SCIENTIFIC NOTE

Two *Hydroptila* (Trichoptera: Hydroptilidae) species new to British Columbia and Canada

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The caddisflies (Trichoptera), comprise a highly diverse, major aquatic insect order often used as an indicator of ecosystem health. Malaise trapping on the Stellako River, British Columbia (B.C.), Canada, has revealed two species new to B.C. and Canada, respectively – *Hydroptila hamata* Morton and *Hydroptila argosa* Ross (Trichoptera: Hydroptilidae). Our new records of these two micro-caddisflies also emphasize the importance of these diminutive insects, which can be easily missed in monitoring and biodiversity assessments.

The Trichoptera are one of the major insect orders used as bioindicators of lotic ecosystems (Lenat 1988). Habitat loss and anthropogenic disturbance have caused a dramatic decline in the abundance and diversity of entomofauna worldwide, including the Trichoptera (Parmesan 2006; Sánchez-Bayo and Wyckhuys 2019). Little was known about trichopteran biodiversity in northern B.C. until recent surveys added several new species records for the province and Canada (Erasmus *et al.* 2018, 2024).

The B.C. Trichoptera fauna was first documented comprehensively by Nimmo and Scudder (1978, 1983). It is diverse, with at least 72 genera and 279 species (Cannings 2007; Erasmus *et al.* 2018, 2024). In addition, Sheffield *et al.* (2019) suggested that potentially many unrecorded or undescribed species of Trichoptera exist across Canada. New species records of smaller Trichoptera belonging to families such as the Hydroptilidae are likely because these species can be easily missed with typical sampling procedures.

Adult hydroptilidids may be mistaken for microlepidopterans: typically, larvae of this family are only 3 mm long, and the adults 6 mm long (Wiggins 1996), which increases the challenges with handling and identification of these species. Also known as purse-case making caddisflies or microcaddisflies, Hydroptilidae occupy a wide range of aquatic habitats, from cold springs to rivers and lakes, where they perform important ecosystem services such as consuming primarily algae (Wiggins 2004) and serving as food for fish and other

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aquatic organisms. According to Rasmussen and Morse (2023), eight genera and 14 species in the Hydroptilidae are recorded in B.C. Four of those belong to *Hydroptila – H. arctia* Ross*, H. consimilis* Morton*, H. rono* Ross*,* and *H. xera* Ross (Cannings 2007; Rasmussen and Morse 2023).

Over the last two decades, DNA barcoding approaches have advanced species identification, dramatically improved the understanding of biodiversity, and expedited species identification (Hebert *et al*. 2003; Zhou *et al.* 2009; Ruiter *et al.* 2013). The Barcode of Life database (BOLD; https://boldsystems.org) contains DNA barcodes of at least 96% of recorded Trichoptera species in Canada and has become an effective approach to identify species and assess the biodiversity of caddisflies and other arthropod taxa (Hebert *et al.* 2003, Sheffield *et al.* 2019).

In the present study, we captured caddisflies using SLAM Malaise traps (BugDorm BT1004, MegaView Science Co. Ltd., Taichung, Taiwan) hung from trees along the edge of the Stellako River from May to September in 2023 and 2024 (Fig. 1). The Stellako River is located in central B.C., on the traditional territory of the Stellat'en First Nation, and flows from Francois Lake (Nadlehbunk'ut) to Fraser Lake (Neetaibunk'ut). Malaise traps, with bottles containing 95% (v/v) ethanol, were set at the high-water mark at four locations: Glenannan Bridge: 54.564333, –125.263833; Cabin Pool: 54.671167, –124.991167; Falls: 54.046131, –124.958686; and Millionaires Pool: 54.018331, –124.968733. Bottles were collected every two weeks. Specimens were submitted for sequencing to the Canadian Centre for DNA Barcoding at the University of Guelph, Guelph, Ontario. Male and female specimens of *Hydroptila hamata* are vouchered at the Royal BC Museum, Victoria, B.C.

