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VEGETATION AND PRODUCTIVE POTENTIAL OF DOMINANT GRASSLANDS BY *Festuca valesiaca* AND *Agrostis capillaris* IN NORTHWESTERN ROMANIA

Laviniu Ioan Nuțu Burescu[1*], Eugenia Adriana Morar-Burescu[2], Simina Florica Ștef[2], Ioana Andra Vlad[3], Szilárd Bartha[1], Iulia Florina Pop[2], Iglicea Bojinescu-Rostescu[2]

[1]Department of Forestry and Forest Engineering, University of Oradea, 26 Magheru Blvd, Oradea, Bihor County, Romania

[2]Doctoral School of Biomedical Sciences, University of Oradea, Piata 1 Decembrie no. 10, Oradea, Bihor County, Romania

[3]Department of Food Engineering, University of Oradea, 26 Magheru Blvd, Oradea, Bihor County, Romania

[*]Corresponding author. E-mail: laviniuburescu@gmail.com

ABSTRACT

The aim of our research is to develop a floristic, phytocenological, ecological, cytogenetic, economic, syndynamic and ecoprotective study of the vegetation of the dominant grasslands of *Festuca valesiaca* Scleicher ex Gaudin and *Agrostis capillaris* L. in the North-West region of Romania. A numer of 20 phytocenological surveys were carried out in the most representative sample areas in order to find answers to the five objectives pursued. The species from the floristic inventory of the grasslands are included in the Association table according to the cenotic affinity criteria as characteristic and differential entities for the cenotaxons of the alliance, order and class. The phytocoenoses of the grasslands gathered in the association *Agrostio-Festucetum valesiacae* are statistically analysedin the results based on tables, histograms, dendrograms, diagrams on the distribution of species in ecological bioforms categories, phytogeographic elements, cytogenetic elements, ecological indices or factors: soil moisture, air temperature, soil chemical reaction.

The succession dynamics of phytocoeneoses, the economic value and the productive potential, the sustainable and eco-protective management of the grasslands were all studied.

The results thus obtained were compared with two reference papers belonging to authors who conducted more recent studies in different geographical regions.

Eight conclusions were drafted in which both the results of the research and the original contribution of the authors are summarized.

Keywords: biodiversity, phytocoenosis, ecological characterization, management.

INTRODUCTION

The grasslands vegetation in northwestern Romania, namely the territories of Oradea Hills, Lăzăreni Hills, and Meseș foothills has a productive potential that provides the source of grass necessary for the nutrition of herbivores, but insufficiently known in terms of spontaneous flora composition, pastoral value, structure of the phytocenological groups, sustainable management and conservation of the genofond and ecofond.

In this paper on the study of the living soil cover in northwestern Romania, in addition to scientific and traditional phytocenological information of the Central European school, the flora inventory, the complex analysis thereof in the form of bioform spectra, phytogeographic elements, genetic types of karyotype, chart of ecological moisture, temperature and chemical reaction index, an attempt is made to broaden the scope and interdisciplinary approach of the dominant grasslandsof the phytocoenoses of the association ***Agrostio-Festucetum valesiacae*** (Syn.:Medicagini-*Festucetum valesiacae* subass. anthoxanthetosum odorati Chifu and Ștefan, 1978).

The association gathers the secondary, permanent grasslands included in the natural habitat of community interest NATURA 2000: 6240*Sub-panonic European steppic grasslands; EMERALD: 34.9 Continental

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steppic; CORINE: 34.312 Central European steppes grasslands; PALAEARTIC HABITATS: 34.911 Panonic loess steppes; 34.9211 Western Pontic thyme steppes, correspondent in Romania R3414 Ponto-Pannonian grasslands of *Festuca valesiaca*, Habitats Directive 92/43/EEC - Council Directive 92/43/EEC on the conservation of natural habitats of wild fauna and flora (Doniță et al., 2005; Gafta and Mountford, 2008).

The aim of our research is to develop a floristic, phytocenological, ecological, cytogenetic, economic, syndynamic and eco-protective study of the dominant grasslands of *Festuca valesiaca* Schleicher ex Gaudin and *Agrostis capillaris* L. (*Agrostis tenuis* Sibth).

In order to achieve our proposed goal, we set the research objectives below:

- finding the floristic composition of the cenosis grasslands, making of the Association table with the classification of all the inventoried species in ecological categories of bioforms, phyto-geographical elements, abundance-dominance quantitative indices, phytocenotic indices of constancy classes;
- classification of species according to their affinity for cenotaxones of alliance, association, order, class, to which they subordinate as well classification of transgressive species from other plant associations or vegetation classes;
- ecological characterization of the grasslands considering the analysis of the belonging of the species to the type of bioform, phytogeographical element, genetic element and to the ecological categories of moisture, temperature, and chemical reaction of the soil;
- establishing the dynamic equilibrium stage i.e. the “meadow climax” of maximum maturity in terms of organic matter production and the direction of evolution of phytocenoses for a certain stage of their existence;
- establishing the economic value of the surveyed grasslands in light of evaluation of their productive potential, the forage quality indices and the share of forage species, and of those with medicinal, aromatic, and honey properties;
- establishing the sustainable management of grasslands, measures for the protection and conservation of rare, endangered, vulnerable, endemic species.

The phytocenoses of the dominant grasslands of *Festuca valesiaca* Schleicher ex Gaudin (steppe wood hair grass) and *Agrostis capillaris* L. (creeping bent grass) have a continental nature and are frequently met in southeastern Europe and to a lesser extent in central Europe. In Romania they were reported in the northwestern region (Pop, 1968; Lacatoș-Herman, 2012; Păscuț, 2012; Czirják, 2014; Gavra, 2014) western Romania (Ardelean, 1999); Banat (Grigore, 1975; Oprea and Oprea, 1995); Transylvania (Hodișan et al., 1974; Schneider-Binder, 1975; Oroian, 1998; Sămărghitan, 2005; Vințan, 2014); Moldova (Horeanu, 1973; Tomescu, 2005; Chifu et al., 2006, 2014); Oltenia (Ciurchea, 1971); Muntenia (Ștefan, 1986); Danube Gorge (Todor et al., 1971); Dobrogea (Dihoru et Doniță, 1970).

MATERIAL AND METHODS

Surveys were carried out in the geographical areas of northwestern Romania, i.e. the Oradea Hills subunits, encompassing the human settlements: Săldăbagiu de Munte, Paleu, Cetariu, Husasău de Criș, Bălaia, Nădar, Spinuș, Sârbi, the low hills and the foothills of the Meseș Mountains, Boziei Hilland the settle ments within Bozniei Hill, Bodiei Hill, Ragului Valley and Lăzăreni Hills.

The biological material studied consists of the natural Ponto-Pannonian grasslands of *Festuca valesiaca* Schleicher ex Gaudin with *Agrostis capillaris* L. widely spread on flat lands, on gentle to moderate slopes with sunny exposures on arid soils with a neutral to slightly basic chemical reaction.

