THE SPECIFIC DIVERSITY OF WEED COMMUNITIES IN WINTER WHEAT AND CORN FIELDS, IN TIMIS COUNTY (2006, 2007)

BIODIVERSITATEA SPECIFICĂ A COMUNITĂȚILOR SEGETALE DIN CULTURILE DE GRÂU ŞI PORUMB DIN JUDEȚUL TIMIŞ (2006, 2007)

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Abstract: *The paper is based on data collected in 112 winter wheat parcels and 97 corn parcels, in 2006 and 2007, according to the Göttingen method. The sampled parcels are mostly situated in plain area of the Timiş County. We divided weed species in significant and non-significant ones, the last ones with a minor contribution to the weeding degree. We consider as diversity parameters the species number per parcel (significant, non-significant, minimal, maximal, average values for each year) and the Shannon-Wiener index. In winter wheat fields we found an average number of weed species per parcels of 26.5 (in 2006) and 23.1 (in 2007), while in corn fields the values were of 22.2 (2006) and 17.5 (2007). The average number of non-significant weed species per parcel per year ranks from 5.5 (corn, 2007) to 7.7 (corn, 2006). The Shannon-Wiener index values ranks from 2.53 (corn, 2007) to 3.27 (winter wheat, 2007). We didn't find strong correlations between the total weed species number per parcel and the corresponding Shannon-Wiener index values. We explain this by the variety of conditions and cultural techniques.*

Rezumat: *Lucrarea este realizată pe baza datelor prelevate în 112 parcele cu grâu şi 97 de parcele cu porumb în anii 2006 şi 2007, conform metodei Göttingen. Parcelele alese spre eşantionare sunt în majoritate situate în zona de câmpie a județului Timiş. Speciile de buruieni sunt împărţite în specii semnificative şi nesemnificative, acestea din urmă cu o contribuţie minoră la realizarea gradului de îmburuienare. Ca parametri ai diversităţii sunt folosiți numărul de specii per parcelă (semnificative, nesemnificative, minim, maxim şi media pe fiecare an) şi indicele Shannon-Wiener. În parcelele cu grâu am găsit în medie 26,5 specii per parcelă (în 2006), respectiv 23,1 (în 2007), în timp ce în porumb am găsit 22,2 specii (2006) şi 17,5 (2007). Numărul mediu al speciilor nesemnificative per parcelă şi per an variază între 5,5 (porumb, 2007) şi 7,7 (porumb, 2007). Valorile indicelui Shannon-Wiener merg de la 2,53 (porumb, 2007) la 3,27 (grâu, 2007). Nu au fost găsite corelaţii semnificative între numărul total de specii per parcelă şi valorea corespunzătoare a indicelui Shannon-Wiener. Explicăm aceasta prin varietatea condiţiilor şi măsurilor tehnologice.*

Key words: *weeds, specific diversity, Shannon-Wiener index, winter wheat, corn, Timiş county*
Cuvinte cheie: *buruieni, diversitate specifică, indice Shannon-Wiener, grâu, porumb, județul Timiş*

INTRODUCTION

The study of weeds in the Banat region (SW Romania) was done until now mainly from an agronomical perspective: mapping, weeding degree, control [7, 8, …]. Some studies were carried out from a phyto-sociological point of view [2, 3, 4]. COSTE [5] published a paper on the conversion of numerical data concerning the weeding degree in phyto-sociological data.

Our aim was to study the biodiversity of weeds communities, more specifically the biodiversity at the species level (specific diversity). This approach was supposed to give answers to the following questions:

- How many species compose the weeds community in wheat and corn fields?

- How many weeds species are important / significant for weeding degree?
- How big are variations in specific diversity from year to year?
- How rank the Shannon-Wiener values in weeds communities?

The study of diversity of weeds, part of the agro diversity [1], may offer a complementary information for the weeds control and dynamics.

