



THE ALLOPERLA SEVERA COMPLEX (PLECOPTERA: CHLOROPERLIDAE) OF WESTERN NORTH AMERICA.

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ABSTRACT

The Chloroperlinae taxon *Alloperla severa* of western North America is reviewed. *Alloperla elevata* and *A. thalia* previously treated as a synonyms of *A. severa* are considered valid species. The male genitalia of all three species are illustrated using the scanning electron microscope.

Keywords: Plecoptera, stonefly, *Alloperla*, *A. elevata*, *A. severa*, *A. thalia*, western North America

INTRODUCTION

Currently, the chloroperlid *Alloperla severa* (Hagen 1861) is considered a wide-ranging western Nearctic species, recorded from Alaska, the Yukon to the Northwest Territories, south to California and Nevada, and east to Colorado (Claassen 1940, Surdick 1985, Lyon & Stark 1997, Stewart & Ricker 1997, Stewart & Oswood 2006). In 1954, Ricker considered both *A. elevata* Frison 1935 and *A. thalia* Ricker 1952 as junior subjective synonyms of *A. severa*. *Alloperla severa* was originally described from Unga Island of the Shumagin Island group, off the southeast coast of the Alaska Peninsula. The holotype of *A. elevata* was taken in Curry County, Oregon, and the holotype of *A. thalia* was collected in Gallatin County, Montana. Ricker (1954) concluded "the Montana specimens are evidently an Interior form of *severa* (*elevata*), rather smaller than the Coast form and possibly differing in other average characters." Studying many specimens of the putative *A. severa* from throughout its reported range indicated that *A.*

elevata and *A. thalia* are valid taxa.

MATERIAL AND METHODS

Specimens were examined from the following colleagues and institutions: Brigham Young University Collection (BYUC), Provo, Utah; Canadian National Insect Collection (CNIC), Ottawa, Ontario; C. P. Gillette Museum of Arthropod Diversity, Colorado State University (CSUC), Fort Collins, Colorado; Illinois Natural History Survey (INHS), Champaign, Illinois; Royal Ontario Museum (ROMC), Toronto, Ontario; Spencer Entomological Museum (SMDV), Vancouver, British Columbia; Bill P. Stark Collection (BPSC), Clinton, Mississippi; and the Kenneth W. Stewart Collection (KWSC), Denton, Texas.

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 Lyon and Stark (1997).

***Alloperla severa* (Hagen)**

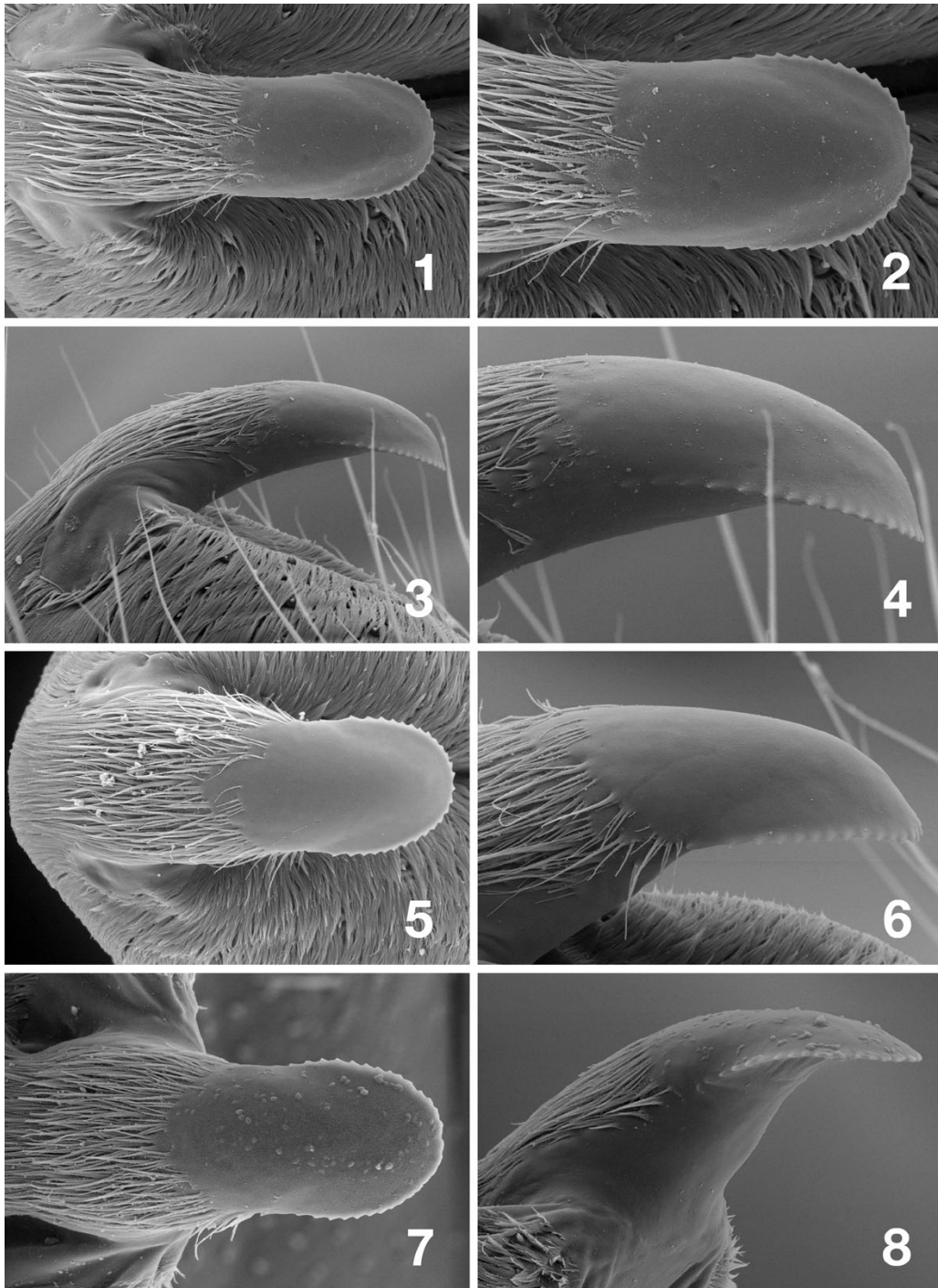
(Figs. 1-8)

Perla severa Hagen 1861: 30. Holotype male, Museum of Comparative Zoology, Harvard, MCZC #252 (abdomen missing): Unga Island, Alaska.

