

Moth flies (Diptera, Psychodidae) from Finnmark, northern Norway

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Records of 18 Psychodidae species collected in Finnmark, northern Norway in 2010 are presented. *Pneumia ussurica* (Wagner, 1994), *Psychoda (Tinearia) lativentris* Berdén, 1952 and *Psychoda (Psychoda) alticola* Vaillant, 1973 have not previously been recorded from Norway and in addition 11 species are recorded from Finnmark for the first time. *P. alticola* is redescribed and figured and *Psychoda dolomitica* Salamanna & Sarà, 1980 **syn. nov.**, is placed as a synonym of *P. alticola*. A note on the morphology of *P. ussurica* is given.

Key words: Psychodidae, *Pneumia ussurica*, *Psychoda (Tinearia) lativentris*, *Psychoda (P.) alticola*, distribution, Finnmark, Norway.

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Introduction

Moth flies (Diptera, Psychodidae) is a species-rich family of small, fuzzy gnats. Most species are aquatic or semiaquatic, but the family exhibits a wide and still poorly explored ecological diversity. Worldwide about 2.900 species are described, but the fauna in most parts of the world remains poorly studied and the actual number of species is clearly much higher (see e.g. Curler & Courtney 2009).

Recently, Kvifte *et al.* (2011) compiled a revised check list of the Norwegian moth flies, listing 36 species. They also suggested that several species remain undetected, since there has been little systematic collection of psychodids in Norway. The present paper presents records of Psychodidae collected in Finnmark, northern Norway during 2010. Only four species have previously been recorded from Finnmark, viz. *Parabazarella subneglecta* (Tonnoir, 1922), *Pneumia stammeri* (Jung, 1954), *Psychoda phalaenoides* (Linnaeus, 1758) and *Psychoda cultella* Salmela, Kvifte & More, 2012 (Vaillant

1983, Håland & Andersen 1996, Kvifte *et al.* 2011, Salmela *et al.* 2012). With the present records the list of Psychodidae from Finnmark now comprise 18 species and a total of 40 moth fly species are known to occur in Norway.

Material and methods

Most of the material was collected in Malaise traps, but some specimens were also caught with sweep nets and in light traps. The material was first sorted to morphospecies using a stereomicroscope. Then samples of each morphospecies were selected for identification and each individual was dissected and mounted on slides in Euparal or Canada balsam. Only slide-mounted specimens were identified while the remaining unidentified specimens are stored in 80% alcohol.

DNA barcodes were obtained in cooperation with the Barcode of Life Data Systems (<http://www.boldsystems.org>). Legs of selected specimens were placed in 96–100% ethanol in a lysis microplate and shipped to the Biodiversity

Institute of Ontario (Canada) where DNA was extracted and sequenced using standard protocol and primers (see Ratnasingham & Hebert (2007) for details on the BOLD project).

DNA sequence analysis was performed in R version 2.12.0 (R Development Core Team 2010). The DNA barcode sequences were compared using neighbor-joining trees based on a matrix of uncorrected pair wise distances. Bootstrap values were computed using 10.000 replicates. The functions used for computing trees and bootstrap values were taken from the R package ape v. 2.6.2 (Paradis *et al.* 2004).

In the redescription all measurements and figures are based on slide-mounted specimens. Wing length is measured as the distance between a line "connecting" the apex of the costal node and jugum to the apex of R_5 . Measurements are given as ranges followed by the mean if 4 or more specimens were measured, followed by the number of specimens measured in parentheses if not specified elsewhere. Morphological terminology is according to Curler & Courtney (2009), the classification follows Kvifte *et al.* (2011).

The localities are described in Ekrem *et al.* (2012) and are referred to below by the locality number only. GenBank accession numbers for DNA barcodes for the specimens sequenced are given in parentheses.

All material collected in Finnmark in 2010 is stored in the entomological collection at the Department of Natural History, University Museum of Bergen (ZMBN).

The species

Tribe Pericomaini

Berdeniella freyi (Berdén, 1954)

Material. FinLoc5, 11–26 June 2010, 2♂♂; 26 June–10 July 2010, 8♂♂ (JQ349571, JQ349574, JQ349572, JQ349573), Malaise trap. FinLoc8, 26 June–10 July 2010, 3♂♂, Malaise trap. FinLoc56, 2–17 July 2010, 2♂♂, Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte *et al.* (2011); in Norway it is previously

taken in southeastern parts of the country and in Nordland. The species is widespread in Europe (Wagner 2012). According to Vaillant (1976) the immatures live in cold mountain streams.

Pneumia borealis (Berdén, 1954)

Material. FinLoc5, 11–26 June 2010, 1♂; 26 June–10 July 2010, 2♂♂ (JQ349585, JQ349586), Malaise trap. FinLoc81, 24 June–20 July 2010, 1♂ (JQ349587), Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte *et al.* (2011); in Norway it is previously taken in Hedmark. Elsewhere it is recorded from Finland, Russia (Karelia and Siberia) and Sweden (Berdén 1954; Salmela 2003, 2005; Wagner 2003).

