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GROUND BEETLES (COLEOPTERA: CARABIDAE) OF WHEAT AGROCENOSIS IN LATVIA

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Abstract. Species composition and zoogeographical peculiarities of ground beetles were studied in agrocenosis of a wheat field in the Jēkabpils district, Dignāja parish (eastern Latvia). A total of 8,683 specimens of carabids representing 41 species and 14 genera were recorded. *Poecilus cupreus* L. (36.08%), *P. versicolor* Strum. (23.93%) and *Harpalus rufipes* Deg. (18.27%) were eudominants. The group of dominants consisted of *Pterostichus melanarius* Ill. (5.81%) and *Carabus cancellatus* Ill. (5.01%). The prevailing forms were open area species (53.66%), mesophilous species (46.34%) and small zoophages (46.34%). Palaearctic species (36.58%) were the dominant zoogeographical element. The trappability peaked in June. Rare carabid species were recorded: *Poecilus punctulatus* Schall. (1 specimen) and *Pterostichus macer* (Marsham, 1802) (1 specimen).
Key words: Coleoptera, Carabidae, agrocenosis, wheat field, fauna, Latvia

Introduction

Ground beetles are one of the fauna components of agrocenosis and play an important role among natural enemies of agricultural pests. Many species of ground beetles are entomophages. Only some phytophages from the genera *Ophonus* Stephens, 1828, *Harpalus* Latreille, 1802 and *Amara* Bonelli, 1810 can damage agricultural cultures.
Fields of cereal crops occupy the most important place among different types of agrocenosis. Only some publications are devoted to studies on the fauna of ground beetles of cereal agrocenosis in Latvia. Ozols (1956) studied wheat pests and the ways to fight them. Skaldere (1981) described the fauna and feeding of ground beetles of barley agrocenosis in the Bauska district (central Latvia). Volkov (1990) studied the structure of the ground beetle complex in the fields of experimental rotation.
Our research will add to the knowledge of the fauna and zoogeographical peculiarities of ground beetles in cereal agrocenoses in Latvia.

Material and methods

Study on carabids was carried out in a wheat field in the Jēkabpils district, Dignāja parish, 3 km NW of Dignāja village (eastern Latvia) from mid-May to mid-September during the period of 2000–2003. The area of the studied agrocenosis was approximately two hectares of clayey-sandy soil bordering with several open habitats (meadow and agrocenosis of potato and strawberry fields).
Material was collected by pitfall traps consisting of glass jars (1 l capacity). The jars were filled with 5% solution of acetic acid and water. The traps were emptied at an interval of 15 days.
The dominance is presented in percentage shares of specimens of a given species in a community. The following dominance classification was applied (Górny & Grüm 1981): eudominants (>10% of all community specimens), dominants (5.1–10%), subdominants (2.1–5%), recedents (1.1–2%) and subrecedents (<1.1%).
The following publications (Barševskis 2003; Lindroth 1992a, b; Koch 1989; Kryzhanovskiy 1983; Turin 2000) were used for ecological characteristics of carabid beetles species. Classification was made: by habitat preference (the following groups were defined: open area species – Oa, forest species – F, species inhabiting open areas and woodlands – OaF, riparian species – Rp); by trophism and body size (LZ – large zoophages, with body mass >100 mg; SZ – small zoophages, with body mass <100 mg; HZ – hemizoophages, feeding on both animal and mixed diets); by humidity requirements (xerophilous species – X, mesophilous species – M, hygrophilous species – H).
Species were classified as particular zoogeographical elements: Holarctic (H), Palaearctic (P), West Palaearctic (WP), Euro-Siberian (ESib) and European (E) on the basis of Barševskis (2003) and Turin (2000).
Systematics was based on Barševskis (2003).

The material is stored in the collection of the Institute of Systematic Biology, Daugavpils University (DUBC).

Results and discussion

As a result of the study on ground beetles of agrocenosis of a wheat field in the Jēkabpils district, a total of 8,683 individuals representing 41 species and 14 genera were caught (Table 1). Tamutis *et al*. (2004) reported 53 species of carabids for ecological and conventional winter wheat fields in Lithuania. In other types of agrocenosis, the number of the recorded species slightly differs: sugar beet – 38 species (Huruk 2005), barley – 41 (Skaldere 1981), potato – 44 (Cinītis 1962), cereal crops – 48 (Ozols 1956), mixed cultures – 64 (Bukejs 2005), cabbage – 68 (Cinītis 1975). Species composition and the number of ground beetles in different agrocenoses differ and depend on edaphic factors, the cultures grown and the neighbouring habitats.

The genera *Amara* Bon. (9 species), *Harpalus* Latr. (6 species) and *Calathus* Bon. (5 species) are presented in more detail below. The representatives of these genera mostly live in open habitats, therefore they prevail in the carabid fauna of agrocenosis.

