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SEASONAL CHANGES IN WEED VEGETATION ON ARABLE PANNONIAN SAND AND LOESS LANDS IN HUNGARY

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Coenological records were made in Hungary's main sand and loess agricultural habitat types. The coverage of each species in monthly changes and their expansion can be tracked from the edge to the inner area of arable areas. Tests were made in autumn and spring aspect monthly. During recording percent estimation method was applied. Sample areas have been identified randomly and theses were modified 1×1 m quadrates according to Németh (2002). From each plots, six boxes were tested. Both edges and infield areas were assessed in 3-3 replicates. Recordings were made in 2010 and 2011, but former data were also used in order to review the rating of the last 50 years. Results clearly separated the weed species of sand and loess areas. Besides common species, incremental plants also appeared. Monthly recordings drew the phenological phases of species. Weed vegetation changes can be tracked and the results help to improve defense efficiency against weeds.

Keywords: national weed survey, arable plants, invasive weed

Introduction

Five national weed surveys on arable lands have been carried out in Hungary since World War II. These surveys covered the whole country and were conducted primarily for plant protection purposes. Their principal goal was to assess expansion and coverage of the most dangerous weed species.

In the last one and a half decade restructuring of land ownership passed off. As a result, both the number of farmers possessing small lands and the extent of these cultivated lands increased. Owing to these processes, significant changes appeared in the dominance relations of arable weed species, thus invasion of some of them intensified, while others were forced back.

National weed surveys on arable lands provide opportunity to create a database that includes the results of not only the present, but also of former surveys. From this database changes of the past 50 years are traceable, consequently weed conditions of certain regions, state of expanding and declining species can all be followed accurately, while integrated weed control techniques are also applicable more effectively.

The aim of the present work was to investigate weed conditions on two agricultural fields situated on loess and sandy bedrock typical for the Pannonian Region.

Materials and methods

Studies were carried out on those agricultural fields on loess and sandy areas of Pest County which had been involved in The Fifth National Weed Survey in 2007-2008 [1]. Exact designation of sampling sites was based on the description of study areas of the second national weed survey [2].

Surveys were conducted in the outskirts of two settlements, Dömsöd and Kartal.

Researches have been performed in the autumn and spring aspects monthly since 2010 with the application of percentage cover assessment method [3, 4].

Regarding sandy sites at Dömsöd samplings were carried out on the following agricultural parcels: 1. corn field, 2. corn stubble, 3. alfalfa parcel, 4. old alfalfa (small parcel), 5. old alfalfa (large parcel), 6. corn field, 7. fallow, 8. wheat field, 9. old alfalfa (ecological farming, small parcel), 10. wheat parcel (ecological farming). Sampling units of 1×1 m modified quadrates (after Németh, 2002) were chosen randomly. On each agricultural parcel 6 quadrates were studied. Both edges and inner parts of the parcels were recorded in 3 replicates [5].

On the loess-covered sites at Kartal 2 transects were studied. On each site, 3 quadrates were sampled in the edges and 3 within the agricultural parcels. For identification of the species nomenclature of Simon (2000) was used [6]. In the case of the species names EPPO codes were applied as well.

For statistical evaluation of the results heatmap analysis was used which is a two way clustering is a graphical way of displaying measured values by using colours that represent numerical values. Lower values tend towards green, while higher values tend towards red tones. Re-arranged rows and columns of the table grouped together represent similarity of dendrograms on the two axes.

Results and conclusions

Data about determinant species according to the results of sampling on the loess experimental site at Kartal in September and October 2010 are published on *Fig. 1*. The figure represents mean percentage weed species cover as the result of all 3 surveys conducted on the agricultural field. Significant coverage differences are observable.

Tripleurospermum inodorum, being an important species as regards for weed control [7] occurred with considerable percentage of cover.

Based on these data it is still a question whether *Tripleurospermum inodorum* belongs to T_4 or T_2 life form species. Although according to Ujvárosi [2, 8] it is a weed of T_4 life form, as a consequence of the changing environmental factors and because of its good adaptability it can overwinter easily and shows patterns of T_2 life form.

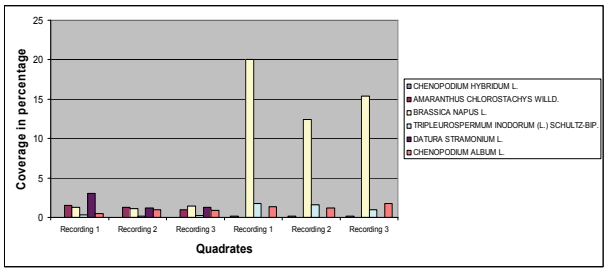

Figure 1: Survey results of autumn sampling at Kartal, 1. transect, within agricultural parcel

Dendrogam of the autumn sampling on sandy fields near Dömsöd shows that records of the different agricultural parcels form separated groups *(Fig. 2)*. This fact is supported by the two-way classification analysis (heat map) as well *(Fig. 3)*.

As for surveys performed on the edges of arable parcels, even if records of the same parcels are linked together on very low difference levels, the following sampling sites edges are observed to be grouped together: parcels 4., 5., 9., parcels 2., 6. and parcels 1., 3., 8. and 10. *(Fig. 4)*.

