

New records of a poorly studied mayfly species, *Eurylophella karelica* Tiensuu, 1935 (Ephemeroptera, Ephemerellidae), in the Baltic Ecoregion

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Abstract

Eurylophella karelica is a rare and poorly investigated species of European Ephemeroptera from the family Ephemerellidae. From the 1930s to 1970s, *E. karelica* has not been reported from historical localities in Karelia, Lithuania and Poland. New localities from Hungary, Slovenia and Lithuania are discovered over the last 2 decades. This article reports first findings of *E. karelica* in Latvia and Estonia and explains sporadic distribution of this species.

Key words

Ephemerellidae; new localities; Latvia; Estonia.

Academic editor: Rodolfo Silva | Received 7 June 2016 | Accepted 13 June 2017 | Published 18 August 2017

Citation: Ozoliņš D, Jēkabsons J, Skuja A, Timm H (2017) New records of a poorly studied mayfly species, *Eurylophella karelica* (Ephemeroptera, Ephemerellidae) Tiensuu, 1935, in the Baltic Ecoregion. Check List 13 (4): 349–353. <https://doi.org/10.15560/13.4.349>

Introduction

In Europe, the genus *Eurylophella* Tiensuu, 1935 is represented by three species (Martynov et al. 2015). *Eurylophella karelica* was the first species described in this genus (Tiensuu 1935). *Eurylophella iberica* is endemic to Iberian Peninsula (Keffermüller and Da Terra 1978) and *E. korneyevi* was recently described from Caucasus region of Georgia (Martynov et al. 2015). Overall, genus *Eurylophella* has a Holarctic distribution with 19 valid species (Burian 2002, Bauernfeind and Soldán 2012, Martynov et al. 2015).

Eurylophella karelica was found in Karelia, formerly Finland (Tiensuu 1935), Lithuania (Kazlauskas 1959, Ruginis 2006, Kovács et al. 2008, 2011), Poland (Keffermüller 1960, Sowa 1961), Hungary and Slovenia (Kovács and Ambrus 1999). However, no recent records

from historical localities in Karelia (Tiensuu 1935) and Poland (Jazdzewska 1995) are known. As it is extirpated from several localities, *E. karelica* was considered as one of the most threatened European mayflies (Kovács and Ambrus 1999).

Little is known regarding biology and ecology of *E. karelica* (Bauernfeind and Soldán 2012). Larvae were found in slow-flowing stretches of rivers and brooks (Kazlauskas 1959, Sowa 1961), as well as in lakes (Keffermüller 1960). Stones, gravel, clay (Tiensuu 1935), submerged macrophytes, roots of riparian vegetation, organic debris (Kovács and Ambrus 1999) and muddy sediment (Sowa 1961) were observed as their preferred habitats. Details of its life cycle are not thoroughly reported. Larvae have been found in late summer, autumn and spring but not in early and mid-summer (Tiensuu



Figure 1. Nymph of *Eurylophella karelica* from Estonia (collected in the Narva River, downstream, 30.09.2010). Scale bar = 1 mm.

1935, Kazlauskas 1959, Kovács et al. 2008, Keffermüller 1960, Sowa 1961, Kovács and Ambrus 1999). Imagines were collected in May, and thus, the life cycle is probably univoltine, overwintering as the larval stage (Uw) (Bauernfeind and Soldán 2012).

This article reports first records of *E. karelica* (Fig. 1) in Latvia and Estonia, additionally, clarifying disjunctive distribution of the species.

Methods

Our study comprises 1) the database of Institute of Biology, University of Latvia, 2) the data of surface water monitoring programme in Latvia, from 2007 to 2013 performed by Latvian Environment, Geology and Meteorology Centre, and 3) the data of *E. karelica* localities in Estonia, provided by Estonian University of Life Sciences.

The localities of species distribution elsewhere in Europe were obtained from publications (Tiensuu 1935, Kazlauskas 1959, Keffermüller 1960, Sowa 1961, Kovács et al. 2008, 2011, Kovács and Ambrus 1999).

The larvae of *E. karelica* in Latvia and Estonia were found in autumn (September–November) and spring (April–May) in lowland streams and rivers. In Latvia, the larvae were found in 9 localities of 7 watercourses, while in Estonia, in 10 watercourses, and exceptionally, in the littoral zone of a Lake Tüandre (Table 1).

