

Overview of selected non-target Dipteran species collected from mosquito traps at Košice Zoo

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Abstract

We summarize the results of a faunistic survey of selected Diptera families from the Zoo Košice. The specimens were collected in conjunction with mosquitoes using a BG-Sentinel 2 trap, with CO₂ as an attractant. Our study focused on non-target Diptera families that were captured during mosquito monitoring and collection. In total of eight fly families, comprising 32 species, were identified. The recorded species were categorized according to their frequency of occurrence in the traps. Half of the recorded species (16 species) were found sporadically. Seven species were considered uncommon, while four species were regularly encountered in the traps. Additionally, five species were identified as very common, including *Tinearia alternata* (Say, 1824) and *Psychodocha cinerea* (Banks, 1894) from the family Psychodidae, as well as *Limonia nubeculosa* Meigen, 1804, *Limonia macrostigma* (Schummel, 1829), and *Atypophthalmus (Atypophthalmus) inustus* (Meigen, 1818) from the family Limoniidae. We hypothesize that these species are attracted to CO₂, which is also emitted during the decomposition of organic matter. Consequently, BG-Sentinel traps may be suitable for capturing not only blood-sucking flies but also a broader range of Diptera species.

Keywords: flies, faunistics, CO₂ trap, frequency

Introduction

The BG-Sentinel traps (BIOGENTS, Germany) and their modifications are widely employed for monitoring populations of day-feeding mosquitoes (e.g. Farajollahi et al. 2009; Cotteaux-Lautard et al. 2013; Arimoto et al. 2015; Diouf et al. 2021; Cilek et al. 2024). These traps are less commonly used for monitoring other blood-sucking flies, such as those from families Ceratopogonidae (e.g. Carvalho et al. 2021; Steele and McDermott 2024), Hippoboscidae (González et al. 2024), Simuliidae (Ruiz-Arrondo et al. 2023), or Phlebotominae (Obenauer et al. 2012; Rodríguez-Rojas et al. 2024).

In addition to the target group, such as mosquitoes and other blood-sucking flies, BG-Sentinel traps often attract variety of other organisms, particularly agile Diptera. To the best of the authors' knowledge, no similar study has specifically focused on these non-target groups. However, these organisms are often considered unwanted samples and are discarded as waste (Grundmann et al. 2025).

In this study, we focused on these non-target organisms, specifically selected certain Diptera groups for analysis. Species from the family Phoridae (see Grundmann et al. 2025) and from group Bibionomorpha will be discussed separately.

Material and methods

The flies included in this work were sampled alongside mosquitoes using a BG-Sentinel 2 trap, with CO₂ as the attractant (see Figure 1). Two traps were positioned near

small lakes within Zoo Košice (see locality data, Figure 2) and operated continuously from July (with the first collection on July 17) until the end of October (with the final collection on October 28). The nets containing the captured insects were replaced twice a week and stored at –20°C until transport to the laboratory, where they were subsequently sorted at –80°C. The samples were later tested for West Nile and Usutu viruses.



Figure 1. Photograph of BG-Sentinel 2 traps (Biogents, Germany) from Zoo Košice (Grundmann et al. 2025).

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After sorting the mosquitoes, the remaining material was preserved in 75% alcohol. The collected flies then sorted to the family level and identified to the species level.

J. Oboňa identified the following families using the corresponding keys: Hippoboscidae (Oboňa et al. 2019), Limoniidae (Podenas et al. 2006; Oosterbroek 2024), Lonchopteridae (Bährmann & Bellstedt 1988), Psychodidae (Withers 1989; Ježek 1977, 1990), Ptychopteridae (Zitek-Zwyrtek 1971), and Trichoceridae (Krzemińska 2021).

J.-P. Haenni identified Scatopsidae using Cook (1974). B. Grundmann identified Sphaeroceridae using the keys of Pitkin (1988) and Roháček (1983, 1984, 1985).

Locality data (See also Figure 2):

Horný rybník – Upper pond (HR): 48°47'11.4"N
21°12'11.9"E, 412 m a.s.l.