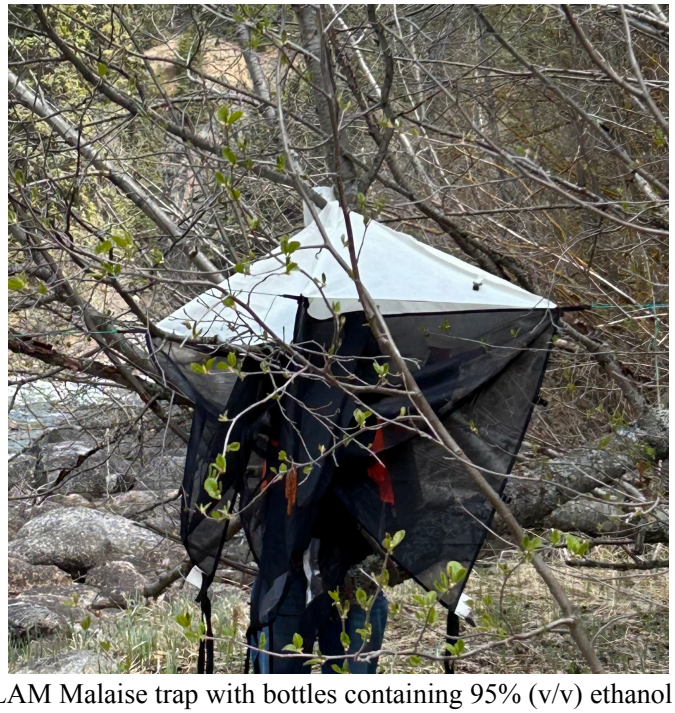

Figure 1. SLAM Malaise trap with bottles containing 95% (v/v) ethanol hung from a tree.

Images of *H. hamata* specimens were generated using 40× magnification on an AmScope Trinocular Zoom Stereo Microscope with the 8MP Imaging System (product #: SM-2T-LED-TP2; Amscope, Irvine, California, United States of America).

We initially identified specimens using the 650-bp sequence in the *CO*1 5′-region and the bioinformatic tools within BOLD to set up neighbour-joining tree analysis based on the Kimura 2-parameter distance model. Data are available at dx.doi.org/10.5883/DS-STELLAKO. We evaluated barcode index numbers (BINs) assigned by BOLD for each specimen to ensure accurate identification.

To assess distribution of *H. hamata* and *Hydroptila argosa*, we consulted checklists by Cannings (2007) and Rasmussen and Morse (2023). In addition, we surveyed the following online databases: Tricoptera World Checklist (Clemson University, Clemson, South Carolina, United States of America; https://trichopt.app.clemson.edu/welcome.php), BOLD (Centre for Biodiversity Genomics, University of Guelph; http://www.boldsystems.org); Electronic Atlas of the Wildlife of British Columbia (University of British Columbia, Vancouver, B.C.; http://ibis.geog.ubc.ca/biodiversity/efauna/); NatureServe (Arlington, Virginia, United States of America; http://www.natureserve.org/); Canadensys (http://www.canadensys.net/), Global Biodiversity Information Facility (http://www.gbif.org/); the Royal BC Museum (http://search-collections.royalbcmuseum.bc.ca/Entomology); Canadian National Collection (Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada; https://www.cnc.agr.gc.ca/taxonomy/TaxonMain.php?lang=en); and E.H. Strickland Entomological Museum (University of Alberta, Edmonton, Alberta, Canada; https://search.museums.ualberta.ca/). The database and museum collection surveys revealed no records for *H. hamata* for B.C. and only unreported *H. argosa* specimens in BOLD. Unreported *H. argosa* specimens were previously collected in the Kamloops, B.C., area in 2008 and 2013 (BOLD Sample ID: 08-JDWBC-1585, 08-JDWBC-2989, 08-JDWBC-3371, BIOUG07257-B04, and others) and in the Yukon, Canada, in 2019 (Sample ID: BIOUG55448-C10, BIOUG55448-G06, BIOUG55449-G10 BIOUG55471-F09, BIOUG55471-H06, and others)

