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THE PLECOPTERA COLLECTION AT THE NATURAL HISTORY MUSEUM IN OSLO

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ABSTRACT
The Natural History Museum, University of Oslo (NHM) houses a very large ethanol collection of Norwegian stoneflies. About half of this material is sorted and labelled; the other half consists of unsorted and largely unidentified samples. In addition, there are some 5000 high quality microscope slides of nymphal and adult body parts. Most samples were collected by the late Albert Lillehammer (1930-1992). In 2010 the collection built by Lillehammer has been digitized and georeferenced. 4305 specimen-based records have been made accessible online through the data portals of *Artskart*, a web service of the Norwegian Biodiversity Information Centre *Artsdatabanken*, and the Global Biodiversity Information Facility (GBIF). In order to facilitate access and future use, the Plecoptera collection at the NHM is described, with comments on the less common Norwegian species. The slide-mounted epiprocts of the males of the Arctic species *Nemoura arctica* Esben-Petersen 1910, *N. sahlbergi* Morton 1896 and *N. viki* Lillehammer 1972 are depicted. The paper concludes with suggestions for future applications of the NHM's stonefly collection.

Keywords: Plecoptera, collections, Norway, Lillehammer, *Nemoura*, epiproct

1. STONEFLIES COLLECTED BY ALBERT LILLEHAMMER

From the 1960s to his early death in 1992, Albert Lillehammer worked at the Zoological Museum of the University of Oslo, which later became part of the Natural History Museum of Oslo (NHM). He worked extensively on river ecology and is best known for his research on the biology and taxonomy of Norwegian stoneflies (Brittain 1993). In this period he built up a large collection of Norwegian stonefly samples. These are part of the museum's entomology collection (which is conventionally abbreviated as ZMUN in specimen lists). Lillehammer collected the bulk of the stonefly collection – 94% of the databased samples – himself in the period from 1964 to 1971. However, the collection he created also includes some samples collected by others between 1925 and 1981. In several cases, Lillehammer's publications refer to specimens that have not been located in the NHM. Such specimens may be amidst unsorted samples (see below) or may have been lost. The collection created by Lillehammer constitutes most of the stonefly material held by the museum, and consists of three parts: an inventoried ethanol collection, a slide-mounted collection and a large amount of unsorted material.

Organized ethanol collection

In the organized part of the Plecoptera collection, specimens are sorted by species. Specimens and labels are placed in 5 ml glass vial filled with 70% ethanol and closed off by a cotton plug. These vials were originally stored in 200 ml glass jars, but in the years 2007-2008 the vials were reorganized into more practical 500 ml bottling jars provided with high

quality rubber rings that minimize evaporation of the liquid. The new jars carry a label indicating the species and collecting event numbers. Jars containing samples of the same species are brought together in plastic crates. There are approximately three hundred such 500 ml jars, each with on average 25 vials. There are often several vials containing specimens of the same species collected at the same time. The specimen labels bear a species name, but no statement as to who performed the identification and when. Based on the collection's history, it can be assumed that all identifications were done by Lillehammer himself. The data of this part of the collection have been digitized and georeferenced in 2010 (see below).

Collecting event numbers

In addition to a label stating the collector, date and locality, the ethanol samples are labelled with a number referring to the collecting event. Two series of numbers have been used: numbers starting with P ranging from P1 to P3115 in the organized collection, and numbers starting with Psv, referring to an expedition to the Pasvik valley in Sør-Varanger in 1966. A typewritten list of the numbers P1 to P3028 has been preserved at the NHM, and has now been scanned and digitized. This list has many gaps, however, and collecting event data not on this list must be retrieved from the labels in the ethanol collection. In some cases individual stoneflies of the same species and from the same collecting event are labelled separately and numbered, e.g. P1234 (1) to P1234 (5). This numbering system is very practical to locate samples inside a jar in the organized ethanol collection. Importantly, most microscope slides only bear the abbreviated species name, a collecting event number and a specimen number. The P and Psv numbers are therefore indispensable to find the origin of the slide-mounted samples, while the specimen number makes it possible to retrieve the remainder of the same animal from the ethanol collection. In addition to the above-mentioned list of collecting events, the NHM also has a file card archive for freshwater fauna collecting events from the 1960s and 1970s, organized by province. These cards often contain additional information such as the water and air temperature and substrate type. However, the cards referring to P and Psv numbers are in between many other cards, and finding information on a particular site is cumbersome even if one knows the province.

