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Influence of *Prunus spinosa* L. shrub on the grassland vegetation in western Romania

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Abstract: *Prunus spinosa* L. is a shrub species that is leading the permanent grassland to the shrubland successional phase. This species has a great occurrence in western Romania and is difficult to control it because it has a great ability of vegetative spreading from roots. The massive presence of this species in some grassland is due mainly to the abandonment and to the diminishing of the livestock. The vegetation was analysed with the linear point-quadrat method. This work has in view to analyse the influence of this species on some vegetation parameters as species richness, number of grasses, legumes and other species, contribution of grasses, legumes and other species, biodiversity indexes (Shannon – *H*' and Simpson – *D* and pastoral value *VP*.

Key words: *correlation, floristic composition, grassland, Prunus spinosa L., vegetation*

INTRODUCTION

Prunus spinosa L. (blackthorn) belongs to *Prunus* genus from the *Rosaceae* family. It grows wildly in various regions (MARAKOGLU *et al.*, 2005) as Europe, Asia, North Africa and North America from lowland to highland (1000 m) (PÂRVU, 2000). It has a great capacity of vegetative spreading, invading the open land areas forming dense and spiny brushwood (PÂRVU, 2000).

It was observed that after two years of management by hay cutting and shrub (*P. spinosa* and *Rubus fruticosus*) clearance, the floristic species richness doubled. Shrub clearance also prevented *R. fruticosus* and *P. spinosa* from further smothering the grassland flora.

Temperate woodlands and meadows support a variety of thorny shrubs (such as blackthorn *Prunus spinosa* L., *Crataegus* spp. and *Rosa* spp.) that are light-demanding and occur mostly along forest edges (STORTELDER *et al.*, 1999 cited by BAKKER *et al.*, 2004).

Another good method for the maintenance over the years of a relatively constant coverage of *P. spinosa* in grassland without clearing the land is the grazing with goats (RAHMANN, 2004).

MATERIAL AND METHODS

The researches presented in this work were carried out during 2003–2008 on two permanent grasslands, one steppe type from Cheglevici and one forest steppe type from Surduc (Timiş County, western Romania).

The grassland from Cheglevici is characterised by a chernozem type soil with a pH of 6.95, the average yearly temperature is 10.5ºC, the multiannual rainfall amount is 541.4 mm and the altitude is 89 m a.s.l.

The grassland from Surduc has a brown soil with a pH of 5.38, the multiannual temperature is 10.4, the average yearly rainfall amount is 690.7 mm and the altitude is 242 m a.s.l.

The coverage index of *P. spinosa* was determined on a permanent quadrate transect of 100 square meters. The herbaceous vegetation data was determined using the linear point-quadrat method (DAGET and POISSONET, 1971). The vegetation parameters analysed were: species richness, number of grasses, legumes and other species number, contribution of grasses, legumes and other species, Shannon index *H'*, Simpson index *D* and pastoral value *VP* on 0–100 scale.

The specific contribution *SC*% was calculated considering the number of contacts and represents the report between the specific frequency of a given species and the total of the specific frequencies of the taxa from the relevé using the following formula:

$$CS_i\ \% = (FS_i / \Sigma FS_i) \cdot 100 \qquad (1)$$

where:

FS_i – specific frequency of the species *i*;

ΣFS_i – the sum of the specific frequencies of the taxons from a relevé (DAGET and POISSONET, 1971).

Shannon's entropy and Simpson index are used for the estimation of the biodiversity.

Shannon's entropy *H'* is calculated using the formula:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i \qquad (2)$$

where:

S – species number from the analysed sample (species richness);

p_i = proportion of *i* species from *S*, respectively n_i:*N* (BEALS *et al.*, 2000).

Simpson's index *D* was calculated using the next formula:

$$D = \sum (n_i / N)^2 = \sum_{i=1}^{S} p_i^2 \tag{3}$$

where:

n_i – total individual number of the species *i*;

N – total number of the individual of the species from the sample (BEALS *et al*., 1999).

The pastoral value *VP* was calculated after the following formula:

$$VP = 0.2\ \Sigma\ (CS_i\ IS_i) \tag{4}$$

where:

CS_i – specific contribution of the species *i*;

IS_i – specific quality index of the species *i* (DAGET and POISSONET, 1971).

The statistical method used is Pearson's correlation coefficient *r*.

RESULTS AND DISCUSSION

Grassland from Cheglevici is dominated by *Cynodon dactylon* and *Bromus hordeaceus*. In the vegetation sward have an important contribution *Achillea millefolium, Polygonum aviculare, Geranium pratense* and *Prunus spinosa* (Tab. 1).