In the present study, six adult specimens of *H. hamata* were collected in 2023 by Malaise traps on 11 July (BOLD Sample ID: T108-STC, T117-STB, T118-STB, T119-STB) at the Cabin Pool and Bridge sites, on 5 August (T134-STB) at the Bridge site, and on 14 September (T138-STB) at the Bridge site. These specimens all binned (> 99% similarly) within BOLD:AAE1757, which contains *H. hamata* specimens from Ontario and New Brunswick, Canada, and from New York and Illinois, United States of America. These identifications were confirmed, based on morphology using published keys of male and female genitalia (Ross 1944; Figs. 2 and 3). An additional four adult *H. hamata* specimens were collected at the Bridge site in 2024 on 27 June (T272-STB), 11 July (T386-STB, T388-STB), and 27 August (T291-STB).

Hydroptila hamata larvae are approximately 3 mm long; adults are up to 5 mm long (Wiggins 2004). The species inhabits both lakes and rivers, especially lotic systems that drain mountainous and hilly terrain (Ross 1944; Rasmussen and Morse 2023). *Hydroptila hamata* has been previously reported from California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming in the United States of America, with its nearest previously recorded location to

B.C. in Washington State (Ross 1944). In Canada, it is known from Manitoba, Ontario, Quebec, and New Brunswick (Cobb and Flannagan 1990; Rasmussen and Morse 2023). The Stellako River *H. hamata* specimens are the first records for B.C.

Figure 2. Male genitalia of *Hydroptila hamata* (lateral aspect) showing the ventral process (arrow) of the seventh sternite. This specimen was collected from the Stellako River, B.C. Photograph by Daniel Erasmus

On the Stellako River, *H. hamata* adults were trapped from June through September. This is consistent with emergences from the Ochre River (50° 04' N) in Manitoba (Cobb and Flannagan 1990) and the late spring to early summer records from Illinois (Ross 1944).

Hydroptila argosa is reported in California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming (Rasmussen and Morse 2023). We collected two adult *H. argosa* during the 2024 season on 27 June (T269-STF) and 11 July (T389-STB) in Malaise traps located at the Falls and Bridge sites, respectively. These *H. argosa* specimens group within the same BIN (BOLD:AAE1782) as the *H. argosa* specimens from Kamloops and Yukon (both previously unreported), as well as specimens from Montana, Yukon, California, and Nevada. We would typically confirm DNA sequence identification with morphology-based identification, but because of the specimens' small size , in this instance we had to use the entire insect for DNA extraction. This prevented post-sequencing confirmation with morphology-based taxonomy. However, based on the phylogenetic tree analysis and binning into BIN BOLD:AAE1782 with 100% similarity, we are confident of this identification. This identification is also supported by the fact that unreported *H.*

argosa specimens were previously collected in the Kamloops area in 2008 and 2013 (BOLD Sample ID: 08-JDWBC-1585, 08-JDWBC-2989, 08-JDWBC-3371, BIOUG07257-B04, and others) and in the Yukon in 2019 (Sample ID: BIOUG55448-C10, BIOUG55448-G06, BIOUG55449-G10 BIOUG55471-F09, BIOUG55471-H06, and others). The *H. argosa* specimens from the Stellako River and the Kamloops area in B.C. and from the Yukon are the first records of this species in Canada (Cannings 2007; Rasmussen and Morse 2023); they represent a substantial northwards expansion of the species' known range. In addition, Bergey *et al.* (2024) reported *H. argosa* as a new state record for Oklahoma, expanding its range eastwards.

Figure 3. Female genitalia (arrow) of *Hydroptila hamata* (ventral aspect) showing the eighth sternite. This specimen was collected from the Stellako River, B.C. Photograph by Daniel Erasmus

Due to their diminutive size, *Hydroptila* species are easily missed in monitoring surveys and biodiversity assessments. However, DNA barcoding tools, which can inform morphology-based methods, assisted with identification of these two species in regions where they had not been recorded previously. Other unrecorded microcaddisfly species are likely present in B.C.'s central and northern Interior and other minimally surveyed regions.

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