



A STUDY OF THE EASTERN NEARCTIC *ALLOPERLA* (PLECOPTERA: CHLOROPERLIDAE) WITH HIRSUTE EPIPROCTS USING THE SCANNING ELECTRON MICROSCOPE

Richard W. Baumann¹ and Boris C. Kondratieff²

¹Department of Biology and Monte L. Bean Life Science Museum,
Brigham Young University, Provo, UT, U.S.A. 84602
E-mail: richard_baumann@byu.edu

²Department of Bioagricultural Sciences and Pest Management,
Colorado State University, Fort Collins, Colorado, U.S.A. 80523
E-mail: Boris.Kondratieff@Colostate.edu

ABSTRACT

Scanning electron microscope images of the epiproct of seven species of eastern Nearctic *Alloperla*: *A. caudata*, *A. chloris*, *A. ideii*, *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. ideii*, *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. ideii* (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. ideii*, *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. ideii*, *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 caudata 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. caudata*, 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. caudata* 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).

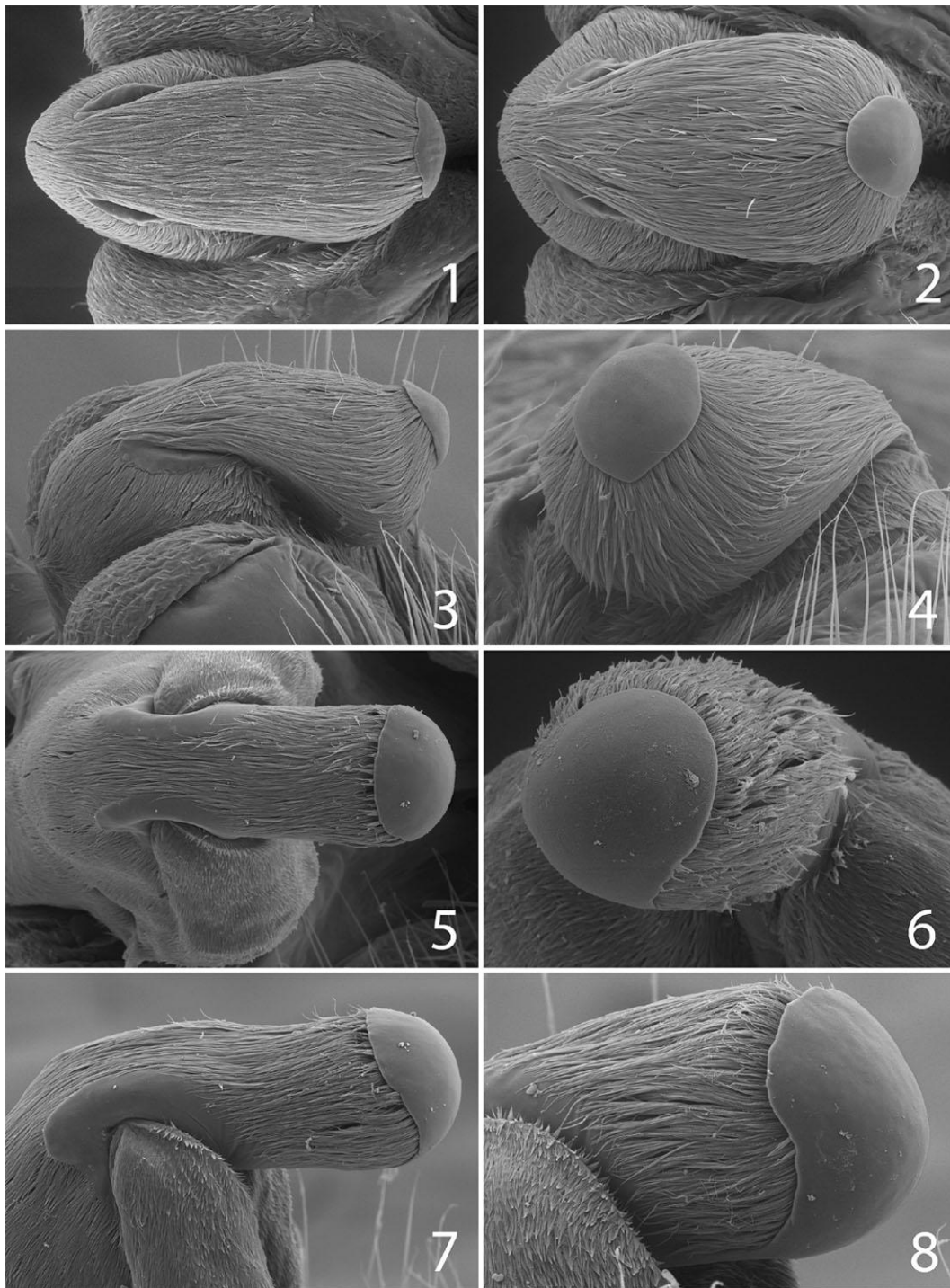
The epiproct tip of *A. ideii* is produced anteroventrally into two almost triangular pilose lateral lobes, with a glabrous apex (Figs. 13-16). This species ranges from Atlantic Canada sporadically south to Georgia and Alabama, being much more common in the northern part of the range (Surdick 2004).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

