

Research on the Participation of Protected Species from the Steppe Grasslands of the ROSCI0201 Podișul Nord-Dobrogean, According to Some Characteristics of the Soil

*Cercetări privind participarea unor specii protejate
din pajiștile stepice ale ROSCI0201 Podișul Nord-Dobrogean,
în relație cu unele caracteristici ale solului*

Teodor MARUȘCA, Daniyar MEMEDEMİN, Adrian OPREA,
Nicoleta MĂRIN, Elena TAULESCU

Abstract

Researches on ecological conditions for protected plant species from grassland need, also, an appropriate evaluation of physical and chemical characteristics of the soil. Within the project "Integrated management of the Podișul Nord-Dobrogean (MiPoNoDo), SMIS code 116964" we studied the permanent grasslands hosted by natural habitat of community interest 62C0 Ponto-Sarmatic steppes. To achieve this goal, we analyzed 67 floristic surveys, from each studied location being collected soil samples from a depth of 0-10 cm, using a soil corer with a diameter of 25 mm. In the floristic surveys, we identified nine protected species, of which *Thymus zygioides* in 13 locations, *Dianthus nardiformis* in 10 locations and *Festuca callieri* in four locations. *Echinops ruthenicus*, *Astragalus glaucus*, *Pimpinella tragium*, *Scorzonera mollis*, *Salvia aethiopis* and *Tanacetum millefolium* were identified in less than four locations. In soil samples, we determined the percentage of soil content in skeleton, pH, carbonates, humus content, phosphorus (P) and potassium (K). For the first two most widespread protected species, we prepared eco-diagrams according to the HUND method (1966). The dependency of the presence and participation of the species *Dianthus nardiformis* is medium on soil skeleton content, indifferent on soil pH, medium to high on humus content and total nitrogen (N), very small to medium on P and small to large on K. For *Thymus zygioides* the dependency on soil skeleton is very high, indifferent on soil pH with a tendency towards neutral to weak alkaline, indifferent on carbonates, medium to very high on humus content and total N, very small to small on P and small to large on K. The species *Festuca callieri* prefers and indicates soils with a high content of skeleton, lacking carbonates and poor in fertilizing elements (N, P, K). Thus, the rare species from the steppe grasslands vegetal layer can be used as indicators for the physical and agrochemical characteristics of the soil, an important tool for biodiversity conservation and proper management of this habitat.*

Keywords: *steppe grasslands, protected plant species, agrochemical soil characteristics*

Introduction

One of the main objectives of ROSCI0201 Podişul Nord Dobrogean, protected area of community importance, is to preserve several rare plant species identified in 62C0 * Ponto-Sarmatic steppe habitat.

In order to achieve this goal, in addition to the anthropogenic pressure represented mainly by overgrazing, it is necessary to study the environmental conditions, from which of first importance are soil physical and chemical characteristics, these elements being able to influence the presence and participation of the protected plant species in vegetation structure.

Since the bibliographic review did not reveal the existence of such approaches at national level, the present study was elaborated with the purpose of deepening the study of the soil-plant relationship from the steppe grasslands.

Materials and Methods

In the field trips from June and July 2019, in addition to the 67 floristic surveys on the 100 sqm (10 m x 10 m) sample area, on the two diagonals of the sample square, soil samples were taken with a soil corer with the diameter of 25 mm at a depth of 10 cm.

Soil samples were analyzed by the National Institute for Research-Development for Pedology, Agro-chemistry and Environmental Protection (ICPA) - Bucharest according to the following methods:

- **pH in aqueous suspension** 1:2,5; SR 7184-13:2001, PTL 04;
- **Carbonates:** gas volumetric method; STAS 7184/ 16-80; PTL 43;
- **Humus:** wet oxidation STAS 7184/ 21-82; PTL 12;
- **P_{AL}:** extractable phosphorus in ammonium acetate-lactates; STAS 7184/ 19-82; PTL 19;
- **K_{AL}:** extractable potassium in ammonium acetate-lactates; STAS 7184/ 18-80; PTL 22.

