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ANNOTATED LIST OF SPECIES

Annotated checklist of louse flies (Diptera, Hippoboscidae) occurring in Estonia

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Abstract. Previous data on Estonian louse flies (Diptera, Hippoboscidae) are dispersed across various, mainly local scientific articles and popular science writings, making them inaccessible to a broader international audience. No comprehensive species list or reviews are currently available. This study consolidates data from published sources, insect collections, and newly collected specimens to provide a comprehensive species list, supplemented with voucher specimen information. In total, nine species are confirmed to occur in Estonia, including two species, *Ornithomya chloropus* (Bergroth, 1901) and *O. fringillina* Curtis, 1836, recorded for the first time. Two species associated with livestock, *Hippobosca equina* Linnaeus, 1758 and *Melophagus ovinus* (Linnaeus, 1758), have been rarely encountered and are apparently nearing local extinction due to the increased use of effective insecticides and a decline in farming. Collection locality maps and habitus photographs from collected specimens are provided for all nine Estonian species.

Key words. Distribution, Europe, faunistics, new country records, taxonomy.

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INTRODUCTION

The louse flies (Diptera, Hippoboscidae) are obligatory hematophagous ectoparasites of mammals and birds. There are more than 210 species known worldwide, including 34 species in Europe (Oboňa et al. 2019, 2023; Levesque-Beaudin and Sinclair 2021; Keve et al. 2024; Gonzáles et al. 2024). Recent decades have seen a revitalized study of the Hippoboscidae, including their systematics and ecology, as well as investigations into their genomics and ability to transmit pathogens (e.g., Oboňa et al. 2019; Gałęcki et al. 2020; Werszko et al. 2020; Li et al. 2022; Yatsuk et al. 2023; Keve et al. 2024). A modern taxonomic key to European Hippoboscidae, allowing reliable identification of 31 of the 34 species, has recently been published by Oboňa et al. (2022).

For Estonia, data on Hippoboscidae are rather scanty and scattered across various local and popular science publications, which are mainly in Estonian, and thus not accessible to a wider audience. There are no synopses or checklists of Estonian hippoboscid flies available. The first data on Hippoboscidae in the Baltic region date back to the mid-19th century when Gimmerthal (1842) noted *Hippobosca equina* Linnaeus, 1758 from Livland (corresponding to the northern part of modern-day Latvia and southern Estonia) and Kurland (western Latvia), which, however, cannot be unequivocally associated with Estonia. The first reliable data on Hippoboscidae in Estonia come from Sintenis (1899), who listed two species: *H. equina* and *Lipoptena cervi* (Linnaeus, 1758). In a brief summary of Estonian invertebrates, Elberg (1995) mentioned a total of seven species as occurring in Estonia but listed only *H. equina* and *L. cervi* at the species level. Kurina et al. (2019) recently added *Lipoptena fortisetosa* Maa, 1968 to the Estonian fauna. The aim of this paper is to summarize all available information on Estonian Hippoboscidae and make it accessible to a wider, international audience.

STUDY AREA

Estonia is located in northeastern Europe, along the eastern shores of the Baltic Sea, positioned within the East European Plain between latitudes 57.50 and 59.82 and longitudes 021.77 and 028.22. Covering an

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area of 45,335 km^2, Estonia is bordered by the Gulf of Finland to the north, the Baltic Sea to the west, Latvia to the south, and Lake Peipsi and Russia to the east. The country falls within a temperate climate zone and serves as a transitional area between maritime and continental climates, placing it at the northern and/or eastern limit of many species' ranges. According to the European Environment Agency (2024), Estonia ranks among the most biodiverse regions for territories of comparable size and latitude.

In the study of Estonian Hippoboscidae, various localities across the country were sampled (e.g. see Figure 1A for collecting localities of *Lipoptena* spp.). The Kabli Ornithological Station on the south-western coast (locality No. 34) and the Vaibla Ornithological Station north of Lake Võrtsjärv (locality No. 69) served as the main collecting sites for bird-associated *Ornithomya* spp.

METHODS

To provide an overview of the published data on Estonian Hippoboscidae, we meticulously surveyed all available literature sources. The majority of the published sources listed below included only the species name without specific data on their occurrence or voucher specimens. However, in cases where specimen data are included in the original publication, we indicate the collecting locality in parentheses after the page number and display it on the corresponding map.

In addition, we rechecked and identified all available hippoboscid material accumulated in Estonian insect collections when necessary. In 19-century material studied, we refer to the original spelling of collecting localities in square brackets. Moreover, targeted collecting was conducted in the summer-autumn seasons from 2020 to 2023. In most cases, the specimens were collected when attacking humans. At the Kabli and Vaibla ornithological stations, the *Ornithomya* specimens were collected during the ringing and measuring of migrating birds. However, usually, the flies left the bird immediately after its capture, thus, the collecting method used does not predominantly allow association of the fly and bird species. When available, we specify the host bird species alongside the fly record below.

The new material is stored in ethyl alcohol, while old collection material is pinned. In total, we studied 383 specimens (in 'Material examined' sections abbreviated as 'spec'). Collecting details of all studied specimens are provided in 'Material examined' sections along with numeric references to localities on respective figures. The material is deposited in the insect collection of the Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences (former Institute of Zoology and Botany), Tartu, Estonia (IZBE) and in the Zoological Museum University of Tartu, Estonia (TUZ). The voucher specimens' data are also accessible via the Estonian eBiodiversity data portal (https://elurikkus.ut.ee; Abarenkov et al. 2010).

We captured images of the species' dorsal habitus using a Leica K5C camera mounted on a Leica 205C stereomicroscope and processed them with LAS X software. We enhanced sharpness using Topaz Sharpen AI software and made final adjustments to the plates using Adobe Photoshop CS5 (see also Kjærandsen et al. 2022).

RESULTS

Our study of the collection and more recently collected material, totalling 383 specimens, yielded a total of nine species, two of which were recorded from Estonia for the first time. The most abundant species was *Lipoptena cervi*, with 192 specimens, followed by *Ornithomya avicularia* (Linnaeus, 1758) and *O. fringillina* Curtis, 1836, with 63 and 47 specimens, respectively. The remaining species were less abundant.

Subfamily Hippoboscinae

Hippobosca equina Linnaeus, 1758

Figures 1B, 2D

Literature sources. Sintenis 1899: 182, 191; Dampf 1924: 55 (Figure 1B: No. 12); Remm 1956: 255; Elberg 1995: 460; Chinery 2005: 212; Martin 2008: 495.

Material examined. ESTONIA – Saare County • Püha [Oesel, Kirschpiel Pyha] (Figure 1B: No. 10); 58.3083, 022.7167; 21.VII.1851; G.A.A. von Flor leg.; 2 spec, IZBE0255234, IZBE0255235, on pins – Pärnu County • Viluvere (Figure 1B: No. 31); 10.VII.1954; collector unknown; 1 spec, TUZ358758, on pin • Kilingi-Nõmme [Quellenstein] (Figure 1B: No. 36); 58.15, 025.0222; VI.1883; M. von zur Mühlen leg., 1 spec, IZBE0255230, on pin – Lääne-Viru County • Võsu-Esku (Figure 1B: No. 55); 59.5620, 026.0555; VIII.1931; Vannary leg.; 1 spec, IZBE0255238, on pin – Ida-Viru County • Uljaste (Figure 1B: No. 58); 59.3806, 026.7667; 05.VIII.1934; D. Kuskov leg.; 1 spec, IZBE0255237, on pin • Karjamaa village near Remniku (Figure 1B: No. 61), 59.0264, 027.4784, 13.VII.1962; H. Remm leg; 1 spec, TUZ358731, on pin – Tartu County • Tartu [Dorpat, um Ufer Embach, Techelfer] (Figure 1B: No. 73); 58.3940, 026.7667; 09.IX.1852; G.A.A. von Flor leg.; 1 spec, IZBE0255236, on pin • Tartu [Dorp.] (Figure 1B: No. 73); without collecting date and collector name; 1 spec, TUZ358754, on pin • Tartu [Dpt.], (Figure 1B: No. 73); without collecting date and collector name;

