EFFECTS OF MOWING INTENSITY ON ORTHOPTERA-ASSEMBLAGES OF MEADOWS IN SOUTHWEST HUNGARY

Nagy A., * Kisfali M.**

*Department of Plant Protection, Faculty of Agricultural Science, University of Debrecen, H-4032 Debrecen Böszörményi str. 138., Fax: +36-52/508-459, E-mail: nagyanti@agr.unideb.hu.
** Department of Evolutionary Zoology and Human Biology, University of Debrecen H-4010 Debrecen P. O. Box 3. Hungary, E-mail: mkisfali@gmail.hu.

Abstract

Low intensity farming systems such as grasslands, hethtlands and wetlands are decreasing across Europe because of agricultural intensification and abandonment. The abandonment and casual management of these habitats might lead to biodiversity loss. The effect of mowing intensity and composition of Orthoptera-assemblages was studied in regularly (once a year) and casually (once in two or more years) managed meadows in the Ormánság (southwest Hungary). The composition of assemblages were characterised on the basis of two-year data (2004-2005) including 22 Orthoptera (8 Ensifera, 14 Caelifera) species. The total number of species and complementarity of species composition was higher in regularly mowed habitats. The intensity of mowing had effect on density and distribution of life form types. In this case the life form spectra of assemblages were more sensitive indicator than species richness. To prove our preliminary results further investigations are necessary.

Key words: Orthoptera fauna, sample, habitat

INTRODUCTION

Temperate low intensity farming systems included grasslands, heathlands and wetlands are species rich habitats originated and maintained by human activity. These systems are decreasing across Europe because of agricultural intensification and abandonment (Bakker & Berendse, 1999). Generally the abandonment leads to changes in habitat structure, reduction in species richness and eventually destruction of habitats. The Orthoptera is one of the most important groups of herbivorous insect living in these grassland systems. Herbivorous insects involved in “bottom up” resource control (Andersen et al., 2001), which makes them sensitive to changes of habitat structure particularly changes of the grass layer, such as occurs during grazing and mowing (Bock & Bock, 1991, Chambers & Samways, 1998, Gebeyehu & Samways, 2002). Based on their sensitivity, relative high species richness and easy sampling and identification orthopterans are commonly used indicators of habitat heterogeneity, ecosystem biodiversity and environmental stress (Andersen et al., 2001).

Considering Orthoptera fauna the Ormánság (southwest Hungary), which is the part of Duna-Dráva National Park, is one of the less studied part of Hungary. In this region the area of mowed grasslands gradually decreased because of agricultural intensification, abandonment and temporally irregular management. We study eight wet grasslands in order to make a list of species and study the effect of decreasing mowing intensity on Orthoptera-assemblages.

MATERIALS AND METHODS

The composition of assemblages and effect of land use intensity was studied in regularly (once a year) and casually mowed (once in two or more years) meadows in 2004 and 2005. The eight studied sampling sites were located along the River Dráva between Drávaszabolcs and Zaláta villages, which area is a part of the Duna-Dráva National Park (Fig. 1).

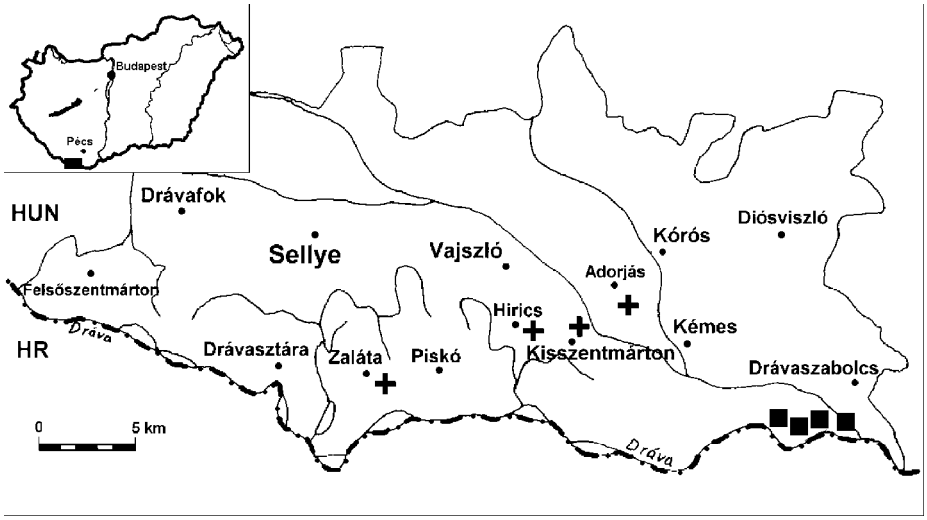

Fig. 1. Orthoptera sampling sites in the Ormánság (southwest Hungary) in 2004-2005. +: casually mowed grasslands (KSZM, KOEL, HIRICS, ZARE), ■: regularly mowed grasslands (DDNP1-4)