MATERIAL AND METHODS

The research was carried on in 2006 and 2007 in locations covering the most natural conditions types in the Timiş County. We sampled winter wheat fields near the following localities: Bacova, Banloc, Bărăteaz, Beba Veche, Beregsău Mare, Biled, Birda, Bucovăţ, Buziaş, Carani, Cărpiniş, Cenad, Cenei, Chevereş, Cioreni, Cioreni, Cruceni, Diniaş, Dudeştii Vechi, Făget, Fârdea, Fibiş, Fîrdea, Foeni, Gătaia, Gelu, Giarmata, Giera, Giulvăz, Gladna Montană, Grabaţ, Ionel, Jamu Mare, Jebel, Jimbolia, Liebling, Lovrin, Lugoj, Margina, Mâtnic, Moraviţa, Murani, Orţişoara, Otelec, Pesac, Pişchia, Recaş, Remetea Mare, Remetea Mică, Şag, Sânandrei, Şandra, Sânmartinu Român, Sânnicolau Mare, Silagiu, Sinersig, Teremia Mare, Timişoara, Topolovăţu Mare, and Traian Vuia (40 parcels sampled in 2006 and 72 in 2007).

Corn fields chosen for our research was located near: Bacova, Bărăteaz, Beba Veche, Becicherecu Mic, Biled, Buziaş, Calacea, Carani, Cărpiniş, Cenad, Chevereş, Cruceni, Cruceni, Dudeştii Noi, Dudeştii Vechi, Fârdea, Fibiş, Foeni, Gătaia, Giarmata, Giera, Giulvăz, Gladna Montană, Hăuzeşti, Hodoni, Ionel, Jamu Mare, Jebel, Liebling, Lovrin, Lugoj, Margina, Mâtnic, Murani, Nădrag, Otelec, Periam, Pesac, Pişchia, Remetea Mare, Remetea Mică, Săcălaz, Şandra, Sânandrei, Sânnicolau Mare, Saravale, Silagiu, Sînnicolau Mare, Timişoara, Tomeşti, Topolovăţ, Traian uia, Uivar, Variaş, and Zolt (51 parcels sampled in 2006 and 46 in 2007).

In each parcel, we collected data (floristic inventory and the number of individuals for each species) according to the Göttingen method; this method consists in using a 0.1 m^2 quadratic frame in 10 points along a parcel diagonal. Putting together in a table the results gave us the weed list and the weeding degree per square meter. In order to obtain a more accurate image on weed flora, we added to the table a list of non-sampled species that we consider "non-significant species" for the weeding degree; in all cases, their populations were composed by few individuals per parcel.

The biodiversity parameters we used are:

- the total weed species per parcel,
- the non-significant weed species per parcel,
- the Shannon-Wiener index values.

In calculating this last one, we used the relation:

$$H' = -\sum_{i=1}^{s} p_i \log_2 p_i$$

were $\mathbf{p_i}$ = the proportion of species **i**, calculated as $\mathbf{N_i/N}$, were $\mathbf{N_i}$ = the number of species **i** individuals, and **N** = the total number of individuals of all species (**S**) in a given parcel.
Proceeding in this way, we assume obtaining a complete image of floristic inventory without distorting the Shannon-Wiener index values.

The maximum values of H' are calculated as:

$$H'_{max} = log_2 S$$

The ratio between **H'** and $\mathbf{H'_{max}}$ is known as regularity (**R**):

$$R = \frac{H'}{H'_{max}}$$

For each year, we checked out the simple correlation between the H' and the total number of species per parcel.

We also calculated for each parameter the standard deviation.

The species nomenclature is taken from The Flora Europaea Database.

RESULTS AND DISCUSSIONS

In 2006, we found in winter wheat parcels an average of 26.48 species per parcel, with a minimum value of 14, and a maximum value of 40. The standard deviation was 7.02. From these 26.48 species, 7.03 was non-significant to the weeding degree, with variation between the extremes of 1 to 14 (the standard deviation = 3.47).

In 2007, the average number of species per parcel was smaller: 23.08, value calculated for a statistical population that ranked from 9 to 41, with a standard deviation of 7.269. The number of non-significant species was also smaller compared to the 2006 value: 5.347, with a standard deviation of 3.824.

The H' value in 2006, also in winter wheat, was 2.94, which may be considered a medium diversity; the extremes of H' were 1.52, respectively 4.16, and the standard deviation was 0.62. R value is 0.63, and the signification of this value is that more than a half of maximal diversity is realized in this case. The correlation between H' and the total number of species is weak, while R2 = 0.3195 (fig. 1).