Slide collection

The NHM holds some 5000 to 6000 microscope slides of Plecoptera mounted by or for Lillehammer. Most of the slides are series of wing preparations of the common Norwegian species, but there are also mounts of male and female genitalia and nymphal appendages, pronota and abdominal segments. The slides are of good quality and in good condition. We may assume that these slides form the basis of Lillehammer's study on within-species morphological variation (notably Lillehammer 1976) and his identification key for the species of Fennoscandia and Denmark (Lillehammer 1988). Using the numbering system explained above, one can in most cases find the remainder of the corresponding individual in the ethanol collection. This is necessary if for example wing size is to be measured relative to overall body size. The cataloguing of the slides is still ongoing. Because of the overlap between the slide and ethanol collections, inventorying the slides will yield only few additional distribution records.

Slide-mounted epiprocts of the three lesser-known *Nemoura* species from Arctic Norway are illustrated in Figures 1-3. These figures supplement the photographs published by Koese (2008): taken together these figures cover most North-Western European species of the genus *Nemoura*.

Unorganized ethanol collection

The ethanol collection of the NHM contains about fifty 2 litre jars labelled "Plecoptera ubestemt" (unidentified Plecoptera). These jars are filled with 70% ethanol and each contains about fifty 10 ml glass jars with plastic caps. These small jars contain 70% ethanol, labels and specimens. The label usually contains information on the collecting event (collector, date and locality), and sometimes a species identification as well. Species identification can be assumed to have been done by Albert Lillehammer, but this is not documented. All this material was probably collected by or for Lillehammer. It consists mostly or entirely of samples from Norway. It is possible that rare species or specimens used in morphological studies are hidden in some of these jars.

In addition there is an amalgam of smaller jars with material from various other collectors. This

small part of the collection is generally well labelled and preserved, and may contain valuable samples, but is in need of organization and cataloguing. It includes some 19th century samples collected by Johan Heinrich Spalckhawer Siebke (1816-1875, conservator at the Zoological Museum in Oslo from 1849 to this death), Lauritz Martin Esmark (1806-1884, conservator from 1847-1854) and Wilhelm Maribo Schøyen (1844-1918, conservator from 1884-1891); all of these identified by Reidar Brekke (1888-1971). In addition, there are some foreign samples from the USA, Iceland and Italy.

Other material

The NHM contains circa 150 identified and 150 unidentified dry pinned stoneflies mostly from the 19th century. The identified ones all belong to ubiquitous species, with the exception of *Xanthoperla apicalis* (see below). Brekke (1941) lists some of these specimens and discusses the older history of the collection. In addition, there is a small, well documented ethanol collection of Plecoptera and other aquatic insects collected, identified and donated to the museum by Kjell Magne Olsen in the first decade of the 21st century. These are subsamples of specimens databased by the BioFokus foundation, for which collecting event data have been available on the Artskart and GBIF portals since 2009.

In the framework of a new research project on Nordic aquatic insects (2010-2014), I am currently collecting fresh specimens of all Nordic species, mostly from Norway. Parts of these new samples are stored in 96% ethanol for the purpose of DNA barcoding and further molecular research. Specimens used for DNA barcoding are stored as tissue samples in 96% ethanol at -80 °C. Surplus specimens are stored in 70% ethanol in the same manner as the organized part of Lillehammer's collection. Labels of specimens in these two new ethanol collections contain complete information about the collecting event and identification, corresponding to a database record; those in 70% ethanol also have a label with a barcode number.

2. GEOREFERENCING PROJECT

In 2010 the organized part of the collection created by Lillehammer was databased and georeferenced following the standards of Norwegian Biodiversity Information Centre *Artsdatabanken*. The data of the collecting events (date, locality and collector) were digitized, and the geographical coordinates using a printed atlas and gazetteer (Statens kartverk 1955, 1990) as well as an online map service of the Norwegian Mapping Authority (norgeskart.no).

Collecting event data were initially retrieved from the typewritten list that had been preserved. This list, however, contained many ambiguous and incomplete records, so that eventually numerous labels had to be checked in the ethanol collection. This operation resulted in 4305 georeferenced records, each representing a species collected at a particular locality and date. Within the framework of this project, it was not feasible to go through all vials to verify the species identifications and count the number of individuals with their sex and life stage. However, obvious labelling errors on the jars were corrected.

