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Preliminary data of the scuttle flies (Diptera: Phoridae) in the linden-oak-hornbeam forest of the Wigry National Park, North East Poland

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Abstract: Faunistic data on 66 species of geophilous scuttle flies cought by emergence traps placed in 6 sites of the linden-oak-hornbeam forest in the Wigry National Park in summer season of 2017 and 2018 are presented. About 60% of the individuals captured each year were species with at least 10 individuals. The same four dominants: *Megaselia pulicaria*-complex, *M. flava*, *M. abdita* and *Gymnophora arcuata* reached the highest abundance in the compared communities during both study seasons. Species with known biology accounted for only half of the captured species, but among them the most numerous (82%) were species whose larvae were classified as sapro-/necro- and mycophagous.

Key words: Phoridae, linden-oak-hornbeam plots, emergence traps, Wigry National Park

INTRODUCTION

Phoridae are usually dark brown or black small flies, with body size from 1.0 to 5.5 mm for most species. They are one of the most abundant families of Diptera in woodland, meadow, agroecosystem and urban habitats. Scuttle flies, due to their highly diversified life cycles and environmental requirements, as well as relatively high number of species, can be useful in ecological studies (Disney & Durska 2008; Durska 2013, 2015a).

To date, over 4000 species have been described, and one-fourth of these occur in the Palaearctic Region. The most abundant in species is the genus *Megaselia* – about 1500 described species. So far, 359 Phoridae species that have been shown from Poland (Disney 1991; Disney & Durska 1998, 2011, 2014, 2017, 2020). Faunistic data on scuttle fly community in the Wigry National Park are presented for the first time.

The first collected data allowed to describe 8 species new to sciences (Disney & Durska 2017, 2020). Currently, the composition of the Phoridae groups breeding in the soil of the hail environments of the WNP was discussed based on data from 2017/18.

MATERIALS AND METHODS

The study is based on the material collected in the Wigry National Park (WNP), the north-eastern edge of Augustów Forest, which is a large forest complex in NE Poland (54°01′ N 23°05′ E). The main forested area of the Park is covered by the association of sub-continental linden-oak-hornbeam wood (Tilio-Carpinetum). The scuttle flies were collected using emergence traps (Durska 2015b), on six linden-oak-hornbeam plots, all in Sobolewo environs:

- Stand 1 – Tilio-Carpinetum calamagrostietosum typicum, 54°01'57"N, 22°59'34"E, 167 m a.s.l, forest district 92d;
- Stand 4a – Tilio-Carpinetum calamagrostietosum typicum, 54°01'51"N, 23°01'27"E, 154 m a.s.l., forest district 127c;
- Stand 4b – Tilio-Carpinetum typicum, 54°01'56"N, 23°00'55"E, 154 m a.s.l. forest district 116f;
- Stand 4c –Tilio-Carpinetum calamagrostietosum typicum, 54°01'53"N, 23°01'06"E, 153 m a.s.l., forest district 116g;

- Stand 5 – Tilio-Carpinetum typicum, 54°04'23"N, 23°00'55"E, 149 m a.s.l., forest district 52c;
- Stand 6 – Tilio-Carpinetum typicum, 54°04'30"N, 23°00'59"E, 161 m a.s.l., forest district 51c.

Three emergence traps were deployed in each of the six plots in 2017 (from 23th May to 8th September) and 2018 (from 29th May to 24th September) (Fig. 1).

Fig. 1. The emergence traps placed on the stand 4B (fot. A. Leidel).

The collected material of Phoridae were identified using a microscope (Leica) and then placed in the tubes with alcohol. The identified material is deposited in the collection of Museum and Institute of Zology PAS in Warsaw and in the University of Cambridge Museum of Zoology (UCMZ).

RESULTS

During the two years study (2017 and 2018), using emergence traps, were collected 1021 scuttle fly individuals (2017: N = 607, 2018: N = 414), represented by 66 identified species (Table 1). The male-to-female sex ratio reached 5.19.

On six oak-hornbeam plots 53 scuttle fly species (plus *Megaselia* sp. 'A' and *Megaselia* sp. 'B') were identified in 2017. The following thirteen species were the dominants (abundance ≥ 10 individuals): *M. pulicaria*-complex (N = 110), *M. flava* (N = 63), *M. abdita* (N = 49), *Gymnophora arcuata* (N = 30), *M. lata* (N = 27), *M. campestris* (N = 16), *M. sornectergata* (N =16), *M. flavicans* (N =14), *M. meconicera* (N = 14), *M. obscuripennis* (N = 13), *M. giraudii*-complex (N =11), *M. fumata* (N = 10) and *M. zonata* (N = 10). The total abundance of these dominant species (N = 383) accounted over 63 % of the scuttle fly community.

