Paradryomyza spinigera Ozerov, 1987 new to Norway, with records of some other little known Diptera from Finnmark (Diptera: Acartophthalmidae, Campichoetidae, Diastatidae, Dryomyzidae, and Micropezidae)

LINN KATRINE HAGENLUND & GUNNAR MIKALSEN KVIFTE

Hagenlund, L.K. & Kvifte, G.M. 2015. *Paradryomyza spinigera* Ozerov, 1987 new to Norway, with records of some other little known Diptera from Finnmark (Diptera: Acartophthalmidae, Campichoetidae, Diastatidae, Dryomyzidae, and Micropezidae). *Norwegian Journal of Entomology* 62, 196–204.

Records of the following species, collected in Finnmark in 2010 are presented: Acartophthalmidae: *Acartophthalmus nigrinus* (Zetterstedt, 1848); Campichoetidae: *Campichoeta griseola* (Zetterstedt, 1855); Diastatidae: *Diastata flavicosta* Chandler, 1987 and *Diastata ornata* Meigen, 1830; Dryomyzidae: *Dryomyza anilis* Fallén, 1820, *Dryope decrepita* (Zetterstedt, 1838), *Paradryomyza spinigera* Ozerov, 1987, and *Pseudoneuroctena senilis* (Zetterstedt, 1846); and Micropezidae: *Calobata petronella* (Linnaeus, 1761), *Neria cibaria* (Linnaeus, 1761), and *Neria commutata* (Czerny, 1930). Of these, *P. spinigera* has not previously been recorded from Norway and *A. nigrinus*, *C. griseola*, *D. ornata*, *D. decrepita*, *P. senilis* and *N. cibaria* are new to Finnmark. Comparison of DNA barcodes with records in the BOLD database confirmed the Holarctic distributions of *A. nigrinus*, *C. griseola* and *D. decrepita*, whereas the barcodes of *D. anilis* form two clearly delimited clusters – one Nearctic and one Palearctic.

Key words: Diptera, Acartophthalmidae, Campichoetidae, Diastatidae, Dryomyzidae, *Paradryomyza spinigera*, Micropezidae, distribution, DNA barcoding, Finnmark, Norway.

Linn Katrine Hagenlund, Department of Natural History, University Museum of Bergen, University of Bergen, P.O. Box 7800, NO-5020 Bergen, Norway. E-mail: linn.hagenlund@uib.no

Gunnar Mikalsen Kvifte, Department of Zoology – Limnology, Institute for Biology, University of Kassel, D-34132 Kassel, Germany & Department of Natural History, University Museum of Bergen, P.O. Box 7800, NO-5020 Bergen, Norway. E-mail: gunnar.kvifte@uib.no

Introduction

In 2010, the Norwegian Biodiversity Information Centre (Artsdatabanken) funded a biodiversity inventory in Finnmark, northern Norway with special focus on insects inhabiting freshwater and other humid habitats. Ekrem *et al.* (2012) outlined the project. The fieldwork was conducted in 2010 and 127 localities were investigated. Eight Malaise traps were operated between June and September from Alta in western Finnmark to the Pasvik area in Sør-Varanger in eastern Finnmark.

So far, the material has yielded 1200 identified species, of which 95 species were recorded for the first time from Norway (Andersen & Hagenlund 2012, Andersen & Kvifte 2012, Ekrem *et al.* 2012, Greve & Andersen 2012, Kvifte 2012, 2013, Søli & Rindal 2012, 2014, Andersen *et al.* 2013, Jonassen *et al.* 2013, Roth & Coulianos 2014, Stur & Borkent 2014). Still, due to the large material collected much remains to be identified and is likely to reveal the presence of further species in

the region.

In the present paper, we give new records from Finnmark of 11 species belonging to the Diptera families Acartophthalmidae, Campichoetidae, Diastatidae, Dryomyzidae and Micropezidae, and discuss genetic variation between European and North American populations.

Material and Methods

The material was collected in Malaise traps. The localities are described in detail in Ekrem *et al.* (2012). Biogeographical regions are given according to Økland (1981). All identified specimens are preserved in alcohol and stored in the Department of Natural History, University Museum of Bergen (ZMBN).

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). A total of 38 sequences were obtained from 11 species. GenBank accession numbers can be found in Table 1.

The Barcode Index Number System (BINs, Ratnasingham & Hebert 2013) is a framework provided on the BOLD Systems webpage (www.boldsystems.org), grouping barcode sequences into clusters, which in many cases can be used as proxies for species identifications. For some of the species, records belonging to the same BIN cluster were available for comparison in the BOLD database, and hence the amount of genetic distance between them examined.