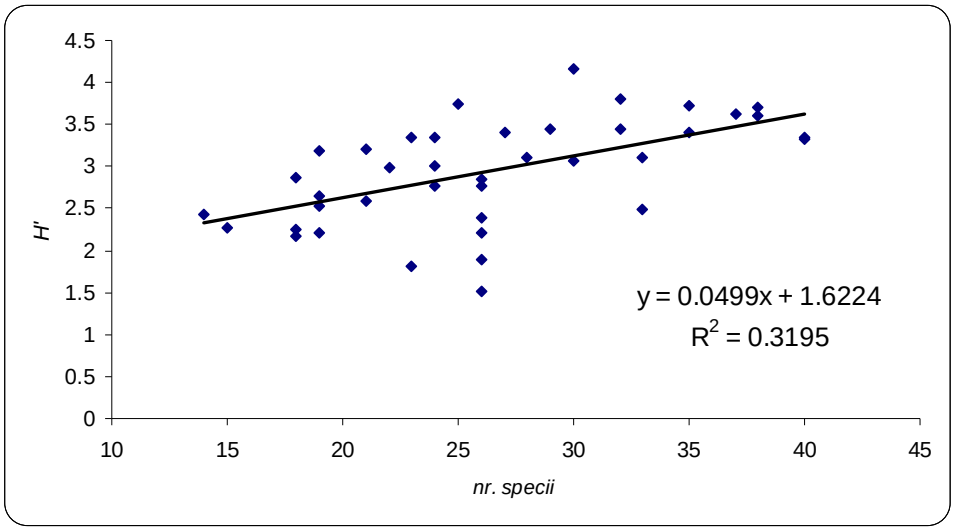

Figure 1. Correlation between the number of weeds species and the corresponding values of SHANNON-WIENER index in studied parcels (Timiş county, 2006) in winter wheat
(nr. $specii_{rom.}$ = number of $species_{engl.}$)

The H' average value in 2007, in winter wheat weeds communities, was higher : 3.263 ; for the extreme values 2.24 and 4.354, we obtained a standard deviation of 0.552, smaller than the corresponding 2006 value. This last value means a smaller variation among parcels' conditions. The R average value was 0.732, compared to the recorded value of 0.63 in

2006. The correlation between H' values and number of species values (fig. 2) is stronger than in 2006, with $R^2 = 0.557$. We noticed a small H' standard deviation: only 0.086. It is to be linked to the climate conditions: warmer and rainier in 2007 [6], that means more optimal conditions for plants, and less intense competition.

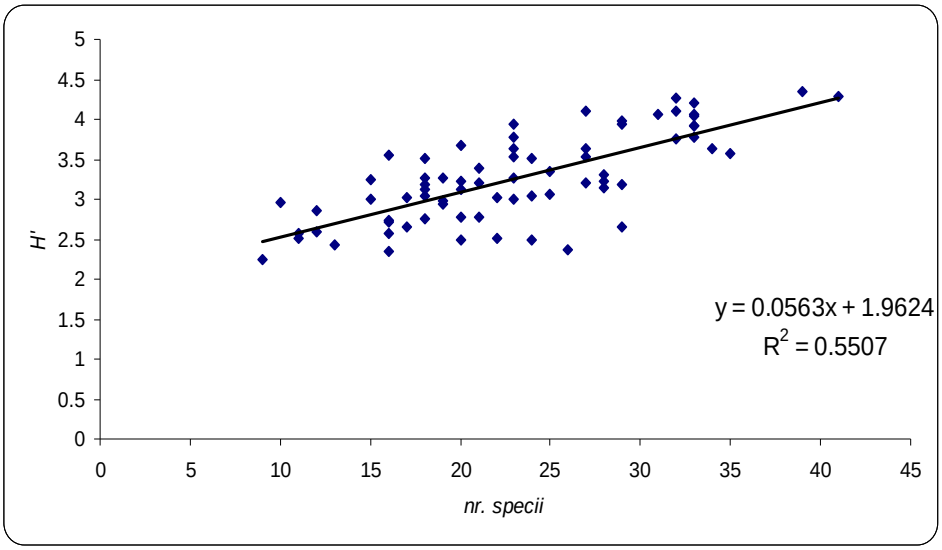

Figure 2. Corelation between the number of weeds species and the corresponding values of SHANNON-WIENER index in studied parcels (Timiş County, 2007) in winter wheat
(nr. $specii_{rom.}$ = number of $species_{engl.}$)

In corn fields, in 2006, we found an average value of 22.18 species per parcel, ranking from 11 to 40, with a standard deviation of 6.66. From these 22.18 species, 7.69 are non-significant (average value, with absolute variation from 0 to 23 and a standard deviation of 4.79.