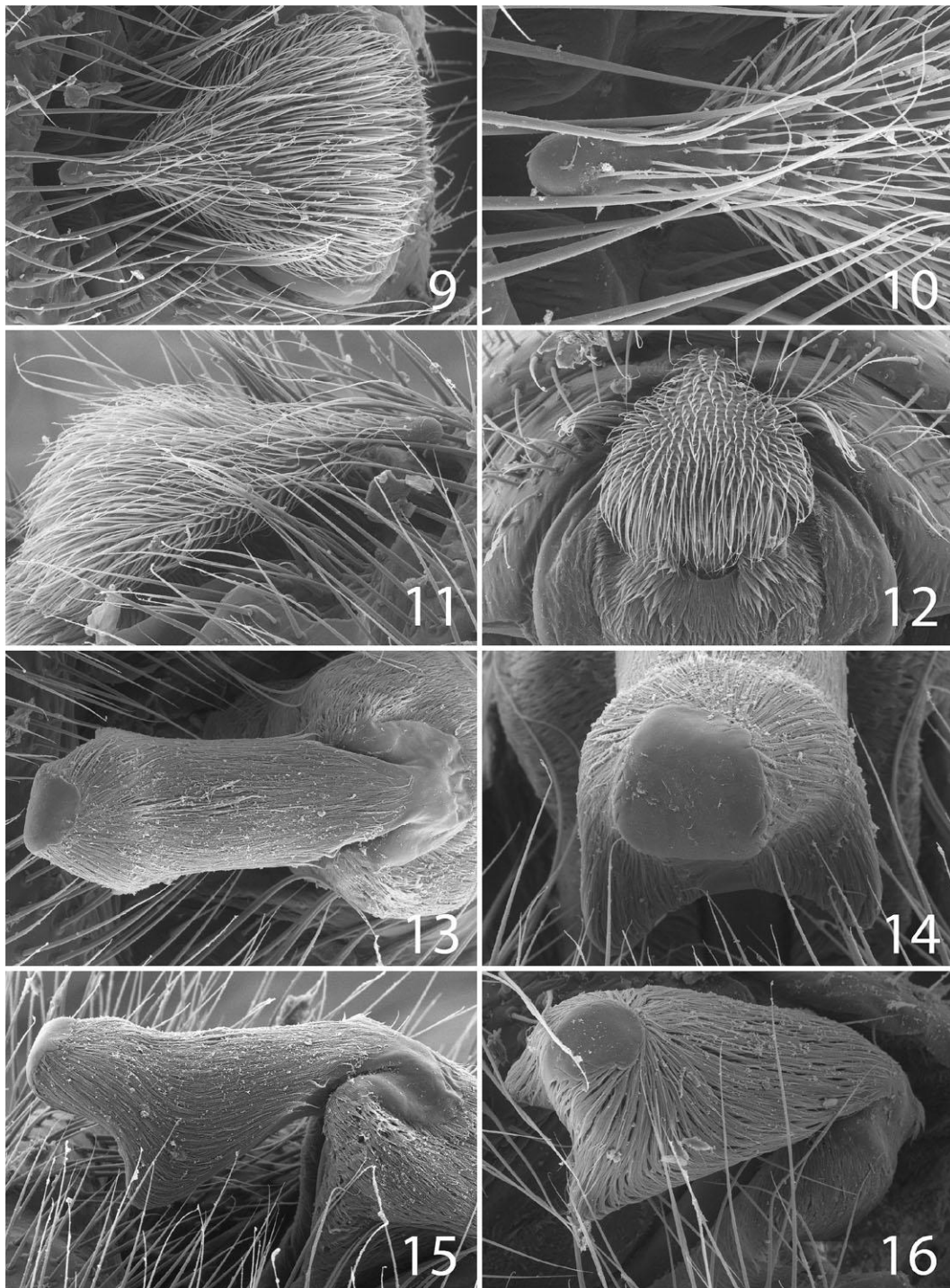
1990, B.C. Kondratieff & R.F. Kirchner, 18 ♂, 13 ♀ (CSUC); **Tennessee:** Sumner Co., trib. Little Trammel Creek, N Turners Station, near TN 174 & Old Hwy. 31, May 11, 2000, B.C. Kondratieff & R.F. Kirchner, 8 ♂, 7 ♀ (CSUC).