Results

ACARTOPHTHALMIDAE

The Acartophthalmidae comprises four European species, all belonging to the genus *Acartophthalmus*. *Acartophthalmus bicolor* Oldenberg, 1910 is the only other species recorded from Norway (Greve 1988, Schacht & Heuck 2010). *Acartophthalmus nigrinus* can be separated from all other European Acartophthalmidae on the combination black antennae and yellowish fore coxae (see key in Ozerov (1986), translated by Schacht & Heuck (2010)).

Acartophthalmus nigrinus (Zetterstedt, 1848)

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 11–26 June 2010, 1♂; 23 July–7 August 2010, 1♂; 7–24 August 2010, 6♂♂4♀♀; Storeng, Gargiavannet, N69.82277° E23.47884°, 90m a.s.l., 7–24 August 2010, 2♀♀; **FI**, Kautokeino: Lahpoluoppal, N69.20992° E23.757661°, 320m a.s.l., 9–24 July 2010, 1♀; **FN**, Porsanger: Rørkulpen, N70.15215° E24.76686°, 28m a.s.l., 26 July–25 August 2010, 1♂; Baukop, N70.20469° E24.90605°, 26m a.s.l., 26 July–25 August 2010, 3♂♂; **FØ**, Sør-Varanger: Russevann, N6944497° E29.89904°, 60m a.s.l., 24 June–20 July 2010, 1♂.

Remarks. *Acartophthalmus nigrinus* is widely distributed in the Holarctic region, but rarely collected (see e.g. Tschirnhaus 2008). The species was recorded for the first time in Norway in Hordaland: Kvam and Buskerud: Sigdal by Thunes *et al.* (2004) while fogging pine tree canopies. According to the Norwegian Biodiversity Centre & GBIF-Norway (2007), the species has later been recorded in Oslo, Telemark, and Rogaland. This is the first record of the species from Finnmark.

The larva of *A. nigrinus* is saprophagous, and can probably utilize a range of decaying substances. Larvae have been reared from dead snails (Tschirnhaus 2008), and adults have been observed on decaying mushrooms (Papp & Ozerov 1998).

In Finnmark, the specimens were caught in Malaise traps close to running and standing waters, mainly in or near woodlands consisting of Downy birch (*Betula pubescens*), willows (*Salix* spp.), Grey alder (*Alnus incana*) and/ or Scots pine (*Pinus sylvestris*), but also in more heterogeneous wetland and bog areas.

TABLE 1. Overview of sequenced specimens of Acartophthalmidae, Campichoetidae, Diastatidae, Micropezidae, and Dryomyzidae collected in Finnmark, Northern Norway in 2010.

Species	Locality	Date	Sample ID	GenBank accesion no.	BIN
ACARTOPHTHALMIDAE					
Acartophthalmus nigrinus (Zetterstedt, 1848)	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal24	KT782264	BOLD:AAN6240
Acartophthalmus nigrinus (Zetterstedt, 1848)	Kautokeino: Lahpoluoppal	9–24 July 2010	FinAcal25	KT782268	BOLD:AAN6240
Acartophthalmus nigrinus (Zetterstedt, 1848)	Porsanger: Rørkulpen	26 July–25 August 2010	FinAcal26	KT782267	BOLD:AAN6240
Acartophthalmus nigrinus (Zetterstedt, 1848)	Sør-Varanger: Russevann	24 June–20 July 2010	FinAcal27	KT782266	BOLD:AAN6240
Acartophthalmus nigrinus (Zetterstedt, 1848)	Porsanger: Baukop	26 July–25 August 2010	FinAcal28	KT782265	BOLD:AAN6240
CAMPICHOETIDAE					
Campichoeta griseola (Zetterstedt, 1855)	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal14	KT782275	BOLD:AAN5689
Campichoeta griseola (Zetterstedt, 1855)	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal15	KT782276	BOLD:AAN5689
DIASTATIDAE					
Diastata flavicosta Chandler, 1987	Porsanger: Baukop	17–26 July 2010	FinAcal19	KT782279	BOLD:ACV0645
Diastata flavicosta Chandler, 1987	Porsanger: Baukop	17–26 July 2010	FinAcal20	KT782280	BOLD:ACV0645
Diastata flavicosta Chandler, 1987	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal21	KT782281	BOLD:ACV0645
Diastata flavicosta Chandler, 1987	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal22	KT782282	BOLD:ACV0645
Diastata flavicosta Chandler, 1987	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal23	KT782278	BOLD:ACV0645
Diastata ornata Meigen, 1830	Kautokeino: Lahpoluoppal	9–24 July 2010	FinAcal16	KT782283	BOLD:ACV3658
Diastata ornata Meigen, 1830	Kautokeino: Lahpoluoppal	25 June–9 July 2010	FinAcal17	KT782285	BOLD:ACD3833
Diastata ornata Meigen, 1830	Kautokeino: Lahpoluoppal	25 June–9 July 2010	FinAcal18	KT782284	BOLD:ACD3833
DRYOMYZIDAE					
Dryomyza anilis Fallén, 1820	Porsanger: Baukop	26 July–25 August 2010	FinAcal09	KT782287	BOLD:ABW1932
Dryope decrepita (Zetterstedt, 1838)	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal10	KT782291	BOLD:ACB3771
Dryope decrepita (Zetterstedt, 1838)	Alta: Gargia Fjellstue	7–24 August 2010	FinAcal11	KT782288	BOLD:ACB3771
Dryope decrepita (Zetterstedt, 1838)	Porsanger: Rørkulpen	26 July–25 August 2010	FinAcal12	KT782289	BOLD:ACB3771
Dryope decrepita (Zetterstedt, 1838)	Sør-Varanger: Sametijohka near Sameti	24 June–20 July 2010	FinAcal13	KT782290	BOLD:ACB3771
Paradryomyza spinigera Ozerov, 1987	Sør-Varanger: Sametijohka near Sameti	20–30 July 2010	FinAcal08	KT782311	BOLD:ACC4822

