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CARABID BEETLES (COLEOPTERA: CARABIDAE) OF LATVIAN AGROCENOSES: REVIEW

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The species composition and structure of carabid beetles species in different Latvian agrocenoses in the period 1960-2009 were summarized. More than 15 articles and unpublished data on the ground-beetles in Latvian agrocenoses were used. For the first time the full list of carabids species of 15 types of Latvian agrocenoses was prepared. In total, 156 carabids species belonging to 41 genera were reported. The genera *Amara* Bon. (with 32 species), *Bembidion* Latr. (with 21 species) and *Harpalus* Latr. (with 16 species) are most richly presented. In different agrocenoses, 15 species of carabid beetles *Amara fulva* (Müll.), *Bembidion lampros* (Hrbst.), *B. properans* (Steph.), *Blemus discus* (F.), *Broscus cephalotes* (L.), *Calathus erratus* (Sahl.), *C. fuscipes* (Gz.), *Carabus cancellatus* Ill., *Clivina fossor* (L.), *Harpalus rufipes* (Deg.), *Loricera pilicornis* (F.), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.) and *Trechus quadristriatus* (Schrnk.) were eudominants. 40 carabids species are established as typical species of Latvian agrocenoses.

Key words: Coleoptera, Carabidae, agrocenoses, Latvia, review.

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INTRODUCTION

In multifunctional agroecosystems polyphagous arthropod predators such as carabid beetles are of the most numerous entomo- and zoophages. They can feed on phytophagous, saprophagous, small predacious arthropods and on fungi (Kromp 1999). Carabids most active and numerous, and able efficiently reduce populations of some pest mites, pest insects: aphids, thrips, coleopterans, sawflies, cicadas, dipterous, and some arthropods such as springtails and slugs (Kromp 1999; Sunderland 1975). Being wide spectrum predators, carabids can find food when there are no pests in agrobiocenosis. At that time, especially in spring, they feed on phytophagous and saprophagous arthropods.

According to mentioned studies, the carabid beetles are regulating factor of pest population in agrocenoses. It is necessary to know the carabid biodiversity, dominance and the interaction among total agrocenosis components especially in context of indirect plant protection.

Data on ground beetles of Latvian agrocenoses were presented in some articles (Ozols 1956,1973; Cinītis 1962, 1975; Svikle 1970; Skaldere 1981a, 1981b; Volkov 1990; Barševskis 1993; Piedītis 1996; Spuris 1995a, 1995b, 1997; Petrova et al.

2005, 2006; Bukejs 2005, Bukejs, Telnov 2007; Bukejs, Balalaikins 2008; Bukejs in press).

MATERIAL AND METHODS

The species composition and structure of carabid beetles species in different Latvian agrocenoses, generally, in the period 1960-2009 were summarized. The basic knowledge about the species diversity of the Carabidae in Latvian agrocenoses was established principially by works Ozols (1956, 1973) on some cereals, Cinītis (1962) and Svikle (1970) on potatoes, Cinītis (1975) on the cruceferous crops (cabbage, rape, garden radish, horse radish, swedish turnip), Skaldere (1981a, 1981b) on barley and clover, Barševskis (1993) on winter rye and clover. Including published (Volkov 1990) and unpublished data of Volkov and Mihnevitsh on 10 types of agrocenoses (barley, winter rye, winter rape, fodder beet, clover, clover–barley mixture, clover-timothy grass mixture, oats, field pea-oats mixture, potatoes). A part of our study based on carabid species recorded in some agrocenoses by Šmits in 1935-1968 (Spuris 1995 a, 1995b, 1997) and by Priedītis (1996) in orchards. In addition, which are published in this paper, most species of Carabidae were presented from publication the authors and co-authors of the present paper of last years: Petrova et al. (2005, 2006) on strawberry; Bukejs (2005) on sandy agrocenosis with mixed cultures (potatoes, cabbage, oats, winter rye, strawberry); Bukejs & Telnov (2007) on sandy agrocenoses; Bukejs & Balalaikins (2008) on wheat; Bukejs (in press) on potatoes. This study based generally on materials collected by a pit-fall trapping method on almost all agrocenoses. The types of agrocenoses, location of the studied areas, types of soil formation, and the years of the study represented in Table 1.

The dominance classification was determined according to 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%).

Genera and species are listed alphabetically. Nomenclature and synonymy are based on Lorenz (2005).

