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Chrysomelid communities (Chrysomelidae, Coleoptera) of xerothermic grasslands (*Inuletum ensifoliae*) in the Wyżyna Miechowska Uplands (Central Poland)

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Abstract: The species composition, abundance and dominance structure of chrysomelids were characterized in xerothermic grasslands in southern Poland (Wyżyna Miechowska Uplands). During a two-year study, a total of 54 species was recorded; the mean value of the abundance index was 9.3, *Longitarsus obliteratus* and *Derocrepis rufipes* being eudominants. The species composition and quantitative structure of the community were similar (S = 80.0%, Re = 70.5%) but diversity, evenness and dominance indices of the community changed slightly although the abundance dynamics of the beetles varied significantly in the study years.

Key words: Coleoptera, Chrysomelidae, communities, xerothermic grasslands, Poland.

Introduction

Communities of xerothermic grasslands belong to the floristically and faunistically richest biocoenoses in Poland. They are the only refuges of very rare plant and animal species representing the southern and south-eastern geographical element. Under the climatic conditions in Poland, most xerothermic communities are of a seminatural character, and their formation and survival are closely associated with regular grazing, mowing or burning. If such communities are left unmanaged, the proportion of tall plants, mainly grasses, increases rapidly, and grasslands near forests become overgrown with shrubs and trees. These processes may lead to a local extinction of xerothermic species within a few decades (Dzwonko & Loster, 1998).

In Poland, such communities are found mainly in the Wyżyna Małopolska Uplands and the Wyżyna Lubelska Uplands and in the river valleys of the Lower Vistula and the Lower Oder (Medwecka-Kornaś & Kornaś, 1977). Ten plant communities have been recorded here (Matuszkiewicz, 2001).

The *Inuletum ensifoliae* community forms floristically very rich, fairly low flowery grasslands consisting of highly calciphilous and xerothermic species (Matuszkiewicz, 2001). In Poland, it occurs mainly in the western part of the Wyżyna Małopolska Uplands, on shallow rendzina formed from chalky marls.

The Wyżyna Miechowska Uplands is the westernmost part of the Wyżyna Małopolska Uplands (the geobotanical division places it in the Miechowsko-Sandomierska Province, the Miechowsko-Pińczowski District). Its chalky limestone elevations are relatively low (300–350 m a.s.l.) and characterized by wide, gentle slopes. Particular chains are separated by vast valleys and the entire area becomes gradually lower and lower eastwards. Annual precipitation is relatively high (700–800 mm on average), but distributed unevenly due to the sculpture of the surface configuration. This is one of the factors, in addition to the substratum, exposure and inclination of the hill sides, which allow the occurrence of a relatively rich fauna and flora associated with arid and warm areas (Petryszak, 1991).

A large group (ca. 35% of species) of phytophagous beetles of the Chrysomelidae family occurring in Poland is associated with communities of thermophilous grassland vegetation (Warchałowski, 1985). The species composition of the chrysomelids there has been studied very well, but less attention has been paid to the knowledge of quantitative ratios (Szymczakowski, 1960, 1965, 1973; Bartkowska, 1989, 1994; Wąsowska, 1994). The interdependence between the composition of the fauna and the plant community has also been little studied.

The aim of this study is to characterize the chrysomelid community (species composition, abundance, dominance structure) in the *Inuletum ensifoliae* community, one of the floristically richest communities of xerothermic grasslands in Poland, and to compare it with the fauna of other sites of xerothermic vegetation in the country.

Study area

The "Biała Góra" steppe–forest reserve situated near Tunel, a site ca. 40 km north of Kraków (19°59′ E, 50°27′ N), occupies the southern, south-western and western slopes of Mt. Piaskowiec (414 m a.s.l.). The sides of 15–20° inclination are overgrown with xerothermic grassland which, in the upper parts, gradually gives way to thermophilous brushwood and then to high *Tilio-Carpinetum* forest

The herbaceous community is dominated by *Inula ensifolia* L. Also abundant are the following species: *Briza media* L., *Thesium linophyllon* L., *Asperula odorata* L., *Prunella grandiflora* Jacq., *Carex humilis* Lyess., *Festuca pallens* Host., *Galium vernum* Scop., *Brachypodium pinnatum* (L.) P.B., *Filipendula hexapetala* Gilib., *Melampyrum arvense* L. and *Centaurea scabiosa* L. At the study site there are also single low trees and shrubs: *Juniperus communis* L., *Carpinus betulus* L., *Betula verrucosa* Ehrh., *Quercus robur* L., *Pinus sylvestris* L., *Crataegus monogyna* Jacq., *Cornus sanguinea* L., *Prunus spinosa* L. and *Rosa* sp. More detailed data on the site is given in PETRYSZAK (1991).