TABLE 1. continued.

Species	Locality	Date	Sample ID	GenBank accesion no.	BIN
Pseudoneuroctena senilis (Zetterstedt, 1846)	Sør-Varanger: Sametijohka near Sameti	24 June–20 July 2010	FinAcal06	KT782314	BOLD:ACV3029
Pseudoneuroctena senilis (Zetterstedt, 1846)	Alta: Gargia Fjellstue	7–24 August 2010	FinAcal07	KT782315	BOLD:ACV3029
MICROPEZIDAE					
Calobata petronella (Linnaeus, 1761)	Kautokeino: Lahpoluoppal	9–24 July 2010	FinAcal31	KT782274	BOLD:ABU7216
Calobata petronella (Linnaeus, 1761)	Alta: Gargia Fjellstue	23 July–7 August 2010	FinAcal29	KT782271	BOLD:ABU7216
Calobata petronella (Linnaeus, 1761)	Alta: Gargia Fjellstue	23 July–7 August 2010	FinAcal30	KT782270	BOLD:ABU7216
Calobata petronella (Linnaeus, 1761)	Alta: Storeng	26 June–10 July 2010	FinAcal32	KT782273	BOLD:ABU7216
Calobata petronella (Linnaeus, 1761)	Alta: Storeng	26 June–10 July 2010	FinAcal33	KT782272	BOLD:ABU7216
Neria cibaria (Linnaeus, 1761)	Sør-Varanger: Sametijohka near Sameti	30 July–10 August 2010	FinAcal39	KT782301	BOLD:ABA2746
Neria cibaria (Linnaeus, 1761)	Sør-Varanger: Russevann	30 July–10 August 2010	FinAcal40	KT782300	BOLD:ABA2746
Neria cibaria (Linnaeus, 1761)	Sør-Varanger: Russevann	24 June–20 July 2010	FinAcal41	KT782299	BOLD:ABA2746
Neria cibaria (Linnaeus, 1761)	Alta: Gargia Fjellstue	11–26 June 2010	FinAcal42	KT782302	BOLD:ABA2746
Neria cibaria (Linnaeus, 1761)	Alta: Gargia Fjellstue	23 July–7 August 2010	FinAcal43	KT782298	BOLD:ABA2746
Neria commutata (Czerny, 1930)	Alta: Storeng	26 June–10 July 2010	FinAcal34	KT782306	BOLD:ABA2747
Neria commutata (Czerny, 1930)	Alta: Storeng	26 June–10 July 2010	FinAcal35	KT782307	BOLD:ABA2747
Neria commutata (Czerny, 1930)	Sør-Varanger: Sametijohka near Sameti	24 June–20 July 2010	FinAcal36	KT782303	BOLD:ABA2747
Neria commutata (Czerny, 1930)	Sør-Varanger: Sametijohka near Sameti	24 June–20 July 2010	FinAcal37	KT782305	BOLD:ABA2747
Neria commutata (Czerny, 1930)	Porsanger: Baukop	17–26 July 2010	FinAcal38	KT782304	BOLD:ABA2747

CAMPICHOETIDAE

There is still no consensus about whether Campichoetidae should be ranked as a separate family or as a subfamily of Diastatidae (see e.g. Chandler 1987, Mathis & Barraclough 2011). The family was first recorded from Norway by Greve & Chandler (2003), based on *Campichoeta griseola* (Zetterstedt, 1855) from Akershus: Bærum and Frogn, Buskerud: Hurum and Vest-Agder: Flekkefjord.