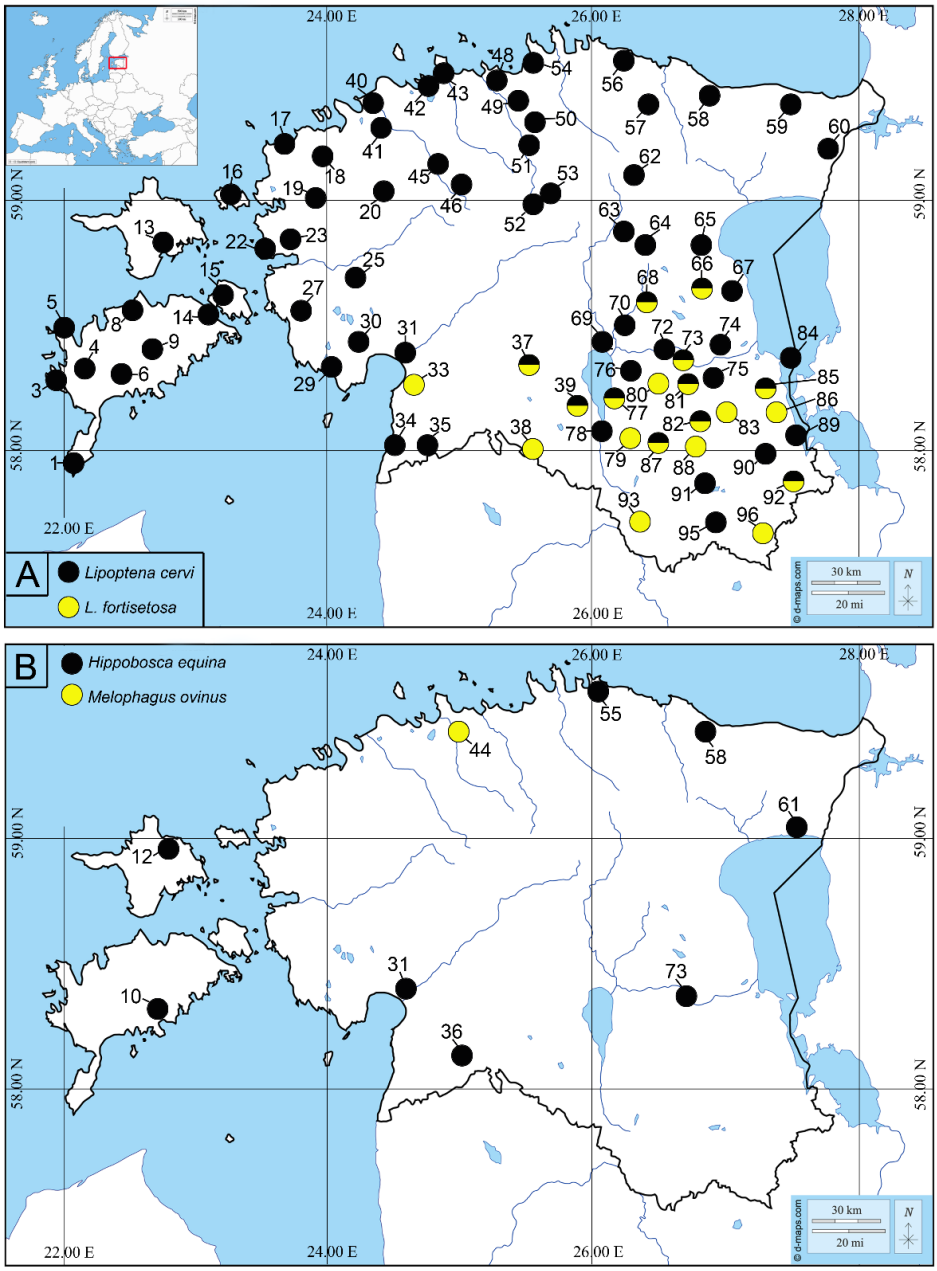

Figure 1. Collecting localities of Estonian Hippoboscidae. **A.** *Lipoptena cervi* and *L. fortisetosa*. **B.** *Hippobosca equina* and *Melophagus ovinus*. The numbers of localities correspond to those in the 'Material examined' sections. Some dots represent more than one nearby site. Base maps of Europe and Estonia: © 2007–2021 https://d-maps.com (accessed on 2024-6-10).

1 spec, IZBE0255231, on pin • Tartu [D.], (Figure 1B: No. 73); without collecting date and collector name; 1 spec, IZBE0255232, on pin. Total: 11 spec.

Identification. The genus *Hippobosca* L. can be distinguished by simple tarsal claws and wings with two cross-veins. Among the three species known to occur in Europe, *H. equina* is a large (wing length 6.0–8.5mm), dark brown species with veins R_{2+3} and R_{4+5} of equal length (Oboňa et al. 2022).

Comments. An additional seven specimens (IZBE0255223–IZBE0255229), with incomplete collecting details, but evidently collected in the second half of the 19th century or the beginning of the 20th century, are deposited in IZBE. The studied material of *H. equina* includes the oldest collection specimens of hippoboscid flies from Estonia. Two specimens were collected by Prof. Gustav Flor (1829–1883) from the surrounding of Püha on the Island of Saaremaa in 1851. The species has not been collected in Estonia since 1962.

Subfamily Lipopteninae

***Lipoptena cervi* (Linnaeus, 1758)**
Figures 1A, 2C

Literature sources. Sintenis 1899: 182, 191; Remm 1956: 255; Remm 1959: 111 (Figure 1A: No. 25); Elberg

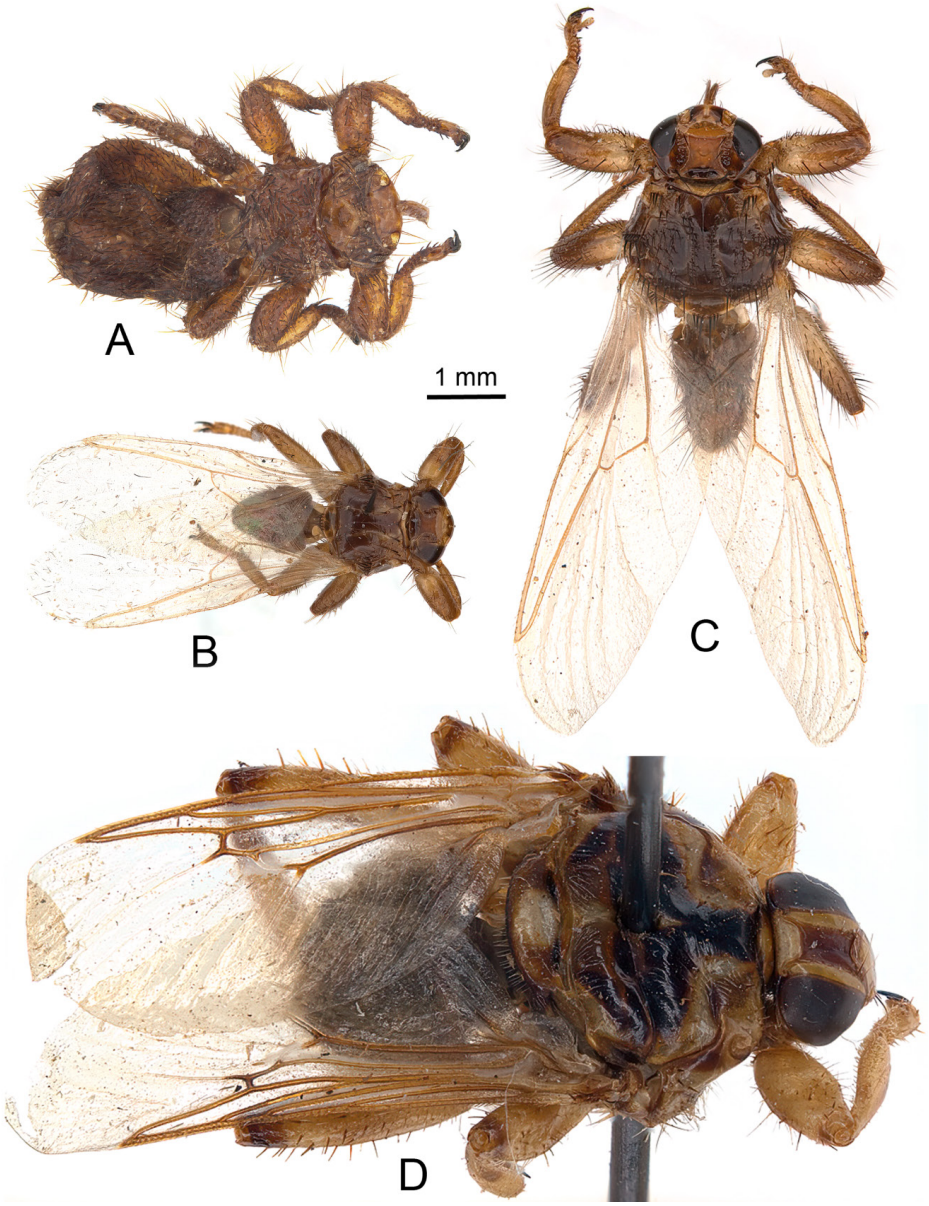

Figure 2. Dorsal habitus of Estonian Hippoboscidae that primarily parasitize mammals. **A.** *Melophagus ovinus*. **B.** *Lipoptena fortisetosa*. **C.** *L. cervi*. **D.** *Hippobosca equina*.