Poecilus cupreus L. (36.08%), *P. versicolor* Strum. (23.93%) and *Harpalus rufipes* Deg. (18.27%) were eudominant species. *Pterostichus melanarius* Ill. (5.81%) and *Carabus cancellatus* Ill. (5.01%) entered the group of dominants. Many authors consider these species to be dominants in different agrocenoses and other open habitats (Bukejs 2005, in press; Cinītis 1975; Huruk 2002a, b, 2005; Kolesnikov & Sumarokov 1993; Skaldere 1981; Soboleva-Dokuchaeva 1995; Tamutis *et al*. 2004).

Subdominants were represented by 1 species, recedents – 1 species and subrecedents – 34 species (Table 2).

Table 1. List and ecological characteristics of ground beetles species of wheat agrocenosis: n – number of specimens, % – percentage share in community, d – domination (ED – eudominant, D – dominant, SD – subdominant, R – recedent, SR – subrecedent), Hab. – habitat preferences (Oa – open area, OaF – open area and forest, F – forest, Rp – riparian), Hum. – humidity requirements (X – xerophilous, M – mesophilous, H – hygrophilous), Troph. – trophism and body size (LZ – large zoophages, SZ – small zoophages, HZ – hemizoophages), Zoog. – zoogeographical characteristics (H – Holartic, P – Palaeartic, WP – West Palaearctic, ESib – Euro-Siberian, E – European).

N	Species	n	%	d	Hab.	Hum.	Troph.	Zoog.
1	*Cicindela campestris* Linnaeus, 1758	3	0.03	SR	OaF	X	LZ	WP
2	*Carabus granulatus* Linnaeus, 1758	2	0.02	SR	OaF	H	LZ	P
3	*Carabus cancellatus* Illiger, 1798	435	5.01	D	OaF	M	LZ	P
4	*Carabus hortensis* Linnaeus, 1758	2	0.02	SR	F	M	LZ	E
5	*Clivina fossor* (Linnaeus, 1758)	33	0.38	SR	Oa	H	SZ	P
6	*Broscus cephalotes* (Linnaeus, 1758)	41	0.48	SR	Oa	X	LZ	ESib
7	*Blemus discus* (Fabricius, 1792)	4	0.05	SR	OaF	H	SZ	P
8	*Trechus quadristriatus* (Schrank, 1781)	3	0.03	SR	OaF	M	SZ	WP
9	*Bembidion properans* (Stephens, 1828)	78	0.90	SR	Oa	H	SZ	Hol
10	*Bembidion ruficolle* (Panzer, 1796)	1	0.01	SR	Rp	H	SZ	ESib
11	*Bembidion quadrimaculatum* (Linnaeus, 1761)	2	0.02	SR	Oa	M	SZ	H
12	*Anchomenus dorsalis* (Pontoppidan, 1763)	349	4.02	SD	OaF	M	SZ	P
13	*Agonum muelleri* (Herbst, 1784)	136	1.57	R	OaF	H	SZ	WP
14	*Calathus fuscipes* (Goeze, 1777)	22	0.26	SR	Oa	M	SZ	WP
15	*Calathus erratus* (C. R.Sahlberg, 1827)	39	0.45	SR	Oa	X	SZ	WP
16	*Calathus ambiguus* (Paykull, 1790)	38	0.44	SR	Oa	M	SZ	WP
17	*Calathus micropterus* (Duftschmid, 1812)	2	0.02	SR	F	M	SZ	P
18	*Calathus melanocephalus* (Linnaeus, 1758)	11	0.13	SR	OaF	M	SZ	WP
19	*Poecilus lepidus* (Leske, 1785)	1	0.01	SR	OaF	X	SZ	ESib
20	*Poecilus versicolor* (Sturm, 1824)	2,078	23.93	ED	Oa	M	SZ	P
21	*Poecilus cupreus* (Linnaeus, 1758)	3,133	36.08	ED	Oa	M	SZ	WP
22	*Poecilus punctulatus* (Schaller, 1783)	1	0.01	SR	Oa	X	SZ	WP