Alloperla chloris: **Kentucky:** Rowan Co., Ramey Creek, Cave Run Lake, Daniel Boone National Forest, May 28, 1993, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); same but May 25, 1994, 1 ♂ (CSUC); **New York:** Clinton Co., True Brook, True Brook Rd. Saranac, 44.6370N, 73.7682W, June 7, 2006, L.W. Myers, 1 ♂, 1 ♀ (CSUC); Delaware Co., Johnson Hollow Brook, Grant Rd., 42.3148N, 74.4704W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 9 ♂, 7 ♀ (CSUC); Essex Co., South Fork Boquet River, Rte. 73, 44.1039N, 73.6913W, June 27, 2007, L.W. Myers & B.C. Kondratieff, 7 ♂, 15 ♀ (CSUC); Franklin Co., Ampersand Brook, Coreys Rd., near Pickerel Pond outlet, 44.1988N, 74.2916W, June 27, 2007, L.W. Myers & B.C. Kondratieff, 5 ♂ (CSUC); Greene Co., Kiskatom Brook, jct. Rte. 32 and Hearts Content Rd., 42.2241N, 73.9864W, June 23, 2007, L.W. Myers, 1 ♂ (CSUC); Schoharie Creek, jct. Denning Rd. and Rte. 23A, 42.2164N, 74.2431W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 17 ♂, 5 ♀ (CSUC); seep to Winter Clove, Maple Lawn Rd., 42.2563N, 74.0431W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 3 ♂, 2 ♀ (CSUC); Lewis Co., Independence River, Pine Grove Rd., 43.7301N, 75.3655W, June 29, 2007, L.W. Myers & B.C. Kondratieff, 19 ♂ (CSUC); Mill Creek, Turin Rd., 43.6319N, 75.3933W, June 29, 2007, L.W. Myers & B.C. Kondratieff, 12 ♂, 13 ♀ (CSUC); Schoharie Co., Mill Creek, Rte. 2, near North Blenheim, 42.4691N, 74.1969W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 18 ♂, 8 ♀ (CSUC); **West Virginia:** Pocahontas Co. Island Lick Run, Watoga State Park, June 24, 1973, B.P. Stark, 1 ♂, 4 ♀ (BYUC).

Alloperla ideii: **CANADA:** New Brunswick, Little River, Hwy. 10, Sunburg, June 12, 1998, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC). **USA:** **Alabama:** Fayette Co., trib. Boxes Creek, 0.1 mi E of AL 13 at Co. Rte. 44, S Elridge, April 19, 1999, D.A. Etnier, 2 ♂, 2 ♀ (CSUC); **Maine:** Washington Co., Tomah Stream, Hwy. 6, June 12, 1998, B.C. Kondratieff & R.W. Baumann, 5 ♂ (CSUC); **New York:** Clinton Co., Ausable River, Rte. 9N, 3mi. W Ausable Forks, 44.4552N, 73.6136W, June 27, 2007, L.W. Myers & B.C. Kondratieff, 16 ♂, 12 ♀ (CSUC);

Greene Co., Catskill Creek, Sand Plains Rd. near S Cairo, 42.2782N, 73.9571W, June 19, 2008, L.W. Myers, 1 ♂, 2 ♀ (CSUC); Hamilton Co., Sacandaga River, Rte. 30, near Hope, 43.2886N, 74.2347W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 9 ♂ (CSUC); Herkimer Co., South Branch Moose River, Rte. 28, near county line, 43.6113N, 75.1032W, July 29, 2007, L.W. Myers, 3 ♂, 4 ♀ (CSUC); Lewis Co., South Branch Moose River, Moose River Rd., 43.6026N, 75.1592W, June 29, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂, 1 ♀ (CSUC); Warren Co., Glen Creek, Glen Creek Rd., 43.5851N, 73.8713W, June 26, 2007, L.W. Myers & B.C. Kondratieff, 4 ♂ (CSUC).