The georeferencing was carried out by Siri Berger, with contributions from Henning Pavels, Åse Wilhelmsen, Trond Øigården, Louis Boumans and John Brittain. As far as possible these contributors identified and georeferenced the localities in the regions they knew best. In 2011 the data were published on Artsdatabanken's web service Artskart (artskart.artsdatabanken.no) and GBIF's data portal (data.gbif.org).

3. SPECIES

Lillehammer's research focused on the ecology and morphological variation of Norwegian stoneflies, rather than on taxonomy per se. This is reflected in what remains of his collection: it contains numerous specimens of the species that are common in Norway, but few of the rare species and very little foreign material.

The inventory of the collection in the framework of the georeferencing project has been very useful to assess both what the museum has and what is missing and probably lost. The resulting database shows that several species occur in more Norwegian provinces (*fylke*) than previously documented by Lillehammer (1988) and Solem (1996), even though specimens were collected in the late 1960s. The update on local distribution will be published elsewhere (Boumans in press).

The Norwegian checklist contains 35 species of stoneflies (Lillehammer 1988; Solem 1996). Three stonefly species figure on the Norwegian Red List (Kjærstad et al. 2010): *Perlodes dispar* (Rambur 1842), *Amphinemura palmeni* Koponen, 1916 and *Protonemura intricata* (Ris 1902). Table 1 shows the Norwegian checklist with the number of collection-based records published by the NHM. Below are some comments on the species of which there are few or no specimens at the museum. Details of localities and collection dates can be retrieved from the online databases of Artsdatabanken and GBIF.

Table 1. Checklist of Plecoptera species recorded for Norway, with the number of occurrence records based on the collection created by Albert Lillehammer at the NHM in Oslo.

		Number of records
	PERLODIDAE	
1	*Arcynopteryx compacta* (MacLachlan 1872)	62
2	*Diura bicaudata* (Linnaeus 1758)	175
3	*Diura nanseni* (Kempny 1900)	343
4	*Isogenus nubecula* Newman 1833	1
5	*Perlodes dispar* (Rambur 1842)	2
6	*Isoperla difformis*(Klapálek 1909)	37
7	*Isoperla grammatica* (Poda 1761)	78
8	*Isoperla obscura* (Zetterstedt 1840)	123
	PERLIDAE	
9	*Dinocras cephalotes* (Curtis 1827)	27
	CHLOROPERLIDAE	
10	*Siphonoperla burmeisteri* (Pictet 1841)	138
11	*Xanthoperla apicalis* Newman 1836	2
	TAENIOPTERYGIDAE	
12	*Taeniopteryx nebulosa* (Linnaeus 1758)	175
13	*Brachyptera risi* (Morton 1896)	332
	NEMOURIDAE	
14	*Amphinemura borealis* (Morton 1894)	154
15	*Amphinemura palmeni* Koponen 1916	0
16	*Amphinemura standfussi* (Ris 1902)	143
17	*Amphinemura sulcicollis* (Stephens 1836)	297
18	*Nemoura arctica* Esben-Petersen 1910	15
19	*Nemoura avicularis* Morton 1894	150
20	*Nemoura cinerea* (Retzius 1783)	301
21	*Nemoura flexuosa* Aubert 1949	47
22	*Nemoura sahlbergi* Morton 1896	3
23	*Nemoura viki* Lillehammer 1972	1
24	*Nemurella pictetii* Klapálek 1900	190
25	*Protonemura intricata* (Ris 1902)	1
26	*Protonemura meyeri* (Pictet 1841)	173
	CAPNIIDAE	
27	*Capnia atra* Morton 1896	286
28	*Capnia bifrons* (Newman 1839)	83
29	*Capnia pygmaea* (Zetterstedt 1840)	78
30	*Capnia vidua* Klapálek 1904	3

31	*Capnopsis schilleri* (Rostock 1892)	158
	LEUCTRIDAE	
32	*Leuctra digitata* Kempny 1899	18
33	*Leuctra fusca* (Linnaeus 1758)	123
34	*Leuctra hippopus* Kempny 1899	366
35	*Leuctra nigra* (Olivier 1811)	220
	Total number of records	4305