Results

Material examined.

Table 1.

The main characteristic differentiating larvae in genus *Eurylophella* are the shape of the paired tubercles on abdominal terga (Allen and Edmunds 1963). In *E.*

karelica, tubercles are long, blunt or moderately sharp on segments 1–3, long and sharp on segments 4–7 and short, barely discernible or absent on segments 8–10 (Fig. 1). Nymphs of *E. karelica* were identified using published keys (Allen and Edmunds 1963, Bauernfeind and Soldán 2012, Martynov et al. 2015). Species identification was approved by Dr Henn Timm from Estonian University of Life Sciences.

Discussion

Nymphs of *E. karelica* were reported from waterbodies situated on plains (Tiensuu 1935, Kazlauskas 1959, Keffermüller 1960, Sowa 1961, Kovács and Ambrus 1999, Kovács et al. 2008). Lithuania, Latvia and Estonia are located in the Baltic Province (Ecoregion No. 15), which also is a lowland area (Illies 1978). Thus, we suggest that *E. karelica* is a lowland species, as it is shown on the distribution map (Fig. 2). The new localities are the first records of *E. karelica* in Estonia and Latvia. Within the Baltic region, they were previously reported only in Lithuania. The record from the littoral zone of Lake Tüandre in Estonia was the second case from the lentic habitat since Keffermüller (1960) found *E. karelica* in Lake Góreckie, a post-glacial, mesotrophic lake in Poland.

The data corroborated earlier reports, which regard *E. karelica* as a relict of the last Ice Age (Keffermüller 1960, Kovács and Ambrus 1999). The absence of nymphs during the summer sampling could be caused either by summer egg diapause or by larvae being too small to be detected by routine sampling methods (Bohle 1972, Brittain 1982). A summer egg diapause have been discussed in North American species of the genus *Eurylophella* (Hamilton and Tarter 1977). However, detailed life cycle studies of *E. karelica* are required to justify these statements.

The distribution of *E. karelica* was considered sporadic with small refugial areas (Kovács and Ambrus 1999). The current findings suggest that this species is more widespread than it was previously predicted. The reasons for this could be inappropriate sampling season (summer) to detect the larvae or absence of the research. Nevertheless, *E. karelica* mostly occurred in small numbers at the reported sampling sites (Tiensuu 1935, Kazlauskas 1959, Keffermüller 1960, Kovács and Ambrus 1999) suggesting relatively low abundances within its habitats. According to Kovács and Ambrus

1999, May is the proper sampling season for adults.

We assume that *E. karelica* inhabit a wider range of European lowland watercourses than expected before. However, appropriate sampling season (autumn to spring) should be considered first to improve the distribution pattern of this species.

Acknowledgements

We thank Natalja Grudule and Marina Čičendajeva from Latvian Environment, Geology and Meteorology Centre

Table 1. The places of finding of *Eurylophella karelica* in Latvia and Estonia during 2007-2013.

