

Research article

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New species and new records of black fungus gnats (Diptera: Sciaridae) from the Viidumäe Nature Reserve, Estonia

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Abstract. An inventory of Sciaridae (Diptera: Sciaroidea) from a eutrophic fen and a spring brook in Viidumäe Nature Reserve (Estonia, Saaremaa Island) recorded a total of 60 species, of which 57 are new records for Estonia, including two that are new to science and described herein as *Cratyna (Diversicratyna) palustricola* sp. nov. (Estonia) and *Sciara bryophila* sp. nov. (Estonia, Finland). This has raised the number of Sciaridae known from Estonia from 6 to 63.

Keywords. Diptera, Sciaridae, Europe, Estonia, Finland, biodiversity.

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Introduction

Black fungus gnats (Diptera Linnaeus, 1758: Sciaridae Billberg, 1820) are lower Diptera that inhabit most terrestrial habitats, breeding in, for example, decaying wood, leaf detritus and fruiting bodies of fungi (e.g., Menzel & Mohrig 2000; Vilkamaa & Komonen 2001), and some species seem to be confined to peat bogs or other moist environments (e.g., Rudzinski 1993; Heller 1998; Salmela & Vilkamaa 2005). In general, the Sciaridae is a very poorly known family, and undescribed species regularly appear in samples from various parts of the Holarctic region (e.g., Hippa *et al.* 2003, 2010; Vilkamaa *et al.* 2013a; Wu *et al.* 2013; Shi *et al.* 2014; Heller *et al.* 2015), even from relatively well-studied Central Europe (Menzel *et al.* 2003a; Heller & Menzel 2013). A small number of species may be pests in

greenhouses or mushroom farms (Menzel *et al.* 2003b). However, the biology and distribution of most species of the family are insufficiently known.

The knowledge of the sciarid fauna of the Baltic countries is very fragmentary (Kurina *et al.* 2011, Table 2). For example, only six species in five genera have previously been recorded from Estonia: *Chaetosciara estlandica* (Lengersdorf, 1929); *Corynoptera saetistyla* Mohrig & Krivosheina, 1985; *Corynoptera trepida* (Winnertz, 1867); *Cratyna* (*Cratyna*) *uliginosa* (Lengersdorf, 1929); *Leptosciarella* (*Leptosciarella*) *brevipalpa* Mohrig & Menzel, 1992 and *Dolichosciara nigrovittata* (Strobl, 1910) (Lengersdorf 1929; Mohrig & Menzel 1994; Menzel & Mohrig 2000; Heller & Menzel 2010; Hippa *et al.* 2010; Vilkamaa *et al.* 2013b). Here we aim to provide new faunistic information on Sciaridae from Saaremaa Island, Estonia, and to describe two newly detected species.

Material and methods

Two study sites were selected in Viidumäe Nature Reserve (Estonia, Saaremaa Island, 58.2966° N, 22.0863° E): a eutrophic fen (Kanna) and a spring brook (Nakimetsa). The Kanna site is an open fen influenced by lime deposits, with a moderate flow of ground water, and occasional dwarf Scots pines (*Pinus sylvestris* L.). The fen is surrounded by pine-dominated heath forest. The Nakimetsa site is a calcareous spring brook near the Viidumäe esker. The brook flows through a pine forest, almost undisturbed, with occasional broadleaf trees. Spring water values for pH (7.86–8.07) and conductivity (23.5–41.4 mS/cm) indicate lime-rich conditions (T. Talvi, pers. com.).

The material was collected using two Malaise traps at each site. Ethylene glycol was used as a preservative in the traps and the material was finally preserved in 70% ethanol. The traps were in situ from mid-April to mid-November 2002, and were emptied at monthly intervals. Sciarids were sorted out from the material and slide-mounted in Euparal. Only males were preserved and studied.

Employed nomenclature and systematics are mainly based on the revision of the Palaearctic fauna (Menzel & Mohrig 2000), the revision of the Nearctic fauna (Mohrig *et al.* 2013), and some works after 2000. These comprise Hippa & Vilkamaa (2004, 2016) [*Xylosciara*, *Claustropyga*]; Hippa *et al.* (2003, 2010) [*Claustropyga*, *Corynoptera* s. str.]; Mohrig & Kauschke (2016) [*Scatopsiara*, in part]; Shin *et al.* (2019) [*Leptosciarella*, *Mouffetina*, *Trichosia*]; Vilkamaa & Menzel (2019) [*Lycoriella*, *Hemineurina*, *Trichocoelina*] and Vilkamaa *et al.* (2004, 2013c) [*Dichopygina*, *Camptochaeta*]. The proposal by Mohrig *et al.* (2017), of *Ctenosciara* Tuomikoski, 1960 as a junior synonym of *Austrosiara* Schmitz & Mjöberg, 1924, was not followed here, because the name-bearing types of the respective type species have not yet been revised and compared.

The examined material, including types, is deposited in the following collections:

MZH = Zoological Museum, Finnish Museum of Natural History, Helsinki, Finland

LMM = Regional Museum of Lapland, Rovaniemi, Finland

SDEI = Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany

A 658 bp fragment of cytochrome c oxidase subunit I (COI) was sequenced from two specimens of *Sciara bryophila* sp. nov. The specimens were placed in 96% ethanol in a 96-well lysis microplate and dispatched to the Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario, where DNA was extracted by a non-destructive method and sequenced using standard protocols and primers (deWaard *et al.* 2008). The new sequences are deposited in GenBank under accession numbers KY200864 and KY200865.

Results

Description of new species

Phylum Arthropoda Latreille, 1829
Class Insecta Linnaeus, 1758
Order Diptera Linnaeus, 1758
Family Sciaridae Billberg, 1820
Genus *Cratyna* Winnertz, 1867

Cratyna (Diversicratyna) palustricola sp. nov.

[urn:lsid:zoobank.org:act:4E4B22E3-0BED-4E10-92CD-F121EE7AF3E4](https://zoobank.org/urn:lsid:zoobank.org:act:4E4B22E3-0BED-4E10-92CD-F121EE7AF3E4)

Figs 1–2

Diagnosis

Rather small species (wing length = 1.6–1.7 mm) with three-segmented palpi. Gonostyli narrowed toward apex, with long apical tooth and 4–6 megasetae. Tegmen conical, broader than long.

Etymology

The name, a noun in apposition, is derived from the Latin words ‘*palustris*’ (‘marshy’) and ‘*-cola*’ (‘inhabitant’), referring to the habitat of the species.

Material examined

Holotype

ESTONIA • ♂; Saaremaa Island, Viidumäe Nature Reserve; 58.2966° N, 22.0863° E; 15 Aug.–11 Sep. 2002; T. Talvi leg; Malaise trap; rich fen; with one male of *Corynoptera postforcipata* Rudzinski, 1993 on the same slide; MZH.