Material and methods

The results discussed in the present paper come from two study years (1983 and 1984). Beetles were collected in an entomological sweep net – this method is the best in quantitative studies of beetles living on the aboveground parts of plants (WITKOWSKI, 1969). The material was collected from April to October (PETRYSZAK, 1991). Samples were collected on average every fortnight (the timing largely depended on the weather). Thirteen samples were collected in 1983 and eleven in 1984 (500 sweeps of the net made one sample).

The chrysomelid material, the basis for the present paper, comprised 1,111 imagines. The abundance of particular species and of entire communities was expressed by means of an index representing the number of individuals per 100 sweeps of the net (relative abundance).

In order to determine the dominance structure of the chrysomelid species the following scale (TISCHLER, 1949; BALOGH, 1958) was adopted:

eudominant (> 10% of all individuals), dominant (5.1–10.0%), subdominant (2.1–5.0%), recedent (1.1–2.0%), subrecedent ($\leq$ 1.0%).

Sørensen's index (*S*) was used to determine the similarity of the species composition of the chrysomelid communities. The quantitative structure of the communities was expressed by Renkonen's index (*Re*) (BALOGH, 1958).

Shannon's index of total species diversity (*H*), Pielou's index of evenness (*E*) and Simpson's index of dominance (*D*) were used as alpha-diversity indices (KREBS, 1997). The trophic groups were established according to BROWN (1985). Four basic groups were distinguished: S_1 – monophages, S_2 – narrow oligophages, S_3 – wider oligophages, and G – polyphages (S – specialist, G – generalist).

Results

Species composition

A total of 54 chrysomelid species was collected from the community studied (Tab. 1). In the first study year, the community included 48 species, in the second 42 species. The species composition in both years was very similar (S = 80.0%). The estimate of the similarity of the chrysomelids collected at the same site in the two years was considered the stability measure of the group of species studied. The very high value of the index indicates a stable group of species adapted to the habitat (WITKOWSKI, 1975).

Of the species collected in 1983, twelve were not recorded in 1984. The majority were tiny species of flea beetles (Alticinae), mostly of the genus *Longitarsus* Berthold, 1827, and tortoise beetles (*Cassida* L., 1758). Of the six species found only in the second study year, three – *Smaragdina salicina*, *Cryptocephalus violaceus* and *Aphthona cyanella* – are considered to be xerothermophilous species. Most species recorded only in one study year were collected as single individuals, generally at the beginning (May) or at the end (September–October) of the growing season. This was probably due to the fact that during these periods the habitat was more intensively penetrated by insects, looking mainly for food and for sites to overwinter.

A considerable number of the species recorded exhibit characteristic of inhabitants of xerothermic grasslands, e.g., *Smaragdina salicina, Cheilotoma musciformis, Coptocephala rubicunda, Cryptocephalus violaceus, Gonioctena fornicata, Aphthona atrovirens, A. cyanella, A. herbigrada, A. ovata, A. pygmaea, A. venustula, Longitarsus exsoletus, L. obliteratus, Derocrepis rufipes, Dibolia cryptocephala* and *D. schillingi.* Of these the species *Cheilotoma musciformis, Gonioctena fornicata, Aphthona atrovirens, A. cyanella, A. herbigrada* and *A. ovata* merit special attention and are rarely found in Poland; they were recorded from few sites in the south of the country.

The vast majority of species were trophically associated with herbaceous plants, but the imagines of several species (e.g., *Smaragdina salicina*, *Cryptocephalus violaceus*, *C. bipunctatus* and *C. labiatus*) were also found on trees or shrubs (oaks – *Quercus* sp., alders – *Alnus* sp., birches – *Betula* sp., roses – *Rosa* sp., hawthorns – *Crataegus* sp. and others) (WARCHAŁOWSKI, 1991).