Table 1. The types of agrocenoses, location of the studied area, types of soil formation and years of the studies

Type of the agrocenosis	Location of studied area	Type of soil formation	The years of the study	Authors
potatoes	Rīga district, Carnikava	sandy and sandy loam	1960-1961	Cinītis (1962)
cruciferous crops (cabbage, rape, horse radish, garden radish, swedish turnip)	Rīga district: Salaspils, Carnikava, Babīte, Ādaži	clay sand sandy sandy sandy and peaty	1967-1968 1966, 1969 1968-1970 1970	Cinītis (1975)
potatoes	Rīga district	sandy and sandy loam	1968-1969	Svikle (1970)
barley, clover	Bauska district	calcareous	1976-1978	Skaldere (1981 a, 1981b)
rye, clover - tymothy grass mixture	Krāslava district	clayey	1984-1987	Barševskis (1993)
potatoes, barley, oats, fodder beet, winter rape, wheat, winter rye, clover, clover-barley mixture, clover-tymothy grass mixture, field pea-oats mixture	Aizkraukle district, Skrīveri	sod-podzolic and sandy loam	1989-1990	Volkov D. and Mihnevitsh O. (unpublished data)
strawberry	Tukums district, Pūre	calceareous podzolic sandy loam on dolomite bedrock	2001-2002	Petrova et al. (2006)
mixed cultures: potatoes, cabbage, rye, oats, strawberry	Daugavpils district, Stropi	sandy	2000-2005	Bukejs (2005)
wheat	Jēkabpils district, Dignāja parish	clayey -sandy	2000-2003	Bukejs & Balalaikins (2008)
potatoes	Jēkabpils district, Salas parish	clayey-sandy	2000-2001	Bukejs (in press)

Table 2. List of ground beetles species of different agrocenoses in Latvia. x – species recorded in agrocenosis

№	Species	sandy agrocenoses with some crops	strawberries	orchards	cruciferous cultures	winter rape	potatoes	wheat	barley	winter rye	oats	pea-oats mixture	clover	clover-timothy grass mixture	clover-barley mixture	fodder beet
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	*Acupalpus exiguus* Dej.															x
2	*A. meridianus* (L.)	x			x				x						x	x
3	*A. parvulus* (Sturm)				x	x	x									x
4	*Agonum duftschmidi* J.Schmidt			x										x		
5	*A. fuliginosum* (Pz.)													x		
6	*A. gracile* (Sturm)									x				x		
7	*A. muelleri* (Hrbst.)			x	x	x	x	x	x	x		x	x	x	x	x
8	*A. sexpunctatum* (L.)	x			x	x	x			x			x	x	x	
9	*A. thoreyi* (Dej.)					x				x	x		x		x	
10	*A. viduum* (Pz.)	x							x	x						x
11	*Amara aenea* (Deg.)	x	x	x	x	x	x	x	x	x			x	x	x	x
12	*A. apricaria (*Pk.)	x		x	x	x	x	x	x	x		x	x			x
13	*A. aulica* (Pz.)	x		x	x	x	x		x	x	x	x	x	x		x
14	*A. bifrons* (Gyll.)	x	x		x	x	x		x	x	x	x	x		x	x
15	*A. brunnea* (Gyll.)			x		x	x					x	x			
16	*A. communis* (Pz.)			x		x	x	x		x		x	x	x	x	
17	*A. consularis* (Duft.)	x	x		x		x	x	x	x			x		x	x
18	*A. convexior* Steph.	x		x				x					x	x		
19	*A. crenata* Dej.						x									
20	*A. curta* Dej.			x												
21	*A. cursitans* Zimm.			x												
22	*A. equestris* (Duft.)						x									
23	*A. erratica* (Duft.)		x			x	x						x			
24	*A. eurynota* (Pz.)					x	x	x	x	x			x	x		
25	*A. famelica* Zimm.			x	x		x			x						x
26	*A. familiaris* (Duft.)	x	x	x	x	x	x	x	x	x			x	x		x
27	*A. fulva* (Müll.)	x		x	x		x	x	x		x	x	x		x	x
28	*A. ingenua* (Duft.)		x					x								x
29	*A. lucida* (Duft.)	x		x												
30	*A. lunicollis* Schiödte			x		x			x		x	x	x	x	x	
31	*A. majuscula* Chaud.				x		x		x							x
32	*A. municipalis* (Duft.)		x				x									
33	*A. nitida* Sturm	x		x		x		x		x			x			
34	*A. ovata* (F.)			x	x	x	x		x	x			x			
35	*A. plebeja* (Gyll.)			x	x	x	x		x	x	x	x	x	x	x	x
36	*A. pulpani* Kult			x												
37	*A. praetermissa* (Sahl.)			x			x									
38	*A. quenseli silvicola* Zimm.				x		x									
39	*A. similata* (Gyll.)	x		x	x	x				x	x	x	x	x	x	x
40	*A. spreta* Dej.	x	x	x	x	x	x	x		x	x			x		
41	*A. strenua* Zimm.		x													

