THE OLIGOTROPHIC MARSHES IN THE SLOPES OF THE APUSENI MOUNTAINS BUILT UP BY THE PHYTOCOENOSES OF THE *Scheuchzerio palustris-Sphagnetum cuspidati* ASSOCIATION (PROVISIONAL NOMEN NUDUM Zólyomi, 1943) ex. Burescu et Mateș, 2024

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Abstract. The aim of this paper is to describe for the first time from a floristic, phytosociological, ecological, syndamic and ecoprotective perspective the phytocoenoses of the association *Scheuchzerio palustris-Sphagnetum cuspidati* nomen nudum, provisional nomen (Zólyomi, 1943) [40] ex Burescu et Mateș, 2024. In order to achieve the proposed goal and objectives, in the timeframe 2020-2021 we carried out 12 phytocoenological surveys in the most representative phytocoenoses of the oligotrophic peatlands in the Gilău, Muntele Mare and Bihor mountains. The distinct floristic and ecological individuality of the studied phytocoenoses requires separation thereof in the association ***Scheuchzerio palustris-Sphagnetum cuspidati*** nomen nudum (Zólyomi 1943) [40] ex Burescu et Mateș, 2024 with *Scheuchzeria palustris* and *Sphagnum cuspidatum* as characteristic and dominant species. The ecological analysis of species by bioform categories shows the dominance of bryophytes closely followed by hemicryptophytes, geophytes and chamaephytes. Composition by categories of phytogeographical elements highlights the dominance of circumpolar-boreal species followed by circumpolar, circumpolar-arctic-alpin and arctic-alpine species. The analysis by ecological categories of soil moisture, air temperature and chemical reaction of the soil highlights the hygrophilic, microthermal and strongly acidophilic nature of the phytocoenoses as an expression of the adaptation of the species to a habitat characterized by a cold microclimate, excess of humidity and a strongly acidic reaction of the soil and water of the oligotrophic marshes (mires) of the Apuseni Mountains.

Key words: phytocoenosis; association; provisional nomen; emendavit.

INTRODUCTION

While reviewing the monographic work on peat bogs in Romania [28], we learned that B. Zólyomi (1943) [40] was the first botanist who reported the presence of the species and contributed with a provisional name (nomen nudum) given to the phytocoenoses built up by *Scheuchzeria palustris* and *Sphagnum recurvum* on the occasion of exploring Tușnad Moss Lake (Kucojszás) in the Harghita mires region.

The entire marshy complex of Molhaș from Tușnad in an area of 80 ha and comprising 13 lakes and about 30 ponds, populated by *Scheuchzeria palustris*, was explored by Zólyomi (1943) [40], on which occasion he mapped in detail the plant communities he found as follows: ***Scheuchzerio-Sphagnetum cuspidati, Scheuchzerio-Caricetum inflatae, Caricetum lasiocarpae, Eriophoreto-Sphagnetum fusci, Pineto-Betuletum caricetosum echinatae, Pinetum silvestris eriophoretosum vaginati, Piceeto-Betuletum,*** without carrying out surveys or phytosociological tables to substantiate the diagnosis of these associations.

Another great botanist who visited the Molhaș marshy complex from Tușnad on the occasion of a trip he made through Transylvania was Schur (1858) [36], but who was not able to thoroughly study the vegetation of the raised bog as he had planned, because at one point the *Sphagnum* blanket bog broke under him, which is why he felt his life was in danger and had to abandon the research, so we do not even have a geobotanical sketch from this valuable researcher.

The species *Scheuchzeuria palustris*, which is rare in the Romania's flora, builds the representative phytocoenoses of the association together with *Sphagnum cuspidatum, Sphagnum recurvum* (*Sph. fallax*) in only a few oligotrophic marshes researched by us in the Apuseni Mountains, namely: the Gilău Mountains, Tăul Căpățânii (lake) also called Vârful Băii located on the Dobrinului Ridge (1,630 m); Tăul Sărat marshes located at the Someșul Rece river spring (1,590-1,603 m); the subalpine wetlands La Poduri located below the peak of Muntele Mare (1,700-1,827 m); Bihor Mountains at Molhașul cel Mare raised bog from Izbuc-Călineasa (900-1,200 m) area.

