

Auchenorrhyncha communities of sandy and limestone grasslands of the Czeszochowa upland (southern Poland)

Dariusz SWIERCZEWSKI¹, Waclaw WOJCIECHOWSKI²

¹Department of Ecology and Nature Conservation, Jan Dlugosz University, Czeszochowa, Poland

²Department of Zoology, University of Silesia, Katowice, Poland

Abstract

The study describes Auchenorrhyncha communities of limestone and sandy grasslands in the area of the Czeszochowa upland in southern Poland. Each leafhopper community is characterized due to the dominance structure, fidelity and ecological parameters (moisture, insolation, host plant specialization and voltinism). Moreover, both Cluster and DCA analyses support the presence of two groups of insect communities associated with the plant assemblages of different types of soil substrate.

Key words: Auchenorrhyncha, grasslands, Poland.

Introduction

Auchenorrhyncha, known as leafhoppers, are a group (ecological guild) of insect herbivores which feed on plant sap and the contents of mesophyll cells. According to Nickel and Hildebrandt (2003), they form an important component of the phytophagous fauna of temperate grasslands and are a useful tool to monitor the biotic conditions of these habitats because: i) the numerous species occur in high population densities, ii) being primary consumers they interact with both plants and predators, iii) they show specific life strategies and occupy specific spatial and temporal niches, iv) they respond rapidly to the management regime and v) whole assemblages can be described quickly by sampling several times a year.

The study covered two ecosystems – steppe-like grasslands on limestone hills and grasslands on sandy soils in depressions. Both are thought to be rare and endangered in Poland. Steppe-like limestone grasslands occur in the Jurassic limestone area stretching from Krakow to Czeszochowa (Wyzyna Krakowsko-Czeszochowska) and known as the Polish Jura. They belong to the xerothermic *Festuco-Brometea* class of plant assemblages associated with highly warm and dry places under more continental climatic conditions. Sandy (psammophilous) grasslands of the *Koelerio glaucae-Corynephoretea canescentis* class represent pioneer plant assemblages on inland, oligotrophic and acidic sands. They are seminatural secondary communities that form parts of the pine forest succession.

Studies covering the leafhoppers of similar grassland habitats in central Europe have been done in Germany (Schiemenz, 1969; Witsack, 1997; 1999), Poland (Gebicki, 1987; Szwedko, 1998), Slovakia (Musil, 1958) and Hungary (Gyorffy, 1982).

Materials and methods

The research was carried out in the northern part of the Czeszochowa Upland (southern Poland), near the vil-

lages of Olsztyn and Mstow. Eleven plots were chosen for examination. Five plots represented sandy grassland assemblages - *Spergulo vernalis-Corynephorum* (sites 1, 2) and *Diantho-Armerietum elongatae* (3-5). The other six plots were classified as limestone grassland assemblages: *Festucetum pallentis* (6, 7), *Sileno-Phleum* (8, 9) and *Adonido-Brachypodietum pinnati* (10, 11). Quantitative studies lasted over a 3-year period (2001-2003) with a similar annual schedule - insects were collected at regular intervals from the beginning of May till October, generally every fortnight, by use of a standard circular sweep-net (30 cm in diameter). A transect across the site was taken and invertebrates were sampled at four equidistant points with 100 sweeps in total. Additionally, to determine the food plants of some leafhopper species a supplementary survey was made in the years 2004-2006.

To describe the structure of leafhoppers communities the following indices were calculated: dominance, frequency, fidelity and Shannon-Weaver species diversity. Moreover, the similarity between communities inhabiting the same plant assemblage was estimated using Cluster and DCA analyses. The ecological classification of species was based on Czechowski and Mikolajczyk (1991). The criteria of zoogeographic classification follow Nickel and Remane (2002).

Results and discussion

Of the 113 species recorded, 102 are typical grassland species. The other 11 taxa represent polyphagous or oligophagous species feeding on woody shrubs and trees. Of the 102 grassland species, 72 feed almost exclusively on monocotyledonous plants - grasses and sedges. The other 30 species feed on dicotyledonous forbs, utilizing mainly Asteraceae and Lamiaceae. The number of recorded species per site varied from 35 for *Spergulo vernalis-Corynephorum* (site 2) and *Adonido-Brachypodietum pinnati* (site 10) to 53 for *Diantho-Armerietum elongatae* (site 4).

The Auchenorrhyncha dominance structure was quite

stable over the three year period, however minor variations were observed mainly due to the differences in weather conditions. The dominant leafhoppers of each community were as follows: of *Spergulo vernalis-Corynephorum* grassland - *Neophilaenus minor* Kirschbaum, *Doratura exilis* Horváth and *Psammotetix excisus* Matsumura; of *Diantho-Armerietum elongatae - Chlorita paolii* Ossiannilsson, *Neoliturus fenestratus* Herrich-Schäffer and *Turrutus socialis* Flor; of *Festucetum pallentis - Erythria aureola* Fallén and *Emelyanoviana mollicula* Boheman; of *Sileno-Phleetum - Acanthodelphax spinosa* Fieber (site 8), *Arocephalus languidus* Flor (site 9) and *T. socialis*; of *Adonido-Brachypodietum pinnati - Adarrus multinotatus* Boheman. The leafhopper community of *Corynephorus canescens* grassland was previously described in Poland by Szwedo (1998) and Germany by Schiemenz (1969) and Witsack (1997). *P. excisus* had the status of being dominant in all three surveys, however the dominance of *N. minor* was only supported in the work of the second author. Regarding the limestone grasslands, an Auchenorrhyncha community similar to that associated with *Festucetum pallentis* on the Czestochowa upland was demonstrated by Witsack (1999). Two of the dominants, *E. aureola* and *E. mollicula*, are in common, but not *Kelisia haupti* Wagner which co-dominated with the latter two species in eastern Germany. Schiemenz (1969) in his extensive work on leafhopper fauna of dry grassland habitats in eastern Germany also reported the community associated with *Brachypodium pinnatum* grassland. Comparing his results with those from this study, it is notable that *A. multinotatus* was the dominant species for this type of grassland in Germany together with *Mocystia crocea* Herrich-Schäffer, although the latter was not recorded in Poland.

