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PHORIDAE (*DIPTERA*) OF WARSAW

ABSTRACT

On the basis of 1066 specimens of *Phoridae* collected in urban green areas of Warsaw, their species composition (36 species), ecological and trophic relationships, and also geographical distribution are characterized. The number of species decreased and the dominance structure was changed when the urban pressure increased.

INTRODUCTION

Phoridae are little known family of flies. Lists of the species occurring in Poland have been prepared only for Pomerania [4, 11, 26, 29—32], partly for south-eastern Poland and the Tatra mountains [9, 12, 23], and recently also for northern part of the country [6]. From Warsaw only Sznabl [33] provides information on *Megaselia rufipes* Mg. reared in his flat located in the Old Town quarter.

The present paper is based on the materials collected in various points of Warsaw as a part of comprehensive zoocoenotic studies dealing with the effect of urban pressure on the fauna. Theoretical premises of these studies, methods, and study area are described elsewhere [3, 17, 22, 35]. The material from Moericke's traps was collected in crowns of such trees as *Tilia* sp., *Acer negundo*, *Acer* sp., *Carpinus betulus*, *Alnus glutinosa*, and *Quercus* sp., all growing in the Łazienki park, the housing estates Stawki and Wierzbno, and in the centre of the town (MDM, Koszykowa street and Wilcza street).

A total of 1066 specimens were identified, or the flies collected in the period from May 26 to October 9, 1976.

The purpose of this paper is to present the species composition of flies of the family *Phoridae* in Warsaw, and to determine their ecological and trophic relationships. Also an attempt was made to analyse the collected *Phoridae* from the point of view of their geographical distribution.

To identify the materials, the keys by Lundbeck, Schmitz and Zajtsev [13, 28, 38] were used.

SPECIES COMPOSITION

In Warsaw 36 species of *Phoridae* have been recorded (Table 7), including 28 in the Łazienki park, 27 in green areas of housing estates, and 19 species in the centre of the town (Table 1). The number of species in the park and in housing estates was similar but it markedly dropped in the centre of the town.

Table 1. The number of species (N), abundance (n) and proportion of *Phoridae* in different types of urban green areas in Warsaw

Habitat	N	%	n	%
Łazienki park	28	77.8	621	58.3
Housing estates (Stawki + Wierzbno)	27	75.0	245	23.0
Centre of the town	19	52.8	200	18.7

In Warsaw, the dominant species is *Megaselia angusta* (Table 2). It also dominates in the Łazienki park. The subdominant species in the town is *Diploneura nitidula*, also being the subdominant in Łazienki and in green areas of housing estates. Green areas of housing estates are dominated by *Megaselia pulicaria*. In the centre of Warsaw, the dominant species is *Megaselia rufipes* (hemisynanthropic species), and the subdominant is *Phalacrotophora fasciata*, a parasite of lady-birds (Table 2).

Table 2. Dominant *Phoridae* in different types of urban green areas in Warsaw (n — number of individuals)

Dominant species	Warsaw							
	Urban green areas							
	Total		Parks		Housing estates		Town centre	
	n	%	n	%	n	%	n	%
Megaselia angusta	244	22.9	207	33.3	23	9.4	14	3.5
Diploneura nitidula	156	14.6	118	19.0	34	13.9	4	2.0
Megaselia pulicaria	115	10.8	31	5.0	52	21.2	32	16.0
Megaselia rufipes	107	10.0	15	2.4	26	10.6	66	33.0
Phalacrotophora fasciata	69	6.5	23	3.7	3	1.2	43	21.5
Other	375	35.2	227	36.6	107	43.7	41	20.5

So far 89 species of *Phoridae* have been recorded from Poland. Among 36 species recorded from Warsaw, 13 have been shown to be new to the fauna of Poland. Thus a total of 102 species of *Phoridae* are known from Poland. It may be expected that the number of species known from Poland and Warsaw will further increase as a result of more detailed study on this family.

ZOOGEOGRAPHICAL ANALYSIS

Among 36 species recorded in Warsaw, the most abundant group of *Phoridae* is represented by the species with European ranges (Table 3). Less abundant group has the Holarctic range. One of the species recorded, *Megaselia picta*, has the cosmopolitan range and another one, *Megaselia rubella*, has the Palaearctic range.

The Łazienki park, green areas of housing estates and the centre of the town are predominated by the species with European ranges (Table 3).