42	*A. tibialis* (Pk.)			x												
43	*Anchomenus dorsalis* (Pont.)	x		x		x	x	x	x	x	x	x	x	x	x	x
44	*Anisodactylus binotatus* (F.)	x			x	x	x			x				x		x
45	*Asaphidion flavipes* (L.)	x				x	x		x	x	x	x	x		x	x
46	*A. pallipes* (Duft.)	x					x		x		x	x	x	x	x	x
47	*Badister bullatus* (Schrnk.)													x		x
48	*B. dilatatus* Chaud.													x		
49	*B. meridionalis* Puel						x									
50	*B. sodalis* (Duft.)													x		
51	*Bembidion assimile* Gyll.			x												
52	*B. azurescens* Dalla Torre			x										x		
53	*B. biguttatum* (F.)								x					x		
54	*B. bruxellense* (Westm.)	x			x											
55	*B. cruciatum polonicum* Müll.			x			x									
56	*B. dentellum* (Thunb.)						x									
57	*B. femoratum* (Sturm)					x	x		x	x	x	x	x	x	x	x
58	*B. gilvipes* (Sturm)	x														
59	*B. guttula* (F.)			x	x	x	x		x	x	x	x	x	x	x	x
60	*B. illigeri* (Net.)	x														
61	*B. lampros* (Hrbst.)	x	x	x	x	x	x	x	x	x	x	x		x	x	x
62	*B. mannerheimii* (Sahl.)	x												x		
63	*B. nigricorne* (Gyll.)	x														
64	*B. obliquum* (Sturm)				x		x									
65	*B. pallidipenne* (Ill.)				x											
66	*B. properans* (Steph.)	x	x	x	x	x	x	x	x	x	x		x	x	x	x
67	*B. pygmaeum* (F.)	x														
68	*B. ruficolle* (Pz.)							x								
69	*B. quadrimaculatum* (L.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
70	*B. saxatile* (Gyll.)						x									
71	*B. tetracolum* Say				x		x		x		x					x
72	*Blemus discus* (F.)				x	x	x	x	x	x	x	x	x	x	x	x
73	*Bradycellus caucasicus* (Chaud.)				x											
74	*Broscus cephalotes* (L.)	x	x		x		x	x								x
75	*Calathus ambiguus* (Pk.)	x	x	x	x		x	x		x				x		
76	*C. erratus* (Sahl.)	x	x		x	x	x	x	x							x
77	*C. fuscipes* (Gz.)	x			x	x	x	x	x	x	x	x	x	x	x	x
78	*C. melanocephalus* (L.)	x	x		x	x	x	x	x	x	x	x	x	x	x	x
79	*C. micropterus* (Duft.)	x			x		x	x	x	x						
80	*Carabus arcensis* Hrbst.				x		x									
81	*C. cancellatus* Ill.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
82	*C. convexus* F.	x												x		
83	*C. granulatus* L.	x			x	x	x	x	x	x		x	x	x	x	x
84	*C. hortensis* L.	x					x	x								x
85	*C. nemoralis* Müll.		x	x			x									
86	*Chlaenius nigricornis* (F.)									x						
87	*Ch. nitidulus* (Schrnk.)			x	x				x	x				x		x
88	*Cicindela campestris* L.						x	x						x		
89	*C. hybrida* L.	x					x									
90	*Clivina collaris* (Hrbst.)						x									
91	*C. fossor* (L.)	x			x	x	x	x	x	x	x	x	x	x	x	x
92	*Cychrus caraboides* (L.)	x													x	
93	*Dicheirotrichus rufithorax* (Sahl.)													x		x
94	*Dromius quadrimaculatus* (L.)	x														
95	*Dyschirius arenosus* Steph.				x					x						

96	*D. globosus* (Hrbst.)				x	x	x		x	x	x	x	x	x	x	x
97	*D. politus* (Dej.)				x		x		x	x	x	x			x	
98	*Harpalus affinis* (Schrnk.)	x	x	x	x	x	x	x	x	x	x	x		x	x	x
99	*H. anxius* (Duft.)	x			x					x						
100	*H. calceatus* (Duft.)						x									
101	*H. distinguendus* (Duft.)				x				x							
102	*H. froelichii* Sturm	x			x		x									
103	*H. griseus* (Pz.)	x					x	x								
104	*H. hirtipes* (Pz.)	x														
105	*H. laevipes* Zett.	x					x			x				x		
106	*H. latus* (L.)	x	x		x		x							x		
107	*H. luteicornis* (Duft.)				x		x									
108	*H. picipennis* (Duft.)	x														
109	*H. rubripes* (Duft.)							x		x				x		
110	*H. rufipalpis* Sturm						x	x		x						
111	*H. rufipes* (Deg.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
112	*H. smaragdinus* (Duft.)	x	x	x	x		x									
113	*H. tardus* (Pz.)	x			x	x	x	x		x		x	x			
114	*Lebia chlorocephala* (Hoff.)	x								x				x		
115	*L. cruxminor* (L.)	x														
116	*Leistus ferrugineus* (L.)													x		
117	*L. terminatus* (Hell.)	x					x			x		x		x		
118	*Loricera pilicornis* (F.)				x	x	x		x	x	x	x	x	x	x	x
119	*Masoreus wetterhallii* (Gyll.)	x														
120	*Microlestes maurus* (Sturm)	x							x	x						
121	*M. minutulus* (Gz.)	x					x									
122	*Notiophilus aquaticus* (L.)				x		x							x		
123	*N. biguttatus* (F.)					x	x			x				x		
124	*N. palustris* (Duft.)						x							x		
125	*Olisthopus rotundatus* (Pk.)											x		x		x
126	*Oodes helopioides* (F.)					x										
127	*Ophonus laticollis* Mannerheim			x	x		x							x		
128	*O. puncticollis* (Pk.)													x		
129	*O. rufibarbis* (F.)	x							x	x				x		
130	*Oxypselaphus obcurus* (Hrbst.)	x			x						x					x
131	*Patrobus atrorufus* (Stroem)				x	x	x		x	x	x	x	x		x	x
132	*Philorhizus sigma* (Rossi)													x		
133	*Platinus assimilis* (Pk.)					x	x		x	x	x	x	x	x		x
134	*P. krynickii* (Sperk)					x										x
135	*Poecilus cupreus* (L.)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
136	*P. lepidus* (Leske)				x		x	x		x						
137	*P. punctatus* (Schall.)						x	x		x						
138	*P. versicolor* (Sturm)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
139	*Pterostichus anthracinus* (Ill.)						x									
140	*Pt. diligens* (Sturm)						x			x						
141	*Pt. macer* (Marsh.)						x	x	x							
142	*Pt. melanarius* (Ill.)	x	x		x	x	x	x	x	x	x	x	x	x	x	x
143	*Pt. minor* (Gyll.)				x			x						x		
144	*Pt. niger* (Schall.)	x			x	x	x	x	x	x	x	x	x	x	x	x
145	*Pt. nigrita* (Pk.)				x	x	x			x	x		x	x		x
146	*P. oblongopunctatus* (F.)	x				x	x				x	x	x			x
147	*Pt. rhaeticus* Heer													x		
148	Pt. *strenuus* (Pz.)	x			x	x	x			x		x	x	x	x	x
149	*Pt. vernalis* (Pz.)				x	x	x		x	x			x	x		x