Alloperla severa, Lyon & Stark 1997: 327. In part.

Material examined. CANADA: ALBERTA: Bow River, 5 mi. W Canmore, 29 July 1965, R.K. Allen, 2 ♂, 8 ♀ (BYUC); Waterton River, Mountain View, 20 July 2000, E. Fuller, 5 ♂, 10 ♀ (BYUC). BRITISH COLUMBIA: Quesnel, 16-25 June 1949, G.J. Spencer & R.S. Smith, 1 ♂, 2 ♀ (SMDV). NORTHWEST TERRITORIES: Trail River, 62° 06' N 122° 12' W, 12 July 1973, D.M. McClymont, 1 ♂, 1 ♀ (ROMC). YUKON TERRITORY: 14 mi. E Dawson, 2 July 1962, P.J. Skitsko, 1 ♂, 1 ♀ (CNIC); Little Creek Campground, 15 July 1984, E.C. Masteller, 1 ♂ (BYUC). USA: ALASKA: Alagnak River, below Kukaklet Lake, above Hallersville, 23 June 2000, R. Beatty, 4 ♂, 2 ♀ (KWSC); Bay of Islands Creek, Naknek Lake, Katmai National Monument, 4 July 1969, K.J. Raedeke, 1 ♂, 2 ♀ (BYUC); 14 July 1969, K.J. Raedeke, 1 ♂, 1 ♀ (BYUC); Brooks River, at Falls, Katmai National Monument, 4 July 1969, K.J. Raedeke, 1 ♂ (BYUC); 25 July 1969, K.J. Raedeke, 6 ♂, 17 ♀ (BYUC); Crooked Creek, near Kasilof, Kenai Peninsula, 16 June 1990, B.F. Robison, 6 ♂, 5 ♀ (BYUC); Kenai River, Hwy 1, Cooper Creek Campground, 14 July 2003, C. Kerst, 5 ♂, 2 ♀ (BYUC, CSUC). IDAHO: Adams Co., East Fork Goose Creek, New Meadows, 26 June 1960, A.R. Gaufin, 2 ♂, 1 ♀ (BYUC). Blaine Co., Big Wood River, Hwy 93, N Hailey, 17 June 1964, A.R. Gaufin, 1 ♂ (BYUC). Lemhi Co., Birch Creek, Hwy 28, Lone Pine, 1 July 1968, A.R. Gaufin, 1 ♂, 1 ♀ (BYUC). Salmon River, Hwy 93, N Salmon, 19 June 1963, A.R. Gaufin, 1 ♂, 2 ♀ (BYUC); Wagonhammer Spring, Hwy 93, S North Fork, 17 June 1965, A.R. Gaufin, 1 ♂ (BYUC). Shoshone Co., Coeur d'Alene River, Rd 10, E Kingston, 11 June 1969, A.R. Gaufin, 40 ♂, 21 ♀ (BYUC). MONTANA: Beaverhead Co., Big Hole River, Hwy 91, Melrose, 5 Aug. 1966, J.R. Grierson, 1 ♂ (BYUC); Big Hole River, Hwy 91, 5 mi. S Divide, 13 Aug. 1967, A.R. Gaufin, 4 ♂, 5 ♀ (BYUC); Big Hole River, Hwy I-15, Glen, 19 June 2004, R.W. Baumann & B.P. Stark, 24 ♂, 10 ♀ (BPSC & BYUC); Wise River, 15 mi. S Wise River, 7 Aug. 1966, J.R. Grierson, 1 ♂, 1

♀ (BYUC). Cascade Co., Sun River, Hwy 20, Sun River, 24 June 1965, A.V. Nebeker, 2 ♂, 4 ♀ (BYUC). Flathead Co., Dutch Creek, North Fork Road, Glacier National Park, 11 July 1969, M.L. Miner, 12 ♂ (BYUC); Flathead River, Hwy 2, Berne Memorial Park, 3 mi. W Hungry Horse, 6 July 1965, A.V. Nebeker, 7 ♂, 7 ♀ (BYUC); Middle Fork Flathead River, Hwy 2, Essex, 8 July 1967, A.R. Gaufin, 16 ♂, 7 ♀ (BYUC); Stillwater River, near Olney, 30 June 1967, A.R. Gaufin, 2 ♂, 4 ♀ (BYUC). Glacier Co., Saint Marys River, Saint Marys Campground, Glacier National Park, 4 July 1968, A.R. Gaufin, 46 ♂, 50 ♀ (BYUC); Saint Marys River, Lower Saint Marys Lake, Glacier National Park, 5 Aug. 1967, M.L. Miner, 16 ♂, 30 ♀ (BYUC); Swift Current Creek, Glacier National Park, 13 July 1963, A.R. Gaufin, 2 ♂ (BYUC). Granite Co., Rock Creek, Squaw Rock Campground, 2 July 1966, M.L. Miner, 5 ♂, 6 ♀ (BYUC); Rock Creek, 5 mi. up Rock Creek Road, 20 July 1973, G. Roemhild, 1 ♂ (CSUC). Lake Co., Jocko River, Hwy 93, Ravalli, 19 July 1963, A.R. Gaufin, 5 ♂, 12 ♀ (BYUC); Mission Creek, below Mission Falls, St. Ignatius, 25 June 1967, A.R. Gaufin, 4 ♂, 3 ♀ (BYUC); Talking Water Creek, Hwy 35, below Blue Bay, Flathead Lake, 5 July 1967, A.R. Gaufin, 17 ♂, 32 ♀ (BYUC). Lincoln Co., Fisher River, Hwy 2, 30 June 1973, A.R. Gaufin, 12 ♂, 26 ♀ (BYUC); Pleasant Valley River, Hwy 8, mile 63, 19 June 1999, M.D. Terry, 2 ♂, 2 ♀ (BYUC); Tobacco River, Hwy 93, near Eureka, 3 July 1964, A.R. Gaufin, 23 ♂, 30 ♀ (BYUC). Missoula Co., Clark Fork River, Turah, 11 July 1962, R.L. Newell, 5 ♂, 9 ♀ (BYUC). Pondera Co., Dupuyer Creek, Hwy 89, Dupuyer, 26 July 1967, A.R. Gaufin, 14 ♂, 19 ♀ (BYUC). Powell Co., Little Blackfoot River, Hwy 12, above Elliston, 25 July 1963, A.R. Gaufin, 2 ♂, 8 ♀ (BYUC); Snowshoe Creek, Hwy 12, E Avon, near junction Little Blackfoot River, 5 Aug. 1966, 1 ♂, 2 ♀ (BYUC). Ravalli Co., Bitterroot River, Hwy 93, Medicine Hot Springs, 16 Aug. 1963, A.R. Gaufin, 5 ♂, 4 ♀ (BYUC); Bitterroot River, River Park, Hamilton, 22 July 2005, R. Durfee, 2 ♂, 9 ♀ (CSUC); 2 July 2006, R. Durfee, 20 ♂, 25 ♀ (CSUC); 23 June 2007, R. Durfee, 11 ♂, 7 ♀ (CSUC). **Male.** Macropterous. Length of forewing 7-9 mm. General color, lime green in life, dirty white in alcohol. Head and pronotum without black markings. Dorsal aspect of epiproct elongate and narrow, subparallel, slightly broader at base, apex evenly rounded, with shallow crenulations (Figs. 1, 2, 5, 7); surface bare in apical half, clothed with dense



