

**The community of coprophagous hydrophilid beetles (Coleoptera: Hydrophilidae) in a pasture near Poznań (West Wielkopolska, Poland)**

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**ABSTRACT.** The community structure and seasonal dynamics of coprophagous hydrophilid beetles were studied in the Wielkopolska region using pitfall traps. The material, collected over 2 years, included 20 species of Hydrophilidae represented by 3,672 individuals and belonging to four genera: *Cercyon* LEACH, 1817, *Cryptopleurum* MULSANT, 1844, *Megasternum* MULSANT, 1844, and *Sphaeridium* FABRICIUS, 1775. The studied community was dominated by *Cercyon pygmaeus*, which made up 33.6% of all gathered beetles. Most collected species were accidental. Hydrophilid beetles were observed from April until September, reaching their highest numbers in spring and late autumn.

**KEY WORDS:** Hydrophilidae, coprophagous beetles, community structure, seasonal dynamics, Poland, Wielkopolska.

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INTRODUCTION

The family Hydrophilidae is represented in Poland by 68 species (PRZEWOŹNY 2004a). This beetle group is very heterogeneous in ecology. Many species representing subfamily Hydrophilinae and some species from the subfamily Sphaeridiinae inhabit aquatic habitats and leave them only to disperse. Species belonging to the subfamily Sphaeridiinae are terrestrial, usually saprophagous, feeding on decaying organic matter. Most of this species is coprophagous and colonize animal droppings in early stages of decomposition (HANSKI & KOSKELA 1977). The group of terrestrial Hydrophilidae is poor in species and in Poland

comprises 21 species classified within the following genera: *Cercyon*, *Cryptopleurum*, *Megasternum*, and *Sphaeridium* (PRZEWOŹNY 2004b).

Coprophagous hydrophilid beetles have been the subject of many ecological, evolutionary and taxonomic studies (HANSKI & KOSKELA 1977, KOSKELA & HANSKI 1977, HANSKI 1980a, HANSEN 1987, HOLTER 2004, BAJERLEIN & PRZEWOŹNY 2005, ANLAS et al. 2008). In Poland, in the last years, entomologists have focused mainly on aquatic hydrophilid beetles (BUCZYŃSKI & PRZEWOŹNY 2002, BUCZYŃSKI & PRZEWOŹNY 2006, PRZEWOŹNY et al. 2006, BUCZYŃSKI et al. 2007), whereas terrestrial representatives of this beetle family are poorly known. The main purpose of this paper was to analyze species composition, dominance structure, and seasonal dynamics of coprophagous hydrophilid beetles in the Wielkopolska region.

#### MATERIAL AND METHODS

The field work was conducted on a pasture located about 20 km north - west from Poznań (Wielkopolska region, Poland, 52°31'N 16°45'E). The pasture was grazed by cows from June to September. The studied area was characterized by dry soil. It was surrounded by arable soils and situated near a small mixed forest. Beetles were sampled using 6 pitfall traps baited with 450 ml of fresh cow dung and emptied in 7 day intervals. Cow dung was gathered from a cowhouse. The pitfall traps were placed in two parallel rows (three traps in a each row). The distance between the rows and between pitfall traps within each row was 1.5 meters. The material was collected in 2003 from March 23 to November 26 and in 2004 from April 3 to December 18 and preserved in 75% ethyl alcohol. Collected beetles were identified under stereomicroscope using keys of FREUDE et al. (1971), HANSEN (1987, 1990), HEUBAUER (1989), HEUBAUER & SCHÖDL (1998). The collected material is deposited in Natural History Collections, Adam Mickiewicz University.

Coefficient of dominance (D) was calculated as the ratio of a number of specimens of particular beetle species to the total number of all analyzed beetles and expressed as a percentage. The following dominance classes were distinguished (GÓRZ 2003): superdominants (> 30.0%), dominants (5,1 – 30.0%), subdominants (1,1 – 5.0%) and recedents (<1.0%).

The curves of numbers of species of hydrophilid beetles showed in the figure 2 were obtained with the Weighted Least Squares Method. Abundances of hydrophilid beetles showed in figures 3 and 4 were expressed as the mean number of specimens collected in particular sampling date per one trap. The standard error (SE) of the mean has been given.

