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TISZABERCEL BIOMONITORING PILOT PROJECT — QUANTITATIVE ORTHOPTEROLOGICAL RESEARCH

I. A. Rácz

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Abstract. Our results prove, that grasslands in different succession state or influenced by human activities, on the flooded area were suitable as sampling sites. In contrary to the disturbances, we found a fairly rich (25 % of the Hungarian fauna) and diverse orthoptera community on the area. In the fresh, very humid grasslands the ratio of the predator Tettigonoida is high, in which the definitely thamnobiont-hygrophilous species are characteristic (*Conocephalus, Ruspolia*). Also the species of the characteristic chortobiont Acridoidea of these associations (*Chrysochraon*, *Parapleurus* and *Mecosthetus*) are strongly hygrophilous. With the decreasing humidity, and as the grassland structure becomes simpler, these species disappear, and those Acridoidea become dominant, which need at least seasonal hygrophilous environment at the early stage of their onthogenesis. On the other hand, it is very typical the significant difference between the Orthoptera fauna of the less and the highly disturbed grasslands. The heavily grazed or intensively cultivated grassland's Orthoptera species composition is quite poor, or can be characterized by one or two ubiquist species. This fact also call our attention to that the strong disturbance can extremely change the composition of the Orthoptera fauna.
Thus, this insect group is highly important not only from the point of view of fauna- and florahistory, but community- and productionbiology, that is indirectly economic and conservational point of view as well. Regarding the bioindicator value of this group, we can conclude, that using either the theory of physiological tolerance, or the theory of community answer as a starting point they are suitable for indication. Since, if we study the qualitative changes of the species composition, or the distribution of the high diversity frequency, we can point out the significant changes of features of the given area.

Keywords: diversity, monitoring, orthoptera, perturbancy, quantitative analysis.

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Introduction

The monitoring project is dealing with a comparative study of grasslands of different associations, conditions and cultivation on the inundation area of both sides of Tisza river, and aims to answer the questions related to the conservation (treatment) management and the use of these areas.

Material and methods

The sampling sites located both on the inundation area (5 samples: 1, 2, 3, 4, and 8) and on the protected side (6 samples: 5, 6, and 7, 9, 10, 11) in grasslands of different associations and conditions (Table 1).

Table 1. Sampling sites of inundation area and protected side

Inundation area	Protected side	Inundation area	Protected side
1. Diófa-lapos (Gávavencsellõ)	5a. Lenc (Gávavencsellõ)	7. Remete-zug (Gávavencsellõ)	8. Görbe-tó (Balsa)
2. Mocsolya (Gávavencsellõ)	5b. Lenc (Gávavencsellõ)		9. Görbe-tó (Gávavencsellõ)
3. Lomos (Gávavencsellõ)	6. Gyuj-tava (Gávavencsellõ)		10. Pók-tava (Tiszabercel)
4. János-tó (Gávavencsellõ)			11. Füzes-ér (Tiszabercel)