Alloperla petasata: **CANADA:** **New Brunswick:** Charlotte Co., stream N of Hwy. 1, Pocologon, June 2, 1992, B.C. Kondratieff & R.W. Baumann, 1 ♂, 1 ♀ (CSUC); Gloucester Co., Tobuswtac River, off Hwy. 8, June 17, 1993, B.C. Kondratieff & R.W. Baumann, 3 ♂ (CSUC); Nepisquit River, Hwy. 360, June 17, 1993, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC); Queens Co., Number 10 Brook, Hwy. 101, June 25, 1993, B.C. Kondratieff & R.W. Baumann, 13 ♂, 17 ♀ (CSUC); **Nova Scotia:** Antigonis Co., Tracodie River, Hwy. 16, June 22, 1993, B.C. Kondratieff & R.W. Baumann, 88 ♂, 10 ♀ (CSUC); Malignant Brook, Old Maryvale Rd., jct. Hwy. 245, June 22, 1993, B.C. Kondratieff & R.W. Baumann, 20 ♂, 10 ♀ (CSUC); Cochester Co., Waughs River, Hwy. 256, The Falls, June 3, 1998, B.C. Kondratieff & R.W. Baumann, 6 ♂ (CSUC); Inverness Co., Broad Cove River, Hwy. 19, Glenville, June 21, 1993, B.C. Kondratieff & R.W. Baumann, 6 ♂ (CSUC); River Inhabitants, Hwy. 105, June 11, 1998, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC); Glen Brook, Hwy. 105, N Melford, June 11, 1998, B.C. Kondratieff & R.W. Baumann, 6 ♂, 1 ♀ (CSUC); Richmond Co., Mill Brook, Hwy. 4, Kempt Rd., June 4, 1998, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC); Pictou Co., Barneys River, Avondale, June 20, 1993, B.C. Kondratieff & R.W. Baumann, 11 ♂ (CSUC); Victoria Co., Upper Baddeck River, N Baddeck, June 21, 1993, B.C. Kondratieff & R.W. Baumann, 28 ♂ (CSUC). **USA:** **Kentucky:** Rowan Co., trib. North Fork Triplett Creek, Conley Rd., 0.4 mi NE I-64, May 25, 1994, B.C. Kondratieff & R.F. Kirchner 1 ♂ (CSUC); Ramey Creek, Cave Run Lake, Daniel Boone National Forest, May 25, 2002, B.C. Kondratieff & R.F. Kirchner 1 ♂ (CSUC); Trigg Co., trib. Casey Creek, Perimeter Rd., Fort Campbell, June