Figs. 1-8. Scanning electron micrographs of the epiproct of *Alloperla severa*. 1-4. Kenai River, Cooper Creek Campground, Alaska. 1. dorsal aspect, 2. apex, dorsal aspect, 3. lateral aspect, 4. apex, lateral aspect. 5-6. Couer d'Alene River, Kingston, Idaho. 5. dorsal aspect, 6. apex, lateral aspect. 7-8. Fisher River, Hwy 2, Montana. 7. dorsal aspect, 8. apex, lateral aspect.

appressed setae in basal half (Figs. 1-8); beak-like in lateral view (Figs. 3, 4, 6, 8). Stem clothed with fine setae (Figs. 1,5,7).

Female. Length of wings 8-11 mm. Subgenital plate triangular, apex more acute, margin usually reaching to center or beyond sternum 9 (Lyon & Stark 1997, Fig. 43).

Diagnosis. The male of *A. severa* can be distinguished from the closely related *A. thalia* by the more elongate and dorsally narrow, bare portion of the epiproct (Figs. 1, 2, 5, 7). In lateral view, the epiproct of *A. severa* is more beak-like, with the apex dipping down beyond the ventral aspect, and the basal portion about ½ of the length of the epiproct (Figs. 3, 4, 6, 8). The epiproct of the closely related *A. thalia* in lateral view, slopes to the apex or is almost hood-like, the bare portion being about 1/3 of the total epiproct length (Figs. 19, 20, 22, 23). The females of *A. severa* and *A. thalia* cannot be reliably distinguished, other than by geographical proximity, or with the presence of associated males.

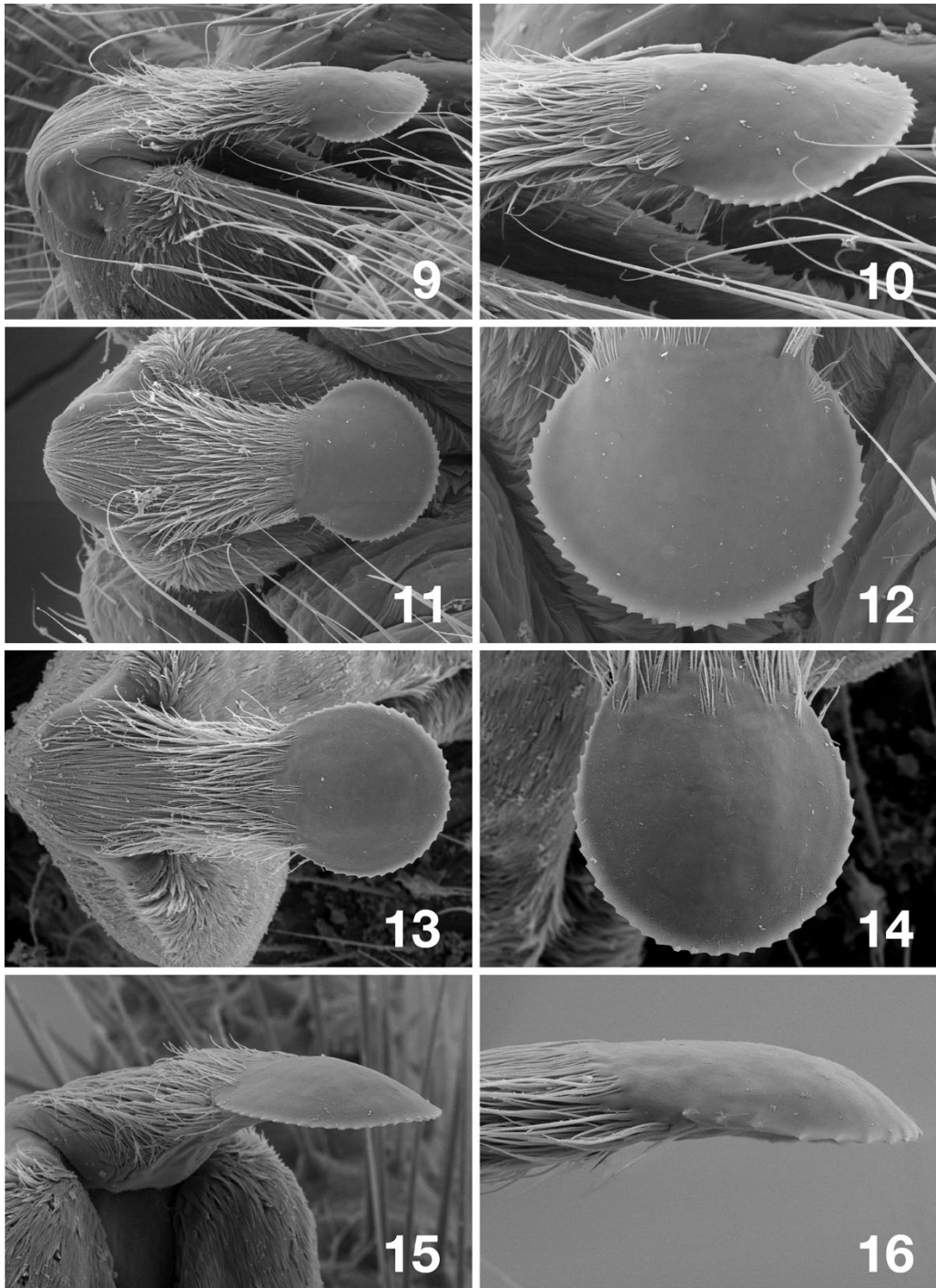
Remarks. *Alloperla severa* appears to be distributed throughout the northern Rocky Mountains in Canada and the United States, being especially abundant in western Montana.

