VEGETATION OF XERO-MESOPHILE MEADOWS FROM ORADEA HILLS

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Abstract

Research carried out in Oradea Hills, Bihor county, aimed at conducting a detailed study on the flora and vegetation of xero - mesophilic meadows vegetating on arid and sunny land of the slopes of low to medium inclination (4° - 15°). Phytocoenosis of these meadows belonging to the plant association Agrostio - Festucetum valesiacae, Borisavljevič et al., 1955 were analyzed and scientifically characterized in terms of floristic composition, biological forms spectrum, floristic elements spectrum, ecological indices diagram, evolution from syndinamic point of view, and economic importance.

Key words: xero – mesophile meadows, Festuca valesiaca

INTRODUCTION

STATE OF KNOLWEGDE

Previous research on the flora and vegetation of meadows in Oradea Hills have not been carried out before those performed for the first time by us. In order to compare the findings with the we research carried out and the results obtained in other geographical regions of western Romania we studies scientific papers of the following authors: Lacatoş (Herman) Maria Laura (2011), Coldea (1972, 1973), Pop (1968), Groza (2008), Ardelean (1999, 2006), Karacsonyi (2011), Czirják (2014), Păşcuţ (2012), Pop et al.. (2002), Doniţă et al., (2005).

MATERIAL AND METHOD

In order to perform the research on xero - meseophile meadows of Oradea Hills we made numerous visits on the field to capture the development phenophases of the individual plants that make phytocoenosis closely correlated with environmental factors. Regarding the sampling technique we selected sampling surfaces of 25-100 m^2 homogeneously in terms of floristic and physiognomic characteristics out of the most representative fragments of phytocoenoses.

Identification of the phytocoenoses of *Agrostio - Festucetum valesiacae* plant association including xero - mesophile meadows was based on floristic criterion using characteristic (true), relevant (dominant), differential and / or recognition type species. Quantitative criteria studied in phytocoenoses research were the abundance and dominance of phyto-

individuals according to the system developed by Braun - Blanquet and completed by Tüxen and Ellenberg (1937) to establish constancy classes (K = I - V). Phytocoenological table prepared contain information on the floristic and cenotic composition and of plant populations composing phytocoenosis – association specific individual, biological form, floristic element (phyto-geographic), environmental parameters (humidity, temperature, soil chemical reaction), serial number of surveys, altitude (ADm), exposure, slope degree (°), area (m2), coverage (%). In the last two columns of the table there are listed the phytocoenological synthetic parameters, the constant (K) which reveals that the degree of fidelity of each species to both the abundance phytocoenoses association and the average dominance - abundance which suggests the herbaceous layer coverage degree. In order to perform the analysis and interpretation of research findings, histograms were drawn enclosing bioforms spectrum, floristic elements spectrum and ecological index chart, humidity (U), temperature (T) and chemical soil reaction (R).

RESULTS AND DISCUSSIONS

Floristic composition showed the in the table of the association Agrostio - Festucetum valesiacae totalling 102 plant species, mainly xerophile and xero-mesophile plants (see Table 1 below). Characteristic and relevant species are *Festuca valesiaca* with an overall coverage of 58.43% and *Agrostis capillaris* with an overall coverage of 16.87%. Beside the afore mentioned in floristic composition there are still 35 plant species characteristic to plant alliance ***Festucion valesiacae*** order ***Festucetalia valesiacae****: Plantago lanceolata, Andropogon ischaemum, Lathyrus nissolia, Plantago argentea, Xeranthemum anuum, Xeranthemum cylandraceum* and the ***Festuco – Brometea*** class: *Ononis spinosa, Eryngium campestre, Agrimonia eupatoria, Galium verum, Anthoxanthum odoratum, Euphorbia cyparissias, Plantago media, Thymus glabrescens, Trifolium campestre, Cynodon dactylon, Hypericum perforatum, Asperula cynanchica, Potentilla argentea, Hieracium pilosella, Koeleria macrantha, Dianthus carthusianorum, Carex caryophyllea, Sanguisorba minor, Teucrium chamaedrys*, etc.