Pneumia mutua (Eaton, 1893)

Material. FinLoc81, 24 June–20 July 2010, 1♂ (JQ349588), Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte *et al.* (2011); in Norway it is previously taken in the southern parts of the country and in Nordland. The species is widespread in Europe (Wagner 2012).

Pneumia stammeri (Jung, 1954)

Material. FinLoc5, 26 June–10 July 2010, 2♂♂ (JQ349590, JQ349589), Malaise trap. FinLoc8, 26 June–10 July 2010, 6♂♂, Malaise trap. FinLoc27, 17 June 2010, 1♂ (JQ349591), net. FinLoc42, 15 June–2 July 2010, 1♂, Malaise trap.

Remarks. Recorded from Finnmark and several other Norwegian counties by Kvifte *et al.* (2011). The species is widespread in Europe (Wagner 2012).

Pneumia ussurica (Wagner, 1994)

Material. FinLoc65, 24 June–20 July 2010, 1♂, Malaise trap.

Comparative material studied. Finland: Le, Enteklö, Syvävuoma, 9 June–23 July 2009, 1♂, Malaise trap, leg. & det. J. Salmela, coll. ZMBN.

Remarks. *Pneumia ussurica* (Wagner, 1994) belongs to the *P. nubila* (Meigen, 1804) complex and is very similar to *P. trivialis* (Eaton, 1893). The two species can most reliably be separated on

the presence in *P. ussurica* of a series of ridges and wrinkles in the distal part of the aedeagus, while in *P. trivialis* and *P. nubila* the aedeagus appears smooth distally (Figures 1A–B). Wagner's (1994) statement that *P. ussurica* and *P. trivialis* can be separated on the number of retinacula is erroneous; Norwegian and Finnish specimens of both species have 5–6 retinacula.

The present record is the first record of *P. ussurica* from Norway. Previous records of the species are from the Ussurian province in eastern Russia and from Finland (Wagner 1994, Salmela 2008).

Pericoma blandula Eaton, 1893

Material. FinLoc56, 26 July–25 August 2010, 8♂♂, Malaise trap. FinLoc81, 19 June 2010, 1♂, net; 24 June–20 July 2010, 9♂♂ (JQ349578, JQ349581, JQ349582, JQ349579, JQ349580), Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte et al. (2011); in Norway it is previously found in the southeastern parts of the country and in Nordland. The species is widespread in Europe (Wagner 2012).

Pericoma rivularis (Berdén, 1954)

Material. FinLoc5, 11–26 June 2010, 2♂♂; 26 June–10 July 2010, 2♂♂ (JQ349583), Malaise trap. FinLoc19, 25 June–9 July 2010, 1♂, Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte et al. (2011); in Norway it is previously reported from Hedmark and Sogn & Fjordane.

Omelková & Ježek (2012) placed *P. rivularis* in *Pneumia* Enderlein, 1935 (= *Satchelliella* Vaillant, 1976) based on the elongated terminal flagellomere, a key diagnostic character for *Satchelliella* in Vaillant (1971, 1976). *Pericoma rivularis* does, however, lack the distally branched retinacula and the wide eye bridge typical for *Pneumia*. The elongate terminal flagellomere is likely to be a plesiomorphic character for Pericomaini as it is in Paramormiini (see Ježek 1990a). We therefore do not consider it to be suitable as a diagnostic character for a genus and choose to keep the species in *Pericoma* until its phylogenetic placement within Pericomaini is better understood.



FIGURE 1. A. *Pneumia ussurica* (Wagner, 1994), male, aedeagus and gonopods. B. *Pneumia trivialis* (Eaton, 1893) male, aedeagus and gonopods.

***Parabazarella subneglecta* (Tonnoir, 1922)**

Material. FinLoc42, 17–26 June 2010, 1♂; 26 July–25 August 2010, 1♂ (JQ349576), Malaise trap. FinLoc56, 15 June–2 July 2010, 2♂♂ (JQ349575, JQ349577), Malaise trap. FinLoc81, 19–26 June 2010, 1♂, Malaise trap. FinLoc94, 17 June 2010, 2♂♂, net.

Remarks. The species was redescribed and figured by Vaillant (1983) based partly on material from western Finnmark. The present records are, however, the first published records from Norway with detailed locality information. The species is widespread in central and southern Europe, but not included for Norway by Wagner (2012).

Tribe Psychodini***Philosepedon humeralis* (Meigen, 1818) complex**

Material. FinLoc8, 11–26 June 2010, 1♂, Malaise trap. FinLoc42, 26 July–25 August 2010, 1♂ (JQ349584); 25 August–3 September 2010, 1♂, Malaise trap.

