

New records and first DNA barcodes of *Sciarosoma nigriclava* (Strobl, 1898) (Diptera, Sciaroidea *incertae sedis*) from Norway

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New records of *Sciarosoma nigriclava* (Strobl, 1898) are presented from Engerdal in Hedmark and Gargjalia outside Alta in Finnmark. This unique species, belonging to the enigmatic *Heterotricha*-group still unplaced in family, has not been recorded in Norway since the genus and species was described under the name *Sciarosoma borealis* Chandler, 2002; at the time only a single male from Østmarka Nature Reserve in Akershus was reported. All four specimens of our new material were successfully DNA barcoded and aligned with a single additional sequence of the species available on The Barcode of Life Data System (BOLD), mined from GenBank. The assigned Barcode Index Number (BIN) for the species displays a considerable distance of some 15% to any other Diptera on BOLD, underscoring the isolated phylogenetic position of the species among the Sciaroidea. Both the new collecting sites are situated within or nearby old-growth pine and spruce forests, supporting the view that the species may serve as an indicator of pristine coniferous forest in the boreal Taiga.

Key words: Diptera, *Sciarosoma*, *Heterotrichia*-group, new distribution, DNA barcoding, NorBOL, indicator species.

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Introduction

Chandler (2002) presented and described a number of enigmatic and little known Sciaroidea genera worldwide, that previously had been shelved, although several of them noticed in collections, due to their ambiguous relationship to any of the established Sciaroidea families. In Europe, these are represented with two genera: the monotypic, extant *Sciarosoma* Chandler, 2002, and *Heterotrichia* Loew, 1850, known with one extant and three fossil species from Baltic amber.

Several attempts to place these various genera in families has still not presented any rigorous conclusions, and the multi-gen phylogenetic study by Ševčík *et al.* (2016) leaves them as *incertae sedis* still pending genetic samples of most of the genera.

While the extant *Heterotrichia takkae* Chandler, 2002 seems to be confined to the south-central parts of Europe (Chandler 2005), *Sciarosoma* has a wider distribution in northern and central Europe (Jaschhof *et al.* 2006). Heller (2012) discovered a 100 years old senior synonym

for *Sciarosoma borealis* Chandler, 2002, which changed its name to *Sciarosoma nigriclava* (Strobl, 1898).

Here, we present new records of *Sciarosoma nigriclava* from Hedmark and Finnmark in Norway, report on the first DNA barcodes obtained on The Barcode of Life Data System (BOLD) through the Norwegian Barcode of Life (NorBOL) initiative and comment on the habitats of the new records.

Materials and methods

The examined material originates from two insect recording projects at Tromsø University Museum and the University Museum of Bergen, supported by The Norwegian Biodiversity Information Centre. The 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).

One leg each from fresh specimens were sent to the Canadian Centre for DNA barcoding, BIO (Guelph, Ontario, Canada), for DNA extraction and bidirectional Sanger sequencing as a part of the 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 M205 C stereomicroscope was used to capture stacked images of a pinned male.

Sciarosoma nigriclava (Strobl, 1898) (Figure 1)

= *Sciarosoma borealis* Chandler, 2002

New records: **NORWAY:** Finnmark (FV), Alta: Gargialia, 69.8059 N 23.4944 E, 211 m. a.s.l., Malaise trap (MT 6), 21 June–29 July 2017 (Leg. J. Kjærandsen & M. T. Dahl), 1 male (TSZD-JKJ-103191). Hedmark (HEN), Engerdal: Åsen, 61.8859 N 11.7828 E, 690 m. a.s.l., Malaise trap (MT 6), 9–23 June 2016 (Leg. Rikmyrsprosjektet), 3 males (TSZD-JKJ-102939, TSZD-JKJ-102940, TSZD-JKJ-102941).

Barcodes: All four specimens were successfully DNA-barcoded (639(5n) - 658(0n) BP) on BOLD and assigned to the Barcode Index Number **BOLD:ADH9941**. Currently this BIN has a single additional specimen mined from GenBank (accession number **KT316857** and published by Ševčík *et al.* (2016)). The assigned nearest neighbour on BOLD is currently (November 2019) unidentified specimens of Limoniidae from Malaysia and Indonesia in **BOLD:ADG8574** at 14.94% distance.

Discussion

The DNA barcodes on BOLD assigned to a unique Barcode Index Number (BIN) at some 15% distance from any other Diptera, match well the presumed unique position of this species in a separate clade, quite distant from both Sciaridae and Mycetophilidae. At the same time, the identity matches with the specimen used for the phylogenetic analyses of the Bibionomorpha by Ševčík *et al.* (2016).

Although the larval stage remains unknown, Jaschhof *et al.* (2006) suggested that *Sciarosoma nigriclava* can serve as an indicator of pristine boreal forest, and presumably prefers old-growth coniferous forest in a quasi-natural state. This conclusion was partly drawn on the observation that the previous single record from Norway was captured in a trunk-window trap mounted on a fruiting body of a red-belt conk (*Fomitopsis pinicola*) on a dead trunk of Norway spruce (*Picea abies*).