The remaining species to the total of 102 classes are transgressive and belong to the following classes: ***Molinio – Arrhenatheretea*****:** *Achillea millefolium, Lotus corniculatus, Trifolium hybridum, Poa pratensis, Daucus carota, Cichorium intybus, Centaurea phrygia, Leontodon hispidus, Lolium perenne, Phleum pratense, Danthonia decumben, Odontites serotina, Cynosurus cristatus, Festuca pratensis, Rhinanthus minor, Ranunculus polyanthemos, Verbena officinalis*, etc, ***Koelerio – Corynephoretea*** : *Filago arvensis, Trifolium arvense, Calamintha vulgaris* etc., ***Artemisietea vulgaris****: Erigeron annuus, Carduus acanthoides, Tanacetum vulgare*, etc., ***Stellarietea mediae****: Convolvulus arvensis, Viola arvensis, Geranium pusillum*, etc., ***Epilobietea angustifolii****: Fragaria vesca, Rubus sulcatus,* ***Rhamno – Prunetea****: Crataegus*

monogyna, Prunus spinosa, etc, ***Querco – Fagetea****: Pyrus pyraster, Malus sylvestris, Ulmus minor*, etc.

Spectral analysis of biological forms (see Chart no. 1 below) highlights the dominance of hemicrypthopytes species (63.72%) followed by annual therophytes (15.86%), and biannual therophytes (4.9%).

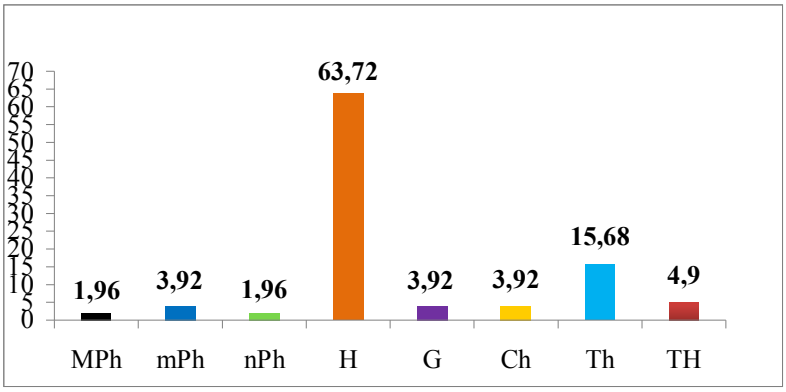

Chart no. 1 – Spectrum of life forms for the phytocoenoses of the Association *Agrostio-Festucetum valesiacae*, where: Mph, mPh, nPh – Phanerophytes; H – Hemicrypthopytes; G – Geophytes; Ch – Chamaephytes; Th – Annual therophytes; TH – Biannual Terophytes.

The floristic elements spectrum (see Chart no. 2) shows that the predominant Eurasian species (54.9%), followed by European species (17.64%), South - European ones (M, Squares. Atl-M) 8.9%, and the central European species (4.9%).

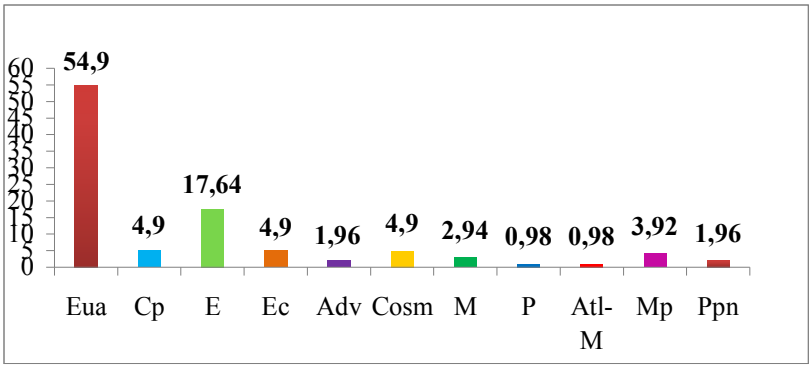

Chart no. 2 – Spectrum of floristic elements for the phytocoenoses of the Association *Agrostio-Festucetum valesiacae*, where: Eua – Eurasian; Cp – Circumpolar; E – European; Ec – Central European; Adv – Adventive; Cosm – Cosmopolitan; M – Mediterranean; P – Pontic; Atl-M – Atlantic - Mediterranean; Mp – Mediterranean - Pontic; Ppn – Ponto - Panonian.

