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RECENT COLLECTION AND DNA BARCODE OF THE RARE COFFEE POT SNOWFLY *CAPNIA NELSONI* (PLECOPTERA: CAPNIIDAE)

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ABSTRACT

The Coffee Pot Snowfly, *Capnia nelsoni* Kondratieff & Baumann, was recollected in July 2012 for the first time since the original type material collected in 1981. Scanning electron micrographs of the male and female terminalia are presented and comparisons with similar species are briefly discussed. The first DNA barcode for this species is presented.

Keywords: *Capnia nelsoni*, winter stoneflies, DNA barcode, Colorado, rheocrene

INTRODUCTION

The Coffee Pot Snowfly (Stark et al. 2012), *Capnia nelsoni* Kondratieff & Baumann 2002, was described from a single male and female from a high elevation rheocrene in north-central Colorado (Kondratieff & Baumann 2002). These specimens were collected from Coffee Pot Springs in Eagle County, Colorado on 7 July 1981 by Milton Campbell, formerly of the Canadian National Collection, while "treading" for staphylinid beetles. Several attempts to collect additional material from the type locality by B.C. Kondratieff, R.W. Baumann, and C.R. Nelson have been unsuccessful. Through the courtesy of Dr. Richard W. Baumann one additional record was recently brought to the attention of B.C. Kondratieff. This single male specimen was collected from a high elevation rheocrene approximately 210 km (130 mi) straight line distance south of the type locality on 26 July 1976 by Donald Ray. This record prompted B.D. Heinold and B.C. Kondratieff to visit the site on 7 July 2012 and successfully collect a large series of adult males, females, and larvae. This large series permitted the authors to more fully describe this rare species morphologically and provide the first DNA barcode sequence.

Specimens are deposited in the C.P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins (CSUC), the Monte L. Bean Museum, Brigham Young University, Provo, Utah (BYUC), the Bill P. Stark Collection, Clinton, Mississippi (BPSC), and the Canadian National Collection, Ottawa, Ontario, Canada (CNCI).

MATERIALS AND METHODS

Material examined. Holotype ♂ and allotype ♀, Type locality: COLORADO, Eagle Co., Coffee Pot Springs, 27 km NW Dotsero, 7 July 1981, 3,201 m elev. [10,500'], J.M. Campbell (CNCI); San Miguel Co., Turkey Creek, above upper Alta Lake, 26 July 1976, Don Ray, 1♂ (BYUC); headwater seeps of Turkey Creek, above waterfall above upper Alta Lake, 37.8852° -107.8385°, 7 July 2012, 3,501 m elev., B.D. Heinold and B.C. Kondratieff, 41♂, 65♀, and 7 larvae (CSUC); same, 10♂, 10♀(BYUC); same, 10♂, 10♀ (BPSC).

DNA Barcoding. Standard protocols from the Canadian Center for DNA Barcoding were followed for extraction (Ivanova et al. 2006a; Ivanova et al. 2006b), PCR (Hajibabaei et al. 2005; Ivanova et al. 2005), and bidirectional sequencing to generate a DNA barcode sequence from one adult male specimen. The final 671 base pair consensus sequence is publicly available on the Barcode of Life Database (BOLD systems; http://www.barcodinglife.com) as EVOTR1385-12.

RESULTS

Morphological Analysis. Kondratieff & Baumann (2002) illustrated the distinctly curved, flattened, and upturned tip of the male epiproct, the large tergal knob on abdominal segment 7, and the indented 8th tergum. Scanning electron microscopy of these structures from the new population agrees well with the original description (Fig. 1, 2). A SEM of the female subgenital plate depicts the lightly sclerotized anterior and shallowly excavated posterior portions of sternum 8 (Fig. 3).

Males of closely related species of *Capnia* are distinguished from *C. nelsoni* as follows: *C. decepta* (Banks) lacks the indention on the 8th tergum and the epiproct has greater depth and tapers gradually with no upturned curvature at the apex in lateral view (Nelson & Baumann 1989); *C. arapahoe* Nelson & Kondratieff possesses horns on the tip of the epiproct and in lateral view is not flattened or ending in a sharp, upturned hook (Nelson & Kondratieff 1988). Other *C. decepta* group species are not known from Colorado and are not contrasted here.