Table 2. List of species

Taxon	Geographical range	Faunal type	Life forms	Relative ab.	Cat.
Ordo: Ensifera (Grylloptera)					
Phaneroptera falcata (Poda 1761)	Eu-Si	Si-Pc	Th	0.252	IV
Leptophyes albovittata (Kollar 1833)	Eu	Po-Med	Th	0.188	III
Conocephalus discolor Thunberg 1815	Eu-Si	Si-Pc	Th	0.335	IV
Conocephalus dorsalis (Latreille 1804)	Eu-W-As	Po-Ca	Th	0.111	II
Ruspolia nitidula (Scopoli 1786)	Af-Eu-Si	Af	Th	0.095	II
Tettigonia viridissima Linne 1758	Eu-Si	Si-Pc	Th	0.169	III
Decticus verrucivorus Linne 1785	Eu-Si	An	Ch-Th	0.21	III
Platycleis affinis Fieber 1853	SE-Eu	Po-Ca	Th	0.143	III
Bicolorana bicolor (Philippi 1830)	Eu-Si	An	Ch	0.159	III
Roeseliana roeselii (Hagenbach 1822)	Eu	Po-Ca	Ch	0.22	III
Gryllus campestris Linne 1758	Af-Eu-W-As	Af	Fi	0.124	II
Ordo: Caelifera (Orthoptera s.str.)					
Calliptamus italicus (Linne 1758)	Eu-Si	An	Geo-Ch	0.178	III
Mecosthetus grossus (Linne 1758)	Eu-Si	Ma	Ch	0.191	III
Parapleurus alliaceus (Germar 1817)	Eu-Si	Ma	Ch	0.099	II
Chrysochraon dispar (Germar 1834)	Eu-Si	An	Ch	0.105	II
Euthystria brachyptera (Ocskay 1826)	Eu-Si	An	Ch	0.121	II
Stenobothrus crassipes (Charpentier 1825)	E-Eu	Po-Med	Ch	0.201	III
Omocestus ventralis (Zetterstedt 1821)	Eu-Si	An	Ch	0.313	IV
Omocestus haemorrhoidalis (Charpentier 1825)	Eu-Si	An	Ch	0.293	IV
Glyptobothrus biguttulus (Linne 1758)	Eu	Po-Ca	Ch	0.434	IV
Glyptobothrus brunneus (Thunberg 1815)	Eu-Si	An	Ch	0.523	V
Glyptobothrus mollis (Charpentier 1825)	Eu-Si	An	Ch	0.351	IV
Chorthippus alobomarginatus (DeGeer 1773)	Eu-Si	Si-Pc	Ch	0.306	IV
Chorthippus dorsatus (Zetterstedt 1821)	Eu-Si	Si-Pc	Ch	0.46	IV
Chorthippus parallelus Zetterstedt 1821	Eu-Si	An	Ch	0.399	IV
Euchorthippus declivus (Brisout 1848)	S-Eu	N-Med-Pc	Geo-Ch	0.402	IV
Dociostaurus brevicollis (Eversmann 1848)	Eu-Am	Po-Ca-Tur	Geo-Ch	0.162	III
Tetrix subulata (Linne 1758)	Ho	Eu-Pc	Ch	0.188	III
Tetratetrix bipunctata (Linne 1758)	Pa	Si-Pc	Ch	0.102	II

Af = African (Ethiopian)	Geo = Geobiont	W = West		
Am = Asia minor	Il = Illyrian			
An = Angarian	Ir = Iranian			
As = Asian	Ho = Holarctic			
Ba = Balcanic	M = Mountain			
C = Central	Ma = Manchurian			
Ca = Caspian	Med = Mediterranean			
Car = Carpathian	Moe = Moesian			
Ch = Chortobiont	N = North			
Cos = Cosmpolitan	Pa = Palaearctic			
Da = Dacian	Pan = Pannonian			
E = East	Pc = Policentric			
Eu = European	Po = Pontic	Relative abund.	Categories	
Fi= Fissurobiont	S = South	0.0625	I	rare
Da = Dacian	Si = Siberian	0.0626 - 0.1250	II	scattered
E = East	Th = Thamnobiont	0.1251 - 0.2500	III	low frequent
Eu = European	Tu = Turanian	0.2501 - 0.5000	IV	frequent
Fi= Fissurobiont	Tur = Turcesthanian	0.5001	V	common

Sampling were done by using standardized grassnetting method, which is common at comparative studies, and by thinning collection. To the quantitative analysis we applied cluster analysis on dominance-similarity, principal component analysis and non-metric multidimensional scaling, to describe the diversity we used diversity-ordering method (NUCOSA 1.05.06, Tóthmérész 1993). For the further proof of these results we have taken into account the given species association lifeform' and fauna-element type' distribution as well (Rácz 1998) (Table 2).

Results

From the 12 sampling sites 1610 individuals of 30 species have been collected (Table 3).