In 2007 we recorded less species per parcel (17.54), and the variation was smaller also than in 2006: minimum - 8, and maximum – 33 (standard deviation = 5.43). The explanation is undoubtedly related to many factors. The number of non-significant species is reduced by almost 50 % than in 2006: 4.48. The standard deviation value (3.15) of non-significant number of species expresses more close to the mean value.

The H' value in 2006 was 2.927, calculated for a statistical population that ranks from 1.901 to 3.908. The regularity goes from 0.461 to 0.782, with a mean of 0.66 and a remarkably small standard deviation (0.088). Between the H' and the total weeds species there are a direct relation (fig. 3), but the R^2 value is small (0.3992); our tables show a diversity of situation, from communities clearly dominated by few species to communities with almost equal populations.

In 2007, in corn fields, H' mean value is 2.53, ranking from 1.281 to 3.633 and a standard deviation of 0.55. All these values are smaller than the similar one in 2006. The regularity value is almost the same than in 2006 (0.63, compared to 0.66). The correlation between H' and the total number of species (fig. 4) are weaker than in 2006; the majority of

numbers of species values are below 20.

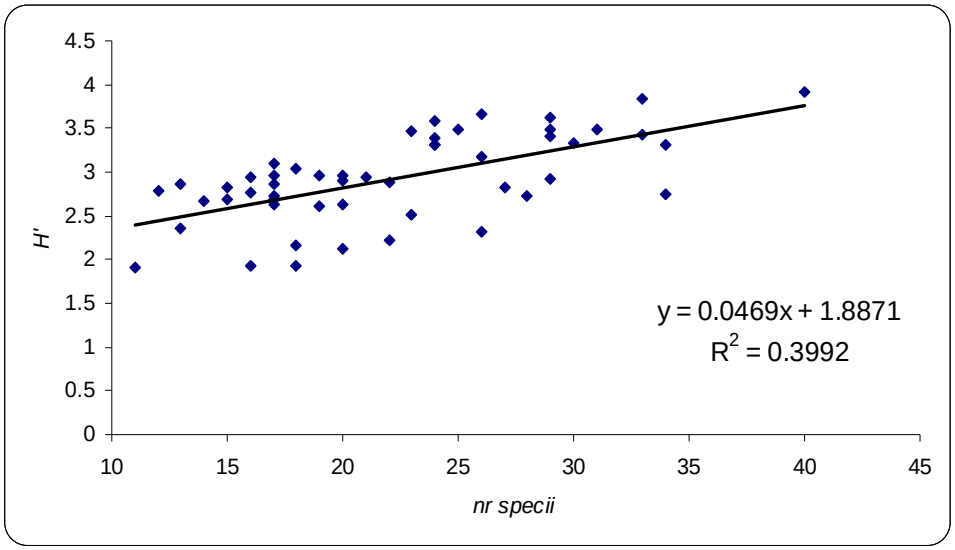

Figure 3: Correlation between the number of weeds species and the corresponding values of SHANNON-WIENER index in studied parcels (Timiş County, 2006) in corn fields
(nr. $specii_{rom.}$ = number of $species_{engl.}$)