Scheuchzeria palustris is a circumpolar-boreal, glacial relict species in the flora of Romania, being also known from the floristic perspective in the Oaș-Maramureș mires region, the Sighet plateau: Tăul lui Dumitru mountain lake - Obcina Ștedia, Iezerul Mare mountain lake, Deseşti commune; La Vârful Negru, La Vlășchinescu, La Hoteni - Ocna-Șugătag commune; Suceava mires region: Dorna Basin Tinovul Mic-Crucea area, cited by Pop (1960) [28], Știol Marsh – Rodna Mountains - Coldea (1990) [13], Flora of Romania (1966) [42].

Exhaustive studies on the phytocoenoses built by *Scheuchzeria palustris* and *Sphagnum cuspidatum* have not been carried out so far, are few in number, which incited us to resort to research on the floristic composition, the interrelationships between the species that have associated to coexist within the same habitat, having in common similar trophic preferences (needs) and ways to adapt to the living environment.

The aim of this work is to make the first description of the turbicol phytocoenoses gathered in the association ***Scheuchzerio palustris-Sphagnetum***

cuspidati nomen nudum (Zólyomi, 1943) [40] ex Burescu et Mateș, 2024, from Apuseni Mountains.

By reviewing the scientific works published in Romania [7, 8, 10, 12, 13, 14, 35,] and in Europe [2, 15, 16, 25, 26, 30, 33], we found that this coenosis does not have a valid description made in the past. That is why in accordance with article 3b, art. 7, art. 45, art. 46 and art. 49 of the International Code of Phytosociological Nomenclature, Barkman *et al.* (1976) [1], Weber *et al.* (2000) [39] it is necessary to redefine the syntaxon "population of *Scheuchzeria palustris*" in the sense of the above name we put forward.

Sporadic presence of the very rare species *Rhynchospora alba*, in one or two populations of the phytocoenosis, led some botanists [11, 16, 20, 32] to refer this phytocoenosis to the association ***Rhynchosporetum albae*** Koch 1926, which is not justified floristically and ecologically for the phytocoenoses of the mires (raised bogs) in Apuseni Mts.

The association we describe has the specificity of a regional syntaxon but which presents phytogeographic links with the vicariant syntaxons in Europe, such as the case of ***Sphagno tenelli-Rhynchosporetum albae***, Osvald 1923 emendavit. Dierssen 1982 (Syntaxon syn: ***Rhynchosporetum albae*** Koch 1926).

In order to achieve the proposed aim, we set the following objectives:

- ✓ Identification of the floristic composition of the phytocoenoses part of the association;
- ✓ Classification of species in a synthetic table of association by their affinity to the coenotaxa to which they are subordinated, alliance, order and vegetation class;
- ✓ Ecological characterization of the cormophytes and bryophytes of the association in the light of distribution to the type of bioforms, phytogeographic element and to the valences of the categories of ecological indices (edaphic humidity, air temperature, chemical reaction of the soil);
- ✓ Highlighting the syndamicity of the phytocoenoses of the association in a certain stage of their existence;
- ✓ Economic and scientific importance;
- ✓ Preservation and protection of nature.

MATERIAL AND METHODS

We carried out the research in the timeframe 2020-2021, by traveling on the itinerary in the Gilău Mountains, with the aim of exploring the oligotrophic soils of the Balomireasa-Căpățâna-Creasta Dobrinului mountain block (1,590-1,630 m), the Mocirle sites (Căpățânii oligotrophic swamps, Tăul Sărat), Vârful Băii (Tăul Căpățânii), Muntele Mare Mt. (1,650-1,700 m) La Poduri site on an area of about 100 ha together with the swampy spruce forests in the surroundings. The marshy complex Molhașul cel Mare (1,160-1,180 m) with an area of 20 ha, from Izbuc-Călineasa, Someșul Cald river spring, Bihor Mountains, was also researched. The biological material we studied consists in the oligotrophic phytocoenoses united in the association ***Scheuchzerio palustris-Sphagnetum cuspidati*** provisional name, nomen nudum (Zólyomi, 1943) [40] ex Burescu et Mateș, 2024 (art.7, art. 46, recomandation 46D).

Identification of the floristic composition of the living soil cover in the slopes of the Apuseni Mountains and the quantitative assessment of the phytotaxa according to the abundance-dominance scale was based on the phytosociological research methods of the Central European school developed by Braun-Blanquet (1964) [4] adapted to the edapho-climatic peculiarities of vegetation in Romania by Borza *et* Boșcaiu (1965) [3] and the practical methods developed by Ivan *et* Doniță (1975) [23], Ivan (1992) [22].

