

Scuttle flies (Diptera: Phoridae) of saline habitats of the Gulf of Gdańsk, Poland

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Results of a survey of the scuttle flies (Diptera: Phoridae) of saline habitats of the Gulf of Gdańsk are reported. Within three study seasons (1999–2001), at ten localities representing coastal brackish and maritime habitats, 39 phorid species were collected. Among these, 36 were new to these areas, and *Xenotriphleba dentistylata* Buck was the first record for Poland. The dominance structure, phenology and abundance of phorids of saline habitats are described.

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1. Introduction

Scuttle flies (Phoridae) are one of the most abundant families of Diptera and “the prime candidate for being the most biologically diverse family of insects on the planet” (Disney 1990, 1994). One-quarter of the ca. 3,000 species described occur in the Palaearctic Region.

The seashore is generally not regarded as a suitable habitat for Phoridae, but the larvae of some New World species of *Megaselia* are known to be intertidal and thus able to cope with fluctuations in salinity (Saunders 1928, Cheng & Hogue 1974). Disney (2002) reported that the European *Megaselia yatesi* lives within the voids of the first shingle ridge above high watermark and that its larvae are likely to be subjected to a range of salinities following the fluctuations of

the tides and rainfall. Its eggs, being in a constantly high humidity, are atypically thin-walled, seemingly because they are not exposed to the risk of desiccation. Records of scuttle flies in maritime habitats are otherwise sparse, apart from scattered records and reports, such as phorids and other Diptera trapped in the oil oozing from a dead whale (Cobert & Disney 1998). Maritime habitats have not been systematically sampled for Phoridae.

In Poland, little is known about scuttle flies of saline habitats. Szadziewski (1983), investigating Diptera of these areas, found only eight phorid species. All of these were haloxenes i.e. species that occur and develop numerously more often in specific non-saline than in saline habitats. In this paper, we report on the phorids of the beaches and coastal brackish areas of the Gulf of Gdańsk.

2. Material and methods

2.1. Study area

Material was collected on ten areas, representing two types of habitat bordering the Baltic Sea – the coastal brackish and marine habitats. The first area was at the Bay of Puck and Gdańsk–Górki Wschodnie, and the second one was formed by the eight beaches adjacent to the Gulf of Gdańsk.

The brackish area, viz. Gdańsk–Górki Wschodnie (the coastal type), is situated at the mouth of the Wisła Śmiała river. The saline area beside the river comprises bulrushes, brackish marshes and brackish meadows. The latter are overgrown by halophytes such as *Aster tripolium*, *Triglochin maritimum*, *Glaux maritima*, and *Atriplex hastatum* var. *salinarium*. On the stony dam, *Aster tripolium*, *Atriplex hastatum*, *Spergularia salina*, *Elymus arenarius*, *Solanum dulcamara* and *Sonchus arvensis* can be found. Stones in the river bottom and flooded parts of the dam – where material was also collected – are covered with algae *Enteromorpha* sp. and *Cladophora* sp.

The flies of the Bay of Puck were caught over coastal waters, and in brackish marshes and meadows along the waterside. The bay banks are covered with *Phragmites communis*, whereas on the meadows occur *Triglochin maritimum*, *Atriplex hastatum* var. *salinum*, *Aster tripolium*, *Glaux maritima* and *Spergularia salina* (Szadziński 1983).

The flies were collected in supralittoral and epilittoral zones of the eight beaches situated near Gdynia – Wzgórze Świętego Maksymiliana (Gdynia–Wzgórze), Gdynia – Orłowo (UTM: CF44), Sopot, Gdańsk – Jelitkowo, Gdańsk – Brzeźno (UTM: CF43), Gdańsk – Górki Wschodnie (UTM: CF52), Władysławowo (UTM: CF37) and Ustka (UTM: XA25). These areas are flat and sandy, and only the locality near Gdynia–Orłowo, adjacent to the cliffs, is a little stony.

2.2. Phorid sampling, and statistical methods

Phorids were collected from the beginning of May to the end of September in 1999 and from the beginning of April to mid October in 2000 and

2001, 1–2 times a week. Flies were collected by sweeping (using an entomological net) over water's surface, algae washed ashore, soils, plants overgrowing dunes and cliffs, and in halophyte communities growing near the saline-water reservoirs. All scuttle flies were preserved in 75% alcohol. *Megaselia* females were not identified to species.