Campichoeta griseola (Zetterstedt, 1855)

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 11–26 June 2010, 1♂1♀.

Remarks. *Campichoeta griseola* is a widely distributed Holarctic species (Mathis &

Barraclough 2011). This is the first record from Finnmark.

In Finnmark, the specimens were caught next to a fast-flowing stream in a forested area with Scots pine, Downy birch, willows, and Grey alder.

DIASTATIDAE

Four of the nine European species of Diastatidae have been recorded from Norway (Chandler 1987, Greve & Solem 1990). One species, *Diastata flavicosta* Chandler, 1987 is previously recorded from Finnmark.

The adults are often collected in marshes, bogs, humid forests and other humid habitats (Mathis & Barraclough 2011).

Diastata flavicosta Chandler, 1987

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 11–26 June 2010, 3♂♂8♀♀; **FN**, Porsanger: Baukop, N70.20469° E24.90605°, 26m a.s.l., 17–26 July 2010, 2♀♀.

Remarks. *Diastata flavicosta* is an Arctic-Alpine to northern boreal species, recorded from the Czech Republic, Finland, Slovakia, Sweden and Switzerland (Mathis & Barraclough 2011). The previous Norwegian record is from Finnmark: Sør-Varanger, Svanvik (Greve & Solem 1990).

The specimens were caught next to streams in forested areas with Scots pine, Downy birch, willows, and Grey alder.

Diastata ornata Meigen, 1830

Material. **FI**, Kautokeino: Lahpoluoppal, N69.20992° E23.757661°, 320m a.s.l., 25 June–9 July 2010, 1♂1♀; 9–24 July 2010, 1♂.

Remarks. *Diastata ornata* is a Holarctic species, distributed from the British Isles to eastern North America with a single doubtful record from Panama (Chandler 1987). This is the first record from Finnmark, and the second record of the species from Norway, as Greve & Solem (1990) reported it from Hordaland: Osterøy.

The specimens from Finnmark were caught at a lake-like bend of the Náhpoljohka River in a complex landscape-mosaic of lakes, streams and rivers, with a dominance of reeds, sedges and willows.

DRYOMYZIDAE

No records from Norway are given in Mathis & Sueyoshi (2011). However, Siebke (1877) lists three species; this material probably needs revision. A key to the species of the family was recently given in Ericson & Hellqvist (2013).

The family consists of 21 species restricted to the northern hemisphere, only five of which occur in Europe (Mathis & Sueyoshi 2011). Most species prefer humid habitats such as forests with an understory of shaded, low vegetation and decaying organic matter. The larvae are saprophagous and live in decaying carrion, excrement and rotting fungi (Mathis & Sueyoshi 2011).

Dryomyza anilis Fallén, 1820

Material. **FI**, Porsanger: Baukop, N70.20469° E24.90605°, 26m a.s.l., 26 July–25 August 2010, 1♂.

Remarks. *Dryomyza anilis* is a widespread Holarctic species (Mathis & Sueyoshi, 2011). It was listed by Siebke (1877) from several localities in the Oslofjord area, Oppdal, Møre og Romsdal, Nord-Trøndelag, and from Finnmark: Alta, Bossekop. According to the Norwegian Biodiversity Centre & GBIF-Norway (2007) it has been collected throughout most of southern Norway, as well as Nord-Trøndelag, Nordland and Finnmark.

It is the most common dryomyzid species in Sweden, and has been found all over the country in a wide variety of habitats: coniferous and deciduous forests, meadows, and gardens, and it is often encountered indoors (Ericson & Hellqvist 2013). The specimen recorded here was trapped near a small stream in birch-willow woodland surrounded by grassland.

Dryope decrepita (Zetterstedt, 1838)

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 11–26 June 2010, 1♂; 7–24 August 2010, 1♀; **FN**, Porsanger: Rørkulpen, N70.15215° E24.76686°,

28m a.s.l., 26 July–25 August 2010, 1♂; **FØ**, Sør-Varanger, Sametijohka near Sameti, N69.40106° E29.71923°, 43m a.s.l., 24 June–20 July 2010, 1♀.