1969: 27; Elberg 1995: 460; Martin 2008: 494; Kurina et al. 2019 (Figure 1A: No. 3, 18, 30, 35, 48, 50, 56, 57, 64, 66, 67, 81, 85).

Material examined. ESTONIA – Saare County • Sääre village (Figure 1A: No. 1); 57.9188, 022.0489; 29.X.2023; H. Pehlak leg.; 2 spec, IZBE0255065, IZBE0255066, in ethyl alcohol • Viidumäe Nature Reserve (Figure 1A: No. 4); 58.2980, 022.1000; 20.IX.1975, 18.VIII.1984–20.IX.1984, 01.X.1988, 15.VIII.1989, 06.IX.1995; K. Elberg leg.; 13 spec, IZBE0255132–IZBE0255140, IZBE0255147, IZBE0255148, IZBE0255182, IZBE0255186, on pins • Undva (Figure 1A: No. 5); 58.4967, 021.9783; 08.VIII.1998, 28.VIII.1999; K. Elberg leg.; 2 spec, IZBE0255142, IZBE0255178, on pins • Mõnnuste (Figure 1A: No. 6); 58.3188, 022.3066; 25.IX.2016; P. Tarlap leg.; 2 spec, TUZ024546, TUZ024547, on pins • Murika village near Tahkuna (Figure 1A: No. 8); 58.5942, 022.5094; 25.IX.2016; P. Tarlap leg.; 1 spec, TUZ023947, on pin • Kaali (Figure 1A: No. 9); 58.3722, 022.6693; 19.IX.1975; K. Elberg leg.; 1 spec, IZBE0255152, on pin • Põripõllu near Orissaare (Figure 1A: No. 14); 16.IX.2023, O. Kurina leg.; 7 spec, IZBE0255069– IZBE0255075, in ethyl alcohol • Muhu, Piiri (Figure 1A: No. 15); 58.6056, 023.1827; 25.VIII.2023 and 21.VIII.2023; O. Kurina leg; 6 spec, IZBE0255084–IZBE0255086, in ethyl alcohol • Koguva (Figure 1A: No. 15); 58.6202, 023.0705; 21.IX.2023; H. Pehlak leg.; 1 spec, IZBE0255063, in ethyl alcohol – Hiiu County • Luguse, SW of Putkaste (Figure 1A: No. 13); 58.8090, 022.7290; 25.VIII.1990; K. Elberg leg.; 1 spec, IZBE0255160, on pin • Kuriste, SW of Putkaste (Figure 1A: No. 13); 58.7938, 022.6343; 25.VIII.1990; K. Elberg leg.; 1 spec, IZBE0255161, on pin – Lääne County • Vormsi, Kersleti (Figure 1A: No. 16); 59.0420, 023.1610; 27.VIII.2002; K. Elberg leg; 3 spec, IZBE0255118, IZBE0255179, IZBE0255180, on pins • Vormsi, Borrby (Figure 1A: No. 16); 59.025, 023.2167; 01.IX.1983 and 27.VIII.2002; K. Elberg leg.; 2 spec, IZBE0255119, IZBE0255120, on pins • Vormsi, Rumpo-Sviby path (Figure