***Alloperla elevata* Frison**
(Figs. 9-16)

Alloperla elevata Frison 1935: 335. Holotype male, INHS, Floras Creek, Curry Co., Oregon, examined.

Material examined. CANADA: BRITISH COLUMBIA: Chilliwack River, Vedder Crossing, 8 May 1938, S. Spencer, 2 ♂, 4 ♀ (CNIC); Sweltzer Creek, near Cultus Lake, 23 July 1936, W.E. Ricker, 3 ♂, 3 ♀ (BYUC); Vancouver Island, Courtenay, June 1965, N.L.H. Krauss, 1 ♂, 1 ♀ (BYUC). USA: CALIFORNIA: Del Norte Co., Klamath River, Hwy 169, Klamath Glen, 8 June 2005, R.W. Baumann & B.C. Kondratieff, 6 ♂, 1 ♀ (BYUC, CSUC); Smith River, Hwy 199, 3 mi. NE Hiouchi, 7 June 2005, R.W. Baumann & B.C. Kondratieff, 1 ♂ (BYUC). Humboldt Co., Klamath River, Aikens Creek, 17 May 2007, J.J. Lee, 5 ♂, 5 ♀ (BYUC); Mad River, Mad River Fish Hatchery, 5 May 2007, J.J. Lee, 6 ♂, 4 ♀ (BYUC); Mattole River, Camp Gephart, near Petrolia, 19 May 2007, J.J. Lee & G. Gephart, 1 ♂, 1 ♀ (BYUC); Redwood Creek, Hwy 101, 14 May 2005, J.J. Lee, 4 ♂,

2 ♀ (BYUC). OREGON: Benton Co., Alsea River, Hwy 34, Salmonberry Park, 11 June 2005, R.W. Baumann & B.C. Kondratieff, 1 ♂ (BYUC). Curry Co., Floras Creek, 22 May 1933, Dimick & Zella, 1 ♂, holotype (INHS); 20 May 1933, Dimick, 1 ♀, allotype (INHS); Sixes River, Sixes River Campground, 9 June 2005, R.W. Baumann & B.C. Kondratieff, 2 ♂ (CSUC); Winchuck River, Winchuck River Campground, 1 June 1991, R.W. Baumann & B.P. Stark, 4 ♂ (BYUC); 8 June 2005, R.W. Baumann & B.C. Kondratieff, 1 ♂, 20 ♀ (BYUC). Lincoln Co., Alsea River, Hwy 34, Blackberry Campground, 3 June 1991, R.W. Baumann & B.P. Stark, 1 ♂, 3 ♀ (BYUC); Canal Creek, Canal Creek Campground, 11 June 2005, R.W. Baumann & B.C. Kondratieff, 1 ♂ (BYUC); Schooner Creek, Rd 106, 7 mi. E Lincoln City, 11 June 2005, R.W. Baumann & B.C. Kondratieff, 1 ♂ (BYUC). Tillamook Co., Wilson River, Hwy 6, 10 mi. NE Tillamook, 12 June 2005, R.W. Baumann & B.C. Kondratieff, 15 ♂ (BYUC, CSUC). WASHINGTON: Clallam Co., Bogachiel River, Hwy 101, near Forks, 18 June 1967, R.W. Baumann, 5 ♂, 1 ♀ (BYUC); Bogachiel River, Hwy 101, Bogachiel River State Park, 14 June 2005, R.W. Baumann & B.C. Kondratieff, 7 ♂, 11 ♀ (BYUC, CSUC). Cowlitz Co., Kalama River, north of Kalama, 16 June 1968, R.W. Baumann, 1 ♂, 6 ♀ (BYUC). Grays Harbor Co., Humptulips River, Hwy 101, Humptulips, 18 June 1967, R.W. Baumann, 10 ♂, 10 ♀ (BYUC); West Fork Humptulips River, NE Humptulips, 14 June 2005, R.W. Baumann & B.C. Kondratieff, 2 ♂, 3 ♀ (BYUC). Jefferson Co., Queets River, junction Hartzell Creek, Olympic National Park, 14 June 2005, R.W. Baumann & B.C. Kondratieff, 13 ♂, 7 ♀ (BYUC, CSUC). Lewis Co., Chehalis River, Hwy 6, Rainbow Falls State Park, 13 June 2005, R.W. Baumann & B.C. Kondratieff, 2 ♂, 2 ♀ (BYUC, CSUC); Cowlitz River, Hwy 505, near Toledo, 16 June 1968, R.W. Baumann, 7 ♂, 13 ♀ (BYUC). Mason Co., Skokomish River, Hwy 110, 17 June 1967, R.W. Baumann, 3 ♂, 2 ♀ (BYUC). Pacific Co., Naselle River, NE Naselle, 13 June 2005, R.W. Baumann & B.C. Kondratieff, 2 ♂ (BYUC); North Nemah River, 3 mi. SE Nemah, 13 June 2005, R.W. Baumann & B.C. Kondratieff, 15 ♂, 12 ♀ (BYUC, CSUC). Skagit Co., Sky Creek, Hwy 20, NW Newhalem, 17 June 2004, R.W. Baumann & B.P. Stark, 16 ♂, 4 ♀ (BYUC). Thurston Co., Deschutes River, Hwy 507, near Rainier, 12 June 1968, R.W. Baumann, 1 ♂, 2 ♀ (BYUC); Nisqually River,



Figs. 9-16. Scanning electron micrographs of the epiproct of *Alloperla elevata*. 9-12. Klamath River, Klamath Glen, California. 9. nearly lateral aspect, 10. apex, nearly lateral aspect, 11. dorsal aspect, 12. apex, dorsal aspect. 13-15. Sixes River, Sixes River Campground, Oregon. 13. dorsal aspect, 14. apex, dorsal aspect, 15. frontal lateral aspect, 16. Humptulips River, Humptulips, Washington. 16. apex, lateral aspect.