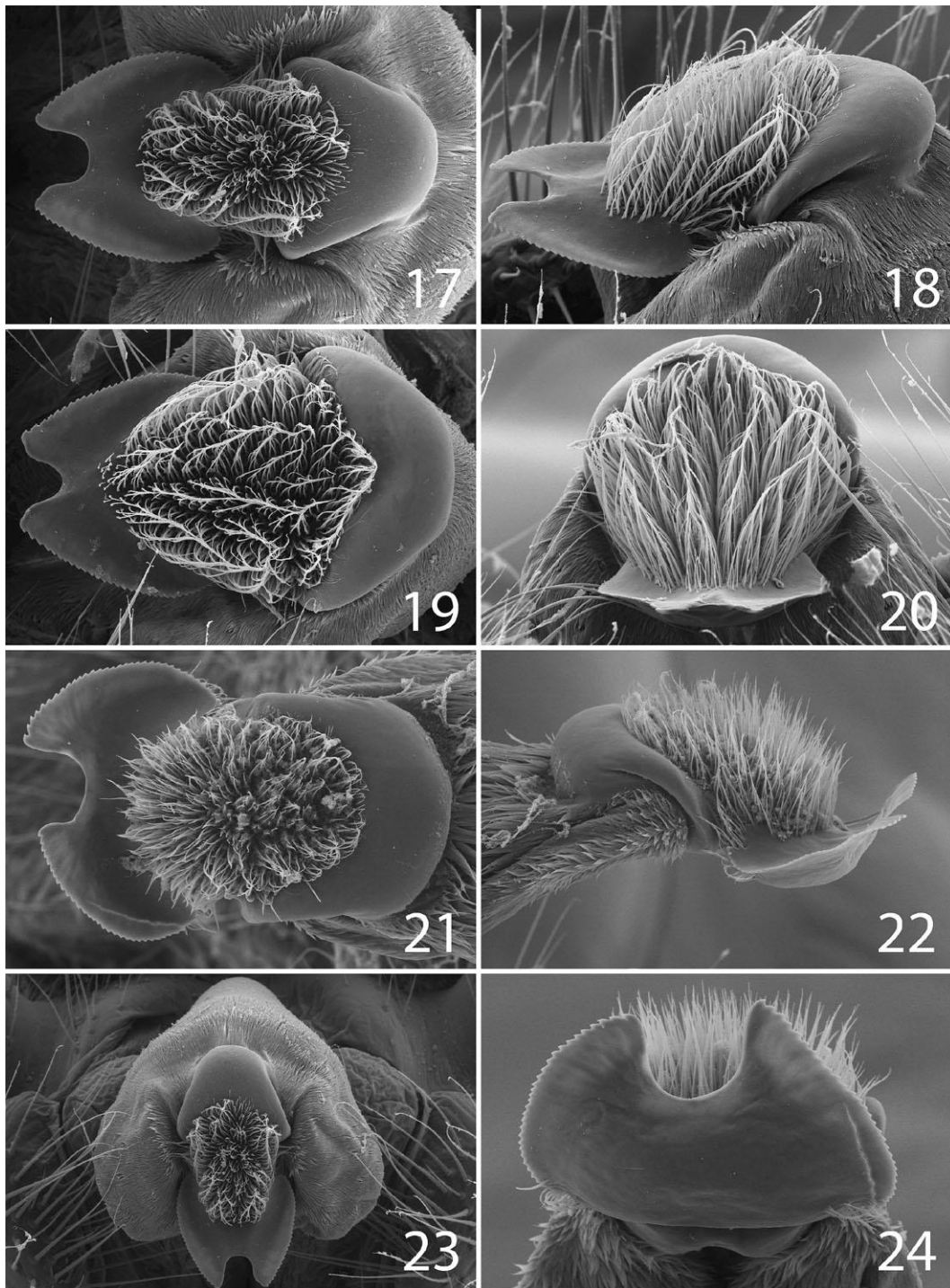


Figs. 9-12. *Alloperla chloris*, male genitalia, Mill Creek, New York. 9. epiproct tip, dorsal; 10. epiproct tip, dorsal, anterior, apex; 11. epiproct tip, lateral; 12. epiproct, posterior. Figs. 13-16. *Alloperla idei*, male genitalia, Sacandaga River, New York. 13. epiproct tip, dorsal; 14. epiproct tip, anterior, apex; 15. epiproct tip, lateral; 16. epiproct tip, dorsolateral, apex.