Classes for soil skeletal content
(2-25 mm)

Naming	Limits (%)
Not necessary	absent
Very low	0,1 - 3,0
Low	3,1 - 7,0
Average	7,1 - 15,0
High	15,1 - 35,0
Very high	> 35,0

The assessment of the physical components, respectively the soil skeleton (2-25 mm), was done after the expert opinion and the following agrochemical components according to the standardized methodology (FLOREA *et alii*, 1987).

Based on the floristic survey and on the main physical and agrochemical characteristics of the

soil, it was possible to produce diagrams using the HUND method (MARUȘCA, 1982; MARUȘCA *et alii*, 2010).

The plant species were determined using the classification proposed by Ciocârlan (2009).

Soil reaction (pH) and percentage content classes (carbonates, humus, N, P and K) are shown at the bottom of each diagram (Figures 2-3).

Initially, the method highlighted the relative presence of a species in the vegetation layer of grassland depending on the agrochemical characteristics of the soil.

Subsequently, the HUND method (1966) was improved by LAUER (1974) and MARUȘCA (1982), introducing in addition the relative participation of plant species according to the same agrochemical characteristics of the soil.

Specifically for this improved method, for each agrochemical factor taken into consideration should be registered all presences and participation of a certain plant species from the vegetal layer. This results in a series of data on the presence and participation of the species, linked to the respective factor.

For the next phase, the largest number regarding the presence in vegetal layer for a plant species it is equalized to 100, the rest of the species from the same floristic survey have to follow proposed method in order to rank the plant species response towards the selected agrochemical factor.

In order to quantify the participation of plant species towards a specific agrochemical factor the same concept is used, respectively the highest value of the participation of a species it is equalized to 100, value against which the lower values of the plant species from the same floristic survey are reported.

The result is a diagram expressing the relative dependency of the presence and participation of a species in the vegetal layer against some physical or agrochemical components of the soil.

Results and Discussions

From the analytical results of the 67 soil samples that accompany the 67 floristic surveys (Figure 1), we notice a quite large variation of the physical and agrochemical values of the soil (Table 1).

Thus, the soil skeleton content (2-25 mm) reaches values from 0 up to almost 50% of the weight of some soil samples.

The soil reaction (pH) is from moderately acidic (5.33) to weak alkaline (8.32) passing through all three classes of values.

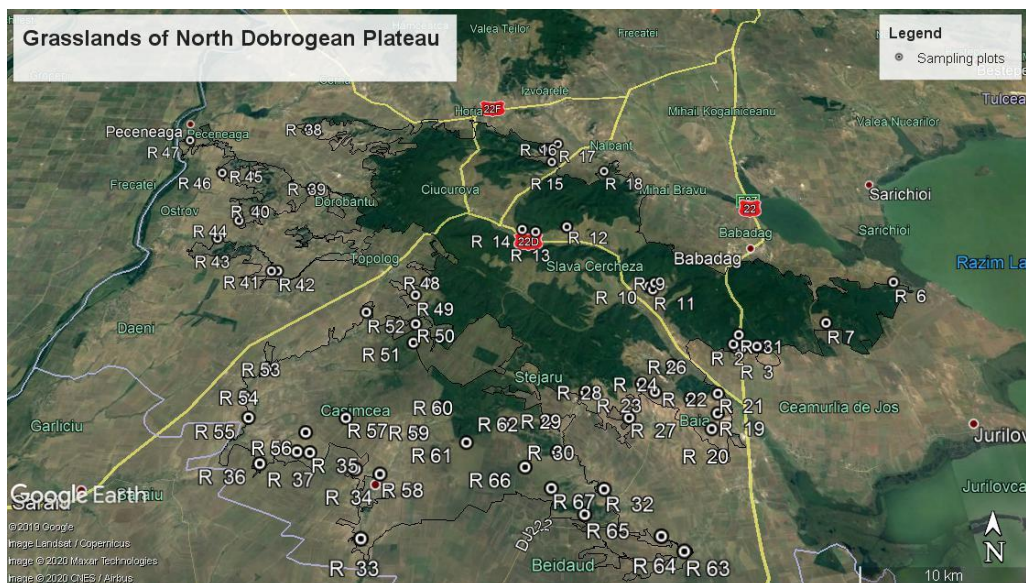


Figure 1. Distribution of floristic surveys from June-July 2019 in
ROSCI0201 Podişul Nord-Dobrogean