Dolný rybník – Lower pond (DR): 48°47'20.6"N
21°12'22.0"E, 411 m a.s.l.

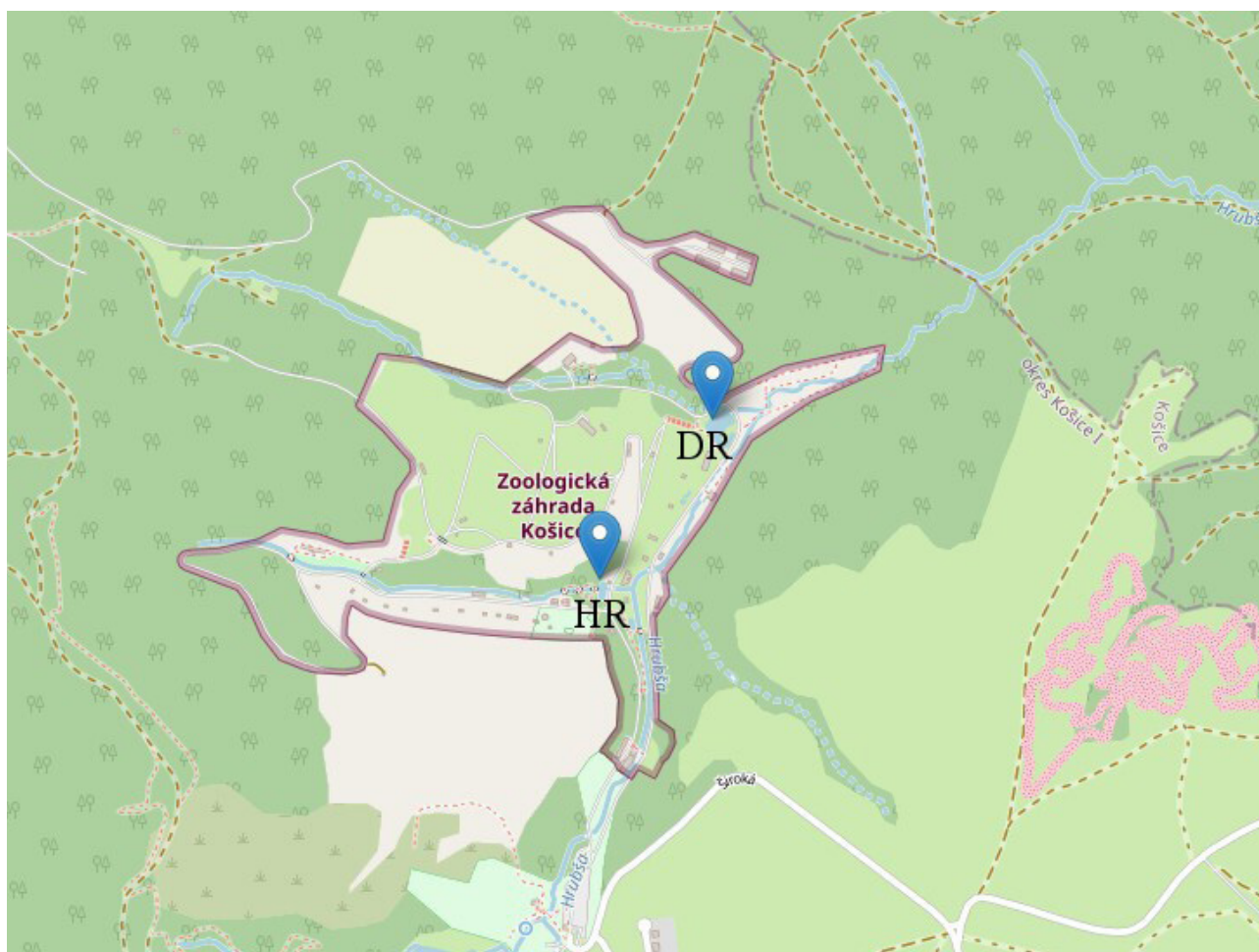


Figure 2. Map of Košice Zoo with points (HR – Horný rybník (Upper pond); (DR) – Dolný rybník (Lower pond) with orthophoto background, generated using the Folium tool. Created as part of an interaction with ChatGPT.