The species number of chrysomelid beetles collected in particular months was different in the two study seasons (Fig. 1). In the first year, two clear maxima – spring (May–June) and late summer (August–September) – and a distinct minimum in July were observed. In the following year, at the beginning of the study (April), the number was much lower, then (until July) it gradually increased, but in August it clearly decreased. Another increase was noticed in September,

Table 1. Survey of chysomelid species in the xerothermic grassland in Wyżyna Miechowska upland.

No	Species	Trophic group	Month	1983		1984	
				n	%	*n*	%
1	*Oulema duftschmidi* (Redtenbacher, 1874)	S_3	7/8–10	0.031	0.28	0.055	0.75
2	*Oulema gallaeciana* (Heyden, 1870)	S_3	4–10	0.308	2.81	0.527	7.27
3	*Oulema melanopus* (L., 1758)	S_3	8–9	0.015	0.14	0.036	0.50
	Oulema sp.			0.031	0.28		
4	*Smaragdina salicina* (Scopoli, 1763)	?	5/6			0.055	0.75
5	*Cheilotoma musciformis* (Goeze, 1777)	S_1	6	0.139	1.26	0.036	0.50
6	*Coptocephala rubicunda* (Laicharting, 1781)	S_3	8	0.031	0.28	0.036	0.50
7	*Cryptocephalus aureolus* Suffrian, 1847	G	6,8	0.015	0.14	0.018	0.25
8	*Cryptocephalus bipunctatus* (L., 1758)	G	5–7	0.077	0.70	0.091	1.25
9	*Cryptocephalus hypochoeridis* (L., 1758)	G	6			0.036	0.50
10	*Cryptocephalus labiatus* (L., 1761)	G	7/8	0.015	0.14	0.018	0.25
11	*Cryptocephalus moraei* (L., 1758)	S_2	6,7	0.031	0.28	0.091	1.25
12	*Cryptocephalus sericeus* (L., 1758)	S_3	6–9	0.200	1.83	0.109	1.50
13	*Cryptocephalus violaceus* Laicharting, 1781	G	6			0.018	0.25
14	*Leptinotarsa decemlineata* (Say, 1824)	S_1	9/10	0.015	0.14	0.018	0.25
15	*Gastrophysa polygoni* (L., 1758)	S_3	5	0.015	0.14		
16	*Gonioctena fornicata* (Brüggemann, 1873)	S_3	5,7–9	0.092	0.84	0.055	0.75
17	*Galeruca tanaceti* (L., 1758)	G	6, 9	0.046	0.42	0.036	0.50
18	*Phyllotreta atra* (F., 1775)	G	10			0.073	1.00
19	*Phyllotreta nemorum* (L., 1758)	S_3	5	0.108	0.98		
20	*Phyllotreta nigripes* (F., 1775)	S_3	4, 9–10	0.031	0.28	0.364	5.01
21	*Phyllotreta undulata* (Kutschera, 1860)	S_3	4–6, 8–9	0.062	0.56	0.036	0.50
	Phyllotreta sp.			0.015	0.14		
22	*Aphthona atrovirens* (Förster, 1849)	S_1	4–6, 8–9	0.446	4.07	0.291	4.01
23	*Aphthona cyanella* (Redtenbacher, 1849)	S_2	9			0.055	0.75
24	*Aphthona euphorbiae* (Schrank, 1781)	S_3	5, 6	0.154	1.41	0.036	0.50
25	*Aphthona herbigrada* (Curtis, 1837)	S_3	9/10	0.031	0.28	0.182	2.51
26	*Aphthona ovata* Foudras, 1861	S_2	5, 9	0.062	0.56	0.036	0.50
27	*Aphthona pygmaea* (Kuschera, 1861)	S_2	5–10	0.231	2.11	0.327	4.51
28	*Aphthona venustula* (Kuschera, 1861)	S_2	4–6, 8, 9	0.846	7.72	0.527	7.27
29	*Longitarsus atricillus* (L., 1761)	G	4	0.015	0.14		
30	*Longitarsus exsoletus* (L., 1758)	S_3	6–8	0.062	0.56	0.036	0.50
31	*Longitarsus ferrugineus* (Foudras, 1860)	S_2	8	0.015	0.14		
32	*Longitarsus kutscherai* (Rye, 1872)	S_3	5	0.031	0.28		
33	*Longitarsus luridus* (Scopoli, 1763)	S_3	4, 5, 8–9	1.246	11.38	0.327	4.51
34	*Longitarsus melanocephalus* (De Geer, 1775)	S_2	8	0.015	0.14		
35	*Longitarsus obliteratus* (Rosenhauer, 1847)	S_3	5–10	2.323	21.21	2.036	28.07
36	*Longitarsus pulmonariae* Weise, 1893	S_3	7/8	0.031	0.28	0.018	0.25
37	*Longitarsus succineus* (Foudras, 1860)	S_3	7/8, 9/10	0.062	0.42	0.073	1.00
38	*Longitarsus suturellus* (Duftschmid, 1825)	S_3	4, 9	0.031	0.28		
39	*Altica oleracea* (L., 1758)	S_3	5, 7–9	0.139	1.26	0.127	1.75
40	*Derocrepis rufipes* (L., 1758)	S_3	4–6	2.400	21.91	0.818	11.28
41	*Chaetocnema aridula* (Gyllenhal, 1827)	S_3	9	0.015	0.14		
42	*Chaetocnema concinna* (Marsham, 1802)	G	4–6, 8, 9	0.185	1.69	0.018	0.25
43	*Chaetocnema hortensis* (Geoffroy, 1785)	S_3	5, 8–10	0.246	2.25	0.073	1.00
44	*Chaetocnema laevicollis* (Thomson, 1866)		6–10	0.339	3.09	0.018	0.25
	Chaetocnema sp.			0.015	0.14		
45	*Dibolia cryptocephala* (Koch, 1803)	S_1	4–10	0.169	1.55	0.127	1.75
46	*Dibolia schillingi* (Letzner, 1847)	S_2	4–7, 9	0.185	1.69	0.236	3.26
47	*Psylliodes affinis* (Paykull, 1799)		4–6, 9	0.046	0.42	0.055	0.75
48	*Hispa atra* L., 1767	S_3	5–9	0.277	2.53	0.091	1.25
49	*Cassida hemisphaerica* Herbst, 1799	S_3	9	0.015	0.14		
50	*Cassida rubiginosa* Müller, 1776	S_3	5	0.015	0.14		
51	*Cassida sanguinolenta* Müller, 1776	S_3	9			0.018	0.25
52	*Cassida vibex* L., 1767	S_3	8, 9	0.015	0.14	0.018	0.25
53	*Cassida viridis* L., 1758	S_3	5	0.015	0.14		
54	*Cassida vittata* Villers, 1789	S_3	5	0.015	0.14		
	Total			10.951	99.99	7.251	99.95