Table 3. Proportions of zoogeographical elements in the *Phoridae* of Warsaw (N — number of species)

Zoogeographical element	Warsaw							
	Urban green areas							
	Total		Parks		Housing estates		Town centre	
	N	%	N	%	N	%	N	%
Cosmopolitan	1	2.80	1	3.60	1	3.70	—	—
Holarctic	14	38.90	12	42.80	11	40.70	10	52.60
Palaearctic	1	2.80	1	3.60	1	3.70	1	5.30
European	20	55.50	14	50.00	14	51.90	8	42.10

The group of *Phoridae* with European ranges, which is very abundant, also includes the species the ranges of which are not precisely known. It is probable that a large proportion of them has Palaearctic and Holarctic ranges.

HABITAT REQUIREMENTS

Most of the *Phoridae* considered here occur in all the types of urban green areas of Warsaw under study (Table 4). A smaller group is represented by the species occurring only in two types of urban green: in the park and in green areas of housing estates. There are also species occurring only in the park or only in housing estates. The smallest group is represented by the species found only in the centre of the town (Table 4).

Adults of all these species have been collected in tree crowns. The literature data show that larvae and adults of *Phoridae* can also be caught in the herb layer and on the soil surface [8, 10, 13, 15, 28]. Adult insects of the genera *Phora*, *Diploneura*, *Megaselia*, *Metopina*, and *Conicera* can be found low at the ground surface, on plants of the genera *Taraxacum*, *Potentilla*, and *Saxifraga* [28].

The larvae of some *Phoridae* live in soil at various depths ranging from 2.5 cm to 1.5 m [14]. But most frequently they can be met on

Table 4. The number of species (N) and the proportion of species for *Phoridae* occurring in urban green areas of one type or common to different types of urban green areas in Warsaw

Types of urban green areas in Warsaw	N	%
Centre of the town	3	8.3
Housing estates	5	13.9
Park	6	16.7
Park + housing estates	6	16.7
Park + housing estates + centre	16	44.4

decaying organic debris in the epigean layer. The decomposition of organic matter cannot be too advanced [28].

Larval and adult *Phoridae* are most often met in forests where moist soil is covered with leaves [28]. They frequently occur in burrows of rodents, ant nests, wasp nests, mushroom-growing cellars, and also in corridors bored by bark beetles [10, 13, 19, 25, 28].

FEEDING HABITS

Feeding habits in flies of the family *Phoridae* are discussed for larvae and adults separately, and only for the species already considered in the literature.

Larvae. In the park, green areas of housing estates and in the centre of the town, the highest proportion of species is represented by saprophages (Table 5).

Table 5. Classification of *Phoridae* living in different types of urban green areas in Warsaw according to the diet of their larvae (N — number of species)

Trophic group	Warsaw							
	Urban green areas							
	Total		Parks		Housing estates		Town centre	
	N	%	N	%	N	%	N	%
Saprophages	14	38.9	11	39.3	8	29.6	7	36.8
Zoophages	2	5.6	2	7.1	1	3.7	1	5.6
Sapro-zoophages	3	8.3	3	10.7	3	11.1	3	15.8
Others (diet unknown)	17	47.2	12	42.9	15	55.6	8	42.1

Zoophagous larvae occur in two endoparasites (Table 5) such as *Borophaga incrassata*, parasitizing larval *Bibio marci* L., and *Phalacrotophora fasciata*. a parasite of lady-bird pupae [18, 21].

The sapro-zoophagous species are represented by *Megaselia giraudii*, *M. rufipes*, and *M. pulicaria*: *M. rufipes* is known as a parasite of *Coleoptera*

[36], locust eggs and flies [20]. It can also be a casual parasite of man [33]. This common species can be found in flats, wasp nests, ant nests, fungi [2, 13, 37], and also in organic matter [5, 13, 33]. *M. giraudii* can parasitize *Thananisimus formicarius* L. (*Cleridae*) [27], it can also feed on dead organic matter [5, 10, 13]. *M. pulicaria* preys upon spider eggs [7]. This species can be found in organic matter [13], ant nests [37], wasp nests, and in fungi [1].

Adults. In this group only *Diploneura cornuta*, a ubiquitous species, is known as a zoophage. It feeds on larvae of other insects [28]. The other species are mostly known as saprophages.

ECOLOGICAL EVALUATION OF THE GROUP

In the material collected there were distinguished dominant species (contributing to more than 5% of the community), subdominant species (from 2 to 5%), influent species (from 1 to 2%) and accessory species (less than 1%) [34].

The number of species and their proportions are shown in Table 6.