In order to establish the structure of the grasslands living soil cover, we made use of the phytocenological research methods of the Central European school developed by Braun-Blanquet (1964), and tailored to the particularities of the Romanian vegetation by Borza and Boșcaiu (1965).

In the study of the vegetal living soil cover we adopted the vegetal association as

basic cenotaxonomic unit (Géhu and Rivas-Martinez, 1981).

The species quantitative and frequency criterion, followed in the itinerary research of the association's phytocoenoses consisted in estimating the density and soil cover by plants, using abundance and dominance indices according to the Braun-Blanquet and Pavillard system (1928), corroborated with constancy class indices (K = IV) which highlights the degree of fidelity of the species to the association phytocoenoses environment.

In order to find the species, and to establish the floristic composition of the phytocoenoses gathered in the vegetal association, 20 phytocenological surveys were carried out, out of which 10 phytocenological surveys were performed in the grasslands from Oradea Hills, five phytocenological surveys were carried out in the hills and foothills of the Meseș Mountains and five phytocenological surveys were made in the Lăzăreni Hills, during the optimal vegetation period.

The floristically and physiognomically homogeneous sample surfaces were chosen from the most representative phytocenoses, ranging 50-100 m^2, the surveys results being recorded in the phytocenological table also called analytical phytosociological table.

The analytical phytosociological table with the species ordered according to the cenotaxonomic criterion, contains scientific information on the floristic and cenotic composition of the plant populations that make up the phytocenosis-individual association, the type of bioforms (live forms), phytogeographic elements, and genetic type (karyotype). When classifying the phytocenoses of the grasslands in the association and the superior cenotaxonomic units i.e. alliance, order, class, the traditional ecological-floristic systems conceived by the authors Tüxen (1955), Braun-Blanquet (1964), Soó (1964-1980), Borza and Boșcaiu (1965) were considered, as well as more recent scientific papers belonging to Oberdorfer (1992), Pott (1995), Borhidi (1996), Mucina (1997), Rodwell et al., (2002), Sanda et al. (2008), Coldea et al. (2012), Chifu et al. (2014).

Classification of species in the categories of bioforms was performed according to the system elaborated by Raunkiaer (1937), improved by Braun-Blanquet (1964), and with the help of the works elaborated by Ellenberg (1979), Sanda et al. (2003), Burescu and Toma (2005), Ciocârlan (2009).

Distribution of species by categories of phytogeographical elements (geoelements) was made according to the classification developed by Meusel and Jäger (1992) and the most recently one adopted by Cristea et al. (2004), while the distribution by categories of ecological indices, moisture (M), temperature (T), and the chemical reaction of the soil (R) was done according to the works of the authors Ellenberg (1979) for Central Europe using a scale of 1 to 9 scale, and Sanda et al. (2003) for Romania using a scale of 1 to 6.

In the phytocenological, ecological, and cytogenetic study of the phytocenoses of the dominant grasslands of *Festuca valesiaca* and *Agrostis capillaries*, we paid special attention to the analysis and statistical interpretation of the results of bioform categories, phytogeographic elements, ecological indices, and cytogenetic categories by graphically illustrating them by means of histograms and dendrograms. The computer processing of surveys in order to build phytosociological was done in light of Kulczynski index (1928) which groups the samples (surveys) according to their floristic resemblance. Based on the comparison between the samples, both the global homogeneity of the surveys as well as the intercenotic variability of the grasslands phytocoenoses could be thus highlighted.

