PHYTOCOENOLOGICAL RESEARCH CONCERNING THE FORESTS OF OAŞ MOUNTAINS (NORTH-WESTERN ROMANIA)

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Abstract. This paper aims to describe abaut the presence of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, found in the studied area. In the Oas Mountains, it was located on the slopes of the Pustiu Mountain of the Turulung Vii village and it comprises 57 species.

The scientific newness lies in approaching a habitat that wasn't sufficiently explored and the results achieved, which involved the identification and the characterization of a association, which is now reported for the first time in the Oas Mountains.

The association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957 was analyzed by us in terms of floristic composition, life forms spectrum, floristic elements and ecological indices.

Keywords: phytocoenoses, association, life forms, floristic elements, ecological indexes, Oaş Mountains.

INTRODUCTION

The Pustiu Mountain is part of the chain Oaş Mountains, west facing, to the Oaş Mountains contact with Somes Plain. Generally it has a rather steep slopes and dominant soils are cambisols, represented by the brown acid soils and andosoils.

The studied region have a temperate continental climate with mild winters (the average temperature varies between -3°C to 3°C) and warm summers (temperature average is 15°C - 20°C). Annual precipitation averages vary between 450-600 mm. The area is arid, with xerothermophylous species, the springs and streams have a very low water flow, that dry up in summer.

Figure 1. Association *Tilio argeteae-Quercetum petraeae-cerris* Soó 1957, from the Pustiu Mountain (Oaş Mountains)

Besides the plant communities described in the literature of specialty in the Oaş Mountains mainly by Ratiu et Gergely (1978, 1979) [21, 22] and Karácsony (1995) [14], we have identified and described a association in the research area, namely the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, which belongs to class *Quercetea pubescenti- petraeae* (Oberdofer 1948) Jakucs 1960.

In Romania, this association has been described in: the Western Carpathians [9, 12,], the Western Hills [15] and in the south of the country [4, 10, 16, 17, 23, 25, 26, 28].

MATERIALS AND METHODS

The identification of the phytocoenoses of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, (Fig. 1), from the Pustiu Mountain was based on field investigations during the years 2010 - 2011. The nomenclature of taxa was done according to Ciocârlan (2009) [7]. In the study of vegetation we used phytocoenologic research methods of Central European school based on the principles and methods elaborated by Braun-Blanquet (1964) [5] and adapted by Borza and Boşcaiu (1965) [3], to the particularities of the vegetal carpet in our country.

The phytocoenologic table of association was structured according to the methodology designed by Braun-Blanquet (1964) [5] and improved by Ellenberg (1974) [11].

The association table (Table 1) contains information on species within the floristic composition of the association, as life forms, floristic elements, ecological indices (moisture (U), temperature (T), chemical reaction of the soil (R)), serial number of the survey, altitude (m.s.m), exposure, inclination (degrees), the consistency of forest stands (%), herbaceous layer cover (%), surface (m^2). A quantitative assessment of the participation of each plant species to describe the association was made with the index of abundance-dominance (AD) after the evaluation system of Braun-Blanquet and Pavillard (1928) [6].

The methodology we used for positioning the association, into the superior coeno-taxonomic units, namely suballiance, alliance, order, class, took into

consideration the traditional ecological-floristic systems developed by Tüxen (1955) [29], Braun-Blanquet (1964) [5], Borza and Boşcaiu (1965) [3], Soó (1980) [27], as well as the more recent works by researchers such as Mucina *et al.* (1993) [18], Pott (1995) [19], Weber *et. al.* (2000) [30], Sanda *et. al* (2008) [24]. In order to position the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957 (analysed by us in this paper) into the superior coeno-taxonomic units we referred to Sanda *et al.* (2008) [24].

For completion of the ecological study of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, we have represented graphically the distribution of life forms, floristic elements and ecological indices.

RESULTS

The association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, was found on the Pustiu Mountain, the only place in the Oaş Mountains, in the Turulung Vii village. The phytocoenoses of the association were found on slopes with exposition west, south-west and south-east, with a drop of 20°- 25°, at altitudes of 200-210 m. Specimens of *Tilia tomentosa* were found in other places of Oaş Mountains area, but not so much to make an association with holm-cerris, in localities that Batarci, Bixad, Camarzana of the studied area.