## RESULTS

The whole material comprised 3,672 individuals of hydrophilid beetles represented by 20 species (Table 1). Among these, 12 species and 2070 individuals belonged to the genus *Cercyon*, three species and 345 individuals belonged to the genus *Cryptopleurum*, one species and 20 individuals represented genus *Megasternum*, and four species and 1237 individuals belonged to the genus *Sphaeridium*. The studied community was dominated by *Cercyon pygmaeus*, which constituted 33.6% of all specimens collected. Other numerous species (dominants) were: *Cercyon lateralis*, *Sphaeridium lunatum*, *Sphaeridium scarabaeoides*, *Cryptopleurum minutum* and *Sphaeridium marginatum*. The group of subdominants was represented by three species, among which *Cercyon haemorrhoidalis* was the most numerous (Fig. 1). Most gathered species (11) were recorded in very low numbers (<1%) (Table 1).

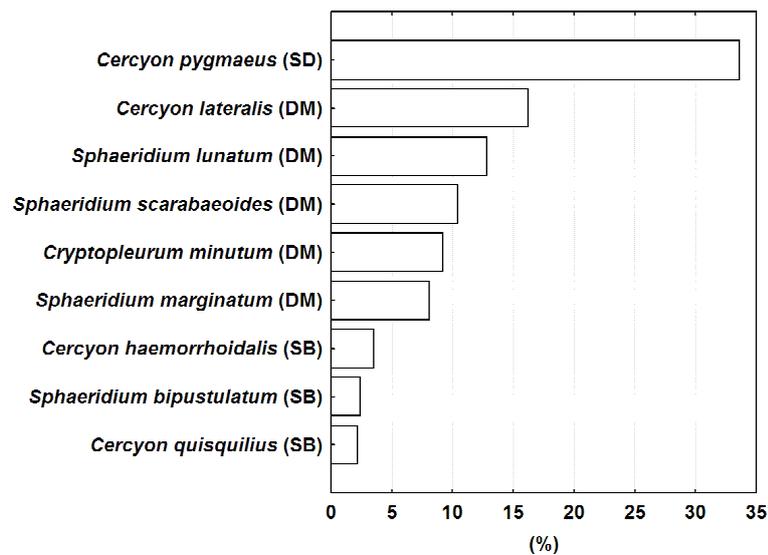
**Table 1.** Beetle species collected with information on their numbers and dominance coefficient (D%).

No.	beetle species	N	D(%)
1.	<i>Cercyon analis</i> (PAYKULL, 1798)	1	< 1
2.	<i>Cercyon haemorrhoidalis</i> (FABRICIUS, 1775)	130	3.5
3.	<i>Cercyon impressus</i> (STURM, 1807)	4	< 1
4.	<i>Cercyon laminatus</i> SHARP, 1873	1	< 1
5.	<i>Cercyon lateralis</i> (MARSHAM, 1802)	595	16.2
6.	<i>Cercyon melanocephalus</i> (LINNAEUS, 1758)	4	< 1
7.	<i>Cercyon nigriceps</i> (MARSHAM, 1802)	8	< 1
8.	<i>Cercyon castaneipennis</i> VORST, 2009	5	< 1
9.	<i>Cercyon pygmaeus</i> (ILLIGER, 1801)	1,233	33.6
10.	<i>Cercyon quisquilius</i> (LINNAEUS, 1760)	81	2.2
11.	<i>Cercyon terminatus</i> (MARSHAM, 1802)	3	< 1
12.	<i>Cercyon unipunctatus</i> (LINNAEUS, 1758)	5	< 1
13.	<i>Cryptopleurum crenatum</i> (KUGELANN, 1794)	2	< 1
14.	<i>Cryptopleurum minutum</i> (FABRICIUS, 1775)	337	9.2
15.	<i>Cryptopleurum subtile</i> SHARP, 1884	6	< 1
16.	<i>Megasternum concinnum</i> (MARSHAM, 1802)	20	< 1
17.	<i>Sphaeridium bipustulatum</i> FABRICIUS, 1781	89	2.4
18.	<i>Sphaeridium lunatum</i> FABRICIUS, 1792	470	12.8
19.	<i>Sphaeridium marginatum</i> FABRICIUS, 1787	297	8.1
20.	<i>Sphaeridium scarabaeoides</i> (LINNAEUS, 1758)	381	10.4
<b>TOTAL</b>		3,672	

The number of species increased from the beginning of April until the end of May (Fig. 2). The highest numbers of species were observed during summer (June, July, August). In September the number of species drastically declined (Fig. 2).