Table 1. Agrostio-Festucetum valesiacae

Association				*Agrostio-Festucetum valesiacae*																		
Location				Meseș Mountains					Oradea Hills									Lăzăreni Hlls				
Bio.	E.f.	2n	Survey no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	K
			Altitude (AMSL)	550	530	500	650	700	210	210	210	210	220	220	220	220	200	200	300	290	310	280	320	
			Vegetation cover (%)	100	100	80	100	90	100	95	100	90	100	100	100	100	100	100	85	90	85	100	90	
			Exposure	V	SV	E	S	N	S	-	N	N	V	V	V	NE	N	NE	SV	S	S	E	V	
			Slope (°)	22	18	10	5	6	10	-	8	6	2	4	10	6	10	8	8	10	7	9	10	
			Surface (m²)	50	50	50	50	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
H	Eua-C	D	*Festuca valesiaca*	2	3	4	5	3	4	5	4	4	5	4	4	4	2	4	3	4	4	5	4	V
H	Cp	P	*Agrostis capillaris*	4	3	+	+	+	1	+	2	1	+	2	2	1	4	1	2	1	1	+	1	V
			Festucion valesiacae																					
Ch-H	Ec	D	*Dorycnium pentaphyllum* ssp. *herbaceum*	.	.	+	.	+	.	.	+	.	+	+	+	+	.	+	+	+	.	+	1	III
Th	Mp	P	*Xeranthemum cylindraceum*	+	+	1	+	3	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	II
H	Eua-C	P	*Festuca rupicola*	+	.	.	+	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	II
H	Eua-M	P	*Dichanthium ischaemum*	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	+	+	.	+	.	II
H	M	D,P	*Echium italicum*	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Th	E	D,P	*Euphrasia stricta*	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	I
Th	Atl-M	D	*Lathyrus nissolia*	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	I
H	M	D	*Plantago argentea*	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	.	.	.	.	.	I
H	Eua	P	*Sanguisorba minor*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Mp	D	*Stachys recta*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Ch	Ppn	P	*Thymus pannonicus*	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Th	Mp	D	*Xeranthemum annuum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
			Festucetalia valesiacae																					
H	Eua	P	*Lotus corniculatus*	+	+	+	+	.	+	+	+	+	+	+	+	+	+	+	.	+	+	+	+	V
H	Mp	D,P	*Eryngium campestre*	+	+	.	.	.	.	+	+	+	+	+	+	+	.	+	1	+	+	+	+	IV
H-G	Eua	D,P	*Euphorbia cyparissias*	.	.	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	+	.	+	IV
H	Ec-M	D,P	*Asperula cynanchica*	+	+	+	.	+	.	.	+	+	.	.	.	.	.	.	+	+	+	.	+	III
H	E	P	*Achillea collina*	.	.	.	.	.	+	+	.	.	.	.	+	+	.	.	.	.	.	.	.	II
H	Ppn-B	P	*Achillea nobilis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	I
H	Eua	D,P	*Agropyron cristatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	I
H	Eua-C	P	*Bromus inermis*	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I
TH	Ec	D	*Carlina biebersteinii*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	I
Th	E	D,P	*Euphorbia stricta*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	I
H	E	D	*Fragaria viridis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Ch-H	Ec-M	D	*Helianthemum nummularium*	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	I
H	E	P	*Hieracium bauhinii*	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Ppn-B	D	*Inula ensifolia*	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	I
H	Eua-C	D	*Inula hirta*	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	I
H	Eua	D	*Linaria vulgaris*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	I
Th	M	D	*Medicago minima*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	I
H	E	D,P	*Potentilla arenaria*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	.	I
H	Eua-C	D	*Scabiosa ochroleuca*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Ch	M-Ec	P	*Teucrium montanum*	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	D,P	*Veronica spicata*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	I
			Festuco-Brometea																					
H	Eua	P	*Agrimonia eupatoria*	+	+	+	+	+	+	.	.	.	.	+	.	.	+	+	.	.	.	.	.	III
H	Eua	P	*Galium verum*	+	+	+	.	.	+	.	+	+	.	+	+	+	+	.	.	.	.	.	.	III
H-Ch	E	D,P	*Ononis spinosa*	.	.	.	.	.	+	.	+	+	+	+	+	+	+	.	.	.	.	.	.	III
H	Eua	D	*Plantago lanceolata*	+	+	.	.	.	+	+	.	+	.	+	.	.	+	.	+	+	.	+	+	III
Ch	Mp	P	*Thymus glabrescens*	.	.	.	+	.	+	.	+	+	+	.	+	+	.	.	+	+	+	.	.	III
Th-TH	E	D	*Trifolium campestre*	.	.	.	.	+	+	+	+	+	1	.	+	+	.	.	+	+	.	+	+	III
H	Cp	P	*Clinopodium vulgare*	+	+	.	.	+	.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	II
H	E	D	*Dianthus carthusianorum*	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	II
H	Eua	P	*Hypericum perforatum*	.	.	.	+	.	+	.	.	.	.	.	+	.	+	+	.	.	.	.	.	II
H	Eua-M	P	*Pimpinella saxifraga*	+	+	+	+	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	II
H	Eua	D,P	*Plantago media*	+	.	.	+	.	+	.	+	.	.	.	+	.	.	+	.	.	.	.	.	II
H	Eua	D	*Potentilla argentea*	.	.	.	.	.	+	.	.	+	.	.	.	+	.	.	+	+	+	.	+	II
H-TH	Mp	P	*Stachys germanica*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	II
H-Ch	E	P	*Polygala comosa*	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	+	+	+	II
Ch	M-Ec	P	*Teucrium chamaedrys*	+	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II
H	Eua-M	P	*Brachypodium pinnatum*	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Th-TH	Eua-M	P	*Bromus hordeaceus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	I
H	Eua	P	*Campanula glomerata*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
G	Eua	P	*Carex caryophyllea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
TH	Eua	D	*Carlina vulgaris*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	I
H	E	D,P	*Centaurea scabiosa*	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
nPh	Ec	P	*Chamaecytisus hirsutus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
H	Ec-M	P	*Coronilla varia*	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
G	Cosm	D,P	*Cynodon dactylon*	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	I
H	Ec-M	P	*Danthonia alpina*	.	.	.	.	.	+	+	.	.	.	+	+	.	.	.	.	.	.	.	.	I
TH	Eua	D,P	*Echium vulgare*	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	D	*Galium mollugo*	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	I
H	Eua-M	P	*Gentiana cruciata*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	D,P	*Hieracium pilosella*	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	+	.	I
H	Cp	D	*Koeleria macrantha*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	I
H	Eua-C	D,P	*Phleum phleoides*	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	I
H	Ec-M	P	*Prunella laciniata*	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Ch	End Carp	P	*Thymus comosus*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua-C	D	*Trifolium montanum*	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	I
			Molinio-Arrhenatheretea																					
H	Eua	D	*Cichorium intybus*	+	+	.	+	.	+	+	+	+	+	.	.	+	+	+	+	+	+	.	+	IV
H	E	D	*Hypochaeris radicata*	.	.	.	.	+	+	+	+	+	+	.	+	.	+	+	+	+	+	.	+	IV
H	Atl-E	D	*Trifolium hybridum*	+	+	.	.	.	+	+	+	.	+	+	+	+	+	+	+	+	+	+	.	IV
H	Eua	P	*Achillea millefolium*	.	.	+	.	.	.	.	+	+	.	+	.	.	+	.	+	+	+	.	+	III
H	Eua	D,P	*Anthoxanthum odoratum*	+	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	+	+	+	.	III
H	Ec	D	*Centaurea phrygia*	+	+	.	.	.	+	+	.	+	+	+	.	+	+	.	.	.	.	.	.	III
H	Eua	D	*Leontodon hispidus*	.	.	.	.	.	+	+	.	.	.	+	.	+	+	.	+	+	.	+	+	III
H	Cosm	D	*Lolium perenne*	.	.	.	.	.	.	+	.	.	.	1	+	+	.	.	.	+	+	+	.	III
H	Cosm	P	*Poa pratensis*	.	+	.	+	.	.	+	+	+	.	+	+	+	+	+	.	.	.	.	.	III
H	Eua	P	*Trifolium repens*	.	.	.	.	.	+	.	+	.	+	1	+	.	.	.	+	+	+	.	+	III
Th	Ec	P	*Centaurium erythraea*	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	II
H	E	D	*Cynosurus cristatus*	+	+	.	.	.	+	.	.	+	.	+	.	+	.	.	.	.	.	.	.	II
H	Eua	D	*Festuca pratensis*	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	+	II
Th	E	D	*Rhinanthus minor*	+	+	+	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	II
H	Eua	D,P	*Vicia cracca*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	+	II
H	Eua	D,P	*Briza media*	+	+	.	.	+	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	I
G	Eua	P	*Calamagrostis epigeios*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
TH	E	D,P	*Campanula patula*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	I
G	Cp	P	*Carex panicea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	I