Nisqually, 13 June 1967, R.W. Baumann, 3 ♂ (BYUC). **Male.** Macropterous. Length of forewing 9-11 mm. General color, lime green in life, white in alcohol. Head and pronotum without black markings. Dorsal aspect of epiproct elongate, constricted near middle, apex broadly rounded, with numerous shallow marginal crenulations fringing apex (Figs.11-14); surface bare in apical half, clothed with dense appressed setae in basal half (Figs. 9-16); in lateral view, disc shaped (Figs. 9, 10, 15, 16). Stem clothed with fine setae (Figs. 9, 11, 13).

Female. Length of wings 10-11 mm. Coloration and markings similar to male. Subgenital plate produced with posterior margin acute to slightly rounded, general outline triangular, margin usually reaching beyond sternum 9 (Frison 1935, Plate XIV, Fig. 41).

Diagnosis. The male of *A. elevata* can be easily distinguished from both *A. severa* and *A. thalia*. by the hour glass shape of the epiproct in dorsal view, enlarged at base, and broadly rounded at apex, bearing fringe of shallow crenulations (Figs. 11-14) and disc shaped in lateral view (Figs. 9, 10, 15, 16). The subgenital plate of the female of *A. elevata* is more rounded at the apex (Frison 1935, Plate XIV, Fig. 41) than either *A. severa* (Lyon and Stark 1997, Fig. 43), or *A. thalia* (Fig. 24).

Remarks. *Alloperla elevata* is a species that appears restricted to larger Coastal streams and rivers of the Pacific Northwest, from northern California to British Columbia. Ricker (1943) in his work on the stoneflies of southwestern British Columbia considered *A. elevata* "...enormously abundant on Sweltzer creek, and moderately so in other medium to large streams near sea level. It has been taken in every month but December and January...". Ricker (1943) described the epiproct of *A. elevata* as "dumbbell-shaped," however, in 1954 he considered that "straight and dumbbell shapes intergrade, and even coastal specimens vary somewhat in this respect." Our examination of material indicates that *A. elevata*, Ricker's "coastal form", is consistent in epiproct shape and form (Figs. 9-16) throughout its known range. Jewett's (1959) description of the epiproct of *A. severa* as "dumbbell shaped" and his use of Frison's (1935) illustration of that species indicates that he might have only examined specimens of *A. elevata*. Jewett (1960) did not report this species from California. Gaufin et al. (1972) listed Montana records for *A. elevata*, but did not include it in the key to the

species. These specimens could be either *A. severa* or *A. thalia*, since both occur in Montana.

Alloperla thalia Ricker

(Figs. 17-24)

Alloperla thalia Ricker 1952: 178. Holotype male, INHS, Central Park Bridge to Cameron Bridge (Gallatin River), Gallatin Co., Montana, examined.

Material examined. USA: COLORADO: Grand Co., Gore Pass Creek, Hwy 84, SW Kremmling, 26 June 1962, A.R. Gaufin, 1 ♂, 2 ♀ (BYUC). Larimer Co., Sheep Creek, Upper Cherokee Park, 15 July 1991, A. Williams, 1 ♂ (CSUC). Routt Co., Elk River, Clark, 17 July 1968, B.R. Oblad, 1 ♂ (BYUC); Mad Creek, junction Elk River, Mad Creek, 17 July 1968, B.R. Oblad, 2 ♂, 1 ♀ (BYUC); Service Creek, near junction Yampa River, 30 June 1967, B.R. Oblad, 1 ♂, 10 ♀ (BYUC); Soda Creek, Steamboat Springs, 16 July 1968, B.R. Oblad, 3 ♂, 5 ♀ (BYUC); Willow Creek, Hahns Peak, 17 July 1968, B.R. Oblad, 1 ♂ (BYUC); Yampa River, Hwy 131, NW Yampa, 19 June 1961, A.R. Gaufin, 12 ♂, 15 ♀ (BYUC); Yampa River, Yampa, 27 June 1968, B.R. Oblad, 6 ♂, 10 ♀ (BYUC). IDAHO: Caribou Co., Tincup Creek, Hwy 34, Tincup Campground, 18 July 1986, R.W. Baumann & B.J. Sargent, 1 ♂ (BYUC). Franklin Co., Cub River, Deer Cliff Inn, 25 June 1955, G.F. Knowlton, 5 ♂, 4 ♀ (BYUC). Fremont Co., Big Springs, 8 July 1976, D.N. Marshall, 1 ♂, 13 ♀ (BYUC); Buffalo River, between Hwy 191 and canyon mouth, 22 June 1976, D.N. Marshall, 1 ♂ (BYUC). MONTANA: Beaverhead Co., Red Rock Creek, 3 mi. above Upper Red Rock Lake, 29 July 1951, C.J.D. Brown, 1 ♂ (BYUC). Big Horn Co., Little Big Horn River, 6 mi. W Wyola, 22 July 1966, J.R. Grierson, 10 ♂, 16 ♀ (BYUC). Broadwater Co., Duck Creek, tributary Canyon Ferry Lake, 8 July 1966, J.R. Grierson, 1 ♂, 3 ♀ (BYUC). Fergus Co., Spring Creek, 2.2 mi. SE Lewiston, 5 July 1966, J.R. Grierson, 8 ♂, 8 ♀ (BYUC). Gallatin Co., Gallatin River, Central Park Bridge to Cameron Bridge, 17, 18 June 1949, R. Horswell, 1 ♂, 1 ♀, holotype and allotype (INHS); West Gallatin River, 6 July 1951, R. Hays, 1 ♂, 2 ♀ (BYUC); 27 July 1951, R. Hays, 1 ♂, 2 ♀ (BYUC); 3 Aug. 1951, R. Hays, 1 ♂, 2 ♀ (BYUC); Duck Creek, Rt 287, 8 mi. N West Yellowstone, 9 June 1987, B.C. Kondratieff, 1 ♂, 7 ♀ (CSUC). Golden Valley Co., Swimming Woman Creek, 0.5 mi. SE