In the phytocoenological study of the vegetation, we used as basic coenotaxonomic unit the plant association according to the definition of the Zürich-Montpellier school, Géhu et Rivas-Martinez (1981) [21]. In order to reproduce as accurately as possible the composition and ecological edapho-climatic peculiarities of the association's phytocoenoses, we carried out 12 phytosociological surveys, of which four surveys in the spring region of Someșul Rece river, Căpățânii oligotrophic swamps (Gilău Mountains); four surveys in the oligotrophic swamps below Muntele Mare Mt. peak and four surveys in the Molhașul cel Mare oligotrophic swamp from Izbuc area, the Someșul Cald river spring area (Bihor Mountains) during the optimal vegetation period (24.08.2020; 25.09.2020; 26.09.2020).

The floristically and physiognomically homogeneous sample areas, with sizes ranging between 6-25 m^2, were selected from the most representative phytocoenoses of the oligotrophic marshes (lakes, ponds) built by *Scheuchzeria palustris* and *Sphagnum cuspidatum* species.

The data from the surveys we conducted were entered in the phytosociological analytical table with the species ordered according to the constancy-presence (K) criterion in the field, to the coenotaxa hierarchically superior to the association.

When classifying the species by cenotaxonomic units, alliance, order, vegetation class in the table, the traditional ecological-floristic systems belonging to the authors Tüxen (1955) [38], Braun-Blanquet (1964) [4], Soó (1964-1980) [36], Borza et Boșcaiu (1965) [3], as well as the ecological-floristic systems critically revised by Oberdorfer (1992) [27], Pott (1995) [30], Borhidi (1996) [2], Mucina (1997) [25], Rodwell *et al.* (2002) [33], Burescu (2003) [5], Sanda *et al.* (2008) [35], Coldea *et al.* (1997) [12], Chifu *et al.* (2014) [8] were all considered.

Ecological characterization of phytotaxa and their classification by bioform categories was done according to the system developed by Raunkier (1937)

[31], improved by Braun-Blanquet (1964) [4], Ellenberg *et al.* (1992) [18], and corroborated with the scientific papers of Sanda *et al.* (2003) [34], Burescu *et* Toma (2005) [6], Ciocârlan (2009) [9].

Designation by categories of phytogeographical elements (geoelements) was made according to the chorological systems according to Meusel *et* Jäger (1992) [24], Sanda *et al.* (2003) [34]. Composition of the phytocoenosis by ecological categories of soil moisture (M), temperature (T), and chemical reaction of the soil (R), was carried out according to Sanda *et al.* (2003) [34].

We processed the research results statistically by including the species in an analytical table of association and by graphic representation of the analyzed ecological categories in histograms and diagrams.

The processing of the phytocoenological surveys in the view of the phytosociological dendrogram was carried out on the computer with the help of *Past 4.03* module program.

RESULTS

Phytocoenoses of *Scheuchzeria palustris* have an extremely limited distribution in the Apuseni Mts., where they develop submerged only in the water of a few small lakes, ponds and shallow troughs of 15-40 cm, constantly covered with blackish-brown water, poor in nutrients, with a very acidic chemical reaction (pH=3.8-4.2) on organic histosols. The plant population of *Scheuchzeria palustris* together with that of the bryophytes, *Sphagnum cuspidatum*, *Sphagnum magellanicum*, *Sphagnum fallax*, grows in sites characterized by a humid, cold climate with a lot of rainfall, and temperatures raging between 3.0°C and 0.9°C [29].

The floristic composition or the specific biodiversity

Floristic inventory of hygrophilous, oligotrophic and acidophilic phytocoenoses gathered in the association ***Scheuchzerio palustris-Sphagnetum cuspidati*** nomen nudum ex Burescu et Mateș, 2024, art. 3b, art. 7, art. 46, art. 46D, totalling 21 phytotaxons, of which 15 cormophytes, six bryophytes, which entails a rather poor biodiversity of a community characterized by floristic, ecological and physiognomic individuality. Holotypus hoc loco: Table 1, Survey no. 2.

