A STUDY OF THE EASTERN NEARCTIC ALLOPERLA (Plecoptera: Chloroperlidae) WITH HIRSUTE EPIPROCTS USING THE SCANNING ELECTRON MICROSCOPE

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ABSTRACT

Scanning electron microscope images of the epiproct of seven species of eastern Nearctic Alloperla: A. caudata, A. chloris, A. idei, A. petasata, A. voinae, A. vostoki, and A. usa are presented. In the male, these species exhibit an epiproct tip that is covered with short appressed or long, nearly erect hairs.

Keywords: Plecoptera, stoneflies, Alloperla, A. caudata, A. chloris, A. idei, A. petasata, A. usa, A. voinae A. vostoki, SEM micrographs, eastern North America

INTRODUCTION

A group of eastern Nearctic Alloperla that Surdick (2004) begins to separate at couplet 17 in her excellent review of the genus is characterized in the male by the epiproct tip covered in some way by either short, fine appressed hairs or by long, nearly erect hairs. Surdick (2004) diagnosed in couplets 17-24 the following species: A. acadiana Harper, A. caddo Poulton and Stewart, A. caudata Frison, A. chloris Frison, A. idei (Ricker), A. petasata Surdick, A. usa Ricker, A. voinae Ricker, and A. vostoki Ricker. Surdick (2004) clearly indicated that these nine species are not a homogenous group and her key implied no close relationships among species. Surdick (2004) separated eight of these species into three groups: Those species with the epiproct tip bulbous and lobed and usually covered with fine appressed hairs including A. petasata, A. caudata, A. idei, A. caddo; those with the epiproct tip flattened and almost covered with hairs including A. chloris, A. acadiana, A. usa; and finally the species, A. vostoki, with the epiproct tip as a hairy knob. Alloperla voinae was included in a group of species where the epiproct tip is a small button-like tab. Further study is clearly necessary to resolve phylogenetic relationships among these distinct taxa.

Although Surdick (2004) provides excellent illustrations and descriptions are available for the above species, none of these species have been examined with scanning electron microscopy to elucidate the fine details of the epiproct tip, except for an excellent dorsal view of the epiproct of an A. usa male from South Carolina (Fig.2.24) in Stark and Nelson (2000). Here we present scanning electron micrographs detailing the remarkable epiproct tip morphology of seven species: A. caudata, A. chloris, A. idei, A. petasata, A. usa, A. voinae, and A. vostoki. Male specimens of A. caddo and A. acadiana were not
available to the authors for study. *Alloperla caddo* is considered rare (Poulton and Stewart 1991) and restricted to the Ouachita Mountains of Arkansas, and *A. acadiana* (Harper 1984) is still apparently known only from the type. Hopefully, these new images of the epiproct tip of the seven species will help contribute to future phylogenetic studies of the genus *Alloperla*.

**MATERIAL AND METHODS**

Representative specimens of the large holdings of this genus were examined and are listed in the Material Examined section from the collections of Brigham Young University (BYUC), Provo, Utah and the C. P. Gillette Museum of Arthropod Diversity, Colorado State University (CSUC), Fort Collins, Colorado.

Adult genitalia were studied with a WILD M8 stereomicroscope. Scanning electron micrographs (SEM) were taken using a Philips XL2 ESEM FEG at Brigham Young University, Provo, Utah. The description of the epiproct follows the style of Surdick (2004).

**RESULTS AND DISCUSSION**

*Alloperla caddo* and *A. petasata* are similar and closely related. The epiproct tip of both species is bulbous, thickly covered with fine appressed hairs and terminates in a glabrous cap (Figs. 1-8). In *A. caddo*, the epiproct tip is enlarged ventrally (Fig. 3), and the glabrous apex is relatively smaller (Figs. 1-4). The shape of the epiproct tip of *A. petasata* is elongate ovoid (Figs. 5 & 7), and the cap-like apex is large and overlaps the entire apex (Figs. 5-8). *Alloperla petasata* is one of more common species of eastern Nearctic *Alloperla*. Its range is widespread from Atlantic Canada south to Georgia and Tennessee, whereas *A. caddo* is listed by Surdick (2004) from primarily the Ozark-Ouachita Highlands and Illinois to Alabama. However, we add Ohio and Tennessee.