The species number was comprised between 21 and 30, respectively the grasses number was between 3 and 4, legumes between 2 and 4 and species from other botanical families between 15 and 20. The contribution of the grasses is relatively low being comprised between 17.65% and 35.83%. The contribution of legumes was comprised between 0.82% and 6.95%, and the *SC*% of the species from other botanical families has a high value, being comprised between 62.49% and 75.59%. *H*' values obtained were characteristic for an average to high biodiversity (2.36–2.96), but the values obtained for *D* were typical for high diversity (0.06–0.14). The high values of biodiversity are due to the great number of annual weeds. The values calculated for *VP* were very low (14.58–18.93) highlighting that the species without or with low forager value have the most important contribution in the grassland sward.

Grassland from Surduc is dominated by *Agrostis tenuis* and *Festuca rupicola*, there being present in an important amount *Holcus lanatus, Plantago lanceolata* and *Daucus carota* (Tab. 1). The species richness was comprised between 21 and 25, respectively the grasses number was between 3 and 5, legumes between 1 and 2

Table 1. Synthesis of the taxa from the grasslands from Cheglevici and Surduc (2003–2008)

Cheglevici	Surduc
Grasses:	**Grasses:**
Cynodon dactylon, Bromus hordeaceus, Alopecurus pratensis, Lolium perenne, Poa pratensis, Poa annua	*Agrostis tenuis, Festuca rupicola, Holcus lanatus, Festuca pratensis, Anthoxanthum odoratum*
Legumes:	**Legumes:**
Medicago lupulina, Lotus corniculatus, Lathyrus tuberosus, Trifolium pratense, Ononis arvensis, Vicia angustifolia, Vicia cracca, Vicia grandiflora	*Lotus corniculatus, Medicago lupulina*
***Juncaceae* and *Cyperaceae*:**	***Juncaceae* and *Cyperaceae*:**
Carex praecox, Luzula avensis	none
Other species:	**Other species:**
Achillea millefolium, Daucus carota, Geranium pratense, Cirsium undulatum, Cichorium intybus, Eryngium campestre, Carlina vulgaris, Polygonum aviculare, Dipsacus fullonum, Xanthium italicum, Agrimonia eupatoria, Scabiosa ochroleuca, Plantago lanceolata, Symphythum officinale, Pastinaca sativa, Inula helenium, Verbascum phlomoides, Linaria vulgaris, Convolvulus arvensis, Capsella bursa pastoris, Carduus acanthoides, Chenopodium album, Taraxacum officinale, Lamium purpureum, Silene alba, Myosotis arvensis, Veronica hederifolia, Adonis estivalis	*Erygeron anuus, Mentha arvensis, Bellis perennis, Hieracium pilosella, Thymus serpyllum, Gallium verum, Euphorbia cyparissias, Erygeron canadensis, Daucus carota, Plantago lanceolata, Hypericum maculatum, Rumex acetosella, Pimpinela major, Viola odorata, Potentilla argentea, Ranunculus acris, Eupatorium cannabinum, Rudbeckia laciniata, Cirsium arvense, Veronica chamaedrys, Pimpinela major, Carpesium cernuum, Leontodon autumnalis, Carthamus lanatus*
Shrubs:	**Shrubs:**
Rosa canina, Prunus spinosa	*Prunus spinosa, Rosa canina, Rubus caesius, Crataegus monogyna*

and species from other botanical families between 15 and 21. The contribution of the grasses is high being comprised between 50.62% and 70%. The contribution of the legumes was comprised between 0.4% and 5.42% and the *SC*% of the species from other botanical families was between 29.6% and 52.48%. *H'* values obtained were characteristic for an average biodiversity (2.04–2.53), but the values obtained for *D* were typical for high diversity (0.12–0.21). The values calculated for *VP* were low to medium (26.94–41.04).

In Figure 1 is presented the evolution of *P. spinosa* coverage index along the time during the study. The values registered in Surduc (9.63–31.56%) were lower than in Cheglevici (3.75–15.27%).

The analysis of the influence of the *P. spinosa* coverage index on the vegetation of both grasslands was realised with the help of the correlation coefficients *r* and determination coefficients R^2 among *P. spinosa* coverage index and species richness, number of grasses, legumes and other species, contribution of grasses, legumes and other species, *H'*, *D* and *VP* (Tab. 2).

