytosociological study has been made using the classic methods specific to Central Europe Phytosociological School, by realizing phytocoenological releves in field

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(using Braun – Blanquet scale having the abundance – dominance indices from + to 5) and then their ordering and grouping in vegetal associations on the basis of characteristic, dominant and differentiate species [1], [3], [7]. Thus, these two plant communities are subordinated to the next superior coenotaxa:

VACCINIO – PICEETEA Br.-Bl. 1939

VACCINIO – PICEETALIA Br.-Bl. 1939

Piceion abietis Pawl. in Pawl. et al. 1928

Hieracio transsilvanici – Piceetum Pawl. et Br.-Bl. 1939

ERICO-PINETEA Horv. 1959

ERICO-PINETALIA Horv. 1959

Seslerio rigidae – Pinion Coldea 1991

Seslerio rigidae – Pinetum sylvestris (Csűrös et Spârchez 1963) Csűrös et al. 1988

The biological forms and floristic elements for each species are those that have been given by V. Ciocârlan [2] and the values for ecological indices (L–light, T–temperature, C–continentality, U–humidity, R–soil pH and N–the nitrogen content of soil) have been established by H. Ellenberg [4].

Results and discussions

Table nr. 1: *Hieracio transsilvanici – Piceetum* Pawl. et Br.-Bl. 1939

Nr. of relevé	1	2	3	4	5	6	7	8	9	10	11	12
Plot area (m^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Altitude (m)	920	940	890	1050	1075	1110	990	920	970	1240	1160	1150
Aspect	E	NE	NE	N	SV	N	NE	E	E	NE	NV	N
Slope (°)	15	10	15	20	15	10	5	15	25	20	15	5
Trees height (m)	32	35	30	28	35	35	35	30	27	25	30	35
Trees diameter (cm)	15-75	10-85	10-80	20-70	12-90	10-85	15-90	19-75	15-70	10-65	15-80	9-80
Trees stratum covering (%)	85	80	90	85	90	70	80	75	85	95	75	70
Schrubs and regeneration stratum covering (%)	5	3	5	3	30	25	15	30	5	3	3	12
Herbs stratum covering (%)	25	20	15	20	35	15	7	15	20	15	5	10
Car. ass.												
Hieracium transsilvanicum	+	+	+	+	-	-	-	+	-	+	+	+
Picea abies	4	4	5	4	4	3	4	4	4	5	4	3
Picea abies juv.	+	+	-	+	1	1	+	+	-	+	+	1
Piceion et Piceetalia excelsae												
Dryopteris dilatata	-	+	-	+	-	+	-	-	+	-	+	-
Luzula sylvatica	1	+	-	-	-	-	+	-	1	2	+	-
Melampyrum sylvaticum	+	+	1	-	-	-	-	+	-	-	+	+
Soldanella hungarica	-	-	+	-	-	-	-	-	+	-	-	-
Calamagrostis villosa	-	-	-	-	-	-	+	-	-	-	-	+
Luzula luzuloides	-	-	+	-	+	+	-	-	+	+	-	+
Melampyrum saxosum	-	-	-	+	-	-	-	-	-	-	-	-
Athyrium distentifolium	-	-	+	-	-	-	-	-	-	-	-	-
Deschampsia flexuosa	-	-	-	-	-	-	-	-	-	-	+	-
Clematis alpina	-	-	+	-	-	-	-	-	-	-	-	-
Lonicera coerule	-	-	-	-	-	+	-	-	-	-	-	-
Calamagrostis arundinacea	1	-	+	-	-	+	-	+	1	+	-	-