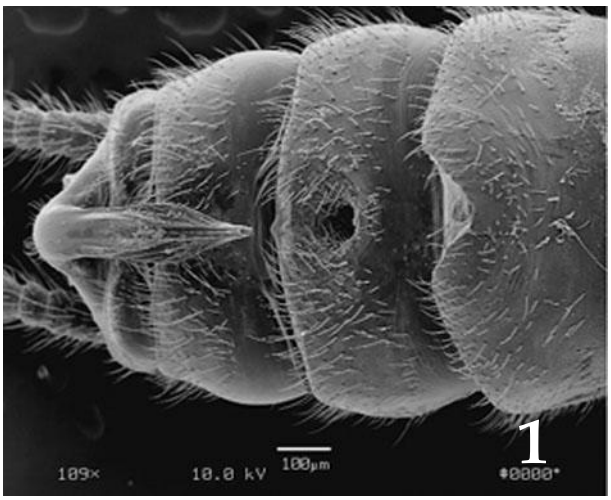
DISCUSSION

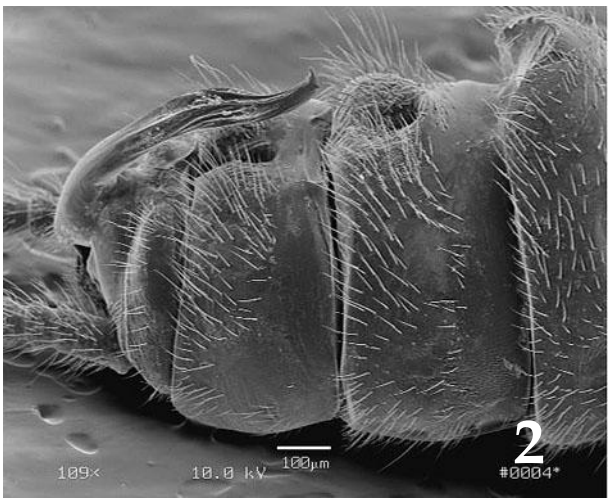
Capnia nelsoni is one of two species of *Capnia*, along with *C. arapahoe* Nelson & Kondratieff (1988), currently known to be restricted to Colorado and highly local in distribution (Heinold & Kondratieff 2010). Specimens of *C. nelsoni* were restricted to a 30 m reach where seepages converged to form the headwaters of Turkey Creek at the bottom of a large mountain bowl. They were collected using beating sheets from dense stands of Bluebells (*Mertensia ciliata* Don) and Heart-leaved Bittercress (*Cardamine cordifolia* Gray) along the small rheocrene. Other stoneflies collected with *C. nelsoni* were adult females of the nemourid *Zapada oregonensis* group and the chloroperlid *Alloperla pilosa* Needham and Claassen. Interestingly, during the same collecting event, a new species of a limnephilid caddisfly of the genus *Allomyia* was collected (personal communication David E. Ruiter, Grants Pass, Oregon). Other stoneflies taken at the type locality of Coffee Pot Springs were *Paraleuctra projecta* (Frison), *Sweltsa borealis* complex, *Zapada cinctipes* (Banks) and *Z. frigida* (Claassen).

Upon description, *C. nelsoni* was tentatively included in the *decepta* group by Kondratieff & Baumann (2002). Muranyi et al. (in preparation) may resurrect the genus *Arsapnia* Banks (1897) (type species = *A. decepta* Banks) which was synonymized with *Capnia* by Claassen (1924). If this happens, *Arsapnia* tentatively will include the *Capnia decepta* group as defined by Nelson & Baumann (1989).

We present the first DNA barcode sequence for *C. nelsoni*; however, additional DNA barcoding of other closely related Capnia species will be necessary to demonstrate *C. nelsoni's* monophyly and better understand the genetic relationship between *C. nelsoni* and other *Capnia* species. A complete revision of *Capnia* species, ideally utilizing both morphology and molecular genetics, will be required to better understand the most appropriate reclassification into existing or newly erected genera (Muranyi et. al in preparation) or into new *Capnia* species groups.