The fidelity of all dominant species exceeded 51%, suggesting that they can also be treated as characteristic species for particular leafhopper communities. Differences between the insects guilds thus distinguished were supported by the results of Cluster and DCA analyses. From these it is clear that the community of *Sileno-Phleetum* shares characters of the fauna of both sandy and limestone grasslands. This corresponds with the botanical composition of the plant assemblage which includes species typical of both types of substrate.

The aim of the ecological analysis was to characterize the particular Auchenorrhyncha communities in relation to such factors as moisture, insolation, host plant specialization and voltinism. The xerophilous element was the most abundant in the leafhopper community inhabiting sandy grassland *Spergulo vernalis-Corynephorum* (73.08%) and rocky limestone grassland *Festucetum pallentis* (61.09%). The highest ratio of monophagous species was recorded for the leafhopper community associated with *Spergulo vernalis-Corynephorum* (46.15%), which reflects the simple structure of this plant assemblage, dominated by *Corynephorus canescens*. Additionally, in all the leafhopper communities distinguished, bivoltine species (65.22-74.19%) and forms hibernating as eggs (60.87-71.43%) were the

most abundant. Regarding the chorology of the particular taxa, species with a wide distribution, i.e. Eurosiberian, European and Transpalaeartic formed the most numerous groups.

This study has provided some valuable information on the state of endangered grassland habitats in Poland and we hope that future data will enable us to support the view of leafhoppers as sensitive indicators of environmental changes.

References

- CZECHOWSKI W., MIKOLAJCZYK W., 1981.- Methods for the study of urban fauna.- *Memorabilia Zoologica*, 34: 49-58.
- GEBICKI C., 1987.- Leafhopper associations (Homoptera, Auchenorrhyncha) in xerothermic communities in the vicinity of Pinczow.- *Acta Biologica. Prace Naukowe Uniwersytetu Slaskiego*, 6: 87-98.
- GYORFFY Gy., 1982.- Auchenorrhyncha of a sandy soil mosaic-grassland: Quantitative relations, bionomic and ecological valence data.- *Folia entomologica hungarica*, 53: 43-54.
- MUSIL M., 1958.- Prispěvek k poznání cikadofauny Slovenska. I. Cikadofauna stepních biotopu.- *Biologia*, 13: 419-427.
- NICKEL H., HILDEBRANDT J., 2003.- Auchenorrhyncha communities as indicators of disturbance in grasslands (Insecta, Hemiptera) – a case study from the Elbe flood plains (northern Germany).- *Agriculture, Ecosystems and Environment*, 98: 47-52.
- NICKEL H., REMANE R., 2002.- Artenliste der Zikaden Deutschlands, mit Angabe von Nahrungspflanzen, Nahrungsbreite, Lebenszyklus, Areal und Gefährdung (Hemiptera, Fulgoro-morpha et Cicadomorpha).- *Beitrage zur Zikadenkunde*, 5: 27-64.
- SCHIEMENZ H., 1969.- Die Zikadenfauna mitteleuropäischer Trockenrasen (Homoptera, Auchenorrhyncha). Untersuchungen zu ihrer Phanologie, Ökologie, Bionomie und Chorologie.- *Entomologische Abhandlungen. Staatliches Museum für Tierkunde in Dresden*, 36: 201-280.
- SZWEDO J., 1998.- Leafhopper communities (Homoptera, Auchenorrhyncha) of psammophilous swards in sand-pit excavations, pp. 35-36. In: *Proceedings of the VIth European Congress of Entomology* (BRUNNHOFER V., SOLDAN T., Eds).- Ceske Budejovice, Czech Republic, 23-29 August 1997.
- WITSACK W., 1997.- Zur Zikadenfauna (Hemiptera, Auchenorrhyncha) ausgewählter Sandtrockenrasen und Zwergstrauchheiden im Elb-Havel-Winkel (Sachsen-Anhalt).- *Untere Havel – Naturkundliche Berichte*, 6/7: 95-101.
- WITSACK W., 1999.- Faunistisch-okologische Untersuchungen an Zikaden an ausgewählten Trockenstandorten in Sachsen-Anhalt. Teil 1: Trockenstandorten im „Unstrut-Triasland“ (Hemiptera: Auchenorrhyncha).- *Reichenbachia*, 33: 197-206.

Authors' addresses: Dariusz SWIERCZEWSKI (corresponding author: dswier@ajd.czest.pl), Department of Ecology and Nature Conservation, Jan Długosz University, Armii Krajowej 13/15, 42-201 Czeszochowa, Poland; Waclaw WOJCIECHOWSKI, Department of Zoology, University of Silesia, Bankowa 9, 40-007 Katowice, Poland.