

Big-headed flies (Diptera, Pipunculidae) from Finnmark, north Norway

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Faunistic records and DNA barcodes are presented for 13 species of Pipunculidae from Finnmark county, North Norway. *Dorylomorpha clavata* Albrecht, 1979, *Pipunculus omissinervis* Becker, 1889, *Chalarus fimbriatus* Coe, 1966 and *Eudorylas jenkinsoni* Coe, 1966 have previously not been recorded from Norway. DNA barcodes of the CO1 gene are presented for all species, and are shown to conform to morphology-based classifications. With the present contribution, 47 species of Pipunculidae are known from Norway and 19 from Finnmark.

Key words: Diptera, Pipunculidae, Finnmark, big-headed flies, faunistics, new records, DNA barcoding.

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Introduction

Big-headed flies (Diptera, Pipunculidae) form a moderately species-rich family of small to medium-sized parasitoid flies. They are easily recognized by their globular heads, which are covered by their large compound eyes, and all species are thought to be endoparasitoids during their larval stage. Most known hosts are nymphs and adults of hoppers (Auchenorrhyncha), but the genus *Nephrocerus* Zetterstedt, 1838 parasitizes adult Tipulidae (Skevington & Marshall 1997, Koenig & Young 2007, Kehlmaier & Floren 2010). The piercing female ovipositor is used to penetrate the host animal and deposit a single egg directly into its body cavity. Oviposition can take place on the hopper's host plant (Huq 1985) or even while the fly is carrying the hopper in the air (Williams 1918).

The systematics and taxonomy of Pipunculidae in Europe has been object of several recent revisions, and 209 species have hitherto been recorded. Knowledge of their distribution, however, remains fragmentary, with some countries having been extensively surveyed and others hardly at all. More faunistic work is necessary to understand and contextualize regional zoogeographic relationships.

The Pipunculidae fauna of Norway is moderately well-studied, with regional revisions given by Collin (1956) and De Meyer *et al.* (1989). Some additional species have also been recorded by Albrecht (1990), De Meyer (1989), Kvifte (2011) and Gammelmo & Söli (2011). A total of 43 species are known to date, but this number is expected to rise as species-rich taxa such as the tribe Eudorylini and the genus *Chalarus* Walker, 1834 are studied in further detail.

Of the Nordic countries, the most thoroughly investigated Pipunculidae fauna is that of Finland, which has been studied most recently by Kehlmaier (2008) and Kehlmaier & Ståhls (2008). A total of 107 species have been recorded, as summarised by Kehlmaier (2014). A comprehensive check-list of Pipunculidae from Denmark was provided by Földvári *et al.* (2001), listing records of 62 species out of 79 expected. Knowledge levels of Swedish Pipunculidae are similar to those of Norway (Collin 1956, De Meyer *et al.* 1989).

From the northernmost county of Norway, Finnmark, the only recorded Pipunculidae in the literature were eight species of *Dorylomorpha* Aczél, 1939, displayed on distribution maps by Albrecht (1990); viz. *D. beckeri* (Aczél, 1939), *D. borealis* (Wahlgren, 1910), *D. maculata* (Walker, 1834), *D. canadensis* Hardy, 1943, *D. xanthopus* (Thomson, 1870), *D. occidentis* (Hardy, 1939), *D. haemorrhoidalis* (Zetterstedt, 1838) and *D. albitarsis* (Zetterstedt, 1844). The present paper provides an annotated check-list of Pipunculidae from Finnmark based on 194 specimens collected in Malaise traps in 2010 by Ekrem *et al.* (2012). Currently, 19 species of Pipunculidae have been recorded from Finnmark and 47 from Norway.

Material and Methods

All specimens treated in this study were collected in Malaise traps during the Finnmark project described by Ekrem *et al.* (2012), and have been identified by the authors. Identifications follow Grootaert & De Meyer (1986), De Meyer (1989), Albrecht (1990), Kuznetsov (1992), Földvári & De Meyer (1999), Kehlmaier (2005, 2006, 2008) and Kehlmaier & Assmann (2008).

DNA barcodes were obtained in collaboration with NorBol and analyzed using neighbour-joining based on uncorrected p-distances. Analyses were carried out in MEGA6 (Tamura *et al.* 2013). BOLD IDs and GenBank accession numbers are given in Table 1.

All material is kept in 96% pure ethanol in the Department of Natural History, the University Museum of Bergen.

Species list

CHALARINAE

Chalarus fimbriatus Coe, 1966

FINNMARK (FØ), Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 1♀.

Comments. First record from Norway. The recorded specimen belongs to “form B” sensu Jervis (1992).