Remarks. The European *Philosepedon humeralis* (Meigen, 1818) complex consists of several morphologically similar species that can be very difficult to identify. Many of these species are known from only a few specimens and intraspecific variation is poorly understood. The specimens recorded here do apparently not match any described species and might belong to an undescribed species.

***Psychoda (Chodopsycha) lobata* Tonnoir, 1940**

Material. FinLoc5, 26 June–10 July 2010, 1♂, Malaise trap. FinLoc19, 9–24 July 2010, 1♂ (JQ349609), Malaise trap. FinLoc21, 6–20 August 2010, 3♂♂ (JQ349607, JQ349610) 2♀♀ (JQ349606, JQ349608), Malaise trap. FinLoc42, 26 July–25 August 2010, 1♂, Malaise trap. FinLoc56, 2–17 July 2010, 3♂♂, Malaise trap. FinLoc65, 24 June–20 July 2010, 1♂; 10–21 August 2010, 4♂♂, Malaise trap. FinLoc81, 24 June–20 July 2010, 2♂♂ (JQ349611); 21 August–6 September 2010, 1♀, Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte *et al.* (2011); in Norway it is previously reported from Vestfold, Telemark, Hedmark,

Rogaland and Hordaland. The species is widespread in Europe (Wagner 2012). According to Bernotienė & Rimšaitė (2009) the larvae live in fungal fruit bodies.

***Psychoda (Logima) albipennis* Zetterstedt, 1850 complex**

Material. FinLoc5, 26 June–10 July 2010, 1♀ (JQ349624); 7–24 August 2010, 2♂♂, Malaise trap. FinLoc8, 26 June–10 July, 1♂; 7–24 August 2010, 1♂; 24–30 August 2010 2♂♂, Malaise trap. FinLoc19, 25 June–9 July 2010, 1♂; 9 July–24 July 2010, 1♂ (JQ349626); 24 July–6 August 2010, 1♂; 6–20 August 2010, 2♂♂; 20–31 October 2010, 1♂, Malaise trap. FinLoc21, 6–20 August 2010, 7♂♂ (JQ349618, JQ349619, JQ349620, JQ349621, JQ349622) 3♀♀ (JQ349616, JQ349617), Malaise trap. FinLoc27, 17 June 2010, 1♀ (JQ349625), net. FinLoc36, 17 June 2010, 8♂♂ 1♀, net. FinLoc42, 26 July–25 August 2010, 5♂♂ (JQ349627), Malaise trap. FinLoc43, 15 June 2010, 1♂, net. FinLoc49, 16 June 2010, 1♀, net. FinLoc56, 15 June–2 July 2010, 2♂♂ (JQ349612) 1♀ (JQ349613); 2–17 July 2010, 2♂♂, Malaise trap. FinLoc61, 16 June 2010, 1♂, net. FinLoc65, 19–24 June 2010, 1♂; 24 June–20 July 2010, 2♂♂ (JQ349614, JQ349615); 10–21 August 2010, 1♂, Malaise trap. FinLoc69, 19 June 2010, 1♀, net. FinLoc81, 10–21 August 2010, 1♂ (JQ349623) 1♀; 21 August–6 September, 1♂, Malaise trap. FinLoc85, 7–8 September 2010, 3♂♂, light trap. FinLoc99, 15 June 2010, 1♂, indoors in window.

Remarks. Following Withers (1988), the *Psychoda albipennis* complex has been treated as a single, variable species in many faunistic studies. However, the presence of at least two species in this complex is suggested both by morphological (Ježek 1983), cytological (Troiana 1978) and ecological (Svensson 2009) evidence. Kvifte *et al.* (2011) recorded two species, *Psychoda albipennis* Zetterstedt, 1850 and *Psychoda satchelli* Quate, 1955, from Norway. However, the taxonomy of this species complex is still poorly understood and revisionary work is needed.

The material collected in Finnmark contains numerous males and females belonging to the *P. albipennis* complex. We have so far refrained from naming any of the specimens because most

of them display character combinations not seen in any of the described European species (see Ježek 1983, 1990b). The DNA barcode data, however, suggest that the specimens from Finnmark all belong to one single species, albeit with low bootstrap support.

***Psychoda (Logima) sigma* Kincaid, 1899**

Material. FinLoc65, 21 August–6 September 2010, 1♂.

Remarks. Not recorded from Finnmark by Kvifte et al. (2011); it was first recorded (as *Psychoda surcoufi* Tonnoir, 1922) in Norway by Andersen & Håland (1995) from Buskerud, Hordaland and Sogn & Fjordane.

***Psychoda (Psychoda) griseescens* Tonnoir, 1922**

Material. FinLoc56, 15 June–2 July 2010, 1♂ (JQ349592), Malaise trap. FinLoc65, 10–21 August 2010, 1♂, Malaise trap. FinLoc81, 24 June–20 July 2010, 1♂, Malaise trap.

