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PHYTOCOENOLOGIC RESEARCH REGARDING BEECH FORESTS ON ROCKS IN THE NORTHERN PART OF BIHOR MOUNTAINS

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ABSTRACT. The paper presents phytocoenologic, ecological and eco-protective research done in the northern part of Bihor Mountains, among beech forests growing on calcareous rocks with rabbit tail (*Sesleria rigida*). The phytocoenoses in the *Seslerio rigidae – Fagetum* Soó et Vida 1963 association which is described in this paper have been identified on a few rocky ridges, at altitudes between 700 – 1400 m. The 16 phytocoenologic surveys that were done in the field and are presented in the table comprise 193 species. Among these, there is a series of endemic species (*Silene nutans* ssp. *dubia*, *Edraianthus graminifolius*, *Thymus comosus*), Carpathian endemisms (*Cardamine glanduligera*, *Primula elatior* ssp. *leucophylla*, *Symphytum cordatum*, *Phyteuma tetramerum*), rare species (*Carex brachystachys*, *Centaurea reichenbachii*, *Iris aphylla*, *Teucrium montanum*, *Veronica bachofenii*, *Sorbus graeca*) as well as vulnerable species (*Campanula rotundifolia* ssp. *kladniana*, *Dianthus kitaibelii* ssp. *spiculifolius*, *Sempervivum marmoreum*) that are found on the Red List.

Keywords: Seslerio rigidae – Fagetum, bioforms, floristic elements, ecological factors, Red List

INTRODUCTION

Bihor Mountains represent the central mountaineous knot of the Apuseni Mountains (Oancea et al., 1987). With altitudes between 800 m and 1700 m, these mountains show intense fragmentation on a complicated assembly of limestone, karstifiable rocks, surrounded at their end by non-karstifiable ones (slates, purple shale rocks, conglomerates). The climate in Bihor Mountains is generally moist and cold. The annual average air temperature is of +2ºC in the northern and southern massifs and of +4ºC in the central limestone platform. In January, the average air temperature is of -7ºC in the high mountainsand -3ºC on valleys, while in July the average temperatures recorded are of 10ºC. The dominating wind blows from the west, bringing along rainfalls and a large number of cloudy days. The annual average precipitation rate in the high areas of Bihor Mountains is over 1400 mm.

The calcareous crags that appear mostly at the edge of plateaus and along gorges have a specific vegetation, typical for rocky areas, on parts that are steep or very steep, namely over 70º. At their margin, on those parts of ridges and crests that are less steep, on widened ledges, at altitudes of 700 – 1400 m, trees appear – both deciduous and coniferous – with a consistency of 0.2 – 0.7.

The phytocoenoses of the Seslerio rigidae – Fagetum Soó et Vida 1963 association have bee identified on several rocky, limestone ridges, located on Valea Galbenei, Piatra Boghii, Pietrele Negre, Valea Ordâncuşei, Someşul Cald Gorge, at altitudes between 700 – 1400 m, on steep slopes (25-60º), with variable exposure and skeletal soils, that have a mildly acid to neutre reaction and a reduced content of humus, of the mull moder type. The annual average temperatures do not surpass 6ºC. The stationary conditions allow for the development, in extreme conditions, of the small beech forests which rarely present a thickening of the canopy higher than 0.4 and which expand over the rocks populated by Sesleria rigida. In the neighbourhood of the spruce trees, the soil becomes more acid, thus allowing acidophilic species from **VACCINIO – PICEETEA** class to appear The trees, aged between 80 – 100 years, have crooked shapes and are strongly branched from the very bottom.