The sampling was made by sweep-net (300 net strokes per site) completed with direct search (15 minutes per site) in a 25*25 m quadrate in each sites, two times a year. During analysis pooled data of years were used, consequently we had 16 samples (8 from casually and 8 from regularly mowed grasslands). For identification of the collected specimens, keys of Harz (1957, 1969, 1975) were used. Most of collected individuals were released after identification. Other part of specimens were identified in

laboratory and placed in the Department of Evolutionary Zoology and Human Biology, University of Debrecen. For nomenclature, we followed Nagy (2003). We used life form types and faunal types according to Rácz (1998).

For the characterisation and comparison of assemblages two types of Whittaker's index (S/α and its variant S/α_{max}, where S is the total number of species, α is the mean number of species and α_{max} is the maximal number of species per site in a given group of sites) (Whittaker, 1960) and the distribution of faunal types were used. The difference of species numbers and proportion of life forms and faunal types between habitat types were analysed with Mann-Whitney U test.

RESULTS

A total of 1956 specimen belonged to 22 Orthoptera (8 Ensifera, 14 Caelifera) and one Mantodea (*Mantis religiosa*) species were found (Table 1). In addition a larva of *Gryllus campestris* were found by direct search. None of the species are protected and only one rere species was found. The studied assemblages consisted of different Mediterranean (eg. Ponto- and Nord- Mediterranean) and Siberian (Angarian and Siberian-policentric) faunal elements. The relative frequencies of these two major groups did not show significant differences between habitat types (Mann-Whitney U=23.00, n=16, p=0.345). The proportion of Mediterranean element, which are generally characteristic for this part of Hungary was higher in casually mowed sites (Table 2).

No single site or habitat type contained all the recorded species but in the regularly mowed sites only *Tetrix subulata* did not occur. Both Whitakker's indices show that the species composition was more heterogeneous in regularly mowed sites than in casually mowed systems. Total heterogeneity of species composition was larger than that between habitats, indicating a differential distribution of species (Table 3). Only the regularly mowed sites had own characteristic species that occurred more than one site by habitat types. Table 1 shows distribution and constancy of species by habitat types.

Table 1

Distribution and proportion of sites occupied by species in different habitat typesOrthoptera species in different habitat types of the Ormánság (southwest Hungary) in 2004-2005; Numbers of sites occupied by species are in pharenthesis. c: constancy in occupied habitat(s), + additional species found by direct search

	casually mowed grasslands	**regularly mowed grasslands**
Common c≥0.7	*Chorthippus prallelus (16)*, *Chorthippus dorsatus (13)*, *Metrioptera roeselii (12)*, *Euchorthippus declivus (12)*	
Frequent 0.5≤c<0.7	*Pezotettix giornae (9)*, *Chorthippus brunneus (9)*	*Calliptamus italicus (4)*
		Chorthippus mollis (4)
Rare c<0.5	*Leptophyes albovittata (7)*, *Omocestus rufipes (7)*, *Ruspolia nitidula (6)*, *Conocephalus discolour (4)*, *Phaneroptera falcate (3)*, *Metrioptera bicolour (3)*, *Chorthippus biguttulus (3)*	
		Tetrix bipunctata (3)
		Pholidoptera griseoaptera (2)
		Odontopodisma decipiens (2)
		Dociostaurus brevicollis (2)
Scattered (found only in one site by habitat types)	*Tettigonia viridissima (2)*	
	Tetrix subulata (1)	*Mecostethus parapleurus (1)*
+		*Gryllus campestris*
No of species	15	21+1

The intensity of mowing had marginally significant effect on both relative frequencies of chortobiont species and density. The number of collected specimens was higher in casually managed sites (Mann-Whitney U=15.00, n=16, p=0.074). The relative frequencies of chortobionts was lower in regularly mowed habitats (Mann-Whitney U=14.00, n=16, p=0.059).

Table 2

Basic characteristics of Orthoptera-assemblages by intensity of land use and habitat types in the Ormánság region in 2004-2005

	casually mowed	**regularly mowed**	**total**
No of sites	4	4	8
No of samples	8	8	16
Total species (*S*)	15	21	22
Mean species/site (α) (SD)	7.4 (1.3)	8.3 (1.7)	7.8 (1.5)
Whitakker's S/α	2.0	2.6	2.8
S/α_{max}	1.67	1.91	2
No of specimen	1149	807	1956
Mean specimen/site (SD)	143.6 (58.3)	100.9 (44.5)	122.3 (54.8)
Faunal types (RF%)			
Mediterranean	23.8	16.4	20.1
Siberian	76.2	83.6	79.9
Life forms (RF%)			
thamnobionts	2.6	5.1	3.9
chortobionts	94.6	86.1	90.4
geo-chortobionts	2.8	8.8	5.7

DISCUSSIONS

The Orthoptera fauna and assemblages of Ormánság are characterised on the basis of 22 species recorded in2004-2005. In order to study the effects of mowing intensity Orthoptra assemblages of four casually and four regularly mowed sites were compared.