Judith Gap, 5 July 1966, J.R. Grierson, 7 ♂, 8 ♀ (BYUC). Judith Basin Co., Judith River, 30 mi. SW Hobson, 2 July 1966, J.R. Grierson, 2 ♂, 2 ♀ (BYUC); Martin Creek, 9.5 mi. above Geyser, 7 July 1966, J.R. Grierson, 15 ♂, 23 ♀ (BYUC). Meagher Co., Sheep Creek, 18 mi. above Smith River, 7 July 1966, J.R. Grierson, 2 ♂, 4 ♀ (BYUC); Spring Creek, Hwy 12, near North Fork Musselshell River, NW Martinsdale, 1 July 1966, J.R. Grierson, 6 ♂, 6 ♀ (BYUC). Park Co., Shields River, 6 mi. NE Willsall, 1 July 1966, J.R. Grierson, 8 ♂, 21 ♀ (BYUC). Stillwater Co., Rosebud Creek, S Absarokee, 27 July 1966, J.R. Grierson, 2 ♂ (BYUC); Stillwater River, Rd. 307, near Absarokee, 25 June 1966, J.R. Grierson, 2 ♂, 1 ♀ (BYUC). Sweet Grass Co., American Creek, 10 mi. above Hwy 191, 30 June 1966, J.R. Grierson, 21 ♂, 11 ♀ (BYUC); Boulder River, 21 mi. SW Big Timber, 28 June 1966, J.R. Grierson, 2 ♂, 5 ♀ (BYUC). Wheatland Co., Carless Creek, 17 mi. SE Judith Gap, 5 July 1966, J.R. Grierson, 1 ♂, 3 ♀ (BYUC). NEVADA: Elko Co., Lamoille Creek, Roads End Picnic Area, 31 July 1996, R.W. Baumann, 5 ♂, 4 ♀ (BYUC); Secret Creek, near Secret Pass, 15 June 1974, B.P. Stark, 3 ♂, 4 ♀ (BPSC). Humboldt Co., Cabin Creek, Santa Rosa Range, 18 June 1977, A.L. Sheldon, 1 ♂ (BYUC); North Fork Little Humboldt River, Santa Rosa Range, 19 June 1977, A.L. Sheldon, 6 ♂, 6 ♀ (BYUC); 29 June 1999, A.L. Sheldon, 1 ♂, 2 ♀ (BYUC). Nye Co., Cherry Creek, Quinn Range, 21 June 2002, A.L. Sheldon, 1 ♂ (BYUC). White Pine Co., Baker Creek, Baker Creek Campground, 3 Aug. 1968, R.W. Baumann, 1 ♂ (BYUC); Kalamazoo Creek, Schell Creek Range, 26 June 1977, A.L. Sheldon, 1 ♂, 2 ♀ (BYUC); McCoy Creek, Schell Creek Range, 26 June 1977, A.L. Sheldon, 1 ♂, 1 ♀ (BYUC); Lehman Creek, Lehman Creek Campground, 3 Aug. 1968, R.W. Baumann, 1 ♀ (BYUC); Upper Lehman Creek, Great Basin National Park, 1 July 2004, P.A. Opler, 1 ♂ (CSUC). UTAH: Davis Co., Mill Creek, Mueller Park, 29 June 1965, R.W. Baumann, 2 ♂, 1 ♀ (BYUC). Duchesne Co., Uinta River, Wandin Campground, 7 Aug. 1975, R.W. Baumann & R.N. Winget, 1 ♂ (BYUC). Emery Co., Huntington Creek, below Electric Lake Dam site, 12 June 1972, E.C. Devenport & R.N. Winget, 3 ♂, 1 ♀ (BYUC); Upper Huntington Creek, 20 June 1972, E.C. Devenport & R.N. Winget, 3 ♂, 1 ♀ (BYUC). Salt Lake Co., Butterfield Creek, W Herriman, 11 June 1987, S.A. Wells & C.R. Nelson, 3 ♂, 7 ♀ (BYUC); Emigration Creek, Pinecrest, 1 July 1966, R.W.

Baumann, 3 ♂, 4 ♀ (BYUC); 20 July 2005, R.W. Baumann & M.H. Goodman, 2 ♂ (BYUC); Parleys Creek, below Mountain Dell Reservoir, 10 June 1954, A.R. Gaufin, 4 ♂, 2 ♀ (BYUC). Sanpete Co., Thistle Creek, E Indianola, 26 June 2003, R.W. Baumann & S.M. Clark, 9 ♂, 11 ♀ (BYUC). Sevier Co., Clear Creek, Hwy 4, off I-70, 27 June 1998, R.G. Call, 2 ♂, 2 ♀ (BYUC); Fremont River, above Mill Meadow Reservoir, 29 June 1989, R.W. Baumann, 4 ♂, 10 ♀ (BYUC); Seven Mile Creek, above Johnson Valley Reservoir, 29 June 1989, R.W. Baumann, 4 ♂, 3 ♀ (BYUC). Summit Co., Beaver Creek, Beaver Creek Campground, 30 June 1977, R.W. Baumann & S.M. Clark, 1 ♂, 2 ♀ (BYUC); East Fork, Blacks Fork, 5 Aug. 1975, R.W. Baumann & R.N. Winget, 1 ♂, 1 ♀ (BYUC); West Fork Blacks Fork, 4 Aug. 1975, R.W. Baumann & R.N. Winget, 6 ♂, 2 ♀ (BYUC); 7 July 2005, R.W. Baumann, 4 ♂, 3 ♀ (BYUC); stream at Lost Lake Campground, Uinta Mountains, 17 July 1978, R.W. Baumann & G.B. Wiggins, 2 ♂, 3 ♀ (BYUC); North Fork Provo River, Hwy 150, near junction Provo River, 6 July 1959, A.R. Gaufin, 2 ♂ (BYUC); Provo River, Upper Bridge, Hwy 150, below Trial Lake, 28 July 1947, A.R. Gaufin, 1 ♂, 2 ♀ (BYUC); Provo River, below Trial Lake, 4 Aug. 1975, R.W. Baumann & R.N. Winget, 1 ♂ (BYUC); Provo River, Hwy 189A, Lemons Grove, below Francis, 14 July 1947, A.R. Gaufin, 2 ♂ (BYUC); Smith-Morehouse Creek, Main Fork Guard Station, 19 July 1961, A.R. Gaufin, 1 ♂ (BYUC); Weber River, above Oakley, 5 Aug. 1975, C. Sakamoto, 1 ♂, 2 ♀ (BYUC). Yellow Pine Creek, 8 mi. E Kamas, 22 July 1974, B.P. Stark & R.W. Clubb, 1 ♂ (BPSC). Tooele Co., Clover Creek, Hwy 199, W Clover, 16 June 1954, A.R. Gaufin, 10 ♂, 8 ♀ (BYUC); 24 June 1954, A.R. Gaufin, 22 ♂, 20 ♀ (BYUC); 14 June 1984, R.W. Baumann, 4 ♂, 8 ♀ (BYUC); 27 May 1988, S.A. Wells, 4 ♂, 4 ♀ (BYUC); Settlement Canyon Creek, E Tooele, Oquirrh Mountains, 30 June 1954, A.R. Gaufin, 5 ♂, 7 ♀ (BYUC); 24 June 1993, S.M. Clark, 4 ♂, 5 ♀ (BYUC); South Willow Creek, Stansbury Mountains, 4 July 1942, S. & D. Muliak, 3 ♂, 6 ♀ (BYUC); South Willow Creek, Boy Scout Campground, 11 June 2007, R.W. Baumann & K.B. Anderson, 15 ♂, 9 ♀ (BYUC); South Willow Creek, Upper Narrows Campground, 4 Aug. 1990, R.W. Baumann & R. Glassford, 1 ♂, 1 ♀ (BYUC); 11 June 2007, R.W. Baumann & K.B. Anderson, 14 ♂, 7 ♀ (BYUC). Uintah Co., South Fork Ashley Creek, Rd 018, 8 Aug. 1991, D.E. Ruitter, 1 ♂