*Fig. 1. Distribuția releveelor floristice efectuate în perioada iunie-iulie 2019,
în ROSCI0201 Podişul Nord-Dobrogean*

The carbon content (%) reaches values from 0 up to 34.1 %, very high respectively, humus (%) from low (1.66%) to very high (15.87), total N from medium (0.141%) to very high (0.708%), P_{AL} (mg / kg) from 4 (very low) to 137 (very high) and K_{AL} from 110 (low) to 696 (very high).

The average values regarding the physical characteristics of the soil for the 67 sample stations located in 62C0* Ponto-Sarmatic steppe habitat are medium (6.9%) for the soil skeleton content. The agrochemical parameters have the following average values: neutral for pH (7.06), medium content of carbonates (5.4%), medium content of humus (6.4%), high content for total N (0.338%), low for P_{AL} (14.9 mg/ kg) and high for K_{AL} (238 mg/ kg), which shows that we have a pretty good soil trophic levels except the phosphorus content.

Table 1. Physical and agrochemical analysis of the soils from surveys from 62C0* habitat with protected plant species in the Podișul Nord-Dobrogean

Tabel 1. Analiza fizică și agrochimică a solurilor din stațiunile cu habitat 62C0* și specii de plante protejate din Podișul Nord-Dobrogean

Specification (nr. surveys)	Values	Participation in vegetal layer %	Skeleton content (2-25 mm) %	pH	Carbonates %	Humus %	Total N %	P _{AL} mg/ kg	K _{AL} mg/ kg
62C0* Habitat (67 surveys)	minimum	x	0,0	5,33	0,0	1,66	0,141	4	110
	maximum	x	49,9	8,32	34,1	15,87	0,708	137	696
	average	x	6,9	7,06	5,4	6,40	0,338	14,9	238
<i>Festuca callieri</i> (4 surveys)	minimum	+	5,2	5,91	0,0	4,29	0,240	10	141
	maximum	20	49,9	6,60	0,0	7,87	0,443	18	256
	average	10,8	23,7	6,27	0,0	6,14	0,336	13,5	187
	Dif** +, -	x	+ 16,8	- 0,76	- 5,4	- 0,26	- 0,002	- 1,4	- 41
	%	x	343	89	0	96	99	91	83
<i>Dianthus nardiformis</i> (10 surveys)	minimum	+	4,2	5,73	0,0	5,01	0,240	5	128
	maximum	8	49,9	7,80	1,1	7,87	0,443	27	256
	average	4,8	21,0	6,59	0,2	6,10	0,327	12,0	169
	Dif** +, -	x	+ 14,1	- 0,44	- 5,2	- 0,30	- 0,011	- 2,9	- 69
	%	x	304	94	4	95	97	81	71
<i>Thymus zygoides</i> (13 surveys)	minimum	1	2,7	5,73	0,0	4,29	0,185	7	120
	maximum	15	39,8	8,06	33,1	13,27	0,557	18	256
	average	5,8	12,5	6,96	5,5	7,04	0,353	10,4	188
	Dif** +, -	x	+ 5,6	- 0,07	+ 0,1	+ 0,64	+0,011	- 4,5	- 50
	%	x	181	99	102	110	104	70	79

- 62 C0* - Ponto-Sarmatic steppe habitat type

- Differences** towards 62C0* average value

In the 67 floristic surveys of 62C0* habitat type, the following nine protected plant species (see Annex), in the order of their presence, were encountered:

Thymus zygoides (5,8% participation in the vegetal layer) in 13 surveys; *Dianthus nardiformis* (4,8% participation) in 10 surveys; *Festuca callieri* (8,3% participation) in four surveys; *Echinops ruthenicus* (1,5% participation) in three surveys; *Astragalus glaucus* (5% participation) in two surveys; *Pimpinella tragioides* (5 % participation) in two surveys and in only one survey *Scorzonera mollis* (2% participation), *Salvia aethiopis* and *Tanacetum millefolium* (5% participation).