150	*Stomis pumicatus* (Pz.)	x					x		x	x					x	x
151	*Syntomus foveatus* (Geoffr.)	x														
152	*S. truncatellus* (L.)	x														
153	*Synuchus vivalis* (Ill.)	x	x		x	x	x		x	x	x	x	x	x	x	x
154	*Trechoblemus micros* (Hrbst.)					x	x		x	x		x	x	x	x	x
155	*Trechus quadristriatus* (Schrnk.)	x	x		x	x	x	x	x	x		x	x	x	x	x
156	*T. secalis* (Pk.)	x			x	x	x		x	x		x	x		x	x
Total number of species in agrocenosis		73	27	41	69	56	95	44	55	70	37	43	52	71	43	60
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

RESULTS AND DISCUSSION

In total, 156 carabids species belonging to 41 genera were reported in fifteen different types of agrocenoses in Latvia (Tab. 2): potatoes – 95 species, fodder beet – 60, barley – 55, oats – 37, wheat – 44, winter rye – 70, winter rape – 56, strawberry – 27, clover – 52, clover-barley mixture – 43, clover-timothy grass mixture – 71, pea-oats mixture – 43, mixed Cruciferae cultures (cabbage, rape, garden radish, horse radish, swedish turnip) – 69, sandy agrocenosis with mixed cultures – 73, orchards – 41.

The analysis of species composition shows, that the genera *Amara* Bon. (with 32 species), *Bembidion* Latr. (with 21 species) and *Harpalus* Latr. (with 16 species) are most richly presented in different agrocenoses (Fig. 1). The representatives of these genera mostly occur in open habitats, therefore they prevail in the carabid fauna of agrocenosis. Representatives of other genera were a little bit fewer (Tab. 2).

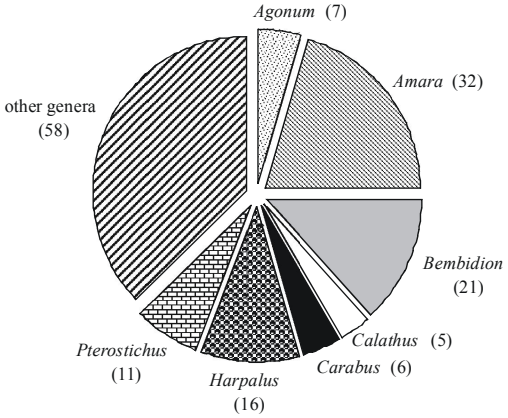

Fig. 1. Genera and species number of carabids recorded in Latvian agrocenoses

In different agrocenoses, 15 species of carabid beetles, *Amara fulva* (Müll.), *Bembidion lampros* (Hrbst.), *B. properans* (Steph.), *Blemus discus* (F.), *Broscus cephalotes* (L.), *Calathus erratus* (Sahl.), *C. fuscipes* (Gz.), *Carabus cancellatus* Ill., *Clivina fossor* (L.), *Harpalus rufipes* (Deg.), *Loricera pilicornis* (F.), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.) and *Trechus quadristriatus* (Schrnk.), were eudominants (Tab. 3).