Remarks. *Dryope decrepita* is widespread in the northern parts of the Holarctic region (Mathis & Sueyoshi 2011). It is the most common *Dryope* species in northern Sweden. *Dryope flaveola* (Fabricius, 1794) can be difficult to distinguish from *D. decrepita*, especially in newly emerged individuals (Ericson & Hellqvist 2013). According to the Norwegian Biodiversity Centre & GBIF-Norway (2007) *D. decrepita* has been collected in Østfold: Rygge; Sogn og Fjordane: Luster and Aurland; Møre og Romsdal: Gjemnes, Fræna, and Nærøy. This is the first record from Finnmark.

It can be found in a wide range of habitats, but most commonly in humid mixed or deciduous forests (Ericson & Hellqvist 2013). In Finnmark it was caught in birch-dominated or mixed forests near streams and rivers.

Paradryomyza spinigera Ozerov, 1987

Material. **FØ**, Sør-Varanger: Sametijohka near Sameti, N69.40106° E29.71923°, 43m a.s.l., 20–30 July 2010, 1♀.

Remarks. *Paradryomyza spinigera* was described from Eastern Russia, Amur Territory by Ozerov (1987) and has later been recorded in North Sweden and Finland by Ericson & Hellqvist (2013). This is the first record from Norway.

The specimen was trapped on the bank of a stream in birch-dominated woodland.

Pseudoneuroctena senilis (Zetterstedt, 1846)

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 7–24 August 2010, 1♂; **FØ**, Sør-Varanger: Sametijohka near Sameti, N69.40106° E29.71923°, 43m a.s.l., 24 June–20 July 2010, 1♂.

Remarks. *Pseudoneuroctena senilis* is a rare species with a northern distribution, usually found in humid coniferous forests (Ericson & Hellqvist 2013). The only other known localities in Europe are from northern Sweden and Finland, but it is also distributed in eastern Asia and Alaska in USA (Ericson & Hellqvist 2013, Mathis & Sueyoshi 2011). Siebke (1877) lists it from Hedmark: Åmot and Sør-Trøndelag: Oppdal. This is the first record from Finnmark.

The specimens from Finnmark were caught near streams, in mixed or birch-dominated forests.

MICROPEZIDAE

This is a mainly tropical family, comprising only 22 European species (Ozerov 2007). Seven species are known from Norway (Greve & Nielsen 1991, Gammelmo & Søli 2011).

The Micropezidae are slender, long-legged flies with a long thorax and mostly long narrow wings (Tschirnhaus 2008). The larvae are mainly saprophagous, and the adults prefer humid forests along rivers and creeks or are restricted to old forests. Others are phytophagous and associated with rhizomes or root nodules, and their adults are found in open habitats (Roháček 2012, Tschirnhaus 2008).

Calobata petronella (Linnaeus, 1761)

Material. **FV**, Alta: Gargia Fjellstue, N69.80525° E23.48937°, 120m a.s.l., 23 July–7 August 2010, 3♂♂3♀♀; Storeng, Gargiavannet, N69.82277° E23.47884°, 90m a.s.l., 26 June–10 July 2010, 4♂♂3♀♀; **FI**, Kautokeino: Lahpoluoppal, N69.20992° E23.757661°, 320m a.s.l., 9–24 July 2010, 3♂♂3♀♀.

Remarks. *Calobata petronella* has a Palearctic distribution (Roháček 2012). It is one of the most common species of the family and is distributed throughout Norway, including Finnmark. It can be found along brooks, the outskirts of deciduous forests, and meadows (Roháček & Barták, 1990, Greve & Nielsen, 1991). The larvae have been reared from sewage, manure/ dung, and decaying grass heaps (Tschirnhaus 2008).

The present specimens were trapped next to rivers and streams in forested areas with Downy birch, willows, Grey alder and Scots pine, or in mosaic wetland habitats of lakes, streams and rivers.

Neria cibaria (Linnaeus, 1761)

Material. **FV**, Alta: Gargia Fjellstue,

N69.80525° E23.48937°, 120m a.s.l., 11–26 June 2010, 1♀; 23 July–7 August 2010, 1♂1♀; Storeng, Gargiavannet, N69.82277° E23.47884°, 90m a.s.l., 26 June–10 July 2010, 3♂♂92♀♀; **FØ**, Sør-Varanger: Russevann, N6944497° E29.89904°, 60m a.s.l., 24 June–20 July 2010, 1♂1♀; 30 July–10 August 2010, 1♀; Sametijohka near Sameti, N69.40106° E29.71923°, 43m a.s.l., 30 July–10 August 2010, 1♂.

Remarks. *Neria cibaria* is widespread in the Palearctic region and very common in Central Europe (Roháček 2012). It is common in southern Norway, with scattered records north up to Nordland: Beiarn (Greve & Nielsen 1991). This is the first record from Finnmark.