(CSUC). Utah Co., Crab Creek, above Thistle, 5 June 1976, R.W. Baumann, 1 ♂, 1 ♀ (BYUC); Wimmer Ranch Creek, below McClellan Lake, 30 May 1981, S.M. Clark, 1 ♂ (BYUC). Wasatch Co., Deer Creek, above Cascade Springs, 15 June 1988, B.C. Kondratieff & R.F. Kirchner, 5 ♂, 3 ♀ (BYUC & CSUC); Trout Creek, above Strawberry Reservoir, 24 July 1965, D.C. Hales, 1 ♂, 1 ♀ (BYUC); 16 June 1966, D.C. Hales, 1 ♂ (BYUC); Provo River, Hwy 189, Deer Creek Park, 9 July 1959, A.R. Gaufin, 3 ♂, 5 ♀ (BYUC); Provo River, Hwy 150, Soapstone Ranger Station, 6 July 1959, A.R. Gaufin, 1 ♂ (BYUC); Provo River, Stewarts Ranch, below junction South Fork, 7 July 1959, A.R. Gaufin, 1 ♂, 3 ♀ (BYUC); Upper South Fork, Provo River, above junction Provo River, 7 July 1959, A.R. Gaufin, 2 ♂, 2 ♀ (BYUC). Washington Co., Leeds Creek, Leeds Canyon, 16 June 1978, W.J. Hanson & G. F. Knowlton, 1 ♂, 1 ♀ (BYUC); headwaters, Santa Clara River, South Juniper Campground, 14 July 2005, R.W. & C.W. Baumann, 2 ♂, 5 ♀ (BYUC). WYOMING: Fremont Co., Dry Creek, Hwy 26, Burris, 20 July 1967, R.W. Baumann, 2 ♂, 6 ♀ (BYUC); Little Wind River, Hwy 287, Fort Washakie, 20 July 1967, R.W. Baumann, 9 ♂, 13 ♀ (BYUC). Lincoln Co., La Barge Creek, Hwy 189, S La Barge, 18 July 1962, A.R. Gaufin, 1 ♂, 5 ♀ (BYUC). Park Co., Yellowstone River, Fishing Bridge, Yellowstone National Park, 25 July 1955, A.R. Gaufin, 10 ♂, 103 ♀ (BYUC); Yellowstone River, Cascade Picnic Area, 30 July 1986, M. Viroda, 1 ♂ (CSUC). Sublette Co., Green River, Hwy 189, N Daniel, 18 July 1962, A.R. Gaufin, 14 ♂, 21 ♀ (BYUC); 19 July 1972, B.P. Stark, 2 ♂, 2 ♀ (BYUC); Green River, Hwy 189, NW Daniel Junction, 19 July 1962, A.R. Gaufin, 1 ♂, 2 ♀ (BYUC); Horse Creek, Hwy 189, Daniel, 18 July 1962, A.R. Gaufin, 1 ♂, 2 ♀ (BYUC); South Piney Creek, Hwy 189, Big Piney, 18 July 1962, A.R. Gaufin, 12 ♂, 10 ♀ (BYUC); Willow Creek, NE Cora, 18 July 1962, A.R. Gaufin, 2 ♂, 3 ♀ (BYUC); Green River, Rt 354, near Daniel, 1 June 1987, B.C. Kondratieff, 2 ♂, 3 ♀ (CSUC).

Male. Macropterous. Forewing length 7-8 mm. General color, lime green in life, white in alcohol. Head and pronotum without black markings. Dorsal aspect of epiproct elongate but short, subparallel, slightly inflated at base, apex evenly rounded, with fringe of shallow crenulations (Figs. 17, 18, 21); dorsal surface bare in apical 1/3 (Figs. 17, 18, 21), clothed with dense appressed setae in basal 2/3 (Figs. 17-23); hood-like in lateral view, apex not extending below

plane of the ventral surface (Figs. 19, 20, 22, 23). Stem clothed with fine setae (Figs. 17, 19, 21, 23).

Female. Length of wings 10-11 mm. Coloration and markings similar to male. Subgenital plate general outline triangular, margin usually reaching to center or beyond sternum 9 (Fig. 24).