1A: No. 16); 58.9750, 023.2870; 27.VIII.2002; K. Elberg leg.; 3 spec, IZBE0255121–IZBE0255123, on pins • Vormsi, Hosby (Figure 1A: No. 16); 58.9790, 023.3670; 28.VII.1983; E. Remm leg.; 1 spec, IZBE0255144, on pin • Nõva (Figure 1A: No. 17); 59.2181, 023.6774; 10.IX.1989; K. Elberg leg.; 1 spec, IZBE0255183, on pin • Tuksi (Figure 1A: No. 17); 59.1953, 023.5389; 29.VIII.2020; O. Kurina leg.; 1 spec, IZBE0255105, in ethyl alcohol • Palivere (Figure 1A: No. 19); 58.9667, 023.8833; 04.IX.1968; K. Elberg leg.; 1 spec, IZBE0255131, on pin • Põgari-Sassi near Puise (Figure 1A: No. 22); 58.7907, 023.5137; 12.IX.2023; H. Pehlak leg.; 3 spec, IZBE0255060, in ethyl alcohol • Ehmja, NW of Martna [Echmes] (Figure 1A: No. 23); 58.8667, 023.7583; IX.1908 and 06.VIII.1910; A. von Hoyningen-Huene leg.; 7 spec, IZBE0255171– IZBE0255177, on pins • Oonga near Martna (Figure 1A: No. 23); 58.8470, 023.7370; 12.IX.1996 and 14.IX.1996; O. Kurina leg.; 2 spec, IZBE0255190, IZBE0255191, on pins • Keskvere, S of Martna (Figure 1A: No. 23); 58.8003, 023.8059; 11.IX.2023; H. Pehlak leg.; 1 spec, IZBE0255059, in ethyl alcohol – **Pärnu County** • Hõbesalu ditch near Vatla (Figure 1A: No. 27); 58.5465, 023.7416; 13.IX.2023; H. Pehlak leg.; 1 spec, IZBE0255061, in ethyl alcohol • Tõstamaa (Figure 1A: No. 29); 58.3360, 023.9950; 15.IX.1982; K. Elberg leg.; 1 spec, IZBE0255153, on pin • Tõstamaa (Figure 1A: No. 29); 58.3690, 023.9580; 03.IX.1994; O. Kurina leg.; 1 spec, IZBE0255191, on pin • Kärbu near Audru (Figure 1A: No. 30); 58.4342, 024.2067; 17.VIII.2019; O. Kurina leg.; 2 spec, IZBE0255197, IZBE0255198, on pins • Pärnu airport (Figure 1A: No. 31); 58.4221, 024.4657; 29.VII.2020; P. Krimm leg.; 1 spec, IZBE0255199, on pin • Raeküla in Pärnu (Figure 1A: No. 31); 58.3550, 024.5660; 11.IX.1982; K. Elberg leg.; 1 spec, IZBE0255154, on pin • Sindi near Pärnu (Figure 1A: No. 31); 58.4030, 024.6610; 14.IX.1982; K. Elberg leg.; 1 spec, IZBE0255155, on pin • Põlendmaa near Pärnu (Figure 1A: No. 31); 58.3660, 024.7704; 12.VIII.2023; H. Pehlak leg.; 1 spec, IZBE0255056, in ethyl alcohol • Kabli (Figure 1A: No. 34); 58.0083, 024.45; 23.VIII.1984; K. Elberg leg.; 1 spec, IZBE0255141, on pin • Nigula Nature Reserve (Figure 1A: No. 35); 58.0159, 024.7203; 19.VIII.1973; V. Siitan leg.; 1 spec, TUZ358736, on pin • Nigula Nature Reserve (Figure 1A: No. 35); 58.0103, 024.7210; 22.VIII.1993; O. Kurina leg.; 1 spec, IZBE0255193, on pin – **Harju County** • Laulasmaa (Figure 1A: No. 40); 59.3882, 024.2377; 29.IX.1982 and 11.VIII.1989; K. Elberg leg.; 2 spec, IZBE0255149, IZBE0255184, on pin • Niitvälja, W of Keila (Figure 1A: No. 40); 59.3167, 024.3167; 29.VII.2003; K. Elberg leg.; 1 spec, IZBE0255187, on pin • Ohtu near Keila (Figure 1A: No. 41); 59.2781, 024.3633; 28.VIII.1988; K. Põldvere leg.; 1 spec, TUZ174365, on pin • Tallinn, Õismäe (Figure 1A: No. 42); 59.4165, 024.6470; 20.VIII.1973; M. Kruus leg.; 1 spec, IZBE0255110, on pin • Laagri near Tallinn (Figure 1A: No. 42); 59.3280, 024.6180; 03.X.1987; M. Kruus leg.; 1 spec, IZBE0255117, on pin • Tallinn, Mähe, Merivälja st. (Figure 1A: No. 43); 59.4687, 024.8352; VIII.2007; A. Baburin leg.; 2 spec, IZBE0255200, IZBE0255201, on pins • Vikipalu near Kehra (Figure 1A: No. 49); 59.35, 025.4333; 10.IX.1991; M. Kruus leg.; 3 spec, IZBE0255111–IZBE0255113, on pins • Soodla, north of Kehra (Figure 1A: No. 49); 59.3860, 025.3650; 10.IX.1991; M. Kruus leg.; 1 spec, IZBE0255115, on pin • Aegviidu (Figure 1A: No. 50); 59.2823, 025.5106; 11.IX.2019; R. Viidalepp leg.; 2 spec, IZBE0255194, IZBE0255195, on pins • Külvandu, SW from Aegviidu (Figure 1A: No. 51); 59.1820, 025.4790; 14.X.1990; M. Kruus leg.; 2 spec, IZBE0255114, IZBE0255116, on pins • Pudisoo, NE of Kuusalu (Figure 1A: No. 54); 08.IX.1975; K. Elberg leg.; 1 spec, IZBE0255162, on pin – **Rapla County** • Vardi, S of Varbola (Figure 1A: No. 20); 59.0126, 024.4337; 15.VIII.2002; K. Elberg leg.; 1 spec, IZBE0255181, on pin • Rangu, N of Märjamaa (Figure 1A: No. 20); 58.9648, 024.4114; 24.VIII.2023; H. Pehlak leg.; 2 spec, IZBE0255058, in ethyl alcohol • Lohu near Kohila (Figure 1A: No. 45); 59.1343, 024.7785; 12.IX.1999; K. Elberg leg.; 1 spec, IZBE0255129, on pin • Roidu, SE of Kohila (Figure 1A: No. 45); 59.1454, 024.8092; 24.VIII.2023; H. Pehlak leg.; 1 spec, IZBE0255057, in ethyl alcohol • Mahtra (Figure 1A: No. 46); 59.1069, 025.0237; 16.VIII.2019; V. Soon leg.; 1 spec, TUZ245237, on pin – **Järva County** • Väätsa (Figure 1A: No. 52); 58.8917, 025.45; 07.X.1959; K. Elberg leg.; 1 spec, IZBE0255166, on pin • Venevere near Roosna-Alliku (Figure 1A: No. 53); 59.00, 025.6833; 30.VIII.1960; K. Elberg leg.; 3 spec, IZBE0255156–IZBE0255158, on pins – **Lääne-Viru County** • Äntu, W of Simuna (Figure 1A: No. 62); 59.0443, 026.2403; 27.VIII.2019; V. Soon leg.; 1 spec, TUZ218687, on pin – **Ida-Viru County** • Koljala (Figure 1A: No. 58); 59.3914, 026.9128; 13.X.2023; H. Pehlak leg.; 3 spec, IZBE0255064, in ethyl alcohol • Kose near Jõhvi (Figure 1A: No. 59); 59.3340, 027.4790; 15.VIII.1990; K. Elberg leg.; 1 spec, IZBE0255145, on pin • Poruni (Figure 1A: No. 60); 59.1758, 027.8298; 17.VIII.1990; K. Elberg leg.; 1 spec, IZBE0255146, on pin • Puhatu (Figure 1A: No. 60); 59.1770, 027.7260; 16.VIII.1959 and 17.VIII.1959; K. Elberg leg.; 5 spec, IZBE0255163, IZBE0255164, IZBE0255202– IZBE0255204, on pins – **Jõgeva County** • Mustjõgi near Tooma (Figure 1A: No. 63); 58.8730, 026.2280; 30.VIII.1968; K. Elberg leg.; 1 spec, IZBE0255130, on pin • Tarakvere village near Torma (Figure 1A: No. 65); 58.7921, 026.7835; 16.IX.2023; H. Pehlak leg.; 1 spec, IZBE0255062, in ethyl alcohol • Pedassaare village (Figure 1A: No. 66); 58.6557, 026.8787; 13.IX.2020; O. Kurina leg.; 1 spec, IZBE0255101, in ethyl alcohol • Nautrasi village (Figure 1A: No. 66); 58.6748, 026.8754; 22.VIII.2021; O. Kurina leg.; 1 spec, IZBE0255317, in ethyl alcohol • Altnurga village, SE of Puurmani (Figure 1A: No. 68); 58.5416, 026.3963; 05.IX.2020; O. Kurina leg.; 12 spec, IZBE0255319, IZBE0255321, in ethyl alcohol – **Viljandi County** • Sinialliku near Ramsi (Figure 1A: No. 37); 58.3018, 025.5541; 02.IX.2023; S. Tooming leg.; 1 spec, IZBE0255028, in ethyl alcohol • Roosilla village, S of Mustla (Figure 1A: No. 39); 58.1695, 025.8824; 11.VIII.2023; H. Pehlak leg.; 1 spec, IZBE0255052, in ethyl alcohol • Villimeeste village, SW of Mustla (Figure 1A: No. 39); 58.2115, 025.7583; 11.VIII.2023; H. Pehlak leg.; 2 spec, IZBE0255054, IZBE0255055, in ethyl alcohol• Vaibla ornithological station (Figure 1A: No. 69); 58.4053, 026.0758; 01.IX.2023–11.IX.2023; Vaibla linnujaam leg.; 2 spec, IZBE0255018, IZBE0255022, in ethyl alcohol – **Tartu**

County • Pataste (Figure 1A: No. 66); 58.5970, 026.7903; 01.IX.2019; O. Kurina leg.; 1 spec, IZBE0255196, on pin • Väänikvere near Laeva (Figure 1A: No. 70); 58.5168, 026.4229; 14.VIII.1995; K. Elberg leg.; 1 spec, IZBE0255151, on pin • Alam-Pedja Nature Reserve (Figure 1A: No. 70); 23.XI.2003; O. Kurina leg.; 1 spec, IZBE0255192, on pin • Ilmatsalu-Kärevere path near Tartu (Figure 1A: No. 72); 58.4070, 026.5260; 24.IX.2005; K. Elberg leg.; 2 spec, IZBE0255127, IZBE0255128, on pins • Kärevere near Tartu (Figure 1A: No. 72); 58.4333, 026.4833; 20.VIII.1980; K. Elberg leg.; 1 spec, IZBE0255167, on pin • Tartu [D.] (Figure 1A: No. 73); 58.375, 026.7167; VIII.1881; F. Sintenis leg.; 2 spec, IZBE0255169, IZBE0255170, on pins • Vorbuse forest near Tartu (Figure 1A: No. 73); 58.4230, 026.6390; 23.VIII.2001; K. Elberg leg.; 3 spec, IZBE0255124–IZBE0255126, on pins • Tartu, Emajõe meadow (Figure 1A: No. 73); 58.3510, 026.7460; 01.VIII.1967; E. Elberg leg.; 3 spec, IZBE0255205– IZBE0255207, on pins • Kabina near Tartu (Figure 1A: No. 73); 58.3417, 026.8352; 20.IX.1975; K. Elberg leg.; 1 spec, IZBE0255185, on pin • Soinaste near Tartu (Figure 1A: No. 73); 58.3287, 026.7463; 07.VIII.2020; H. Pehlak leg.; 1 spec, IZBE0255098, in ethyl alcohol • Sirgumetsa, NE of Luunja (Figure 1A: No. 74); 58.4293, 027.0063; 13.VIII.2023; O. Kurina leg.; 1 spec, IZBE0255068, in ethyl alcohol • Sudaste (Figure 1A: No. 75); 58.3289, 026.9424; 10.X.2020; Ü. Jäe leg.; 1 spec, IZBE0255188, on pin • Mäeotsa, SE of Puhja (Figure 1A: No. 76); 58.3220, 026.3590; 01.X.1982; K. Elberg leg.; 1 spec, IZBE0255143, on pin • Nigula rivulet near Rannu (Figure 1A: No. 77); 58.2257, 026.1432; 27.IX.1954; collector unknown; 1 spec, TUZ358764, on pin • Rannu (Figure 1A: No. 77); 58.2350, 026.1712; 21.VIII.2022; O. Kurina leg.; 13 spec, IZBE0255076– IZBE0255083, in ethyl alcohol • Piirissaar, Tooni village (Figure 1A: No. 84); 58.3817, 027.5165; 30.IX.2023; O. Kurina leg.; 2 spec, IZBE0255088, in ethyl alcohol • Liispõllu (Figure 1A: No. 85); 58.2963, 027.2620; 19.VIII.2020; O. Kurina leg.; 1 spec, IZBE0255108, in ethyl alcohol – Põlva County • Kosovo near Ahja (Figure 1A: No. 75); 58.2579, 027.057; 17.VIII.2017; V. Soon leg.; 1 spec, TUZ0110833, on pin • Käbliku, NE of Saverna (Figure 1A: No. 82); 58.0962, 026.7585; 10.XI.2023; H. Pehlak leg.; 1 spec, IZBE0255067, in ethyl alcohol • Haavametsa near Järvselja (Figure 1A: No. 85); 58.2792, 027.3779; 12.IX.2023; V. Soon leg.; 1 spec, TUZ351670, on pin • Ilumetsa near Meenikunno (Figure 1A: No. 90); 57.9732, 027.2520; 28.VIII.1991; T. Kesküla leg.; 4 spec, TUZ358737–TUZ358740, on pins – Valga County • Pikasilla (Figure 1A: No. 78); 58.0849, 026.0531; 28.VII.1975; collector unknown; 1 spec, TUZ358749, on pin • Kääriku (Figure 1A: No. 87); 58.0044, 026.3879; 08.IX.1972 and 03.IX.1983; collectors unknown, 2 spec, TUZ358747, TUZ358748, on pins – Võru County • Lüübnitsa (Figure 1A: No. 89); 58.0600, 027.5770; 30.IX.2023; S. Varusk leg.; 4 spec, IZBE0255089, in ethyl alcohol • Kerreti bog, W of Võru (Figure 1A: No. 91); 26.VIII.1960; K. Elberg leg.; 1 spec, IZBE0255165, on pin • Kubija near Võru (Figure 1A: No. 91); 57.8180, 027.0030; 22.VIII.1960; K. Elberg leg.; 1 spec, IZBE0255168, on pin • Huule, N of Orava (Figure 1A: No. 92); 57.9430, 027.4240, 24.VIII.1991; K. Elberg leg.; 1 spec, IZBE0255150, on pin • Kamnitsa, N of Orava (Figure 1A: No. 92); 57.9276, 027.4339; 24.VIII.1991; K. Elberg leg.; 1 spec, IZBE0255159, on pin • Rõuge (Figure 1A: No. 95); 57.7313, 026.9298; 12.VIII.1971; collector unknown; 1 spec, TUZ358746, on pin. Total: 192 spec.