Paratypes

ESTONIA • 1 ♂; same collection data as for holotype; 12 Apr.–15 May 2002; with 1 male of *Claustropyga brevichaeta* (Mohrig & Antonova, 1978) on the same slide; MZH • 1 ♂; same collection data as for holotype; 17 Jul.–15 Aug. 2002; with 2 males of *Corynoptera unidentata* (Hippa & Vilkamaa, 1994) on the same slide; SDEI • 2 ♂♂; same collection data as for holotype; 16 Jun.–17 Jul. 2002; with 1 male of *Lycoriella lundstromi* (Frey, 1948) on the same slide; MZH.

Description

Male

HEAD. Brown. Maxillary palpus very pale brown. Antenna concolorous, pale brown. Eye bridge 3 facets wide. Face with 6 scattered dark setae of various length. Clypeus with 1 dark seta. Maxillary palpus with 3 segments; segment 3 longest, segment 2 shortest; segment 1 with one long sharp seta, with dorsal pit of sensilla. Fourth antennal flagellomere $2.4 \times$ as long as wide, neck shorter than broad; longest setae shorter than width of flagellomere.

THORAX. Unicolorous brown. Setae dark. Anterior pronotum with 2 setae. Prothoracic episternum with 5–6 setae. Scutellum with 4 long setae and some short setae.

WING. Length = 1.6–1.7 mm. Anal lobe very small. Width/length = 0.35–0.40. $R1/R = 0.60$. $c/w = 0.60$ –0.75. $r-m$ shorter than bM , both veins non-setose. Halter pale brown.

LEGS. Yellowish. Coxal setae dark. Fore tibial organ with pale vestiture, forming indistinct patch. Fore tibial spur slightly longer than tibial width.

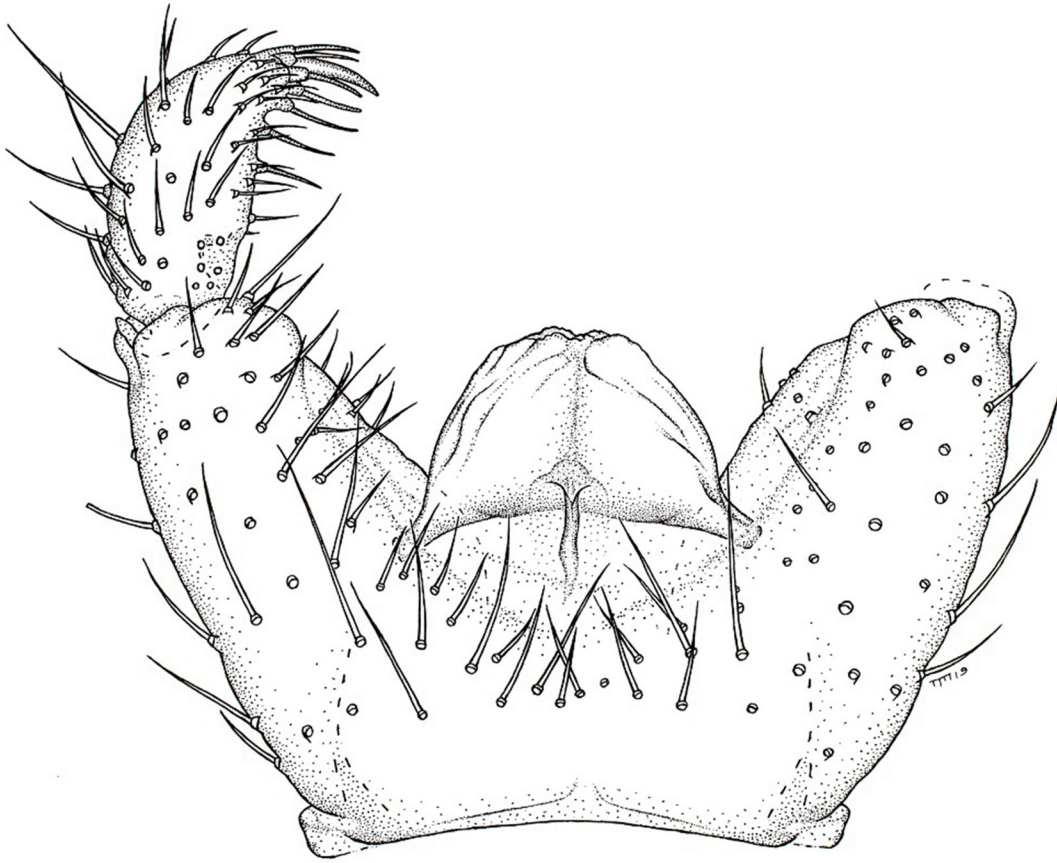


Fig. 1. *Cratyna (Diversicratyna) palustricola* sp. nov., holotype (MZH), hypopygium, ventral view.

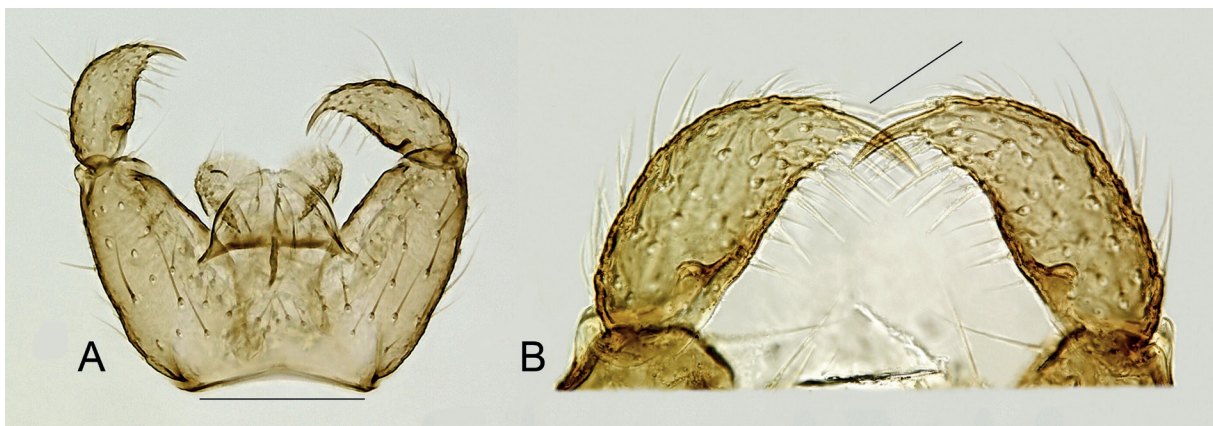


Fig. 2. *Cratyna (Diversicratyna) palustricola* sp. nov. **A.** Hypopygium (holotype, MZH), ventral view. **B.** Gonostyli (paratype, MZH), ventral view. Scale bars: A = 130 μ m; B = 40 μ m.