In paragraph **Note**: species are categorized according to the frequency of occurrence in traps (1 case = 1 qualitative presence; a total of 50 cases) into the following categories: sporadic (one occurrence), not common (two occurrences), common (between two and five occurrences, or less than 10%), and very common (more than five occurrences, or more than 10%).

In paragraph **Comment**: a brief note on each species is provided, with the source of the identification either from the determination literature or from Roháček & Ševčík (2009).

Results

A total of 32 species belonging in eight families were found in the BG-Sentinel 2 traps, namely: Hippoboscidae (2 spp.), Limoniidae (12 spp.), Lonchopteridae (1 sp.), Psychodidae (2 spp.), Ptychopteridae (1 sp.), Scatopsidae (3 spp.), Sphaeroceridae (10 spp.), and Trichoceridae (1 sp.) (see the Annotated list of recorded species).

Annotated list of recorded species**Diptera****Hippoboscidae***Lipoptena cervi* (Linnaeus, 1758)**Note:** sporadically**Comment:** A widespread and common native blood sucking species in Europe, known as deer ked.*Lipoptena fortisetosa* Maa, 1965**Note:** sporadically**Comment:** A widespread and common not native blood sucking species in Europe, known as Asian deer ked.**Limoniidae***Achyrolimonia decemmaculata* (Loew, 1873)**Note:** not common**Comment:** A species widespread in Europe.*Atypophthalmus (Atypophthalmus) inustus* (Meigen, 1818)**Note:** very common**Comment:** A probably saproxylic species, widespread in Europe.*Discobola annulata* (Linnaeus, 1758)**Note:** common**Comment:** A saproxylic and/or fungivorous species, widespread in Europe.*Epiphragma (Epiphragma) ocellare* (Linnaeus, 1760)**Note:** not common**Comment:** A species associated with a dead *Fagus* wood, widespread in Europe.*Erioptera (Erioptera) lutea* Meigen, 1804**Note:** common**Comment:** A eurytopic, ubiquitous species inhabiting a wide spectrum of habitats, widespread in Europe.*Ilisia maculata* (Meigen, 1804)**Note:** sporadically**Comment:** A marshland species, widespread in Europe.*Limonia macrostigma* (Schummel, 1829)**Note:** very common**Comment:** A marshland species, widespread in Europe.*Limonia nubeculosa* Meigen, 1804**Note:** very common**Comment:** A eurytopic, ubiquitous species inhabiting a wide spectrum of habitats, widespread in Europe.*Metalimnobia (Metalimnobia) quadrimaculata* (Linnaeus, 1760)**Note:** common**Comment:** A species associated with the wood-decaying fungus, widespread in Europe.*Molophilus (Molophilus) ochraceus* (Meigen, 1818)**Note:** sporadically**Comment:** A marshland species, widespread in Europe.*Pseudolimnophila (Pseudolimnophila) sepium* (Verrall, 1886)**Note:** common**Comment:** A marshland species, widespread in Europe.*Rhipidia (Rhipidia) maculata* Meigen, 1818**Note:** sporadically**Comment:** A species associated with the rotting wood, widespread in Europe.**Lonchopteridae***Lonchoptera strobli* de Meijere, 1906**Note:** sporadically**Comment:** A common species in Central Europe, particularly in wet forests.**Psychodidae***Psychodocha cinerea* (Banks, 1894)**Note:** very common**Comment:** A eurytopic, ubiquitous species inhabiting a wide spectrum of habitats, widespread in Europe.*Tinearia alternata* (Say, 1824)**Note:** very common**Comment:** A eurytopic, ubiquitous species inhabiting a wide spectrum of habitats, widespread in Europe.**Ptychopteridae***Ptychoptera longicauda* (Tonnoir, 1919)**Note:** sporadically**Comment:** Species included in the Data Deficient (DD) category – a species with a lack of data in Slovakia.**Scatopsidae***Apiloscatopse flavicollis* (Meigen, 1818), female.**Note:** sporadically**Comment:** A widespread and common species in wooded areas of whole of Europe.*Apiloscatopse scutellata* (Loew, 1846)**Note:** not common**Comment:** A widespread and common species in wooded areas of whole of Europe.*Holoplugia lucifuga* (Loew, 1870) (Figure 3)**Note:** sporadically