Identification. The genus *Lipoptena* Nitsch can be distinguished by simple tarsal claws and wings with one cross-vein. Among the European *Lipoptena* species, *L. cervi* is a large species (body length 5.0–6.0 mm) with 30–35 setae on each side of the thorax (Oboňa et al. 2022).

Comments. *Lipoptena cervi* is a very frequent and abundant species during August-September in Estonian forests. The majority of the studied specimens were collected while attacking humans.

***Lipoptena fortisetosa* Maa, 1965**

Figures 1A, 2B

Literature sources. Kurina et al. 2019: 4–8 (Figure 1A: No. 38, 73, 79, 80, 81, 83, 85, 86, 87, 88, 92, 93, 96).

Material examined. ESTONIA – Pärnu County • Jaamaküla near Pärnu (Figure 1A: No. 33); 58.2809, 024.7214; 22.VII.2021; V. Soon leg.; 1 spec, TUZ311463, on pin – Viljandi County • Vardi near Viljandi (Figure 1A: No. 37); 58.2951, 025.5507; 13.IX.2023; K. Tooming leg.; 1 spec, IZBE0255029, in ethyl alcohol • Roosilla near Tarvastu (Figure 1A: No. 39); 58.1695, 025.8824; 11.VIII.2023; H. Pehlak leg.; 1 spec, IZBE0255053, in ethyl alcohol – Jõgeva County • Nautrasi near Levala (Figure 1A: No. 66); 58.6748, 026.8754; 22.VIII.2021; O. Kurina leg.; 1 spec, IZBE0255318, in ethyl alcohol • Altnurga near Laeva (Figure 1A: No. 68); 58.5416, 026.3963; 05.IX.2020; O. Kurina leg.; 1 spec, IZBE0255320, in ethyl alcohol – Tartu County • Tartu, Dendropark (Figure 1A: No. 73); 58.3958, 026.6911; 10.VIII.2020 and 25.IX.2020; O. Kurina leg.; 2 spec, IZBE0255106, IZBE0255107, in ethyl alcohol • Tartu, Dendropark (Figure 1A: No. 73); 58.3929, 026.6981; 26.VI.2023; K.J. Valk leg.; 1 spec, IZBE0255027, in ethyl alcohol • Tartu, Raudtee str. (Figure 1A: No. 73); 58.3480, 026.6937; 28.VIII.2017; T. Kesküla leg.; 1 spec, IZBE0255208, on pin • Tartu, Aruküla tee 34 (Figure 1A: No. 73); 58.3965, 026.6969; 08.VII.2020; H. Pehlak leg.; 1 spec, IZBE0255097, in ethyl alcohol • Rannaküla near Rõngu (Figure 1A: No. 77); 58.1875, 026.1150; 08.VIII.2020; O. Kurina leg.; 3 spec, IZBE0255103, in ethyl alcohol • Reinu village in Tähtvere (Figure 1A: No. 73); 58.3893, 026.6725; 16.VII.2015; O. Lehtsaar leg.; 1 spec, TUZ073451, on pin • Paluküla near Kurista (Figure 1A: No. 81); 58.2576, 026.9552; 19.VIII.2022; V. Soon leg.; 1 spec, TUZ009469, on pin – Põlva County • Voorepalu (Figure 1A: No. 82); 58.1505, 026.8799; 03.VIII.2023; O. Kurina leg.; 1 spec, IZBE0255087, in ethyl alcohol • Mooste (Figure 1A: No. 83); 58.1654, 027.1575; 11.VII.2020; O. Kurina leg.; 4 spec, IZBE0255102, in ethyl alcohol – Valga County • Prange near Puka (Figure 1A: No. 79); 58.04, 026.20; 12.VII.2020; J. Viidalepp leg.; 1 spec,

IZBE0255104, in ethyl alcohol – Võru County • Piusa (Figure 1A: No. 92); 57.8417, 027.4667; 08.VII.2011; V. Vaher leg.; 1 spec, IZBE0255209, on pin. Total: 25 spec.

Identification. Among the European *Lipoptena* species, *L. fortisetosa* is a small species (body length 2.8–3.2 mm) with 8–12 setae on each side of the thorax (Oboňa et al. 2022).

Comments. According to Kurina et al. (2019), the first specimen of *L. fortisetosa* from Estonia was collected in 2014. However, we located a previously overlooked specimen in the IZBE collection (IZBE0255209), collected in 2011 from the southeast corner of the country. The studied specimens were collected while attacking humans.

***Melophagus ovinus* (Linnaeus, 1758)**
Figures 1B, 2A

Literature sources. Remm 1956: 255; Kaarma et al. 2000: 19, 22; Martin 2008: 495; Järvis 2013: 19; Järvis and Mägi 2013: 48.

Material examined. ESTONIA – Harju County • Lagedi (Figure 1B: No. 44); 59.4000, 024.9333; 15.VI. 2005; A. Joost leg; 13 spec, from sheep, IZBE0255211–IZBE0255222, on pins.

Identification. Following Oboňa et al. (2022), the species can easily be distinguished by reduced wings and absence of halters (cf. Figure 3A). Moreover, palps are almost as long as head, completely covering the proboscis.

Comments. Although referred to in entomological and veterinary literature (Remm 1956; Järvis and Mägi 2013), the studied specimens are the only known vouchers from Estonia.

Subfamily Ornithomyinae

***Crataerina pallida* (Olivier in Latreille, 1811)**
Figures 3A, 4B

Literature sources. Chinery 2005: 212; Alt and Mägi 2016: 5.

Material examined (all specimens have been collected from Tartu – Figure 2A: No. 73). ESTONIA – Tartu County • Tartu; 58.3792, 026.7230; 20.V.1933; V. Vinkel leg.; 2 spec, TUZ358732, TUZ358733, on pins • Tartu, flooded meadow of river Emajõgi; 58.3540, 026.7460; 01.VII.1967; E. Elberg leg.; 2 spec, IZBE0255246, IZBE0255247, on pins • Tartu, Vanemuise 21; 58.3559, 026.7200; 06.VI.1976; Tumala leg.; 3 spec, IZBE0255249 – IZBE0255251, on pins • Tartu, Marja 14; 58.3861, 026.7116; 04.VI.2002; O. Kurina leg.; 1 spec, IZBE0255244, on pin • Tartu, Vanemuise 46; 58.3734, 026.7163; 12.VII.2006 and 19.V.2008; E. Õunap leg.; 3 spec, IZBE0255241–IZBE0255243, on pins • Tartu, Vanemuise 46; 58.3734, 026.7163; 09.V.1953; Loor leg.; 1 spec, TUZ358730, on pin • Tartu, Vanemuise 46; 58.3734, 026.7163; 10.VI.1957, 07.VIII.1958, 21.V.1959, 29.V.1978; collector unknown; 4 spec, TUZ358742–TUZ358744, TUZ358762 on pins •Tartu, Toomemägi; 58.3734, 026.7163; 16.VI. 2016; K. Sammet leg.; 1 spec, IZBE0255245, on pin • Tartu, Kaunase pst 12; 58.3743, 026.7652; 21.V.2020; K. Kesküla leg.; 1 spec, IZBE0255316, on pin. Total: 18 spec.