N	Species	n	%	d	Hab.	Hum.	Troph.	Zoog.
23	*Pterostichus melanarius* (Illiger, 1798)	504	5.81	D	OaF	H	LZ	ESib
24	*Pterostichus macer* (Marsham, 1802)	1	0.01	SR	Oa	M	SZ	WP
25	*Pterostichus niger* (Schaller, 1783)	2	0.02	SR	F	H	LZ	ESib
26	*Pterostichus minor* (Gyllenhal, 1827)	2	0.02	SR	OaF	H	SZ	ESib
27	*Amara aenea* (DeGeer, 1774)	39	0.45	SR	Oa	M	HZ	P
28	*Amara spreta* Dejean, 1831	4	0.05	SR	OaF	M	HZ	ESib
29	*Amara familiaris* (Duftschmid, 1812)	2	0.02	SR	OaF	M	HZ	P
30	*Amara nitida* Sturm, 1825	2	0.02	SR	OaF	M	HZ	ESib
31	*Amara convexior* Stephens, 1828	1	0.01	SR	OaF	M	HZ	ESib
32	*Amara communis* (Panzer, 1797)	1	0.01	SR	Oa	M	HZ	P
33	*Amara ingenua* (Duftschmid, 1812)	2	0.02	SR	Oa	X	HZ	ESib
34	*Amara fulva* (O. F. Müller, 1776)	11	0.13	SR	Oa	X	HZ	ESib
35	*Amara apricaria* (Paykull, 1790)	1	0.01	SR	Oa	M	HZ	P
36	*Harapalus griseus* (Panzer, 1796)	5	0.06	SR	Oa	X	HZ	P
37	*Harpalus rufipes* (DeGeer, 1774)	1,586	18.27	ED	Oa	X	HZ	P
38	*Harpalus affinis* (Schrank, 1781)	81	0.93	SR	Oa	X	HZ	P
39	*Harpalus rubripes* (Duftschmid, 1812)	1	0.01	SR	Oa	X	HZ	P
40	*Harpalus rufipalpis* Sturm, 1818	20	0.23	SR	Oa	X	HZ	WP
41	*Harpalus tardus* (Panzer, 1796)	4	0.05	SR	Oa	X	HZ	ESib
	Total number of specimens	8,683						
	Number of species	41						

Table 2. Ecological characteristics of the carabid community of a wheat field in the Jēkabpils district, Dignāja parish: S – number of species, n – number of specimens, % – percentage share in the community.

Ecological characteristics	Ecological elements	S	%	n	%
Habitat	Open area species	22	53.66	7,217	83.12
	Forest species	3	7.32	6	0.07
	Open area and forest species	15	36.58	1,459	16.80
	Riparian	1	2.44	1	0.01
Humidity requirements	Xerophilous	13	31.71	1,795	20.67
	Mesophilous	19	46.34	6,126	70.55
	Hygrophilous	9	21.95	762	8.78
Trophic type	Large zoophage	7	17.08	989	11.39
	Small zoophage	19	46.34	5,934	68.34
	Hemizoophage	15	36.58	1,760	20.27

Analysis across the living environments showed the predominance of open area species (22 species or 53.66%). The number of individuals belonging to this group was 83.12% of the cumulative community. Species typical for open-forest areas were also numerous and were represented by 15 species (36.58% of all the recorded species) and 1,459 individuals (16.80%). The shares of forest and riparian species were smaller (Table 3). The absence or presence of such species and the number of individuals in agrocenosis depend on neighbouring habitats. In our case, this was clearly seen when only open habitats constituted the neighbouring environment.

Considering humidity requirements, mesophilous species definitely prevailed accounting for 19 species (46.34%) or 70.55% of the total number of the captured carabids in the community (Tables 1, 2).

With aspect to trophic type and body size, the domi-

Table 3. Shares of zoogeographical elements in the carabid community of a wheat field: S – number of species, n – number of specimens, % – percentage share in the community.

Zoogeographical elements	S	%	n	%
Holarctic	2	4.88	79	0.91
Palaearctic	15	36.58	4,619	53.20
West Palaearctic	11	26.83	3,407	39.24
Euro-Siberian	12	29.27	576	6.63
European	1	2.44	2	0.02
Total	41	100.00	8,683	100.00

nant group was that of small zoophages (19 species – 46.34%). Individuals representing these species accounted for 68.34% of the total number of the carabids captured (Tables 1, 2).

The investigated fauna of ground beetles included five zoogeographical elements: Holarctic, Palaearctic, West Palaearctic, Euro-Siberian and European species. The zoogeographical structure of ground beetles in the wheat field was characterised by the predominance of Palaearctic species (15 species). Holarctic and European species were represented very poorly (Tables 1, 3). The individuals of Palaearctic and West Palaearctic complexes were predominants including mass species *P. versicolor* Strum., *P. cupreus* L. and *H. rufipes* Deg. Similar results were obtained during the studies on ground beetles of wheat agrocenoses in Ukraine (Kolesnikov & Sumarokov 1993) and of others agrocenoses in Poland (Huruk 2002a, b) and Russia (Soboleva-Dokuchaeva 1995).

Two peaks of seasonal activity were observed. The first occurred in June and the lower one in August (Fig. 1). Huruk (2002a) reports about such activity in July and August. Skaldere (1981) points out that the peak of activity depends on climate.