To describe the dominance structure of communities, a dominance index (D) was used (Durska 2001):

$$D = n/N * 100\% \quad (1)$$

where n = the abundance of a given species, and N = the accumulated abundance of all phorid species.

The dominance index (D) was used to classify the species into four classes: (1) eudominant (over 15.0%), (2) dominant (from 5.1% to 15.0%), (3) subdominant (from 1.1% to 5.0%) and (4) accessory species (up to 1.0%).

3. Results

The material contained 230 phorid imagines. The phorid fauna of the saline habitats sampled proved to be richer (39 species belong to 11 genera) than expected, in view of the limited collecting by means of netting only. The most abundant genus *Megaselia* was represented by 21 species (only males, ca. 60% of the total catch) (Table 1).

3.1. Dominance structure

The cumulative abundance of the three eudominant (*M. subnudipennis*, *M. ignobilis*, *M. pulicaria* complex) and one dominant species (*M. brevicostalis*) exceeded 60% of the total catch. The subdominants were represented by nine species (Fig. 1). Among the species of the lowest abundance, one male of *Xenotripleba denticulata* (Buck, 1997) was collected on 27th of May, on the beach near Gdynia–Brzeźno. It is the first record for Poland.

Table 1. Species composition, abundance and phenology of Phoridae in saline habitats of the Gulf of Gdańsk (1999–2001). * = species new to the Polish fauna