Remarks. Not recorded from Finnmark by Kvifte et al. (2011); it is previously reported from Hedmark, Rogaland, Hordaland and Sogn & Fjordane. The species is widespread but not abundant in Europe (Wagner 2012).

***Psychoda (Psychoda) alticola* Vaillant, 1973**

Psychoda alticola Vaillant, 1973a: 139.

Psychoda dolomitica Salamanna & Sarà, 1980: 14, **syn. nov.** Figures 2–3.

Material. FinLoc05, 11–26 June 2010, 3♂♂, 26 June–10 July 2010, 5♂, (JQ349642, JQ349635, JQ349638, JQ349636, JQ349640) 2♀♀ (JQ349641, JQ349639); 7–24 August 2010, 12♂♂, Malaise trap. FinLoc08, 26 June–10 July 2010, 1♂, Malaise trap. FinLoc42, 17–26 July 2010, 1♀ (JQ349637); 26 July–25 August, 2♂♂, Malaise trap. FinLoc56, 26 July–25 August 2010, 1♂, Malaise trap. FinLoc81, 24 June–20 July 2010, 1♂; 21 August–6 September 2010, 1♂, Malaise trap. FinLoc85, 7–8 September 2010, 1♂, light trap.

Additional material. BV Ål: Storeteigen, 60.61527°N 8.50653°E, 21 May–19 June 2000, 8♂♂, Malaise trap, leg. J. Skartveit, M. Fremmersvik & R. Ellingsen, coll. ZMBN.

Comparative material studied. Italy:

Trentino, Alto Adige, Bolzano province, Pa Nat Stelvio, Sulden Valley, Glurnser Alm near Stilfser Joch, SW of Trafoi, 2,315 m a.s.l., 46°32'07.1" N, 10°27'50.4", leg. E. C. Lange & J. Ziegler, det. R. Wagner 2011, coll. R. Wagner.

Diagnostic characters. *Psychoda alticola* can be separated from other *Psychoda* species by the following combination of characters: antennae with 15 segments; eye bridge with 4 rows of facets; aedeagus asymmetrical with expanded distal tips; paramere large, dorsally subtriangular with two stout proximolateral projections and two ventral apodemes at about level of hypandrium; subgenital plate of male T-shaped with a series of transverse ridges. The similar *Psychoda terskolina* Vaillant & Joost, 1983 has eye bridge with 5, 4, 4, 4, 4 rows of facets; distiphalli with narrow apex and paramere with narrow proximolateral projections.

Redescription

Male (n = 24–26).

Head (Figure 2A). Broader than long. Eye bridge of 4 rows of facets, separated by about 0.5 facet diameters; interocular suture present. Frontal scar patch broad apically, tapering to about middle of interocular space. Antennae with 15 segments (Figures 2B–C); scape cylindrical, pedicel round; flagellomeres nodiform, each carrying one pair of Y-shaped ascoids. Flagellomeres 13–15 without internodes, flagellomeres 14–15 diminutive. Length of antennal segments (in µm): 73–105, 87; 48–68, 58; 108–165, 141; 98–160, 133; 95–160, 133; 85–150, 131; 90–148, 128; 83–145, 125; 78–143, 121; 85–148, 116; 70–133, 108; 50–123, 93; 30–58, 44; 20–33, 26; 20–33, 28. Labellum with four strong and one weak digit, carrying one medial and one lateral bristle. Palp without special features. Length of palpomeres (in µm): 75–113, 97; 75–102, 90; 68–108, 89; 78–128, 108.

Thorax. Without special features.

Wing (Figure 2D). Length 1.7–2.3, 2.0 mm. Membrane clear. Sc about 1.3 times the length of costal node, with pointed apex. Wing forks complete. Bases of M_{1+2} and CuA_1 expanded. CuA_2 with expanded base, tapering towards apex. R_5 terminating in wing apex. CuA_2 distal to both R-fork and M-fork. Veins R_3 , R_4 , M_1 and M_2 slightly curved distally.

