RESEARCHES CONCERNING SOIL pH ON INVASIVE SPECIES FROM GRASSLANDS

CERCETĂRI PRIVIND INFLUENTA pH-ULUI SOLULUI ASUPRA SPECIILOR INVAZIVE DIN PAJIŞTI

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Abstract: *Ecologic and economic impact of invasive species is perceived from local to global level. The purpose of this work is to provide useful pieces of information concerning plant species invasion phenomenon in Romanian grasslands. Researches were realized during 2003-2005 on 38 permanent grasslands situated in places with different environmental conditions from Banat region (western Romania). Grasslands studied in this work show a great soils variety. Thus is quantified the comportment of invasive species under the influence of soil pH. For this purpose here is calculated the correlation considering as dependent variable annual coefficient of grassland surface occupation (spreading coefficient) with invasive species.*

Rezumat: *Impactul ecologic şi economic al speciilor invazive se simte de la nivel local la scară globală. Scopul acestei lucrări este să aducă informaţii utile privind fenomenul invaziei speciilor de plante în pajiştile din România. Cercetările au fost realizate în perioada 2003-2005 pe 38 de pajişti situate în locuri cu condiţii de mediu diferite din Banat (vestul României). Pajiştile studiate în această lucrare prezintă o mare varietate a condiţiilor de sol. Astfel s-a cuantificat comportamentul speciilor invazive sub influenţa pH-ului solului. În acest scop a fost calculate coeficientul de corelaţie considerând ca variabilă dependentă coeficientul anual de ocupare a suprafeţei cu specii invazive (coeficient de răspândire).*

Key words**:** *invasive species, spreading coefficient, soil pH, correlation.*
Cuvinte cheie: *specii invazive, coeficient de răspândire, pH-ul solului, corelaţie.*

INTRODUCTION

The role of the ecosystem disturbances in promotion of invasive plant species is essential. Undergrazing, overgrazing and the absence of the maintenance works on grasslands lead to the invasive plant species proliferation. Environmental changes are also determined by the change of the pressure of some anthropic factors (use, fertilisation, maintaining work, management), which are influencing the botanical composition of the permanent grasslands (SĂRĂȚEANU, 2006).

The most frequent invasive plant species in western Romanian permanent grasslands are from the next botanical families: *Rosaceae* (*Prunus spinosa, Crataegus monogyna, Rosa canina, Rubus caesius*), *Fabaceae* (*Sarothamnus scoparius, Amorpha fructicosa, Ononis spinosa*), *Juncaceae* (*Juncus effussus*), *Asteraceae* (*Carduus acanthoides, Carlina vulgaris, Carthamus lanatus, Cirsium undulatum*), *Apiaceae (Eryngium campestre)*, *Dipsacaceae* (*Dipsacus fullonum*), *Euphorbiaceae* (*Euphorbia cyparissias*) *Poaceae* (*Calamagrostis epigeios, Botriochloa ischaemum*), *Dennstaedtiaceae* (*Pteridium aquilinum*) *etc.* (SĂRĂȚEANU, 2006).

VERMEIJ (*1996*) cited by BOOTH *et al*. (*2003*) defines invasion as the geographical expansion of a species in an area unoccupied previously by this species. This definition includes also the idea that the most of the invasive species are non-native, but this is not a necessary condition.

Surface covering models presented are framing in the radial expansion model described by COUSENS & MORTIMER (*1995*), which shows that the invasive plants are expanding through a circular advancing front. Thus, initial surface occupied is increasing whit a half from the radius of the former generation, and the expanding rate is constant.

The small differences appeared in the most of the cases can be explained with a theory formulated by MAXWELL *et al.* (*2003*), which says that some individuals from the former population are spreading at a smaller or bigger distance far from the invasion source forming a satellite population of that species. Satellite populations will act as a new invasion source continuing to increase in the same way with the original source.

MATERIAL AND METHOD

Researches were realized during 2003-2005 on 26 permanent grasslands situated in places with different environmental conditions from Banat region (western Romania). The data were collected twice a year: at the end of May and at the beginning of September. Research plots were situated at altitudes comprised between 87 and 370 m, on soils with pH between 5.4 and 8.0 pH.

One of the research methods used in this work is mapping the aerial projection of invasive plant species (shrubs and herbs) on 100 m^{-2} (10 m x10 m) plots divided in 25 m^{-2} (5m x 5m) sub plots.