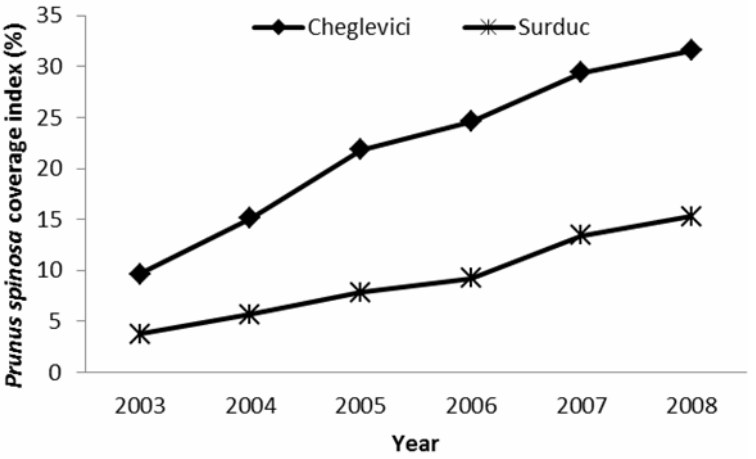

Fig. 1. Evolution in time of *P. spinosa* coverage index

Table 2. r and R^2 among *P. spinosa* coverage index and species richness, number of grasses, legumes and other species, contribution of grasses, legumes and other species, H', D and VP ($\alpha = 0.05$; one-tailed test; $df = 5$; *ns* $p > 0.05$, * $p < 0.05$, ** $p < 0.025$, *** $p < 0.01$)

Specification		Species richness	Number of			*SC*%			*H'*	*D*	*VP*
			grasses	legumes	others	grasses	legumes	others			
Cheglecivi	r	0.29^{ns}	0.02^{ns}	0.43^{ns}	0.18^{ns}	-0.42^{ns}	0.31^{ns}	0.43^{ns}	0.26^{ns}	-0.11^{ns}	0.12^{ns}
	R^2	0.09	0.00	0.19	0.03	0.18	0.10	0.17	0.07	0.01	0.01
Surduc	r	–0.83***	0.10^{ns}	-0.14^{ns}	–0.66*	–0.66*	-0.32^{ns}	0.81**	0.41^{ns}	-0.61^{ns}	–0.68*
	R^2	0.69	0.01	0.02	0.43	0.44	0.10	0.63	0.16	0.38	0.46

The obtained correlation coefficients were different between the analysed grasslands. In the case of grassland from Cheglevici there wasn't any correlation between the analysed variables, even it has a greater coverage index of *P. spinosa*.The correlation coefficients obtained for the grassland from Surduc were the following: strong negative relationship with species richness ($r = –0.83$), medium strength positive relationship with the contribution of the species from other families ($r = 0.81$), and weak negative relationship with the number of the species from other families ($r = –0.66$), grasses contribution ($r = –0.66$) and pastoral value ($r = –0.68$).

Other researches from literature have shown that the effects of shrub encroachment on plant diversity are ambiguous (PIHLGREN, 2007). Some studies have demonstrated negative effect of shrubs on plant diversity (LINDBORG and ERIKSSON, 2004 cited by PIHLGREN, 2007) and other correlation analyses showed that increasing proportion of the pasture area covered by shrubs had a positive effect on species richness on most taxa (SÖDERSTRÖM *et al*., 2001).

CONCLUSIONS

The encroachment of *P. spinosa* in grasslands has different influence on the vegetation sward, from the point of view of the coverage index of the shrub and the management intensity. At lower coverage indexes *P. spinosa* can determinate the decrease of the species richness, the contribution of the species from other families increasing instead of the decrease of their number of taxa. Also, the increase of the contribution of the taxa from other families is determining a lower pastoral value. Other values of the coverage index aren't determining significant changes on the vegetation cover.

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STRESZCZENIE

Wpływ śliwy tarniny (*Prunus spinosa* L.) na roślinność trawiastą w zachodniej Rumunii

Słowa kluczowe: *korelacja, Prunus spinosa L., roślinność, skład florystyczny, użytki zielone*

Śliwa tarnina (*Prunus spinosa* L.) jest gatunkiem, który zmienia trwałe użytki zielone w ekosystemy zdominowane przez roślinność krzewiastą. Gatunek jest powszechny w zachodniej Rumunii i trudny do opanowania ze względu na dużą zdolność wegetatywnego rozmnażania z korzeni. Masowe pojawy gatunku w ekosystemach trawiastych spowodowane są zaniechaniem ich użytkowania i zmniejszeniem obsady zwierząt. Roślinność analizowano linową metodą punktowo-kwadratową. Celem badań była analiza wpływu gatunku na pewne cechy roślinności takie jak bogactwo gatunkowe, liczba i udział gatunków trawiastych, motylkowych i innych, wskaźniki różnorodności gatunkowej (Shannona – *H'* i Simpsona – *D*) oraz wartość pastwiskowa VP.

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