It is surprising that *C. nelsoni* has persisted at the Turkey Creek locality despite the heavy metal mining that occurred in the immediate area. From 1878 through the 1940's, gold, silver, zinc, and lead (Colorado Mines 2012) were extracted from mines immediately above and adjacent to the site, leaving tailings piles, mine portals, a small diversion (below which no *C. nelsoni* specimens were found), roads, and other structures. However, the rheocrene





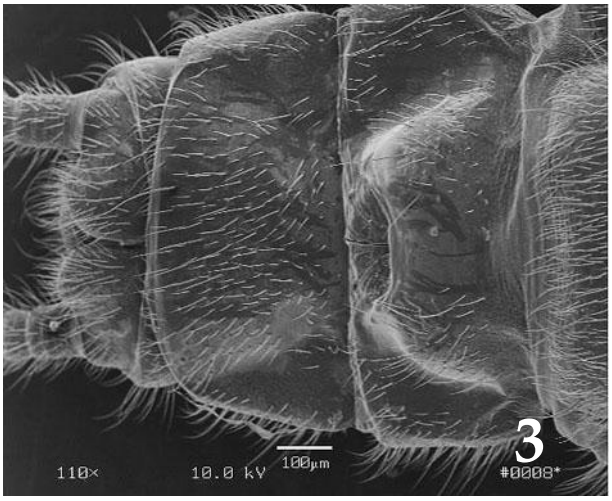


Fig. 1. *Capnia nelsoni* male terminal abdominal segments, dorsal.
Fig. 2. *Capnia nelsoni* male terminal abdominal segments, lateral.
Fig. 3. *Capnia nelsoni* female terminal abdominal segments, ventral.

originates from springs and may not surface long enough to accumulate harmful levels of toxins in the short reach where *C. nelsoni* was found. Additional populations of *C. nelsoni* probably occur in Colorado given the long distance of diverse high elevation topography between the two known occurrences. Locating new populations will help understand this species and provide valuable information about high elevation streams especially considering anticipated effects of climate change.

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REFERENCES

Banks, N. 1897. New North American neuropteroid insects. Transactions of the American Entomological Society, 24:21-31.

Claassen, P.W. 1924. New species of North American Capniidae (Plecoptera). The Canadian Entomologist, 56:43-57.

Colorado Mines. 2012. Mining Artifacts. Available online at http://www.miningartifacts.org/Colorado-Mines.html.

Hajibabaei, M., J.R. deWaard, & N.V. Ivanova. 2005. Critical factors for assembling a high volume of DNA barcodes. Philosophical Transactions of the Royal Society: Biological Sciences, 360:1959-1967.

Heinold, B.D. & B.C. Kondratieff. 2010. Description of the female of *Capnia arapahoe* (Plecoptera: Capniidae). Entomological News, 121:281-283.

Ivanova, N.V., J.R. deWaard, M. Hajibabaei, & P.D.N. Hebert. 2005. Protocols for high volume DNA barcoding. Draft submission to: DNA working group Consortium for the Barcode of Life. Published online at http://www.dnabarcoding.ca/

Ivanova, N.V., J.R. deWaard, & P.D.N. Hebert. 2006a. An inexpensive, automation-friendly protocol for recovering high-quality DNA. Molecular Ecology Notes, 6:998-1002.

Ivanova, N., C. Grainger, & M. Hajibabaei. 2006b. Glass fiber DNA extraction: A new inexpensive method for high throughput DNA isolation. CCDB Advances, Methods Release No. 1.

Kondratieff, B.C. & R.W. Baumann. 2002. A review of the stoneflies of Colorado with description of a new species of *Capnia* (Plecoptera: Capniidae). Transactions of the American Entomological Society, 128:385-401.

Murányi, D., M. Gamboa, & K.M. Orci. In preparation. *Zwicknia* gen. n. for the *Capnia bifrons* species group, with the description of three new species based on morphology, drumming signals and molecular genetics, and a synopsis of the West Palearctic and Nearctic genera of Capniidae (Plecoptera).

Nelson, C.R. & B.C. Kondratieff. 1988. A new species of *Capnia* (Plecoptera: Capniidae) from the Rocky Mountains of Colorado. Entomological News, 99:77-80.

Nelson, C.R. & R.W. Baumann. 1989. Systematics and distribution of the winter stonefly genus *Capnia* (Plecoptera: Capniidae) in North America. The Great Basin Naturalist, 49:289-363.

Stark, B.P., K.W. Stewart, S.W. Szczytko, R.W. Baumann, & B.C. Kondratieff. 2012. Scientific and common names of Nearctic stoneflies (Plecoptera), with corrections and additions to the list. Miscellaneous Contribution No. 1. The Caddis Press, Columbus, Ohio.

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