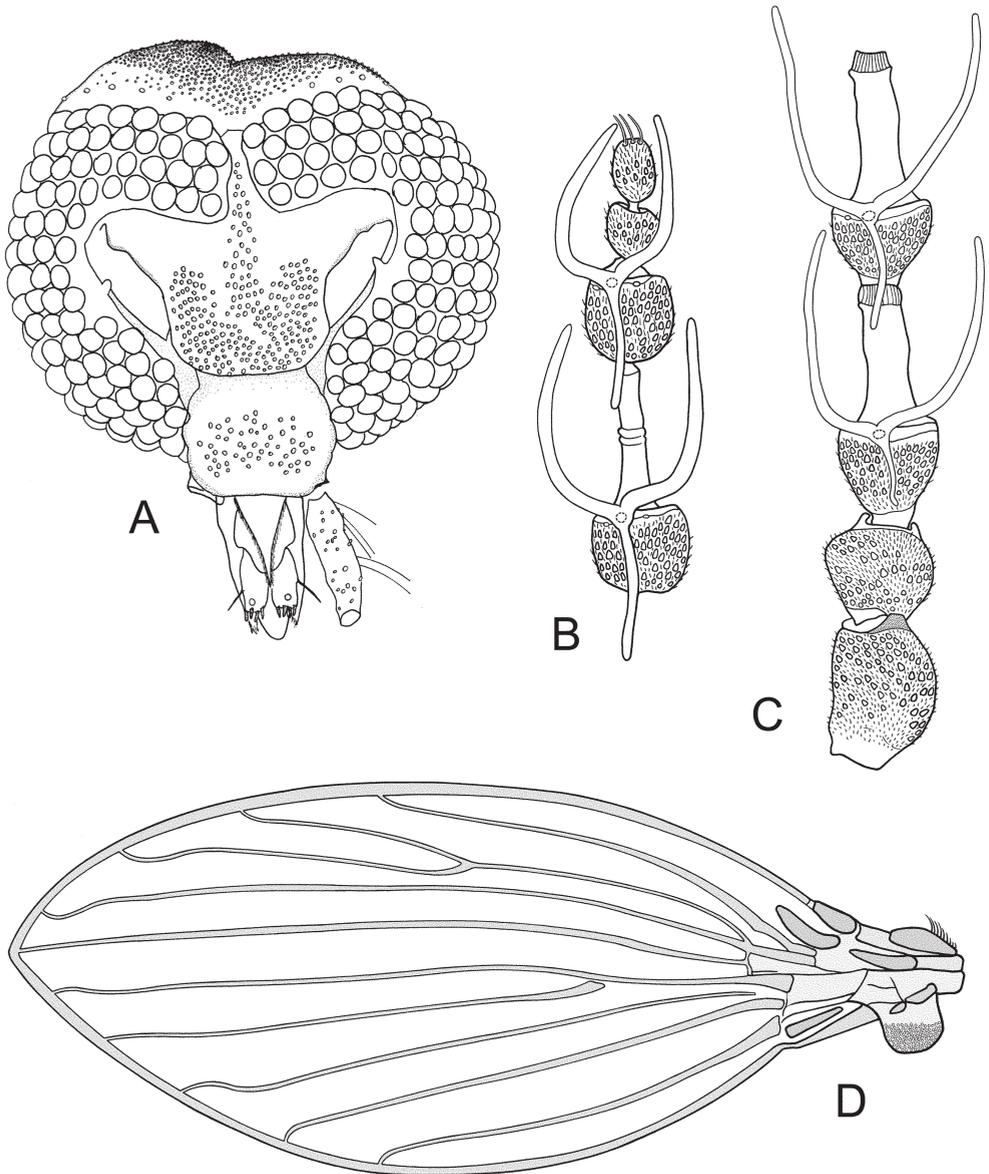


FIGURE 2. *Psychoda alticola* Vaillant, 1973, male. A. Head. B. Apex of antenna. C. Base of antenna. D. Wing.

Genitalia (Figure 3A). Aedeagus asymmetrical. Basiphallus laterally compressed; distiphalli consisting of 1 single, narrow branch and 1 bifurcate, distally expanded branch. Subgenital plate broadly T-shaped with several transverse ridges, proximolaterally with narrow apodemes.

Distiphallic branch narrow, reaching slightly beyond level of hypandrium, both distally expanded distiphallic branches reaching apex of subgenital plate. Single large paramere present, parallel to long distiphallic branch, reaching from level of hypandrium to apex of subgenital plate;