MATERIAL AND METHODS

Taking into consideration works of reference in specialized literature (Boşcaiu et al., 1982, Sanda et al., 2008), the association Seslerio rigidae – Fagetum Soó et Vida 1963 has been integrated in the sub-alliance of calcophile Carpathian-Dacian beech forests, in the following coeno-system:

QUERCO – FAGETEA Br.-Bl. et Vlieger in Vlieger em. Borhidi 1996

Fagetalia sylvaticae Pawłowski in Pawłowski et al. 1928

Symphyto cordati – Fagion Vida 1959

Epipactido – Fagenion Boşcaiu et al.1982

During the field observations and research, we have used methods of phytosociological research of the Central-European School, based on the principles and methodologies ellaborated by Braun-Blanquet (1928) and adapted by Borza (1934), Borza et Boşcaiu (1965) to the particularities of the vegetation layer in our country. The phytocoenological surveys done during the 8 field trips organized between May 2010 – August 2011 comprised

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sample surfaces that were homogenous from a floristic and physionomic point of view, which were chosen in the fragments characteristic to the researched phytocoenoses, varying in size from 400 to 800 sq.m.

The qualitative appreciation of each species' participation in the description of the associations has been done by means of the abundance-dominance index (AD), by the Braun-Blanquet et Pavillard (1928) evaluation system, completed by Tüxen et Ellenberg (1937). The association table ellaborated contains information regarding the species that make the floristic composition of the association, the bioform, the floristic element, ecological indexes (humidity, temperature, the chemical soil reaction), the karyologic index, the recorded number of the survey, the altitude (m.s.m.), the exposure, inclination (degrees), the trees' consistency (%), the grassy layer (%), the moss layer (%), the surface (sq.m.), the place and date of the surveying. The constancy (K) and the average abundance-dominance (ADm) were calculated and introduced at the end of the table. In order to bring the ecological study of the association to a whole, we have represented graphically the distribution of biological forms, of floristic elements, of ecologic factors and karyologic indexes.

RESULTS AND DISSCUSIONS

The Seslerio rigidae – Fagetum Soó et Vida 1963 association is little researched and known in Romania (Sanda et al., 2007, Täuber, 1987).

Out of the total 193 species surveyed in the 16 phytocoenologic investigations (table 1), 63 phytotaxons (32.6%) belong to sub-alliances, alliances and orders in the QUERCO – FAGETEA class, proving the integration of the association in this class. The large number of transgressive species is explained by the specific habitat conditions. Thus, species from the ASPLENIETEA TRICHOMANIS class found the best conditions for development on calcareous rocks with cracks and here we can mention Asplenium trichomanes ssp. quadrivalens, Asplenium ruta-muraria, Sempervivum soboliferum, whose constancy is over III. On the gravel and debris that result from the rocks' erosion, as well as on the grassy ledges and narrow platforms of these crags we find transgressive species from the classes THLASPIETEA ROTUNDIFOLII and SESLERIETEA ALBICANTIS, among which those with higher constancy are: Galium album, Moehringia muscosa, Campanula rotundifolia ssp.kladniana (vulnerable species), Thymus comosus. In the herbaceous layer there is a series of xero-mesophile species from the FESTUCO – BROMETEA class and mesophile species from the MOLINIO – ARRHENATHERETEA class.

The phytocoenoses in the association shelter a series of endemic species (Silene nutans ssp. dubia, Edraianthus graminifolius), Carpathian endemisms (Cardamine glanduligera, Primula elatior ssp. leucophylla, Symphytum cordatum), rare species (Carex brachystachys, Teucrium montanum, Veronica bachofenii) as well as vulnerable species (Campanula rotundifolia ssp.kladniana, Dianthus kitaibelii ssp. spiculifolius, Sempervivum marmoreum), found on the Red List (Dihoru, Negrean, 2009).

When analysing the diagram of ecological factors (Fig. 1), we notice the dominance of mesophile (U3-3,5 = 43,5%) and xero-mesophile (U2-2,5 = 37,3%) plant species, which proves that these phytocoenoses are adapted to the environment which has a level of humidity inclining from sufficient to scarce. Regarding the temperature, the species behaviour shows the dominance of micro-mesothermal ones (T3-3,5 = 48,2%) and microthermal ones (T2-2,5 = 26,9%), which indicates an average annual temperature specific to forests and rocky parts of mountainous areas. With regard to the chemical soil reaction, the most frequent species are weak acidic-neutrophile species (R4-4,5 = 39,4%) and acidic-neutrophile ones (R3-3,5 = 28%).