Key: Month – month of occurrence; *n* – abundance index; % – proportion; S_1–S_3 – specialists; G – generalists.

and it reached a much higher level than in the same period of the previous year.

The development course of the majority of chrysomelids is unknown or known only partially, therefore the results can be explained only generally. In spring, adults of the species overwintering as adults appear first (often in March), adults of the species that overwintered as preimaginal stages appear a little later (from the beginning of May). Species of the former group (e.g., *Derocrepis rufipes*) oviposit during April and May, then their numbers gradually fall and in the second half of June they occur only rarely. Much more numerous is the group of species overwintering as preimaginal stages. The intensity of their occurrence is the greatest in May and June (WARCHAŁOWSKI, 1971), however, this seems to relate to the species overwintering in pupal stage. Some species, adults of which are collected much later – in August, and even in September (e.g., *Coptocephala rubicunda, Longitarsus rubiginosus, L. obliteratus*), probably overwinter in larval stage (or even as an egg) and their growth takes place (and is completed) in the following year, after the growing season starts. The weather conditions in a given year (also in winter) could modify the life cycle to some extent.

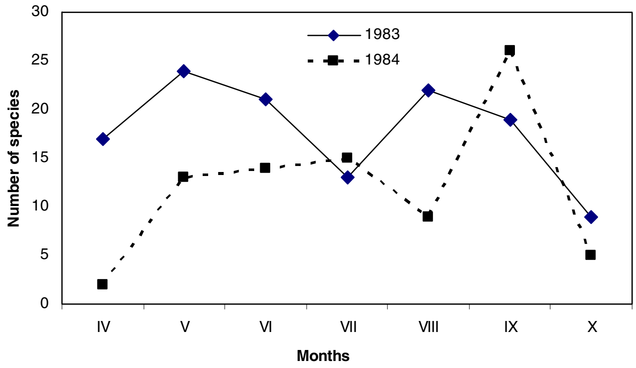

Fig. 1. Number of chrysomelid species in the *Inuletum ensifoliae* xerothermic grassland in consecutive months of growing seasons in 1983 and 1984.