The flora of the association (Figure 1) studied in this area is quite rich totaling a number of 57 species in 3 relevés grouped in the phytocoenologic table (Table 1). It integrates species of *Quercion petraeae, Fraxino orni-Cotinetalia* and *Quercetea pubescenti-petraeae*. Out of the total number of species, 52 of them belong to the coenotaxa subordinating the association, and 5 species are transgressive and are adjacent to other associations.

The tree layer is dominated by *Quercus petraea, Quercus cerris, Tilia tomentosa*, making a good curdling of the canopy of 0.8. The trunk diameters vary between 40 - 45 cm and their height is from 20 to 30 m. The edifying species, also are accompanied by the following species: *Carpinus betulus, Acer campestre, Cerasus avium*.

The undergrowth and the offspring cover roughly 10% - 15% of the area and consist of the following species: *Quercus petraea, Quercus cerris, Tilia tomentosa, Carpinus betulus, Acer campestre, Cornus mas*.

The shrubs layer is unevenly dispersed in the wooded area, and it consist of the following species: *Cornus mas, Corylus avellana, Cornus sanguinea, Rubus hirtus, Rosa canina, Crataegus monogyna*.

The herbaceous layer with a coverage of 10% - 20%, is composed of: *Oxalis acetosella, Galium schultesii, Festuca heterophylla, Carex spicata, Viola hirta, Stellaria media, Euphorbia amygdaloides, Pulmonaria officinalis, Lathyrus vernus*. The species in this synousia come in to the alliance *Quercion petraeae* Zólyomi et Jukucs in Sóo 1963, of them we mention *Primulla veris, Trifolium mediu.*

Of the recognition species for the order *Fraxino orni-Cotinetalia* Jakucs 1960, we mention: *Cornus mas, Tamus communis, Lithospermum purpurocaeruleum* and for the class *Quercetea pubescenti-petraeae* (Oberdofer 1948) Jakucs 1960, we enumerate the following: *Crataegus monogyna, Polygonatum odoratum, Cornus sanguinea, Viola hirta*.

Table 1. The association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957 in Pustiu Mountain

					No. Land Surveys	1	2	3
					Exposition	V	SV	SE
					Altitude (m.s.m)	200	210	200
					Slope (degree) (°)	20	25	20
					Consistency of tree layer (%)	0.8	0.8	0.8
					Herbaceous cover layer (%)	20	15	10
L.f.	F.e.	U	T	R	Surface (m^2)	400	400	400
0	1	2	3	4	5	6	7	8
					Char. Ass.			
PhM	Eua	2.5	2.5	0	*Quercus petraea*	4	4	4
PhM	M	2	3.5	3	*Quercus cerris*	1	1	1
PhM	B	2.5	3.5	3	*Tilia tomentosa*	3	3	3
					Tilia tomentosa (reg.)	+	.	+
					Quercion petraeae			
H	Eua	3	2	5	*Primula veris*	+	.	+
H	Eua	3	3	0	*Trifolium medium*	.	+	+
					Fraxino orni-Cotinetalia			
PhM	P-M-Ec	2	3.5	4	*Cornus mas*	+	.	+
G	Atl-M	3	3.5	4	*Tamus communis*	+	.	.
H	Ec(M)	2.5	4	4	*Lithospermum purpurocaeruleum*	+	.	.
					Quercetea pubescenti-petraeae			
PhM	E	2.5	3.5	4	*Acer tataricum*	+	+	.
H	Ec	2.5	3.5	5	*Calamintha menthifolia*	+	.	.
Phm	E	2.5	3	3	*Crataegus monogyna*	+	+	+
G	Eua(M)	2	3	4	*Polygonatum odoratum*	+	.	+
PhM	E	2	3	4	*Pyrus pyraster*	+	+	+
PhM	E	2.5	3	4	*Sorbus torminalis*	+	.	+