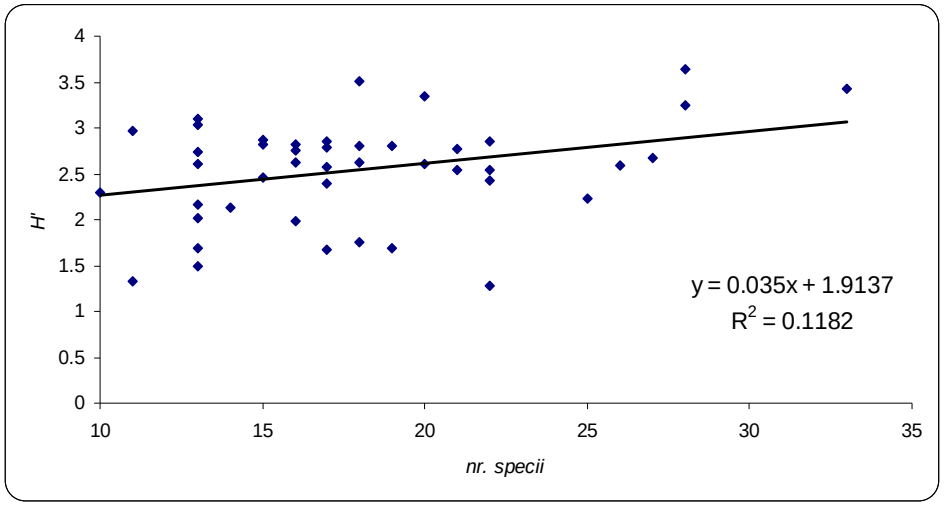

Figure 4. Correlation between the number of weeds species and the corresponding values of SHANNON-WIENER index in studied parcels (Timiş County, 2007) in corn fields
(nr. $specii_{rom.}$ = number of $species_{engl.}$)

CONCLUSIONS

The number of weed species was higher in winter wheat than in corn fields, in both years, 2006 and 2007. The highest value was recorded in winter wheat, in 2006: 26.48 species per parcel, average value. In 2007 the mean number of weed species was higher than in 2006 in the studied agro ecosystems.

The number of non-significant species shows no differences, between corn fields and winter wheat fields. In absolute terms, the percentage of non-significant species ranks from 22 % (winter wheat, 2007) to 32.7 % (corn, 2007).

For each considered year, the H' values in winter wheat fields are higher than in corn fields.

There are not strong direct correlations betweens H' and the total number of weed species. We explain this aspect by the diversity of conditions and factors.

For the studied area, the extension of the study for many years and the study of influence of main factors on the diversity in weeds communities is to be done. Elucidating aspects of weeds as communities could improve the efficiency of their control.

BIBLIOGRAPHY

1. BROOKFIELD H., STOCKING M., 1990 - Agrodiversity: definition, description and design, Global Environmental Change, 9, 2,: 77-80
2. BUJOREAN G., GRIGORE S., ARVAT N., 1962 - Despre problema statorniciei unor specii de buruieni în culturile de prăşitoare şi în semănăturile de toamnă, Lucrări ştiinţifice ale Institutului agronomic Timişoara, V,: 97-114, 1962
3. BUJOREAN G., GRIGORE S., ARVAT N., COSTE I., 1971 - Cercetări privind îmburuienarea culturilor de grâu şi porumb din vestul Republicii Socialiste România, Comunicări de botanică, XII,: 297-304, 1971
4. BUJOREAN G., POPESCU I., POPESCU C. P., 1956 - Contribuţii la studiul geobotanic al buruienilor de pe cernoziomurile din vestul R. P. R. (Note geobotanice I), Studii şi cercetări ştiinţifice, agricultură, 3 (3-4), Timişoara: 97-43
5. COSTE I., 1997 - Contribuţii metodologice privind utilizarea datelor de cartare numerică în studiile de cenologie la speciile de buruienid, Lucrări ştiinţifice, agricultură, XXIX, U.S.A.M.V.B. Timişoara: 249-259,
6. FĂRCĂŞESCU A.-M., 2008 - Cercetări privind studiul florei segetale şi a gradului de îmburuienare la principalele culture din judeţul Timiş, Doctoral thesis, USAMVB Timişoara, 2008
7. GRIGORE S., COSTE I., POP A., BÎLTEANU T., 1976 - Cartarea buruienilor în judeţele Timiş şi Arad (1973-1975), Producţia vegetală – cereale şi plante tehnice, 5,: 26-30, 1976
8. JURCULEŢ M., 2004 - Cercetări asupra ecologiei speciilor segetale şi a potenţialului de infestare a ecosistemelor agricole în sud-vestul României (Banat), Doctoral thesis, U.S.A.M.V.B. Timişoara, 2004
9. * * * „Flora Europaea Database", at URL http://www.rbge.org.uk …