Table 6. Dominance structure of *Phoridae* occurring in urban green areas of Warsaw (N — number of species, n — number of individuals)

Class of dominance	N	%	n	%
Dominants	5	13.9	691	64.8
Subdominants	6	16.7	221	20.7
Influents	5	13.9	88	8.3
Accessory species	20	55.5	66	6.2

Since this family is little known, it is difficult to estimate its abundance and expansiveness, as well as the degree of synanthropization. As far as the problem of synanthropization is concerned, we can only suggest that zoophagous species associated with synathropic hosts will be synanthropic. *M. rufipes* is a common hemisynanthropic species [22, 33].

RECAPITULATION

It is not possible to characterize fully the species composition and the origin of the *Phoridae* of Warsaw since the material collected in this town is too scarce, no information on the species occurring in Mazovia is available, and the data on *Phoridae* living in other parts of Poland are not complete. On the basis of the material collected, an attempt was made to provide a general characteristic of this poorly known family which abundantly occurs in Warsaw.

Phoridae were found in all the types of urban green areas under study. Dominants and subdominants living in these habitats belong to common species [13, 28]. When the habitats were arranged along the gradient of increasing urban pressure, the number of species decreased, this being consistent with Pisarski's [24] conclusion that the increase in urban pressure is followed by faunal impoverishment.

Zoogeographical analysis has shown that the species with European ranges are most abundant in Warsaw (Table 3). But many species with poorly known ranges are likely to be included to this group.

The analysis of habitats requirements in *Phoridae* suggests that the larvae and adults of saprophagous species occur in different biotopes but with similar humidity [28]. Some species are likely to have high ecological amplitudes, e. g. eurytopic *Diploneura cornuta*, and some have lower ecological amplitudes, e. g. oligotopic parasites and saprophages which require specific humidity.

Phoridae can occur in epigean and herb layers [13, 15, 28], and also in the tree and shrub layers. They belong to the flies most often caught by Moericke's traps [16].

The *Phoridae* of Warsaw include two endoparasitic species (*Phalacrotophora fasciata* and *Borophaga incrassata*) and three sapro-zoophagous species (*Magaselia rufipes*, *M. giraudii*, *M. pulicaria*). They are dominated by saprophagous species (Table 5).

It is not possible to provide a more detailed ecological characteristic of this group since *Phoridae* are not sufficiently well known.

CONCLUSIONS

1. In Warsaw, 36 species of the family *Phoridae* have been recorded in tree crowns.

2. The number of species in different types of urban green areas of Warsaw dropped with increasing urban pressure; there were 28 species in the Łazienki park and 19 species in the centre of the town.

3. Various types of urban green areas in Warsaw were dominated by different species of *Phoridae*. *Megaselia angusta* predominated in the Łazienki park, *M. pulicaria* in green areas of housing estates, and *M. rufipes*, a hemisynanthropic species, in the centre of the town.

THE SPECIES OF *PHORIDAE* NEW TO THE FAUNA OF POLAND

Chaetopleurophora pygidialis Schmitz

European species. Warsaw: Łazienki park; one female on an oak, caught in August 1976.

Spiniphora bergenstamni (Mik)

Holarctic species. Warsaw: Łazienki park, housing estate Wierzbno; 3 females and 3 males caught on limes and alders from June to September 1976.

Triphleba nudipalpis (Beck.)

European species. Warsaw: centre — Wilcza street 64; 1 male caught on the box-elder in September 1976.

Diploneura cornuta (Bigot)

Holarctic species. Warsaw: centre — Wilcza street 64; 1 female caught on the box-elder in July 1976.

Diploneura ? *glabra* Schmitz

European species. Warsaw: housing estate Stawki; 1 female caught on a lime in July 1976.

Borophaga irregularis (Wood)

European species. Warsaw: housing estate Stawki; 1 male caught on a lime in October 1976.

Megaselia quadriseta Schmitz

European species. Warsaw: Łazienki park, housing estates Wierzbno and Stawki; 17 specimens (15 females and 2 males) caught on limes from June to September 1976.

Megaselia ? *gregaria* (Wood)

European species. Warsaw: Łazienki park, housing estates Stawki and Wierzbno, centre — MDM; 44 specimens (35 females and 9 males) caught on limes, alder, oak, and hornbeam from June to October 1976.

Megaselia ? *morteanseni* Lundb.

European species. Warsaw: Łazienki park, housing estate Wierzbno; 5 females caught on limes and an oak in August and September 1976.

Megaselia pygmaea (Zett.)

European species. Warsaw: Łazienki park, housing estate Wierzbno and Stawki, centre — MDM, Wilcza street 64; 15 specimens (11 females and 4 males) on limes, oak, hornbeam, maple, and box-elder from June to October 1976.