The data presented in Table 1 show that *Festuca callieri* prefers carbonate-free soils with a high soil skeleton content, moderately acidic reaction and lower content in fertilizing elements.

The species *Dianthus nardiformis* also prefers soils poor in carbonates and fertilizing elements but richer in the soil skeleton content.

Thymus zygoides prefers moderately acidic to neutral soils, richer in humus and nitrogen, poor in P and K and with a lower soil skeleton content.

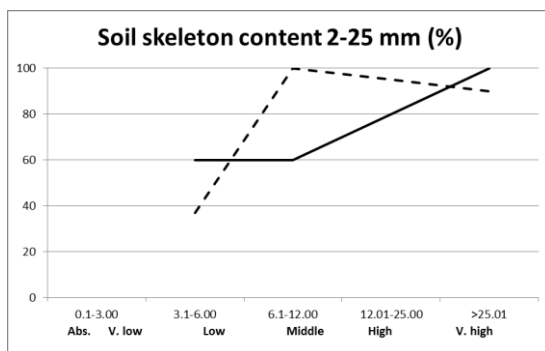
A more detailed analysis of the dependency regarding the presence and participation towards the physical and agrochemical characteristics, for the first two species in order of their presence (*Dianthus nardiformis* and *Thymus zygoides*), is shown in figures 2 and 3.

Thus, the species *Dianthus nardiformis* has the highest presence on soils with a very high skeletal content and the *Thymus zygoides* species on a medium content. Regarding participation in the vegetal layer, *Dianthus nardiformis* was more abundant on soils with medium skeleton content and *Thymus zygoides* on the soil with a very high skeleton content.

Considering the dependency of the presence and participation towards the main characteristics of the soil, the species *Dianthus nardiformis* is almost indifferent to pH of the soil, prefers a medium content in carbonates, from medium to high in humus and total N, from very small to medium in P content and from small up to high in K.

Compared to the same agrochemical characteristics of the soil, the species *Thymus zygoides* is equally indifferent to pH with some tendency towards neutral-weak alkaline, indifferent to carbonates on soils with a medium to very high content in humus, from medium to high in total N content, from very low to low in P and from low up to high in K content.

The results regarding the dependency of the two species on the physical and agrochemical characteristics of the soil emphasize the importance of this approach for the appropriate evaluation of the factors that influence the diversity of the vegetal layers.



