

Species diversity of ground beetles (Coleoptera: Carabidae) in field groves

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The aim of the study was to gather information on the species composition and structure of groups of Carabidae present in field groves in the years 2000–2001. The specimens trapped belonged to 89 species. The dominant species in the groves were *Pterostichus melanarius* and *Pterostichus oblongopunctatus*. Of the Carabidae species caught 89% were predators.

Key words: Carabidae, field groves, species diversity

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INTRODUCTION

Epigeic ground beetles (Coleoptera: Carabidae) are useful species in that they can naturally control many plant pests (Sunderland, 1975). They are also indicative of the state of habitats. As a result, they are an interesting subject of study for entomologists. Obtaining good knowledge and understanding of carabid assemblages seems important as much for agriculture and forestry as for natural sciences in order to make an inventory of ground beetle species in Poland (Węgorzek, Trojanowski 1989). The purpose of the present study was to collect information on the Carabidae fauna, such as species composition and community structure, among assemblages of carabids inhabiting field groves.

Research area and method the study was conducted at the Experimental Station of the University of Warmia and Mazury in Olsztyn situated in the village of Tomaszkowo near Olsztyn. The

study was carried out in the years 2000 and 2001. Three field groves, which differed in character, were chosen for observations. Grove I was situated 100 m away from a surfaced road and 200 m away from a dirt road. It covered a forested area (pine – 90% and birch – 10%) of 0.18 ha. The trees were about 45 years old. Grove II was located 50 m away from a dirt road, near a farmstead. It covered a forested area of 0.06 ha with 70-year-old maple-trees, birches and spruces. It was adjacent to a 3-hectare pine coppice. Grove III covered a forested area (0.35 ha) containing 20% pines and 80% birches, growing near a marshy area. The age of the trees in that grove was estimated to be 30 years. The species composition and dynamics of the occurrence of ground beetles were examined by trapping beetles into modified Barber's traps. Five sites were chosen randomly in every grove to set traps. The traps were emptied once weekly. Each research cycle lasted from May to October.

Table 1. List of 89 species of ground beetles in field groves

Years	2000	2000	2000	2001	2001	2001
Species	Z - I	Z - II	Z - III	Z - I	Z - II	Z - III
1	2	3	4	5	6	7
<i>Acupalpus exiguus</i> (Dejean, 1829)						1
<i>Agonum sexpunctatum</i> (Linnaeus, 1758)			1			
<i>Amara aenea</i> (De Geer, 1774)						2
<i>A. bifrons</i> (Gyllenhal, 1810)		10	3	2		3
<i>A. brunnnea</i> (Gyllenhal, 1810)	34	16	13	22	10	16
<i>A. communis</i> (Panzer, 1797)	1	2	18	3	2	43
<i>A. consularis</i> (Duftschmid, 1812)			1		1	1
<i>A. convexior</i> (Stephens, 1828)		1	1	1	1	
<i>A. equestris equestris</i> (Duftschmid, 1812)					1	
<i>A. famelica</i> (Zimmermann, 1832)			1			
<i>A. familiaris</i> (Duftschmid, 1812)				4	1	1
<i>A. fulva</i> (Degeer, 1774)			1			
<i>A. ingenua</i> (Duftschmid, 1812)					1	
<i>A. lunicollis</i> (Schiodte, 1837)			1			2
<i>A. ovata</i> (Fabricius, 1792)				1		
<i>A. plebeja</i> (Gyllenhal, 1810)		2	8	1	1	4
<i>A. similata</i> (Gyllenhal, 1810)						1
<i>A. tricuspidata</i> (Dejean, 1831)			1			
<i>Anchomenus dorsalis</i> (Pontoppidan, 1763)	2	3	19	13	6	49
<i>Anisodactylus binotatus</i> (Fabricius, 1787)		9			8	1
<i>A. nemorivagus</i> (Duftschmid, 1812)					1	
<i>Asaphidion flavipes</i> (Linnaeus, 1761)			1			3
<i>Badister bullatus</i> (Schrank, 1798)				1		2
<i>B. lacertosus</i> (Sturm, 1815)	6	2		2	1	
<i>B. meridionalis</i> (Puel, 1925)					1	
<i>Bembidion lampros</i> (Herbst, 1784)			2	1	1	
<i>B. properans</i> (Stephens, 1828)			1			4
<i>B. tetracolum</i> (Say, 1823)	2	4	1	8	5	2
<i>Bradycellus caucasicus</i> (Chaudoir, 1846)					1	
<i>Calathus ambiguus</i> (Paykull, 1790)		2		2		
<i>C. erratus erratus</i> (Sahlberg, 1827)				2	1	
<i>C. fuscipes</i> (Goeze, 1777)	12	14	6	63	4	1
<i>C. melanocephalus</i> (Linnaeus, 1758)	3	5		1	5	
<i>C. micropterus</i> (Duftschmid, 1812)	47	5	24	54	3	12
<i>Carabus arvensis</i> (Herbst, 1784)	7			1		
<i>C. cancellatus</i> (Illiger, 1798)	3	9	2	6	9	9
<i>C. coriaceus coriaceus</i> (Linnaeus, 1758)					1	1
<i>C. glabratus</i> (Paykull, 1790)					1	
<i>C. granulatus</i> (Linnaeus, 1758)	4	31	5	15	26	10
<i>C. hortensis</i> (Linnaeus, 1758)	75	13	7	28	35	1
<i>C. marginalis</i> (Fabricius, 1794)	2		2			
<i>C. nemoralis</i> (O.F. Muller, 1764)	32		7	22	6	2
<i>C. violaceus</i> (Linnaeus, 1758 ssp. <i>wolffi</i>)	3	3	1	3	3	1
<i>Clivina fossor</i> (Linnaeus, 1758)		1	2		2	
<i>Curtonotus audicus</i> (Panzer, 1797)					1	
<i>C. gebleri</i> (Dejean, 1831)				1		
<i>Cychnus caraboides</i> (Linnaeus, 1758)	40	13	2	52	18	1
<i>Dicheirotichus rufithorax</i> (Sahlberg, 1827)				1		
<i>Dyschiriodes globosus</i> (Herbst, 1784)		1			6	
<i>Elaphrus cupreus</i> (Duftschmid, 1812)		1				
<i>Epaphius secalis</i> (Paykull, 1790)	5	1		3	1	1
<i>Europhitus fuliginosus</i> (Panzer, 1809)	3			9		
<i>E. gracile</i> (Sturm, 1824)				2		