0	1	2	3	4	5	6	7	8
H	Eua	2.5	3	4	*Agrimonia eupatoria*	.	+	.
H	Eua	3	3	0	*Campanula persicifolia*	+	.	.
PhM	Ec	3	3	4	*Cornus sanguineus*	.	+	+
Phn	Ec	2.5	3	0	*Cytisus nigricans*	+	.	.
H	E(M)	2.5	3	3	*Festuca heterophylla*	.	.	+
H	E(Cont)	2	4	3	*Fragaria viridis*	+	.	.
H	Eua	2.5	2.5	0	*Galium verum*	+	.	.
H	Ec	2.5	3	3	*Lathyrus niger*	+	.	.
PhM	E(M)	2.5	3	3	*Ligustrum vulgare*	+	+	.
H	Ec	25	3	5	*Melittis melissophyllum*	+	.	.
H	E	2.5	3.5	3	*Potentilla alba*	.	+	.
H	Eua(M)	2.5	2.5	3	*Tanacetum corymbosum*	+	.	.
H	Ec	1.5	4	4	*Veronica teucrium*	+	.	.
H	E(M)	2	4	4	*Vincetoxicum hirundinaria*	.	+	+
H	Ec	2	3	4	*Coronilla varia*	.	+	.
H	Eua	2	3	4	*Viola hirta*	.	+	.
					Querco - Fagetea			
PhM	E	3	3	3	*Cerasus avium*	+	+	+
G	Ec	3	3	4	*Cardamine bulbifera*	+	.	+
H	E	3.5	3	4	*Carex sylvatica*	+	.	+
G	Eua	3.5	3	4	*Circaea lutetiana*	+	+	+
G	E	2.5	3	3	*Convallaria majalis*	+	.	+
Ch	E	3	3.5	4	*Euphorbia amygdaloides*	+	+	+
Phn	Atl-M	3	3	3	*Hedera helix*	+	.	+
H	Cp	4	3	3	*Oxalis acetosella*	+	+	+
H	E	3.5	3	3	*Pulmonaria officinalis*	+	+	+
H	Eua	3	3	0	*Stellaria holostea*	+	+	+
Ch	Eua	2	2	2	*Veronica officinalis*	+	+	+
Th	Eua	4	3	4	*Impatiens noli-tangere*	+	.	.
PhM	E	2.5	3	3	*Acer campestre*	.	+	.
H	Eua	2.5	4	4	*Brachypodium pinnatum*	+	+	.
H	Eua	0	3	0	*Carex spicata*	.	+	+
PhM	E	3	3	3	*Carpinus betulus*	+	.	.
G	E	2.5	3	4	*Cephalanthera longifolia*	+	.	+
H	Eua	3	3	3	*Lathyrus vernus*	+	.	.
G	Ec	2.5	3	3	*Galium schultesii*	+	.	.
H	E	3	2.5	3	*Rubus hirtus*	.	+	+
					Variae syntaxa			
Th	Eua(M)	3	3	4	*Alliaria petiolata*	+	+	.
Th	Eua	2.5	3	3	*Lapsana communis*	+	.	.
PhM	Eua	0	0	0	*Pinus sylvestris*	.	.	+
PhM	Adv	2.5	4	0	*Robinia pseudoacacia*	+	+	.
Phn	E	2	3	3	*Rosa canina*	+	+	+
Th	Cosm	3	0	0	*Stellaria media*	.	+	.
Ch	Mp	2	3.5	4	*Teucrium chamaedrys*	.	+	+

where: L.f. - life forms; PhM - Megaphanerophytes; Phm - Mezophanerophytes; Phn - Nanophanerophytes; Ch - Chamaephytes; H - Hemicryptophytes; G - Geophytes; Th - Annual therophytes.
F.e. - floristic elements: Cp - Circumpolar; Eua - Eurasian; E - European; Ec - Central European; Cosm - Cosmopolitan; Atl-M - Atlantic-Mediterranean; B - Balkan; Mp - Pontic-Mediterranean; M - Mediterranean; Carp-B - Carpathian-Balkanic; P-M-Ec - Ponto-Mediterranean-Central European; Adv - Adventive. Ecological indices: U – soil moisture, T - temperature, R - the chemical reaction of the soil.
Place and date of relevés: 1-3 - Pustiu Mountain, 21.07.2011.