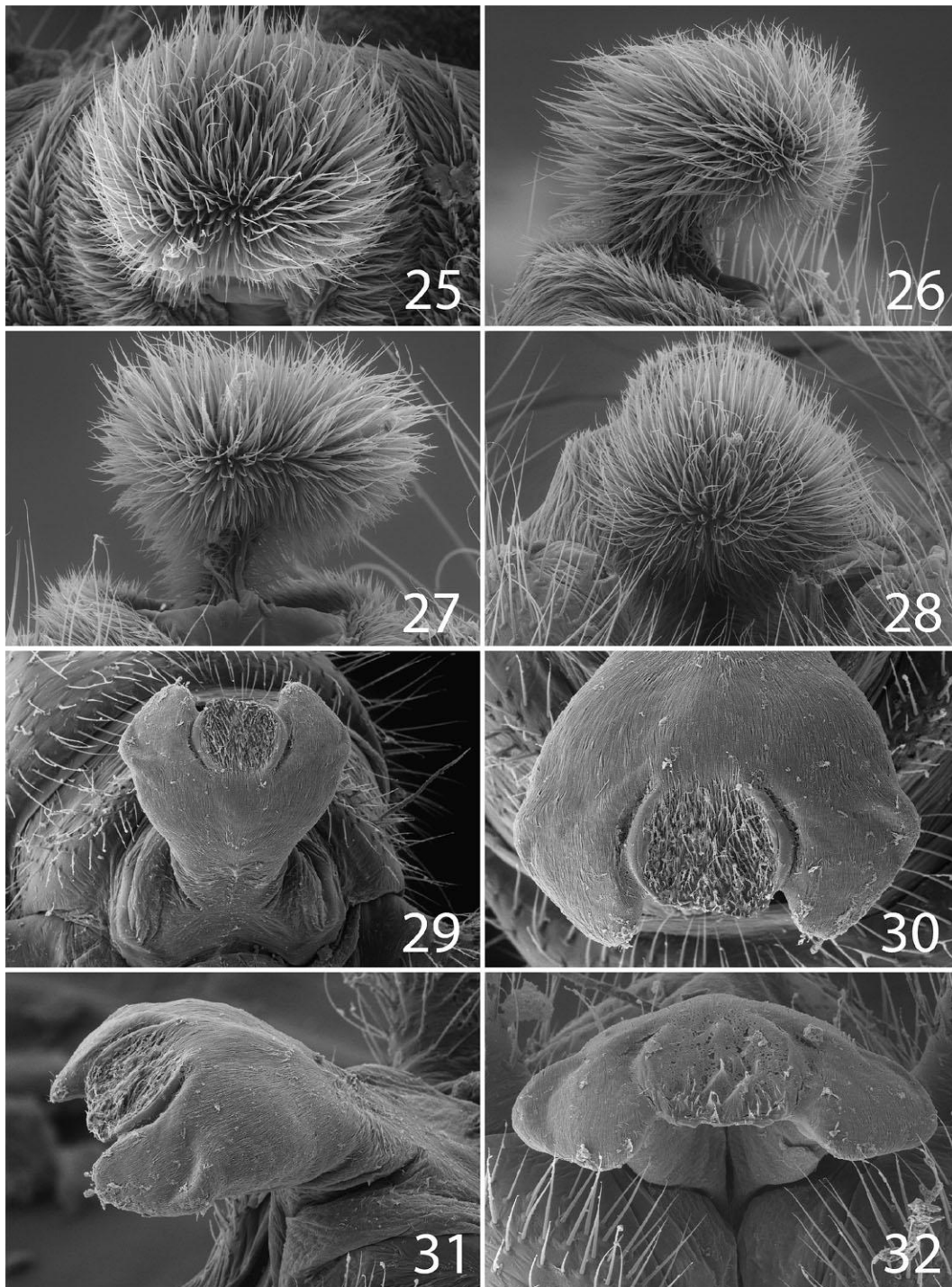
10, 2004, B.H. Bauer, 3 ♂, 1 ♀ (CSUC); Dry Fork Creek, Pryor Trail, Fort Campbell, 2 June 2004, B.H. Bauer, 16 ♂, 31 ♀ (CSUC); Little West Fork, Mc Nair Road, Fort Campbell, 12 May 2004, B.H. Bauer, 3 ♂, 1 ♀ (CSUC); **Maine:** Piscataquis Co., Kingsburg Stream, Rte. 15, Abbot Village, June 11, 1993, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC); Waldo Co., Bear Brook, Knox Station, July 8, 1993, D.S. Potter, 2 ♂ (BYUC); Halfmoon Stream, Rte. 220, Thorndike Village, June 13, 1993, B.C. Kondratieff & R.W. Baumann, 1 ♂ (CSUC); **New Hampshire:** Carroll Co., Ellis River, Hwy. 16, Jackson, May 30, 1987, R.W. Baumann & G.Z. Jacobi, 1 ♂, 1 ♀ (BYUC); **New York:** Clinton Co., Stillwater Brook, Morhaus Rd., off Rand Hill Rd., W Jericho, 44.7945N, 73.6642W, May 28, 2008, 4 ♂, L.W. Myers & R. Mowrey (CSUC); True Brook, True Brook Rd. Saranac, 44.6370N, 73.7682W, June 20, 2006, L.W. Myers, 2 ♂, 1 ♀ (CSUC); Essex Co., East Branch Ausable River, Rte. 9N, near Rattlesnake Knob, 44.3476N, 73.7587W, June 27, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂ (CSUC); Franklin Co., Ampersand Brook, Coreys Rd. near Pickerel Pond outlet, 44.1988N, 74.2916W, June 27, 2007, L.W. Myers & B.C. Kondratieff, 4 ♂ (CSUC); North Branch Saranac River, Loon Lake Rd., 44.5393N, 74.0515W, July 27, 2006, 1 ♂, 4 ♀, L.W. Myers (CSUC); Greene Co., seep to Winter Clove, Maple Lawn Rd., 42.2563N, 74.0431W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂ (CSUC); Hamilton Co., Sacandaga River, Rte. 30, near Hope, 43.2886N, 74.2347W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂ (CSUC); Oswego Co., Little Sandy Creek, Hwy. 13, E Lacona, June 17, 1997, B.C. Kondratieff & R.W. Baumann, 15 ♂ (CSUC, BYUC); Schoharie Co., Mill Creek, Rte. 2, near North Blenheim, 42.4691N, 74.1969W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂, 1 ♀ (CSUC); Tomkins Co. Locke Creek, Ludlowville, June 1, 1987, L.L. Pechuman, 2 ♂, 5 ♀ (BYUC); Warren Co., Indian Brook, Rte. 9N, jct. Indian Brook Rd., 43.6381N, 73.7727W, June 26, 2007, L.W. Myers & B.C. Kondratieff, 3 ♂ (CSUC); **North Carolina:** Swain Co., Nantahala River, US 19, 2 mi. NE Nantahala, May 19, 1994, B.C. Kondratieff & R.F. Kirchner 1 ♂ (CSUC); **Ohio:** Hocking Co. Ash Cave, Hocking Forest, June 28, 1952, A.R. Gaufin, 1 ♂ (BYUC); Lawrence Co., Storms Creek, Wayne National Forest, Lake