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Table 1. (continued)

1	2	3	4	5	6	7
<i>Harpalus affinis</i> (Schrank, 1781)						1
<i>H. calceatus</i> (Duftschmid, 1812)			1			
<i>H. griseus</i> (Duftschmid, 1812)				1	1	5
<i>H. latus</i> (Linnaeus, 1758)	2	1		2	1	1
<i>H. progrediens</i> (Schauberg, 1922)	1		8			
<i>H. quadripunctatus</i> (Dejean, 1829)	14			17	2	3
<i>H. rufipes</i> (De Geer, 1774)	36	56	18	17	27	27
<i>H. smaragdinus</i> (Duftschmid, 1812)					1	
<i>H. solitarius</i> (Dejean, 1829)	1					
<i>H. tardus</i> (Panzer, 1797)			3		1	
<i>H. xanthopus winkleri</i> (Schauberg, 1923)	2	1	1			
<i>Lebia chlorocephala</i> (Hoffmannsegg, 1803)					1	
<i>Leistus ferrugineus</i> (Linnaeus, 1758)	1	5	3		2	1
<i>L. rufescens</i> (Fabricius, 1775)	11	29			13	1
<i>Loricera pilicornis</i> (Fabricius, 1775)				4	2	1
<i>Microlestes minutulus</i> (Goeze, 1777)		1				1
<i>Nebria brevicollis</i> (Fabricius, 1792)		2		2	2	
<i>Notiophilus aquaticus</i> (Linnaeus, 1758)		3			1	
<i>N. biguttatus</i> (Fabricius, 1779)	11	2	1	7	1	2
<i>N. palustris</i> (Duftschmid, 1812)	4	2	2	2	3	6
<i>Ophonus rufibarbis</i> (Fabricius, 1792)				1	1	
<i>Panagaeus bipustulatus</i> (Fabricius, 1775)	1				2	1
<i>Platynus assimilis</i> (Paykull, 1790)	72	4		121	4	
<i>P. krynickii</i> (Sperk, 1835)	3					
<i>Poecilus versicolor</i> (Sturm, 1824)	16	40	17	8	12	17
<i>Pterostichus anthracinus</i> (Illiger, 1798)						1
<i>P. melanarius melanarius</i> (Illiger, 1798)	60	93	33	313	104	8
<i>P. niger</i> (Schaller, 1783)	37	11	7	87	12	6
<i>P. nigrita</i> (Paykull, 1790)		2		1	2	
<i>P. oblongopunctatus</i> (Fabricius, 1787)	124	29	26	138	22	74
<i>P. quadrifoveolatus</i> (Letzner, 1852)		1		1		
<i>Pterostichus strenuus</i> (Panzer, 1797)	34	5	3	47	5	6
<i>Stonis pumicatus</i> (Panzer, 1796)	2	1			3	1
<i>Synuchus vivalis vivalis</i> (Illiger, 1798)	2	4	2	1	4	2
<i>Trechus quadristriatus</i> (Schrank, 1781)			1		1	
Number of species	39	43	41	48	60	47
Number of individuals	715	440	257	1094	394	339
Simpson's index (1/D)	12.8	11.38	16.59	7.81	10.4	10.15
% index of species abundance J _D	46.2	51.2	39.0	43.8	45.0	44.7