***Isogenus nubecula* Newman 1833**
Buskerud: Sigdal, Tempelbekken, Norefjell, 1.x .1966, 1 nymph [slide marked P258, bearing nymphal pronotum, leg, cercus and maxilla]

This is an inhabitant of large lowland rivers that was once rather common in central and northern Europe. It suffered a dramatic decline in most of its range due to pollution and habitat fragmentation (Zwick 1992, 2004; Fochetti & de Figueroa 2006; Koese 2008: 91). It is a rare species in Scandinavia as well (Hoffsten & Malqvist 2003). The material in the NHM contains no complete specimen. The Norwegian data portal Artskart contains two observations of these species based on collection specimens. As these were collected in the province of Troms, outside of the species' known distribution (Lillehammer 1985, 1988; Zwick 1992), the identification should be checked.

***Perlodes dispar* (Rambur 1842)**
Oslo, Sørkedalselva, Langlielva, 25.ii.1969, 1 nymph, leg. Smestad [slide marked P1669 with nymphal cercus, leg and maxilla]; Akershus, Søndre Høland, 1♂ [slide with no further labelling, bearing male subanal lobe and cerci; the municipality Søndre Høland existed between 1924 and 1966].

This species is widely distributed and common in Europe (Zwick 2004). The north-western border of its distribution lies in south-eastern Norway, where it occurs in shallow streams with a high summer temperature (Lillehammer 1988:67). There are relatively many observations of this species in south-western Sweden (Swedish biodiversity information portal artportalen.se, last accessed 25 August 2011). The NHM contains no complete specimens. Artskart includes two collection-based records from the province of Troms. As these collection sites are far from the known distribution of this species (Lillehammer 1985, 1988), the identification of these specimens should be checked.

***Xanthoperla apicalis* (Newman 1836)**
Buskerud [Ringerike] viii.[18]45, 2♀, leg. J.H. Siebke, det. R. Brekke [two specimens on two pins, additional labels 'Siebke', '33' , 'Gf2276 ZM Oslo', respectively '34' and 'Gf 2277 ZM Oslo']; [Hedmark] Elverum, [no date], 2♀, leg. J.H. Siebke, det. R. Brekke [two specimens on a single pin, additional labels 'Siebke', '35-36' and 'Gf 2278 ZM Oslo']; Nord-Trondelag: Steinkjer, Ogna, 1 imago sex ?, 22.vii.1967, leg. ? [ethanol specimen, genitalia removed and lost]; Grong, Fjerdingelven, 1 male, 2.vii.1970, leg. A. Lillehammer [ethanol specimen, genitalia slide-mounted, labelled P2137].

Xanthoperla apicalis is a species of larger rivers in Europe (Lillehammer 1988:80). It was historically widespread in Europe but suffered from habitat fragmentation and has become very rare in central Europe (Zwick 1992, 2004; Koese 2008:105). It is also rare in Norway, with a scattered and little known distribution. The nineteenth century specimens in the NHM are listed by Brekke (1941) under the name *Chloroperla borealis* Bengtsson, 1933. According to Brekke, Schøyen (1887) refers to these same specimens under the name *Isopteryx apicalis* Newm. Schøyen does not cite specimens explicitly, but lists the municipalities Christiania (= Oslo), Ringerike and Elverum. Brittain (1983; Brittain et al. 1984) discusses finds from the Namsen and Sanddøla rivers in Nord Trondelag, as well as the river Glomma in Hedmark.

Note: Zwick (2004) remarks that figure 114 in Lillehammer (1988:76) does not show the pronotum of *X. apicalis*. The NHM slide collection includes three slides marked 'P39 *X. apicalis*', bearing a nymphal hind leg, cerci, two heads, one pronotum