Vesuvius, Township 245, May 19, 1993, B.C. Kondratieff & R.F. Kirchner, 5 ♂ (CSUC); Scioto Co., Turkey Creek, T-99, Shawnee National Forest, May 19, 1990, B.C. Kondratieff, R.F. Kirchner & J. Welch, 1 ♂, 1 ♀ (CSUC); **Pennsylvania:** Pike Co, Delaware River, Dingman Ferry, May 29, 1996, B.C. Kondratieff, 2 ♂ (CSUC); Dingman Falls Creek, Dingman Falls, May 29, 1996, B.C. Kondratieff, 7 ♂ (CSUC). **Tennessee:** Montgomery Co., Dry Fork Creek, Pryor Trail, Fort Campbell, June 10, 2004, B.H. Bauer, 7 ♂, 6 ♀ (CSUC); **Virginia:** Franklin Co., Grassy Fork Creek, Co. Rd. 613, May 21, 2002, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Rockingham Co. Big Run, Shenandoah National Park, May 31, 1975, J.F. & D. Burger, 1 ♂, 1 ♀ (BYUC); **West Virginia:** Pocahontas Co., Cochran Creek, Hwy. 92, Pocahontas Campground, May 21, 1990, R.W. Baumann & S.M. Clark, 2 ♂ (BYUC).

Alloperla usa: **USA:** **Alabama:** Cleburne Co., Cheaha Creek, Cheaha State Park, May 14, 1988, R.W. Baumann, R.F. Kirchner, B.C. Kondratieff & C.R. Nelson, 5 ♂, 2 ♀ (BYUC); **Georgia:** Fannin Co., Toccoa River, Rte. 60, May 19, 1985, B.C. Kondratieff, 1 ♂ (CSUC); **North Carolina:** Avery Co., Linville River, Blue Ridge Parkway, May 18, 1994, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Buck Co. Buck Creek, Sunnyvale, May 9, 2001, M.D. Terry, 2 ♂ (BYUC); Haywood Co., East Fork Pigeon River, Shining Rock National Recreation Area, May 13, 1990, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Jackson Co., seeps into Mull Creek, Rd. 1737, May 23, 1993, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Right Fork Cove Creek, Co. Rd. 1395, May 23, 1993, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Macon Co., Cullasaja River, Rte. 28, N Falls, May 24, 1993, B.C. Kondratieff, R.F. Kirchner & J. Welch, 3 ♂ (CSUC); Watauga Co., stream along Blue Ridge Parkway, mile 301, NE Linville, July 12, 2007, B.C. Kondratieff, R.E. Zuellig & D.R. Lenat, 1 ♂ (CSUC); Yancey Co. Old Mitchell Trail, Mount Mitchell State Park, July 12, 2008, B.C. Kondratieff, R.E. Zuellig & D.R. Lenat, 1 ♂, 2 ♀ (CSUC); **Ohio:** Ashland Co. trib. Frog Hollow Creek, Mohican State Park, June 1, 1989, R. W. Baumann & R. F. Kirchner, 2 ♂, 3 ♀ (BYUC); **Pennsylvania:** Warren Co., West Fork Hemlock Run, June 11, 1979, E.C. Masteller, 1 ♂ (CSUC); **South Carolina:** Pickens Co., Wildcat Creek, 9 km NW Clemson, May 24, 1981, B.P. Stark, T.R. White & V.



Figs. 17-24. *Alloperla usa*, male genitalia. 17. epiproct tip, dorsal, Mount Mitchell Park, North Carolina; 18. epiproct tip, lateral, Mount Mitchell Park, North Carolina; 19. epiproct tip, dorsal, Buzzard Branch, West Virginia; 20. epiproct tip, anterior, Buzzard Branch, West Virginia; 21. epiproct tip, dorsal, Cheaha Park, Alabama; 22. epiproct, lateral, Cheaha Park, Alabama; 23. epiproct, dorsal, Mount Mitchell Park, North Carolina; 24. epiproct tip, apex, ventral, Cheaha Park, Alabama.



Figs. 25-28. *Alloperla zostocki*, male genitalia, Twenty Mile Creek, Pennsylvania. 25. epiproct tip, dorsal; 26. epiproct tip, lateral; 27. epiproct tip, anterior, ventral; 28. epiproct, anterior, apex. Figs. 29-32. *Alloperla voinae*, Ampersand Brook, New York. 29. epiproct, dorsal; 30. epiproct, dorsal, apex; 31. epiproct, lateral; 32. epiproct, anterior, apex.

