

Coprophagous hydrophilid beetles (Coleoptera: Hydrophilidae) as carriers of phoretic deutonymphs of *Uropoda orbicularis* (Acari: Mesostigmata) in Poland

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Abstract. During a study 20 hydrophilid beetle species and 2,457 individuals of beetles belonging to 4 genera: *Cercyon*, *Cryptopleurum*, *Megasternum* and *Sphaeridium* were collected. On the surface of the bodies of 59 beetles (2.40% of the beetles collected) belonging to six species, 174 cases of phoresy [55 deutonymphs of *Uropoda orbicularis* (Müller, 1776) and 119 pedicels without deutonymphs] were observed. New hydrophilid beetle carriers of phoretic deutonymphs of *U. orbicularis* are given. Most mites were carried by *Sphaeridium* species. The population dynamics of both groups of arthropods was also studied. Most cases of phoresy were recorded in May and in the second half of July. However, phoretic deutonymphs were not present on the body surface of hydrophilid beetles throughout the whole period of this study.

INTRODUCTION

There are many papers on phoresy of uropodid mites on scarabaeid beetles (e.g. Costa, 1963; Stewart & Davis, 1967; Chmielewski, 1977; Hunter & Rosario, 1988; Maśán, 1994; 2001; Gwiazdowicz, 2000; Kofler & Schmölzer, 2000; Błoszyk et al., 2002; Bajerlein & Błoszyk, 2004; Haitlinger, 2004). In contrast, phoresy of uropodid mites on hydrophilid beetles is poorly known. Deutonymphs of *U. orbicularis* have been found on hydrophilid beetles by Faasch (1967) and Karg (1989). Kofler & Schmölzer (2000) give only *Cercyon impressus* as the carrier of deutonymphs of *U. orbicularis* and *Uroobovella obovata* (Canestrini, Berlese 1884) in Austria. Bajerlein & Błoszyk (2004) included hydrophilid beetles in their study of the deployment of phoretic deutonymphs of *U. orbicularis* on the body surface of beetles that inhabit cow dung in Poland, but do not cite the species.

The main purpose of this study was to determine the species of hydrophilid beetles that carry phoretic deutonymphs of *U. orbicularis* and determine whether phoretic deutonymphs show a preference for a particular species of carrier. Moreover, the infestation rates of beetles by phoretic deutonymphs and the population dynamics of both groups of arthropods were recorded.

Among Hydrophilidae one group of species inhabits aquatic habitats – subfamily Hydrophilinae and another belonging to the subfamily Sphaeridiinae inhabits dung (e.g. *Cercyon*, *Cryptopleurum*, *Megasternum*, *Sphaeridium*). The majority of studies on Hydrophilidae in Poland focus on those species that inhabit aquatic habitats (e.g. Buczyński & Przewoźny, 2002; Przewoźny, 2002; Przewoźny & Buczyński, 2002; 2003; Bidas & Przewoźny, 2003; Buczyński et al., 2003; Przewoźny & Lasoń, 2003). There is a lack of data on coprophagous hydrophilid beetles in Poland. Therefore, this paper is not only concerned with the phenomenon of phoresy of uropodid mites on hydrophilid beetles but it also gives new data on coprophagous hydrophilid beetles in Poland.

MATERIAL AND METHODS

The research was carried out on a pasture about 20 km north-west of Poznań (Wielkopolska province, Poland) from March to November 2003. Beetles and the deutonymphs attached to their body surface were collected using 6 pitfall traps (Bunalski, 1996). The traps were emptied at 7 day intervals. The lure substrate was cow dung. The beetles and mites were preserved in 75% ethyl alcohol. The beetles with phoretic deutonymphs were identified directly in 75% ethyl alcohol (in order to preserve the deutonymphs) and beetles without mites were dried before identification (dried beetles are easier to identify). The beetles were identified under a stereomicroscope using the keys of Freude et al. (1971), Hansen (1987, 1990), Hebauer (1989) and Hebauer & Schödl (1998). The systematics of hydrophilid beetles follows that of the Checklist of Polish Hydrophiloidea (Przewoźny, 2004).

Phoretic deutonymphs were mounted on microscope slides and subsequently determined using the keys by Karg (1989) and Maśán (2001). All cases of phoresy were noted – deutonymphs and pedicels without deutonymphs were recorded separately.

The value of dominance (D) for each species of beetle was the total number of specimens of that species divided by the total number of hydrophilid beetles collected during the whole season. The infestation of beetles by deutonymphs was estimated using the prevalence, intensity and density values used by Skoracka (2004). Prevalence is the number of beetles carrying mites divided by the total number of beetles expressed as a percentage. Intensity is the mean number of cases of phoresy (deutonymphs and pedicels) per infested beetle. Density is the mean number of cases of phoresy per hydrophilid beetle. We also found phoretic deutonymphs of *U. orbicularis* on beetles belonging to the families Staphylinidae, Histeridae, Aphodiidae, Geotrupidae and Scarabaeidae. Most cases of phoresy were recorded for dung beetles (Aphodiidae, Geotrupidae and Scarabaeidae). This material is deposited in the Department of Animal Taxonomy and Ecology, Adam Mickiewicz University.