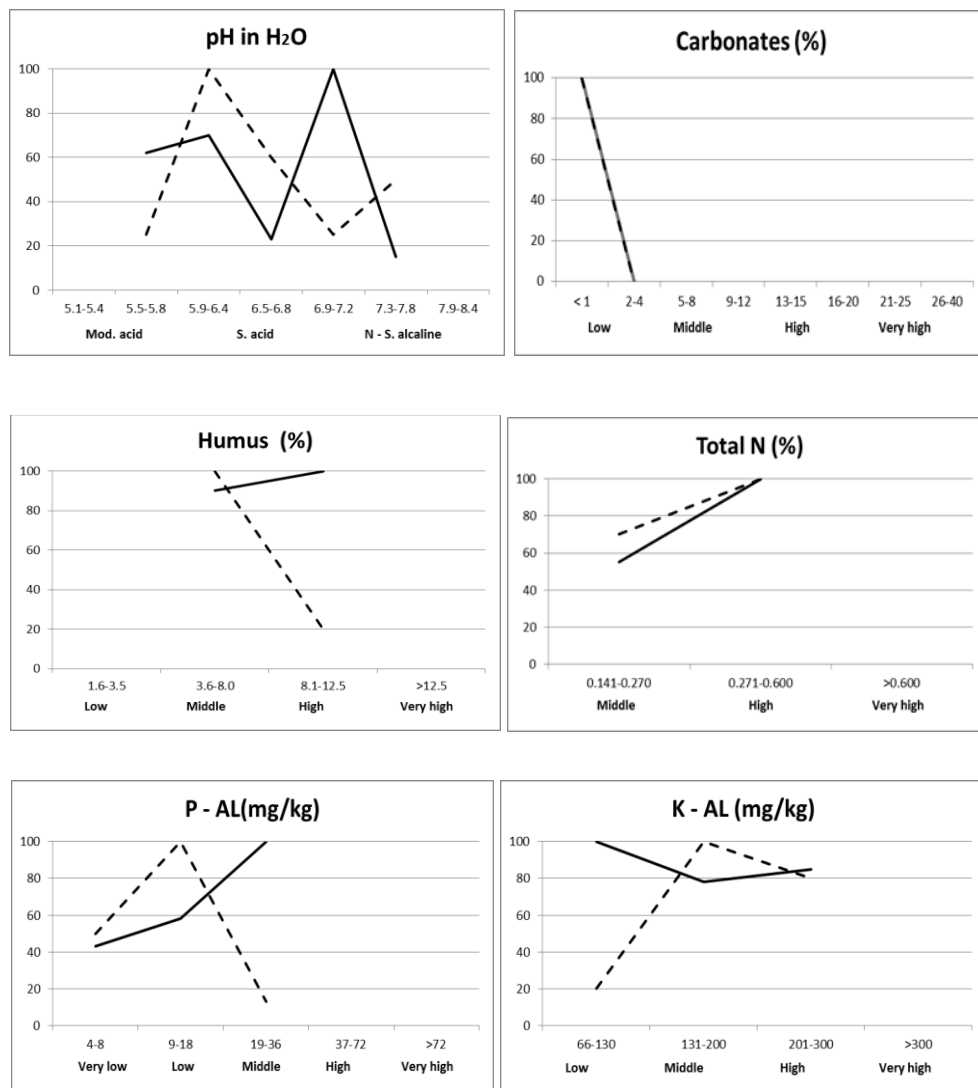
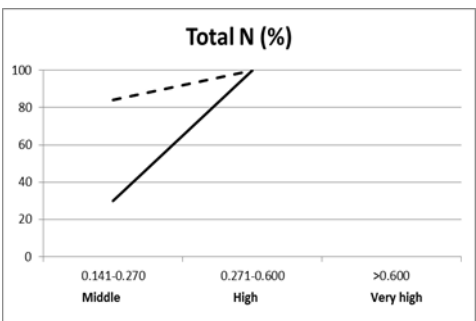
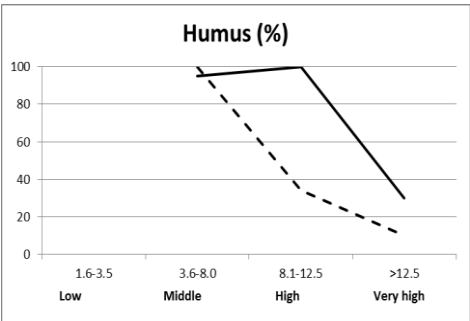
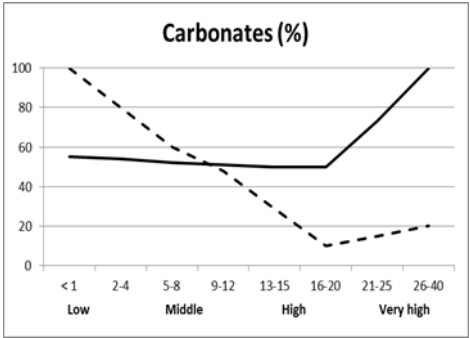
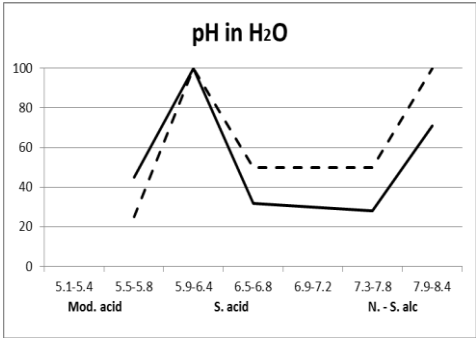
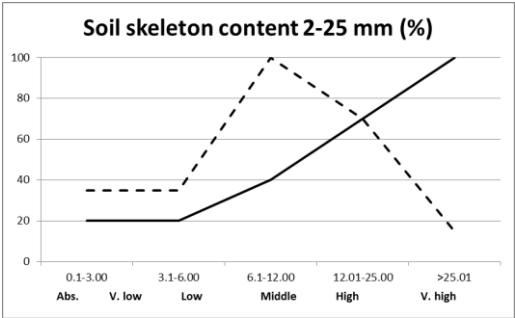