Bio.	E.f.	2n	Survey no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	K
Ch-H	Cosm	D	*Cerastium holosteoides*	+	+	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	P	*Dactylis glomerata*	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
H	E	P	*Danthonia decumbens*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	+	.	I
H	Cp	D,P	*Festuca rubra*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	I
H	Eua	D	*Leucanthemum vulgare*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	P	*Phleum pratense*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	I
H-Ch	E-M	P	*Polygala vulgaris*	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Cosm	P	*Prunella vulgaris*	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	I
H	Cosm	D	*Rumex acetosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	I
H	Eua	P	*Sanguisorba officinalis*	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	I
H	Eua	D	*Stellaria graminea*	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
TH-H	Eua	D	*Tragopogon pratensis* ssp. *orientalis*	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	.	.	I
H-TH	Eua	D	*Trifolium pratense*	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	I
			Trifolio-Geranietea sanguinei																					
H	E	D	*Ranunculus polyanthemos*	.	.	.	.	.	+	.	.	.	.	+	+	+	+	+	.	.	.	.	.	II
H	Eua	D	*Astragalus glycyphyllos*	.	.	.	.	.	.	+	+	.	+	.	.	.	.	+	.	.	.	.	.	I
H	E	D,P	*Centaurea jacea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
nPh	Ec	P	*Cytisus nigricans*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	I
H	Eua	D	*Fragaria vesca*	+	.	.	+	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	I
H	Eua	P	*Trifolium medium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
			Stellarietea mediae																					
G	Cosm	P	*Convolvulus arvensis*	.	.	.	.	.	+	.	.	+	+	.	+	+	.	.	+	+	+	.	+	III
Th-TH	Adv	P	*Erigeron annuus*	.	.	.	.	.	+	+	.	+	.	+	.	+	.	+	+	.	+	+	.	III
Th	E-M	D,P	*Geranium pusillum*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	+	.	I
G	Eua	P	*Sonchus arvensis*	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Th	P-Cauc-B	D	*Vicia grandiflora*	.	.	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	.	I
			Artemisietea vulgaris																					
TH-H	Eua-M	D	*Daucus carota* ssp. *carota*	+	.	+	.	+	+	.	+	.	.	.	+	+	+	.	.	+	+	.	+	IV
TH	E	D	*Carduus acanthoides*	+	+	.	.	.	+	.	+	+	+	.	.	+	.	.	+	+	+	.	+	III
TH	Eua-C	D	*Dipsacus laciniatus*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
H	Eua	D	*Tanacetum vulgare*	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	I
			Koelerio-Corynephoretea																					
Th	Eua	D	*Trifolium arvense*	.	.	.	.	.	+	+	1	+	+	.	+	1	.	+	+	+	+	.	+	III
Th	Eua-M	P	*Filago vulgaris*	.	.	.	.	.	1	+	+	+	.	.	.	.	.	.	+	.	+	.	+	II
Th	Eua-Cosm	P	*Vulpia myuros*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	I
			Galio-Urticetea																					
H	Atl-M	P	*Epilobium lamyi*	.	.	.	.	.	+	.	.	+	.	.	.	.	+	+	.	.	.	.	.	I
H	Eua	P	*Scrophularia nodosa*	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	I
			Rhamno-Prunetea																					
nPh	E	P	*Rosa canina*	+	+	+	+	+	.	.	.	+	.	.	.	+	+	1	+	+	+	+	.	IV
mPh	Eua	D	*Crataegus monogyna*	+	+	+	+	+	.	.	.	+	.	.	.	1	2	1	+	+	+	.	+	III
mPh	Eua-M	P	*Prunus spinosa*	+	.	.	.	+	.	.	.	.	.	.	.	+	1	+	+	+	.	+	.	III
mPh	E	D	*Pyrus pyraster*	+	.	+	+	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	II
nPh	Ec	P	*Rubus praecox*	.	.	.	.	.	.	.	.	+	.	.	.	+	+	1	.	.	.	.	.	II
MPh	E	D	*Malus sylvestris*	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	I
H	Eua	D	*Origanum vulgare*	+	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
			Variae Syntaxa																					
Th-TH	Eua-M	D	*Bromus arvensis*	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H-Ch	End Carp	P	*Dianthus spiculifolius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	I
H	Ec	D,P	*Hieracium hoppeanum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	I

RESULTS AND DISCUSSION

The Ponto-Pannonian grasslands of *Festuca valesiaca* with *Agrostis capillaris* colonize large areas (50-100 ha) on a substratum consisting of sandy clays, sandstones, loess deposits, calcareous marls, on preluvosol and eutricambosol soils with a moderate level of base saturation (50-60%), deficient in terms of moisture, and with a weak acid-neutrophilic to neutral chemical reaction. The relief is diversified, from long and wide peaks with an altitude ranging 210 to 302 m at the contact with the Northwest Plain of Romania, to hills and plateaus with an altitude ranging 450 to 700 m, at the contact with the Meseș Mountains, on gentle to moderate slopes (6-18°C), with predominantly southern and southwestern exposures. The geographical territory surveyed is located within a temperate climate area where multiple climatic influences interfere i.e. oceanic, Scandinavian-Baltic, excessive continental, Pontic and sub-Mediterranean influences. North Atlantic cyclones (Icelandic) bring moisture-rich air masses, and the North African anticyclone brings hot air masses causing drought.

The floristic composition or the specific biodiversity

Finding floristic composition of the grasslands represents a first objective pursued in this study. The floristic inventory of the dominant grasslands of the phytocoenoses of the association ***Agrostio-Festucetum valesiacae*** totals a number of 131 cormophyte species (Table 1) which means a very rich biodiversity as the expression of optimal living conditions provided by the habitat in which it develops. The dominant species that instil the physiognomy of the cenosis are *Festuca valesiaca* with a general coverage rate of 55.17%, maximum constancy (K = V) and *Agrostis capillaris* with a coverage rate of

14.97%, maximum constancy (K = V), being codominant.

The cenotaxonomic units of the association and the floristic structure thereof

Classification of species by cenotaxones of the plant association is another objective pursued in our study. Along with the association' dominant and characteristic species i.e. *Festuca valesiaca, Agrostis capillaris* a number of 129 species also vegetates in the phytocenosis plant, of which 12 xerophilous differential species are characteristic for the Alliance ***Festucion valesiacae***. These species are moderately thermophilic specific to steppe or steppe grasslands and reached their development peak in postglacial (boreal) climate period: *Dorycnium pentaphyllum* ssp. *herbaceum*, *Xerantheum cylindraceum*, *Festuca rupicola*, *Dichanthium ischaemum*, *Echium italicum*, *Euphrasia stricta*, *Lathryrus nissolia*, *Plantago argentea*, *Sanguisorba minor*, *Stachys recta*, *Thymus pannonicus*, *Xeranthemum annum*, etc. (Table 1), order ***Festucetalia valesiacae***; 21 species which are xeromesophiles, xerotherms conditioned to a large extent by an edaphic climate: *Lotus corniculatus*, *Euphorbia cyparissias*, *Asperula cynanchica*, *Eryngium campestre*, *Achillea colina*, *Achillea nobilis*, *Agropyron cristatum*, *Bromus inermis*, *Helianthemum nummularium*, *Inula ensifolia*, *Inula hirta*, *Medicago minima*, *Potentilla arenaria*, *Scabiosa ochroleuca*, *Teucrium montanum*, *Veronica spicata*, etc. (Table 1); class ***Festuco-Brometea*** encompasses 34 species, of which the following ones appear with a higher frequency: *Agrimonia eupatoria*, *Galium verum*, *Ononis spinosa*, *Plantago lanceolata*, *Thymus glabrescens*, *Trifolium campestre*, *Clinopodium vulgare*, *Dianthus carthusianorum*, *Hypericum perforatum*, *Pinpinella saxifraga*, *Plantago media*, *Potentilla argentea*, *Stachys germanica*, *Polygala comosa*, *Teucrium chamaedrys*, *Brachypolium pinnatum*, *Centaurea scabiosa*, *Coronilla varia*, *Gentiana cruciata*, *Hieracium pilosella*, *Koeleria macrantha*, *Phleumphleoides*, etc. (Table 1). A substantial number of species are transgressive from the connective associations, subordinated to the vegetation classes ***Molinio-Arrhenatheretea*** i.e. 32 species: *Cichorium intybus*, *Hypochaeris radicata*, *Trifolium hybridum*, *Achillea millefolium*, *Anthoxanthum odoratum*, *Centaurea phrygia*, *Leontodoa hispidus*, *Leontodoa hispidus*, *Lolium perenne*, *Poa pratensis*, *Trifolium repens*, *Centaurium erythraea*, *Cynosurus cristatus*, *Festuca pratensis*, *Rhinanthus minor*, *Vicia cracca*, etc. which shows us the attenuating influence of the subcontinental climate on the habitat surveyed; ***Trifolio-Geranietea sanguinei*** (six species), ***Stellarietea mediae*** (five species), ***Artemisietea vulgaris*** (four species), ***Koelerio-Corynephoretea*** (three species), ***Galio-Urticetea*** (two species) and ***Rhamno-Prunetea*** (seven species) (Table 1). The dendrogram of the association (Figure 1) suggests a high uniformity degree in the floristic composition but also a certain phytocenotic diversity, the similarity index values ranging 0.975 to 0.375.