Jassidophaga fasciata (Roser, 1840)

FINNMARK (FV), Alta: Gargiaveien at Storeng, 69.82277 N 23.47884 E, 120 m.a.s.l., 26.VI–10.VII.2010, 1♂1♀; Alta: Gargiaveien at Gargia fjellstue, 69.80525 N 23.48937 E, 120 m.a.s.l., 10.VII–23.VII.2010, 2♀♀; 23.VII–7.VIII.2010, 1♀; FN, Porsanger: Stabbursdalen, Rørkulpen, 70.15215 N, 24.76686 E, 28 m.a.s.l., 17.VII–26.VII.2010, 2♀♀; FØ, Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 2♀♀; Sametijohka at Sameti, 69.40106 N 29.71923 E, 43 m.a.s.l., 20.VII–30.VII.2010, 1♀.

NEPHROCERINAE

Nephrocerus lapponicus Zetterstedt, 1838

FINNMARK (FV), Alta: Gargiaveien at Gargia fjellstue, 69.80525 N 23.48937 E, 120 m.a.s.l., 10.VI–28.VI.2010, 1♂; 28.VI–10.VII.2010, 1♂.

PIPUNCULINAE

Tomosvaryellini

Tomosvaryella cilitarsis (Strobl, 1910)

FINNMARK (FI), Kautokeino: Lahpoluoppal, Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 6.VIII–20.VIII.2010, 1♂; FØ, Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 30.VII–10.VIII.2010, 1♂.

Tomosvaryella sylvatica (Meigen, 1824)

FINNMARK (FI), Kautokeino: Lahpoluoppal,

Table 1. DNA sequenced Pipunculidae from Finnmark, with GenBank accession numbers and BOLD IDs.

Species	Municipality	Locality	GenBank accession number	BOLD number
<i>Chalarus fimbriatus</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381936	FIACA013-15
<i>Jassidophaga fasciata</i>	Alta	Gargiaveien, Storeng	KT381960	FIACA026-15
<i>Jassidophaga fasciata</i>	Alta	Gargiaveien, Gargia Fjellstue	KT381938	FIACA027-15
<i>Jassidophaga fasciata</i>	Sør-Varanger	Sametijohka, at Sameti	KT381967	FIACA028-15
<i>Jassidophaga fasciata</i>	Alta	Gargiaveien, Storeng	KT381935	FIACA029-15
<i>Jassidophaga fasciata</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381929	FIACA030-15
<i>Jassidophaga fasciata</i>	Porsanger	Stabbursdalen, Rørkulpen	KT381940	FIACA031-15
<i>Nephrocerus lapponicus</i>	Alta	Gargiaveien, Gargia Fjellstue	KT381962	FIACA032-15
<i>Nephrocerus lapponicus</i>	Alta	Gargiaveien, Gargia Fjellstue	KT381964	FIACA090-15
<i>Tomosvaryella cilitarsis</i>	Kautokeino	Lahpoluoppal, Nahpoljohka	KT381954	FIACA038-15
<i>Tomosvaryella cilitarsis</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381948	FIACA039-15
<i>Tomosvaryella sylvatica</i>	Kautokeino	Lahpoluoppal, at lake	KT381959	FIACA037-15
<i>Dorylomorpha borealis</i>	Porsanger	Baukop, Stream from Vuolit Gealbbotjavri	KT381945	FIACA014-15
<i>Dorylomorpha borealis</i>	Sør-Varanger	Sametijohka, at Sameti	KT381932	FIACA015-15
<i>Dorylomorpha borealis</i>	Alta	Gargiaveien, Storeng	KT381949	FIACA016-15
<i>Dorylomorpha borealis</i>	Kautokeino	Lahpoluoppal, Nahpoljohka	KT381963	FIACA017-15
<i>Dorylomorpha borealis</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381951	FIACA018-15
<i>Dorylomorpha clavata</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381939	FIACA019-15
<i>Dorylomorpha maculata</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381947	FIACA020-15
<i>Dorylomorpha maculata</i>	Sør-Varanger	Sametijohka, at Sameti	KT381930	FIACA021-15
<i>Dorylomorpha maculata</i>	Kautokeino	Lahpoluoppal, Nahpoljohka	KT381944	FIACA022-15
<i>Dorylomorpha maculata</i>	Kautokeino	Lahpoluoppal, at lake	KT381961	FIACA023-15
<i>Dorylomorpha maculata</i>	Porsanger	Baukop, stream from Vuolit Gealbbotjavri	KT381950	FIACA024-15
<i>Pipunculus omissinervis</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381943	FIACA034-15
<i>Pipunculus campestris</i> agg.	Kautokeino	Lahpoluoppal, Nahpoljohka	KT381958	FIACA033-15
<i>Pipunculus campestris</i> agg.	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381955	FIACA035-15
<i>Pipunculus campestris</i> agg.	Porsanger	Stabbursdalen, Rørkulpen	KT381966	FIACA036-15
<i>Cephalops aeneus</i>	Porsanger	Baukop, Stream from Vuolit Gealbbotjavri	KT381953	FIACA001-15
<i>Cephalops aeneus</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381931	FIACA002-15
<i>Cephalops aeneus</i>	Porsanger	Baukop, Stream from Vuolit Gealbbotjavri	KT381941	FIACA003-15
<i>Cephalops aeneus</i>	Porsanger	Stabbursdalen, Rørkulpen	KT381965	FIACA004-15
<i>Cephalops aeneus</i>	Porsanger	Stabbursdalen, Rørkulpen	KT381937	FIACA005-15
<i>Cephalops varipes</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381933	FIACA006-15
<i>Cephalops varipes</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381934	FIACA007-15
<i>Cephalops vittipes</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381946	FIACA008-15
<i>Cephalops vittipes</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381952	FIACA009-15
<i>Cephalops vittipes</i>	Sør-Varanger	Pasvik, Lake south of 96-Høyden	KT381957	FIACA010-15
<i>Cephalops vittipes</i>	Sør-Varanger	Sametijohka, at Sameti	KT381968	FIACA011-15
<i>Cephalops vittipes</i>	Sør-Varanger	Sametijohka, at Sameti	KT381956	FIACA012-15
<i>Eudorylas jenkinsoni</i>	Kautokeino	Lahpoluoppal, Nahpoljohka	KT381942	FIACA025-15

Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 25.VI–9.VII.2010, 1♂.

Comments. The genitalia of the male specimen were dissected but lost before identification during transfer between tubes. Thus, species identification by morphological means was not possible. DNA barcoding placed the specimen unambiguously with Central European and Finnish specimens of *T. sylvatica*.

***Dorylomorpha borealis* (Wahlgren, 1910)**

FINNMARK (FV), Alta: Gargiaveien at Storeng, 69.82277 N 23.47884 E, 120 m.a.s.l., 23.VII–7.VIII.2010, 1♂; FI, Kautokeino: Lahpoluoppal, Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 24.VII–6.VIII.2010, 1♂; FN, Porsanger: Baukop, Stream from Vuolit Gealbbotjavri, 70.20469 N, 24.90605 E, 26 m.a.s.l., 17.VII–26.VII.2010, 1♂; 26.VII–25.VIII.2010, 4♂♂; FØ, Sør-Varanger, Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 20.VIII–30.VII.2010, 1♂; Sametijohka at Sameti, 69.40106 N 29.71923 E, 43 m.a.s.l., 24.VI–20.VII.2010, 1♀.

***Dorylomorpha clavata* Albrecht, 1979**

FINNMARK (FØ), Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 1♂.

Comments. First record from Norway. Previously recorded from Finland, Mongolia, Kazakhstan and Russia.

***Dorylomorpha maculata* (Walker, 1834)**

FINNMARK (FV), Alta: Gargiaveien at Storeng, 69.82277 N 23.47884 E, 120 m.a.s.l., 7.VIII–24.VIII.2010, 1♂; FI, Kautokeino: Lahpoluoppal, Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 24.VII–6.VIII.2010, 2♀♀; Kautokeino: Lahpoluoppal, at lake, 69.20992 N 23.757661 E, 24.VII–6.VIII.2010, 1♂1♀; FØ, Porsanger: Baukop, Stream from Vuolit Gealbbotjavri, 70.20469 N, 24.90605 E, 26 m.a.s.l., 26.VII–25.VIII.2010, 1♂2♀♀; Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 1♂; 20.VII–30.VII.2010, 1♂3♀♀; 30.VII–10.VIII.2010, 2♀♀; Sør-Varanger: Sametijohka

at Sameti, 69.40106 N 29.71923 E, 43 m.a.s.l., 30.VII–10.VIII.2010, 10♂♂5♀♀; 10.VIII–21.VIII.2010, 6♂♂4♀♀; 21.VIII–6.IX.2010, 1♂3♀♀.

Pipunculini

***Pipunculus omissinervis* Becker, 1889**

FINNMARK (FØ), Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 1♂.