The numbers of hydrophilid beetles varied in 2003 with a distinct peak in the middle of May (Fig. 3). Throughout the rest of the season their abundance increased and decreased several times. In 2004, the number of Hydrophilidae was lower in comparison with the previous year. As in 2003, the abundance fluctuated, with two distinct peaks at the beginning of June and in the middle of August (Fig. 3).

In the spring of 2003, representatives of *Cercyon* dominated and the numbers of *Sphaeridium* were low (Fig. 4). At the end of July and the beginning of August, the abundance of *Sphaeridium* increased and the numbers of *Cercyon* declined. In 2004, the numbers of *Sphaeridium* peaked at the beginning of June, when the abundance of *Cercyon* was low. Numbers of specimens from both genera were similar in August (Fig. 4).



**Fig. 1.** Dominance structure of recorded hydrophilid beetles. Legend: SD – superdominants, DM – dominants, SB – subdominants. Accidental species were not taking into account in this figure.

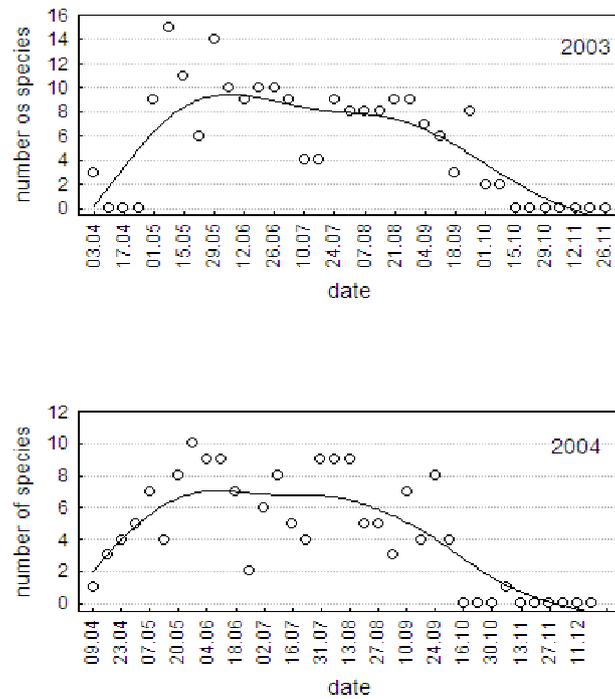


Fig. 2. Seasonal changes in number of hydrophilid beetle species in 2003 and 2004.

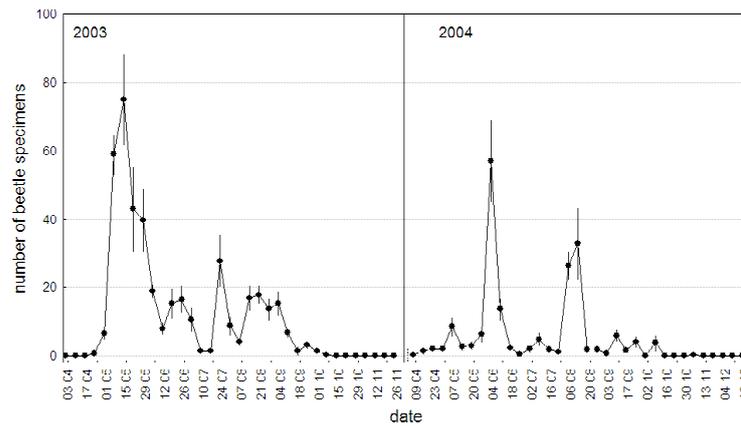


Fig. 3. Seasonal dynamics of hydrophilid beetles in 2003 and 2004.