TABLE 1. The list of species of coprophagous hydrophilid beetles (Hydrophilidae) collected, with their abundance, dominance and number of cases of phoresy: deutonymphs and pedicels, recorded on particular species of beetle (N – beetle abundance; D – beetle dominance; DN – the number of phoretic deutonymphs; PD – the number of pedicels (without deutonymphs); DP – the total number of deutonymphs and pedicels).

	Species of beetle	N	D (%)	DN	PD	DP
<i>Cercyon</i>						
1	<i>Cercyon pygmeus</i> (Illiger, 1801)	989	40.25	0	0	0
2	<i>Cercyon lateralis</i> (Marsham, 1802)	481	19.58	5	4	9
3	<i>Cercyon haemorrhoidalis</i> (Fabricius, 1775)	60	2.44	2	3	5
4	<i>Cercyon quisquilius</i> (Linnaeus, 1761)	25	1.02	0	0	0
5	<i>Cercyon atricapillus</i> (Marsham, 1802)	8	0.33	0	0	0
6	<i>Cercyon impressus</i> (Sturm, 1807)	4	0.16	0	0	0
7	<i>Cercyon melanocephalus</i> (Linnaeus, 1758)	4	0.16	0	0	0
8	<i>Cercyon obsoletus</i> (Gyllenhal, 1808)	2	0.08	0	0	0
9	<i>Cercyon analis</i> (Paykull, 1798)	1	0.04	0	0	0
10	<i>Cercyon laminatus</i> Sharp, 1873	1	0.04	0	0	0
11	<i>Cercyon terminatus</i> (Marsham, 1802)	1	0.04	0	0	0
12	<i>Cercyon unipunctatus</i> (Linnaeus, 1758)	1	0.04	0	0	0
<i>Cryptopleurum</i>						
1	<i>Cryptopleurum minutum</i> (Fabricius, 1775)	260	10.58	0	0	0
2	<i>Cryptopleurum subtile</i> Sharp, 1884	6	0.24	0	0	0
3	<i>Cryptopleurum crenatum</i> (Panzer, 1794)	2	0.08	0	0	0
<i>Megasternum</i>						
1	<i>Megasternum obscurum</i> (Marsham, 1802)	11	0.45	0	0	0
<i>Sphaeridium</i>						
1	<i>Sphaeridium lunatum</i> Fabricius, 1792	236	9.61	39	28	67
2	<i>Sphaeridium scarabeoides</i> (Linnaeus, 1758)	159	6.47	8	77	85
3	<i>Sphaeridium marginatum</i> Fabricius, 1787	142	5.78	1	1	2
4	<i>Sphaeridium bipustulatum</i> Fabricius, 1781	64	2.60	0	6	6
Total		2457	100.00	55	119	174

RESULTS

During the study, 2,457 hydrophilid beetles belonging to 20 species from the following genera: *Cercyon*, *Cryptopleurum*, *Megasternum* and *Sphaeridium* were collected. On the body surface of 59 beetles, 174 cases of phoresy (55 deutonymphs of *U. orbicularis* and 119 pedicels without deutonymphs) were observed.

The list of beetle species with information on whether they carried deutonymphs or pedicels without deutonymphs, their abundance (N) and dominance (D) are given in Table 1.

The maximum number of cases of phoresy found on one beetle was 37. Most cases of phoresy were observed in May and at the end of July. The prevalence value was 2.40% for the whole season, but varied between 0.00% and 25.00%. The intensity value was 2.95 for the whole season and varied between 1.00 and 7.50. The density value was 0.07 for the whole season and varied between 0.00 and 1.88. The highest values for all the indices were observed in the middle of July.

The population dynamics of the hydrophilid beetles and incidence of phoresy is shown in Figs 1–2. The cases of phoresy involving *U. orbicularis* and coprophagous hydrophilid beetles did not occur throughout the whole season. The first phoretic deutonymphs were observed at the beginning of May, and one week earlier pedicels without deutonymphs. The last phoretic deutonymphs were observed at the end of August (Fig. 3).