Table 1

Agrostio-Festucetum valesiacae Borisavljevič et al. 1955

L.f.	F.e.	U	T	S.r.	2n	No. Land Surveys	1	2	3	4	5	6	7	8	K	ADm
						Altitude (m.s.m.)	220	173	206	170	280	180	200	250		
						Exposure	V	N	N	S	S	N	S	–		
						Slope (°)	4	8	8	10	15	4	12	–		
						Area (m^2)	100	100	100	100	100	100	100	100		
						The coverage of grass layer (%)	100	100	100	90	90	100	100	90		
H	Cp-Bo	0	0	0	P	As. *Agrostis capillaris*	2	4	2	1	1	1	1	2	V	16.87
H	Eua(C)	1.5	4	4	D	As. *Festuca valesiaca*	4	1	4	4	4	5	4	4	V	58.43
						Festucion valesiacae. Festucetalia valesiacae										
H	Eua	0	0	0	D	*Plantago lanceolata*	+	+	.	+	+	+	+	.	IV	0.37
H	Eua	1.5	5	3	P	*Andropogon ischaemum*	.	.	.	+	+	.	.	.	II	0.12
Th	Atl-M	3	3.5	3	D	*Lathyrus nissolia*	.	+	.	.	.	.	.	.	I	0.06
H	M	1.5	4.5	4	D	*Plantago argentea*	.	+	.	.	.	.	.	.	I	0.06
Th	Mp	2	4	3	D	*Xeranthemum annuum*	.	.	.	+	.	.	.	.	I	0.06
Th	Mp	1.5	4	3	P	*Xeranthemum cylindraceum*	.	.	.	.	.	.	.	+	I	0.06
H	Ec	2	3	3	P	*Achillea collina*	.	.	.	.	+	.	.	.	I	0.06
						Festuco-Brometea										
Ch-H	E(M)	0	3.5	0	D.P	*Ononis spinosa*	+	+	+	+	+	+	+	.	V	0.43
H	P	1	5	4	D.P	*Eryngium campestre*	+	.	+	+	+	+	.	+	IV	0.37
H	Eua	2.5	3	4	P	*Agrimonia eupatoria*	+	+	.	+	+	.	+	.	IV	0.31
H	Eua	2.5	2.5	0	D	*Galium verum*	.	+	+	.	+	.	+	+	IV	0.31
H	Eua	0	0	0	D.P	*Anthoxanthum odoratum*	+	.	.	+	+	.	1	.	III	0.81
H	Eua	2	3	4	D.P	*Euphorbia cyparissias*	+	+	.	.	+	.	+	.	III	0.25
H	Eua	2.5	0	4.5	D.P	*Plantago media*	.	.	+	+	+	.	+	.	III	0.25
Ch	Ppn	2	4	0	P	*Thymus glabrescens*	.	.	1	.	.	.	+	+	II	0.75
Th-TH	E	3	3	0	D	*Trifolium campestre*	.	.	+	.	.	.	+	.	II	0.12
G(H)	Cosm	2	3.5	0	D.P	*Cynodon dactylon*	.	.	.	.	+	.	+	.	II	0.12
H	Eua	3	3	0	P	*Hypericum perforatum*	.	+	.	.	+	.	+	.	II	0.18
H	Ec	2.5	0	3	P	*Pimpinella saxifraga*	.	.	+	.	.	.	+	.	II	0.12
H	Mp	2	3.5	4.5	D.P	*Asperula cynanchica*	.	.	+	.	+	.	+	.	II	0.18
H	Eua	3	3	2.5	D	*Hypochoeris radicata*	.	+	+	.	+	.	.	.	II	0.18
H	Eua	2	4	2	D	*Potenttila argentea*	.	.	.	.	.	+	+	.	II	0.12
H	E(M)	2.5	0	0	D.P	*Hieracium pilosella*	.	.	.	.	+	.	.	.	I	0.06
H	Cp	2	4	5	D.P	*Koeleria macrantha*	.	.	.	.	+	.	.	.	I	0.06
H	E	2	5	5	D	*Dianthus carthusianorum*	.	.	.	+	.	.	.	.	I	0.06
G	Eua(M)	2	2.5	0	P	*Carex caryophyllea*	.	.	.	.	.	.	+	.	I	0.06
H	Eua	2	3.5	4	P	*Sanguisorba minor*	.	.	.	.	.	.	+	.	I	0.06
Ch	M-Ec	2	3	4	P	*Teucrium chamaedrys*	.	.	.	.	.	.	+	.	I	0.06
H-Th	Mp	2	4	4	P	*Stachys germanica*	.	.	.	.	.	.	+	.	I	0.06
Ch-H	Ec	2	3	4	D	*Helianthemum nummularium*	+	.	.	.	.	.	.	.	I	0.06
H	M-Ec	2.5	3.5	3	P	*Prunella laciniata*	+	.	.	.	.	.	.	.	I	0.06
H	Eua	0	3	0	D.P	*Briza media*	+	.	.	.	.	.	.	.	I	0.06
H	Eua	3	0	3	D	*Galium mollugo*	.	1	.	.	.	.	.	.	I	0.62
						Molinio-Arrhenatheretea										
H	Eua	3	0	0	P	*Achillea millefolium*	+	+	+	1	+	+	+	.	V	1
H	Eua	2.5	0	0	P	*Lotus corniculatus*	+	+	+	+	+	+	+	+	V	0.5
H	E(M)	3.5	3	4	D	*Trifolium hybridum*	+	+	+	+	+	+	.	.	IV	0.37