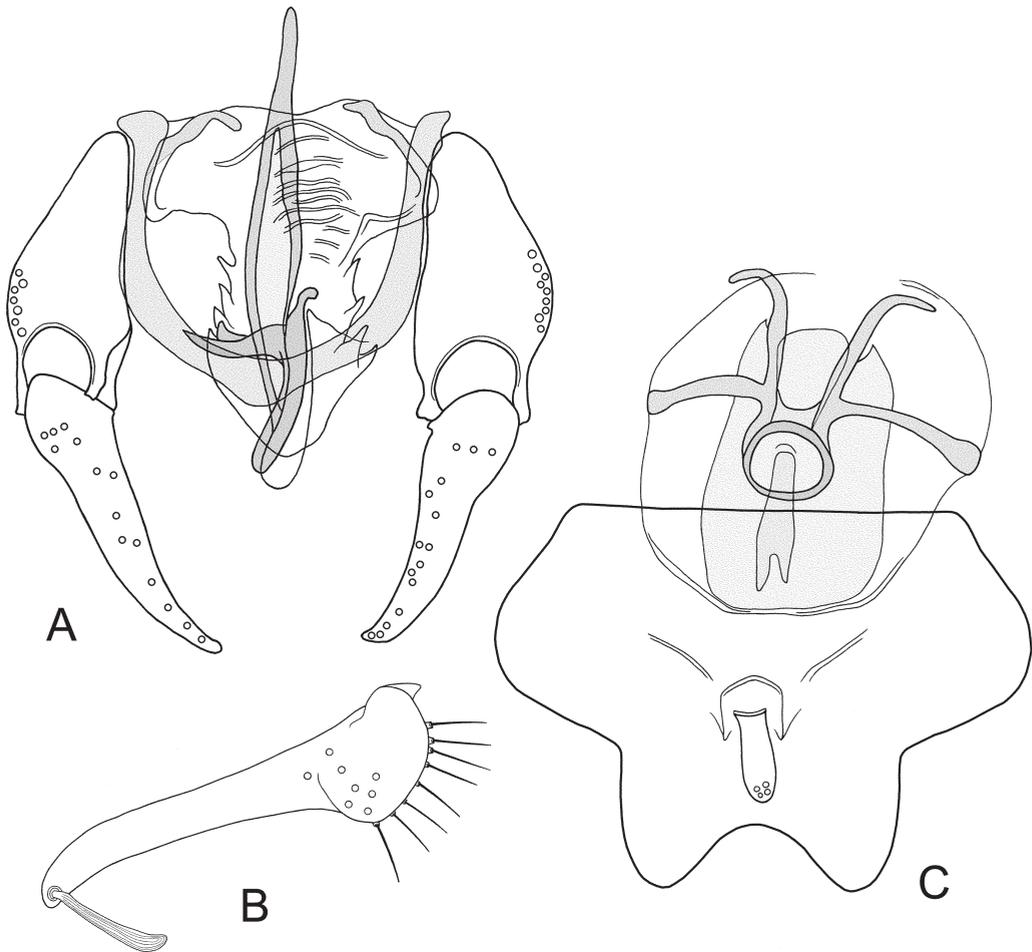


FIGURE 3. *Psychoda alticola* Vaillant, 1973. **A.** Male aedeagus and gonopods. **B.** Male surstylus. **C.** Female subgenital plate.

basally with two lateral projections, one narrow, projecting away from narrow distiphallic branch and one broader, flanked by subrectangular apodeme for its entire length and another subtriangular apodeme for about half its length. Hypandrium broad, almost reaching apex of gonocoxite. Gonocoxite weakly bulbous, about 0.8 times as long as gonostyle. Gonostyle sinuous with hooked apex. Epandrium ovoid, epandrial plate reaching level of subgenital transverse ridges. Surstyli (Figure 3B) curved; bulbous with small projection at base; with hook distal to single retinaculum; retinaculum slightly less than 1/3 of cercopod length.

Female (n = 3).

Head. Eye bridges separated by about 1.5 facet diameters. Length of antennal segments (in μm): 75–100; 55–65; 105–140; 98–130; 98–130; 95–140; 93–125; 88–120; 88–115; 85–113; 80–108; 73–98; 35–53; 20–28; 23–28. Length of palpomeres (in μm): 90–110; 88–115; 90–110; 113–140.

Wing. Wing length 2.1–2.6 mm.

Genitalia. (Figure 3C). Subgenital plate about 1.5 times as broad as long. Anterior margin slightly concave, posterior margin bilobate with comparatively even "shoulders". Median digit about 3 times as long as broad, slightly broader

at middle than at base and apex. Other details as figured.

Remarks. Based on the figures in Vaillant (1973a) and Salamanna & Sarà (1980), as well as the overlapping distribution, *Psychoda dolomitica* Salamanna & Sarà, 1980 is placed as a junior synonym of *P. alticola* Vaillant, 1973. Neither Vaillant (1973a) nor Salamanna & Sarà (1980) mention the transverse ridges of the subaedeagal plate, even though they are present also in Italian specimens.

The subgenital plates of our DNA-associated female specimens are differently shaped than those illustrated by Vaillant (1973a) and Salamanna & Sarà (1980), however this might be due to different orientation on the slides.

Distribution. The species is previously recorded from several alpine localities in Austria, the Czech Republic, France, Germany, Italy and Romania (Wagner 1977, Salamanna & Sarà 1980, Ježek 2006). In the present paper it is recorded from Finnmark and Buskerud in Norway.

Psychoda (P.) phalaenoides (Linnaeus, 1758)

Material. FinLoc5, 7–24 August 2010, 2♂♂; 24–30 August 2010, 2♂♂ (JQ349632, JQ349629), Malaise trap. FinLoc8, 26 June–10 July 2010, 1♂; 7–24 August 2010, 1♂, Malaise trap. FinLoc10, 18 June 2010, 2♂♂, net. FinLoc21, 6–20 August 2010, 1♂ 2♀♀, Malaise trap. FinLoc42, 17–26 June 2010, 1♂; 26 July–25 August 2010, 2♂♂, Malaise trap. FinLoc56, 2–17 July 2010, 1♂; 26 July–25 August 2010, 1♂ (JQ349630), Malaise trap. FinLoc65, 24 June–20 July 2010, 1♂, Malaise trap. FinLoc81, 24 June–20 July 2010, 1♂, Malaise trap.