Table 1. Phoridae found in the linden-oak-hornbeam forest of the Wigry National Park. Dominant species, at least at one site of the habitat types (xx ≥10 individuals; xxx ≥ 100 individuals), are shown in bold type; * – species whose locus typicus relates to the sites studied (Disney & Durska 2017, 2020); [a] – probable trophic group of larvae.

No	Species	2017	2018	Larval diet
1	***Conicera floricola*** Schmitz	-	xx	sapropagous
2	***Gymnophora arcuata*** (Meigen)	xx	xx	unknown
3	***Gymnophora quartomollis*** Schmitz	-	xx	unknown
4	***Megaselia abdita*** Schmitz	xx	xx	necrophagous
5	*Megaselia aculeata* (Schmitz)	x	x	unknown
6	**Megaselia aliusalius* Disney	x		unknown
7	*Megaselia altifrons* (Wood)	x	x	[a] saprophagous
8	*Megaselia angusta* (Wood)	x	-	unknown
9	*Megaselia bovista* (Gimmerthal)	x	x	mycophagous
10	*Megaselia brevicostalis* (Wood)	**x**		polysaprophagous
11	***Megaselia campestris*** (Wood)	xx	x	unknown
12	*Megaselia ciliata* (Zetterstedt)	x	-	zoophagous
13	*Megaselia citrinella* Buck		x	unknown
14	***Megaselia dahli*** (Becker)	-	xx	unknown
15	*Megaselia dimidia* Schmitz	x		unknown
16	*Megaselia diversa* (Wood)	x		[a] sapropagous
17	***Megaselia elongata*** (Wood)	x	xx	zoophagous
18	**Megaselia* sp. *exwignatpark* Disney	x		unknown
19	***Megaselia flava*** (Fallén)	xx	xx	mycophagous
20	*Megaselia flavescens* (Wood)	x		unknown
21	***Megaselia flavicans*** Schmitz	xx	x	unknown
22	***Megaselia flavicoxa*** (Zetterstedt)	x	xx	zoophagous
23	*Megaselia frameata* Schmitz	x	x	mycophagous
24	***Megaselia fumata*** (Malloch)	xx	x	unknown
25	*Megaselia fusca* (Wood)	x	-	[a] saprophagous
26	*Megaselia fuscovariana* (Schmitz)	x	-	unknown
27	***Megaselia giraudii***–complex	xx	x	polysaprophagous
28	*Megaselia gregaria* (Wood0	x	-	unknown
29	*Megaselia halterata* (Wood0	x	x	mycophagous
30	*Megaselia hirsuta(Wood0*	x	-	unknown
31	***Megaselia ignobilis*** (Schmitz)	x	xx	unknown
32	*Megaselia involuta* (Wood)	-	x	unknown
33	***Megaselia lata*** (Wood)	xx	x	mycophagous
34	*Megaselia latifrons* (Wood)	x	x	unknown
35	*Megaselia longicostalis* (Wood)	x	x	necrophagous
36	*Megaselia lutea* (Meigen)	x	-	mycophagous
37	*Megaselia major* (Wood0	x		unknown
38	***Megaselia meconicera*** (Speiser)	xx	x	[a] saprophagous
39	*Megaselia minor* (Zetterstedt)	x	-	necrophagous
40	*Megaselia nasoni* (Malloch)	-	x	zoophagous
41	*Megaselia nigra* (Meigen)	1		mycophagous
42	***Megaselia obscuripennis*** (Wood)	xx	5	zoophagous
43	*Megaselia picta* (Lehmann)	-	x	unknown
44	**Megaselia* sp. *pilusdepilata* Disney	x		unknown

Table 1 continued on the next page

Continuation of the Table 1

No	Species	2017	2018	Larval diet
45	*Megaselia pleuralis* (Wood)	x	-	polysaprophagous
46	**Megaselia polonici* Disney	-	x	unknown
47	*Megaselia propingua* (Wood)	x	x	unknown
48	***Megaselia pulicaria***-complex	xxx	xx	polysaprophagous
49	*Megaselia pumila* (Meigen)	x	x	mycophagous
50	*Megaselia pusilla* (Meigen)	x	x	saprophagous
51	**Megaselia quasirufifrons* Disney	x		unknown
52	**Megaselia reduncus* Disney	-	x	unknown
53	*Megaselia rubella* (Schmitz)	x	x	mycophagous
54	*Megaselia ruficornis* (Meigen)	x	-	saprophagous
55	*Megaselia rufipes* (Meigen0	-	x	polysaprophagous
56	*Megaselia scutellaris* (Wood0	x	x	mycophagous
57	**Megaselia setaeneclobi* Disney	x		unknown
58	***Megaselia sornectergata*** Disney	xx	x	unknown
59	*Megaselia subnudipennis* (Schmitz)	-	x	necrophagous
60	*Megaselia sulphuripes* (Meigen)	x	-	unknown
61	*Megaselia sylvatica* (Wood0	x	x	mycophagous
62	*Megaselia unicolor* (Schmitz)	x	x	[a] saprophagous
63	*Megaselia verralli* (Wood)	x	x	unknown
64	**Megaselia wigryensis* Disney	-	x	unknown
65	***Megaselia zonata*** (Zetterstedt)	xx	x	unknown
-	*Megaselia* sp. A	x		unknown
-	*Megaselia* sp. B	x		unknown
-	*Megaselia* sp. males	-	xx	-
-	*Megaselia* sp. females	xx	xx	-
-	*Phora* sp. females	xx	x	-
66	*Triphleba lugubris* (Meigen)	-	x	zoophagous