Species	Larval feeding	Specimens/month							total	%	
		IV	V	VI	VII	VIII	IX	X			
1 <i>Borophaga femorata</i> (Meigen)	unknown	–	–	–	–	–	–	1	–	1	0.43
2 <i>Borophaga subsultans</i> (Linne)	unknown	–	–	–	6	–	–	–	–	6	2.61
3 <i>Conicera dauci</i> (Meigen)	saprophagous	–	–	–	2	–	–	1	–	3	1.30
4 <i>Conicera floricola</i> Schmitz	saprophagous	–	–	–	1	–	–	–	–	1	0.43
5 <i>Conicera similis</i> (Haliday)	necrophagous	–	–	1	–	–	–	–	–	1	0.43
6 <i>Conicera schnittmanni</i> Schmitz	saprophagous	–	–	–	–	1	–	–	–	1	0.43
7 <i>Dorhniphora cornuta</i> (Bigot in De La Sagra)	polyphagous	–	–	–	–	1	–	–	–	1	0.43
8 <i>Diplonevra nitidula</i> (Meigen)	zoophagous	–	–	–	–	–	–	1	–	1	0.43
9 <i>Gymnoptera vitripennis</i> (Meigen)	zoophagous	–	–	–	1	–	–	–	–	1	0.43
10 <i>Megaselia aculeata</i> (Schmitz)	?saprophagous	–	–	1	–	–	–	–	–	1	0.43
11 <i>Megaselia affinis</i> (Wood)	unknown	–	–	–	1	–	–	–	–	1	0.43
12 <i>Megaselia brevicostalis</i> (Wood)	saprophagous	2	–	1	7	–	–	–	–	10	4.35
13 <i>Megaselia campestris</i> (Wood)	unknown	–	–	–	2	–	–	–	–	2	0.87
14 <i>Megaselia ciliata</i> (Zetterstedt)	zoophagous	–	–	–	1	–	–	–	–	1	0.43
15 <i>Megaselia diversa</i> (Wood)	?saprophagous	–	–	–	–	–	–	1	–	1	0.43
16 <i>Megaselia emarginata</i> (Wood)	unknown	–	–	–	1	–	–	–	–	1	0.43
17 <i>Megaselia errata</i> (Wood)	saprophagous	–	–	1	–	–	–	–	–	1	0.43
18 <i>Megaselia giraudii</i> (Egger)	polyphagous	–	3	–	2	–	–	–	–	5	2.17
19 <i>Megaselia hirticus</i> (Schmitz)	?saprophagous	–	–	1	–	–	–	–	–	1	0.43
20 <i>Megaselia hortensis</i> (Wood)	?saprophagous	–	–	–	1	–	–	–	–	1	0.43
21 <i>Megaselia humeralis</i> (Zetterstedt)	unknown	–	–	–	–	–	–	1	–	1	0.43
22 <i>Megaselia ignobilis</i> (Schmitz)	unknown	–	7	11	1	6	–	–	–	25	10.87
23 <i>Megaselia involuta</i> (Wood)	unknown	–	–	2	–	–	–	–	–	2	0.87
24 <i>Megaselia manicata</i> (Wood)	?saprophagous	–	1	–	–	1	–	–	–	2	0.87
25 <i>Megaselia pleuralis</i> (Wood)	saprophagous	–	–	–	–	–	–	1	–	1	0.43
26 <i>Megaselia pulicaria</i> complex (Fallen)	polyphagous	4	3	–	9	2	2	–	–	20	8.70
27 <i>Megaselia pumila</i> (Meigen)	unknown	–	–	1	–	1	–	–	–	2	0.87
28 <i>Megaselia ruficornis</i> (Meigen)	necrophagous	–	–	1	1	–	–	–	–	2	0.87
29 <i>Megaselia subnudipennis</i> (Schmitz)	necrophagous	–	9	25	9	10	–	–	–	53	23.04
30 <i>Megaselia verralli</i> (Wood)	unknown	–	–	–	2	–	–	–	–	2	0.87
31 <i>Megaselia</i> sp. (females)	X	3	8	16	19	17	7	–	–	70	30.43
32 <i>Phora artifrons</i> Schmitz	unknown	–	–	–	1	–	–	–	–	1	0.43
33 <i>Phora atra</i> (Meigen)	saprophagous	–	–	–	1	–	–	–	–	1	0.43
34 <i>Phora edentata</i> Schmitz	unknown	–	–	–	1	–	–	–	–	1	0.43
35 <i>Phora holosericea</i> Schmitz	zoophagous	–	–	1	–	–	–	–	–	1	0.43
36 <i>Pseudacteon formicarum</i> (Verrall)	zoophagous	–	–	–	1	–	–	–	–	1	0.43
37 <i>Spiniphora bergentamni</i> (Mik)	necrophagous	–	–	1	–	–	–	–	–	1	0.43
38 <i>Spiniphora dorsalis</i> (Becker)	?saprophagous	–	–	–	1	–	–	–	–	1	0.43
39 <i>Triphleba dudai</i> (Schmitz)	saprophagous	–	–	–	1	–	–	–	–	1	0.43
*40 <i>Xenotriphleba dentistylata</i> Buck	?saprophagous	–	1	–	–	–	–	–	–	1	0.43
Total		9	32	63	72	39	15	0	230	100.00	

3.2. Phenology

During the study, the highest number of species and specimens were observed in July and also in June, and the lowest number in April and September. In October no phorids were collected (Fig.

2). The first individuals of *Megaselia subnudipennis* (23% of the total catch) and *M. ignobilis* (10.9%) were recorded in May. The abundance peaks of these two species occurred in June. *M. pulicaria* – complex (8.7%) and *M. brevicostalis* (4.4%) had their abundance peaks in

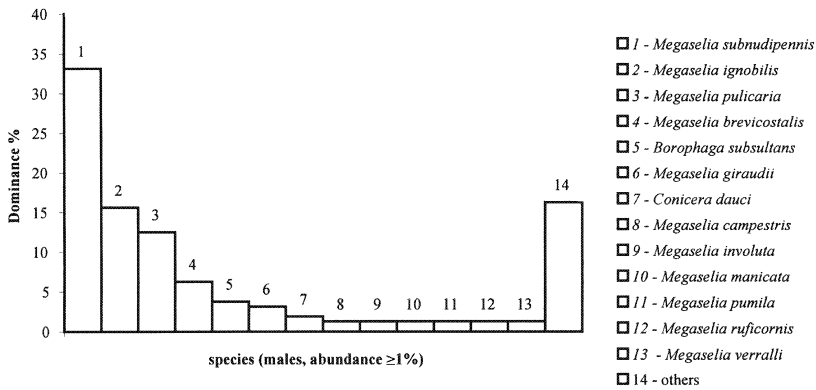


Fig. 1. The dominance structure of the phorid communities in saline habitats of the Gulf of Gdańsk.