Ranunculus carpaticus	-	+	-	+	-	-	-	-	-	+	-	-
Abieti – Piceion et Athyrio – Piceetalia												
Athyrium filix-femina	-	+	+	-	+	-	-	+	+	-	-	-
Abies alba	+	1	+	+	+	1	1	+	1	-	+	+
Abies alba juv.	+	+	+	-	+	-	-	-	+	+	-	+
Rosa pendulina	+	-	+	-	+	-	-	+	-	-	+	+
Valeriana tripteris	-	+	+	-	-	-	-	-	+	-	-	+
Fragaria vesca	-	+	-	+	-	+	-	-	-	+	-	+
Vaccinio – Piceetea												
Sorbus aucuparia	+	-	+	-	-	-	+	-	+	+	-	-
Sorbus aucuparia juv.	-	-	+	-	-	-	-	-	+	-	-	-
Pinus sylvestris	-	-	+	-	-	-	-	+	-	-	-	-
Lycopodium selago	+	+	-	+	+	+	-	-	+	+	-	-
Oxalis acetosella	1	2	1	2	+	+	+	+	1	+	+	+
Lycopodium annotinum	-	+	-	-	-	-	-	+	-	-	-	-
Pyrola rotundifolia	-	-	-	-	+	-	-	+	-	+	-	-
Vaccinium myrtillus	-	+	+	-	3	2	1	2	-	+	+	-
Vaccinium vitis-idaea	-	-	-	-	-	+	+	+	-	+	-	-
Orthilia secunda	-	+	-	-	-	+	-	-	-	-	-	-
Campanula abietina	+	+	-	-	-	+	-	+	+	-	+	-
Homogyne alpina	-	+	+	+	+	-	-	+	-	+	-	+
Moneses uniflora	+	-	-	+	-	-	-	+	-	-	-	-
Corallorhiza trifida	+	-	-	-	-	-	-	-	-	-	-	+
Listera cordata	+	-	+	-	-	-	+	-	-	+	-	-
Streptopus amplexifolius	-	-	-	-	-	+	-	-	-	-	-	-
Fagetalia sylvaticae et Querco - Fagetea												
Fagus sylvatica	1	-	-	1	+	1	+	+	-	-	+	1
Fagus sylvatica juv.	+	-	-	-	-	+	+	-	+	-	-	+
Acer pseudoplatanus	-	+	-	-	-	+	-	-	+	-	-	+
Galium odoratum	+	+	-	-	-	-	-	+	-	-	-	+
Mercurialis perennis	-	-	-	+	-	-	-	-	-	-	-	-
Gymnocarpium dryopteris	-	-	-	+	-	-	-	-	-	-	-	-
Anemone ranunculoides	-	+	-	+	-	-	-	-	-	-	-	-
Euphorbia amygdaloides	+	+	-	-	+	-	+	+	-	-	-	+
Maianthemum bifolium	-	-	+	-	-	-	-	-	+	-	-	-
Lathyrus vernus	+	-	-	+	-	-	-	-	-	-	-	-
Dryopteris filix-mas	+	-	+	+	+	-	-	+	+	-	+	-
Hepatica nobilis	+	+	-	-	+	-	-	-	-	-	-	+
Corylus avellana	-	-	+	-	-	-	-	-	-	-	-	+
Pulmonaria rubra	+	-	+	+	+	-	+	-	-	+	-	-
Primula elatior ssp. leucophyla	-	-	-	-	+	-	-	-	-	-	-	-
Dentaria glandulosa	-	-	-	+	-	-	-	+	-	-	-	+
Symphytum cordatum	-	+	-	+	-	-	-	-	+	-	-	+
Polystichum aculeatum	+	-	-	-	-	-	-	-	-	+	-	-
Elyno – Seslerietea												
Juniperus sabina	-	-	+	-	-	-	-	-	-	-	-	-
Asplenietea trichomanis												
Silene nutans ssp. dubia	-	-	+	-	-	-	-	-	-	-	+	-
Hieracium bifidum	-	+	-	-	-	-	-	-	-	-	-	-
Variae syntaxa												
Alnus incana	-	-	+	-	-	-	-	-	-	-	-	-
Betula pendula	+	-	+	-	-	-	-	-	-	+	-	-
Polygonatum verticillatum	-	-	+	-	-	-	+	+	-	-	+	-
Veronica officinalis	-	-	+	-	-	+	+	-	-	+	-	-

Veronica urticifolia	-	+	-	+	+	-	+	-	+	-	-	+
Rubus idaeus	-	+	-	-	+	-	+	-	+	-	+	-
Sambucus racemosa	+	-	-	-	-	+	-	-	-	+	-	-
Euphorbia carniolica	+	-	+	+	-	-	-	-	+	-	-	+
Urtica dioica	+	-	-	-	-	+	-	-	-	-	-	-
Gentiana asclepiadea	+	+	-	+	-	+	-	-	-	+	-	+
Hieracium pojoritense	+	-	-	-	+	-	-	-	-	-	-	-
Ajuga reptans	+	+	-	-	-	-	-	-	+	+	-	-
Impatiens noli-tangere	-	-	-	-	-	-	-	-	-	-	-	+
Aconitum moldavicum	-	+	-	-	-	-	-	-	-	-	-	-

Place and date of relevées: Rel. 1, 2, 4, 7, 11 = Cheile Bicazului: 27-30.07.2005; Rel. 3, 8 = Cheile Şugăului: 27.07.2005; Rel. 10 = Suhardul Mic: 29.07.2005; Rel. 5, 6, 9, 12 = Lacu Roşu: 27-28. 07.2005.