The cenosis described by Ardelean (1999) in the upper basin of the Crişul Alb River gathers 74 cormophyte species, which means a reduced biodiversity compared to 131 species found by us. Of these, nine species are included in the basic cenotaxones of the association ***Festucion valesicae***, ***Festucetalia valesiacae*** as against 33 species found by us, and 22 species are included in the ***Festuco-Brometea*** association as against 34 found by us.

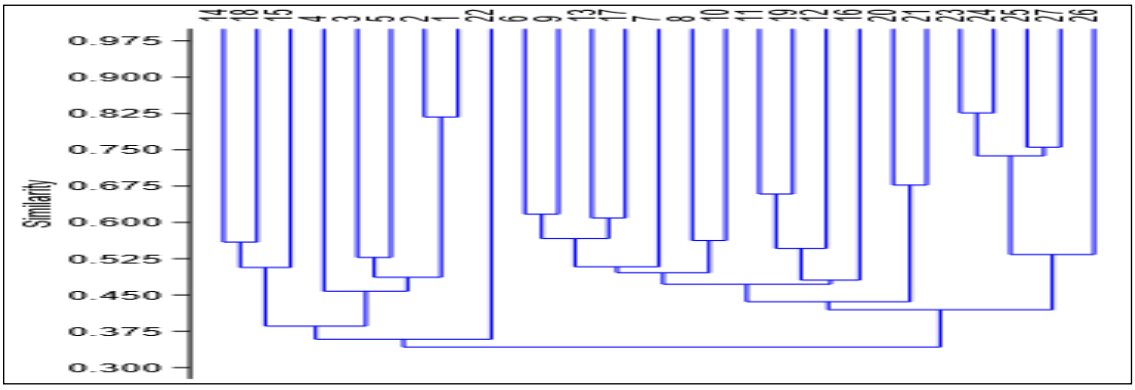


Figure 1. Kulczynski Similarity index of the *Agrostio-Festucetum valesiacae* association for the northwestern Romania territories

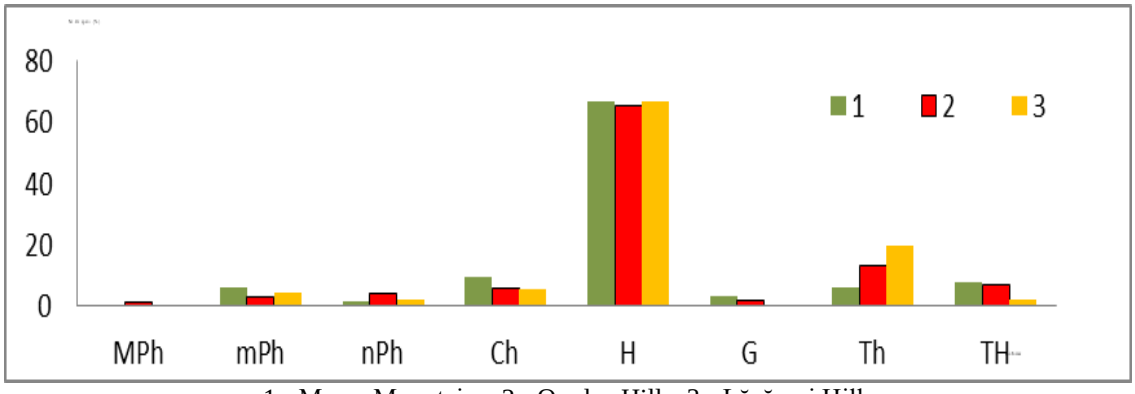
Ecological characterization of the grasslands plant species

In order to achieve the goal and meet the main objectives proposed in this study, a thorough analysis of the composition of grassland phytocenoses by ecological categories of bioforms, phytogeographic elements, ecological indices (moisture, temperature, soil chemical reaction), and genetic categories (number the basic pairs of chromosomes that make up the gene pool) was made. The ecological characterization of the grasslands in the light of the distribution of the species by the type of bioform, phytogeographical element, and genetic element is another fundamental objective of our study.

Composition of grasslands by bioform categories

The analysis of the species that make up the continental steppe grasslands in northwestern Romania in terms of bioforms types is an important aspect because it highlights the orographic characteristics that are predominant in the habitat, and the influences exerted on plants by abiotic and biotic environmental factors. Learning the type of bioform is important because it expresses the way species adapt to the living environment to protect their regenerating buds during vegetative rest, frosty winters, excessively dry summers, highlighting the phenomenon of corm modelling from morphological, anatomical, and physiological perspectives, a process that took place in the phytohistorical periods within a long series of evolutionary transformations.

The bioforms spectrum (Figure 2) shows the categorical dominance of hemicryptophytes in the following shares: 65.09% in Oradea Hills, 66.67% in the hills and foothills of Meseș Mountains, 68.55% in Lăzăreni Hills, with an average share of 66.76% in northwestern Romania, these plants being the main components of grasslands.