In the spectrum of life forms (Fig. 2) the dominant are the hemicryptophytes (H = 43.85%), their abundance being influenced by the moderate temperate climate, by natural phenomena (trees felled by wind and snow) and irrational exploitation. The hemicryptophytes are followed by phanerophytes (Ph = 31.57% of which: PhM = 24.56%, Phm = 1.75%, Phn = 5.26%) as they are the basic constituents of forests. The phanerophytes are followed by geophytes (G= 12.28%), therophytes (Th = 7.01%) and chamaephytes (Ch = 5.26%).

The floristic elements spectrum (Fig. 3) highlights numerical predominance of European species (E = 33.33%), followed by the Eurasian species (Eua = 31.57%) and Central European species (Ec = 17.54%). The presence in the investigated territory to the Atlantic-Mediterranean elements (Atl-M = 3.5%), Pontic-Mediterranean (Mp = 1.75%), Circumpolar (Cp = 1.75%), Balkan (B = 1.75%), Cosmopolitan (Cosm = 1.75%), Carpathian-Balkan (Carp-B = 1.75%), Adventive (Adv = 1.75%) and Ponto-Mediterranean-Central European (P-M-Ec = 1.75%).

The analysis of the main ecologic indices (Fig. 4) confirms that this association is dominated by the xero-mesophylous species ($U_{2-2.5}$ = 59.64%) followed by mesophylous ($U_{3-3.5}$ = 31.57%), meso-hygrophylous (U_4 =3.5%) and eurihydrophylous (U_0 = 3.5%). Depending on the temperature, most species from the

association are micro-mesothermophylous species ($T_{3-3.5}$ = 75.43%), followed by microthermophylous ($T_{2-2.5}$ = 10.52%), moderate thermophylous (T_4 =10.52%) and eurithermophylous (T_0 = 3.5%) and after the chemical reaction of the soil, the dominant species are weakly acid-neutrophylous (R_4 = 38.59%), followed by acid-neutrophylous (R_3 = 36.84%) and euri-ionical (R_0 = 17.54%) and neutral-basophylous (R_5 = 5.26%).
From the diagram analysis of ecological indices results the thermophylic character the association has, most species are xero-mesophilous (59.64%) and micro-mesothermophilous (75.42%).

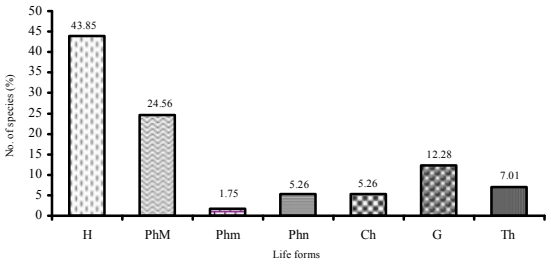

Figure 2. The life forms spectrum of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, where: H - Hemicryptophytes; PhM -Megaphanerophytes; Phm - Mezophanerophytes; Phn - Nanophanerophytes; Ch - Chamaephytes; G - Geophytes; Th - Annual therophytes

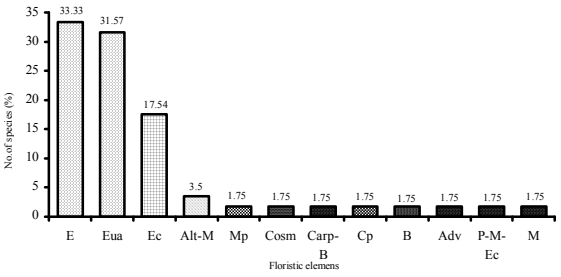

Figure 3. Spectrum of floristic elements for the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, where: Eua - Eurasian; E - European; Ec - Central European; Cp - Circumpolar; P-M-Ec – Pontic-Mediterranean-Central European; Carp-B - Balkan-Carpathian; B - Balkan; Mp - Pontic-Mediterranean; Atl-M - Atlantic-Mediterranean; M – Mediterranean; Cosm - Cosmopolitan