The species that build and instills the physiognomy of the association are *Scheuchzeria palustris L.* which is a circumpolar-boreal, glacial relict species with a general coverage of 70.84% ADm, maximum constancy (K=V), and *Sphagnum cuspidatum*, circumpolar bryophyte with a general coverage of 76.66% ADm, maximum constancy (K=V), located on the southern side of the geographical area of its distribution in Europe. Along with the aformentions elements, the floristic composition consists also in an important nucleus of species which are characteristic and differential for the alliance ***Scheuchzerion palustris*** Nordhagen 1936 ex. Tx. 1937, *Carex limosa*, *Drosera rotundifolia*, *Drepanocladus fluitans*, *Lycopodium innundatum*, *Rhynchospora alba*, the order ***Scheuchzerietalia palustris*** Nordhagen 1936, class ***Scheuchzerio-Caricetea nigrae*** (Nordhagen1937) Tüxen 1937: *Carex magellanica* subsp. *irrigua*, *Sphagnum fallax*, *Sphagnum rusowii*, *Drosera intermedia*, *Eriophorum scheuchzeri* (see Table 1).

The analysis of the dendrogram illustrates a constant uniformity of the floristic composition of the phytocoenoses of this association, which demonstrates the need for separation as an independent cenotaxonomic unit, indices of similarity index values ranging 0.6 to1.0.

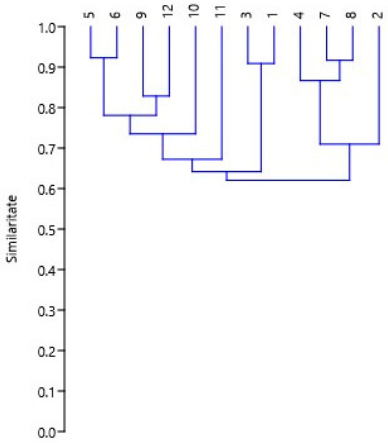

Figure 1. *Kulczyncski* Similarity index of the *Scheuchzerio palustris-Sphagnetum cuspidati* association for the Apuseni Mountains

It is worth mentioning that together with the phytotaxa listed above, a cluster of eight species develops, namely *Carex pauciflora*, *Sphagnum magellanicum*, *Eriophorum vaginatum*, *Vaccinium microcarpum*, *Vaccinium oxycoccos*, *Empetrum nigrum*, *Andromeda polifolia* and *Polytrichum strictum*, characteristic of the ***Oxycocco-Sphagnetea*** class with ombrotrophic, oligotrophic, acidophilic vegetation, very close to the phytocoenosis analyzed by us from a floristic and ecological perspective, which substantiate the inclusion in this association.

Ecological characterization of the association's flora and vegetation

Analysis of the ecological categories within the phytocoenosis of the ***Scheuchzerio palustris-Sphagnetum cuspidati*** association is necessary since the ecological spectrum obtained in the form of histograms and diagrams shows numerically and percentageally the distribution of the association species by the type of bioform, phytogeographical element, genetic karyotype as well as the share thereof in the ecosystem according to the ecological valences in relation to ecological factors: soil moisture, air temperature and chemical reaction of the soil.

Table 1. *Scheuchzerio palustris-Sphagnetum cuspidati* nomen nudum Zólyomi (1943) ex Burescu et Mateș, 2024