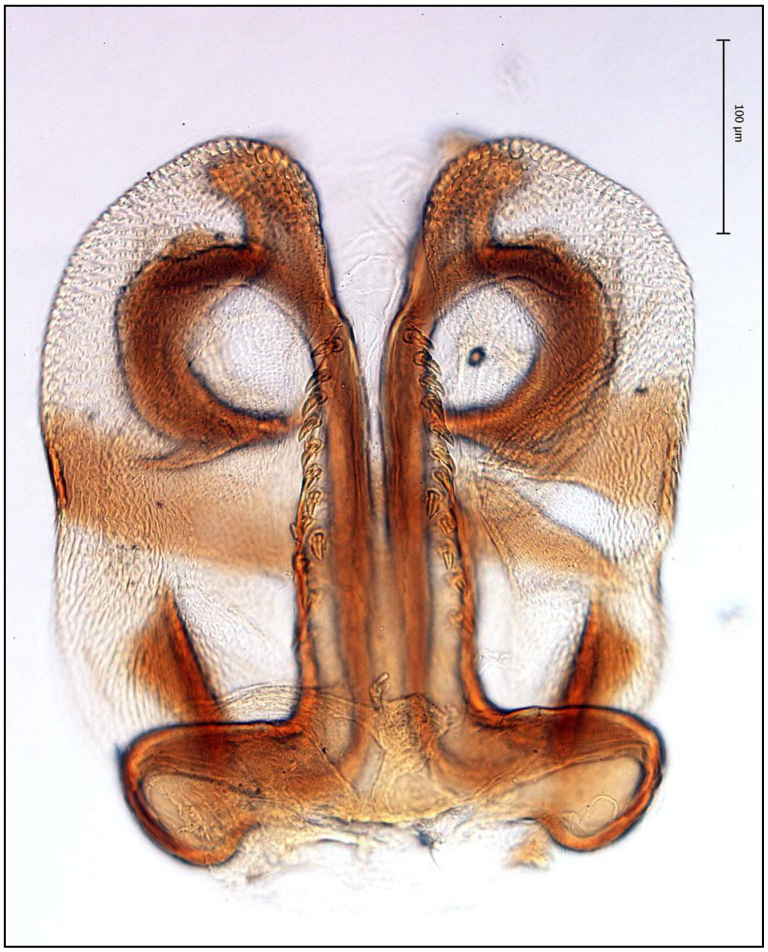

Fig. 1. Epiproct of male *Nemoura arctica* from Suoppatjavrre, Kautokeino (specimen P2749 no. 5). Photo L. Boumans.

and a complete small nymph. The incomplete collecting event data associated with P39 is 'Storelva, 26.iv.1966'. The pronota in these slides do not look like Lillehammer's fig. 114. However, they are probably *Siphonoperla* (Peter Zwick, personal communication September 2011).

***Amphinemura palmeni* Koponen 1916**

The NHM contains no ethanol-preserved or slide-mounted specimens labelled as such, nor do Lillehammer's publications bear evidence that he studied specimens of *A. palmeni*. The online data portals do not contain any observations either. Very few findings of this species have ever been reported.

The absence of specimens and observations of this red-listed taxon is due to the uncertainty of its taxonomic status. Koponen (1917) described *Amphinemura palmeni* from the Kola Peninsula in northwest Russia. Brinck (1949:19) considered the name to be a synonym of *A. standfussi* (Ris 1902), "considering the description and the type material". Then Tobias (1973) described *A. norvegica* from northern Norway. Meinander (1975) reports that Tobias and Baumann later checked the type of *A. palmeni* and found out that both *A. norvegica* and the Nearctic *A. linda* (Ricker 1952) were conspecific with *A. palmeni*. Illies's catalogue (1966:185) reproduces Brinck's opinion, while his chapter in Limnofauna Europaea (Illies 1978) later follows Meinander. Lillehammer's

(1988) identification key and handbook lists *A. palmeni* as a valid species and *A. norvegica* Tobias 1973 as its junior synonym.

I am currently re-examining the taxonomic status of this species. Preliminary analyses of mitochondrial sequences from *P.* cf. *palmeni* from Finnmark and Troms provinces in Norway and bordering Finland (northern Lapland province) show that two distinct clades of *standfussi*-like stoneflies occur in northern Scandinavia. Further research should establish whether these clades can be considered as easterly forms of *A. standfussi*, and whether the different clades interbreed.

***Nemoura arctica* Esben-Petersen 1910**

This arctic species is common in northern Fennoscandia (Lillehammer 1985), and also reported as widely distributed in arctic and subarctic North America (e.g. Walters et al. 2009). The ethanol collection includes ten samples from Finnmark and one from Abisko in northern Sweden. The slide collection includes mounts of wings, male genitalia (Fig. 1) and nymphal pronota.