Abundance

The abundance of the community was high – 9.28 individuals per 100 sweeps (10.95 in 1983 and 7.25 in 1984).

There were great differences in the course of the seasonal changes in the abundance of chrysomelids in the two study years (Fig. 2). In 1983, by the start of the study (end of April), abundance was very high and in mid-May it increased further. Then it gradually decreased, reaching a minimum at the beginning of July. However, by the second half of July another abundance increase was recorded, and this continued throughout August. After a rapid decrease at the beginning of September, due to poor weather conditions (PETRYSZAK, 1988), the abundance of chrysomelids increased quickly and reached spring level. In October, it was considerably lower.

In 1984, the abundance of beetles at the beginning of the growing season was much lower than in the previous year (Fig. 2). A relatively slight increase ("spring peak") was recorded in the second half of May and after that abundance decreased, reaching a minimum in the first half of July (as in the previous year). At the end of the month, abundance increased again, but it did not reach (in August) the same level as in the previous year, so the decrease at the beginning of September was quite marked. The autumn maximum (in the second half of September) was very high, much higher than that in spring and in the same period in the previous year.

Following the changes in the abundance of particular species in consecutive months, it was discov-

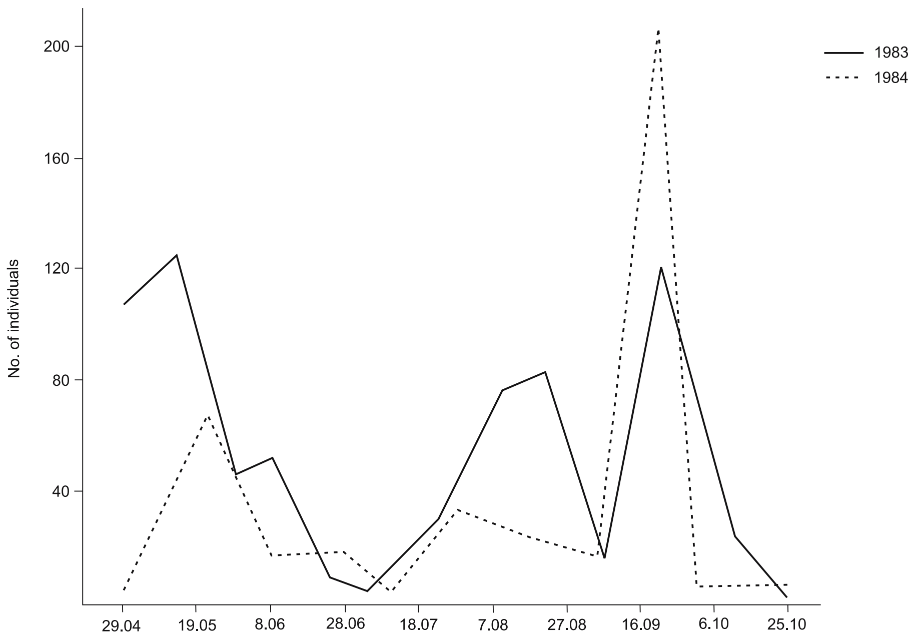

Fig. 2. Seasonal abundance dynamics of chrysomelids in the *Inuletum ensifoliae* xerothermic grassland in 1983 and 1984. X-axis – date from the beginning to the end of sampling season.

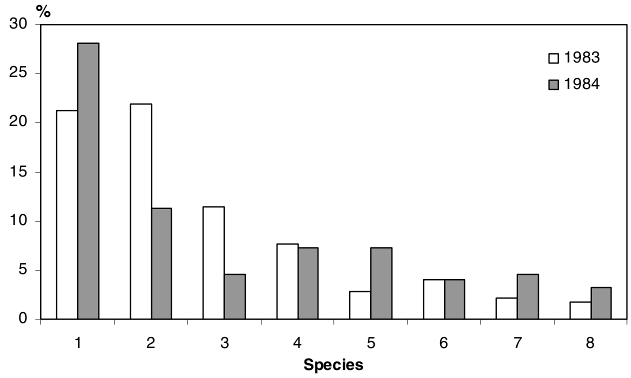

Fig. 3. Dominance structure of the chrysomelid community in the *Inuletum ensifoliae* xerothermic grassland (species with share over 2.1% included): 1 – *Longitarsus obliteratus*, 2 – *Derocrepis rufipes*, 3 – *Longitarsus luridus*, 4 – *Aphthona venustula*, 5 – *Oulema gallaeciana*, 6 – *Aphthona atrovirens*, 7 – *A. pygmaea*, 8 – *Dibolia schillingi.*