Bio.	E.f.	M	T	R	2n	Survey no.	1	2	3	4	5	6	7	8	9	10	11	12	K	ADm
						Altitude (m)	1596	1590	1598	1600	1622	1622	1625	1622	1220	1217	1214	1210		
						Herbaceous layer coverage (%)	50	65	40	70	70	45	82	50	75	82	90	95		
						Moss layer coverage (%)	100	100	65	100	100	100	100	100	100	85	70	85		
						Surface (m^2)	12	6	12	8	20	4	6	20	100	20	10	25		
G	Cp-Bo	5	2.5	2	D	As. *Scheuchzeria palustris*	3	4	3	4	4	3	4	3	4	4	5	5	V	70.84
Brchs	Cp					As. *Sphagnum cuspidatum*	5	5	4	5	5	5	5	5	5	4	4	4	V	76.66
						Scheuchzerion palustris Nordhagen 1936 ex Tx. 1937														
G	Cp-Bo	5	2	1.5	P	*Carex limosa*	+	+	+	1	1	1	2	2	1	2	+	+	V	6.29
H	Cp-Bo	5	2.5	1	D	*Drosera rotundifolia*	+	.	+	.	+	+	.	.	1	+	.	+	III	0.25
Brchs	Cp					*Drepanocladus fluitans*	.	+	.	+	.	.	+	+	.	+	+	.	III	0.25
H	Cp-Bo	5	0	2	DP	*Rhynchospora alba*	.	.	.	.	.	.	.	.	+	+	+	+	II	0.16
Ch	Cp	5	2.5	1	P	*Lycopodium innundatum*	+	+	+	.	.	.	.	.	.	.	.	.	II	0.12
						Scheuchzerietalia palustris Nordhagen 1936. ***Scheuchzerio-Caricetea nigrae*** R.Tüxen 1937														
G	Cp-A-a	5	2	2	P	*Carex magellanica subsp. irrigua*	+	.	+	.	+	+	.	.	1	+	.	+	III	0.66
Brchs	Cp-Bo					*Sphagnum fallax (Sph. recurvum)*	+	.	+	.	.	+	+	.	+	.	.	+	III	0.25
Brchs	Cp					*Sphagnum russowii*	.	.	.	.	.	.	.	.	+	1	1	1	II	1.29
H	Cp	5	3	1.5	D	*Drosera intermedia*	.	.	.	+	.	.	+	+	.	.	.	.	II	0.12
H	Cp-A-a	5	1.5	2.5	D	*Eriophorum scheuchzeri*	.	+	.	.	.	.	.	.	.	.	+	.	I	0.08
						Sphagnion magellanici Kästner et Flösner 1933														
G	Cp-Bo	5	2.5	1	P	*Carex pauciflora*	1	+	.	+	+	+	+	+	.	+	.	+	IV	0.75
Brchs	Cosm					*Sphagnum magellanicum*	.	.	.	.	1	1	+	+	1	2	+	1	IV	3.69
nPh-Ch	Cp-A-a	3.5	0	0	D	*Empetrum nigrum*	.	+	+	.	.	.	.	.	+	.	+	+	III	0.20
						Sphagnetalia magellanici (Pawlowski 1928) Moore 1968. ***Oxycocco-Sphagnetea*** Br.-Bl. et Tx. 1943														
H	Cp	4.5	0	1.5	D	*Eriophorum vaginatum*	+	+	+	+	+	+	+	+	+	.	+	.	V	0.41
Ch	A-a	5	0	2	D	*Vaccinium microcarpum*	.	+	.	.	+	+	+	+	+	+	+	+	IV	0.32
Ch	Cp-Bo	5	0	2	P	*Vaccinium oxycoccos*	.	+	.	.	.	+	.	.	+	.	.	.	II	0.12
nPh-Ch	Cp-Bo	5	2.5	1	P	*Andromeda polifolia*	.	.	.	.	.	.	.	.	+	.	+	1	II	0.50
Brchs	Cp-Bo					*Polytrichum strictum*	+	.	+	.	.	.	.	.	.	+	+	.	II	0.08
						Vaccinio-Piceetea Br.-Bl. 1939														
MPh	E	0	0	0	D	*Picea abies*	.	.	.	.	+	+	+	.	.	.	+	+	III	0.20

Place and date of surveying: Căpățânii oligotrophic swamps - Gilău Mountains, 1-4, 28.08.2020 (Survey no. 1: Lat.N: 46°29`08.3``, Long.E:23°07`47,1``; Survey no. 2: Lat.N: 46°29`08``, Long.E: 23°07`45.1``; Survey no. 3: Lat.N: 46°29`06.8``, Long.E: 23°07`45.9``; Survey no. 4: Lat.N: 46°29`07.4``, Long.E: 23°07`44.4``), oligotrophic swamps under Muntele Mare Mt. peak - La Poduri site in Gilău Mountains, 5-8, 25.09.2020 (Survey no. 5: Lat.N:46°29`49.4``, Long.E: 23°15`42.6``; Survey no. 6: Lat.N: 46°29`49.2``, Long.E:23°15`47.1``; Survey no. 7: Lat.N: 46°29`49.9``, Long.E: 23°15`46.3``; Survey no. 8: Lat.N: 46°29`50.6``, Long.E: 23°15`46``), Molhașul Mare oligotrophic swamp from Izbuce Padiș area, Bihor Mountains, 9-12, 26.09.2020 (Survey no. 9: Lat.N:46°35`25.9``, Long.E: 22°45`44``); Survey no. 10: Lat.N: 46°35`23.4``, Long.E:22°45`46.3; Survey no. 11: Lat.N: 46°35`25.4``, Long.E: 22°45`45.9``; Survey no. 12: Lat.N: 46°35`27.9``, Long.E: 22°45`42.2``).