***Nemoura sahlbergi* Morton 1896**

Finnmark, Kistrand [Porsanger], Myreng, bekk, 2.vii.1968, 27 nymphs, leg. A.Lillehammer [labelled P1441: ethanol; slides with nymphal legs and cerci specimens numbered 2 and 5; with nymphal pronotum specimens no. 1-4]; Finnmark, Tana, Tjernet, bekk [stream], 3.vii.1968, 1 nymph, leg. A. Lillehammer [P1461: only slide with nymphal legs and cerci]; Finnmark, Kautokeino, Hannujokka, 26.vi. 1972, circa 50 imagos, leg. A.Lillehammer [P2693: ethanol; slides of the epiproct of three male specimens numbered 30-32]; Finnmark, Porsanger, Skoganvarre Ovrevatn, N 69.84390° E 25.07600°, 1♂, leg. L. Boumans, T. Ekrem & S. Roth, det. L. Boumans, col. NHM barcoding tissue collection EPT-637.

Nemoura sahlbergi is a Palaearctic, and possibly circumpolar species (Teslenko & Bazova 2009). It occurs in the northernmost parts of Fennoscandia and is common in the province of Finnmark (Lillehammer 1985; 1988:118). Lillehammer probably used this material for his description of the nymph (Lillehammer 1972b). Figure 2 shows one of the epiprocts in the slide collection.

***Nemoura viki* Lillehammer 1972**

Finnmark, Kautokeino, Emmatjernbekken, 29.vi.1972, 55 imagos, leg. A. Lillehammer [labelled P2694: ethanol, specimens stored individually in numbered vials, together with their detached right forewing; slide-mounted epiprocts specimens no. 49-52]; slide-mounted epiproct of an additional, unlabelled specimen.

Only records from northernmost parts of Finland and Norway were known to Lillehammer (1988:118). Later, Johansson and Nilsson (1989, 1994) reported isolated finds of *N. viki* from the Swedish province of Västerbotten, 500 km south of the previously reported distribution. The Artskart database includes two collection-based records from the province of Troms in northern Norway. In all, there are very few records of this taxon. By all likelihood all specimens at the NHM have been identified by Lillehammer, but this is not documented. One of the slide-mounted epiprocts is shown in Fig. 3. The type specimens of *N. viki* appear to be missing (see below). The specimens used for the description of the nymphs (Lillehammer 1986) have not been located either.

***Protonemura intricata* Ris 1902**

Finnmark: Sør-Varanger, veget. Oterbekk under tregren [vegetation Oterbekk stream, under tree branch], 17.vii.1966, 1♂ leg. A. Lillehammer [ethanol]; Alta, Gargia, Gargiaelva, N 69°48.30 E 23°29.30, 23.vii.2010, 1♀; Nesseby, Nyborg, stream, N 70°10.65 E 28°36.60, 28.vii.2010, 2♀; Lebesby, Kunes: Austerelva, N 70°20.60 E 26°31.15, 28.vii.2010, 1♂; Sør-Varanger, Nordvest-bukta, Emanuelbekken, N 69°18.20 E 29°15.75, 30.vii.2010, 1♀; all 2010 specimens leg. L. Boumans, T. Ekrem & S. Roth, det. L. Boumans.

This species is widespread in Europe (Illies 1978), but in Scandinavia it is restricted to the northernmost parts as it reached the peninsula only from the northeast (Lillehammer 1988). The older material at the NHM contains only a single specimen collected during the Pasvik expedition in 1966. New samples collected in 2010 indicate that the species is currently not rare in Finnmark.

***Capnia vidua* Klapalek 1904**

Troms, Storfjord, bekk v. Hattengen, 26.vi. 1968, leg. Lillehammer [2 slide-mounted wings labelled P1403];