ABDOMEN. Pale brown, paler than thorax. Setae dark and rather short. Hypopygium (Figs 1, 2A) brown, as abdomen. Gonocoxae longer than gonostyli; ventral setosity of gonocoxae normal, sparse. Gonostyli (Figs 1, 2B) elongated, narrowed towards apex, mesial side slightly impressed; setosity sparse; with long apical tooth, with 4–6 megasetae (subequal in size, slender, straight); apically with long curved seta. Tegmen unmodified, conical, broader than long, with small aedeagal teeth; aedeagal apodeme short.

Taxonomic remarks

Cratyna palustricola sp. nov. belongs to the subgenus *Diversicratyna* Menzel & Mohrig, 1998. The new species resembles *Cratyna spiculosa* (Rudzinski, 1993) and *Cr. unispinula* (Mohrig & Menzel, 1992) in having a narrow gonostylus with a long apical tooth and a group of apical and/or subapical megasetae (cf. Rudzinski 1993: 286, figs 11–14; Mohrig & Menzel 1992: 3, fig. 3a–d). *Cratyna palustricola* sp. nov. and *Cr. unispinula* are similar in having the megasetae very narrow (thickened in *Cr. spiculosa*) and in having the maxillary palpus with three segments (two in *Cr. spiculosa*). *Cratyna palustricola* sp. nov. differs from *Cr. unispinula* in having a broader gonostylus, with its subapical megasetae more numerous (4–7 vs 2) and the basalmost ones placed nearly at the middle of the gonostylus. Furthermore, *Cr. palustricola* sp. nov. has a modified long seta on the dorsal side of the gonostylus, not a megaseta as *Cr. unispinula* sometimes does (see Menzel & Mohrig 2000).

By its gonostylus, *Cratyna (Diversicratyna) palustricola* sp. nov. resembles *Corynoptera salmelai* Vilkamaa, Hippa & Heller, 2013 and *Corynoptera spiciforceps* Vilkamaa, Hippa & Heller, 2013. *Cratyna palustricola* is similar to *C. spiciforceps* in having the gonostylus evenly narrowed towards apex, whereas *C. salmelai* has it bulged medially. *Cratyna palustricola* is similar to *C. spiciforceps* and differs from *C. salmelai* in having the tegmen rounded apically and in having a sensory pit on the 1st palpal segment, whereas *C. salmelai* has sharp apicolateral teeth on its tegmen and the 1st palpal segment with a patch of sensilla. Furthermore, *C. spiciforceps* has an elongated seta medially on its gonostylus. *Cratyna (Diversicratyna) palustricola* sp. nov. differs from both species of *Corynoptera* in having 2 megasetae, not normal setae, on the dorsal side of the apical tooth of the gonostylus, confirming its generic placement.

Genus *Sciara* Meigen, 1803

Sciara bryophila sp. nov.

[urn:lsid:zoobank.org:act:DD54A2D5-89FC-448C-914A-95FF4F6FAF52](https://zoobank.org/act:DD54A2D5-89FC-448C-914A-95FF4F6FAF52)

Figs 3–4

Sciara sp. n. – Salmela & Vilkamaa 2005: 288, 290 (part of Finnish material).

Sciara sp. A – Salmela *et al.* 2015: 65, 88 (part of Finnish material).

Diagnosis

Wing length 2.2–2.7 mm, anal lobe strong. Gonostylus with a strong, densely setose subapical lobe. Setose medial lobe is smaller than the subapical lobe, with (2–4) megasetae, or none. Apical megasetae (5–9) of gonostylus rather short. Tegmen long and conical, apically divided. Aedeagal teeth in a long and narrow area, numerous and evenly short.

Etymology

The name, a Latin adjective, is derived from the Latinized Greek words ‘*bryon*’ (‘moss’) and ‘*philo*’ (‘loving’), referring to the mossy habitat of the species.

Material examined

Holotype

FINLAND • ♂; Lapponia kemensis pars orientalis, Pelkosenniemi, Sudenvaaranapa; 67.189° N, 27.639° E; 28 Jul.–23 Sep. 2014; J. Salmela leg.; Malaise trap; rich fen; in ethanol; BOLD: JS-COI-2016-0161; GenBank: KY200864; LMM NVO.20170727.

Paratypes

FINLAND • 1 ♂; same collection data as for holotype; in ethanol; BOLD: JS-COI-2016-0162; GenBank: KY200865; LMM NVO.20170728 • 1 ♂; Ostrobothnia borealis pars borealis, Keminmaa, Kallinkangas; 65.8162° N, 24.5036° E; 27 Jun.–28 Jul. 2014; J. Salmela leg.; Malaise trap; rich fen; in Euparal; JS-sl-2015-0001; LMM NVO.20170449 • 1 ♂; same collection data as for preceding; in Euparal; MZH • 5 ♂♂; same collection data as for preceding; 28 Jul.–23 Sep. 2014; in Euparal; MZH • 4 ♂♂; same collection data as for preceding; 28 Jul.–23 Sep. 2014; in Euparal; SDEI • 2 ♂♂; Ostrobothnia borealis pars borealis, Tervola, Karhakkamaa; 66.2031° N, 25.1231° E; 1 Jun.–2 Aug. 2004; J. Salmela leg.; Malaise trap; calcareous rich fen and spring; in Euparal; MZH • 1 ♂; Ostrobothnia borealis pars borealis, Ylitornio, Palokas; 66.4319° N, 24.9267° E; 7–28 Aug. 2017; J. Salmela leg.; Malaise trap; rich fen; in ethanol; LMM NVO.20171126 • 1 ♂; Tavastia borealis, Toivakka, Ruostesuo; 62.0807° N, 25.9070° E; 1–27 Jul. 2003; J. Salmela leg.; Malaise trap; rich sloping fen; in Euparal; MZH.

ESTONIA • 1 ♂; Saaremaa Island, Viidumäe Nature Reserve; 58.2966° N, 22.0863° E; 14 Jun. –17 Jul. 2002; T. Talvi leg.; Malaise trap; rich fen; in Euparal; MZH.

Other material

FINLAND • 7 ♂, 2 ♀; Lapponia kemensis pars orientalis, Pelkosenniemi, Kätkäaapa-Serrijoki; 67.16738° N, 27.8772° E; 31 Jul.–29 Sep. 2015; J. Salmela leg.; Malaise trap; rich fen; DIPT-JS-2015-0426; LMM NVO.20170572 • 1 ♂, 1 ♀; same collection data as for holotype; DIPT-JS-2016-0002; LMM NVO.20170607.

Description

Male

HEAD. Brown, antenna unicolorous, paler brown, maxillary palpus very pale brown. Eye bridge 2–3 facets wide. Face with 18–27 setae, clypeus with 1–5 setae. Maxillary palpus with 3 segments; segments long, segment 3 longest, segment 2 shortest; palpal segment 1 with 6–8 setae, with indistinct dorsal patch of sensilla; body of 4th flagellomere 2.2–3.0 × as long as wide, without distinct apical margin, neck much shorter than broad, sensilla pale and fine, longest sensilla shorter than width of flagellomere.