The main-component analysis (Fig.1) call our attention to the arrangability of samples, but the scattering of samples also suggest the possibility of arrangement from various standpoints.

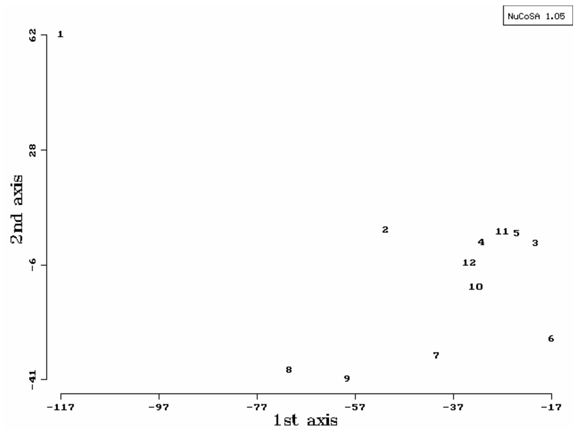

Fig. 1. Principal component analysis of sampling sites.

The results of the cluster analysis, which depends on the perturbance, are the followings (Fig.2):

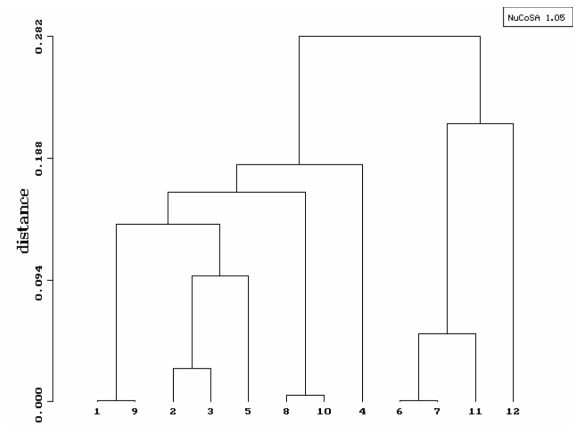

Fig. 2. Cluster analysis of sampling sites.

The first main group is highly heterogeneous. The common characteristic of the sampling sites belonging here is the strong perturbancy, which is caused by flooding in habitats on the inundation side (1, 2, 3, 4, 8), while on the protected side by the heavy grazing (9, 10) or extended crop cultivation and artificial fertilization (5). The second main group - sampling sites: 6, 7, 11, 12 - consists of only sites from the protected side, which were previously used for grazing, except No. 6. However, the regeneration of the sites have already been observed after quitting grazing.

The fact that the second main group consists of sites from the protected side, let us think that there should be a difference between the sites from the inundation are and the protected side. Using the non-metric scaling method, this difference can be shown (Fig.3), since the sampling sites from the inundation area (1, 2, 3, 4, and 8) forms a group, and the sites from the protected side (5, 6, 7, 9, 10, 11) forms an other distinct one.

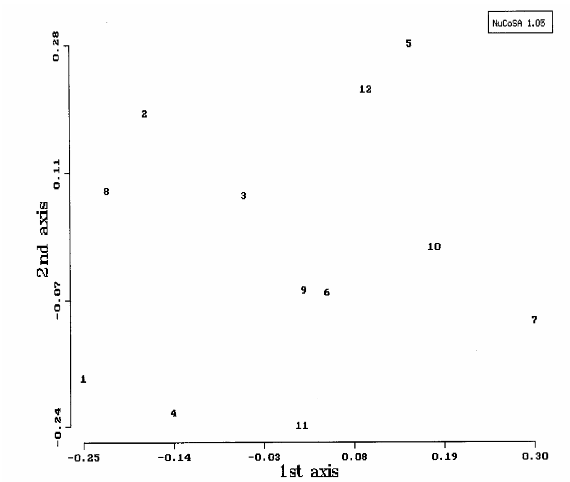

Fig. 3. Non-metric multidimensional scaling of sampling sites.