Cross, 4 ♂ (BYUC); Wildcat Creek, Issaqueena Lake Area, May 4, 1985, B.C. Kondratieff, 1 ♂ (CSUC); **Tennessee:** Pickett Co., Flint Fork of Longham Branch, Flint Fork Road, May 2, 1999, R.J. Fulcher, 1 ♂ (CSUC); **Virginia:** Grayson Co. Middle Fork Helton Creek, Mount Rogers, July 24, 1982, B.C. Kondratieff, 2 ♂, 1 ♀ (BYUC); Montgomery Co. Craig Creek, Rte. 621, June 10, 1983, B.C. Kondratieff, 1 ♂, 1 ♀ (BYUC); Patrick Co. trib. Rock Castle Creek, Rte. 605, Rocky Knob Recreation Area, May 17, 1994, B.C. Kondratieff, 1 ♂, 2 ♀ (CSUC). **West Virginia:** Greenbrier Co., Coats Run, Rte. 39, May 24, 2002, B.C. Kondratieff & R.F. Kirchner, 1 ♂ (CSUC); Kanawha Co., Buzzard Branch, I-64/I-77, May 16, 1994, B.C. Kondratieff & R.F. Kirchner 1 ♂, 2 ♀ (CSUC); Buzzard Branch, CR 83, 4 mi. S Pratt, 28 May 1992, B.C. Kondratieff & R.F. Kirchner, 1 ♂, 3 ♀ (CSUC); Buzzard Branch, Paint Creek, Hwy. I-77, May 16, 1994, R.W. Baumann & B.C. Kondratieff, 1 ♂ (BYUC).

***Alloperla voinae*:** **USA: New York:** Clinton Co., Cold Brook, Standish Rd., High Banks, 44.6191N, 73.9032W, July 27, 2007, L.W. Myers, 4 ♂ (CSUC); Franklin Co., Ampersand Brook, Coreys Rd., near Pickerel Pond, 44.1988N, 74.2916W, June 27, 2007, L.W. Myers, 4 ♂ (CSUC); same but July 28, 2007, L.W. Myers & B.C. Kondratieff, 4 ♂, 3 ♀ (CSUC).

***Alloperla vostoeki*:** **CANADA: Nova Scotia:** Middle River, August 16, 1967, D.C. Ferguson, 1 ♂ (BYUC). **USA: New York:** Greene Co., Schoharie Creek, jct. Denning Rd. and Rte. 23A, 42.2164N, 74.2431W, June 25, 2007, L.W. Myers & B.C. Kondratieff, 1 ♂ (CSUC); **Pennsylvania:** Erie Co. Twenty Mile Creek, Hwy 20, Robinson Stop, 4 June 1997, R.W. Baumann & B.C. Kondratieff, 14 ♂, 8 ♀ (BYUC & CSUC).

ACKNOWLEDGEMENTS

The following persons assisted in collections or contributed material, Ralph F. Kirchner, Huntington, West Virginia; Luke W. Myers, SUNY, Plattsburgh, New York; Bill, P. Stark, Mississippi College, Clinton, Mississippi and Robert E. Zuellig, USGS, Fort Collins, Colorado. Michael Standing, Brigham Young University Electron Microscope Laboratory produced the electron micrographs. The final figure plates were constructed by Randy Baker, graphic artist, Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah.

REFERENCES

- Harper, P.P. 1984. *Alloperla acadiana* n. sp. (Plecoptera: Chloroperlidae) du Nouveau-Brunswick. *Revue d'Entomologie du Québec*, 29:83-85.
- NatureServe. 2009. <http://www.natureserve.org/> accessed 14 April 2009.
- Poulton, B.C. & K.W. Stewart. 1991. The stoneflies of the Ozark and Ouachita Mountains (Plecoptera). *Memoirs of the American Entomological Society*, Number 38:116pp.
- Stark, B.P. & C.R. Nelson. 2000. The Nearctic plecopteran families: morphology and systematics. In B.P. Stark and B.J. Armitage (editors). *Stoneflies (Plecoptera) of eastern North America. Volume I. Pteronarcyidae, Peltoperlidae, and Taeniopterygidae*. *Bulletin of the Ohio Biological Survey, New Series 14 (1):11-28*.
- Surdick, R.F. 2004. Chloroperlidae (The Sallflies). In B.P. Stark and B.J. Armitage (editors). *The stoneflies (Plecoptera) of eastern North America. Volume II, Chloroperlidae, Perlidae, and Perlodidae (Perlodinae)*. *Bulletin of the Ohio Biological Survey, New Series 14 (4):1-60*.

Received 22 April 2009, Accepted 3 July 2009, Published 26 August 2009

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Illiesia](#)

Jahr/Year: 2009

Band/Volume: [05](#)

Autor(en)/Author(s): Baumann Richard W., Kondratieff Boris C.

Artikel/Article: [A study of the Eastern Nearctic Alloperla \(Plecoptera: Chloroperlidae\) with Hirsute epiprocts using the scanning electron microscope. 99-107](#)