Many european authors reported these species as eudominants or dominats in different agrocenoses and other open habitats (Kolesnikov, Sumarokov 1993; Soboleva-Dokuchaeva 1995; Aleksandrowicz 2002; Huruk 2002a, b, 2005; Kikas, Luik 2002; Luik et al. 2000, 2002; Tamutis et al. 2004, 2007). Species composition and the number of ground beetles in different agrocenoses differ and depend on the neighbouring habitats, edaphic factors, the cultures grown, annual climatic conditions, the soil compound, field size, intensity of cultivation, fertilisation, using herbicides and chemical treatments (Kromp 1999; Irmler 2003; Gongalsky & Cividanes 2008).

40 carabids are established as typical species of Latvian agrocenoses (these species were found in more than half investigated agrocenoses): *Agonum muelleri* (Hrbst.), *Amara aenea* (Deg.), *A. apricaria* (Pk.), *A. aulica* (Pz.), *A. bifrons* (Gyll.), *A. communis* (Pz.), *A. consularis* (Duft.), *A. familiaris* (Duft.), *A. fulva* (Müll.), *A. lunicollis* Schiödte, *A. plebeja* (Gyll.), *A. similata* (Gyll.), *A. spreta* Dej., *Anchomenus dorsalis* (Pont.),

Table 3. Eudominant and dominant carabids species in Latvian agrocenoses (percentage share in the community)

Types of agrocenoses: 1 – oats (after Volkov and Mihnevitsh, unpublished data), 2 – pea-oats (after Volkov and Mihnevitsh, unpublished data), 3 – barley (after Volkov and Mihnevitsh, unpublished data), 4 – barley (after Skaldere 1981a), 5 – barley (after Skaldere 1981b), 6 – clover-barley (after Volkov and Mihnevitsh, unpublished data), 7- winter-rape (after Volkov and Mihnevitsh, unpublished data), 8- winter-rye (after Volkov and Mihnevitsh, unpublished data), 9 – wheat (after Bukejs, Balalaikins 2008), 10 – clover (after Skaldere 1981a), 11 – clover (after Volkov and Mihnevitsh, unpublished data), 12 – clover-timothy (after Volkov and Mihnevitsh, unpublished data), 13 – fodder beet (after Volkov and Mihnevitsh, unpublished data), 14 – potatoes (Svikle 1970), 15 – potatoes (Cinîtis 1962), 16 – potatoes (after Volkov and Mihnevitsh, unpublished data), 17 – potatoes (after Bukejs in press), 18 – cruciferous cultures (after Cinîtis 1975), 19 – strawberry (after Petrova et al. 2006).

		Types of agrocenoses																		
№	Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	*Agonum muelleri* (Hbst.)		6,9					7,5	6,2											
2	*Amara fulva* (Müll.)															11,7			9,6	
3	*Bembidion lampros* (Hrbst.)	11,42	5,9				8,7													
4	*Bembidion properans* (Steph.)			5,2	23,3	12,8	10,92				10,4	5,02		7,1						
5	*Bembidion quadrimaculatum* (L.)													8,7			8,7			
6	*Blemus discus* (F.)	15,57	8,0	7,0			9,09		8,4			12,2		7,03			12,0			
7	*Broscus cephalotes* (L.)														6,2					54,7
8	*Calathus erratus* (Sahl.)																			32,6
9	*Calathus fuscipes* (Gz.)														10,2					
10	*Carabus cancellatus* Ill.	13,83	11,75	16,34			11,75	5,8	8	5,01			11,6	8,2			14,8			
11	*Clivina fossor* (L.)	15,0	13,79	16,9			21,9	14,4	20,71			20,3	25,0	15,9		10,0	15,1			
12	*Dischirius globosus* (Hrbst.)		5,4	7,6								7,6								
13	*Harpalus rufipes* (Deg.)			7,3	9,5	17,7				18,3	13,6			10,1	27,9	20,7	7,4		46,4	
14	*Loricera pilicornis* (F.)							7,0	7,4			11,1	9,1							
15	*Poecilus cupreus* (L.)		9,3		20,5			11,7	13,83	36,1	32,0		21,3			5,0		40,95		
16	*Poecilus versicolor* (Sturm)									23,9								18,71		
17	*Pterostichus melanarius* (Ill.)	11,19	12,0	8,7	26,1	31,4		9,8	7,4	5,8	23,5	5,3		8,4	23,3	25,8	12,4		9,1	
18	*Trechus quadristriatus* (Schrnk.)													18,9						
Total number of species in agrocenosis		37	43	44	32	41	44	55	50	41	25	51	25	70	54	44	49	44	68	27
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Asaphidion flavipes (L.), *Bembidion femoratum* (Sturm), *B. guttula* (F.), *B. lampros* (Hrbst.), *B. properans* (Steph.), *B. quadrimaculatum* (L.), *Blemus discus* (F.), *Calathus fuscipes* (Gz.), *C. melanocephalus* (L.), *Carabus cancellatus* Ill., *C. granulatus* L., *Clivina fossor* (L.), *Dyschirius globosus* (Hrbst.), *Harpalus affinis* (Schrnk.), *H. rufipes* (Deg.), *Loricera pilicornis* (F.), *Patrobus atrorufus* (Stroem), *Poecilus cupreus* (L.), *P. versicolor* (Sturm), *Pterostichus melanarius* (Ill.), *P. niger* (Schall.), *P. strenuus* (Pz.), *Synuchus vivalis* (Ill.), *Trechoblemus micros* (Hrbst.), *Trechus quadristriatus* (Schrnk.) and *T. secalis* (Pk.).