The diversity of the sampling sites from the inundation area (Fig.4) decreases from No. 8 towards No. 2, 4, and 3, while the site No. 1 cannot compare to any of them. The decreasing diversity well indicates the growing perturbancy. In case of the protected side we may conclude the same (Fig.5), since we found decreasing diversity to the direction of 9, 7, 12, 11, or 9, 6, 12, 11. The sample No. 10 and 5 can only be interpreted between themselves.

Discussion

From our results we can conclude, that there are no — in some ways — undisturbed grasslands can be found on the whole area. The sampling sites were influenced either by the flood, or were at a different stage of succession, or disturbed by human activities. In contrary to this, we found a relatively rich (25 % of the Hungarian orthoptera fauna) and diverse orthoptera community on the area (Table 2).

Table 3. Species of sampling sites

Species \ Sites	1	2	3	4	5a	5b	6	7	8	9	10	11
Phaneroptera falcata	0	2	0	0	0	4	6	7	3	0	0	0
Leptophyes albovittata	0	5	0	0	3	5	0	7	6	2	0	0
Conocephalus discolor	0	7	0	0	0	6	16	14	0	0	0	0
Conocephalus dorsalis	0	2	0	0	0	15	13	10	0	0	0	0
Ruspolia nitidula	0	2	0	0	0	2	1	3	0	0	0	0
Tettigonia viridissima	0	0	0	0	0	3	0	7	0	0	0	0
Decticus verrucivorus	0	0	0	0	0	2	0	6	0	0	0	0
Platycleis affinis	0	0	0	0	0	5	0	0	8	3	0	0
Bicolorana bicolor	5	0	0	0	0	0	6	4	0	0	0	0
Roeseliana roeselii	4	12	0	0	1	3	9	15	0	0	0	0
Gryllus campestris	6	3	0	6	6	0	4	5	8	3	5	5
Calliptamus italicus	0	0	0	0	0	0	0	0	31	25	0	0
Oedaleus decorus	0	0	0	0	0	0	0	0	4	0	0	0
Mecosthetus grossus	0	0	0	0	0	7	0	0	0	0	0	0
Parapleurus alliaceus	0	0	0	0	0	32	0	27	0	0	0	0
Chrysochraon dispar	8	7	0	0	0	7	1	16	0	0	0	0
Euthystria brachyptera	45	0	0	0	0	0	0	0	0	0	0	0
Stenobothrus crassipes	0	0	0	0	0	0	0	0	29	0	0	0
Omocestus ventralis	15	17	2	0	0	0	10	6	11	8	0	8
Omocestus haemorrhoidalis	0	0	0	0	0	0	0	0	4	0	0	0
Glyptobothrus biguttulus	13	0	14	14	16	0	7	9	12	11	0	12
Glyptobothrus brunneus	11	14	0	8	11	0	9	10	12	11	14	14
Glyptobothrus mollis	0	0	0	0	0	0	0	0	2	0	0	0
Chorthippus alobomarginatus	7	0	0	0	10	0	3	7	5	0	0	0
Chorthippus dorsatus	121	43	16	25	19	0	12	37	25	18	24	22
Chorthippus parallelus	13	19	11	16	7	25	48	61	55	22	11	22
Euchorthippus declivus	0	0	0	0	0	0	0	0	14	0	0	0
Dociostaurus brevicollis	0	0	0	0	0	0	0	0	16	9	0	0
Tetrix subulata	5	6	0	0	3	0	6	0	0	0	0	0
Tetratetrix bipunctata	0	5	0	0	0	0	2	6	5	0	0	0
	253	144	43	69	76	116	153	257	250	112	54	83