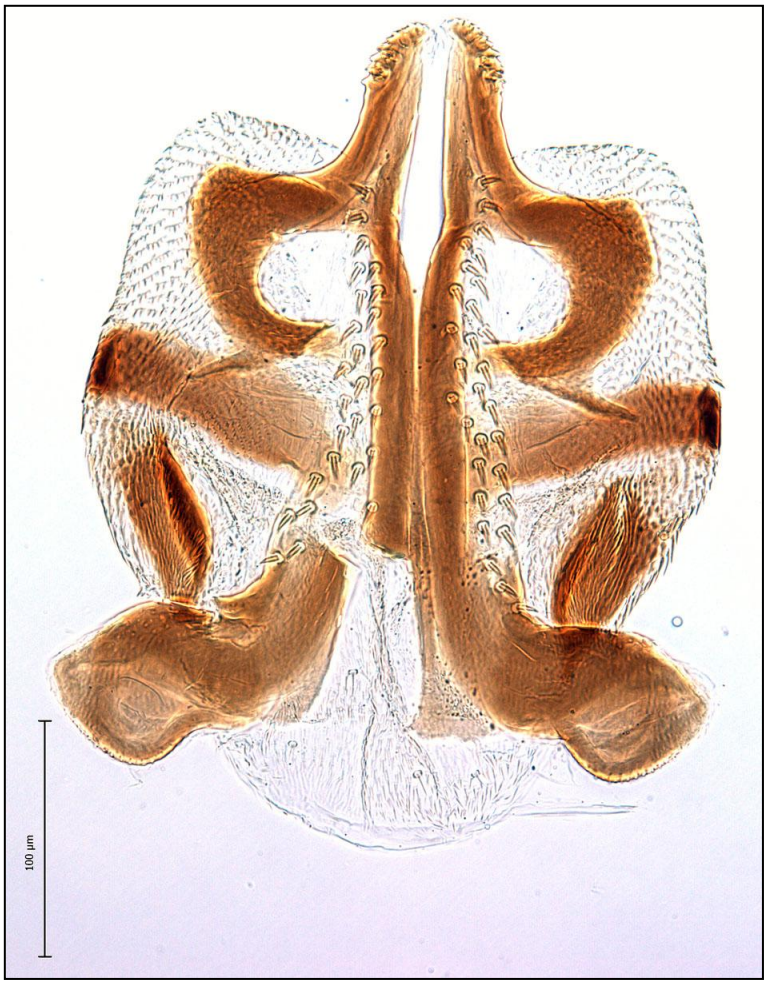

Fig. 2. Epiproct of male *Nemoura sahlbergi* from Hannujokka, Kautokeino (specimen P2693 no. 32). Photo L. Boumans.

Finnmark, Kautokeino, Hannujokka, 28.vi. 1968, leg. Lillehammer [3 slide-mounted wings labelled P1420 no. 1,2,4]; Finnmark, Kautokeino, Jobbevare Sibejokka, 29.vi. 1968, leg. Lillehammer [2 slide-mounted wings labelled P1413 no. 0, 1]

This stonefly has a scattered boreo-montane distribution in Europe (Illies 1978). In Scandinavia it occurs only in the northernmost parts (Lillehammer 1988). In addition to the slide-mounted wings from Norway, the NHM includes a small ethanol collection of nymphs and imagos from Iceland from the 1970s, which are among the specimens cited by Lillehammer et al. (1986). Artskart lists seven other collection-based records from the provinces Troms and Finnmark.

4. TYPE SPECIMENS

Albert Lillehammer described one new species, *Nemoura viki* Lillehammer 1972. The holotype, allotype and paratypes of *N. viki* listed by Lillehammer (1972a) date from 1966 and 1968. They should be present in the NHM, but I have not been able to locate them. There is a possibility that they are in the unorganized part of the wet collection, but they have probably been lost.

The dry type collection of the NHM contains the imaginal syntypes of *Capnia oklandi* Morton 1923 from Novaya Zemlya (Morton 1923). Morton cites 4♀