The studied fauna is poor in protected and rare species. The only species that is rare in the Orthoptera fauna of Hungary was *Odontopodisma decipiens* (Rácz, 1998). The strong Mediterranean effect, which is general in southwest Hungary (Praeillyricum) (Varga & Gyulai, 1978, Varga, 2004, Sólymos, 2005) could not be proved. The relative frequency of Mediterranean elements was only 20.1%.

The total species number was higher in regularly mowed grasslands, because of relatively large heterogeneity of sites. The mean species richness did not differ significantly between habitat types, but was highest in regularly managed sites. Intensity of land use had effect on density and distribution of life forms. Regular mowing change vegetation structure and provide suitable conditions for geo-chortobiont species (eg. *Calliptamus italicus*, *Chorthippus mollis*, *Dociostaurus brevicollis*) which are originally prefer sparse vegetation.

Our results show that the regular management can maintain species rich Orthoptera-assemblages while the abandonment and casual use leads to diversity loss. In our case distribution of life forms was more sensitive indicator of changes than number of species. The differences between casually and regularly mowed sites can be partially caused by spatial distribution of studied sites therefore further investigations are necessary to prove our preliminary results.

The study and monitoring of Orthoptera assemblages can help to protect and manage these habitats which is particularly important in case of protected areas.

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REFERENCES

1. Andersen, A. N., Ludwig, J. A., Mowe, L. M. & Rentz, D. C. F., 2001, Grasshopper biodiversity and bioindicators in Australian tropical savannas: Responses to disturbance in Kakadu National Park. - Austral Ecol. 26: 213-222.
2. Bakker, J. P. & Berendse, F., 1999, Constrains in the restoration of ecological diversity in grassland and heathland communities.- Trend in Ecology and Evolution 14(2):63-68.

3. Bock, C. E. & Bock, J. H., 1991, Response of grasshoppers (Orthoptera: Acrididae) to wildfire in a southeastern Arizona grassland. - Am. Midl. Nat. 125: 162-167.
4. Chambers, B. Q. & Samways, M. J., 1998, Grasshopper response to a 40-year experimental burning and mowing regime, with recommendations for invertebrate conservation management. - Biodivers. Conserv. 7: 985-1012.
5. Gebeyehu, S. & Samways, M. J., 2002, Responses of grasshopper assemblages to long-term grazing management in semi-arid African Savannah. - Agric., Ecosyst. Environ. 95: 613-622.
6. Harz, K., 1957, Die Geradflügler Mitteleuropas. - Veb Gustav Fischer Verlag, Jena. 494 pp.
7. Harz, K., 1969, Die Orthopteren Europas / The Orthoptera of Europe (Vol I.). - Dr. W. Junk N. V., The Hague. 749 pp.
8. Harz, K., 1975, Die Orthopteren Europas / The Orthoptera of Europe (Vol II.). - Dr. W. Junk B. V., The Hague. 939 pp.
9. Nagy, B., 2003, A revised check-list of Orthoptera-species of Hungary supplemented by Hungarian names of grasshopper species. - Folia Entomol. Hung. 64: 85-94.
10. Rácz, I. A., 1998, Biogeographical survey of the Orthoptera Fauna in Central Part of the Carpathian Basin (Hungary): Fauna types and community types. - Articulata 13(1): 53-69.
11. Sólymos, P., 2005, Természetvédelmi prioritások meghatározása Magyarország puhatestűinek elterjedési adatai alapján (Mollusca, Gastropoda) /Conservation prioritization based on distribution of land snails in Hungary (Mollusca, Gastropoda). - PhD thesis, Debreceni Egyetem Természettudományi Kar, Debrecen. 120 pp.
12. Varga, Z., 2004, Populációk és Gének vándorúton. - Mindentudás egyeteme http://www.mindentudas.hu/varga/20040216varga.html, Accessed 2006. 14/11.
13. Varga, Z & Gyulai, I., 1978, Die Faunelemente-Einteilung der Noctuiden Ungarns und die Verteilung der Faunelemente in den Localfaunen. - Acta. Biol. Debrecina 15: 257-295.
14. Whittaker, R. H., 1960, Vegetation of the Siskiyou Mountains, Oregon California - Ecological Monographs 30(3):279-338.