L.f.	F.e.	U	T	S.r.	2n	No. Land Surveys	1	2	3	4	5	6	7	8	K	ADm
H	Cp	3	0	0	P	*Poa pratensis*	+	+	+	.	+	.	+	+	IV	0.37
TH-H	Eua(M)	2.5	3	0	D	*Daucus carota ssp. carota*	.	.	+	.	+	+	+	+	IV	0.31
H-TH	Eua	2.5	3.5	4.5	D	*Cichorium intybus*	.	+	+	+	+	.	+	.	IV	0.31
H	Ec	3	2.5	3	D	*Centaurea phrygia*	+	+	.	.	.	.	+	+	III	0.25
H	Eua	3.5	0	0	P	*Trifolium repens*	1	.	+	.	1	+	.	.	III	1.37
H	Eua	2.5	0	0	D	*Leontodon hispidus*	+	+	.	.	+	+	.	.	III	0.25
H	Eua(M)	2.5	4	4.5	D	*Lolium perenne*	+	.	.	+	.	+	+	.	III	0.25
H	Eua(M)	3.5	0	0	P	*Phleum pratense*	+	.	.	.	.	+	.	.	II	0.12
H	E	0	3	2	P	*Danthonia decumbens*	+	.	+	.	.	.	.	.	II	0.12
Th	Eua	3	3	0	P	*Odontites serotina*	+	.	.	.	.	.	+	.	II	0.12
H	E	3	3	3	D	*Cynosurus cristatus*	+	.	.	.	.	.	+	.	II	0.12
H	Cp-Bo	3	3	0	P	*Prunella vulgaris*	+	+	.	.	.	.	.	.	II	0.12
H	Eua	3.5	3	0	D	*Holcus lanatus*	.	+	.	.	.	.	+	.	II	0.12
H	Eua(M)	2.5	2	3	D	*Stellaria graminea*	.	.	+	.	.	.	.	+	II	0.12
H	Eua	3.5	0	0	D	*Festuca pratensis*	+	.	.	.	+	+	.	.	II	0.18
Th	E	3	0	0	D	*Rhinanthus minor*	+	+	.	.	.	.	+	.	II	0.18
H	Eua	2.5	3	3	D	*Ranunculus polyanthemos*	+	+	.	.	.	.	+	.	II	0.18
H-TH	Eua	3	0	0	D	*Trifolium pratense*	.	+	+	.	.	.	.	.	II	0.12
Th-H	Cosm	3	3	4	D	*Verbena officinalis*	.	+	.	.	+	.	.	.	II	0.12
Th	Eua	3	3	2	P	*Centaurium erythraea*	.	+	.	.	+	.	+	.	II	0.18
H	Cosm	3.5	0	4	P	*Potentilla reptans*	.	+	.	.	.	.	.	.	I	0.06
H	Eua	4.5	3	0	P	*Epilobium tetragonum*	.	+	.	.	.	.	.	.	I	0.06
H	Eua	3	0	3	D.P	*Vicia cracca*	.	+	.	.	.	.	.	.	I	0.06
H-Ch	Eua	3	0	0	P	*Veronica chamaedrys*	.	+	.	.	.	.	.	.	I	0.06
H	Adv	3.5	3	4	P	*Juncus tenuis*	+	.	.	.	.	.	.	.	I	0.06
G	Eua	4	3	4	P	*Juncus compressus*	+	.	.	.	.	.	.	.	I	0.06
H	Eua	3	3	0	P	*Sanguisorba officinalis*	.	+	.	.	.	.	.	.	I	0.06
TH	E	3	2.5	3	D.P	*Campanula patula*	.	+	.	.	.	.	.	.	I	0.06
H(G)	Eua(M)	4.5	3	0	P	*Mentha longifolia*	.	.	+	.	.	.	.	.	I	0.06
TH-H	Eua	3	3	4	D	*Tragopogon orientalis*	.	.	+	.	.	.	.	.	I	0.06
H	Eua(M)	3	0	4	P	*Dactylis glomerata*	.	.	+	.	.	.	.	.	I	0.06
H	Eua	2.5	3	3	D	*Inula salicina*	.	.	.	.	+	.	.	.	I	0.06
H	E	3.5	0	4	D	*Pimpinella major*	.	.	.	.	.	.	+	.	I	0.06
H	E	3	2	0	P	*Alchemilla vulgaris*	.	.	.	.	.	.	.	+	I	0.06
						Koelerio-Corynephoretea										
Th	Eua(M)	2	3	0	P	*Filago vulgaris*	.	.	+	+	.	.	.	+	II	0.18
Th	Eua(M)	1.5	3	4	D	*Trifolium arvense*	.	.	+	.	+	.	.	+	II	0.18
H	Cosm	2	3	2	P	*Rumex acetosella*	.	+	.	.	.	.	.	.	I	0.06
H	Cp-Bo	2	3	3	P	*Calamintha vulgaris*	.	+	.	.	.	.	.	.	I	0.06
						Artemisietea vulgaris										
Th	Adv	4	0	4	P	*Erigeron annuus*	+	.	.	.	+	+	.	.	II	0.18
TH	Eua(M)	2	3	0	D	*Carduus acanthoides*	.	.	+	.	+	.	.	.	II	0.12
Th	Eua	3.5	3.5	4	P	*Xanthium strumarium*	.	.	.	+	.	.	+	.	II	0.12
H	Eua	3	3	0	D	*Tanacetum vulgare*	.	+	.	.	.	.	.	.	I	0.06
TH	Eua(C)	4	3.5	4	D	*Dipsacus laciniatus*	.	.	+	.	.	.	.	.	I	0.06
						Stellarietea mediae										
H-G	Cosm	0	0	0	P	*Convolvulus arvensis*	.	.	.	+	.	+	.	.	II	0.12
Th	Eua	3	3	0	D	*Viola arvensis*	.	+	.	.	.	.	.	.	I	0.06