Hieracio transsilvanici – Piceetum association (**Table nr. 1**) includes the spruce-fir forests, wide spread in the researched area, covering mountains versants with varied slopes and expositions, between 900 and 1400 m altitude. The trees stratum is dominated by *Picea abies*, species that realize an average covering degree of 65-85%, reach the 30-35 m height and trunks diameter between 10 and 90 cm. In some phytocoenosis, *Abies alba* (fir) can be present (without becoming co-dominant or sub-dominant) and also *Fagus sylvatica, Sorbus aucuparia, Acer pseudoplatanus, Betula pendula* can be present. Shrubs stratum flora is less rich in plants species, reduced abundance – dominance indices presenting *Sambucus racemosa, Rubus idaeus, Vaccinium myrtillus* etc, while in the herbs stratum *Oxalis acetosella, Hieracium transsilvanicum, Campanula abietina, Gentiana asclepiadea* and other species are present. Besides the characteristic species to the association, alliance, order and *Vaccinio – Piceetea* vegetation class, in the studied areas are also present representative species to *Querco – Fagetea* class (*Gymnocarpium dryopteris, Maianthemum bifolium, Euphorbia amygdaloides, Dryopteris filix-mas, Hepatica nobilis* etc.) or, rarely, to *Elyno-Seslerietea* class (*Juniperus sabina*). The floristic elements spectrum points out the fact that in this vegetal association structure prevails the central – european (mountain) elements (32%) and circumpolar elements (25%) followed by the eurasiatic (21%) and endemic (11%) elements. The life-forms spectrum presents the preponderance of the hemicryptophyte species (47%) followed by phanerophyte (25%) and geophyte (15%) species. Ecological indices spectrum (**Fig. 1**) reveals the presence and preponderance of shadow species, characteristic to a relative cold mountain climate, preferring moist, acid and relative poor in mineral N soils. In some cases, significant values can also present the indifferent species.

Fig. 1 Ecological indices spectrum of *Hieracio transsilvanici - Piceetum* association

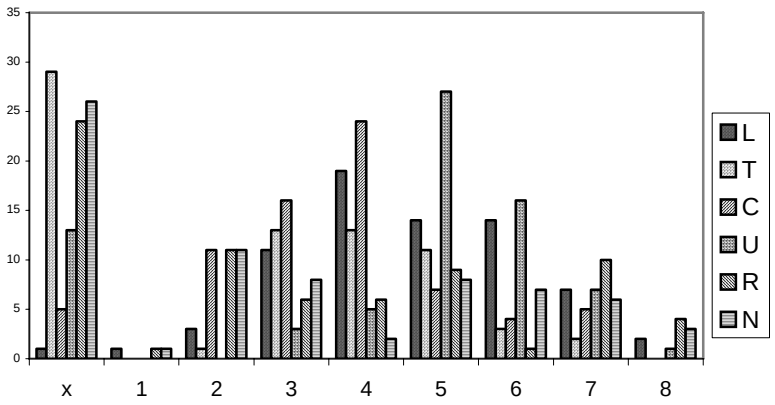


Table nr. 2: *Seslerio rigidae – Pinetum sylvestris* (Csűrös et Spârchez 1963) Csűrös et al. 1988