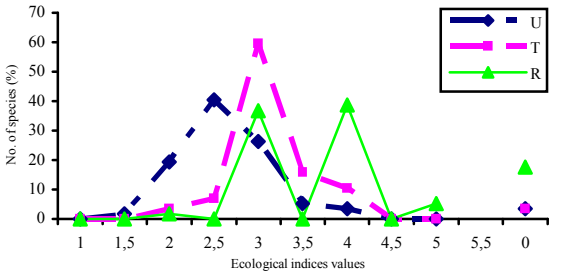

Figure 4. Diagram of ecological indices for the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, where: U - soil moisture, T - temperature, R - the chemical reaction of the soil

DISCUSSIONS

The research we conducted on the Pustiu Mountain, between the years of 2010 and 2011, showed that apart from de present forests: *Quercetum petraeae-cerris* Soó 1963, *Querco petraeae-Carpinetum* Soó et Pócs 1957, *Genisto tinctoriae-Quercetum petraeae* Klika 1932 and *Carpino-Fagetum* Paucă 1941, the area still has the forests of *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, an association which is now reported for the first time in the Oaş Mountains.

The phytocoenoses investigated by Coste, (1975) [9], in the oak forests, lime and cerris of the Locvei Mountains placed the associations *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, from a cenotaxonomic point of view, in that period in the class *Quercetea pubescenti-petraeae* (Oberdofer 1948) Jakucs 1960, the order *Orno-Cotinetalia* Jakucs 1960 and the alliance *Quercion farnetto* I. Horvat 1954.

Compared with the description performed by Coste, (1975) [9], we can observe differences of the coenotaxonomic classification of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957. In the present study the investigated associations are classified in coenotaxonomic terms in the class *Quercetea pubescenti-petraeae* (Oberdofer 1948) Jakucs 1960, the order *Fraxino orni-Cotinetalia* Jakucs 1960 and the alliance *Quercion petraeae* Zólyomi and Jukucs in Sóo 1963.

If we compare the association identified and described by us from the Pustiu Mountain (Oaş Mountains) with those of the Ribis Valley (Caras-Severin Country, Locvei Mountains) described by Coste, (1975) [9] we find many similarities and few differences.

In the floristic composition of phytocoenoses of the association *Tilio argenteae-Quercetum petraeae-cerris* Soó 1957, 57 species are described in Pustiu Mountain (Oaş Mountains) and 65 species in Ribis Valley (Locvei Mountains).

The life forms spectrum reveals the prominence of hemicryptophytes in both territories (H = 43.85% (Pustiu Montain, Oaş Mountains); H = 38.4% (Ribis Valley, Locvei Mountains). The lush of hemicryptophytes in the two territories suggests a climate that is temperate, which favours the grassy species.

Differences in life-forms give terophytes biennial species (TH = 7.7%) found in (Ribis Valley, Locvei Mountains), which on the (Pustiu Montain, Oaş Mountains), are missing. In the forests of the (Pustiu Montain, Oaş Mountains), terophytes annual have a weight of 7.01% (Th = 7.01) missing in (Ribis Valley, Locvei Mountains).

In terms of floristic composition (Ribis Valley, Locvei Mountains), there is some similarity in the fact that they share a total of 23 species.

There are also some disimillarities by the fact that from the (Ribis Valley, Locvei Mountains), there are a number of 42 species, which are missing in the forests of (Pustiu Montain, Oaş Mountains).

European species together with Central European species amount to a percentage of 36.6%, which explains the wet and moderately thermophilous nature of the stations where mixed oak forests, lime and cerris develop.

In the Pustiu Montain, (Oaş Mountains), there are present Carpathian-Balkan (1.75%), Balkan (1.75%), Cosmopolitan (1.75%), Advent (1.75%) and Pontic-Mediterranean-Central European (1.75 %) elements, which in the Ribis Valley, Locvei Mountains are missing.

In the Ribis Valley (Locvei Mountains) there are Pontic-Pannonian (3.0%) and Dacian-Balkan (1.5%), which in the Pustiu Mountain (Oaş Mountains) are missing.

The analysing the data from the diagram of ecological indices we conclude that the mixed oak forests, lime and cerris from the two hydrographic areas (Oaş Mountains and Locvei Mountains) have a strong xero-mesophylous, micromesothermophylous character, growing on weak acid brown earths, as seen from the prevalence of weakly acid-neutrophylous, acid-neutrophylous and euri-ionical species.