No.	Latitude (N)	Longitude (E)	Details
1	56°05.0484'	021°09.9396'	Latvia, Sventāja Stream, at Latvian-Lithuanian border, 22.10.2008, 1 nymph leg./det. N. Grudule, voucher specimen deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre; the same locality, 20.10.2013, 3 nymphs, leg./det. D. Ozoliņš, voucher specimens deposited in "Hydrobiological collections" of Institute of Biology, University of Latvia, project No. LLIV-230.
2	56°21.8712'	021°13.1064'	Latvia, Bārta River, 0.2 km upstream of Dūkupji, 08.05.2007, 6 nymphs leg./det. N. Grudule; the same locality 06.05.2009, 4 nymphs, leg./det. N. Grudule, voucher specimens deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre.
3	56°51.2670'	021°12.6282'	Latvia, Tebra Stream, mouth, 14.10.2008, 1 nymph, leg./det. N. Grudule, voucher specimen deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre.
4	57°02.9430'	022°47.5866'	Latvia, Abava River, upstream of Kandava, 20.05.2009, 1 nymph, leg./det. N. Grudule, voucher specimen deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre.
5	57°02.9430'	022°52.8588'	Latvia, Abava River, upstream of Püre, 15.10.2008, 3 nymphs, leg./det. N. Grudule, voucher specimens deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre.
6	56°24.2850'	024°10.6572'	Latvia, Mēmele River, mouth, 01.11.2013, 2 nymphs, leg. A. Skuja, det. D. Ozoliņš, voucher specimens deposited in "Hydrobiological collections" of Institute of Biology, University of Latvia, project No. LLIV-230.
7	56°22.5792'	024°40.2450'	Latvia, Mēmele River, at Latvian-Lithuanian border, 16.05.2011, 2 nymphs leg./det. N. Grudule, voucher specimens deposited in "Benthic macroinvertebrate sample collections" of "Surface water monitoring programme in Latvia" in Latvian Environment, Geology and Meteorology Centre; the same locality, 16.11.2013, 1 nymph, leg. A. Skuja, det. D. Ozoliņš, voucher specimen deposited in "Hydrobiological collections" of Institute of Biology, University of Latvia, project No. LLIV-230.
8	56°26.3412'	024°55.3368'	Latvia, Viesīte Stream, mouth, 22.11.2013, 2 nymphs, leg. A. Skuja, det. D. Ozoliņš, voucher specimens deposited in "Hydrobiological collections" of Institute of Biology, University of Latvia, project No. LLIV-230.
9	56°24.1224'	024°56.0814'	Latvia, Dienvidsusēja River, downstream of Nereta, 22.11.2013, 1 nymph, leg. A. Skuja, det. D. Ozoliņš, voucher specimen deposited in "Hydrobiological collections" of Institute of Biology, University of Latvia, project No. LLIV-230.
10	59°12.3900'	025°26.2600'	Estonia, Jägala Stream, Voose, 20.09.2010, 9 nymphs, leg. H. Timm, det. K. Käiro, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
11	58°28.7500'	024°59.7000'	Estonia, Halliste Stream, Riisa, 14.09.2010, 5 nymphs, leg./det. K. Käiro, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
12	59°06.6700'	027°47.8300'	Estonia, Narva River, downstream, 30.09.2010, 3 nymphs, leg. H. Timm, det. K. Käiro, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
13	58°27.9100'	025°12.0900'	Estonia, Lemmjogi Stream, Oksa, 28.04.2008, 2 nymphs, leg. H. Timm, det. K. Käiro, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
14	59°01.0000'	027°06.9000'	Estonia, Rannapungerja Stream, downstream, 30.09.2010, 2 nymphs, leg./det. K. Käiro, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
15	58°15.8400'	024°41.1090'	Estonia, Reiu Stream, Metsaääre, 15.05.2012, 2 nymphs, leg./det. H. Timm, voucher specimens deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
16	58°27.4200'	024°59.4700'	Estonia, Raudna Stream, Meiekose, 28.04.2008, 1 nymph, leg. H. Timm, det. K. Käiro, voucher specimen deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
17	59°18.2800'	024°07.6000'	Estonia, Vasalemma Stream, at the bridge, 19.05.2010, 1 nymph, leg. H. Timm, det. K. Käiro, voucher specimen deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
18	57°54.5500'	026°19.6200'	Estonia, Väike Emajõgi Stream, 1 km downstream of Sangaste dam, 13.09.2010, 1 nymph, leg./det. H. Timm, voucher specimen deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
19	59°01.0002'	027°06.9168'	Estonia, Rannapungerja Stream, Lemmaku 26.09.2011, 1 nymph, leg./det. U. Kruus, voucher specimen deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.
20	57°56.9220'	025°37.6980'	Estonia, Lake Tünder, littoral zone, 13.05.2013, 1 nymph, leg./det. H. Timm, voucher specimen deposited in "Hydrobiological collections" (EMHC) in Centre for Limnology, Estonian University of Life Sciences.