1 - Meseș Mountains; 2 - Oradea Hills; 3 - Lăzăreni Hills

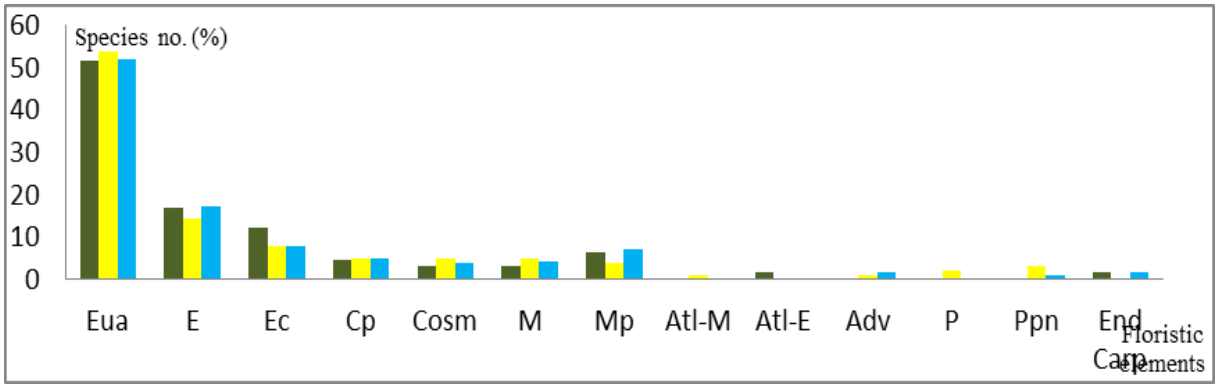
Figure 2. Comparative spectrum of the bioforms of the *Agrostio-Festucetum valesiacae* association

Terophyte plants (annual and biannual) have a relatively substantial participation with the following percentages: 19.80% in the Oradea Hills, 14.23% in the Meseș foothills, 24.05% in the Lăzăreni Hills, and an average of 19.36% in the northwestern Romania geographical area. The average share of 19.36% and the frequency of spreading terophytes in the territory are consistent with the influences of the following elements: zoo-anthropic factors, deforestation, expansion of agricultural crops, intensive grazing, and environmental pollution.

The distribution of bioforms in the grasslands in the Crișului Alb River basin, (Ardelean, 1999) i.e. hemicryptophytes (70%) and terophytes (19%) is within reasonable limits with those found in thegrasslands from northwestern Romania region.

Composition of grasslands by categories of phytogeographical elements

The geographical area structure of the grasslands cormoflora in northwestern Romania region highlights the participation of a large number of categories of phytogeographic elements of various florogenetic origins and in varying proportions (Figure 3). Becoming familiar with the proportions of the categories of geoelements that make up the flora of the studied geographical area gives us information on the richness and diversity of the genofond, and the area-geographical interferences caused by migration of plant species in time.



1 - Meseș Mountains; 2 - Oradea Hills; 3 - Lăzăreni Hills

Figure 3. Comparative spectrum of phytogeographic elements from northwestern Romania - *Agrostio-Festucetum valesiacae* association

Flora of phytocenoses of the association ***Agrostio-Festucetum*** valesiacae is characterized by the predominance of the Eurasian species in Oradea Hills (16.67%), Meseș foothills, Lăzăreni Hills (50.05%) resulting in an average of 51.84% for the surveyed territory. Over the Eurasian species there were overlapped in various phytohistorical stages, the European phytogeographical elements (14.15% in the Oradea Hills, 16.67% in the Meseș foothills, and 20.40% in the Lăzăreni Hills), Central European elements (7.54% in Oradea Hills, 12.12% in the Meseș foothills, 3.70% in the Lăzăreni Hills), circumpolar (4.71% in the Oradea Hills, 4.54% in the Meseș foothills, 5.5% in the Lăzăreni Hills) which attests the belonging of the geographical area studied to the Holarctic region, the Eurosiberian subregion, the Central European domain, the Pannonia province, the Northwestern Plain District of Romania, and the Northwestern District of the Apuseni Mountains (Western Carpathian) - the Meseș Mountains cluster.

Thermophilic species of southern European origin occur in a rather modest share (11.78%) of which Mediterranean species form a share 3.87% (*Echium italicum, Plantago argentea, Medicago minima, Thymus glabrescens, Teucrium chamaedrys, Teucrium montanum*), Mediterranean-Pontic species represent a share of 6.97% (*Xeranthemum cylindraceum, Xeranthemum annnuum, Stachys recta, Stachys germanica, Eryngium campestre, Veronica orchidea*), and the Atlantic-

Mediterranean are in a share of 0.94% (*Epilobium lamyi*). The Pontic, Pontic-Pannonian, Pontic-Pannonian-Balkan species form a share of 6.56% (*Vicia grandiflora, Achillea nobilis, Inula ensifolia, Chamaecytisus austriacus*) and highlight the existence of florogenetic connections with the flora of the Pannonian Plain, flora living in the steppe lands of the Black Sea and the Balkanand Moesian flora growing south of the Danube River.

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

The analysis of the species that make up the grasslands flora, depending on the requirements in terms of moisture, temperature, soil chemical reaction is important since it highlights the ecological specificity of the habitat amid the complex local soil and climate factors, which are accurate indicators of sites where plant growth.

Table 2. Distribution of species by ecological categories (moisture - M, temperature - T, soil chemical reaction - R) for plant habitats in northwestern Romania

Surveyed areas / Ecological categories (%)		1	1.5	2	2.5	3	3.5	4	4.5	5	0
Meseș Mountains	M	4.54	6.06	30.30	21.21	28.79	3.03	1.51	-	-	4.54
	T	-	-	1.51	4.54	43.94	4.54	13.64	-	6.06	25.76
	R	-	-	-	-	22.73	1.51	31.82	4.54	4.54	34.85
Oradea Hills	M	1.88	7.54	27.35	20.75	26.41	6.6	1.88	-	-	7.54
	T	-	-	1.88	4.71	38.67	13.2	16.03	0.94	3.77	20.75
	R	-	-	1.88	0.94	19.81	-	30.18	4.71	2.83	39.62
Lăzăreni Hills	M	-	11.11	33.33	12.96	18.52	9.26	3.7	-	-	11.11
	T	-	-	-	-	35.19	11.11	16.67	1.85	5.55	29.63
	R	-	-	9.26	-	14.81	-	35.18	-	2.37	38.39

According to plant preferences in terms of moisture (Table 2) it results that most species are: xero-mesophiles (48.10%) and xerophiles (9.42%) totalling 57.52 in the Oradea Hills; xero-mesophiles (51.51%) and xerophiles (10.6%), totalling 62.11% in the Meseș foothills; xero-mesophiles (46.92%) and xerophiles (11.11%) totaling 58.09% in the Lăzăreni Hills, as a consequence of the moisture deficit of the sub-panonic steppe habitat where these plant species vegetate, which represents high shares compared to the grasslands described in the Biharia Massif by Buia et al. (2021), where xero-mesophilic plants reach a percentage of only 22.84%. The mesophilic species from the mountain grasslands reach a percentage of 33.01% in the Oradea Hills, 31.82% in the Meseș foothills, and 27.78% in the Lăzăreni Hills. The water-ampholerant species (with a wide ecological amplitude with regard moisture) are present in small percentages i.e. only 7.54% in the Oradea Hills, 4.54% in the Meseș foothills and 11.11% in the Lăzăreni Hills.