L.f.	F.e.	U	T	S.r.	2n	No. Land Surveys	1	2	3	4	5	6	7	8	K	ADm
Th-TH	Ppn	3	3	0	D	*Vicia grandiflora*	.	+	.	.	.	.	.	.	I	0.06
Th	E(M)	2.5	3	0	D.P	*Geranium pusillum*	.	+	.	.	.	.	.	.	I	0.06
H	Eua(M)	2	4	4	D	*Lathyrus tuberosus*	.	+	.	.	.	.	.	.	I	0.06
G	Eua(M)	0	0	0	D	*Cirsium arvense*	.	+	.	.	.	.	.	.	I	0.06
						Epilobietea angustifolii										
H	Eua	3	2.5	0	D	*Fragaria vesca*	.	+	.	.	+	.	+	.	II	0.18
nPh	Ec	3.5	3	2.5	P	*Rubus sulcatus*	.	+	.	.	+	.	+	.	II	0.18
						Isoëto-Nanojuncetea										
Th	Eua(C)	2	3	2	D	*Gypsophila muralis*	.	.	+	.	.	.	.	.	I	0.06
H	Eua(M)	4	3	4	P	*Mentha pulegium*	.	.	+	.	.	.	.	.	I	0.06
						Rhamno-Prunetea										
mPh	E	2.5	3	3	D	*Crataegus monogyna*	.	1	.	.	+	.	.	.	II	0.68
mPh	Eua	2	3	3	P	*Prunus spinosa*	.	+	.	.	.	.	1	.	II	0.68
nPh	E	2	3	3	P	*Rosa canina*	.	+	.	.	+	.	+	.	II	0.18
mPh	E	3	3	3	P	*Euonymus europaeus*	.	.	.	.	.	.	+	.	I	0.06
						Querco-Fagetea										
H	E	2.5	3	3	P	*Festuca heterophylla*	.	+	.	.	.	.	.	.	I	0.06
H	Eua	3.5	3	0	P	*Scrophularia nodosa*	.	+	.	.	.	.	.	.	I	0.06
MPh	E	2	3	4	D	*Pyrus pyraster*	.	+	.	.	.	.	.	.	I	0.06
mPh	E	3.5	3	4	D	*Malus sylvestris*	.	+	.	.	.	.	.	.	I	0.06
H	Eua	3	3	0	P	*Trifolium medium*	.	.	.	.	.	.	+	.	I	0.06
MPh	Eua	3	3	1	P	*Ulmus minor*	.	.	.	.	.	.	+	.	I	0.06
H	Eua	3	3	4	D	*Astragalus glycyphyllos*	.	.	.	.	.	.	+	.	I	0.06