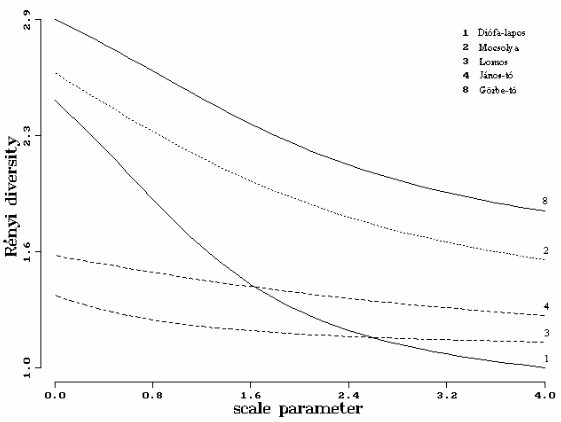

Fig. 4. Diversity ordering of sampling sites of the inundation area.

In the fresh, very humid grasslands the ratio of the predator Tettigonoida is high, in which the definitely thamnobiont-hygrophilous species are characteristic (*Conocephalus dorsalis*, *Ruspolia nitidula*). Also the species of the characteristic chortobiont Acridoidea of these associations (*Chrysochraon dispar*, *Parapleurus alliaceus* and *Mecosthetus grossus*) are strongly hygrophilous. From this point of view, hardly any difference can be found among the sites from the inundated side and the less disturbed protected sites. With the decreasing humidity, and as the grassland structure becomes simpler, these species disappear, and those Acridoidea become dominant, which need at least seasonal hygrophilous environment at the early stage of their onthogenesis. On the other hand, the significant difference is very typical between the Orthoptera fauna of the less and the highly disturbed grasslands. The heavily grazed or intensively cultivated grassland's Orthoptera species composition is quite poor, or can be characterized by one or two ubiquist species. This fact also call our attention to that the strong disturbance can extremely change the composition of the Orthoptera fauna (Rácz and Varga 1996).

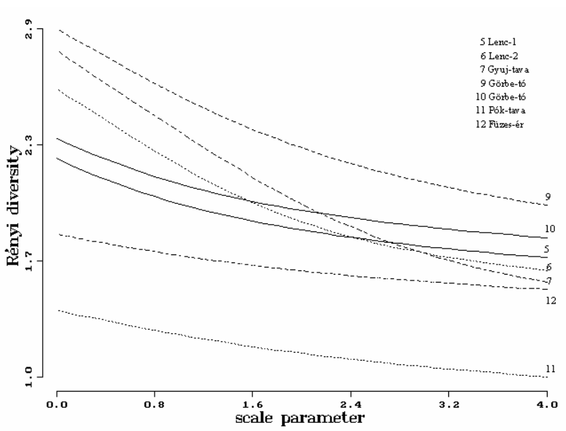

Fig. 5. Diversity ordering of sampling sites of the protected side.

Thus, this insect group is highly important not only from the point of view of fauna- and florahistory, but community- and productionbiology, that is indirectly economic and conservational point of view as well. Regarding the bioindicator value of this group, we can conclude, that using either the theory of physiological tolerance, or the theory of community answer as a starting point they are suitable for indication (Dorda 1998). Since, if we study the qualitative changes of the species composition, or the distribution of the high diversity frequency, we can point out the significant changes of features of the given area.

References

Dorda, D. (1998): Heuschreckenzönosen als Bioindikatoren auf Sand- und submediterranen Kalkmagerrasen des saarländisch-lotharingischen Schichtstufenlandes. — Abh. DELATTINA *23*, 5-368.

Rácz I. and Varga Z. (1996): Life-form spectra of Orthoptera and bio-indication in grassland — Symp. „Research, Conservation, Management", Aggtelek-Jósvafõ, May 1-5. 1996.

Rácz I. (1998): Biogeographical survey of the Orthoptera Fauna in Central Part of the Carpathian Basin (Hungary): Fauna types and community types. — Articulata *13*, 53-69.

Tóthmérész B. (1993): NuCoSA 1.05: Number Cruncher for Community Studies and other Ecological Application. — Abstr.Bot. *17*, 283-187.