Comment: A rarely collected species in wooded areas of temperate Europe. Immature stages in rotten wood of senescent trees.



Figure 3. *Holoplagia lucifuga* (Loew, 1870) from Zoo Košice.

Sphaeroceridae

Apteromyia claviventris (Strobl, 1909)

Note: sporadically

Comment: Species known from most of Europe and living in leaf litter and various cavernicolous habitats.

Bifronsina bifrons (Stenhammar, 1855)

Note: sporadically

Comment: A common species, occurring in various rotting matter.

Coproica ferruginata (Stenhammar, 1855)

Note: sporadically

Comment: A very common species, particularly abundant on accumulated excrement.

Coproica hirtula (Rondani, 1880)

Note: sporadically

Comment: A synanthropic common species, polysaprophagous.

Ischiolepta pusilla (Fallén, 1820)

Note: not common

Comment: A polysaprophagous (preferably coprophagous) and habitat-tolerant species.

Minilimosina fungicola (Haliday, 1836)

Note: not common

Comment: A polysaprophagous widespread species.

Svarciella v-atrum (Villeneuve, 1917)

Note: sporadically

Comment: A polysaprophagous species of the zone of deciduous forest.

Pullimosina heteroneura (Haliday, 1836)

Note: sporadically

Comment: A common polysaprophagous and eurytopic species, living in various decayed substrates.

Pullimosina vulgesta Roháček, 2000

Note: not common

Comment: A very common species, in grassland habitats in Central Europe.

Spelobia clunipes (Meigen, 1830)

Note: not common

Comment: A polysaprophagous and very common species developing in various rotting substrates.

Trichoceridae

Trichocera (Saltrichocera) recondita Starý, 2000

Note: sporadically

Comment: A more common species at least in central Europe. Adults fly from end of September till December.

Discussion

Except for the family Hippoboscidae, which is the target group, we present an overview of selected non-target Diptera species captured in mosquito traps at Zoo Košice. Half of the identified species (16 spp. – 50%) were found only sporadically, likely representing random occurrences in the traps. Seven species (22%) were considered uncommon, indicating repeated occurrence in the traps. This raises the question of whether these species represent random occurrences or if the traps provide an attractant for these groups of organisms as well. Four species (12%) were commonly captured, namely *D. annulata*, *E. (E.) lutea*, *M. (M.) quadrimaculata*, *P. (P.) sepium*, all from the family Limoniidae. Five species (16%) were very common, including *T. alternata* and *P. cinerea* from the family Psychodidae, as well as *L. nubeculosa*, *L. macrostigma* and *A. (A.) inustus* from the family Limoniidae. All the species mentioned in both categories are likely saprophagous (Oosterbroek 2024; Ježek 1977, 1990). *D. annulata*, *M. (M.) quadrimaculata*, *A. (A.) inustus* are more saproxylic, while *P. (P.) sepium* prefers marshland habitats, alongside *L. macrostigma*. *E. (E.) lutea* is a eurytopic, ubiquitous species inhabiting a wide range of habitats, similar to *L. nubeculosa*, *T. alternata*, and *P. cinerea*. Therefore, we hypothesize that these species are attracted by CO₂, which is also produced during the decomposition of organic material. To the best of our knowledge, no comparable studies have been conducted across Europe, and as such, this work can be considered a ‘pilot’ study”. These traps, therefore, may be suitable not only for capturing blood-sucking flies but also for a border range of Diptera species.

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