ered that some species were collected during the entire growing season, generally in small numbers of individuals, while others were found mostly in particular months, but in large numbers. The spring maximum abundance, occurring in April/May in 1983 and in May in 1984, was mainly due to individuals of *Derocrepis rufipes* and *Aphthona venustula*. Most of the species recorded in summer were not typical of the plant community, but there also were a few characteristic of the habitat. The former included, e.g., pollen-feeding *Cryptocephalus* spp. (occurring only at this time of the year), or eurytopic *Oulema gallaeciana*, the latter *Dibolia cryptocephala* and *Aphthona pygmaea*. All these species were recorded in small numbers of individuals. The autumn maximum (falling generally in September) was created mainly by *Longitarsus obliteratus* and *L. luridus*, by *Aphthona atrovirens* and also by *Chaetocnema hortensis, Ch. laevicollis* (in 1983), *Aphthona herbigrada* and *Phyllotreta nigripes* (in 1984).

Dominance structure

Changes in the species composition and abundance of the communities in both study years were reflected in the dominance structure (Fig. 3). Despite differences in the seasonal dynamics of the abundance of particular species (Tab. 2) the dominance structure of the community was relatively stable and the dominance similarity of the community in the two years (expressed by Renkonen's number) was 70.50%.

The most abundant species in the community (eudominants) were: *Longitarsus obliteratus* (average 23.67%; 21.21% and 28.07% in 1983 and 1984, respectively) and *Derocrepis rufipes* (18.09%; 21.91% and 11.28%). *Longitarsus luridus* (8.91%; 11.38% and 4.51%) and *Aphthona venustula* (7.56%; 7.72% and 7.27%) were dominants, *Oulema gallaeciana* (4.41%; 2.81% and 7.27%) and *Aphthona atrovirens* (4.05%; 4.07% and 4.01%) were subdominants.

Adults of the above-mentioned species were collected, generally, only during part of the growing season – *Derocrepis rufipes* and *Aphthona venustula* in spring (not later than the end of June), *Aphthona atrovirens, Longitarsus obliteratus* and *Longitarsus luridus* – in late summer (August and September).

Table 2. Number of individuals of chrysomelid species in successive months of the growing seasons in 1983 and 1984 (species with share of over 1.0% included).

Month	IV		V		VI		VII		VIII		IX		X	
Species	‘83	‘84	‘83	‘84	‘83	‘84	‘83	‘84	‘83	‘84	‘83	‘84	‘83	‘84
Derocrepis rufipes	68	3	81	27	7	15								
Aphthona venustula	14		38	25	2	3			1			1		
Aphthona euphorbiae	3		7	1		1								
Cheilotoma musciformis					9	2								
Cryptocephalus sericeus			3		7	2	3	1		2		1		
Hispa atra			1		8	2		2	5		4	1		
Cryptocephalus moraei					1	2	1	3						
Cryptocephalus bipunctatus			2		3	3	2							
Dibolia schillingi	1	1	2	3	3		5	6			1	3		
Aphthona pygmaea	4		2	1	1		4	9		1	3	7	1	
Chaetocnema concinna	1		3	1	1				4		3			
Dibolia cryptocephala	2		2	2	2	1	1	2	2		1	2	1	
Altica oleracea	1		3		4		1	1		1		3		2
Oulema gallaeciana	1		2		3	1	10	3	3	12	1	6		7
Chaetocnema laevicollis					1		1	1	13		6		1	
Chaetocnema hortensis				1					2		10	1	4	
Aphthona atrovirens	3		2		1				19		4	16		
Longitarsus luridus	1		3	1			1		38	2	40	15	8	
Longitarsus obliteratus	2		1		5		6	1	68		57	111	12	
Phyllotreta nigripes	1											17	1	3
Aphthona herbigrada											2	9		1

Table 3. Number of species, number of individuals and indices of alpha-diversity of the chrysomelid communities in Wyżyna Miechowska Uplands.