THORAX. Brown, pleura slightly paler. Setae dark. Anterior pronotum with 3–10 setae. Prothoracal episternum with 7–16 setae. Scutum with short dorsocentrals, with some longer and shorter laterals, scutellum with more than 4 long setae, and some short setae.

WING. Fumose brown. Length = 2.2–2.7 mm. Width/length = 0.45. Anal lobe strong. Veins distinct. R1/R = 1.1–1.65. c/w = 0.55–0.75. r-m subequal with bM. M and CuA setose, stM with some setae, r-m non-setose or with 1–7 setae, bM non-setose or rarely with 1 seta.

LEGS. Pale brown, coxae darker. Coxal setae dark. Fore tibial organ with pale and fine vestiture forming large subtriangular patch. Fore tibial spur as long as tibial width. Hind tibia without spinose setae. Claws without teeth.

ABDOMEN. Brown, slightly paler than thorax. Setae dark, strong and rather long. Hypopygium (Figs 3A, 4) brown, concolorous with abdomen. Gonocoxae short and broad, nearly as long as gonostyli, mesial

margin with sparse setosity. Gonostylus (Fig. 3B) with 5–9 megasetae apically (average 7 by $n = 13$), with richly setose subapical lobe and small densely setose medial lobe with 0–4 strong megasetae on its apical side (0 in southern populations, i.e., Estonia and Toivakka (Fig. 4), 2–4 megasetae present in northern populations). Tegmen long and conical, apically with indistinctly divided medial process, ventrally with narrow elongated area of small aedeagal teeth, all aedeagal teeth numerous and evenly short; aedeagal apodeme sclerotised and very short.

Taxonomic remarks

Sciara bryophila sp. nov. belongs to the *Sciara humeralis* group in the sense of Menzel & Mohrig (2000). These have a basically triangular gonostylus, strongly impressed and narrowed towards the apex, with strong megasetae (spines) which in some species are arranged in a long and narrow apical group on a common basal projection, and a basal, densely setose lobe. Although there is some variation between the specimens of *Sciara bryophila* sp. nov. from different localities, for example, the specimens from northern Finland have stronger gonostylar megasetae than the central Finnish and Estonian specimens, we regard all as conspecific.

Sciara bryophila sp. nov. is similar to *S. multispinulosa* Mohrig & Kozánek, 1992 – described from North Korea in Mohrig *et al.* (1992: 19, fig. 1a–c) and redescribed by Sutou *et al.* (2004: 185, fig. 6a–b) on the basis of Japanese material – and *S. kitakamiensis* Sutou, 2004 described from Japan in Sutou *et al.* (2004: 186, fig. 7a–d). The mentioned three species have the gonostylus dorsally strongly impressed with a dorsobasal short lobe and a stronger ventral lobe with short, curved spine-like setae and the apex with strong megasetae, two of which are placed on a common basal body dorsally in the subapical part. *Sciara bryophila* sp. nov. is similar to *S. kitakamiensis* in having the ventral lobe of the gonostylus in the apical half of the gonostylus, and the gonostylus with only 9 strong megasetae, whereas *S. multispinulosa* has the ventral lobe at the middle of the gonostylus, and the gonostylus with 15–18 weak megasetae. *Sciara bryophila* sp. nov. is similar to *S. multispinulosa* and differs from *S. kitakamiensis* in having its

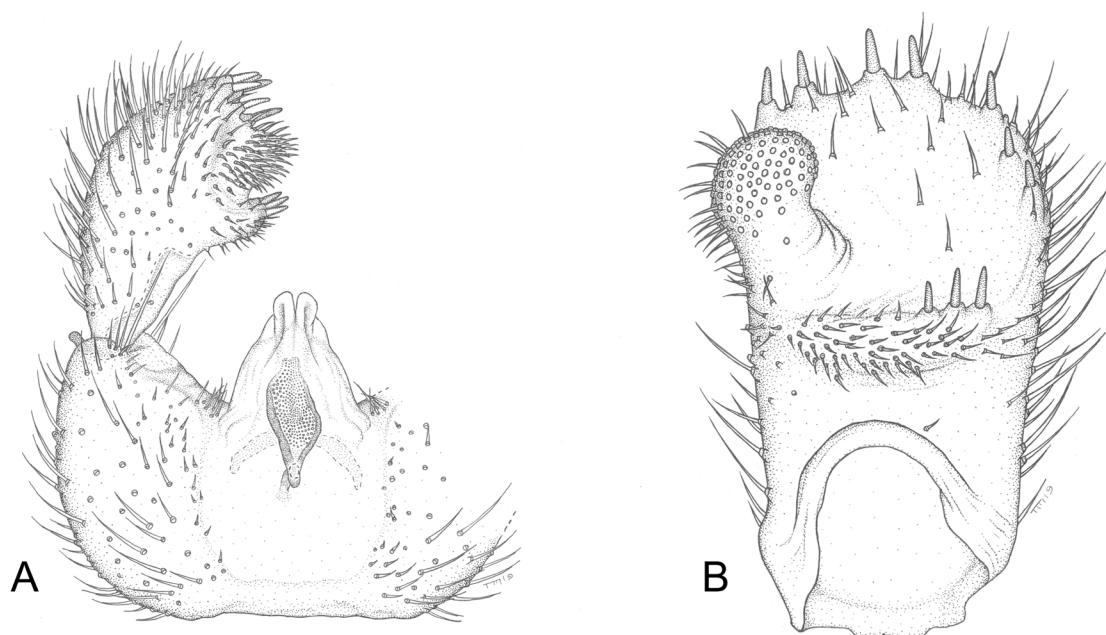


Fig. 3. *Sciara bryophila* sp. nov., holotype (LMM NVO.20170727). A. Hypopygium, ventral view. B. Gonostylus, mesial view.

gonostylus ventrally more impressed, its dorsal lobe more prominent and the dorsosubapical pair of setae much longer than their common base. Furthermore, *S. bryophila* sp. nov. differs from *S. kitakamiensis* in having the apical megasetae of the gonostylus separate, not placed in a common long basal projection, and in having the ventral lobe less apical in position and in having a few megasetae on the apical side of the ventral lobe (*S. kitakamiensis* has the ventral lobe nearly apical in position and has no megasetae on its dorsal side).

DNA analyses

In the BOLD (Ratnasingham & Hebert 2007) database, the present barcodes cluster in a unique BIN (Barcode Index Number, BOLD:ADD2461), shared by no other specimens. The closest specimen in BOLD is 3.29% distant (K2P) from the sequenced type specimens, and the closest BIN (BOLD:ADD2588) is mainly composed of specimens belonging to *S. humeralis* Zetterstedt, 1851.



Fig. 4. *Sciara bryophila* sp. nov., paratype from Estonia, Viidumäe (MZH), hypopygium, ventral view. Scale bar = 300 μ m.