Composition by categories of bioforms

The spectrum of bioforms (Fig. 2) is dominated by bryophytes of the genus *Sphagnum* (28.57%) which regenerate explosively through vegetative stem clones forming a 5 m thick layer of peat, in a volume of 120,000 m^3, in Vârful Băii oligotrophic marsh (Dobrinului Ridge -Gilăului Mountains); a 4.5 m thick layer in volume of 250,000 m^3 in Mocirle oligotrophic marsh, Căpățânii marshes (Gilău Mountains), a 3.5 m thick layer in volume of 100,000 m^3 in La Poduri oligotrophic marsh site (Muntele Mare Mt.), and a 4 m thick layer, in a volume of 320,000 m^3 in Molhașul Mare oligotrophic marsh from Izbuc-Călineasa area (Bihor Mountains) [7] In the ecological spectrum of the phytocoenosis, bioforms from the category of hemicryptophytes (23.8%) adapted to an excessively temperate continental climate are followed in descending order by geophytes (19.04%) with metamorphosed stems (rhizomes) hidden in the soil, and by chamaephytes (14.28%) with erect stems or

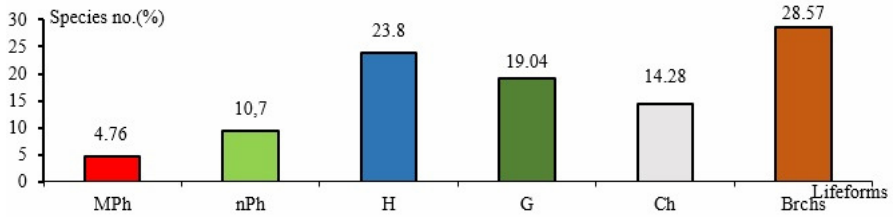

Figure 2. Spectrum of bioforms from the *Scheuchzerio palustris-Sphagnetum cuspidati* association.
Legend: MPh= megaphanerophytes, nPh= nanophanerophytes, H= hemicryptophytes, G= geophytes, Ch= chamaephytes, Brchs= bryophytes

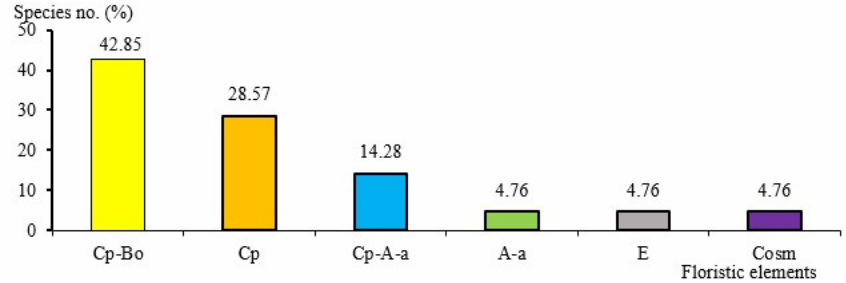

Figure 3. Spectrum of phytogeographic elements (geoelements) from the *Scheuchzerio palustris-Sphagnetum cuspidati* association.
Legend: Cp-Bo=circumpolar-boreal, Cp=circumpolar, Cp-A-a=circumpolar-arctic-alpine, A-a=arctic-alpine, E=European, Cosm=cosmopolitan

bushes in the form of pads that confers them resistance to thermal and water stress. Nanophanerophytes and megaphanerophytes have an insignificant share.

Composition by categories of phytogeographic elements (geoelements)

The geographical area of the species within the surveyed territories (Fig. 3) presents a less diversified to relatively homogeneous phytogeographic picture, made up of a small procession of species in which the circumpolar-boreal elements are dominant (42.85%), accompanied by the circumpolar (28.57%), circumpolar-arctic-alpine (14.28%) and arctic-alpine (4.76%) species, mostly being glacial relicts.

Composition by ecological categories with moisture, temperature and chemical reaction of the soil

Knowledge of the composition of the association's phytocoenoses by ecological categories of moisture (M), temperature (T) and chemical reaction of the soil (R) is important because the result of the analysis of ecological valences (species requirements with regard to the main ecological factors) indicates us the ecological specificity of the habitats in which oligotrophic plants have been living and growing for millennia

The ecological indices diagram (Fig. 4) presents the phytocoenoses related exclusive dominance of hygrophilous species (U_5=80%) at the expense of mesohygrophilous, mesophilic and euryhydric species which have an insignificant share (6.66%).

In relation to the air temperature (Fig. 4), microthermic species are dominant ($T_{2\text{-}2.5}$=46.66%), closely followed by eurythermals (T_0=40%), which can be explained in terms of the adaptation of the species to a habitat with a cold and humid microclimate specific to the peatland in the subalpine floor of the Apuseni Mountains. Against this backdrop, cryophilic species - hechistotherms ($T_{1.5}$=6.66%), micromesotherms (T_3=6.66%) have a very small share.