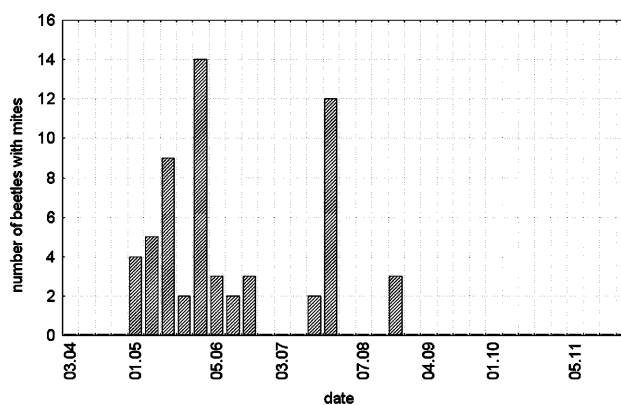


Fig. 1. Population dynamics of coprophagous hydrophilid beetles (Hydrophilidae) carrying mites (abundance of hydrophilid beetles in Figs 1–2 expressed as the total number of beetles collected from 6 traps on a particular date; dates in the figures are the first sampling date in a particular month).

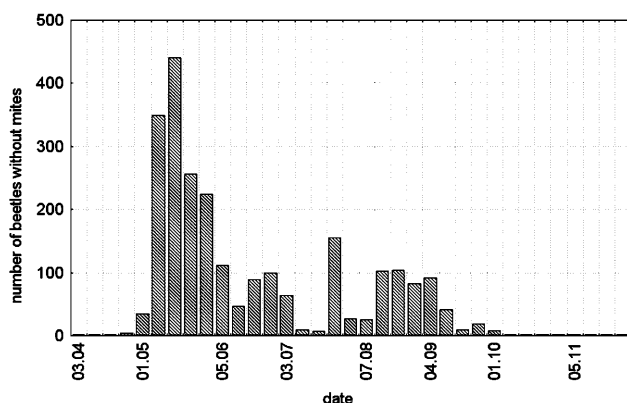


Fig. 2. Population dynamics of coprophagous hydrophilid beetles (Hydrophilidae) not carrying mites.

DISCUSSION

Uropoda orbicularis is known to be phoretic on a wide range of dung beetles (e.g. Faash, 1967; Makarova, 1995; Haitlinger, 1999; Gwiazdowicz, 2000; Maśán, 2001; Bajerlein & Błoszyk, 2004). However, phoresy of *U. orbicularis* and other uropodid mites on coprophagous hydrophilid beetles was poorly studied until now.

During this study, all coprophagous hydrophilid beetle species known from Poland, except *Sphaeridium substriatum* Faldermann, 1838, were found. Cases of phoresy were recorded for six species: *Cercyon lateralis*, *C. haemorrhoidalis*, *Sphaeridium scarabaeoides*, *S. lunatum*, *S. marginatum* and *S. bipustulatum*. However, on the body surface of *S. bipustulatum* only pedicels without deutonymphs were observed. All these beetle species are reported for the first time as carriers of deutonymphs of *U. orbicularis* in Poland.

The fact that phoresy was recorded for six (30%) of the 20 species, seems to indicate that this group of beetles does not play an important role in dispersal of deutonymphs of *U. orbicularis*. In comparison, during spring over 17,000 cases of phoresy were recorded on 19 of the 25 species of dung beetles (Scarabaeoidea), collected at the same time as the hydrophilid beetles. The values for prevalence, intensity and density were also higher in the case of dung beetles.

The fact that most cases of phoresy were for species belonging to genus *Sphaeridium* and few for the two *Cercyon* species (of the 12 species recorded), may be explained by the size of the beetles. Species of *Sphaeridium* are the biggest of all the coprophagous hydrophilid beetles collected and probably therefore preferred by phoretic deutonymphs. In comparison, phoresy on *Cercyon* seems to be accidental. This is supported by the fact, that phoretic deutonymphs were not carried by *Cercyon pygmeus*, which was the most numerous species and made up 40% of the beetle community.

The abundance of phoretic deutonymphs of *U. orbicularis* on coprophagous hydrophilid beetles is presented for the first time. Most cases of phoresy were observed in May and in the second half of July, which is probably associated with the higher abundance of beetles at that time.

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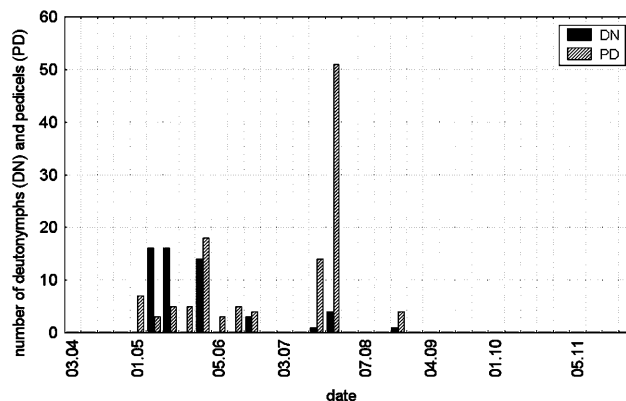


Fig. 3. Population dynamics of phoretic *U. orbicularis* divided into deutonymphs (DN) and pedicels (PD) (abundance of deutonymphs and pedicels expressed as the total number of deutonymphs and pedicels found on all beetles collected on a particular date; dates in the figure are the first sampling date in a particular month).

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