Ecology and distribution

The new species occurs in rich fens, that is, in peatlands dominated by brown mosses and characterised by pH values around 7 or even above. In Finland the species occurs from south boreal to north boreal zones, but in South Finland it is known only from one site (Toivakka). It is assumed that *S. bryophila* sp. nov. is a rare or relict-like species in the hemiboreal and south boreal zones, being more common in mid and north boreal zones, especially in areas with limestone or calcareous bedrock. There are no records from the subalpine zone and the species may be absent from the northernmost parts of Fennoscandia.

Faunistics

A relatively high number of new species and species new for the Estonian fauna were recorded from a rather small number of studied specimens ($n=225$). *Corynoptera saetistyla* (24 specimens), *C. verrucifera* (Lengersdorf, 1952) (17 specimens), *Cratyna nobilis* (Winnertz, 1867) (17 specimens), *Camptochaeta camptochaeta* (Tuomikoski, 1960) (13 specimens) and *Corynoptera postforcipata* Rudzinski, 1993 (12 specimens) were most numerous. Most of the detected sciarid species are known from Central and/or Northern Europe, while many of them are common and widespread in the Palaearctic region. The sciarid species recorded in the Viidumäe Nature Reserve from April to November 2002 with four Malaise traps are listed in Table 1.

Discussion

A total of 225 individuals belonging to 60 species were identified, of which *Cratyna palustricola* sp. nov. and *Sciara bryophila* sp. nov. are new to science. Of the 60 species collected in the Viidumäe Nature Reserve, only three were already known from other localities in Estonia: *Corynoptera saetistyla*, *Corynoptera trepida* and *Cratyna uliginosa*. Thus, 57 sciarid species are here recorded for the first time from Estonia, including the two previously undescribed species (Table 1). The previously identified species *Chaetosciara estlandica*, *Leptosciarella brevipalpa* and *Dolichosciara nigrovittata* were not found in our study, which may be due to the habitat structure of the collected areas and/or the trapping method used. Consequently, 63 sciarid species are currently known from Estonia. They are spread over 19 genera as follows: *Bradysia* Winnertz, 1867 (7 species); *Camptochaeta* Hippa & Vilkamäa, 1994 (3); *Chaetosciara* Frey, 1942 (1); *Claustropyga* Hippa, Vilkamäa & Mohrig, 2003 (2); *Corynoptera* Winnertz, 1867 (14); *Cratyna* Winnertz, 1867 (5); *Ctenosciara* Tuomikoski, 1960 (1); *Dichopygina* Vilkamäa, Hippa & Komarova, 2004 (2); *Dolichosciara* Tuomikoski, 1960 (3); *Leptosciariella* Tuomikoski, 1960 (4); *Lycoriella* Frey, 1942 (4); *Mouffetina* Frey, 1942 (1); *Prosciara* Frey, 1942 (1); *Pseudolycoriella* Menzel & Mohrig, 1998 (1); *Scatopsiara* Edwards, 1927 (5); *Sciara* Meigen, 1803 (2); *Scythropochroa* Enderlein, 1911 (1); *Trichosia* Winnertz, 1867 (4); *Xylosciara* Tuomikoski, 1957 (2).

Faunistically significant are *Camptochaeta sicilicula* Hippa & Vilkamäa, 1994, *Corynoptera marinae* Mohrig & Mamaev, 1986, *Corynoptera subtetrachaeta* Komarova, 1995 and *Dolichosciara saetosa* (Lengersdorf, 1929). Only one individual of each of these rare species was captured in the Viidumäe Nature Reserve during an entire vegetation period. Furthermore, only a few specimens of these four species exist in collections, and they have been found in very few places in Europe.

Our results have revealed that the sciarid fauna of Estonia is very poorly known so far. The new faunistic records clearly reflect the lack of previous studies rather than a large sampling effort in the present study. This is supported by the comparison of the previously known species inventory of the Baltic States with that of the Fennoscandian countries (Table 2). Currently only 63 species are known from Estonia, 28 from Latvia and 22 from Lithuania. The Fennoscandian fauna is much better studied (Norway = 143 species; Sweden = 299 species; Finland = 370 species). About 450 to 500 sciarid species are expected for the fauna of Fennoscandia and at least 300 for the Baltic States.

Table 1 (continued on the next page). Sciaridae Billberg, 1820 collected from Viidumäe Nature Reserve in Estonia. Material from Kanna and Nakimetsa are combined. Abbreviations: * = First record from Estonia. Collecting periods: **1** = 12 Apr.–15 May 2002; **2** = 15 May–16 Jun. 2002; **3** = 16 Jun.–17 Jul. 2002; **4** = 17 Jul.–15 Aug. 2002; **5** = 15 Aug.–11 Sep. 2002; **6** = 11 Sep.–17 Nov. 2002. Subgenera: *Bae.* = *Baeosciara*; *Cra.* = *Cratyna* s. str.; *Div.* = *Diversicratyna*; *Lep.* = *Leptosciarella* s. str.; *Sca.* = *Scatopsciara* s. str.; *Spa.* = *Spathobdella*; *Tri.* = *Trichosia* s. str.; *Xen.* = *Xenopygina*; *Xyl.* = *Xylosciara* s. str.

Species	Collecting periods					
	1	2	3	4	5	6
<i>Bradysia aprica</i> (Winnertz, 1867) *	1		2		2	
<i>Bradysia brevispina</i> Tuomikoski, 1960 *			1			
<i>Bradysia pectoralis</i> (Staeger, 1840) *			1			
<i>Bradysia regularis</i> (Lengersdorf, 1934) *		1				
<i>Bradysia submoesta</i> Mohrig & Krivosheina, 1989 *	1	1	2		1	
<i>Bradysia tilicola</i> (Winnertz, 1867) *			1			
<i>Bradysia trivittata</i> (Staeger, 1840) *	1		1			
<i>Camptochaeta camptochaeta</i> (Tuomikoski, 1960) *	8	5				
<i>Camptochaeta coei</i> (Freeman, 1983) *	1					
<i>Camptochaeta sicilicula</i> Hippa & Vilkamaa, 1994 *		1				
<i>Claustropyga brevichaeta</i> (Mohrig & Antonova, 1978) *	5					
<i>Claustropyga heteroclausea</i> (Rudzinski, 1991) *	1					
<i>Corynoptera barbata</i> Tuomikoski, 1960 *					1	
<i>Corynoptera boletiphaga</i> (Lengersdorf, 1940) *	1		1			
<i>Corynoptera forcipata</i> (Winnertz, 1867) *		1	3			1
<i>Corynoptera irmgardis</i> (Lengersdorf, 1940) *	4		1			1
<i>Corynoptera marinae</i> Mohrig & Mamaev, 1986 *					1	
<i>Corynoptera melanochaeta</i> Mohrig & Menzel, 1992 *			1			
<i>Corynoptera postforcipata</i> Rudzinski, 1993 *		1	9		2	
<i>Corynoptera saetistyla</i> Mohrig & Krivosheina, 1985			16		8	
<i>Corynoptera sphenoptera</i> Tuomikoski, 1960 *	2		1		1	1
<i>Corynoptera subtetrachaeta</i> Komarova, 1995 *	1					
<i>Corynoptera trepida</i> (Winnertz, 1867)	2	3	1			
<i>Corynoptera tridentata</i> Hondru, 1968 *					1	
<i>Corynoptera unidentata</i> (Hippa & Vilkamaa, 1994) *			1	2		
<i>Corynoptera verrucifera</i> (Lengersdorf, 1952) *	12	5				
<i>Cratyna</i> (<i>Cra.</i>) <i>uliginosa</i> (Lengersdorf, 1929)		1				
<i>Cratyna</i> (<i>Div.</i>) <i>spiculosa</i> (Rudzinski, 1993) *		1			1	1
<i>Cratyna</i> (<i>Div.</i>) <i>palustricola</i> sp. nov.*	1		2	1	1	
<i>Cratyna</i> (<i>Spa.</i>) <i>falcifera</i> (Lengersdorf, 1933) *		1	3		3	
<i>Cratyna</i> (<i>Spa.</i>) <i>nobilis</i> (Winnertz, 1867) *	12	1	1		3	
<i>Ctenosciara hyalipennis</i> (Meigen, 1804) *	5	3				
<i>Dichopygina nigrohalteralis</i> (Frey, 1948) *	1	1				
<i>Dichopygina ramosa</i> Vilkamaa, Hippa & Komarova, 2004 *	2					
<i>Dolichosciara ornata</i> (Winnertz, 1867) *		5				3