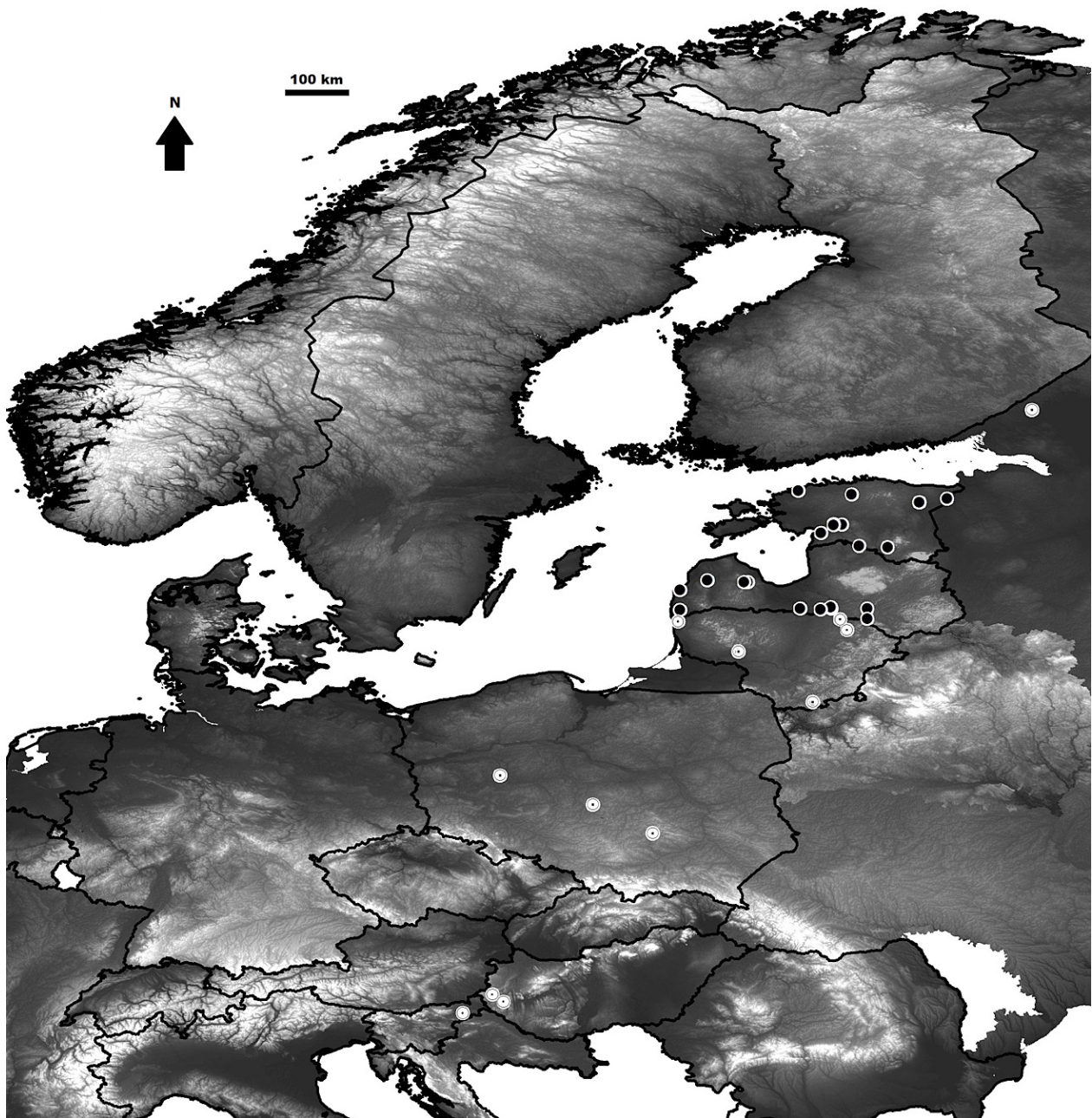


Figure 2. Distribution map of *Eurylophella karelica*. White dots: published localities from formerly Finland (Tiensuu 1935), Lithuania (Kazlauskas 1959, Kovács et al. 2008, Kovács et al. 2011), Poland (Keffermüller 1960, Sowa 1961), Hungary and Slovenia (Kovács and Ambrus 1999), black dots: new records from Latvia and Estonia (2007–2013).

for providing the data from surface water monitoring programme in Latvia. Authors also want to thank Uģis Kagainis for valuable comments on historical literature of Latvian arthropod collections.

Authors' Contributions

DO, AS and HT collected the data. DO and HT wrote the text. JJ made the map.

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