

Pachyneura fasciata Zetterstedt, 1838 (Diptera, Pachyneuridae) DNA barcoded from the northernmost forests of the world

JOSTEIN KJÆRANDSEN

Kjærandsen, J. 2019. *Pachyneura fasciata* Zetterstedt, 1838 (Diptera, Pachyneuridae) DNA barcoded from the northernmost forests of the world. *Norwegian Journal of Entomology* 66, 77–80.

New records of *Pachyneura fasciata* Zetterstedt, 1838 are presented from Harrelv Nature Reserve at Varanger Peninsula, Norway, where a lush riverine ravine dominated by grey alder (*Alnus incana*) forms one of the worlds' northernmost patches of forests. This expands the known distribution of *Pachyneura fasciata* far north of the Taiga belt with continuous natural spruce forest, previously assumed to demark its northern distribution limit in Fennoscandia. Fresh specimens were successfully DNA barcoded and compared with a few other records of the species available on The Barcode of Life Data System (BOLD), including a record from Primorskiy Krai in far east Russia, which is genetically separated from the European population by a distance of 2.09%.

Key words: Diptera, Pachyneuridae, *Pachyneura*, Norway, new records, new distribution, biology, DNA barcoding.

Jostein Kjærandsen, Tromsø University Museum, UiT - The Arctic University of Norway, P.O. Box 6050 Langnes, NO-9037 Tromsø. E-mail: jostein.kjarandsen@uit.no

Introduction

The family Pachyneuridae (including Cramptonomyiinae) was regarded as sister-group to the families Bibionidae and Hesperinidae combined by Ševčík *et al.* (2016), and these three families together ranked as the most ancestral families in their concept of Bibionomorpha *sensu stricto*. This small family concept comprises four extant genera, *Pachyneura* Zetterstedt, 1838 (Palaeartic, 2 species), *Cramptonomyia* Alexander, 1931 (Nearctic, 1 species), *Pergratospes* Krivosheina & Mamaev, 1970 (East Palaeartic, 1 species), and *Haruka* Okada, 1938 (East Palaeartic, 1 species).

Paramonov & Salmela (2016) reviewed all known records of *Pachyneura fasciata* Zetterstedt, 1838, a species distributed in the Taiga belt throughout the Palaeartic Region. They reported the species from southern Norway only, while the northern distribution limit was at 68 degrees north

in Finland and at the Kola Peninsula of Russia. Paramonov & Salmela (2016) further reviewed the various habitats the species inhabits, and noted that the northern limit appears to follow the distribution limit of continuous spruce forests in Europe, although at Kamchatka the species has been recorded from bush tundra as well.

Here, new records are presented from the Varanger Peninsula in Norway and new DNA barcodes obtained on The Barcode of Life Data System (BOLD) are commented on.

Materials and methods

The examined materials originate from an ongoing insect collecting survey throughout Northern Norway, supported by UiT – The Arctic University of Norway and The Norwegian Biodiversity Information Centre. Most examined

specimens were dried from the ethanol samples by use of HMDS baths (see Brown 1993), pinned and lodged in the entomological collections at Tromsø University Museum, UiT – The Arctic University of Norway (TMU). A couple of specimens are kept in 95% ethanol in freezer at TMU as source for further genetic study.

One leg each from fresh specimens were sent to the Canadian Centre for DNA barcoding, BIO (Guelph, Ontario, Canada), for DNA extraction and bi-directional Sanger sequencing as a part of the Norwegian Barcode of Life (NorBOL) initiative (see Kjærandsen 2017), itself a branch of the International Barcode of Life project (iBOL).

A Leica MC170HD microscope camera mounted on a Leica M205C stereomicroscope was used to capture images of a pinned male and female. Stacked images were stitched and moderately photo-shopped into a collage image.