Table 1 (continued). Sciaridae Billberg, 1820 collected from Viidumäe Nature Reserve in Estonia. Material from Kanna and Nakimetsa are combined. Abbreviations: * = First record from Estonia. Collecting periods: **1** = 12 Apr.–15 May 2002; **2** = 15 May–16 Jun. 2002; **3** = 16 Jun.–17 Jul. 2002; **4** = 17 Jul.–15 Aug. 2002; **5** = 15 Aug.–11 Sep. 2002; **6** = 11 Sep.–17 Nov. 2002. Subgenera: *Bae.* = *Baeosciara*; *Cra.* = *Cratyna* s. str.; *Div.* = *Diversicratyna*; *Lep.* = *Leptosciarella* s. str.; *Sca.* = *Scatopsciara* s. str.; *Spa.* = *Spathobdella*; *Tri.* = *Trichosia* s. str.; *Xen.* = *Xenopygina*; *Xyl.* = *Xylosciara* s. str.

Species	Collecting periods					
	1	2	3	4	5	6
<i>Dolichosciara saetosa</i> (Lengersdorf, 1929) *			1			
<i>Leptosciariella</i> (<i>Lep.</i>) <i>fuscipalpa</i> (Mohrig & Mamaev, 1979) *	2					
<i>Leptosciariella</i> (<i>Lep.</i>) <i>subpilosa</i> (Edwards, 1925) *					1	
<i>Leptosciariella</i> (<i>Lep.</i>) <i>viatica</i> (Winnertz, 1867) *	2					
<i>Lycoriella ingenua</i> (Dufour, 1839) *			1			
<i>Lycoriella latilobata</i> Menzel & Mohrig, 2000 *		1				
<i>Lycoriella lundstromi</i> (Frey, 1948) *			1			
<i>Lycoriella minutula</i> Mohrig & Krivosheina, 1987 *		1	1			
<i>Mouffetina pulchricornis</i> (Edwards, 1925) *					1	
<i>Prosciara prosciarioides</i> (Tuomikoski, 1960) *	2		2		4	
<i>Pseudolycoriella subbruckii</i> (Mohrig & Hövemeyer, 1992) *		2	2		4	
<i>Scatopsciara</i> (<i>Sca.</i>) <i>atomaria</i> (Zetterstedt, 1851) *		1				
<i>Scatopsciara</i> (<i>Sca.</i>) <i>calamophila</i> Frey, 1948 *	1					
<i>Scatopsciara</i> (<i>Sca.</i>) <i>neglecta</i> Menzel & Mohrig, 1998 *			1			
<i>Scatopsciara</i> (<i>Sca.</i>) <i>pusilla</i> (Meigen, 1818) *					1	
<i>Scatopsciara</i> (<i>Xen.</i>) <i>vagula</i> Tuomikoski, 1960 *	1					
<i>Sciara bryophila</i> sp. nov. *			1			
<i>Sciara hebes</i> (Loew, 1869) *			1			
<i>Scythropochroa radialis</i> Lengersdorf, 1926 *					1	
<i>Trichosia</i> (<i>Bae.</i>) <i>scotica</i> (Edwards, 1925) *	1					
<i>Trichosia</i> (<i>Tri.</i>) <i>acrotricha</i> Tuomikoski, 1960 *					1	
<i>Trichosia</i> (<i>Tri.</i>) <i>caudata</i> (Walker, 1848) *	6	2				
<i>Trichosia</i> (<i>Tri.</i>) <i>confusa</i> Menzel & Mohrig, 1997 *	1					
<i>Xylosciara</i> (<i>Xyl.</i>) <i>microdon</i> (Frey, 1948) *	1					
<i>Xylosciara</i> (<i>Xyl.</i>) <i>spectabilis</i> Rudzinski, 1992 *	1	1				

The high number of identified species, the two newly described species and the high proportion of species that were newly recorded for the Estonian fauna show that even relatively small field studies can make a major contribution to biodiversity research. However, the discovery of new and faunistically interesting species shows also that mires, eutrophic fens and spring water-influenced habitats may provide new insights into sciarid ecology and taxonomy, and that they are worth protecting.

Table 2. Numbers of genera and species of Sciaridae Billberg, 1820 in Fennoscandia and the Baltics. Remark: countries are listed according to their geographical location from north-west (NW) to south-east (SE).

Region	Countries	Number of		References
		genera	species	
Fennoscandia	Norway	22	143	Heller & Menzel (2010); Vilkamaa & Menzel (2019); Menzel <i>et al.</i> (2020) [including Jan Mayen and Svalbard]
	Sweden	28	299	Heller <i>et al.</i> (2009, 2015, 2016); Heller & Menzel (2010, 2013); Vilkamaa <i>et al.</i> (2013a, 2013c, 2013d); Vilkamaa & Menzel (2019)
	Finland	29	370	Heller & Menzel (2010); Vilkamaa (2014); Heller <i>et al.</i> (2015); Salmela <i>et al.</i> (2015); Hippa & Vilkamaa (2016); Vilkamaa & Menzel (2019)
Baltics	Estonia	19	63	Lengersdorf (1929); Mohrig & Menzel (1994); Menzel & Mohrig (2000); Heller & Menzel (2010); Hippa <i>et al.</i> (2010); Vilkamaa <i>et al.</i> (2013b); this study
	Latvia	10	28	Mohrig <i>et al.</i> (1985); Menzel (1992); Mohrig (1993); Mohrig & Menzel (1993, 1994, 1997); Menzel & Mohrig (1997, 2000); Heller & Menzel (2010); Hippa <i>et al.</i> (2010)
	Lithuania	10	22	Mohrig & Menzel (1993); Pakalniškis <i>et al.</i> (2000, 2006); Podėnas & Pakalniškis (2000); Heller & Menzel (2010); Kurina <i>et al.</i> (2011)