Figure 2. Dependency of presence (--- %) and participation (---- %) of the species *Dianthus nardiformis* (present in 10 surveys) on the physical and agrochemical characteristics of the soil

Fig. 2. Dependența prezenței (--- %) și participării (---- %) speciei *Dianthus nardiformis* (prezentă în 10 relevee) față de caracteristicile fizice și agrochimice ale solului



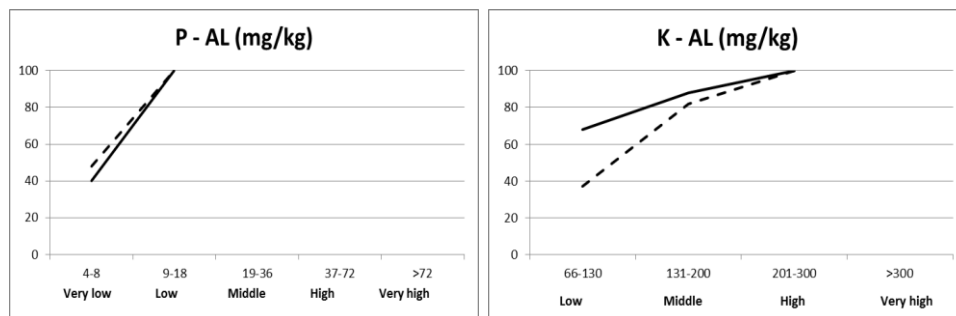


Figure 3. Dependency of presence (--- %) and participation (— %) of the species *Thymus zygioides* (present in 13 surveys) on the physical and agrochemical characteristics of the soil

Fig. 3. Dependența prezenței (--- %) și participării (— %) speciei *Thymus zygioides* (prezentă în 13 relevee) față de caracteristicile fizice și agrochimice ale solului

Conclusions

In addition to intensive grazing, the protected plant species characteristic to the natural habitat of community interest 62C0* Ponto-sarmatic steppes from ROSCI0201 Podișul Nord Dobrogean are strongly influenced by the physical and agrochemical characteristics of the soil.

The species *Dianthus nardiformis* prefers skeletal soils with low carbonate and phosphorus content.

The species *Thymus zygioides* prefers neutral to low alkaline soils, rich in humus and very poor in phosphorus.

The species *Festuca callieri* grows on soils with a high content of skeleton, lacking carbonates and poor in fertilizing elements.

Plants, especially rare species are true "phytometers" for the main physical and agrochemical characteristics of the soil.

Annex – Selection of protected plant species from Podișul Nord Dobrogean*Dianthus nardiformis**Thymus zygoides**Festuca callieri*

Echinops ritro
subsp. *ruthenicus*



Pimpinella tragium
subsp. *litophila*

Astragalus glaucus



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**Teodor MARUȘCA¹, Daniyar MEMEDEMİN¹,
Adrian OPREA², Nicoleta MĂRIN³, Elena TAULESCU⁴**

¹ Association for Sustainable Development DAKIA
maruscat@yahoo.com

² Progresul Silvic Society

³ National Research and Development Institute
for Soil Science, Agrochemistry and Environment – ICPA Bucharest

⁴ Research and Development Institute for Grasslands Brașov