Remarks. *Psychoda phalaenoides* is a common cosmopolitan species associated with ruminant dung (Svensson 2009). It is known from large parts of Norway including Finnmark and Troms (Kvifte *et al.* 2011).

Psychoda (Psychodocha) gemina (Eaton, 1904)

Material. FinLoc67, 30 July 2010, 1♂, net. Loc85, 30 July 2010, 2♂♂, net.

Remarks. Not recorded from Finnmark by Kvifte *et al.* (2011); it is previously reported from Hordaland and Nordland. The species is

widespread in Europe (Wagner 2012).

Psychoda (Tinearia) lativentris Berdén, 1952

Material. FinLoc5, 26 June–10 July 2010, 2♀♀ (JQ349595, JQ349596), Malaise trap. FinLoc8, 26 June–10 July 2010, 2♂♂; 7–24 August 2010, 5♂♂; 24–30 August 2010, 3♂♂ (JQ349594) 2♀♀ (JQ349603), Malaise trap. FinLoc21, 6–20 August 2010, 2♂♂ (JQ349604) 8♀♀ (JQ349601, JQ349600, JQ349599, JQ349597, JQ349605, JQ349594), Malaise trap. FinLoc65, 19–24 June 2010, 1♀ (JQ349602); 20–30 July 2010, 1♀ (JQ349593), Malaise trap. FinLoc85, 7–8 September 2010, 1♂, light trap.

Remarks. *Psychoda lativentris* is listed for Norway by Wagner (2012) based on extrapolation from its Swedish distribution (R. Wagner pers. comm.). The present records represent the first published records of the species from Norway. Vaillant (1973b) states that the species is almost exclusively parthenogenetic. However, several males are present in the material from Finnmark. The larvae are adapted to organically enriched wet silt (Vaillant 1973b).

Psychoda cultella Salmela, Kvifte & More, 2012

Material. FinLoc21, 6–20 August 2010, 1♂, Malaise trap. FinLoc 42, 26 July–25 August 2010, 2♂♂, Malaise trap. FinLoc65 19–24 June 2010, 1♂ (JQ349634); 7–20 July 2010, 1♂ (JQ349633), Malaise trap. FinLoc81, 24 June–20 July 2010, 1♂; 21 August–6 September 2010, 1♂, Malaise trap.

Remarks. Seven specimens belonging to *P. cultella* were collected in Finnmark and were used as paratypes in the original description of the species (Salmela *et al.* 2012). The species is also known from Finland (Salmela 2011).

DNA barcoding

In DNA barcoding, specimens are identified by matching short sequences of DNA from unidentified specimens with sequences from a comprehensive library of reliably identified specimens (Hebert *et al.* 2003). The present study is the first contribution of Psychodinae specimens