Identification. Following Oboňa et al. (2022), the species can be distinguished by reduced wings, which are at most three times as long as wide, about 1.5 times as long as head and thorax, and 1.3–1.5 times as long as hind femur. The wing tip is attenuate but without a narrow, elongated apical portion (Figure 4B, Oboňa et al. 2022: Figure 16).

Comments. One additional specimen (TUZ358763), with incomplete collecting details but probably collected in mid-1900s, is deposited in TUZ. It is noteworthy that all 18 specimens of *C. pallida* have been collected from urban areas of Tartu.

***Stenepteryx hirundinis* (Linnaeus, 1758)**
Figures 3A, 4A

Literature sources. Chinery 2005: 212; Alt and Mägi 2016: 5.

Material examined. ESTONIA – Pärnu County • Varbla (Figure 2A: No. 28); 58.4271, 023.7390; 25.VI.1976; M. Masing leg.; 1 spec, TUZ358750, on pin • Kabli ornithological station (Figure 2A: No. 34); 58.0142, 024.4496; 02.IX.2005; A. Leivits leg., 1 spec, IZBE0255042, in ethyl alcohol – Tartu County • Tartu (Figure 2A: No. 73); 58.3750, 026.7167; VI.1882; collector unknown; 1 spec, IZBE0255239, on pin • Tartu, surroundings of Estonian National Museum (Figure 2A: No. 73); 58.3952, 026.7433; 01.VI.2015; Ü. Jäe leg.; 1 spec, IZBE0255240, on pin. Total: 4 spec.

Identification. Following Oboňa et al. (2022), the species can easily be distinguished by narrowed wings, which are at least six times as long as wide and twice as long as the head and thorax (cf. Figure 4A).

Comments. One additional specimen (TUZ358761), without collecting data but evidently collected in the second half of the 19th century, is deposited in TUZ.

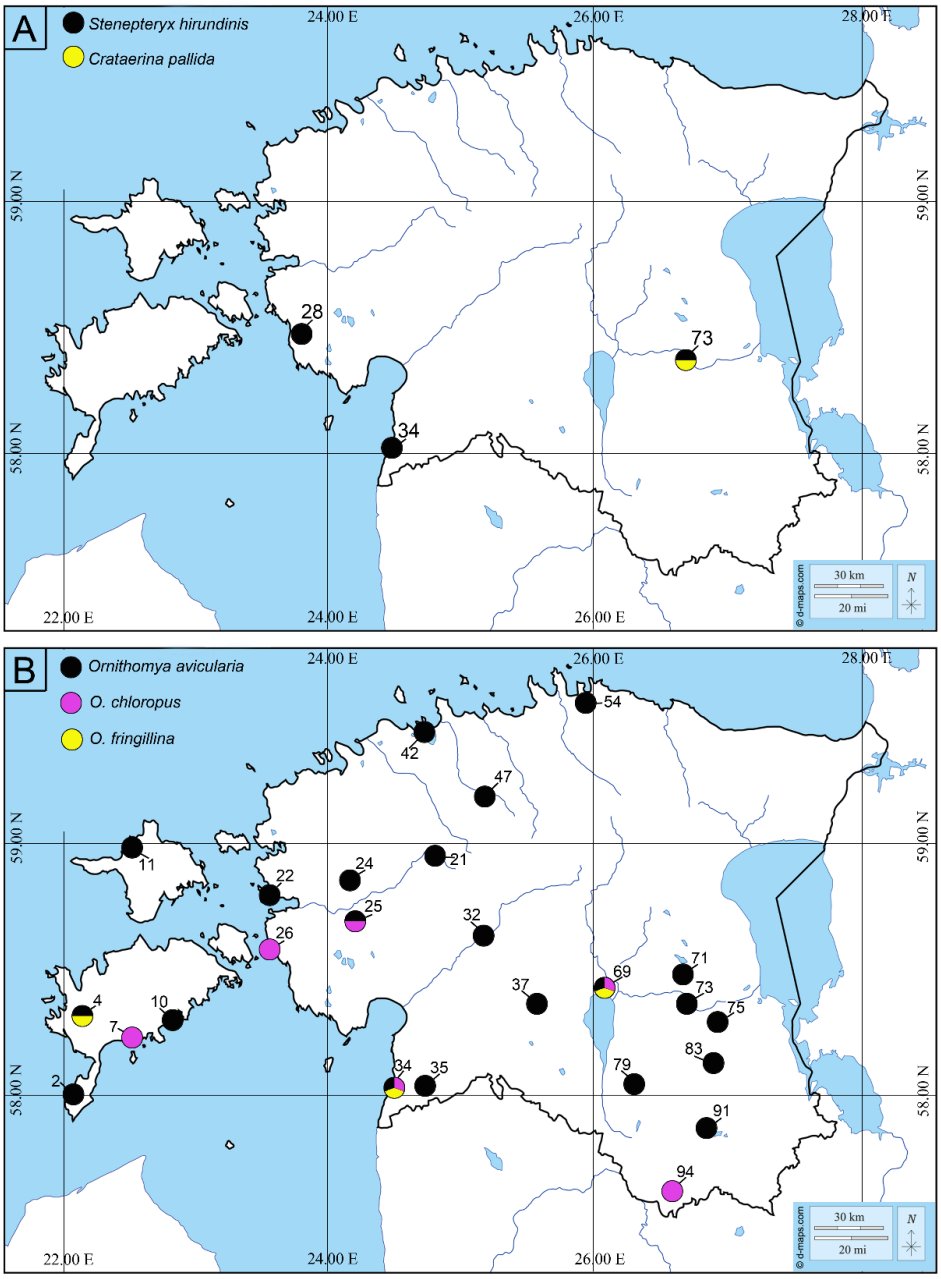

Figure 3. Collecting localities of Estonian Hippoboscidae. **A.** *Stenepteryx hirundinis* and *Crataerina pallida*. **B.** *Ornithomya avicularia*, *O. chloropus*, and *O. fringillina*. For explanation, see Figure 1.

Tribe Ornithomyini

***Ornithomya avicularia* (Linnaeus, 1758)**

Figures 3B, 4D

Literature sources. Dampf 1924: 56 (5 specimens collected in August–September 1922 from Estonian raised bogs but without exact locality data); Remm 1956: 255; Alt and Mägi 2016: 5.

Material examined. ESTONIA – Saare County • Viidumäe Nature Reserve (Figure 2B: No. 4); 58.3, 022.1; 22.VII.1967; E. Remm leg.; 1 spec, IZBE0255289, on pin • Ohessaare (Figure 2B: No. 2); 58.00, 022.025; 10.VII.1978; K. Elberg leg.; 1 spec, IZBE0255282, on pin • Sandla (Figure 2B: No. 10); 58.30, 022.825; 09.VII.1978; K. Elberg leg.; 1 spec, IZBE0255279, on pin – Hiiu County • Kõrgessaare (Figure 2B: No. 11); 58.9833, 022.4667; 15.VI.2003; K. Elberg leg.; 1 spec, IZBE0255283, on pin – Lääne County • Põgari-Sassi near Puise (Figure 2B: No. 22); 58.7907, 023.5137; 29.VII.2023; H. Pehlak leg.; 1 spec, IZBE0255051, in ethyl alcohol • Silla near Kullamaa (Figure 2B: No. 24); 58.8333, 024.1666; 20.VII.2023; Ü. Väli leg.; 4 spec, from young birds of hybrid of *Clanga clanga* (Pallas, 1811) + *C. pomarina* (Brehm, CL, 1831), IZBE0255094, IZBE0255095, in ethyl alcohol – Harju County • Põhja-Tallinn (Figure 2B: No. 42); 59.4430, 024.7236; 25.VII.2019; V. Soon leg.; 1 spec, TUZ274331, on pin • Liiva near Kose (Figure 2B: No. 47); 59.1666, 025.1666, 17.VII.2023; Ü. Väli leg.; 4 spec, from young birds of hybrid of *Clanga clanga* + *C. pomarina*, IZBE0255090,