The domination of association by *Tilia tomentosa,* especially in the young stage is determined by the extremely high regeneration power of it. This may suggest the idea that the combination of lime with *Quercus* species is favored not only by favorable climatic conditions (with mild winters and warm summers), a relatively open canopy that allows the light to penetration to the ground but also the anthropogenic influence.

The associations described are stable in terms of dynamics and ecological balance, none of the dominant species of the tree or of the herbaceus layer tend to replace each other inherently in their competition for food and light.

The economic value of these forests is high; they provide wood for industry and are also used as firewood. They also host different economic categories of plants: food, fodder, honey, medicinal, industrial and decorative.

The researche accomplished in the perimeter of Oaş Mountains illustrate that the resort Pustiu Mountain from the Turulung Vii, is unique in the area, where there is a remarkably increasing number of xero-thermophilous species, being included in the nature reserve „Tur River – The Lower Tur River”(HCJ no. 4/1995 Law No. 5/2000, code 2680) on the conservation of natural habitats, flora and wild fauna [32].

The mixed oak forests, lime and cerris have suffered in the recent years an anthropogenic influence due to the aggressive timber exploitation by traders, the abusive and uncontrolled cuttings by some owners.

These types of forests are under strong anthropogenic pressures, but must be maintained, because they consolidate the land about to degrade, maintain the soil and herbaceous vegetation and attract rain.

REFERENCES

[1] Ardelean, A., (2006): Flora şi vegetaţia judeţului Arad. Academiei Române Publishing House, Bucharest, 508 p.
[2] Ardelean, A., (1999): Flora şi vegetaţia din Valea Crişului Alb – de la izvoare până la ieşirea din ţară, „Vasile Goldis” University Press, Arad, 311 p.
[3] Borza, Al., Boşcaiu, N., (1965): Introducere în studiul covorului vegetal. Academiei Romane Publishing House, Bucharest, 342 p.
[4] Boşcaiu, N., Lupşa, V., Resmeriţă, I., Coldea, G., Schneider, E., (1971): Vegetaţia lemnoasă mezo-xerotermă (Orno-Cotinetalia) din Defileul Dunării, Ocrotirea naturii, Bucharest , 15(1): 49-55.
[5] Braun-Blanquet, J., (1964): Pflanzensoziologie. Springer-Verlag, Wien-New York, 3, Aufl, pp. 12-24.
[6] Braun-Blanquet, J., Pavillard, J., (1928): Vocabulairae de Sociologie Végétale. Troisicme edition. Imprimerie Lemair -Ardres, pp. 15-18.
[7] Ciocârlan, V., (2009): Flora ilustrată a Romaniei. Pteridophyta et Spermatophyta. Ceres Publishing House, Bucharest, 1141 p.
[8] Cristea, V., Gafta, D., Pedrotti, F., (2004): Fitosociologie. Presa Universitară Clujeană Publishing House, Cluj-Napoca, 394 p.
[9] Coste, I., (1975): Flora şi vegetaţia Munţilor Locvei. PhD Thesis, University „Babes-Bolyai”, Cluj-Napoca, Borza, Al. and Csürös, Şt., Coordinators, pp. 457-460.
[10] Dihoru, Gh., Cristurean, I., Andrei, M., (1973): Vegetaţia din valea Mraconiei-depresiunea Dubova din Defileul Dunării, Acta Botanica Horti Bucurestiensis, 1972-1973: 353-423.
[11] Ellenberg, H., (1974): Zeigerwerte der Gefässpflanzen Mitteleuropas - Scripta Geobotanica. Göttingen, 9: 1-97.
[12] Hoborka, I., (1980): Flora şi vegetaţia din Munţii Dognecei. PhD Thesis, University „Babes-Bolyai”, Cluj-Napoca, Csürös, Şt., coordinator, pp. 126-127, 131.
[13] Karácsonyi, C., Negrean, G., (1986-1987): Contribuţii la flora Munţilor Oaş - Gutâi (jud. Satu Mare), Satu - Mare, Studii şi Comunicări, VII-VIII: 373-377.
[14] Karácsonyi, C., (1995): Flora şi vegetaţia judeţului Satu Mare, Museum Sătmărean Publishing House, 182 p.
[15] Karácsonyi, C., (2011): Flora şi vegetaţia Dealurilor Tăşnadului şi a colinelor marginale, „Vasile Goldis” University Press, Arad, pp. 155-159.
[16] Matacă, S., Şt., (2003): Parcul Natural Porţile de Fier: floră, vegetaţie şi protecţia naturii. PhD Thesis, Academia Română, Institute of Biology, Bucharest, Boşcaiu, N., Coordinator, pp. 438-441.
[17] Matacă, S.Ş., (2003): Ètudes gèosymphytosociologiques dans le Parc Naturel "Porţile de Fier" (Romania), Contribuţii botanice, Cluj-Napoca, 38(2): 57-67.
[18] Mucina, L., Grabherr, G., Ellmaner, T., (1993): Die Pflanzengesellschaften Österreich, teil I. Anthropogene Vegetation, (Gustav Fischer) Verlag, Jena-Stuttgart-New-York, 13: 149-169.
[19] Pott, R., (1995): Die Pflanzengesellschaften Deutschlands. 2 Auflage, Verlag Eugen Ulmer, Stuttgard, 622 p.
[20] Raţiu, O., Gergely I., Moldovan, I., (1977): Consideraţii fitocenologice asupra pădurilor depresionare din „Ţara Oaşului”, Contribuţii botanice, Cluj Napoca, pp. 9-18.
[21] Raţiu, O., Gergely, I., (1978): Analiza complexă a florei „Ţării Oaşului”, Contribuţii botanice, Cluj-Napoca, pp. 217-226.
[22] Raţiu, O., Gergely, I., (1979): Caracterizarea sinecologică a principalelor fitocenoze lemnoase din