When making a comparison with the grasslands found in the upper basin of the Crișul Alb River (Ardelean, 1999), the latter are composed of a mixture of xero-mesophilic (44.38%), xerophilous (13.42%), mesophilic (29.75%), mesothermic (43%), eurythermic (24.26%), moderately thermophilic (13.14%), thermophilic (5.5%), euryionic (36.39%), weakly acid-neutrophilic (24.27%) species, and neutro-basifiles (6.6%) which means results partially close to those obtained by us in the surveyed carried out in northwestern Romania.

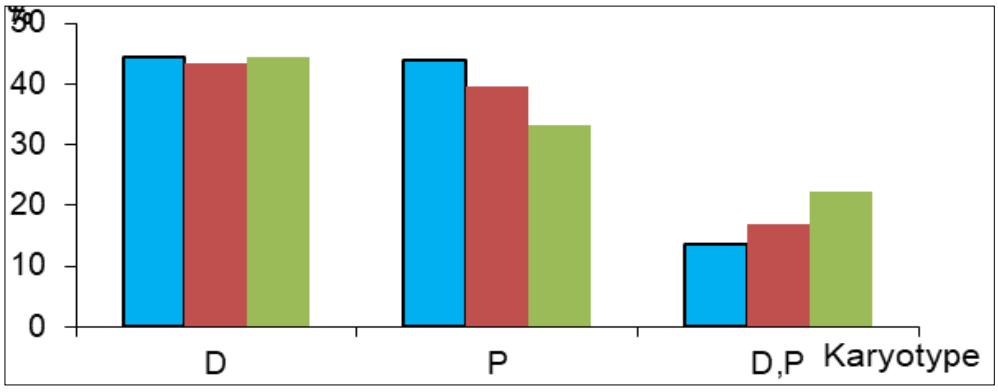
Regarding the temperature factor (Table 2) the continental temperate climate specific to the studied geographical area is favourable for the development of mesothermal species present the following percentages: 51.87% in the Oradea Hills, 48.48% in the Meseș foothills, 46.30% in the Lăzăreni Hills. The

thermally ampholerant species occur in the following shares: 20.75% in the Oradea Hills, 25.76% in the Meseș foothills and 29.63% in the Lăzăreni Hills, when compared to those present in the Biharia Massif (Buia et al., 2021) which reach a percentage of 34.28%.

The chemical reaction of the soil favours the development of ionic amphitolerant species in the following percentages: 39.62% in the Oradea Hills, 38.39% in the Lăzăreni Hills, and 34.85% in the Meseș Mountains followed by the weakly acid-neutrophilic ones in the following shares: 36.36% in the Meseș Mountains, 35.18% in the Lăzăreni Hills, and 34.89% in the Oradea Hills (Table 2), compared to the Biharia Massif grasslands, which are dominated by acidophilic species in a share of 28.57% (Buia et al., 2021).

In the cariological spectrum of the flora (Figure 4) the predominant species are species with diploid genotype i.e. 43.39% in the Oradea Hills, 44.40% in the Lăzăreni Hills, and 42.42% in the Meseș foothills, followed by the polyploid species i.e. 39.62% in the Oradea Hills, 33.30% in the Lăzăreni Hills and 43.94% in the Meseș foot hills as against the research conducted by Buia et al. (2021) in the Biharia Massif where the grasslands are dominated by polyploid species (47.85%) followed by diploid species (31.42%).

The high percentage of diploids provides the genetic potential of evolution through allopolyploidy and autopolyploidy. Polyploid plants present a high capacity for phytosociological competition, colonization of the bare space and adaptation to the living environment. The diplo-polyploid species are present in shares of only 16.97% in the Oradea Hills, 13.64% in the Meseș foothills, and 22.20% in the Lăzăreni Hills.



1 - Meseș Mountains; 2 - Oradea Hills; 3 - Lăzăreni Hills

Figure 4. Karyological spectrum of the *Agrostio-Festucetum valesiacae* association with regard the genetic karyotype in northwestern Romania

The dynamics of the phytocenoses of the dominant species in the association

With regard the ecosystem syndynamics of the Ponto-Pannonian grasslands of *Festuca valesiaca* and *Agrostis capillaris*, it is currently in a relatively stable equilibrium called climax with stable environmental factors. The presence of isolated clusters of shrubs consisting *Crataegus monogyna*, *Prunus spinosa*, *Cornus sanguinea*, *Rosa canina*, *Pyrus pyraster*, *Malus sylvestris* in the structure of the grasslands suggests their evolution towards the phytocenoses of the woody vegetation of the class ***Rhamno-Prunetea***. Under the circumstances created by the decrease of the groundwater level, the aridisation and desertification of the land correlated with an irrational and unbalanced overgrazing, especially on steep slopes, a regressive-involution succession can be reached, towards the degraded grasslands of association **Botriochloetum** (***Andropogemienum***) ***ischaemic*** fact suggested by the abundance and frequency of the following xerophilous and xerothermic species: *Botriochloa ischaemum*, *Medicago minima*, *Asperula cynanchica*, *Xeranthemum cylindraceum*, *Plantago argentea*, *Thymus pannonicus*, *Festuca rupicola* var. *sulcata*, *Brachypodium*

pinnatum, Veronica spicata, Inula ensifolia, Trifolium arvense, Eryngium campestre, Echium vulgare.

Grasslands economic value and productive potential

It is another objective proposed and pursued in our study. The grasslands containing the following dominant species: *Festuca valesiaca, Festuca rupicola, Agrostis capillaris, Lotus corniculatus, Bromus inermis, Medicago minima, Trifolium pretense, Coronilla varia, Trifolium repens, Trifolium hybridum, Lolium perenne, Poa pretense, Trifolium montanum, Phleumphleoides, Festuca pratensis, Vicia cracca* accompanied by other good forage species, and spread at altitudes ranging 300-600 m (nemoral-sessile oak floor) in the case of Oradea Hills, and at altitudes ranging 500-800 m (in the beech-sessile oak floor) in the Meseș foothills, are used in extensive and selective grazing from spring to autumn. The pastoral value (PV) corresponding to xeromesophilic habitats is heterogeneous ranging from an intermediate value i.e. 57.87% in the Meseș foot hills, down to 47.39% in the Lăzăreni Hills to a better one i.e. 63.21% in the Oradea Hills, with an average green grass production of 5 t/ha in the Oradea Hills, 7 t/ha in the Meseș foot hills and, respectively, a total production of 4.500 t/ 900 ha in the Oradea Hills and 5.600 t/ 800 ha in the Meseș foothills (Table 3). The grazing capacity (CP) or the load with animals in the grazing season is 0.77 livestock (cattle) units (UVM) per hectare, respectively, 459 UVM/ 900 ha in the Oradea Hills, 0.80 UVM/ ha, respectively, 512 UVM/ 800 ha in the Meseș foothills, 0.51 UVM/ ha in Lăzăreni Hills and a dry matter intake coefficient of 90-95% for the entire geographical area.