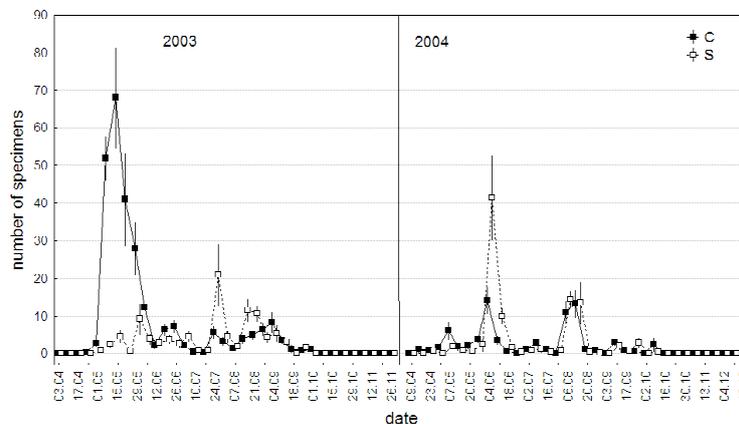


Fig. 4. Seasonal dynamics of *Cercyon* (C) and *Sphaeridium* (S) in 2003 and 2004.

## DISCUSSION

The present paper gives a detailed characteristic of a coprophagous hydrophilid beetle community from western Poland. Hydrophilidae have been the subject of many ecological studies in different parts of Europe (HANSKI 1980a, b, HANSKI & KOSKELA 1977, OTRONEN & HANSKI 1983, SOWIG 1997, HUTTON & GILLER 2004, ANLAS et al. 2008). Preliminary results on the species composition and abundance of coprophagous Hydrophilidae were presented in the previous paper by BAJERLEIN & PRZEWOŹNY (2005). That paper however, concerned mostly the phenomenon of phoresy of a mite *Uropoda orbicularis* on hydrophilid beetles.

All species recorded by the authors have been already indicated from Poland (PRZEWOŹNY 2004). Attention should be paid in particular to *Cercyon castaneipennis* Vorst 2009. Recent taxonomic studies on *Cercyon* genus have demonstrated that two very similar species occur in Europe: *Cercyon castaneipennis* and *Cercyon obsoletus* (VORST 2009). The first one is a new species, recognized distinct from *C. obsoletus*. *Cercyon castaneipennis* is known from central Europe and southern part of northern Europe, whereas *C. obsoletus* was recorded from central and eastern Europe. All specimens collected by the authors and identified previously as a *Cercyon obsoletus* (BAJERLEIN & PRZEWOŹNY 2005) turned out to be individuals of *Cercyon castaneipennis*.

Most recorded species were representatives of *Cercyon* and *Sphaeridium* genera. Among 12 collected *Cercyon* species, only four had substantial participation in the studied community. Domination of species and individuals of *Cercyon*, which are generalist coprophagous, is a characteristic feature of coprophagous hydrophilid beetle communities. The

*Sphaeridium* genus, a specialist coprophagous, was less abundant in species and individuals. Among the four gathered species of *Sphaeridium*, *S. bipustulatum* was the least abundant. HANSKI (1980a) found that this species is the rarest among *Sphaeridium* species in northern Europe. Our results confirm that this species is one of the rarest *Sphaeridium* species in Europe.

The constant number of species observed during the season is typical for hydrophilid beetles. Hydrophilid species are multivoltine and almost all the species occur throughout most of the season (HANSKI & KOSKELA 1977).

Seasonal changes in hydrophilid beetle abundance followed a different pattern in every year. In 2003, a distinct peak of abundance was observed at the beginning of May and during summer the abundance varied, whereas in the next year two marked peaks in the numbers of Hydrophilidae were observed. This may be influenced by differences in climatic conditions between 2003 and 2004. However, seasonal dynamics of coprophagous hydrophilid beetles in Poland require further studies.

Body sizes are spaced-out in Hydrophilidae (HANSKI 1980a). This is related to the carnivorous habits of hydrophilid larvae and interspecific competitive interactions. Adults of *Sphaeridium* and *Cercyon* are coprophagous but their larvae feed on dipteran larvae. Previous observations have shown that *Sphaeridium* species are common in the absence of large *Cercyon* species, which is connected with the greater abundance of *Sphaeridium* prey (KESSLER & BALSBAUGH 1972). This competitive interaction is probably the best explanation of the inverse relationship between the abundance of *Sphaeridium* and *Cercyon* observed in our study.

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