Comments. First record from Norway. Previous records are from Belgium, Finland, Germany, Great Britain, Hungary, Italy, Mongolia, the Netherlands, Russia, Spain and Switzerland (Kehlmaier 2008). Literature records from Belgium, Great Britain, the Netherlands and Spain were originally attributed to *P. phaeton* Coe, 1966, which is currently regarded as a junior synonym of *P. omissinervis* (Kehlmaier 2008). The Nearctic species *P. hertzi* (Rapp, 1943) is cited as morphologically identical to *P. omissinervis*, but DNA barcodes indicate that the two are separate species (Kehlmaier 2008). From the closely related *P. campestris* Latreille, 1802, male *P. omissinervis* can only be separated by the male genitalia, whereas females are indistinguishable.

***Pipunculus campestris* agg.**

FINNMARK (FI), Kautokeino: Lahpoluoppal, Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 6.VIII–20.VIII.2010, 1♀; FN, Porsanger: Stabbursdalen, Rørkulpen, 70.15215 N, 24.76686 E, 28 m.a.s.l., 17.VII–26.VII.2010, 2♀♀; FØ, Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 3♀♀.

Comments. The females recorded above represent either *P. omissinervis* or *P. campestris*, but despite DNA barcoding we could not reliably associate them with either. See discussion for more details.

***Cephalops aeneus* Fallén, 1810**

FINNMARK (FN), Porsanger: Baukop, stream from Vuolit Gealbbotjavri, 70.20469 N, 24.90605 E, 26 m.a.s.l., 26.VII–25.VIII.2010, 2♀♀; 25.VIII.–3.IX.2010, 1♂; Porsanger:

Stabbursdalen, Rørkulpen. 70.15215 N, 24.76686 E, 28 m.a.s.l., 26.VII–25.VIII.2010, 1♂3♀♀; **FØ**, Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 30.VII–10.VIII.2010, 1♀.

Cephalops varipes (Meigen, 1824)

FINNMARK (**FØ**), Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 30.VII–10.VIII.2010, 2♂♂2♀♀.

Cephalops vittipes (Zetterstedt, 1844)

FINNMARK (**FØ**), Sør-Varanger: Pasvik, Lake at 96-høyden, 69.44497 N, 29.89904 E, 60 m.a.s.l., 24.VI–20.VII.2010, 23♂♂21♀♀; 20.–30.VII.2010, 18♂♂19♀♀; 30.VII–10.VIII.2010, 7♂♂9♀♀; 10.–21.VIII.2010, 2♂♂1♀; Sør-Varanger: Sametijohka at Sameti, 69.40106 N 29.71923 E, 43 m.a.s.l., 24.VI–20.VII.2010, 4♀♀.

Eudorylini

Eudorylas jenkinsoni Coe, 1966

FINNMARK (**FI**), Kautokeino: Lahpoluoppal, Nahpoljohka, 69.21029 N, 23.76200 E, 320 m.a.s.l., 6.–20.VIII.2010, 1♀.

Comments. First record from Norway. Previous records are from Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Italy, Japan, Latvia, the Netherlands, Poland, Portugal, Slovakia, Sweden and Switzerland (Kehlmaier 2005, Kehlmaier & Ståhls 2008).

Discussion

DNA barcoding. Forty specimens belonging to all species recorded herein were sequenced successfully, and the results fit well with morphology-based classifications (Figure 1). This allows us to be confident also in identifications based on undiagnostic specimens, such as in the case of the damaged *Tomosvaryella sylvatica* male. However, the success of DNA barcoding for identification must be evaluated on a case-by-case basis, and we have one example in this limited data set where extra care must be employed.

DNA barcodes of identified specimens from Northern Norway match well with conspecific specimens from Finland and Central Europe (C. Kehlmaier, unpublished). However, it has recently been demonstrated that CO1 is not always reliably species-specific within the genera *Chalarus* (Kehlmaier & Assmann 2010), *Nephrocerus* (Skevington *et al.* 2007) and *Pipunculus* (C. Kehlmaier, unpublished).

In the *P. campestris* species group, the signal of the two character systems are in conflict. Whereas males of *P. campestris* and *P. omissinervis* can be separated morphologically, their CO1 haplotypes form two taxonomically overlapping clades. Based on a preliminary dataset of CO1 barcodes of Palaearctic *Pipunculus* (Kehlmaier, unpublished), both clades contain clear *P. omissinervis* males, but one also contains several *P. campestris* males from Central Europe. Of the four sequenced specimens of the *P. campestris* group in the present study, one male and one female form a presumably “pure” *P. omissinervis* clade, whereas the other two females cluster in a distinctly divergent *P. campestris*/*P. omissinervis* clade (uncorrected p-distances 8–8.7 %). This situation is not commented on in further detail as it will be subject in a more ample future study.