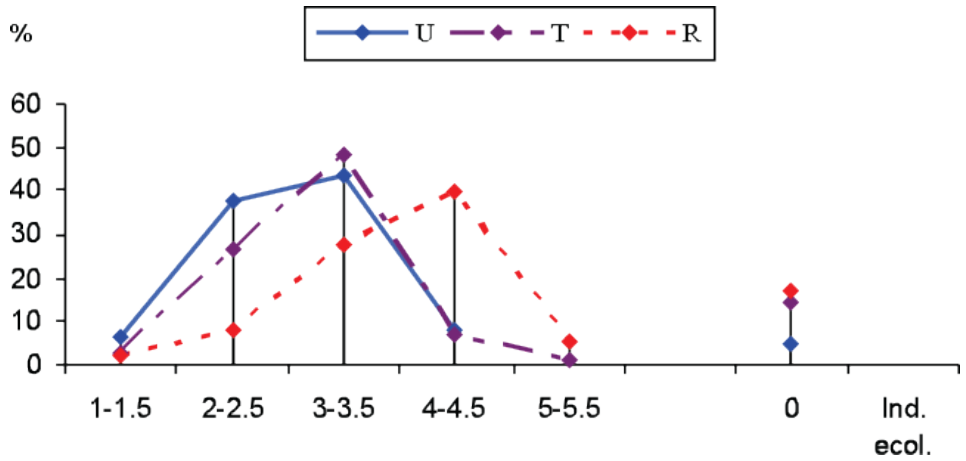

Fig. 1 Diagram of the ecological factors for the phytocoenoses in the ass.*Seslerio rigidae – Fagetum* Soó et Vida 1963

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When analysing the life form spectrum (Fig. 2), we observe that hemicryptophyte (H = 57%) and phanerophyte (Ph = 17,1%) are predominant, being followed by geophytes (G = 10,9%), camephytes (Ch = 8,3%) and terophytes (Th-TH = 6,7%).

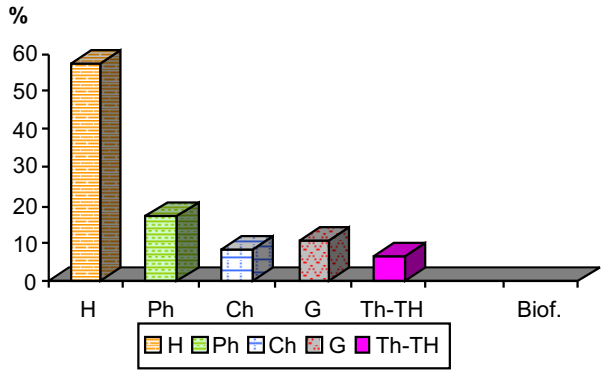

Fig.2 Spectrum of life forms for the phytocoenoses in the ass. *Seslerio rigidae – Fagetum Soó* et Vida 1963

The spectrum of floristic elements (Fig. 3) shows a good participation of Eurasian species (Eua = 26,4%), European species (E = 20,7%) as well as Central-European ones (Ec = 17,1%), followed by Carpathian (Carp = 11,3%) and circumpolar (Cp = 8,2%), Mediterranean Pontic (M-Pont = 5,6%), Alpine-Carpathian (Alp-Carp = 4,6%) and cosmopolitan species (Cosm = 4,1%). Atlantic Mediterranean and Dacian species are ittle represented - 1% each.