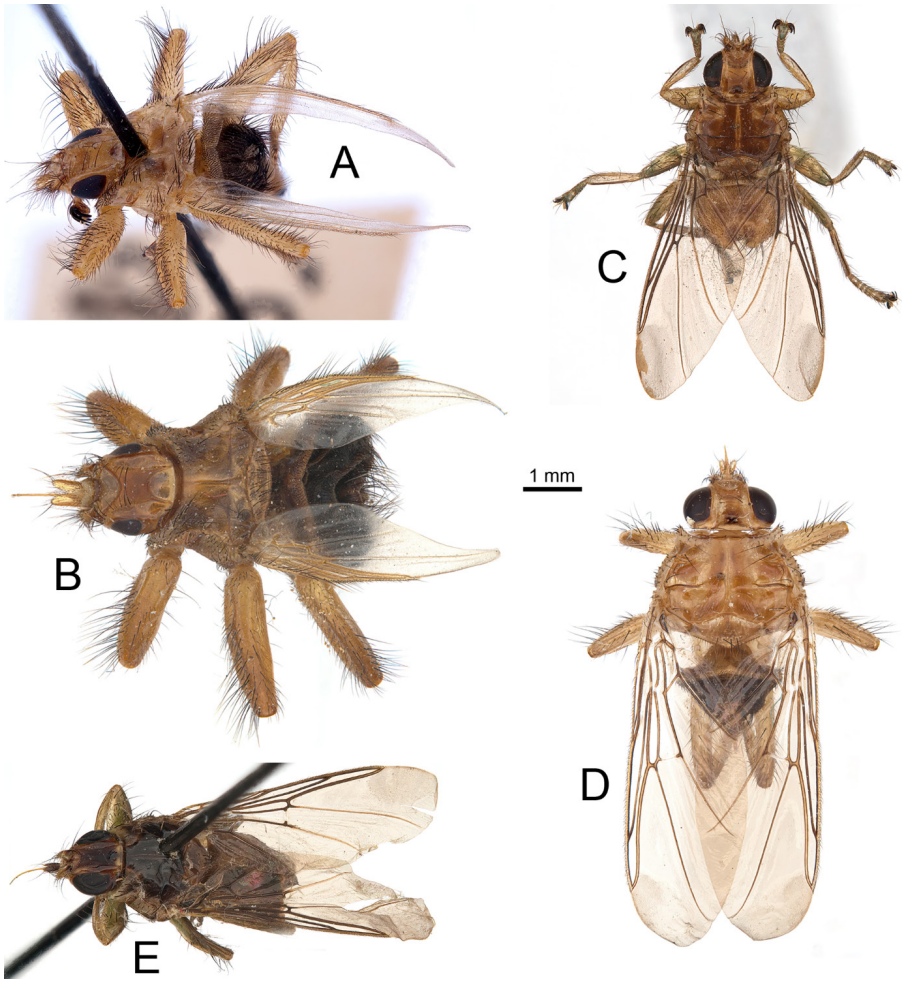

Figure 4. Dorsal habitus of Estonian Hippoboscidae that primarily parasitize birds: **A.** *Stenepteryx hirundinis*. **B.** *Crataerina pallida*. **C.** *Ornithomya fringillina*. **D.** *O. avicularia*. **E.** *O. chloropus*.

IZBE0255091, in ethyl alcohol – **Rapla County** • Raela near Raiküla (Figure 2B: No. 21); 58.9497, 024.7700; 12.VII.2020; V. Aitsam leg.; 1 spec, IZBE0255287, on pin – **Pärnu County** • Maalinna near Avaste (Figure 2B: No. 25); 58.6615, 024.162; 14.VIII.1952; H. Remm leg.; 2 spec, TUZ358741, TUZ358752, on pins • Mädara (Figure 2B: No. 32); 58.6936, 025.2191; 08.VI.2024; V. Soon leg.; 1 spec, TUZ358768, on pin • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 02.IX.2005–16.IX.2005; A. Leivits leg.; 23 spec, IZBE0255030– IZBE0255032, IZBE0255034– IZBE0255039, IZBE0255041, IZBE0255043, IZBE0255045; IZBE0255047– IZBE0255049, in ethyl alcohol • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 15.IX.2023; M. Leivits leg.; 1 spec, from *Dendrocopos major* (Linnaeus, 1758), IZBE0255002, in ethyl alcohol • Nigula Nature Reserve (Figure 2B: No. 35); 58.0159, 024.7203; 15.VIII.1999; O. Kurina leg.; 1 spec, IZBE0255285, on pin – **Viljandi County** •Viljandi (Figure 2B: No. 37); 59.3645, 025.5978; 16.VII.2015; collector unknown; 1 spec, TUZ037595, on pin • Vaibla ornithological station (Figure 2B: No. 69); 58.4053, 026.0758; 01.IX.2023–15.IX.2023; Vaibla linnujaam leg.; 5 spec, IZBE0255014, IZBE0255021, IZBE0255023, IZBE0255024, in ethyl alcohol – **Lääne-Viru County** • Palmse (Figure 2B: No. 54); 59.5185, 025.9570; 03.VIII.1976; E. Remm leg.; 1 spec, IZBE0255281, on pin – **Tartu County** • Kastli near Lähte (Figure 2B: No. 71); 58.5000, 026.6666; 21.VII.2023; Ü. Väli leg.; 4 spec, from young birds of *Clanga pomarina*, IZBE0255092, IZBE0255093, in ethyl alcohol • Tartu, flooded meadow of river Emajõgi (Figure 2B: No. 73); 58.3540, 026.7460; 01.VII.1967; E. Elberg leg.; 1 spec, IZBE0255288, on pin • Tartu (Figure 2B: No. 73); 58.3685, 026.7031; 17.VII.2067; K. Remm leg.; 1 spec, IZBE0255278, on pin • Tartu, Marja 14 (Figure 2B: No. 73); 58.3862, 026.7114; 15.VI.2002; O. Kurina leg.; 1 spec, IZBE0255284, on pin • Tartu, Mõisavahe 4 (Figure 2B: No. 73); 58.3711, 026.7712; 05.VIII.2020; E. Õunap leg.; 1 spec, IZBE0255109, on pin • Tartu, Kreutzwaldi 5 (Figure 2B: No. 73); 58.3918, 026.6946; 04.VII.2023; M. Kruus leg.; 1 spec, IZBE0255096, on pin • Karjasilla near Sudaste (Figure 2B: No. 75); 58.3281, 026.9447; 23.VI.2010; O. Kurina leg.; 1 spec, IZBE0255286, on pin – **Põlva County** • Valgesoo (Figure 2B: No. 83); 58.1167, 027.0667; 27.VI.1966; K. Elberg leg.; 1 spec, IZBE0255277, on pin – **Valga County** • Prange near Puka (Figure 2B: No. 79); 58.0417, 026.2083; 15.VII.2020; V. Viidalepp & J. Viidalepp leg.; 1 spec, IZBE0271003, on pin – **Võru County** • Sõmerpalu (Figure 2B: No. 91); 57.8573, 026.8503; 14.VII.1993; K. Elberg leg.; 1 spec, IZBE0255280, on pin. Total: 63 spec.

Identification. The genus *Ornithomya* Latreille can be distinguished by bifid tarsal claws and wings with three cross-veins posterior to the radial veins. Among the European *Ornithomya* species, *O. avicularia* is a relatively large species (body length 3.0–3.5 mm) with the C sector of the wing between R_1 and R_{2+3} longer than that between R_{2+3} and R_{4+5}, and microtrichia only on the apex and in cell m_1 (Oboňa et al. 2022).

Comments. Six additional specimens (IZBE0255272–IZBE0255276, TUZ358759), with incomplete collecting details but evidently collected in the 20th century, are deposited in IZBE and TUZ. In four cases, the specimens were collected from young birds of the genus *Clanga* (12 specimens in 3 cases) and from an adult of *Dendrocopos major* (Linnaeus, 1758) (1 specimen). However, in majority of the cases, information on the host bird species is absent. *O. avicularia* can occasionally also attack humans. It is the most frequent bird-associated hippoboscid fly species in Estonia.

***Ornithomya chloropus* (Bergroth, 1901)**

Figures 3B, 4E

Literature sources. Absent.