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References

- deWaard J., Ivanova N., Hajibabaei M., Hebert P.D.N. 2008. Assembling DNA Barcodes. *In*: Martin C. (ed.) *Environmental Genomics*: 275–293. Methods in Molecular Biology 410. Humana Press Inc. https://doi.org/10.1007/978-1-59745-548-0_15
- Heller K. 1998. Beiträge zur Sciaridenfauna Schleswig-Holsteins (Diptera). Teil 1. Das Trentmoor bei Plön. *Dipteron* 1: 45–56.
- Heller K. & Menzel F. 2010. Fauna Europaea: Sciaridae. *In*: Beuk P.L.T. & Pape T. (eds) *Fauna Europaea: Diptera, Nematocera. Fauna Europaea Version 2.3*. Available from <http://www.faunaeur.org> [accessed 22 Jun. 2016].
- Heller K. & Menzel F. 2013. Drei neue Trauermückenarten aus Mitteleuropa (Diptera: Sciaridae). *In*: Weber D. (ed.) *Die Höhlenfauna Luxemburgs*: 337–348. Ferrantia 69. Musée national d’histoire naturelle du Luxembourg, Luxembourg.
- Heller K., Vilkamaa P. & Hippa H. 2009. An annotated check list of Swedish black fungus gnats (Diptera, Sciaridae). *Sahlbergia* 15: 23–51.

- Heller K., Hippa H. & Vilkamaa P. 2015. Taxonomy of *Bradysia* Winnertz (Diptera, Sciaridae) in the Northern Holarctic, with the description of four new species. *European Journal of Taxonomy* 122: 1–15. <https://doi.org/10.5852/ejt.2015.122>
- Heller K., Köhler A., Menzel F., Olsen K.M. & Gammelmo Ø. 2016. Two formerly unrecognized species of Sciaridae (Diptera) revealed by DNA barcoding. *Norwegian Journal of Entomology* 63: 96–115.
- Hippa H. & Vilkamaa P. 2004. The genus *Xylosciara* Tuomikoski (Diptera, Sciaridae): phylogeny and review of the species. *Acta Zoologica Fennica* 214: 1–38.
- Hippa H. & Vilkamaa P. 2016. New species of *Claustropyga* Hippa, Vilkamaa & Mohrig (Diptera, Sciaridae) from the Holarctic region. *Zootaxa* 4088 (4): 594–600. <https://doi.org/10.11646/zootaxa.4088.4.10>
- Hippa H., Vilkamaa P. & Mohrig W. 2003. Phylogeny of *Corynoptera* Winnertz and related genera, with the description of *Claustropyga* gen. nov. (Diptera, Sciaridae). *Studia dipterologica* 9 (2) (2002): 469–511.
- Hippa H., Vilkamaa P. & Heller K. 2010. Review of the Holarctic *Corynoptera* Winnertz, 1867, s. str. (Diptera, Sciaridae). *Zootaxa* 2695: 1–197. <https://doi.org/10.11646/zootaxa.2695.1.1>
- Kurina O., Vilkamaa P. & Rimsaite J. 2011. Eleven species of Sciarioidea (Diptera) new to the Lithuanian fauna. *New and Rare for Lithuania Insect Species* 23: 101–105.
- Lengersdorf F. 1929. Die Sciariden (Trauermücken) des Zehlaubruches. *Schriften der physikalisch-ökonomischen Gesellschaft zu Königsberg* 66 (2): 313–319.
- Menzel F. 1992. Beiträge zur Taxonomie und Faunistik der paläarktischen Trauermücken (Diptera, Sciaridae). Teil II. Die Sciaridae des Museums für Naturkunde der Humboldt-Universität zu Berlin. *Beiträge zur Entomologie* 42 (2): 259–277. <https://doi.org/10.21248/contrib.entomol.42.2.259-277>
- Menzel F. & Mohrig W. 1997. Revision der paläarktischen Arten von *Trichosia* Winnertz sensu Tuomikoski, 1960 (Diptera, Sciaridae). – Teil I. Gattung *Trichosia* Winnertz, 1867. *Studia dipterologica* 4 (1): 3–40.
- Menzel F. & Mohrig W. 2000. *Revision der paläarktischen Trauermücken (Diptera: Sciaridae)*. *Studia dipterologica* Supplement 6 (1999): 1–761, Ampyx-Verlag, Halle an der Saale.
- Menzel F., Gammelmo Ø., Olsen K.M. & Köhler A. 2020. The black fungus gnats (Diptera: Sciaridae) of Norway – Part I: species records published until December 2019, with an updated checklist. *ZooKeys* 957: 17–104. <https://doi.org/10.3897/zookeys.957.46528>
- Menzel F., Schulz U. & Taeger T. 2003a. Neue Trauermücken aus dem nordostdeutschen Tiefland, mit einer ökologischen Betrachtung von Wurzelteller-Fängen und einer Checkliste der aus Berlin/Brandenburg bekannten Arten (Diptera: Sciaridae). *Beiträge zur Entomologie* 53 (1): 71–105. <https://doi.org/10.21248/contrib.entomol.53.1.71-105>
- Menzel F., Smith J.E. & Colauto N.B. 2003b. *Bradysia difformis* Frey and *Bradysia ocellaris* (Comstock): two additional Neotropical species of black fungus gnats (Diptera: Sciaridae) of economic importance: a redescription and review. *Annals of the Entomological Society of America* 96 (4): 448–457. [https://doi.org/10.1603/0013-8746\(2003\)096\[0448:BDFABO\]2.0.CO;2](https://doi.org/10.1603/0013-8746(2003)096[0448:BDFABO]2.0.CO;2)
- Mohrig W. 1993. Der Artenkreis *Corynoptera concinna* (Winnertz 1867) (Diptera, Sciaridae). *Bonner zoologische Beiträge* 44 (1–2): 47–55.
- Mohrig W. & Kauschke E. 2016. New black fungus gnats (Diptera, Sciaridae) of North America. Part I. Genus *Scatopsiara* Edwards, 1927. *Zootaxa* 4150 (4): 401–435. <https://doi.org/10.11646/zootaxa.4150.4.3>