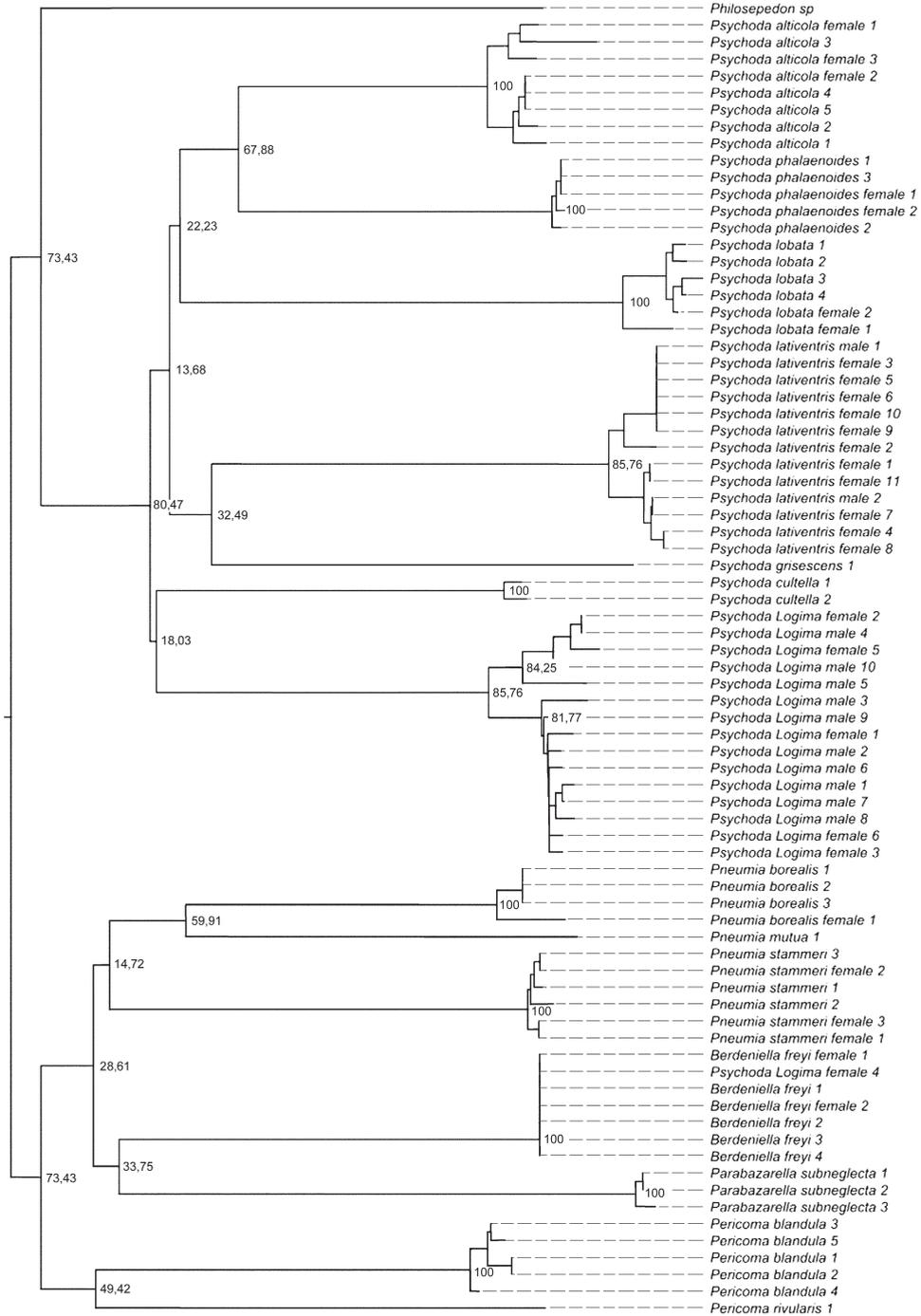


FIGURE 4. Neighbour-joining tree of DNA barcodes of the Psychodidae species collected in Finnmark in 2010. See text for details.

to this database, as well as the first test of barcoding as a method for reliable Psychodine identification. Sampling of the present collection yielded 78 sequences from 15 species. In the resulting neighbor-joining tree (Figure 4), virtually all sequences clustered into groups corresponding to their current species, subgenus and genus classification. One exception was a single female of the *Psychoda albipennis* complex which grouped with *Berdeniella freyi*. The erroneous placement of this specimen is probably due to cross-contamination between microplate wells, as its sequences are completely identical to the sequences from the four *Berdeniella* males.

Bootstrap support was generally low for internal nodes, but high for the species-clusters. The only species with bootstrap values below 100% were the *Psychoda (Logima) albipennis* complex (excluding the *Berdeniella*-contaminated female), which was only retrieved in 85.76% of the replicates, and *Psychoda lativentris*, which had a support value of 86.14%. These are also the most problematic species from a morphological point of view.

Apart from the mentioned *Psychoda (Logima)* female that clustered with the *Berdeniella* specimens, pair-wise absolute distances between species ranged from 7–16 %, whereas within-species distances ranged from 0–2.49 %.

Discussion

During the project 18 species of Psychodidae were collected in Finnmark. Of these, eight species belonged to the tribe Pericomaini and ten to the tribe Psychodini. Too few specimens were identified to facilitate for any quantitative study of sex ratios or flight period dynamics. However, it appears that the Pericomaini have their flight activity restricted to early summer whereas the Psychodini are active throughout summer and autumn.

The identified species are mostly widely distributed in Europe, with a few exceptions that appear to be species with northern or eastern distribution. *Pneumia ussurica* is previously reported from Finland and Russia (Far East) and

probably represents an eastern faunal element in Finnmark. The same can be said for *Parabazarella subneglecta*: although this species is widespread in western continental Europe, it has probably not dispersed through southern Fennoscandia as it appears to be absent from that area. The species is, however, widespread in Finland (Salmela 2003, 2011). In similar alpine habitats in South Norway, a different and as yet undescribed *Parabazarella* species takes its place.

The recently described *Psychoda cultella* appears to be a northern fauna element; although it also has been found quite far south, both in Norway and Finland (Salmela *et al.* 2012). *Psychoda alticola* appears to be an arctic-alpine species, having previously been taken only in mountainous areas in South and Central Europe.

Two of the species recorded were not identified to species with certainty due to the unresolved taxonomy of their respective species complexes. Further taxonomic research incorporating a phylogenetic approach using both morphological characters and DNA data will be necessary to get a better understanding of these species groups.

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