In terms of the chemical reaction of the water and the soil of the mires (Fig. 3), the strongly acidophilic species (R_1=46.66%) have an overwhelming share, closely accompanied by the acidophilic ones (R_2=40%) and way behind by the euriionic species (R_0 =13.33%).

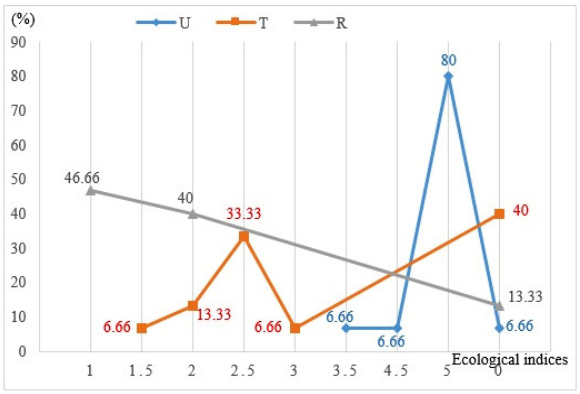

Figure 4. Diagram of the distribution of ecological indices for the *Scheuchzerio palustris-Sphagnetum cuspidati* association. Legend: $U_{3\text{-}3.5}$=mesophilic species, $U_{4.5}$=mesohygrophilic species, U_5=hygrophilic species, U_0=hydric amphitolerant species; T_1=hechistothermal species (cryophilic), $T_{2\text{-}2.5}$=microthermal species, T_3=micromesothermal species, T_0=thermally amphitolerant species; R_1=strongly acidophilic species, R_2=acidophilic species, R_0=euriionic species.

Karyological spectrum

The karyological spectrum (Fig. 5) of the flora of the phytocoenoses gathered in the association ***Scheuchzerio palustris-Sphagnetum cuspidati*** is dominated by diploid species (53.33%) which represent the generic resources necessary for evolution, closely accompanied by polyploid species (40%) which are responsible for interspecies competition and colonization of the habitat by the plant population. The diplo-polyploid elements have an insignificant share.

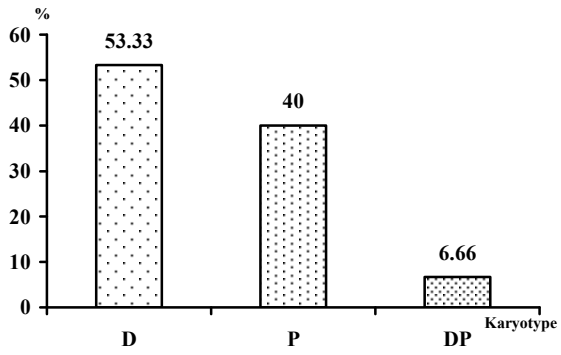

Figure 5. Karyological spectrum for the *Scheuchzerio palustris-Sphagnetum cuspidati* association. Legend: D=diploid karyotype, P=polyploid karyotype, DP=diplo-polyploid

DISCUSSION

Vegetation syndynamics

The presence of eight transgressive species from the ***Sphagnion magellanici*** alliance, ***Sphagnetalia magellanici*** order and ***Oxycocco-Sphagnetea*** class in the floristic composition of the phytocoenosis suggests the evolution of the association's vegetation towards these coenotaxa, in relation to the changes in the excess moisture occurred in the soil, the water' and soil's pH as the main ecological factors determining the balance of the ecosystem. Exploitation of peat deposits, drainage of oligotrophic marshes, construction of roads and related infrastructure, grazing and the transit of animals through the habitat are part of the most harmful anthropic interventions, which lead to the destabilization of the ecological balance and the degradation of the ecosystem.

Economic and scientific importance

Scheuchzeria palustris is a toxic plant since its aerial parts having a high content of hydrocyanic acid. Herbivorous animals from the Cervidae family consumes it in dry state in autumn and winter.

Peat deposit is of particular economic importance, as it can be used in energy, construction, chemical, pharmaceutical, medicine (balneology), and agriculture sectors but also in households, etc.

Peat bogs have a paleontological-scientific relevance in the multi-millenary archiving of pollen grains and fossil relics of beings which lived in distant phytohistorical periods, on the basis of which the succession and evolution of vegetation on Earth can be traced back.