„Ţara Oaşului" (jud. Satu Mare), Contribuţii botanice, Cluj-Napoca, pp. 85-118.
[23] Roman, N., (1974): Flora şi vegetaţia din sudul podişului Mehedinţi, Academiei R.S.R., Publishing House, Bucharest, 222 p.
[24] Sanda, V., Kinga, O., Burescu, P., (2008): Fitocenozele din România, sintaxonomie, structură, dinamică şi evoluţie. Ars Docendi Publishing House, Bucharest, 570 p.
[25] Sanda, V., Răduţoiu, D., Burescu, P., Blaj-Irimia, I., (2007): Breviar fitocenologic. Partea a IV-a. Sitech Publishing House, Craiova, pp. 159-160.
[26] Scheider-Binder, E., Boşcaiu, N., Coldea, G., Lupşa, V., Plămadă, E., Resmeriţă, I., Stoicovici, L., (1970): Zur Felsenvegetation der Sektoren Eşelniţa- Mraconia und Kazanpass-Tricule (Durchbruchtal der Donau) I., Revue roumaine de biologie: Série de botanique, Bucharest, 15(5): 311-322.
[27] Soó, R., (1964-1980): A magyar flora és vegetacio rendszertani, növényföldrajzi kézikönyve, Akadémiai Kiadó, Budapest, pp. 1-6.
[28] Todor, I., Gergely, I., Bârcă, C., (1971): Contribuţii la cunoaşterea florei şi vegetaţiei din zona Defileului Dunării între oraşul Moldova Veche şi comuna Pojejena (judeţul Caraş-Severin), Contribuţii botanice, Cluj, pp. 203-256.
[29] Tüxen, R., 1955, Das System der nordwestdeutschen Pflanzengesellschaften, Mitt Floristic-Sociologie Arbeitsgen, n. Folge, 5: 155-176.
[30] Weber, H. E., Moravec, J., Theurillat, J.-P., (2000): International Code of Phytosociological Nomenclature. 3rd edition, Journal of vegetation Science 11: 739–768. Opulus Press, Uppsala, Sweden.
[31] *** http://rbg-web2.rbge.org.uk/FE/fe.html accessed in September 2012.
[32] *** http://apmsm.anpm.ro/pages/categorie/81 accessed on 8 September 2012.

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