The data obtained in this way helped us to analyze spatial distribution, and to calculate the coverage index for studied species, which is the ratio in percent of the surface covered by shrubs, to the surface of the plot.

Also, these data helped us to calculate the spreading coefficient, which represents the increase in surface covered by shrubs starting from a reference surface of $1m^2$ between two years ($year^{-1}$).

Grasslands studied in this work show a great soils variety. In this way we have collected soil samples from all studied plots and the chemical analyzes were done in the agro-chemistry lab of Banat's University of Agricultural Sciences and Veterinary Medicine from Timişoara.

Statistical methods used are linear regression and Bravais-Pearson correlation.

RESULTS AND DISCUSSIONS

In Romania, only 6.6% from grassland surface is not affected by degradation processes. Erosion and landslides affect the biggest part of the grasslands (60%). Humidity excess and alkalinity affect every 10%, or less from the total grassland surface. There are 379 000 hectares with parental material on the surface, which are totally degraded grasslands (MOISUC & ĐUKIC, 2002).

In Timiş County and neighbour counties the situation is similar; different is only the size of the surface affected by degradation processes, depending by the specific of the county's relief. In this way, in Caraş Severin County 81.1% from grasslands are affected by soil erosion, in Timiş 35.5% have humidity excess, in Hunedoara 21.1% from grasslands surface has parental material on the surface (MOISUC & ĐUKIC, 2002).

Soil reaction has an important influence on the botanical composition of vegetation carpet. Due to this fact they can characterize the taxa concerning their tolerance for some certain values of soil reaction.

Invasive species have usually wide tolerance limits concerning soil chemical reaction, the greatest part of the analysed species in this work being indifferent or acid-neutrophylic after the characterisation realised by different authors (table 1). This fact shows that invasive species are adapted to a great variety of environmental conditions.

Table 1

Soil reaction indexes of studied invasive species

Species	SANDA V. *et al.* (1983)*	KOVACS A. (1979)**
Euphorbia cyparissias L.	4	x
Juncus effusus L.	3	x
Carduus acanthoides L.	0	x
Eryngium campestre L.	4	8
Dipsacus laciniatus L.	4	7
Carlina vulgaris L.	0	x
Xanthium spinosum L.	3	x
Carthamus lanatus L.	0	x
Pteridium aquilinum (L.) Kuhn	0	3
Rosa canina L.	3	x
Crataegus monogyna Jacq.	3	8
Prunus spinosa L.	3	x
Rubus caesius L.	4	7
Ononis spinosa L.	0	x
Sarothamnus scoparius (L.) Wimmer	2	-

* 0 – indifferent; 2 – acidophilic; 3 – acid-neutrophylic; 4 – weakly acid-neutrophylic

** x – indifferent; 3 – mostly in acid soils; 7, 8 – neutral soils (from weakly acid to weakly basic)

Evaluating invasive species comportment determined by soil pH we have calculated correlation coefficients and polynomial regression between these two variables.

There is considered invasive species (herbs and shrubs) annual spreading coefficient as dependent variable and soil pH as independent one (figure 1, figure 2, figure 3).

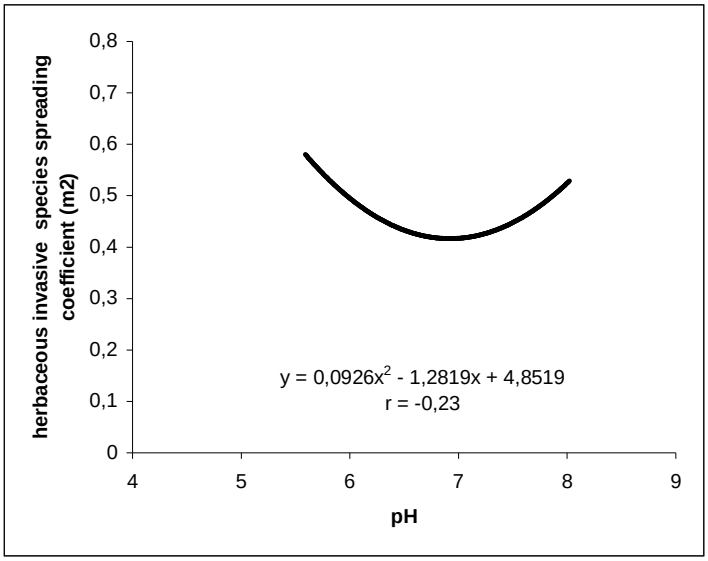

Figure 1 Correlation between soil pH and surface occupation coefficient of herbaceous invasive species