Diversity of Pipunculidae in Finnmark. Prior to this study, the only records of Pipunculidae from Finnmark were those of Albrecht (1990) who lists eight species of *Dorylomorpha* from the county in his revision of the genus. All specimens examined in this study were collected during Ekrem *et al.*'s (2012) Finnmark project, which specifically targeted aquatic insects. Thus, the Pipunculidae specimens were just by-catch and cannot be considered a representative sample of Finnmark's diversity of the family. Many additional species of Pipunculidae are likely to be found in the future when also drier habitats are surveyed. Nevertheless, the present records of 13 morphologically delimited species and 14 CO1 clades represent a considerable increase in the knowledge of Pipunculidae from Northern Norway, raising the Finnmark County's fauna to 19 and the Norwegian fauna to 47 species respectively.

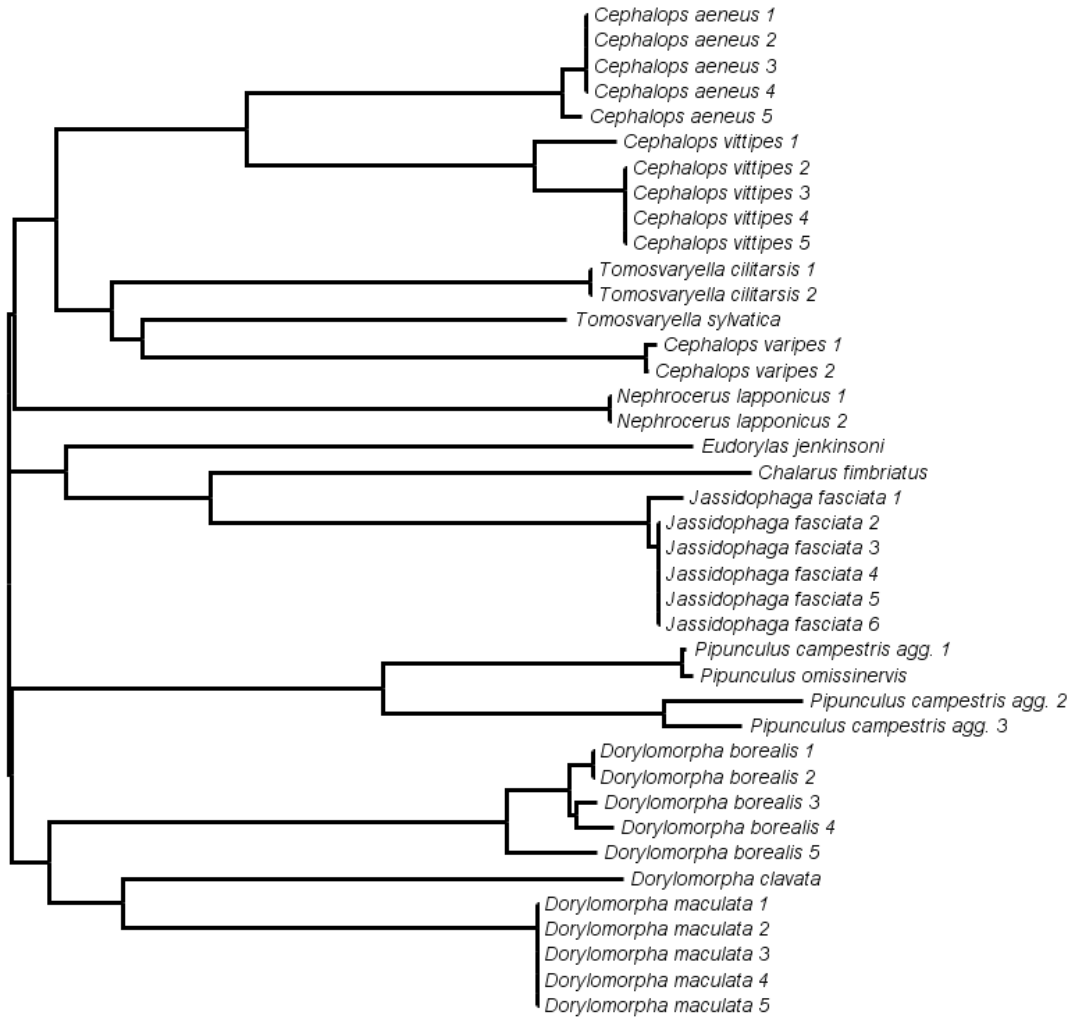


FIGURE 1. Unrooted neighbour-joining phenogram based on uncorrected p-distances of the CO1 barcode for Pipunculidae species collected in Finnmark.

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