Maximum periods also depend on the development type of ground beetles. The peak of seasonal activity in

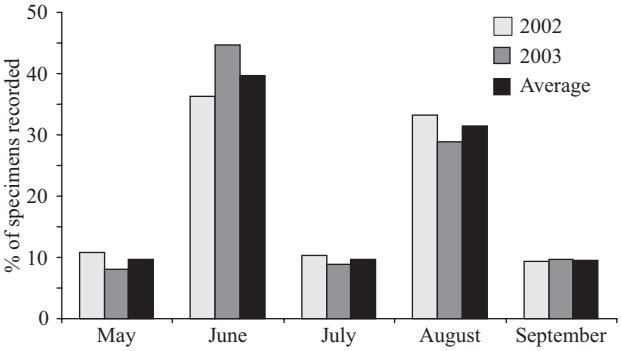

Figure 1. Seasonal dynamics of carabids in wheat agrocenosis in Latvia.

June is connected with 'spring' species such as *Poecilus cupeus* L., *P. versicolor* Strum., etc.

Seasonal dynamics of eudominant and dominant carabid species was similar (Fig. 2).

Two rare carabid species were recorded.

Poecilus punctulatus Schall. (1 specimen), the species very rare in Latvia. Over the last 100 years, this species was recorded in a few localities in the southeastern part of the country. It is eurytopic and xerophilous species, which occur in different dry and open habitats: sandy fields and meadows, heaths, dunes and forest edges with unfrequent vegetation, etc. (Koch 1989).

Pterostichus macer (Marsham, 1802) (1 specimen). In Latvia, this species inhabits dunes, beaches, xeric meadows and fields (Barševskis 2003).

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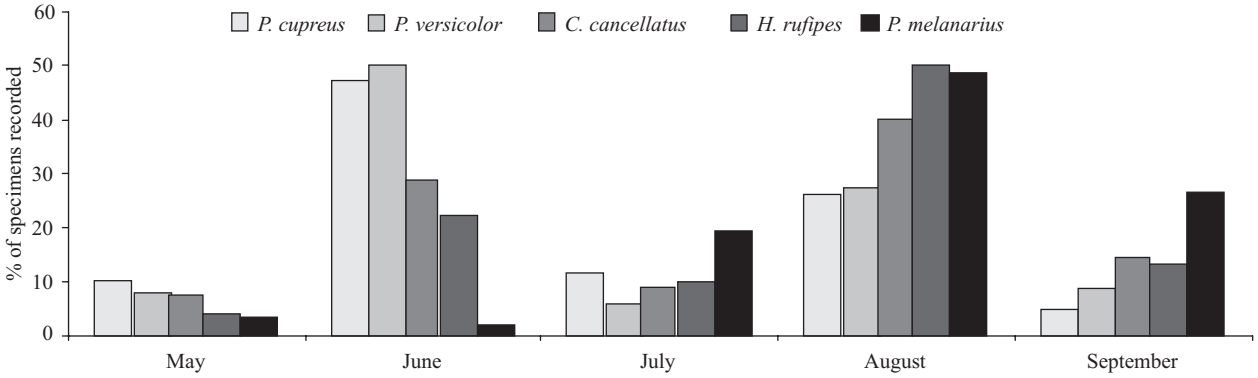

Figure 2. Seasonal dynamics of eudominant and dominant carabid species in wheat agrocenosis during the entire study period.

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Kviečių agrocenozės vabalai-geofilai (Coleoptera: Carabidae) Latvijoje

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Santrauka

Vabalų-geofilų rūšių sudėtis ir zoogeografiniai ypatumai buvo tirti vieno kviečių lauko agrocenozėje Jekabpilio rajone Latvijos rytinėje dalyje. Iš viso buvo užfiksuoti 8683 individai, kurie priklausė 41 rūšiai ir 14 genčių. *Poecilus cupreus* L. (36,08%), *P. versicolor* Strum. (23,93%) ir *Harpalus rufipes* Deg. (18,27%) buvo eudominantai. Dominuojančių rūšių grupę sudarė *Pterostichus melanarius* Ill. (5,81%) ir *Carabus cancellatus* Ill. (5,01%). Atvirų buveinių rūšys sudarė 53,66%, mezofilinės rūšys – 46,34%, smulkieji zoofagai – 46,34%. Palearktinės rūšys sudarė dominuojantį zoogeografinį elementą. Didžiausias sezoninis aktyvumas buvo stebimas birželio mėnesį. Taip pat buvo užregistruoti reti Carabidae šeimos atstovai *Poecilus punctulatus* Schall. (1 individas) ir *Pterostichus macer* (Marsham, 1802) (1 individas).

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