The new localities presented by us confirm the association to old-growth conifers and pristine boreal forest sites in Norway. The collecting site at Åsen in Engerdal is a small and gently sloping complex of rich to extremely rich fen, situated at about 690 m. a.s.l. The locality, which has several rich to extremely rich spring brooks, is scored as B (important) by Naturbase (Miljødirektoratet 2018a). The area surrounding the Malaise trap is partly tree clad dominated by spruce trees, many of which are quite old, and a mix of low coniferous and deciduous trees (*Picea abies*, *Pinus sylvestris*, *Betula pubescens*, *Alnus incana*) (Figure 2A).

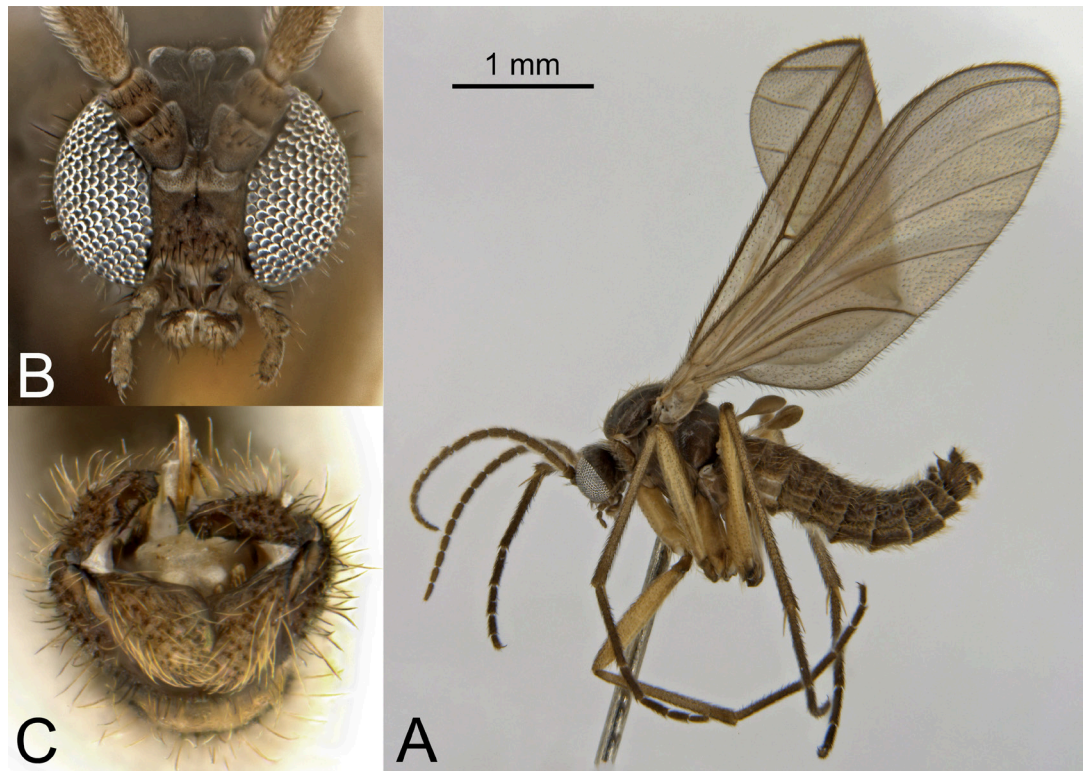


FIGURE 1. This pinned (glued to a minuten) male of *Sciarosoma nigriclava* (Strobl, 1898) from Gargjalia in Alta, Finnmark (TSZD-JKJ-103191) demonstrates how even tiny gnats can be safely pinned and display detailed enough morphology for identification when dried by use of HMDS baths. **A.** Habitus from lateral side. **B.** Head in frontal view. Note the lack of eye-bridge behind the antennae. **C.** Male terminalia, unmounted in caudal view. Even without maceration, enough details of the terminalia are exposed to enable identification. Photos: Jostein Kjærandsen.

Surrounding the fen there is open pine and spruce forest, which has been subjected to forestry since the 1940's, but several pockets of pristine coniferous forest are present nearby (Leif Galten, pers. comm.). The locality lies only a few km from other localities of untouched forest, including Vordaberget and Gutulisjøen, which make up the largest old-growth and pristine pine forests in southern Norway (Reiso 2005). The collecting site Gargjalia in Alta is another rich, mixed forest on limestone, dominated by old-growth pine. Scored as A (highest value) by Naturbase (Miljødirektoratet 2018b), it is a renowned locality visited by many entomologists. The Malaise trap was deployed on a narrow ledge in the middle of a steep, west-facing hillside rich in exposed rocks, just above Gargia Fjellstue (Figure 2B). The trees

here are a mixture of old-growth pine, birch and juniper (*Juniperus communis*) (Figure 2C).

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FIGURE 2. New collecting sites for *Sciarosoma nigriclava* (Strobl, 1898) in Norway. **A.** The Malaise trap at a rich fen at Åsen in Engerdal. Photo: Linn Katrine Hagenlund. **B.** Gargialia in Alta, with view down on Gargia Fjellstue. Photo: Jostein Kjærandsen. **C.** Just next to the old pine seen in B, the Malaise trap was deployed on a narrow ledge in the otherwise steep terrain. Photo: Jostein Kjærandsen.

granted permission to place Malaise traps at their properties during the field season. We are further 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 Gargialia, fulfilling the Nature in Norway (NiN) registration requirements of the projects.

infraorder Bionomorpha *sensu lato* (Diptera).
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