Presence in the carabid community in Latvian agrocenoses generally active entomophagous species, we may conclude that in agrocenoses frequently dominate commonly active predators and effective regulators of the crop pests. Prevalence the predatory carabid species in carabid communities of the agrocenosis designate its high regulated role in respect of crop pests.

Predatory carabids *Carabus cancellatus* Ill., *Broscus cephalotes* (L.), *Bembidion lampros* (Hrbst.), *B. quadrimaculatum* (L.), *B. properans* Steph.), *Pterostichus melanarius* (Ill.)were estimated as active entomophages of the Latvian Cruciferous crop pests (Noctuidae, Pieridae, Chrysomelidae, Elateridae and Nitidulidae) (Cinitis 1975). Predatory *B. cephalotes* prefer the larvae and pupae of the colorado beetles (*Leptinotarsa decemlineata* Say.) and larvae of Elateridae and Noctuidae (Svikle 1970; Ponomarenko 1997). Species *Bembidion* feed with cabbage aphids, Diptera eggs and larvae, chrysomelids, nitidulids and cecidomyiids, curculionids (Sytona) (Svikle 1970; Tischler 1971; Ozols 1973). Predatory carabids *B. lampros* (Hrbst.) feed with aphids and with its main food – Collembola and Diptera, *P. cupreus* (L.) – with aphid, cicada and various Arthropoda larvae (Tischler 1971; Sunderland 1975). *B quadrimaculatum* (L.) feed with eggs and larvae of *L. decemlineata* (Kryzhanovskij, 1974). Predatory *C. cancellatus* Ill. can feed with Diptera (*Bolitophila*, *Exechia*, *Mycetophila*) and

imago of *L. decemlineata* (Kryzhanovskij 1974). Predatory *Carabus nemoralis* Müll. is active entomophage of cabbage aphids, some Diptera and Lepidoptera (Noctuidae) (Kryzhanovskij 1974). Predatory *Pterostichus melanarius* stated as feeder of slugs from Agriolimacidae, Limacidae, Arionidae, and as active entomophage of the vegetable pests (McKemey et al. 2003; Foltan 2004).

Regarding to carabid food specialisation, the guestion is disputable. Predatory species *Bembidion lampros* (Hrbst.) and *Poecilus cupreus* (L.) were observed as plant pests in some occasions in Latvian agrocenoses (Eglitis 1954; Ozols 1973). It is established, that predatory ground beetle *Clivina fossor* L. can injury the corn seeds and roots in the Latvian field conditions and strawberry in East Europe (Cinovskis 1961). From one hand, *Harpalus rufipes* (Deg.) is seedeaters of various crops (Kryzhanovskij 1974; Honek et al. 2003) and known in Latvia as widely distributed injurious species on strawberry and cereal crops (Ozols 1973). And from other hand, it is known as more significant and effective entomophage, it predated on imago of *L. decemlineata,* larvae of Noctuidae, beetles of Sitona, slugs (*Deroceras reticulatum* (Mull.), aphids and more other pests (Svikle 1970; Tischler 1971; Honek et al. 2003). *Harpalus affinis* (Schrnk.) known as active seed eaters (Honek et al. 2003) but predated on 20 species athropods and known as active zoophage in orchards and is generalist biocontrol agent of fruit flies (*Bactrocera oleae, Rhagoletis cerasi*) (Kryzhanovskij 1974; Lochard et al. 2008).

Species of *Amara* as a rule are phytophages but can eat by eggs and pupae of Diptera (Tischler 1971). Plant eating carabid *A. aenea* (Deg.) is stated as predator of the aphids, Chrysomelidae and Curculionidae (Kryzhanovskij 1974).

Thus, Carabids as polyphagous predators play a very important role in controlling agricultural insect pests. Their significance is well documented in the above-mentioned entomological literature. Carabids are considered as natural factors, they feed almost exclusively on insects and thus constitute a regulatory factor in the most agrocenoses and ecosystems.

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REFERENCES

Aleksandrowicz O.R. 2002. Influence of Decis spraying on the community structure and species composition of beetles (Insecta: Coleoptera) on a potato field. Baltic Journal of Coleopterology, 2 (2): 145–153.

Barševskis A. 2003. Ground beetles (Coleoptera: Carabidae, Trachypachidae & Rhysodidae) of Latvia. Daugavpils, Baltic Institute of Coleopterology: 1–264. [in Latvian, English summary]

Bukejs A. 2005. Fauna of ground-beetles (Coleoptera: Carabidae) in sandy agrocenosis of Stropi (Daugavpils distr., Latvia). Acta Biologica Universitatis Daugavpiliensis, 5 (1): 23–26.

Bukejs A., Telnov D. 2007. Materials about the fauna of beetles (Insecta: Coleoptera) of Naujene rural municipality (Daugavpils district, Latvia). Part 2. Acta Biologica Universitatis Daugavpiliensis, 7 (2): 191–208.