RESULTS AND DISCUSSION

During the two years of observations in the three groves 3 239 individuals of Carabidae were trapped. They belonged to 89 species (tab. 1). The total of 1 412 Carabidae specimens were caught in 2000, while in 2001 the response number

was 1 872. The most numerous were the genera: *Amara* (16 species), *Carabus* (9 species), *Harpalus* (9 species) and *Pterostichus* (7 species). The three habitats varied in the number of carabid assemblages, the number of species and species diversity. The highest numbers of ground beetles were found in grove I (56% of all beetles

Table 2. Dominant and sub-dominant species in the analysed carabids assemblages

Species	Z - I	Z - II	Z - III
<i>Pterostichus melanarius</i> (Illiger, 1798)	20.6	23.6	6.9
<i>Pterostichus oblongopunctatus</i> (Fabricius, 1787)	14.5	6.1	16.8
<i>Anchomenus dorsalis</i> (Pontoppidan, 1763)	-	-	11.4
<i>Platynus assimilis</i> (Paykull, 1790)	10.7	-	-
<i>Anara communis</i> (Panzer, 1797)	-	-	10.2
<i>Harpalus rufipes</i> (De Geer, 1774)	-	9.9	7.5
<i>Pterostichus niger</i> (Schaller, 1783)	6.9	-	-
<i>Carabus granulatus</i> (Linnaeus, 1758)	-	6.8	-
<i>Poecilus versicolor</i> (Sturm, 1824)	-	6.2	5.7
<i>Carabus hortensis</i> (Linnaeus, 1758)	5.7	5.7	-
<i>Catathus micropterus</i> (Dollschmid, 1812)	5.6	-	6.0
<i>Cychrus caraboides</i> (Linnaeus, 1758)	5.1	3.7	-
<i>Leistus rufescens</i> (Fabricius, 1775)	-	5.0	-
<i>Pterostichus strenuus</i> (Panzer, 1797)	4.5	-	-
<i>Catathus fuscipes</i> (Goeze, 1777)	4.1	-	-
<i>Anara brunnea</i> (Gyllenhal, 1810)	3.1	3.1	4.9
<i>Carabus nemorensis</i> (O.F.Müller, 1764)	3.0	-	-

trapped). Groves II and III were determined to have comparable numbers of carabids (26 and 18% respectively). The number of Carabidae species was the highest in grove II, located near the farmstead. The index of species diversity (Simpson 1/D) shows certain differences between the two years of our study (tab. 1). It reached the highest value in the year 2000 in grove III, which was encircled by arable fields and forests. According to Skłodowski (1995), Skłodowski & Porowski (2000), the index of species diversity „D” attains maximum values in the time when pioneer fauna is gradually retreating to give way to mature fauna (forest species). High values (within an interval of 39.0–51.2%) obtained when determining the per cent index of species abundance (JD), which expresses species abundance of every genus in an analysed biocenosis, suggested that the biocenosis we studied was rather poor (Jankowski 2001).

The dendrogram presenting similarities between species compositions of the three habitats (fig. 1) shows only slight differences between grove I and the other tree communities. Assessment of the structure of dominance was based on Renoken's scale. Those species with dominance index above 5% were considered as dominant. The distribution of dominance of species in the three groves varied. Some shift was observed regarding species in each class of dominance and

percentages of species in a particular class (tab. 2). Two species, however, can be pointed as dominants for all the three groves in the two years of observations. These are *Pterostichus melanarius* Ill. and *Pterostichus oblongopunctus* Fabr. The analysis of the trophic structure of Carabidae assemblages helped to distinguish large and small zoophages and hemizoophages. The percentage of large zoophages tends to increase as habitat conditions improve (Szyszko 1974). This was confirmed in the course of our observations. Zoophages constituted 89% of the trapped ground beetles. Nearly half of them were large zoophages.

SUMMARY

In the years 2000 and 2001 a total number of 3239 ground beetles of 89 species were trapped in field groves. *P. melanarius* and *P. oblongopunctatus* were constantly dominant species. Nearly 90% of the Carabidae species, including most of the dominant species of carabids in field groves, were predators. The observations showed that field groves were a potential source of species diversity of useful Carabidae. Consequently, it appears that such field groves, woods and coppices should be well protected.

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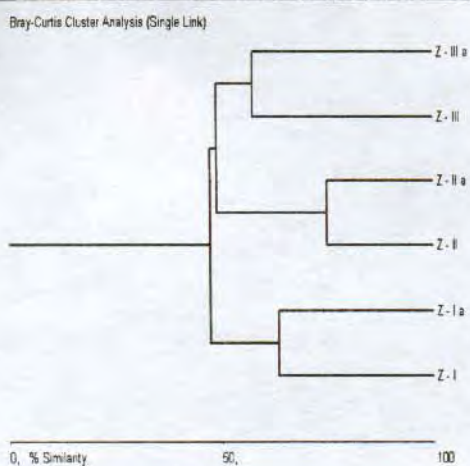


Fig. 1. Dendrogram of species similarities for Carabidae in the groves

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