The species can be found up to the low alpine zone in a range of different habitats including humid forested habitats and along brooks and rivers (Greve & Midtgaard 1986, Roháček 2012). In Finnmark, the specimens were caught along streams or lakes, on bogs or in deciduous or mixed woodland.

Neria commutata (Czerny, 1930)

Material. **FV**, Alta: Storeng, Gargiavannet, N69.82277° E23.47884°, 90m a.s.l., 26 June–10 July 2010, 1♂4♀♀; **FN**, Porsanger: Baukop, N70.20469° E24.90605°, 26m a.s.l., 17–26 July 2010, 1♂1♀; FØ, Sør-Varanger: Sametijohka near Sameti, N69.40106° E29.71923°, 43m a.s.l., 24 June–20 July 2010, 2♂♂.

Remarks. *Neria commutata* is a Palearctic species (Roháček 2012). It is distributed all over Norway, but does not occur in great numbers (Greve & Nielsen 1991). It prefers overgrown banks along running water in lowland and submontane habitats (Roháček 2012). In Finnmark, the specimens were caught near fast and slow-flowing rivers and streams, with banks dominated by sedges (*Carex* spp.) in deciduous woodlands.

Discussion

At high latitudes, many species have been identified as having circumpolar distributions. However, for some putative Holarctic species DNA barcodes have revealed high sequence divergences, which in some cases has prompted reevaluations of morphological characters and lead to the recognition of cryptic or pseudocryptic species. Kjærstad *et al.* (2012) found very high sequence divergence (7.8%) between European and North American *Siphlonurus alternatus* (Say, 1824) (Ephemeroptera) and argued the possibility that these represent cryptic species. Similarly, Anderson *et al*. (2013) found high sequence divergence between European and North American *Micropsectra* Kieffer, 1908 (Diptera: Chironomidae) and after further examination found consistent morphological differences and described three new species.

For four Holarctic species included in this study, namely *Acartophthalmus nigrinus, Campichoeta griseola*, *Dryope decrepita*, and *Pseudoneuroctena senilis*, COI sequences of both European and North American specimens were available in the BOLD database and clustered in the same BINs. Sequence divergence in these species was low (p-distance ranging from 0% to 1.87%), suggesting that these species are widespread Holarctic species rather than geographically separated, cryptic sister species. Similar results have been found by Jonassen *et al*. (2013) for three species of Dolichopodidae; Boumans & Baumann (2012) for the stonefly *Amphinemura palmeni* (Koponen, 1917); and Kjærstad *et al*. (2012) for several species of Ephemeroptera.

On the other hand, Nearctic and Palearctic specimens of *Dryomyza anilis* cluster in two different BINs. The barcode of our specimen matches well with specimens from Germany, Finland and Norway (BOLD:ABW1932), but the p-distance with Canadian specimens (BOLD:AAC6974) reaches 14.99%. There may thus be grounds to suspect cryptic speciation, and we recommend a revision of the taxonomy of the species based on morphological comparisons of specimens from both populations. The name *Dryomyza pallida* Day, 1881 (currently in synonymy with *D. anilis*, see Mathis & Sueyoshi 2011) is available for the Nearctic species if consistent differences can be found.

Diastata ornata, Calobata petronella, Neria cibaria, N. commutata and *Paradryomyza*

spinigera have so far only been barcoded from Europe, and *Diastata flavicosta* barcodes exist only from Finnmark. Genetic variation in these species was low to moderate (within cluster p-distances ranging from 0% to 2.34%). However, the present sequences of *Diastata ornata* belong to two separate BIN-clusters (BOLD:ACV3658 and BOLD:ACD3833), which nevertheless cluster together and are separated by p-distances of less than 2%.

The present study has added seven new records for Finnmark and one for Norway. It illustrates the usefulness of BINs as a means to investigate species' distributions and cryptic speciation across continents. As more data is added to the BOLD database, more detailed information about the genetic variation between populations can be obtained and more species can be investigated in this way.

Acknowledgements. The fieldwork and initial sorting of the material for this study was funded by a grant from the Norwegian Biodiversity Information Centre (Artsdatabanken). We are indebted to Geir Søli for providing information on the relevant families from the collections in the Natural History Museum, Oslo. Trond Andersen offered encouragement and advice and kindly commented on the manuscript.

References

Andersen, T. & Hagenlund, L.K. 2012. Caddisflies (Trichoptera) from Finnmark, northern Norway. *Norwegian Journal of Entomology* 59, 133–154.

Andersen, T. & Kvifte, G.M. 2012. Phantom midges (Diptera, Chaoboridae) from Finnmark, northern Norway. *Norwegian Journal of Entomology* 59, 155–157.