Pachyneura fasciata Zetterstedt, 1838

(Figure 1)

New records: NORWAY: Finnmark (FN), Tana: Harrelv Nature Reserve, 70°23'30"N, 028°15'21"E, 50 m a.s.l., Malaise trap (MT 4), 19 June–28 July 2017 (Leg. J. Kjærandsen & M. T. Dahl), 3 males (TSZD-JKJ-103132, TSZD-JKJ-107338, TSZD-JKJ-107340), 5 females (TSZD-JKJ-103133, TSZD-JKJ-103134, TSZD-JKJ-103415, TSZD-JKJ-107339, TSZD-JKJ-107341); Harrelv Nature Reserve, 70°23'30"N, 028°15'20"E, 50 m a.s.l., window trap (WT 4), 19 June–28 July 2017 (Leg. J. Kjærandsen & M. T. Dahl), 1 male (TSZD-JKJ-103130), 1 female (TSZD-JKJ-103131).

Barcodes: Five of the examined specimens, 2 males (TSZD-JKJ-103130, TSZD-JKJ-103132) & 3 females (TSZD-JKJ-103131, TSZD-JKJ-103133, TSZD-JKJ-103134) were successfully DNA-barcoded (all 658 BP, 0n, 100% similar) on BOLD and assigned to the Barcode Index Number **BOLD:ADH9707**. Currently this BIN has three additional members. One,

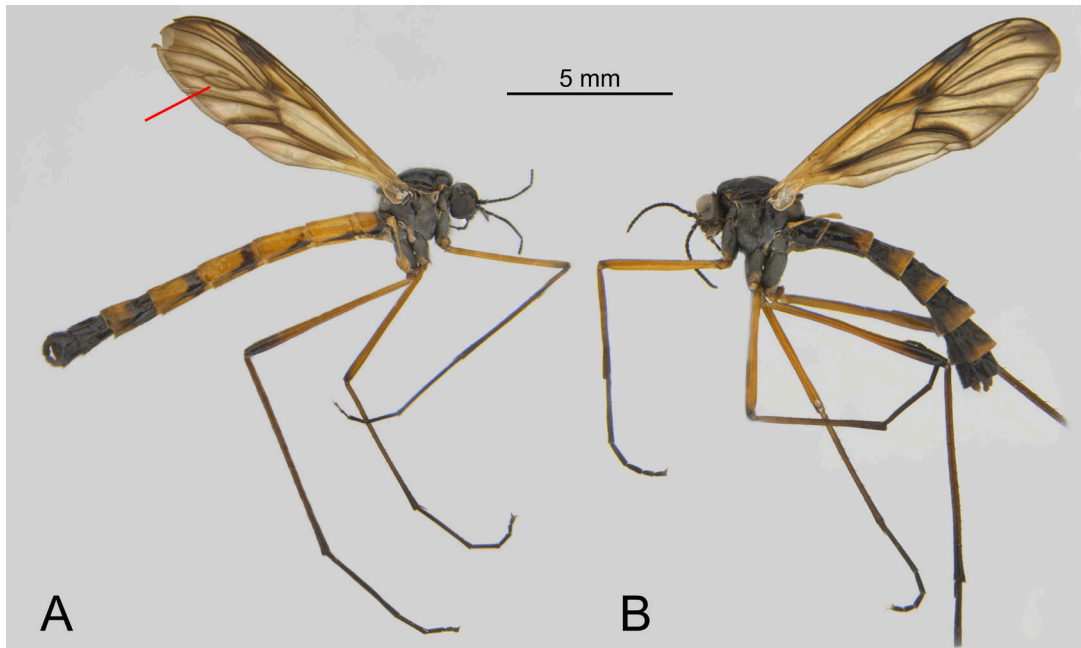


FIGURE 1. *Pachyneura fasciata* Zetterstedt, 1838, stitched and slightly photo-shopped collage of pinned couple. A. Male (TSZD-JKJ-107338), note the aberrant loop of the posterior vein (M2) of the anterior fork (red pointer). B. Female (TSZD-JKJ-107339). Photos: Jostein Kjærandsen.

which is 99.68% similar, is mined from GenBank (accession number **KT316871** and published by Ševčík *et al.* (2016)). Another specimen, from Primorskiy Krai in Far East Russia, is 2.09% distant from the European population. The assigned nearest neighbour on BOLD is currently (November 2019) North-American specimens of *Symphoromyia* (Rhagionidae) in **BOLD:AAP6398** at 10.5% distance.