In the collected material, on the same six plots, 44 scuttle fly species were identified in 2018, among which the largest numbers reached ten dominant species (abundance ≥10 individuals): *M. pulicaria*-complex (N = 57), *M. flava* (N = 31), *Gymnophora quartomollis* (N = 26), *G. arcuata* (N = 24), *M. dahli* (N = 23), *M. flavicoxa* (N =21), *M. ignobilis* (N = 20), *M. abdita* (N = 15), *Conicera floricola* (N = 12) and *M. elongata* (N = 10). The dominants (N = 239) accounted almost 58 % of the phorid community.

The scuttle fly species, with a known biology (or probably known biology), accounted for over 51 % (S = 34) of the compared species. Among them, the most numerous group (S = 28) were species with the sapro-/necro- and mycophagous larvae (over 82 %). The rest group consisted of six species with zoophagous larvae (*Megaselia ciliata* – facultative parasitoid of slugs: *Arion* sp., *Deroceras* sp., *Megaselia elongata* - facultative parasitoid of Julidae, *Megaselia flavicoxa* and *Megaselia obscuripennis* – parasitoid of Sciaridae, *Megaselia nasoni* prey on spider eggs, and *Triphleba lugubris* – parasitoid of queen pupae of Vespidae).

The differences in the number of species found on the plots in 2017 ranged from four to forty species. Whereas in 2018, differences in the number of species found on particular plots were small, from fourteen to nineteen species.

COMMENTS

During the study on Phoridae in Wigry National Park in 2017 and 2018, conducted on the six plots, 1021 specimens were collected, represented by 66 species, among them eight species from the genus *Megaselia* were described as new to science in 2017 and 2020 (Table 1) (Disney & Durska 2017, 2020).

The same four dominants: *M. pulicaria*-complex, *M. flava*, *M. abdita* and *Gymnophora arcuata* was found in both comparable communities (Table 1).

The most of the scuttle fly species found on the plots are common species with wide range of occurrence, but among the dominants *M. sornectergata* is the species new to the Polish fauna (Table 1) (Disney 1991; Durska 2013, 2015a; Disney & Durska 2020).

The male-to-female sex ratio using the emergence trap method reached 5.19, in contrast to data obtained using yellow plastic pans from habitats after fire (sex ratio: 0.13) (Durska 2015a). It is worth adding that the sex ratios of Phoridae obtained in field collection, compared to those from rearings, are often dominated by one sex (Disney 1994). Based on the above data, it can be concluded that the differences in sex ratios obtained in these studies are related not only to the behaviour between the sexes, but also to the trapping method (Disney 1994, Durska et al. 2010, Durska 2013, Prescher et al. 2002).

It could be assumed, that the lower species richness and lower abundance of Phoridae species found in the 2018 samples compared to 2017 may be associated with exceptionally high temperature and low rainfall in 2018.

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STRESZCZENIE

[**Wstępne dane dotyczące zadrowatych (Diptera: Phoridae) lasu lipowo-grądowego w Wigierskim Parku Narodowym**]

W pracy przedstawiono pierwsze dane o zadrowatych (Diptera: Phoridae) wykazanych z lasów lipowo-grądowych Wigierskiego Parku Narodowego. W materiale Phoridae, zebranym w letnich sezonach roku 2017 i 2018 metodą pułapek naziemnych rozstawionych na sześciu stanowiskach, stwierdzonych zostało 66 gatunków zadrowatych, w tym osiem gatunków zostało stąd wykazanych jako nowe dla nauki. Ponad 60 % wszystkich osobników należało do gatunków zebranych w liczebnościach powyżej 10 osobników. W porównywanych zgrupowaniach obu badanych sezonów stwierdzono te same cztery dominanty, tj. *Megaselia pulicaria*-complex, *M. flava*, *M. abdita* i *Gymnophora arcuate*. Gatunki o znanej biologii stanowią zaledwie połowę stwierdzonych tu gatunków, jednakże wśród nich najliczniej reprezentowane (82% osobników) były gatunki, których larwy są zaklasyfikowane jako sapro-/nekro- i mykofagi.

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