Community of	Number of species	Number of individuals	Shannon's index (H)	Pielou's index (E)	Simpson's index (D)
1983	48	712	2.687	0.694	0.889
1984	42	399	2.810	0.752	0.881

The diversity indices used (Tab. 3) indicate that species diversity and especially the structure of the community studied were relatively stable and, in the two study years, underwent only slight changes.

Discussion

In Poland, studies on xerothermophilous beetles have been carried out since the beginning of the 1950s, by Szymczakowski (1960, 1965, 1973), mainly in the Wyżyna Małopolska Uplands. The author observed a regional differentiation in the species composition of these insects and believed that one of the factors responsible for this was the type of substratum. The greatest number of conspicuously xerothermic species and common and abundant occurrence of some of them were recorded by the cited author in gypseous hills in the lower Nida River. On chalky hills in the Wyżyna Miechowska Uplands there were fewer markedly thermophilous species and many of them (e.g., *Gonioctena fornicata*) occurred there far less abundantly.

Szymczakowski (1960) noted that not all beetles recorded from the habitat under discussion were associated with it to the same degree. Most species from xerothermic areas also occur in other biotopes (such as meadows, waste lands, balks, roadsides). Some of them (e.g., *Cryptocephalus moraei*, species of the genus *Phyllotreta*, *Longitarsus succinneus*) occur in that biocoenosis in great abundance and undoubtedly play an important role there. A trait characteristic of the fauna there is due to stenotopic species for which the habitats under discussion provide optimum conditions (in Poland). According to the author, in the Wyżyna Małopolska Uplands these species included the following: *Cheilotoma musciformis, Coptocephala rubicunda, Gonioctena fornicata, Longitarsus obliteratus, Dibolia schillingi* and *D. cryptocephala* (these were also collected in the reserve studied). The third group of beetles occurring in xerothermic biotopes consists of alien species that appear there accidentally while entering from nearby areas. Xerothermic grassland may occasionally be a wintering site for beetles from nearby fields or meadows although, generally, beetles from xerothermic grasslands migrate to adjoining forest edges.

In the reserve studied, the third group of species (alien, occasional species) was very small. Migrations between the xerothermic grassland and the *Tilio-Carpinetum* forest (growing on the top of the hill) in the reserve seem to be small scale. In the two habitats, there were 20 shared species (35 species were collected in the linden-oak-hornbeam forest; Wąsowska, 1996) but the similarity of species composition of the beetles was not high ($S = 44.06\%$ in 1983 and 28.13% in 1984). A significant proportion of the shared species was represented by a few (1–4) individuals and the quantitative similarity of the communities (expressed by Renkonen's index) was very small ($Re = 11.94\%$ and 15.97% in 1983 and 1984, respectively).

In Poland, studies on chrysomelids conducted in xerothermic grasslands are, as a rule, of a decisive faunistic character, and their objective is to investigate new stenotopic species, unique to this habitat. The most complete data, comprising a complete list of species and quantitative data, come from studies on the fauna of the Góry Świętokrzyskie Mts and of Roztocze (Bartkowska, 1989, 1994; Wąsowska, 1994). Xerothermic grasslands belong to habitats rich with respect to the number of chrysomelid species – in these habitats in Roztocze, 132 species (over 60% of all Chrysomelidae collected in this region of Poland) were recorded, and 34 of these exclusively in this biotope (Wąsowska, 1994), in the Góry Świętokrzyskie Mts, 138 species (over 66% of the chrysomelids of this region), 48 species exclusively there (Bartkowska, 1989). These studies covered sites of different phytosociological status – some sites comprised fragments of secondary grasslands (mesoxerothermic) or saxatile ones, or thermophilous brushwood. The floristic diversity of the sites (and of their vicinity) undoubtedly influenced the species composition of chrysomelids. In the Góry Świętokrzyskie Mts, at a site partly overgrown with thermophilous brushwood, Bartkowska (1989) collected many species feeding on the leaves of trees and shrubs, such as *Cryptocephalus coryli* (L., 1758), *C. nitidulus* F., 1787, *C. nitidus* (L., 1758), *C. ocellatus* Drapiez, 1819, *Chrysomela populi* L., 1758, *Phratora tibialis* (Suffrian, 1851), *Galerucella lineola* (F., 1781), *Agelastica alni* (L., 1758), *Crepidodera aurata* (Marsham, 1802) and *C. fulvicornis* (F., 1792).