Discussion

Pachyneura fasciata is easy to identify among European Diptera by its habitus (Figure 1), considerable size and specific wing venation with thick veins, thereof its Greek genus name *pachys* = thick, *neuron* = nerve. Harrelv Nature Reserve is the only locality, among hundreds of insect samples collected throughout Northern Norway, where the species have been found. It, thus, appears to be a rare element of the local fauna, compared with the many records from Finland (Paramonov & Salmela 2016). The DNA barcodes on BOLD confirms its unique identity and range throughout

the Palearctic Region, with a certain isolation between the Fennoscandian and far east Russian populations, as seen by the 2.09% genetic distance. Worth a note is that one of the males collected has a fully developed, aberrant loop of the posterior vein (M₂) of the anterior fork on its left wing, and a similar but not fully developed loop on its right wing (Figure 1A).

The new records at 70°23'30"N, 028°15'21"E marks by far the northernmost distribution of the species in the world. The locality is situated about 100 km N-NW of the northernmost spruce forest, consisting of small patches of Siberian spruce *Picea abies* subsp. *obovata* in the Pasvik valley, while the closest pine forest can be found some 50 km to the south in Finland. Harrelv Nature Reserve (Figure 2) is a steep-sided riverine ravine with a lush flood-forest dominated by grey alder (*Alnus incana*), situated at the western side of the Varanger Peninsula. Although, at this latitude, the site is lying at the border of the true arctic tundra biome, the valleys along the eastern border of the Tana River delta holds small patches of the northernmost forests of the world. The collecting site at Harrelv Nature Reserve is,

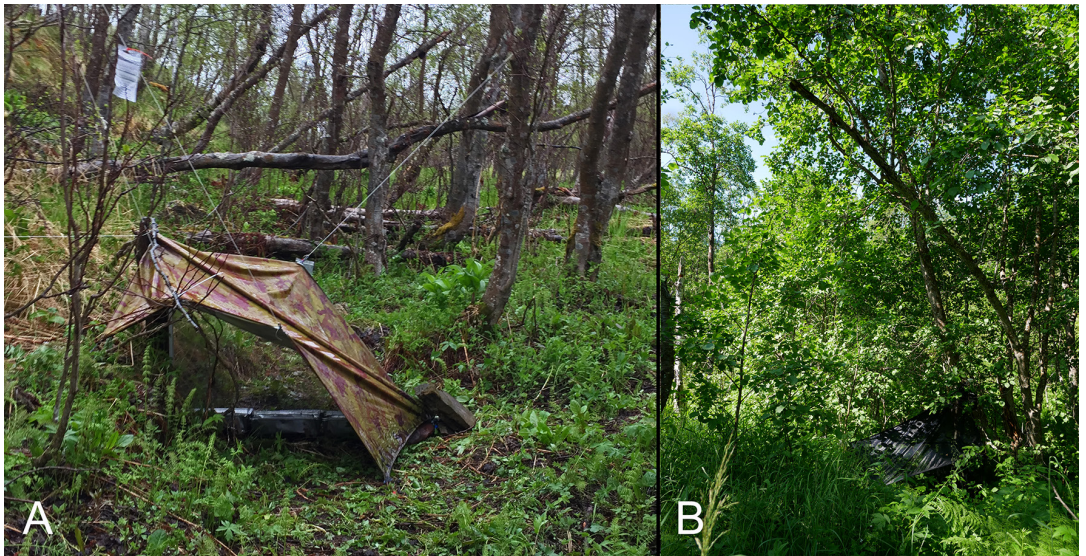


FIGURE 2. Collecting site for *Pachyneura fasciata* Zetterstedt, 1838 at Harrelv Nature Reserve in Finnmark, Norway (70°23'30"N, 028°15'21"E). **A.** The window trap photographed on June 19 2017. Note the row of lying grey alder logs. Photo: Jostein Kjerandsen. **B.** The Malaise trap was placed at the other end of the row of alder logs, here photographed in dense vegetation on July 28 2017. Photo: Amandine Deschamps.