Andersen, T., Hagenlund, L.K., Håland, Ø., Kvifte, G.M. & Skartveit, J. 2013. New records of lower Diptera ("Nematocera") from Finnmark, northern Norway. *Norwegian Journal of Entomology* 60, 182–189.

Anderson, A.M., Stur, E. & Ekrem, T. 2013. Molecular and morphological methods reveal cryptic diversity and three new species of Nearctic *Micropsectra* (Diptera: Chironomidae). *Freshwater Science* 32, 892–921.

Boumans, L. & Baumann, R.W. 2012. *Amphinemura palmeni* is a valid Holarctic stonefly species (Plecoptera: Nemouridae). *Zootaxa* 3537, 59–75.

Chandler, P.J. 1987. The families Diastatidae and Campichoetidae (Diptera, Drosophiloidea) with a revision of Palaearctic and Nepalese species of *Diastata* Meigen. *Entomologica Scandinavica* 18, 1–50.

Ekrem, T., Roth, S., Andersen, T., Stur, E., Søli, G. & Halvorsen, G.A. 2012. Insects inhabiting freshwater and humid habitats in Finnmark, northern Norway. *Norwegian Journal of Entomology* 59, 91–107.

Ericson, N. & Hellqvist, S. 2013. De svenska buskflugorna (Diptera: Dryomyzidae) med *Paradryomyza spinigera* som ny art för landet. *Skörvnöpparn* 5, 1–4.

Gammelmo, Ø. & Søli, G.E. 2011. Notes on new and interesting Diptera from Norway. *Norwegian Journal of Entomology* 58, 189–195.

Greve, L. 1988. *Acartophthalmus bicolor* Oldenberg, 1910 (Acartophthalmidae, Diptera), a new family and species to the Norwegian fauna. *Fauna Norvegica Series B* 35, 91.

Greve, L. & Midtgaard, F. 1986. The Clusiidae (Diptera) from the islands Håøya and Ostøya in the Oslofjord area and a survey of the family in Norway. *Fauna Norvegica Series B* 33*,* 86–92.

Greve, L. & Solem, J. 1990. Notes on the genus *Diastata* in Norway (Diptera, Diastatidae). *Fauna Norvegica Series B,* 37, 33–35.

Greve, L. & Nielsen, T.R. 1991. A survey of the family Micropezidae in Norway. *Fauna Norvegica Series B*, 38, 77–87.

Greve, L. & Chandler, P.J. 2003. The family Campichoetidae (Diptera) newly recorded for Norway. *Dipterists Digest second series* 10, 44–45.

Greve, L. & Andersen, T. 2012. Lacewings (Neuroptera) and Alderflies (Megaloptera) from Finnmark, northern Norway. *Norwegian Journal of Entomology* 59, 122–132.

Jonassen, T., Andersen, T. & Kvifte, G.M. 2013. Empidoidea (Diptera) from Finnmark, northern Norway. *Norwegian Journal of Entomology* 60, 201–245.

Kjærstad, G., Webb, J.M. & Ekrem, T. 2012. A review of the Ephemeroptera of Finnmark – DNA barcodes identify Holarctic relations. *Norwegian Journal of Entomology* 59, 182–195.

Kvifte, G.M. 2012. First record of *Anomalochaeta guttipennis* (Zetterstedt, 1838) from Norway (Diptera, Opomyzidae). *Norwegian Journal of Entomology* 59, 120–121.

Kvifte, G.M. 2013. The genus *Leiomyza* Macquart,

1835 in Norway (Diptera, Asteiidae). *Norwegian Journal of Entomology* 60, 62–64.

Mathis, W.N. & Barraclough, D.A. 2011. World Catalog and Conspectus on the family Diastatidae (Diptera: Schizophora). *Myia* 12, 235–266.

Mathis, W.N. & Sueyoshi, M. 2011. World Catalog and Conspectus on the Family Dryomyzidae (Diptera: Schizophora). *Myia* 12, 207–233.

Norwegian Biodiversity Centre & GBIF-Norway. 2007. *Species Map Service 6.1*. Norwegian Biodiversity Centre & GBIF-Norway 2007–2015. Available from: http://artskart. artsdatabanken.no/default.aspx (accessed 20 August 2015).

Ozerov, A.L. 1986. Review of the family Acartophthalmidae (Diptera) with description of a new species. *Zoologichesky Zhurnal* 65, 807–809.

Ozerov, A.L. 1987. Dipterans of the family Dryomyzidae in the fauna of the USSR. *Byull. Mosk. Obshch. Ispytatel. Prir. Otdel. Biol*. [Bulletin of the Moscow Society of Naturalists, biological section] 92, 36–42 [in Russian].