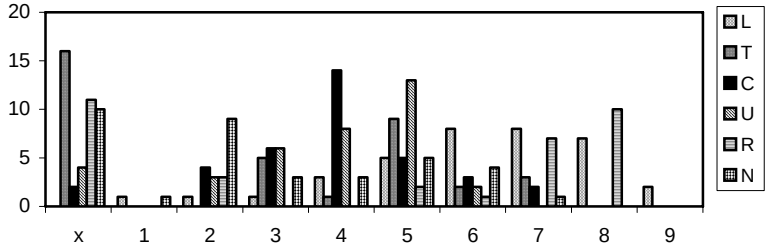
Nr. of relevé	1	2	3	4	5
Altitude (m.s.m.)	1325	1286	1155	1260	1200
Aspect	S	S	SV	SV	SE
Slope (º)	20	35	25	30	20
Herbs stratum covering (%)	30	50	35	40	30
Shrubs stratum covering (%)	5	5	5	10	5
Tree stratum covering (%)	65	55	65	65	70
Plot area	100	100	100	100	100
Car. ass.					
Sesleria rigida	3	2	1	+	+
Pinus sylvestris	3	2	3	3	3
Seslerio rigidae – Pinion					
Juniperus communis	1	-	+	1	+
Cotoneaster integerrimus	+	+	+	+	-
Erico – Pinetalia					
Iris ruthenica	+	+	+	-	-
Cirsium erisithales	+	-	-	+	+
Vaccinio – Piceetea et Vaccinio – Piceetalia					
Picea abies	1	3	1	2	2
Hieracium transsilvanicum	+	+	-	+	-
Vaccinium vitis-idaea	+	-	+	+	-
Orthilia secunda	+	+	-	+	+
Oxalis acetosella	+	-	+	+	-
Melampyrum sylvaticum	+	+	+	+	-
Fagetalia sylvaticae					
Fagus sylvatica (juv.)	+	-	-	+	-
Daphne mezereum	+	+	-	+	+
Carex sylvatica	+	-	-	+	-
Calamagrostis arundinacea	+	1	1	+	1
Stipio pulcherrime – Festucetalia pallentis et Seslerio – Festucion pallentis					
Festuca pallens	1	-	+	-	+
Erysimum odoratum	-	+	-	-	+
Jovibarba heuffelii	-	+	-	-	-
Aliae					
Laserpitium krapfii	+	-	-	-	+
Carex montana	+	-	-	+	-
Bupleurum falcatum	+	+	+	+	+
Scabiosa columbaria	+	+	-	-	+
Carduus glaucinus	+	+	+	+	-
Ranunculus montanus ssp. pseudomontanus	+	+	-	-	+
Daphne cneorum	+	-	+	-	-
Cruciata glabra	-	+	+	+	-
Seseli libanotis	+	+	+	-	+
Campanula carpatica	-	+	-	+	+
Fragaria vesca	+	+	+	-	-
Phyteuma orbiculare	+	+	-	-	+
Silene nutans ssp. dubia	-	+	-	-	-
Thesium dollineri	+	-	-	-	-
Valeriana tripteris	-	+	+	+	+
Gnaphalium sylvaticum	-	+	-	-	-
Galium flavescens	+	-	-	-	-
Laserpitium latifolium	-	+	+	+	-
Pimpinella saxifraga	+	-	-	-	-

Place and date of relevées: Rel. 1-5 = Suhardul Mic: 29.07.2005

Seslerio rigidae – Pinetum sylvestris association (**Table nr. 2**) includes relict *Pinus sylvestris* phytocoenosis installed on calcareous versants (25-30º), on poor and superficial soils having southern and south – western expositions of the Suhardul Mic Mountain (situated in Hăşmaşul Mare – Lacu Roşu – Cheile Bicazului National Park territory). The general covering degree of the vegetation varies between 75 – 85%. The trees stratum is edified by *Pinus sylvestris*, species presenting an average covering degree (about 50 %). Besides this, *Picea abies* species can also be met (sometimes realizing a

significant covering). The shrubs stratum is less developed, reduced values of abundance – dominance indices presenting *Juniperus communis, Cotoneaster integerrimus, Vaccinium vitis-idaea, Daphne mezereum* and *Daphne cneorum*. The herbs stratum includes the characteristic species *Sesleria rigida* and also *Iris ruthenica* and *Cirsium erisithales* (characteristic to superior coenotaxa). As a consequence of the contact of these pine phytocoenosis with the spruce-fir forests, the floristic structure of this association contains also species from *Vaccinio – Piceetea* class (*Hieracium transsilvanicum, Orthilia secunda, Oxalis acetosella, Melampyrum sylvaticum* etc.), *Querco – Fagetea* (*Daphne mezereum, Carex sylvatica, Calamagrostis arundinacea* etc.) and even *Festuco – Brometea* (*Festuca pallens, Erysimum odoratum, Jovibarba heuffelii*). In the floristic composition the hemicryptophytes (65%) are prevalent, yet also the wooden species are significantly represented – 23% phanerophytes and 9% chamaephytes. The floristic elements spectrum reveals the preponderance of eurasiatic (29%) and central - european (26%) elements but also carpatho – balcanic (24%) are well represented. Ecological indices spectrum (**Fig. 2**) reflects the increased proportion of heliosciophytes species, most of them indifferent to temperature, preferring moderate moist and slight alkaline soils.

Fig. 2 Ecological indices spectrum of S*eslerio rigidae - Pinetum sylvestris* association



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