Considering values of percentage cover and highlighting the four most frequently occurred species – *Medicago sativa* /MEDSA/, *Stellaria media* /STEME/, *Triticum aestivum* /TRZAX/, *Capsella bursa-pastoris* /CAPBP/ – significant differences can be observed *(Fig. 5)*. Wheat parcels stand out clearly.

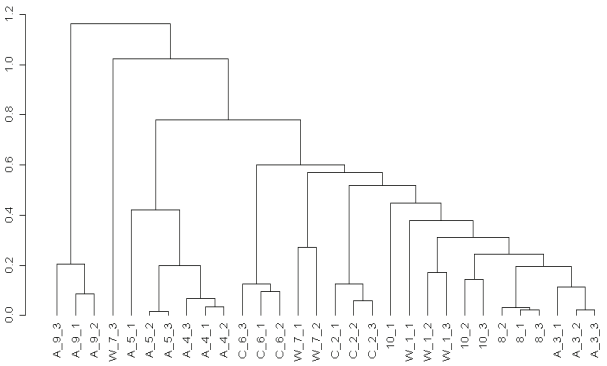

Figure 2: Classification of survey results from agricultural parcel at Dömsöd based on 2 autumn surveys (A-alfalfa, W-wheat stubble, C-Corn stubble, first numbers refer for the different areas examined while second numbers refers to the different quadrates)

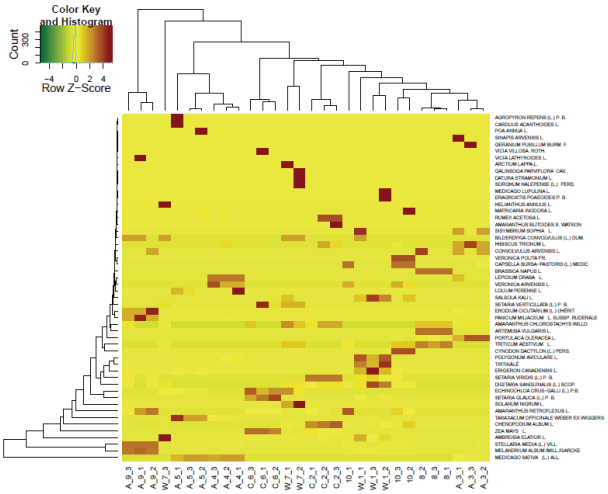

Figure 3: Results of the two-way classification of survey results from agricultural parcel at Dömsöd based on 2 autumn surveys

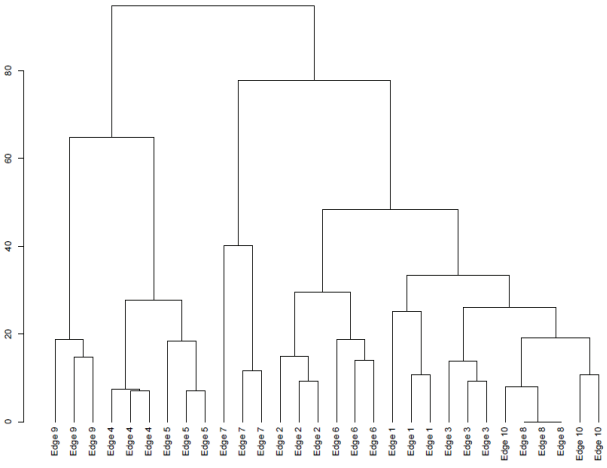

Figure 4: Classification of survey results from the edges of agricultural parcels at Dömsöd based on 2 autumn surveys

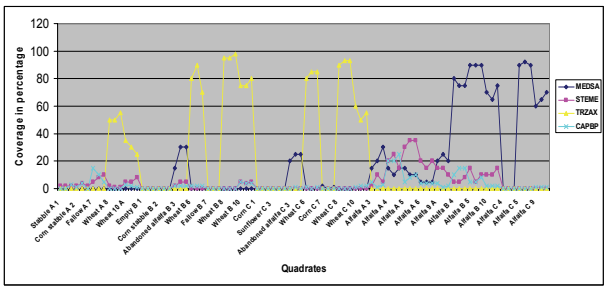

Figure 5: Percentage cover values of the four most frequent species based on the surveys at Dömsöd

Conclusions

The two last national weed surveys produced comparable results as the order of the first 10 most important weed species differ barely in the two cases [9, 10]. The most drastic changes appeared after the 50s owing to the introduced large-scale farming methods. During the process of establishing collective farms agricultural lands were united and brought under intensive cultivation. Large-scale application of herbicides, being the most responsible factor for the transformation of weed species composition in Hungary was initiated in those years as well. The following significant change came along with the political transition, when huge part of the agricultural fields came under private ownership again. At this point once more the number of farmers running small fields and the extent of these cultivated lands increased, as did the territory of fallow lands, while area under chemical weed-control decreased. As a consequence, new and dangerous weed species appeared on arable lands.

Comparing our research results with data from earlier weed surveys it can be concluded that the order of the most important weed species did still not change [9, 10]. However, coverage value and frequency of *Tripleurospermum inodorum* did increase, which is important regarding plant protection aspects. Defensive measures against this weed species should be reorganized on loess arable lands. Weeds appeared adjusted to agricultural parcels which demands another way of defence strategy as well. As transformed agricultural structure does not enable large-scale weed control any more, local conditions and variability of cultivated fields should become driving factors behind defence. Although variability of edges makes weed control even more difficult, they are important because of species diversity on arable land [11, 12, 13].

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