Ozerov, A.L. 2007. Micropezidae. In Pape T. (ed.) Fauna Europaea: Diptera, Flies. Fauna Europaea version 1.3, http://www.faunaeur.org (accessed 06 August 2015).

Papp, L. & A.L. Ozerov. 1998. *Family Acartophthalmidae.* Pp. 227–232 in Papp, L. & Darvas, B. (Eds.) Contributions to a manual of Palaearctic Diptera, Vol. 3. Science Herald, Budapest.

Ratnasingham, S. & Hebert, P.D.N. 2007. BOLD: The Barcode of Life System. *Molecular Ecology Notes* 7, 355–364. http://dx.doi.org/10.1111/j.1471-8286.2007.01678.x

Ratnasingham, S. & Hebert, P.D.N. 2013. A DNA-Based Registry for All Animal Species: The Barcode Index Number (BIN) System. *PLoS ONE* 8, e66213, 1-16. DOI:10.1371/journal.pone.0066213.

Roháček, J. (2012). The fauna of Pseudopomyzidae, Micropezidae, Megamerinidae and Psilidae (Diptera) in the Gemer area (Central Slovakia). *Časopis Slezského zemského muzea Series A* 61, 131–142.

Roháček, J. & Barták, M. 1990. Micropezidae (Diptera) of Czechoslovakia. *Časopis Slezského zemského muzea Series A* 39, 97–111.

Roth, S. & Coulianos, C-C. 2014. A survey of aquatic and terrestrial Heteroptera in northern Europe with special regard to Finnmark, Norway (and adjacent regions). *Norwegian Journal of Entomology* 61, 99–116.

Schacht, W. & Heuck, P. 2010. Zweiflügler aus Bayern XXVI mit Nachträgen (Acartophthalmidae, Odiniidae, Opomyzidae, Anthomyzidae, Aucaligastridae, Periscelididae, Asteiidae, Braulidae). *Entomofauna Zeitschrift für Entomologie* 31, 437–452.

Siebke, H. 1877. *Enumerato Insectorum Norvegicorum. Fasciculum IV*. Catalogum Dipterorum Continentem (J. Sparre Schneider, ed.). 255 pp.

Søli, G.E.E & Rindal, E. 2014. Fungus gnats (Diptera, Mycetophilidae) from Finnmark, northern Norway. *Norwegian Journal of Entomology* 59, 158–181.

Søli, G.E.E & Rindal, E. 2012. The genus *Sylvicola* Harris, 1780 (Diptera, Anisopodidae) in Norway, with a key to the North European species. *Norwegian Journal of Entomology* 61, 91–200.

Stur, E. & Borkent, A. 2014. When DNA barcoding and morphology mesh: *Ceratopogonidae* diversity in Finnmark, Norway. *Zookeys* 463, 95–131.

Thunes, K.H., Skartveit, J. Gjerde, I., Starý, J., Solhøy, T., Fjellberg, A., Kobro, S., Nakahara, S., zur Strassen, R., Vierbergen, G., Szadziewski, R., Hagan, D.V., Grogan, Jr., W.L., Jonassen, T., Aakra, K., Anonby, J., Greve, L., Aukema, B., Heller, K., Michelsen, V., Haenni, J.-P., Emeljanov, A.F., Douwes, P., Berggren, K., Franzen, J., Disney, R.H.L., Prescher, S., Johanson, K.A., Mamaev, B., Podenas, S., Andersen, S., Gaimari, S.D., Nartshuk, E., Søli, G.E.E., Papp, L., Midtgaard, F., Andersen, A., von Tschirnhaus, M., Bächli, G., Olsen, K.M., Olsvik, H., Földvári, M., Raastad, J.E., Hansen, L.O. & Djursvoll, P. 2004. The arthropod community of Scots pine (*Pinus sylvestris* L.) canopies in Norway. *Entomologica Fennica* 15, 65–90.

Tschirnhaus, M. von 2008. 4.3.01 Acartophthalmidae, Borboropsidae, Chyromyidae, Micropezidae, Odiniidae, Opetiidae, Periscelididae, Pseudopomyzidae, and Tanypezidae. Pp. 65–97. In Ziegler J. (ed.): Diptera Stelviana. A dipterological perspective on a changing alpine landscape. Vol 1, Studia dipterologica. Supplement 16, 395 pp.

Økland, K.A. 1981. Inndeling av Norge til bruk ved biogeografiske oppgaver – et revidert Strandsystem. *Fauna* 34, 167–178.

Received: 5 October 2015
Accepted: 1 November 2015