Sixty four species of Chrysomelidae were collected (during a five-year study) in the *Inuletum ensifoliae* community in the Góry Świętokrzyskie Mts (C Poland) (Bartkowska, 1989). The most abundant (the paper gives no detailed quantitative data) were *Cryptocephalus fulvus* (Goeze, 1777), *Phyllotreta atra, P. nemorum, P. vittula* (Redtenbacher, 1849), *Aphthona czwalinai* Weise, 1888, *A. herbigrada, Longitarsus exsoletus, L. luridus, L. nasturtii* (F., 1792), *L. parvulus* (Paykull, 1799), *L. salviae* Gruev, 1975, *L. succineus, Altica pusilla* (Duftschmid, 1825), *Asiorestia ferrug-*

inea (Scopoli, 1763)*, Chaetocnema concinna, Dibolia schillingi* and *Psylliodes cucullatus* (Illiger, 1807) (several tens of individuals of each species). Less numerous (over a dozen to a few tens of individuals) were: *Coptocephala rubicunda, Phyllotreta undulata, P. vittata* (F., 1801)*, Longitarsus melanocephalus, Altica oleracea* and *Chaetocnema hortensis*. The majority of the species mentioned were also commonly found in other habitats. In the community of the reserve studied in the Wyżyna Miechowska Uplands the only species equally abundant were *Longitarsus luridus, Dibolia schillingi, Chaetocnema hortensis, C. concinna* and *Aphthona herbigrada*. The other species were less abundant or never collected. Sixty four chrysomelid species were collected (in 3 years) in the *Inuletum ensifoliae* community in Roztocze (SE Poland) (Wąsowska, 1994); 30 of these were also recorded from the reserve in the Wyżyna Miechowska Uplands. There, the most abundant species were *Derocrepis rufipes* and *Phyllotreta atra* as well as *Longitarsus luridus, L. obliteratus, L. rubiginosus* (Foudras, 1860)*, L. noricus* Leonardi, 1976 and *Phyllotreta vittula*. Thus, the quantitative ratios were similar to those in the community of the reserve in the Wyżyna Miechowska Uplands (however, *L. rubiginosus* was not found there, and *P. atra* was collected only during one study year, in October). At the same site in Roztocze, Bartkowska (1994) recorded 35 chrysomelid species, 18 of which were also recorded from the reserve in the Wyżyna Miechowska Uplands. The following species were reported by the cited author as those collected most numerously (estimated data): *Cryptocephalus moraei, Chrysolina varians* (Schaller, 1783)*, Longitarsus luridus, L. succineus* and *Derocrepis rufipes* (several tens of individuals) and *Aphthona cyparissiae* (Koch, 1803)*, Asiorestia ferruginea* and *Dibolia schillingi* (over a dozen to a few tens of individuals).

Studies conducted in the community of xerothermic grasslands (*Inuletum ensifoliae*) in Poland show that chrysomelids are represented there mainly by tiny species of flea beetles (subfamily Alticinae), which occur very abundantly – comprising more than half of the species composition in the community of the reserve studied. A lot of them are eurytopic species also occurring commonly in other habitats. However, most of them could be recognized as characteristic of the biotope discussed, e.g., those mentioned by Szymczakowski (1960–1973): *Dibolia schillingi, D. cryptocephala, Longitarsus obliteratus* and *Aphthona herbigrada*. The group of stenotopic species should also include *Aphthona atrovirens, A. cyanella, A. ovata, A. pygmaea, A. venustula* and *Longitarsus pulmonariae*. The biology of these species (and of many others) is poorly known, yet in Poland they occurred in the southern part of the country, mainly in xerothermic habitats. It seems that *Derocrepis rufipes* should also be recognized as a species characteristic of the habitat; it is distributed much more widely, but is always found there and very numerously in spring. In Poland, some of these species are recorded exclusively (or mainly) from xerothermic sites and are considered characteristic (exclusive or selective) of this biotope. Other thermo- or xerophilous (stenotopic) species of the subfamilies Clytrinae, Cryptocephalinae and Chrysomelinae, in Poland are also recorded exclusively from such biotopes and are considerably less abundant. Adults of these species (that provide the basis for most studies) feed in the upper layers of vegetation (shrubs), and out of the breeding season they do not occur commonly. In order to find to what extent the above species are associated with the plant community studied it is necessary to carry out further studies in xerothermic communities, bearing in mind their phytosociological status.

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