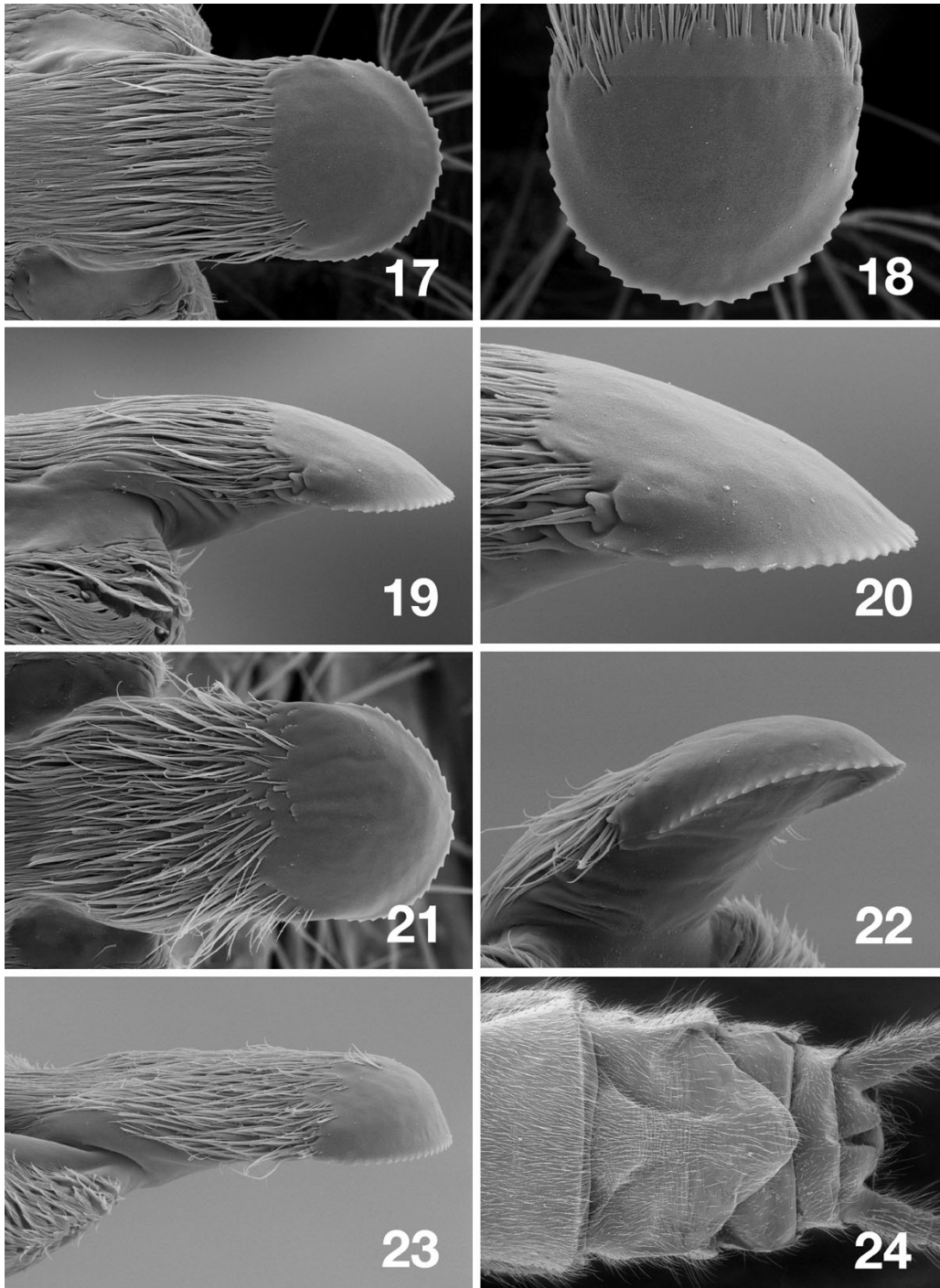
Diagnosis. Males of *A. thalia* can be distinguished from *A. severa* by the shorter epiproct, with the bare portion 1/3 of the length of the epiproct (Figs. 17, 18, 21), and in lateral view, hood-like to helmet-like apically, the apex not extending below the plane of the ventral surface (Figs. 19, 20, 22, 23).

Remarks. Ricker (1952) in his original description of *A. thalia* compared it with *A. neglecta* Frison, a southern Appalachian species, but not with either *A. elevata* or *A. severa*, apparently because the two Montana males had an epiproct with lateral margins "straight-sided" (Ricker 1954). Previously, *A. thalia* was identified as *A. severa* (Baumann et al. 1977, Kondratieff & Baumann 2002). However, the details of the *A. severa* epiproct were unavailable until Lyon & Stark (1997) provided excellent figures. These SEM photographs indicated to the authors that more than one taxon was present in western North America.

Distribution. The northern North American representative of this complex is *A. severa*. It occurs in Alaska from Mount McKinley west to the Aleutian Islands and south to the Canadian border (Stewart & Oswood 2006). Sporadic records exist from throughout northwestern Canada, with most collections from the Canadian Rocky Mountains. In the continental United States, *A. severa* occurs abundantly in the streams of Glacier National Park and northwestern Montana. It occurs in northern Idaho, but no confirmed records are available from Washington. *Alloperla elevata* is found in the Pacific Northwest from southern British Columbia to northern California. It occurs in rivers and large creeks that drain to the Pacific Ocean.

The more southern representative of the complex is *A. thalia*. Records exist from southern Idaho, southcentral Montana, and Wyoming. Additionally, disjunct populations occur in Colorado, Utah, and Nevada.

Alloperla pilosa Needham & Claassen 1925, which Lyon and Stark (1997) included in a similar appearing species pair with *A. severa*, is indeed similar, but lacks the fringe of shallow crenulations that rings the sclerotized apex of the epiproct in *A*



Figs. 17-23. Scanning electron micrographs of the epiproct of *Alloperla thalia*. 17-20. Thistle Creek near, Indianola, Utah. 17. dorsal aspect, 18. apex, dorsal aspect, 19. lateral aspect, 20. apex, lateral aspect. 21-22. Crab Creek near Thistle, Utah. 21. dorsal aspect, 22. oblique aspect, 23. West Fork Blacks Fork, Utah. 23. lateral aspect, 24. Emigration Creek, Pinecrest, Utah. female subgenital plate, ventral.

thalia, *A. elevata*, and *A. severa*. However, *A. pilosa* only occurs in the southern Rocky Mountains, so its distribution just overlaps with *A. thalia*. It is most common in Colorado (Kondratieff & Baumann 2002), but a record exists from New Mexico (Jacobi et al. 2005). Single *Alloperla* females have been collected from two widely separated localities in Arizona, that could represent *A. pilosa* or *A. thalia*.

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