Preservation and protection of nature

The phytocoenoses of this association are included in the European Habitat Natura 2000: 7140 Transition mires and quaking bogs. Priority habitat EMERALD: ! 54.5 according to the Habitats Directive (92/43/EEC) [41], Doniță *et al.* (2005) [17], Gafta *et* Mountford (2008) [19]. The bogs built by the phytocoenoses of the ***Scheuchzerio palustris-Sphagnetum cuspidati*** association shelter glacial relict species such as: *Andromeda polifolia*, *Carex limosa* (LC), *Carex pauciflora*, *Drosera rotundifolia* (NT), *Empetrum nigrum* (NT), *Eriophorum vaginatum*, *Lycopodium innundatum* (NT), *Rhynchospora alba* (VU), *Scheuchzeria palustris* (VU), *Vaccinium microcarpum* (NT), *Vaccinium oxycoccos* (NT), as well as some rare, vulnerable species: *Carex magellanica* subsp. *irrigua* (VU), *Eriophorum scheuchzeri* (LC), which is why they were declared protected areas and managed according to a well-prepared dedicated management plan.

Since in this study a new coenotaxon was described for the first time for the alliance ***Scheuchzerion palustris*** Nordhagen 1936 ex Tx. 1937, order ***Scheuchzerietalia palustris*** Nordhagen 1936, class ***Scheuchzerio-Caricetea nigrae*** (Nordhagen 1937) Tüxen 1937, we have no terms of comparison with another similar coenotaxon described elsewhere in other geographical regions in the last decades of the century XX-XX1.

In Europe, ***Scheuchzerio palustris-Sphagnetum cuspidati*** (Zólyomi 1943) [40] was provisionally described, but the above name and related association are not validated according to the international code of phytosociological nomenclature [1, 33] art. 3b.

The floristic and coenotaxonomic composition of a new plant association for the vegetation of mires in South-Eastern Europe, Apuseni Mountains was described for the first time.

The distinct floristic individuality determined by the seasonal ecological conditions in which the turbidic, oligotrophic phytocoenoses of the Apuseni Mountains develop requires separation thereof in the association ***Scheuchzerio palustris-Sphagnetum cuspidati*** nomen nudum (Zólyomi 1943) [40] ex Burescu et Mateș, 2024, it having ***Scheuchzeria palustris*** and ***Sphagnum cuspidatum*** as characteristic and dominant species, accompanied by 10 characteristic and differential species for the hierarchically superior coenotaxa of the association ***Scheuchzerion palustris*** Nordhagen 1936 ex Tx. 1937, ***Scheuchzerietalia palustris*** Nordhagen 1936, ***Scheuchzerio-Caricetea nigrae*** R.Tüxen 1937.

Ecological analysis by categories of bioforms highlights the dominance of bryophytes (28.57%) followed by hemicryptophytes (23.8%), geophytes (19.04) and chamaephytes (14.28%).

Composition of the phytocoenosis by categories of phytogeographical elements (geoelements) shows us the overwhelming dominance of circumpolar-boreal species (42.85%), accompanied by circumpolar-proper species (28.57%), circumpolar-arctic-alpine ones (14.28%) and alpine arctic species (4.76%) which are characteristic for silvotundra and tundra in the subarctic regions of the Earth, having gained ground in time in the subalpine floor of the Apuseni Mountains.

Analysis by ecological categories (ecological indices) of soil moisture, air temperature and chemical reaction of the soil highlights the hygrophilic (80%), microthermic (46.66%) and strongly acidophilic

(46.66%) nature of the association phytocoenoses as an expression of species adaptation in a habitat characterized by a cold microclimate, excess moisture and a strongly acid pH of the soil and water of the oligotrophic swamps located at one of the highest altitude in the Apuseni Mountains.

The humid, cool climate, rich in precipitation with temperatures between 3.0°C and 0.9°C [29] as well as the oligotrophic substrate of the strongly acidic histosols in the peatlands of the Apuseni Mountains is favorable for the development of glacial relict species (*Andromeda polifolia*, *Carex limosa*, *Carex pauciflora*, *Drosera rotundifolia*, *Drosera intermedia*, *Vaccinium microcarpum*, *Vaccinium oxycoccos*), vulnerable (*Scheuchzeria palustris*, *Rhynchospora alba*, *Carex magellanica* subsp. *irigua*) which must be protected by declaring special conservation areas.

Composition by karyotype genetic categories shows the dominance of species of diploid genotype (53.33%) closely followed by polyploid species (40%).

Conflict of interest. There is no actual or potential conflict of interest in relation to this article.

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