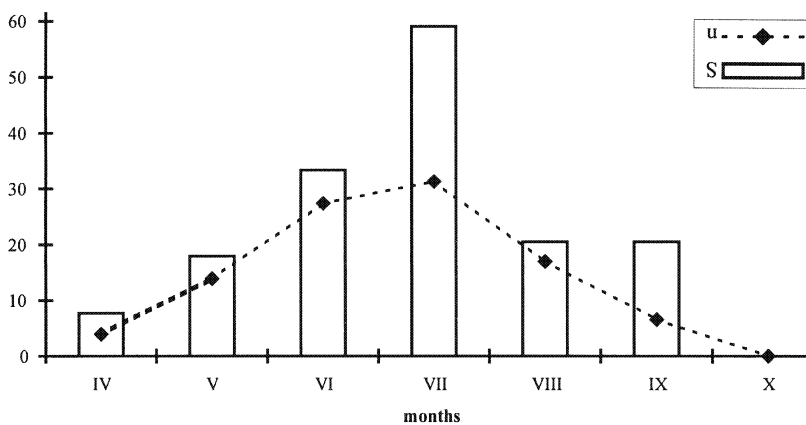


Fig. 2. Seasonal changes in the number of phorid species (S) and relative phorid abundance (n) in saline habitats of the Gulf of Gdańsk.

July. Their first individuals were collected in April.

The phenology of these four most common *Megaselia* species were characterised by one abundance peak during the summer (June–July).

3.3. Species richness and abundance, and trophic groups

The highest number of phorid species were recorded on beaches situated near Gdynia–Wzgórze (over 56% of the species recorded) and Władysławowo (over 35% of species) (Fig. 3).

The highest abundance of scuttle flies was recorded for the beaches in Gdynia–Wzgórze (over 42% of the total numbers of specimens) and Gdańsk–Brzeźno (over 29%) (Fig. 3). The latter locality is a typical sandy beach, with dunes. In Gdańsk–Brzeźno, the most numerous species was necrophagous *Megaselia subnudipennis* (ca.

64%), but in Gdynia–Wzgórze *M. ignobilis* (ca. 21%) dominated. In Gdańsk–Górki Wschodnie no phorids were collected.

The saprophagous and necrophagous phorids (over 50%) were the most abundant group of species with known larval diets. (Fig. 4). Their abundance peaks fell in the summer (June–July) when most organic matter (mostly algae and fishes) was washed ashore (Table 1).

Four *Megaselia* species *M. diversa*, *M. hirticrus*, *M. pleuralis* and *M. pumila* were recorded on the meadows and swamps of the Gulf of Puck (salinity ca 7.4%). These species were not observed in the other investigated habitats.

4. Discussion

Szadziewski (1983) during his investigation of saline flies in different habitats of Poland found infrequent phorid species: *Aenigmatias lubbockii*

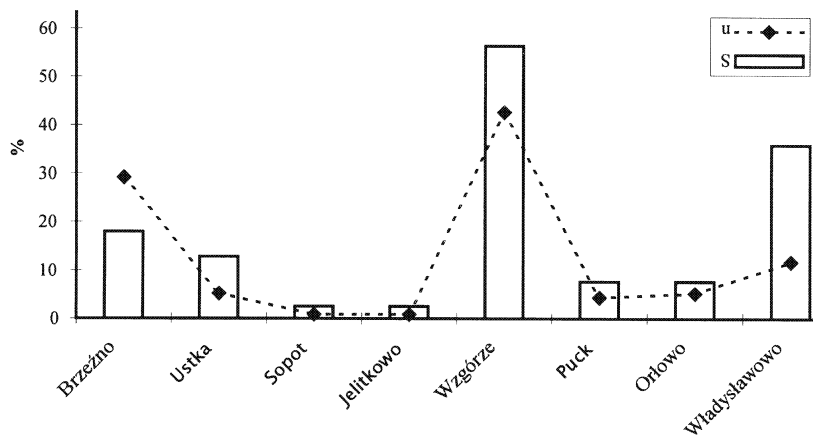


Fig. 3. Comparison of the number of species (S) and abundance (n) of Phoridae in saline habitats of the Gulf of Gdańsk.