Bukejs A., Balalaikins M. 2008. Ground beetles (Coleoptera: Carabidae) of wheat agrocenosis in Latvia. Acta Zoologica Lituanica, 18 (2): 134–138.

Bukejs A. in press. Complex of carabid beetles (Coleoptera: Carabidae) of potato field agrocenosis in Eastern Latvia. Acta Zoologica Lithuanica, 19 (3).

Cinītis R. 1962. Carabid beetles in agrobiocenosis of potato field. Latvijas Entomologs, 5: 25–28.

Cinītis R. 1975. Die Laufkäfer in den Agrozönosen der Kreuzblütlerkulturen. Latvijas Entomologs, 17: 7–26.

Cinovskis J.P. 1961. [Clivina fossor L. – Maisschadling in den Verhaltnissen der

Lettischen SSR]. Пальценожка Clivina fossor L. – вредитель кукурузы в условиях Латвийской ССР. В кн.: Фауна Латвийской ССР и сопредельных территорий, Т. 3, Труды АН Латвийской ССР, 20. Рига: 163–164. [in Russian]

Eglītis V.K. 1954. Soil Fauna Latvian SSR. Publishing house Academy of Science Latvian SSR, Riga: 1–262. [in Russian]

Foltan P. 2004. Influence of slug defence mechanisms on the prey preferences of the carabid predator Pterostichus melanarius (Coleoptera, Carabidae). Eur. J. Entomol., 101 (3): 359–364.

Gondalsky K.B., Cividanes F.J. 2008. Distribution of carabid beetles in agroecosystems across spatail scales – A review. Baltic Journal of Coleopterology, 8 (1): 15–30.

Górny M., Grüm L. 1981. Metody stosowane w zoologii gleby. PWN, Warszawa.

Honek A., Martinkova Z., Jarosik V. 2003. Ground beetles (Carabidae) as seed predators. Eur. J. Entomol., 100: 531–544.

Huruk S. 2002a. Ground beetles (Coleoptera, Carabidae) of brown soil in one-year-old farm crops. Baltic Journal of Coleopterology, 2 (1): 25–37.

Huruk S. 2002b. Carabids (Coleoptera, Carabidae) in strawberry plantations on brown soils. Baltic Journal of Coleopterology, 2 (2): 105–116.

Huruk S. 2005. Analysis of structures of carabid (Coleoptera, Carabidae) of communities from meadows, crops and wasteland on chernozem soil around the village of Telatyn in Roztocze. Acta Biologica Universitatis Daugavpiliensis, 5 (1): 11–22.

Kolesnikov L. O., Sumarokov A. M. 1993. Zonal peculiarities of the fauna of carabids (Coleoptera, Carabidae) of the wheat field coenoses in the forest-steppe and steppe zones of the Ukraine. Entomological Reviews, 72 (2): 326–332.

Irmler U. 2003. The spatail and temporal pattern of carabid beetles on arable fields in northern Germany (Schleswig-Holstein) and their value as ecological indicators. Agriculture, Ecosystems and Environment, 98: 141–151.

Kikas A., Luik A. 2002. The influence of different mulches on strawberry yield and beneficial entomofauna. Proc. 4th Int. Strawberry Symp. (Eds. Hietaranta et al.). Acta Horticulture, 567, ISHS: 701–704.

Kryzhanovskij O.L. (ed.) 1974. Insects and ticks – the pests of agricultural cultures. II. Coleoptera. Leningrad, Nauka: 1–336. [in Russian]

Kromp B. 1999 Carabid beetles in sustainable agriculture: a review on pest control efficacy, cultivation impacts and enhancement. Agriculture, Ecosystems and Environment, 74: 187–228.

Lochard, G., Mouton, S., Garcin, A. 2008. Potential of ground arthropods as predators of larvae and pupae of fruit flies (Diptera: Tephritidae). Integrated Plant Protection in Stone Fruit IOBC/wprs Bulletin, 37: 83–90.

Lorenz W. 2005. Nomina Carabidarum – a Directory of the Scientific Names of Ground Beetles (Insecta, Coleoptera "Geadephaga": Trachypachidae and Carabidae incl. Paussinae, Cicindelinae, Rhysodinae). Second edition. Tutzing, published by the author: 1–993.

Luik, A., Eenpuu, R., Heidemaa, M., Arus, L., Tarang, T., Vares, A. 2000. Carabids in different agrocoenosis of Estonia. In: Proceedings of the International Conference "Development of environmentally friendly Plant Protection in the Baltic Region", Tartu, Estonia, September 28-29: 114–117.

Luik A., Tarang T., Veromann E., Kikas A., Hanni L. 2002. Carabids in the Estonian crops. Proceedings of the scientifics international conference "Plant protection in the Balltic Region in the context of integration to EU", September 26-27, 2002, Kaunas, Akademija, Leidykla "Lutute": 68–70.