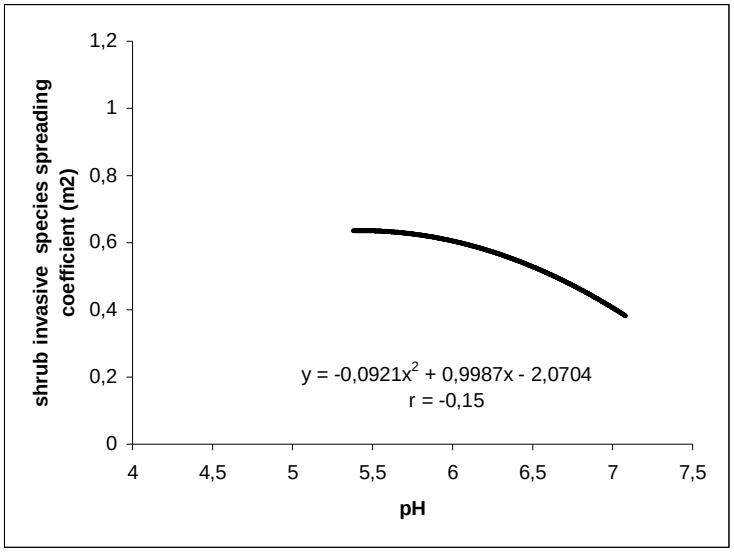

Figure 2 Correlation between soil pH and surface occupation coefficient of shrub invasive species

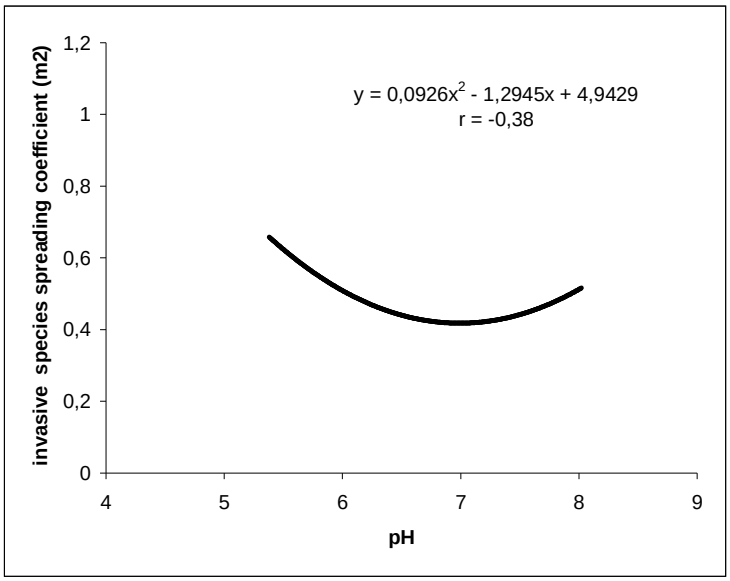

Figure 3 Correlation between soil pH and surface occupation coefficient of invasive species

Between the occupation coefficient of the surface with invasive species and soil pH isn't found any interrelation (*r = -0.38*) as can be noticed from the regression curve trend.

Values of correlation coefficients for herbaceous species are *r = -0.23*, and for shrubs *r = -0.15*; in both cases isn't any correlation.

These results are confirming the fact that invasive species studied here have a great tolerance interval for soil reaction, this fact determining them to be adaptable to a great variety of soil types.

CONCLUSIONS

The actual state of the most Romanian grassland is deeply influenced by the agricultural activities from the communist period, and from the actual period too, because after 1989 a lot of these surfaces were irrationally used or abandoned. Also, the number of animals that are using these permanent grasslands is decreasing powerfully.

These conditions have determined deep changes in Romanian grassland vegetation structure. In this way there appeared favourable conditions for spreading of some species with invasive traits that have negative influence on the initial valuable vegetation, some of them becoming dominant in the vegetation carpet (SĂRĂȚEANU & MOISUC, 2004).

Also, soil acidification, or alkalinisation are influenced by grassland management. But invasive species are tolerant to a great soil variety. In this way soil reaction isn't a limiting factor for invasive species annual spreading coefficient.

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