Table 3. Forrage productivity of grasslands of the *Agrostio-Festucetum valesiacae* association

Studies areas	Pastoral value (PV)	Green fodder index (GFI)	Green mass production MV (t/ha)	Number of animals or load CP (UVM/ha)
Meseș Mountains	57.87	3.45	8.28	0.80
Oradea Hills	63.21	3.72	9.32	0.77
Lăzăreni Hills	47.39	2.68	6.16	0.51

Grasslands are depreciated in some places due to the fact that a large number of non-valuable, toxic species invade them i.e. *Botriochloa ischaemum, Brachipodium pinnatum, Carlina vulgaris, Daucus carota* ssp. *carota, Echium vulgare, Eryngium campestre, Origanum vulgare, Verbena officinalis, Calamagrostis epigeios, Euphorbia cyparissias, Ononis spinosa, Erigeron annuus, Carduus acanthoides, Hypericum perforatum*, undershrubs such as *Rosa canina, Rubus praecox*, shrubs like *Crataegus monogyna, Prunus spinose*, etc. By appropriate agro-technical measures, toxic and non-toxic species can be "phased out". In addition to the fodder species with good and very good value, there are many medicinal, food and culinary, aromatic, honey, decorative plant species present in the floristic composition, which can be used in the local industry. Through the strong rhizomes, the clump-forming bushes of the perennial species, the grasslands having *Festuca valesiaca* and *Agrostis capillaris* as dominant species strongly are sodding the soil substrate thus playing an important role in the anti-erosion protection of the soil, having a paedogenesis role and regulating the water cycle. These grasslands also play an important role in preserving the floristic and faunal values of the ecosystem.

Management and conservation of grasslands in nortwestern Romania

The grasslands consisting of the phytocenoses of the ***Agrostio-Festucetum valesiacae*** association encompass a high biodiversity totalling 131 cormophyte species, included in the natural habitat of community interest NATURA2000 6240* Sub-pannonic steppic grasslands, R3414 Ponto-Pannonian grasslands of *Festuca*

valesiaca. In order to counteract the decline in biodiversity and preserve species identity, it is necessary to adopt specific management and monitoring measures such as: ensuring an optimal load with animals of 0.51 units of livestock (cattle) per hectare up to 0.80 UVM/ha, for the consumption of the entire quantity of green grass, reduction of litter resulting from non-consumable refusals of animals, introduction of rational grazing on plots, observance of an optimal sheepfold, one cow per 6 m^2, or 5-6 night, one sheep per 6 m^2, observance of the optimal grazing duration of about 150 days in Oradea Hills and 170 days in the Meseș foothills, timely quantification of biodiversity indices for populations of rare and protected species.

CONCLUSIONS

The floristic inventory of the phytocenoses of the grasslands gathered in the ***Agrostio-Festucetum valesiacae*** association totals 131 cormophyte species, which highlights its high biodiversity.

The analysis of the ecological categories of bioforms of the steppe grasslands in northwestern Romania shows the dominance of hemicryptophytes (66.76%) followed by terophytes (19.36%) and cameophytes (5.53%).

Depending on the genetic center of origin in which they were formed, the geographical distribution area in which the speciation process took place, Eurasian (51.84%), European (17.07%), Central European (7.78%), Circumpolar (4.91%), Mediterranean (3.87%), Mediterranean-Pontic (6.97%), Pontic-Pannonian (2.34%) species predominate in the phytocenoses of the grasslands in northwestern Romania.

When compared to the main ecological factors, soil moisture, air temperature, chemical reaction of the soil, the phytocenoses of the ***Agrostio-Festucetum valeasiacae*** association have a nature ranging from xeromesophilic-xerophilous i.e. 57.52% (Oradea Hills), 62.11% (Meseș foothils) to mesophilic i.e. 33.01% (Oradea Hills), 31.82% (Meseș foothills), from mesothermic (51.87%) to moderately thermophilic (20.74%) in the case of Oradea Hills, and from mesothermic (48.48%), to euritermic (25.76%) and thermophilic nature (19.7%) in the Meseș foothills.

The cytogenetic analysis illustrates the share of diploid species i.e. 43.39% in the Oradea Hills, 44.4% in the Lăzăreni Hills, and 42.42% in the Meseș foothills, which stores the reserve of genes for evolution, followed by the polyploid species i.e. 39.62% in the Oradea Hills, 33.3% in the Lăzăreni Hills, and 43.43% in the Meseș foothills, whose genes confer a great capacity to colonize the territory, and to adapt to the soil and climate conditions of the habitat.

Following the evaluation of the productive potential of the fodder plant species, it results that the grasslands within the surveyed territory have a medium pastoral value (i.e. 57.87%) in the Meseș Mountains and a good pastoral value (i.e. 63.21%) in the Oradea Hills, while generating a green grass production of 5 t/ha in the Oradea Hills and of 7 t/ ha in the Meseș foothills.

Measures for sustainable management and conservation of biodiversity were set in order to maintain the ecological balance of the ecosystem.

The bibliographic list contains a number of 46 references representing the authors whose scientific papers have been reviewed and cited in the text.

ABBREVIATIONS

The following categories of abbreviations are used in this paper:

(i) In terms of classification of plant species by the categories of ecological indices: moisture (M), temperature (T) and chemical reaction of the soil (R).

With regard soil moisture, the species surveyed maybe: xerophilic = M 1-1.5, Xero-mesophylic = M 2-2.5, mesophylic = M 3-3.5, meso-hydrophilic = M 4-4.5, M5 = hydrophilic, eurihydrous = M0.

Considering air temperature, the plant species surveyed can be: Microthermal = T 2-2.5, micro-mesothermal = T3-3.5, moderat thermal = T4-4.5, thermal = T5, eurithermal (thermally amphi-tolerant) = T0.

In terms of a chemical reaction of the soil, the surveyed plant species can be:

acidophilous = R2, acid-neutrophilous = R3, weak acid netrophiloni = R4, neutral basiphlous = R5, euriionic (ionic amfitolerant) = R0.

(ii) Quantitatice phtyto-population indices according to the average abundance-dominance (ADm) scale and the general soil may be: 5 = 87.5% (75-100%), 4 = 62.5% (50-75%), 3 = 37.5% (25-100%), 2 = 17.5% (10-25%), 1 = 5% (1-10%), + = 0.5% (0.1-1%).

(iii) The constancy of the species of the general frequency (K) can be: I = the species is present in the samples surveyed in a percentage of less than 20%, II = presence of the species is between 21 and 40%, III = presence of the species ranges 41-60%, IV = presence of the species is between 61-80%, V = presence of species of 81-100%.

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