Megaselia rubella Schmitz

Palaearctic species. Warsaw: Łazienki park, housing estate Wierzbno, centre — MDM; 15 specimens (13 females and 2 males) caught on limes, hornbeam, alder, and oak from June to October 1976.

Metopina galeata (Hal.)

European species. Warsaw: Łazienki park, housing estate Wierzbno, centre — MDM, Wilcza street 64; 17 specimens (7 females and 10 males) on limes, oak, maple, and box-elder from June to September 1976.

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Table 7. Check-list of *Phoridae* species occurring in Warsaw

No.	○ — literature data + — unpublished data Species	Warsaw			
		Parks	Green areas in housing estates	Town centre	Other sampling areas
1	2	3	4	5	6
1	*Aneurina thoracica* (Meig.)	+	—	—	—
2	*Chaetopleurophora pygidialis* Schmitz	+	—	—	—
3	*Spiniphora bergenstamni* (Mik)	+	+	—	—
4	*Triphleba nudipalpis* (Beck.)	—	—	+	—
5	*Triphleba distinguenda* (Strobl)	+	—	—	—
6	*Diploneura cornuta* (Bigot)	—	—	+	—
7	*Diploneura* ? *glabra* Schmitz	—	+	—	—
8	*Diploneura nitidula* (Meig.)	+	+	+	—
9	*Borophaga carinifrons* (Zett.)	—	—	+	—
10	*Borophaga incrassata* (Meig.)	+	—	—	—
11	*Borophaga irregularis* (Wood)	—	+	—	—
12	*Conicera atra* Meig.	—	+	—	—
13	*Conicera minuscula* Schmitz	—	+	—	—
14	*Phora aterrima* (Fabr.)	+	+	+	—
15	*Phora schneri* (Beck.)	+	+	+	—
16	*Megaselia giraudii* (Egg.)	+	+	+	—
17	*Megaselia picta* (Lehm.)	+	+	—	—
18	*Megaselia quadriseta* Schmitz	—	+	—	—
19	*Megaselia ruficornis* (Meig.)	+	+	—	—
20	*Megaselia analis* Lundb.	+	—	—	—
21	*Megaselia angusta* (Wood)	+	+	+	—
22	*Megaselia discreta* (Wood)	+	+	+	—
23	*Megaselia flava* (Fall.)	+	—	—	—
24	*Megaselia* ? *frontalis* (Wood)	+	+	—	—
25	*Megaselia* ? *gregaria* (Wood)	+	+	+	—
26	*Megaselia halterata* (Wood)	+	+	+	—
27	*Megaselia lutea* (Meig.)	+	+	+	—
28	*Megaselia minor* (Zett.)	+	+	+	—
29	*Megaselia* ? *mortenseni* Lundb.	+	+	—	—
30	*Megaselia* ? *propinqua* (Wood)	+	+	+	—
31	*Megaselia pulicaria* (Fall.)	+	+	+	—
32	*Megaselia pygmaea* (Zett.)	+	+	+	—
33	*Megaselia rubella* Schmitz	+	+	+	—
34	*Megaselia rufipes* (Meig.)	+	+	+	○
35	*Phalacrotophora fasciata* (Fall.)	+	+	+	—
36	*Metopina galeata* (Hal.)	+	+	+	—

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ZADROWATE (*DIPTERA, PHORIDAE*) WARSZAWY

STRESZCZENIE

Przedstawiono skład gatunkowy *Phoridae* w oparciu o 1066 okazów much zebranych metodą pułapek Moerickego, w zieleni miejskiej Warszawy w 1976 roku. Stwierdzono występowanie 36 gatunków, w tym 13 nowych dla fauny Polski.

Liczba gatunków w badanych typach zieleni miejskiej — park, osiedla, centrum — zmniejsza się wraz ze wzrostem presji urbanizacyjnej, wynosząc odpowiednio: 28, 27 i 19 gatunków. W parkach dominuje *Megaselia angusta*, w osiedlach — *M. pulicaria*, w centrum — hemisynantrop *M. rufipes*.

Stwierdzono, że we wszystkich typach zieleni miejskiej najwyższy udział procentowy mają gatunki o zasięgu europejskim (55,5%) i holarktycznym (38,9%), a pod względem troficznym — saprofagiczne (38,9%).

PHORIDAE (*DIPTERA*) ВАРШАВЫ

РЕЗЮМЕ

На основании 1066 особей *Phoridae*, собранных в 1976 г. в городской зелени Варшавы, представлен их видовой состав (36 видов), экологические и трофические отношения, а также размещение. По мере роста урбанизационного пресса наблюдалось падение количества видов и изменение доминирующих видов.