*Alloperla chloris* originally described from New York is also a rather widespread species, recorded from Nova Scotia, Canada south to Georgia, northwest to Ohio (Surdick 2004). The epiproct tip of this species is flattened and almost triangular in dorsal aspect with a nipple-like apex (Figs. 9-12). Usually the epiproct is level with the cowl in repose (Fig. 11).

The epiproct tip of *A. idei* is produced anteroventrally into two almost triangular pilose lateral lobes, with a glabrous apex (Figs. 13-16). This species ranges from Atlantic Canada sporadically south to Georgia and Alabama, being much more common in the northern part of the range (Surdick 2004). Individuals are often attracted to black light traps.

The epiproct tip of *A. usa* is distinctive among all other North American *Alloperla* species by the notched apex forming lateral flaps with edges serrate (Figs. 17-24). Additionally, the pilosity is restricted dorsally to the center of the tip (Figs. 17-23). This species is common in small headwater streams of the middle and southern Appalachians from Georgia, Alabama to Pennsylvania, and west to Ohio.

Males of *A. vostoki* are easily distinguished by the raised knob-like epiproct tip, covered with many hairs on a thin neck (Figs. 25-28). This uncommon species has a narrow range, found in medium sized streams draining into Lake Erie, the St. Lawrence River and a few adjacent drainages (Surdick 2004).

The large cowl, forming flaps that almost completely encircle the epiproct tip that is almost flat in dorsal view (Figs. 29-32) easily distinguishes *A. voinae*. Surdick (2004) lists the geographical range of this uncommon species as the St. Lawrence drainages and adjacent Atlantic drainages of Quebec and Nova Scotia south to New York. Both *A. voinae* and *A. vostoki* are considered species vulnerable to extirpation or extinction (NatureServe 2009).

**Material examined.** *Alloperla caddo*: **USA:** Alabama: Lauderdale Co., Little Butler Creek, RR bridge on Co. Rd. 61, May 25, 1990, S. Harris, 1 ♂, 2 ♀ (CSUC); Missouri: Greene Co. Little Sac River, above Fellows Lake, May 25, 1972, R.W. Baumann, 8 ♂, 10 ♀ (BYUC); Newton Co., Carver Branch, George Washington Carver National Monument, June 27, 1989, B.C. Kondratieff & M. Harris, 2 ♂, 3 ♀ (CSUC); Ozark Co. Pine Creek, Hwy. 181, May 31, 1986, B.C. Poulton, 3 ♂, 2 ♀ (BYUC); Taney Co. Blue Creek, near Swan, May 23, 1972, R.W. Baumann, 2 ♂, 3 ♀ (BYUC); Bull Creek, Hwy 176, S Ozark, May 10-17, 1972, B.K. Newman, 26 ♂, 40 ♀ (BYUC); Ohio: Ross Co., Ralston Run, OH 722 bridge, May 25, 1992, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Scioto Co. Turkey Creek, Rte. 125, jct. Pond Lick Run, May 19,
Figs. 1-4. *Alloperla caudata*, male genitalia. 1. epiproct tip, dorsal, Bull Creek, Missouri; 2. epiproct tip, dorsal, anterior. Turkey Creek, Ohio; 3. epiproct tip, lateral, Turkey Creek, Ohio; 4. epiproct tip, anterior, apex, Turkey Creek, Ohio; Figs. 5-8. *Alloperla petasata*, male genitalia. 5. epiproct tip, dorsal, Little Sandy Creek, New York; 6. epiproct tip, anterior, apex, Ash Cave, Ohio; 7. epiproct tip, lateral, Little Sandy Creek, New York; 8. epiproct tip, lateral, apex, Little Sandy Creek, New York.
1990, B.C. Kondratieff & R.F. Kirchner, 18 ♂, 13 ♀ (CSUC); **Tennessee**: Sumner Co., trib. Little Trammel Creek, N Turners Station, near TN 174 & Old Hwy. 31, May 11, 2000, B.C. Kondratieff & R.F. Kirchner, 8 ♂, 7 ♀ (CSUC).


REFERENCES


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