thus, a unique eutrophic megaphorb with neutro-nitrophilic and mesohydrophilic species at the border of the tundra biome. Here one can find an unusual mixture of southern species like the fern *Matteucia struthiopteris* and arctic species like *Veratum lobelianum* (Karlsen 2014). The plant species recorded at the collecting site includes: *Alnus incana* ssp. *kolaensis* intermediate form ssp. *incana*, *Chamerion angustifolium*, *Cicerbita alpina*, *Crysopteris montana*, *Dryopteris expansa*, *Equisetum arvense*, *Filipendula ulmaria*, *Geranium sylvaticum*, *Geum rivale*, *Matteucia struthiopteris*, *Millium effusum*, *Paris quadrifolia*, *Rumex acetosa* ssp. *lapponicus*, *Stellaria nemorum*, *Urtica dioica* var. *holosericea*, *Valeriana sambucifolia* and *Veratrum lobelianum*.

The likely larval habitat for *Pachyneura fasciata* in this environment is in the xylem of flat lying, decaying logs of grey alder (Figure 2A), although birch (*Betula pubescens*) was also present in near vicinity (see habitat discussion in Paramonov & Salmela (2016)). Thus, it follows that *Pachyneura fasciata* is not strictly limited to the distribution range of continuous spruce forests in Europe, like suggested by Paramonov & Salmela (2016), but can utilize decaying wood all the way up to the northernmost deciduous forests of the world. It remains to be explored if the species also extends to the remaining Varanger Peninsula, like seen in the bush tundra of Kamchatka.

Acknowledgements. Insect collecting surveys throughout northern Norway were supported by UiT – The Arctic University of Norway and The Norwegian Biodiversity Information Centre under the project grants “North-eastern elements of the Norwegian fauna of fungus gnats” (2015-17, project grant 70184233/45-14) and “Fungus gnats in karst landscapes of Nordland – adding up the fauna of Northern Norway” (2018-20, project grant 70184238/27-17). I am very grateful to Martin Torp Dahl (technician), Patrycja Dominiak (technician) and Jon Peder Lindemann (PhD-student) who assisted in the fieldwork, the DNA-barcoding and dry-mounting of the pinned specimens, and to Amandine Deschamps who recorded the plant species community at the collecting sites, fulfilling the Nature in Norway (NiN) registration requirements of the projects.

References

- Brown, B.V. 1993. A further chemical alternative to critical-point-drying for preparing small (or large) flies. *Fly Times* 11, 10.
- Karlsen, S.R. 2014. En artsrik flora. In: Jensvoll, I. (ed.). Varangerhalvøya – et lite stykke Arktis. *Ottar* 2014(4), 52–57. [in Norwegian]
- Kjærandsen, J. 2017. Building the DNA barcode library of Holarctic Mycetophilidae (Diptera). *Genome* 60 (11), 954. <http://www.nrcresearchpress.com/doi/abs/10.1139/gen-2017-0178#.WnCC1qinFaQ>
- Paramonov, N.M. & Salmela, J. 2016. Pachyneuridae (Diptera): new data on the geographic range and designation of the lectotype of *Pachyneura fasciata* Zetterstedt, 1838. *Zootaxa* 4117, 513–528.
- Ševčík, J., Kasprák, D., Mantič, M., Fitzgerald, S., Ševčíková, T., Tóthová, A. & Jaschhof, M. 2016. Molecular phylogeny of the megadiverse insect infraorder Bibionomorpha *sensu lato* (Diptera). *PeerJ* 4:e2563, <https://doi.org/10.7717/peerj.2563>

Received: 13 November 2019

Accepted: 28 November 2019