Place and date of surveys: 1 – Săldăbagiu de Munte locality (Bihor county) 19.07.2010; 2 – Paleu locality (Bihor county) 19.07.2010; 3 – Cetariu locality (Bihor county) 19.07.2010; 4 – Husasău de Criş locality (Bihor county) 21.07.2010; 5 – Bălaia locality (Bihor county) 13.07.2011; 6 – Nădar locality (Bihor county) 16.07.2011; 7 – Spinuş locality (Bihor county) 28.07.2011; 8 – Sârbi locality (Bihor county) 14.08.2011.

Ecological indices diagram (see Chart no. 3) indicates that according to humidity factor xero - mesophilic species prevail (40.19%) at the same level with the mesophilic species (40.19%) followed by hydrous amfi-tolerant species (7.8%). In terms of heat, micro - mesothermal species prevail (57.8%) followed by thermal amfi-tolerant ones (23.5%) and moderate – thermophilic species (9.8%). Regarding the chemical reaction of soil the majority euriionic species (40.19%) followed by weak acid - neutrophils ones (30.39%) and the acid – neutrophils species (19.6%).

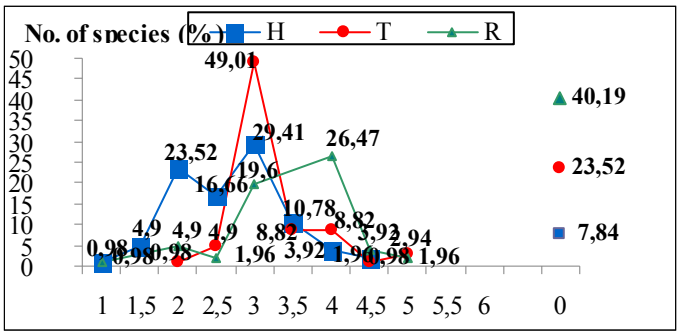

Chart no. 3 – Diagram of ecological indices for the association *Agrostio-Festucetum valesiacae*, where: H – Humidity; T – Temperature; R –Chemical reaction of soil

Vegetation dynamics. Sequence of phytocoenoses of plant association *Agrostio - Festucetum valesiacae* encompassing xero - mesophilic meadows in Oradea Hills, in case of non-grazing and anthropogenic non-intervention is towards woody vegetation including ***Rhamno - runetea*** class shrubs.

Economic importance. These meadows are used by locals as meadows for their animals, and generate an average production and a good forage value.

CONCLUSIONS

- Phytocoenosis of xero - mesophilic meadows subordinated to *Agrostio - Festucetum valesiacae* plant association have a very rich biodiversity, illustrated by the floristic composition aggregating a number of 102 species of plants.
- From the analysis of bioforms it results that the hemicrypthopytes have the largest share (63.7%), the main components of xero - mesophilic meadows which indicates the belonging of researched territory to the

temperate climate regions that show the habitat characteristics and the influences of ecological factors on them.

- Analysis of floristic elements reveals the presence of a wide range of species from different geographical origins with specific environmental requirements, dominated by Eurasian species (54.9%) whose genesis was spread over the vast territory of Europe and Asia territory, and also on he territory of ancient Dacia, over which various elements interfered in different phyto-historical periods: European (17.64%), Mediterranean, Mediterranean - Pontic Atlantic - Mediterranean (8.9%), and Central - European (4.9%) elements.
- Edaphic and climate factors chart (humidity, temperature, soil chemical reaction) shows that the majority of species are xero - mesophilic species (40.19%) that grow in sunny meadows on arid lands, mesophilic species (40.19%) favoured by atmospheric and soil humidity, micro - mesothermal species (57.8%), thermal amfi-tolerant species (23.5%), euriionic species (40.19%) and low - neutrophilic acid species (30.39%).
- Xero - mesophilic meadows phytocoenosis in Oradea Hills embedded in *Agrostio - Festucetum valesiacae* plant association is a rare natural habitat of community interest whose conservation requires the designation within the "Special Areas of Conservation (SAC)" Natura 2000: code 6240* Sub - Pannonian steppe meadows, R3414 Ponto - Pannonian *Festuca Valesiaca* meadows.

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