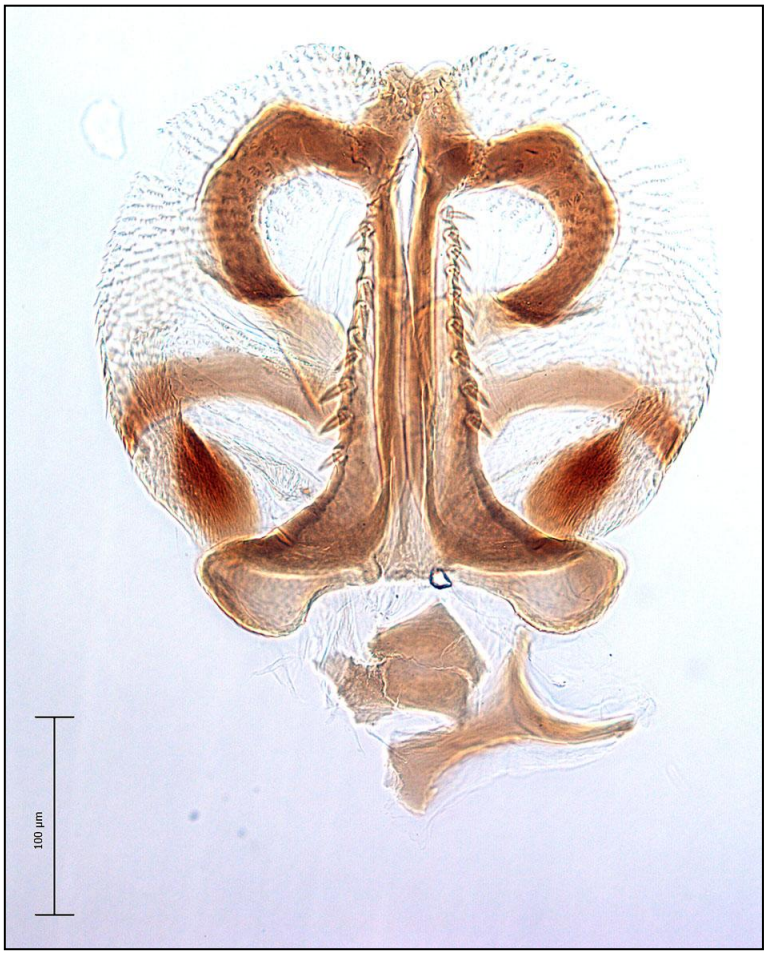

Fig. 3. Epiproct of male *Nemoura viki* from Emmatjernbekken, Kautokeino (specimen P2694 no. 49). Photo L. Boumans.

no. 130, 3♀ no. 174, 1 nymph no. 175 and 1 nymph no. 178. The seven imagines are preserved, four of these labelled as 'TYPE'. Two of the latter, and one of the specimens not labelled as type, lack the abdomen. *Capnia oklandi* is considered a junior synonym of *C. zaicevi* Klapálek, 1914 (Zhiltzova 1964; Zhiltzova 1966).

5. FUTURE APPLICATIONS OF THE COLLECTION

The Plecoptera collection at the NHM contains large numbers of samples of the local fauna, both older and recent ethanol material, slide mounts and frozen tissue samples. This makes the collection particularly valuable for (further) studies of intraspecific variation, comparing populations at different altitudes and latitudes. Since the last glaciation, stonefly species dispersed to Scandinavia from the south or the northeast. Those arriving from the south followed a westerly route over Denmark, or an easterly route over Finland. In some cases the same species arrived via two routes and two distinct subpopulations meet in the peninsula (Lillehammer 1985; 1988: 25-27). Future research may show to which of the stonefly species this applies, and whether these two lineages interbreed. In addition to these historical lineages, local environmental circumstances often lead to populations with atypical morphology or ecology. Stoneflies have a reputation for being variable in these respects (Lillehammer 1988: 36-40, and references in this chapter), perhaps

more so than other insect orders. Because of its size and good documentation, the slide collection has much potential for future morphometric research that makes use of new techniques and statistical analysis. The slides can also be photographed or scanned for illustration purposes (Fig.1-3).

Although the type specimens of *N. viki* have not been located, other material identified by Lillehammer can be used for a reassessment of the status of this taxon.

The Artsdatabanken database currently contains more than 16 500 Norwegian stonefly records, including some 1225 from the first half of the 20th century. The Museum of Natural History and Archaeology of the Norwegian University of Science and Technology in Trondheim plans to publish an additional 16 000 records (pers. comm. Jan Ivar Koksvik, 17 Jan 2011). This makes Plecoptera one of the best documented insect orders, and opens up for, among other things, studies in the phenology of common species. Firstly, the flight times of various species could be more accurately mapped on climatic regions of this elongated and mountainous country. Secondly, the long time series makes it possible to identify possible changes. For this purpose, however, the records need to include the life stage and ideally the sex of the specimens. This information is currently lacking from the data pertaining to most of the NHM's ethanol collection, and would require an inspection of the collection specimens.

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