Material examined. ESTONIA – Saare County • Mullutu near Kuressaare (Figure 2B: No. 7); 58.2927, 022.3774; 11.VIII.1953; collector unknown; 1 spec, TUZ358751, on pin – Pärnu County • Puhtu near Virtsu (Figure 2B: No. 26); 58.5514, 023.4678; 20.VII.1965; collector unknown; 1 spec, TUZ358753, on pin • Avaste (Figure 2B: No. 25); 58.6615, 024.162; 10.VII.1977; H. Remm leg.; 1 spec, TUZ358735, on pin • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 02.IX.2005–16.IX.2005; A. Leivits leg.; 1 spec, IZBE0255040, in ethyl alcohol • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 26.IX.2005; A. Leivits leg.; 2 spec, IZBE0255290, ZBE0255291, on pins – Viljandi County • Vaibla ornithological station (Figure 2B: No. 69); 58.4053, 026.0758; 30.VIII.2023–03.IX.2023; Vaibla linnujaam leg.; 3 spec, IZBE0255013, IZBE0255016, IZBE0255026, in ethyl alcohol – Võru County • Mõniste (Figure 2B: No. 94); 57.6140, 026.5908; 01.VII.1967; collector unknown; 1 spec, TUZ358745, on pin. Total: 10 spec.

Identification. Among the European *Ornithomya* species, *O. chloropus* is a relatively small species (body length 2.1–2.6 mm) with the C sector of the wing between R_1 and R_{2+3} not longer than that between R_{2+3} and R_{4+5}. The triangular brown spots on the ventral side of the head are narrowed and reach the jugular setae; the scutellum usually has 6 or more setae (Oboňa et al. 2022).

Comments. One additional specimen (TUZ358760) collected on 03.VIII.1873, but without locality details, is deposited in TUZ. Most specimens were collected from ornithological stations in connection with birds, but detailed host species information is lacking.

***Ornithomya fringillina* Curtis, 1836**

Figures 3B, 4C

Literature sources. Absent.

Material examined. ESTONIA – Saare County • Viidumäe Nature Reserve (Figure 2B: No. 4); 58.3, 022.1; 22.VII.1967; E. Remm leg.; 1 spec, IZBE0255251, on pin – Pärnu County • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 26.IX.1998, 12.X.1998, 02.IX.2005; A. Leivits leg.; 20 spec, IZBE0255252– IZBE0255271, on pins; 8 spec, IZBE0255033, IZBE0255044, IZBE0255046, IZBE0255050, in ethyl alcohol • Kabli ornithological station (Figure 2B: No. 34); 58.0142, 026.4469; 13.IX.2023–19.IX.2023; M. Leivits leg.; 8 spec, from 7 different specimens of *Poecile montanus* (Conrad von Baldenstein, 1827), IZBE0255000, IZBE0255001, IZBE0255003– IZBE0255005, IZBE0255008, IZBE0255011 in ethyl alcohol; 18.IX.2023; M. Leivits leg.; 1 spec, from *Periparus ater* (Linnaeus, 1758), IZBE0255006, in ethyl alcohol; 18.IX.2023–19.IX.2023; M. Leivits leg.; 2 spec, from 2 different specimens of *Poecile palustris* (Linnaeus, 1758), IZBE0255007, IZBE0255010, in ethyl alcohol; 19.IX.2023; M. Leivits leg.; 1 spec, from *Phylloscopus collybita* (Vieillot, 1817), IZBE0255009, in ethyl alcohol; 21.X.2023; K.J. Valk leg.; 1 spec, IZBE0255012, in ethyl alcohol – Viljandi County • Vaibla ornithological station (Figure 2B: No. 69); 58.4053, 026.0758; 30.VIII.2023–15.IX.2023; Vaibla linnujaam leg.; 5 spec, IZBE0255015, IZBE0255017, IZBE0255019, IZBE0255020, IZBE0255025, in ethyl alcohol. Total: 47 spec.

Identification. Among the European *Ornithomya* species, *O. fringillina* is a relatively small species (body length 1.9–2.5 mm) with the C sector of the wing between R_1 and R_{2+3} not longer than that between R_{2+3} and R_{4+5}. The brown spots on the ventral side of the head do not reach the jugular setae; the scutellum usually has 4 setae (Oboňa et al. 2022).

Comments. The majority of the specimens were collected from ornithological stations in connection with birds. However, the host bird species (*Poecile montanus, P. palustris, Periparus ater, Phylloscopus collybita*) were registered only for 13 specimens.

DISCUSSION

Although Elberg (1995) mentioned seven Hippoboscidae species as occurring in Estonia, earlier literature sources list only six species by name. Moreover, only three out of these six species; *Hippobosca equina*, *Lipoptena cervi*, and *Ornithomya avicularia*, are accompanied by collection data, while the other three species are merely named. Kurina et al. (2019) added *Lipoptena fortisetosa*, providing detailed information on its distribution. The current study adds two species—*Ornithomya chloropus* and *O. fringillina*—to the Estonian list, and provides voucher specimen data for all nine species. In comparison to neighbouring areas, there are eight species known from Lithuania (Pakalniškis et al. 2006), seven from Latvia (Karpa 2008), ten from Finland (Pohjoismäki and Kahanpää 2014), and ten from the northwestern part of Russia (Grunin 1970). Altogether, 13 species of hippoboscid flies occur in the region, with six species common to all areas (Table 1). *Olfersia fumipennis* (Sahlberg, 1886), a Nearctic species, and *Ornithophila metallica* (Schiner, 1864), a southern Palaearctic species, are both recorded from Finland but not from neighbouring areas. These species may be dispersed by migrating birds, and it is expected that they will be recorded in Estonia in the future. The same is true for two additional species—an eastern Palaearctic and Oriental species, *Crataerina obtusipennis* Austen, 1926, and a southern Palaearctic species, *Icosta minor* (Bigot in Thomson, 1858)—both recorded from the northwestern part of Russia (Grunin 1970), but not from other areas. *Lipoptena fortisetosa* reaches its northern distribution limit in Estonia, but range expansion northwards is expected according to Kurina et al. (2019). Indeed, compared to Kurina et al. (2019), the new collection data show a slight range shift northwards, including records from Jõgeva County, over 30 km north of earlier findings (Figure 1A: localities No. 66 and No. 68).

Two Estonian species associated with livestock have rarely been encountered and are evidently nearing local extinction due to increased use of effective insecticides and a decline in livestock farming. *Melophagus ovinus*, parasitizing sheep, although frequently mentioned in local veterinary literature (Järvis and Mägi 2013), was collected only once in 2005 from northern Estonia, while *H. equina*, parasitizing mainly horses and cattle, was last recorded in 1962. Taking into account that louse flies have been found to be vectors of several pathogens, such as *Bartonella* spp., *Babesia* spp., and *Trypanosoma* spp., among others (e.g. Peña-Espinoza et al. 2023, Keve et al. 2024), future monitoring of their diversity and distribution is of utmost importance.

Table 1. Hippoboscidae species occurring in Estonia and neighbouring countries. Data sources: Estonia (original data), Finland (Pohjoismäki and Kahanpää 2014), Latvia (Karpa 2008), Lithuania (Pakalniškis et al. 2006), and the northwestern part of Russia (Grunin 1970).

Species	Estonia	Finland	Latvia	Lithuania	NW Russia
Hippobosca equina Linnaeus, 1758	+	+	+	+	+
Lipoptena cervi (Linnaeus, 1758)	+	+	+	+	+
Lipoptena fortisetosa Maa, 1965	+			+	
Melophagus ovinus (Linnaeus, 1758)	+	+	+	+	+
Crataerina obtusipennis Austen, 1926					+
Crataerina pallida (Olivier in Latreille, 1811)	+	+		+	+
Stenepteryx hirundinis (Linnaeus, 1758)	+	+	+	+	+
Icosta minor (Bigot in Thomson, 1858)					+
Olfersia fumipennis (Sahlberg, 1886)		+			
Ornithomya avicularia (Linnaeus, 1758)	+	+	+	+	+
Ornithomya chloropus (Bergroth, 1901)	+	+	+		+
Ornithomya fringillina Curtis, 1836	+	+	+	+	+
Ornithophila metallica (Schiner, 1864)		+			
Total	**9**	**10**	**7**	**8**	**10**

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: OK. Data curation: OK, KJV. Formal analysis: OK, KJV. Funding acquisition: OK. Investigation: OK, KJV. Methodology: OK. Resources: OK. Supervision: OK. Project administration: OK. Software: OK. Validation: OK. Visualization: OK. Writing – original draft: OK. Writing – review and editing: OK, KJV.

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Data availability

All data that support the findings of this study are available in the main text.

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