- Mohrig W. & Menzel F. 1992. Neue Arten europäischer Trauermücken (Diptera, Sciaridae). *An International Journal of Dipterological Research* 3 (1–2): 1–16.
- Mohrig W. & Menzel F. 1993. Revision der paläarktischen Arten der *Bradysia brunnipes*-Gruppe (Diptera, Sciaridae). *Bonner zoologische Beiträge* 44 (3–4): 267–291.
- Mohrig W. & Menzel F. 1994. Revision der paläarktischen Arten von *Phytosciara* Frey (Diptera: Sciaridae). *Beiträge zur Entomologie* 44 (1): 167–210.
- Mohrig W. & Menzel F. 1997. Revision der paläarktischen Arten von *Trichosia* Winnertz *sensu* Tuomikoski, 1960 (Diptera, Sciaridae). Teil II. Gattungen *Leptosciarella* Tuomikoski, 1960 und *Trichodapus* gen. nov. *Studia dipterologica* 4 (1): 41–98.
- Mohrig W., Krivosheina N. & Mamaev B. 1985. Beiträge zur Kenntnis der Trauermücken (Diptera, Sciaridae) der Sowjetunion. Teil VIII. Neue Arten aus europäischen Gebieten. *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere* 112 (3): 299–310.
- Mohrig W., Menzel F. & Kozánek M. 1992. Neue Trauermücken (Diptera, Sciaridae) aus Nord-Korea und Japan. *An International Journal of Dipterological Research* 3 (1–2): 17–32.
- Mohrig W., Heller K., Hippa H., Vilkamaa P. & Menzel F. 2013. Revision of black fungus gnats (Diptera: Sciaridae) of North America. *Studia dipterologica* 19 (1–2) (2012): 141–286.
- Mohrig W., Kauschke E. & Heller K. 2017. *Austrosciara* Schmitz & Mjöberg, 1924, a senior synonym of *Ctenosciara* Tuomikoski, 1960 (Diptera: Sciaridae) and the description of a new brachypterous species in the genus. *Zootaxa* 4344 (2): 357–366. <https://doi.org/10.11646/zootaxa.4344.2.10>
- Pakalniškis S., Rimšaitė J., Sprangauskaitė-Bernotienė R., Butautaitė R. & Podėnas S. 2000. Checklist of Lithuanian Diptera. *Acta Zoologica Lituanica* 10 (1): 3–58. <https://doi.org/10.1080/13921657.2000.10512316>
- Pakalniškis S., Bernotienė R., Lutovinovas E., Petrašiūnas A., Podėnas S., Rimšaitė J., Sæther O.A. & Spungis V. 2006. Checklist of Lithuanian Diptera. *New and Rare for Lithuania Insect Species* 18: 16–154.
- Podėnas S. & Pakalniškis S. 2000. Supplement to the Diptera fauna of Lithuania. *Acta Zoologica Lituanica* 10 (3): 20–26. <https://doi.org/10.1080/13921657.2000.10512332>
- Ratnasingham S. & Hebert P.D.N. 2007. BOLD: The Barcode of Life Data System (www.barcodinglife.org). *Molecular Ecology Notes* 7: 355–364. <https://doi.org/10.1111/j.1471-8286.2007.01678.x>
- Rudzinski H.-G. 1993. Mücken und Fliegen aus dem Schluifelder Moos, Ober-Bayern. Zweite Liste (Diptera: Nematocera: Sciaridae). *Entomofauna* 14 (16): 281–304.
- Salmela J. & Vilkamaa P. 2005. Sciaridae (Diptera) from central Finland: faunistics and taxonomy. *Entomologica Fennica* 16: 287–300. <https://doi.org/10.33338/ef.84273>
- Salmela J., Siivonen S., Dominiak P., Haarto A., Heller K., Kanervo J., Martikainen P., Mäkilä M., Paasivirta L., Rinne A., Salokannel J., Söderman G. & Vilkamaa P. 2015. Malaise-pyynti Lapin suojelalueilla 2012–2014 [Malaise-trapping of insects in conservation areas in Lapland within 2012–2014]. *Metsähallituksen luonnonsuojelujulkaisu, Sarja A*, 221: 1–141.
- Shi K., Huang J., Zhang S. & Wu H. 2014. Taxonomy of the genus *Peyerimhoffia* Kieffer from mainland China, with a description of seven new species (Diptera, Sciaridae). *ZooKeys* 382: 67–83. <https://doi.org/10.3897/zookeys.382.4948>
- Shin S., Lee H. & Lee S. 2019. Proposal of a new subfamily of Sciaridae (Diptera: Sciaridae), with description of one new species from South Korea. *Zootaxa* 4543 (1): 127–136. <https://doi.org/10.11646/zootaxa.4543.1.8>

- Sutou M., Ito M.T. & Menzel F. 2004. A taxonomic study on the Japanese species of the genus *Sciara* Meigen (Diptera: Sciaridae). *Studia dipterologica* 11 (1): 175–192.
- Vilkamaa P. 2014. Checklist of the family Sciaridae (Diptera) of Finland. In: Kahanpää J. & Salmela J. (eds) Checklist of the Diptera of Finland. *ZooKeys* 441: 151–164.
<https://doi.org/10.3897/zookeys.441.7381>
- Vilkamaa P. & Komonen A. 2001. Redescription and biology of *Trichosia* (*Baeosciara*) *sinuata* Menzel & Mohrig (Diptera: Sciaridae). *Entomologica Fennica* 12 (1): 46–49. <https://doi.org/10.33338/ef.84095>
- Vilkamaa P. & Menzel F. 2019. Re-classification of *Lycoriella* Frey *sensu lato* (Diptera, Sciaridae), with description of *Trichocoelina* gen. n. and twenty new species. *Zootaxa* 4665 (1): 1–67.
<https://doi.org/10.11646/zootaxa.4665.1.1>
- Vilkamaa P., Hippa H. & Komarova L.A. 2004. The genus *Dichopygina* gen. n. (Diptera: Sciaridae). *Insect Systematics and Evolution* 35 (1): 107–120. <https://doi.org/10.1163/187631204788964691>
- Vilkamaa P., Hippa H. & Heller K. 2013a. Taxonomy of the Sciaridae (Diptera) of Northern Europe: description of eight new species. *Studia dipterologica* 20 (1): 47–58.
- Vilkamaa P., Heller K. & Hippa H. 2013b. New species of Sciaridae (Diptera) to the Finnish fauna. *Sahlbergia* 19 (1–2): 20–29.
- Vilkamaa P., Hippa H. & Heller K. 2013c. Review of the genus *Camptochaeta* Hippa & Vilkamaa (Diptera, Sciaridae), with the description of nine new species. *Zootaxa* 3636 (3): 476–488.
<https://doi.org/10.11646/zootaxa.3636.3.6>
- Vilkamaa P., Hippa H. & Heller K. 2013d. Notes on the taxonomy of the Holarctic *Corynoptera* Winnertz *sensu lato* (Diptera, Sciaridae) with description of six new species. *Zootaxa* 3710 (4): 322–332.
<https://doi.org/10.11646/zootaxa.3710.4.2>
- Wu H., Shi K., Huang J. & Zhang S. 2013. Review of the genus *Dolichosciara* Tuomikoski (Diptera, Sciaridae) from China. *Zootaxa* 3745: 343–364. <https://doi.org/10.11646/zootaxa.3745.3.3>

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