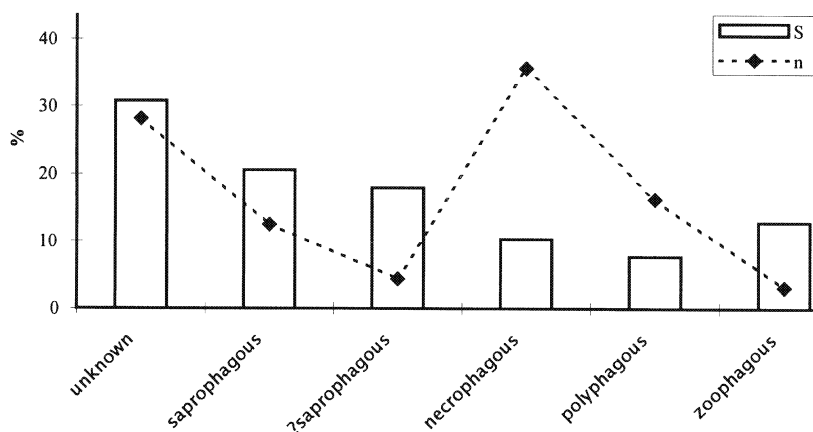


Fig. 4. Comparison of the number of species (S) and abundance (n) of Phoridae of different trophic groups in saline habitats of the Gulf of Gdańsk.

(Verrall), *Megaselia brevicostalis* (Wood), *M. minuta* (Aldrich), *M. pumila* (Meigen), *M. stigmatica* (Schmitz), *M. unguicularis* (Wood), *Pseudacteon formicarum* (Verrall) and *P. lundbecki* Schmitz. Szadziewski (1983) caught no phorids in marine habitats. However, in brackish area of the coastal type, Szadziewski collected six of the above-mentioned species: in Gdańsk–Górki Wschodnie, he collected *M. pumila*, *M. stigmatica*, *M. unguicularis*, *P. formicarum* and *P. lundbecki*, and *M. brevicostalis* on the locality adjacent to the Gulf of Puck. In our study, only three of these species were found, viz. *M. brevicostalis* and *P. formicarum* on the beaches, but *M. pumila* was found near the Gulf of Puck. The lack of phorids in Gdańsk–Górki Wschodnie was related to the few samples caught on this locality.

Neither the authors nor Szadziewski (1983)

found the truly halophilic species. All of the species found in saline areas are known to occupy other habitats, and the most of them are considered as members of the soil-borne insect fauna (Buck 1994, Weber & Schiegg 2001). Saprophagous and necrophagous species dominate especially open sites such as open woodlands (pine plantations) and agricultural habitats (Prescher 1992, Disney 1994, Buck 1997, Durska 2001, 2002).

In the coastal brackish habitats near Puck, we caught only 11 phorid individuals (*M. diversa*, *M. hirticrus*, *M. pleuralis*, *M. pumila* and *Megaselia* spp. females). Of these, *M. diversa* and *M. pleuralis* have previously been recorded by Corbet & Disney (1998) among Diptera trapped in the oil oozing from a dead whale.

The scuttle flies with saprophagous and/or necrophagous larvae, reported from saline habi-

tats, belong to the most abundant trophic group. However, phorid fauna is more numerous in other maritime habitats. The beaches adjacent to the Gulf of Gdańsk are rather polluted and have abundant organic matter, such as decaying animals and washed-ashore algae, that attract saprophagous flies.

In another study, among 51 families of Diptera of saline habitats of the Gulf of Gdansk, the abundance of the scuttle flies made up 0.75% of the total catch (14 sampling positions; E. Kaczorowska, unpubl. data). The most abundant taxa were Chironomidae (ca. 28%), Ephydriidae (ca. 20%) and Chloropidae (ca. 14%). Phorids, with the majority being saprophagous and necrophagous species, peaked in July, when they represented almost 30% of the Diptera.

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