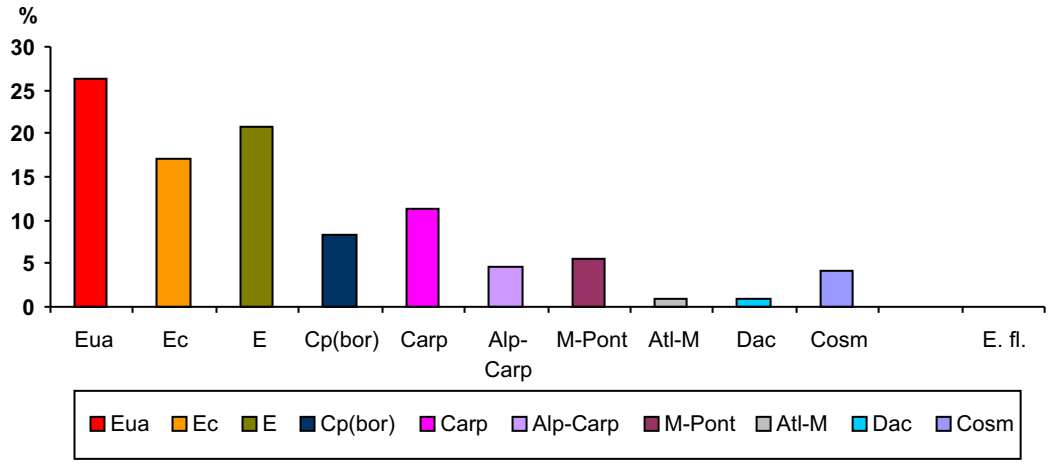

Fig.2 Spectrum of the floristic elements for the phytoceonoses in the ass. *Seslerio rigidae – Fagetum Soó* et Vida 1963

The analysis of the association from a karyologic point of view (Fig. 3) shows a predominance of polyploid species (P = 40,4%) as compared to diploid ones (D = 38,9%), the karyotype being unknown for 3.6% of the species. The diploidy index value is I = 0,96.

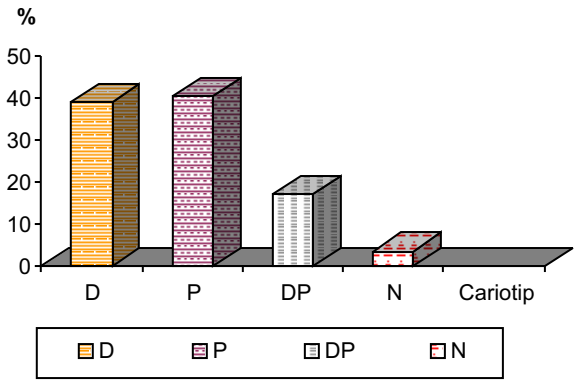

Fig. 3 Karyologic spectrum for the phytocoenoses in the ass. Seslerio rigidae – Fagetum Soó et Vida 1963

CONCLUSIONS

The phytocoenoses of the Seslerio rigidae – Fagetum Soó et Vida 1963 association are developing in the northern part of Bihor Mountains, on calcareous rocky terrain situated at altitudes between 650-1400 m, with varied exposure. According to Boşcaiu et al., 1982, the association has a low cenotic coagulation; only 32.6% of the taxons identified within these phytocoenoses belong to the QUERCO – FAGETEA class.

The phytocoenoses of the association Seslerio rigidae - Fagetum Soo et Vida 1963 are dominated by hemicryptophyte (H = 57%), highlighting the influence of extreme environmental conditions with excessively low temperatures during winter and high in the summer, expression of a cold microclimate, wind and the dry of the rocky slopes, very inclined.

The floristic elements spectrum reveals for the beech forest mixed with coniferous having the characteristic species Sesleria rigida, the highest percentage (28.8%) for the European and Central European species, whose genesis is closely linked the ridge of the Carpathians, including Apuseni Mountains. The Eurasian elements, accounting for 26.4%, also underline the good cohabitation of these plants with the European and Central Europe species. In a relatively small percentage (11.3%), in the association phytocoenoses the Carpathian species occur, some of which are endemic, as well as Alpine-Carpathian species (4.6%), whose genesis is closely related to high altitudes of the Carpathian Mountains.

The phytocoenoses of the association Seslerio rigidae - Soo et Vida Fagetum 1963 have a high conservation value, given total number of species (193) gathered in the association table. A scientific importance have Carpathian endemic species identified (3 taxa), endemic species (2 taxa), rare species (3 taxa), vulnerable species (3 taxa), which are on the Red List.

Regarding the protection and conservation of natural forest ecosystems including the rare association Seslerio rigidae - Soo et Vida Fagetum 1963, endangered, the protection and management measures are provided in the Apuseni Natural Park Management Plan.

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