McKemey A.R., Symondson W.O.C., Glen D.M. 2003. Predation and prey size choise by the carabid beetles Pterostichus melanarius (Coleoptera, Carabidae): the dangers of extrapolating from laboratory to field. Bulletin of Entomological Research, 93 (3): 227–234.

Ozols E. 1956. Study cereal crop pests and control measures in Latvian SSR. [Изучение

вредителей зерновых культур и меры борьбы с ними в Латвийской ССР.] In: Sbornik trudov po zastchite rastenij. Publishing house Academy of Science Latvian SSR, Riga: 35–42. [In Russian]

Ozols E. 1973. Agricultural Entomology. 3 ed. Rîga, Zvaigzne: 1–496. [in Latvian]

Petrova V., Barševskis A., Čudare Z. 2005. Functional biodiversity of carabid beetles (Coleoptera, Carabidae) in the strawberry agrocenozis. Book of abstract: 3rd International Conference "Research and Conservation of the Biological Diversity in Baltic Region", Daugavpils University, Daugavpils, Latvia, 20-22 April 2005: 91.

Petrova V., Čudare Z., Cibuļskis R. 2006. Predators and herbivores (Coleoptera) naturally occuring on strawberry (Latvia). Acta Biologica Universitatis Daugavpiliensis, 6 (1-2): 155-159.

Ponomarenko A.V. 1997. Soil habituated insects and plant protection principles with pests. Rostov-na-Donu: 1–168. [in Russian]

Piedītis A. 1996. Kultūraugu kaitēkļi. Rīga, Zvaigzne ABC: 1–294.

Skaldere S. 1981a. Ground beetles of the field agrocenozes. In: Тезисы докладов научно-производственной конференции "Защита растений в республиках Прибалтики и Белоруссии". Вильнюс: 97–98. [In Russian]

Skaldere S. 1981b. The carabid beetles in the barley agrocenosis of Latvia. Latvijas Entomologs, 24: 38–42.

Soboleva-Dokuchaeva I. I. 1995. Peculiarities of forming of ground-beetles fauna (Coleoptera: Carabidae) in agrocenoze neighbouring to forest in the Non-Chernozem area. Entomological Reviews, 74 (3): 551–576.

Spuris Z. 1995a. Viktora Šmita ieguldījums Latvijas skreivaboļu (Coleoptera, Carabidae) izpētē. 1. Ģints Amara Bonelli, 1810, s. l. [The investment by Viktors Šmits to the knowledge of Latvian ground beetles (Coleoptera, Carabidae). 1. Genus Amara Bonelli, 1810 s.l.] Latv. Entomol. Arhīvs, 1: 18–23. [In Latvian]

Spuris Z. 1995b. Viktora Šmita ieguldījums Latvijas skreivaboļu (Coleoptera, Carabidae) izpētē. 2. Genus Agonum Bonelli, 1810 s.l. [The investment by Viktors Šmits to the knowledge of Latvian ground beetles (Coleoptera, Carabidae). 2. Genus Agonum Bonelli, 1810 s.l.] Latv. Entomol. Arhīvs, 2: 23–31. [In Latvian]

Spuris Z. 1997. Viktora Šmita ieguldījums Latvijas skreivaboļu (Coleoptera, Carabidae) izpētē. 3. Ģints Bembidion Latreille, 1802 s.l. [The investment by Vktors Šmits to the knowledge of Latvian ground beetles (Coleoptera, Carabidae). 3. The Genus Bembidion Latreille, 1802 s.l.]. Latv. Entomol. Arhīvs, 4: 17–28. [in Latvian]

Sunderland K.D. 1975. The diet of some predatory arthropods in cereal crops. J. Appl. Ecol. 12: 507–515.

Svikle M. 1970. Ground beetles in potatoes fields agrobiocenosis in Latvian conditions, and those significance as potencial entomofaques of the colorado beetles (Leptinotarsa decemlineata Say). In: Proceedings of the 7th Baltic Countries Plant Protection conference, 2. Elgava: 94–97. [In Russian]

Tamutis V. 2000. Carabid beetles species diversity and abundance in some agrobiocenoses. In: Proceedings of the International Conference "Development of environmentally friendly plant protection in the Batic Region", Tartu, Estonia, Sep. 28-29, 2000: 200–203.

Tamutis V., Monsevičius V., Pekarskas J. 2004. Ground and rove beetles (Coleoptera: Carabidae, Staphylinidae) in ecological and conventional winter wheat fields. Baltic Journal of Coleopterology, 4 (1): 31–40.

Tamutis V., Žiogas A., Šaluchaitė A., Kazlauskaitė S., Amšiejus A. 2007. Epigeic beetles (Coleoptera) communities in summer barley agrocenoses. Baltic Journal of Coleopterology, 7 (1): 83–98.

Tischler W. 1971. Agrarökologie. Moscow, Kolos: 1–655. [In Russian].

Volkov D.A. 1990. Carabid complex structure in the experimental crop rotation fields of Latvia. In: Proceedings of the 3-rd All-Union conference of the carabidologists "Fauna and Ecology of the carabids", Kishinev: 11-12.

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