Baumann, R.W., and B.P. Stark 2017. Variation in the epiproct of *Arsapnia decepta* Banks, 1897 (Plecoptera: Capniidae), with comments on *Arsapnia coyote* (Nelson & Baumann 1987). *Illiesia*, 13(01):1-21. https://doi.org/10.25031/2017/13.01

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VARIATION IN THE EPIPROCT OF *ARSAPNIA DECEPTA* BANKS, 1897 (PLECOPTERA: CAPNIIDAE), WITH COMMENTS ON *ARSAPNIA COYOTE* (NELSON & BAUMANN 1987)

Richard W. Baumann[1] & Bill P. Stark[2]

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

[2] Department of Biology, Box 4045, Mississippi College, Clinton, Mississippi, U.S.A. 39058
E-mail: stark@mc.edu

ABSTRACT

Epiprocts and tergal processes were examined using scanning electron microscopy for scattered populations of *Arsapnia decepta* Banks, 1897 and *A. coyote* (Nelson & Baumann, 1987) from throughout their known ranges. Epiproct lengths ranged from 379-578 µm among *A. decepta* males from 19 sites, and from 575-618 µm for *A. coyote* males from two sites. Among *A. decepta* males, the numbers of thick spine-like epiproct setae ranged from 10-34 per cluster. We conclude that *A. decepta,* as currently defined, shows considerable variation in epiproct dimensions, numbers of epiproct setae per cluster, and width of the dorsal process on tergum 7. In addition, the limited data from our small sample of *A. coyote* specimens, and the molecular data published recently by colleagues, support continued recognition of this closely related species. SEM images are presented to document the observed variation in these structures from various populations in western North America.

Keywords: Plecoptera, Capniidae, *Arsapnia decepta, A. coyote,* epiproct morphology, scanning electron microscopy

INTRODUCTION

The genus *Arsapnia* was originally proposed by Banks (1897), but was placed as a synonym of *Capnia* Pictet, 1841 by Claassen (1924), where it remained until Murányi et al. (2014) re-established the group as a valid Nearctic genus based on the eight members of the *Arsapnia decepta* species group (Nelson & Baumann 1989). *Arsapnia decepta* Banks, 1897 is presently known from scattered populations in Arizona, Colorado, Mexico (Baja California; Chihuahua), New Mexico, and Nevada (DeWalt et al. 2017, Jewett 1966, Kondratieff & Baumann 2002, Nelson & Baumann 1989, Sargent et al. 1991). Our preliminary observations of epiproct morphology for Eagle Creek, New Mexico and Redstone, Colorado populations showed significant variation in numbers of spine-like setae clustered dorsally on the epiproct surface (10-15 *vs* 19-24 respectively) and epiproct length (413 µm *vs* 525 µm respectively). Consequently, we chose to evaluate epiproct variation with SEM among populations identified as *A. decepta* from throughout the range of the species. We also comment on *A. coyote* (Nelson & Baumann, 1987b), considered the sister species of *A. decepta*, and known only from southern California where *A. decepta* has not been reported (Nelson & Baumann 1987b, 1989).

MATERIALS AND METHODS

Samples of *A. decepta* stored in 75-80% ethanol were obtained from the Bill P. Stark collection at Mississippi College, Clinton, Mississippi (BPSC), C.P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado (CSUC), and the Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah (BYUC). Samples from which scanning electron micrographs were made are listed below as "Material examined". No attempt was made to list all localities where *A. decepta* populations are known.

Wings were removed from specimens and the bodies sonicated for 10-15 seconds to remove debris. Cleaned specimens were inspected under a SZH10 Olympus dissecting microscope, or a Wild M-8 stereoscope, and then dehydrated through 90, 95 and 100% ethanol for 10 minutes each. Subsequently, specimens were transferred to hexamethyldisilizane (HMDS) for 30-60 minutes before mounting on aluminum stubs using double sided adhesive copper tape. Stubs were sputter coated with gold palladium and examined with an Amray 1810 scanning electron microscope at Mississippi College, or a Philips XL30 ESEM FEG microscope at the Brigham Young University Electron Microscopy Laboratory. Epiproct terminology follows that of Nelson & Baumann (1989).

RESULTS

Arsapnia decepta Banks, 1897
Shortbeak Snowfly

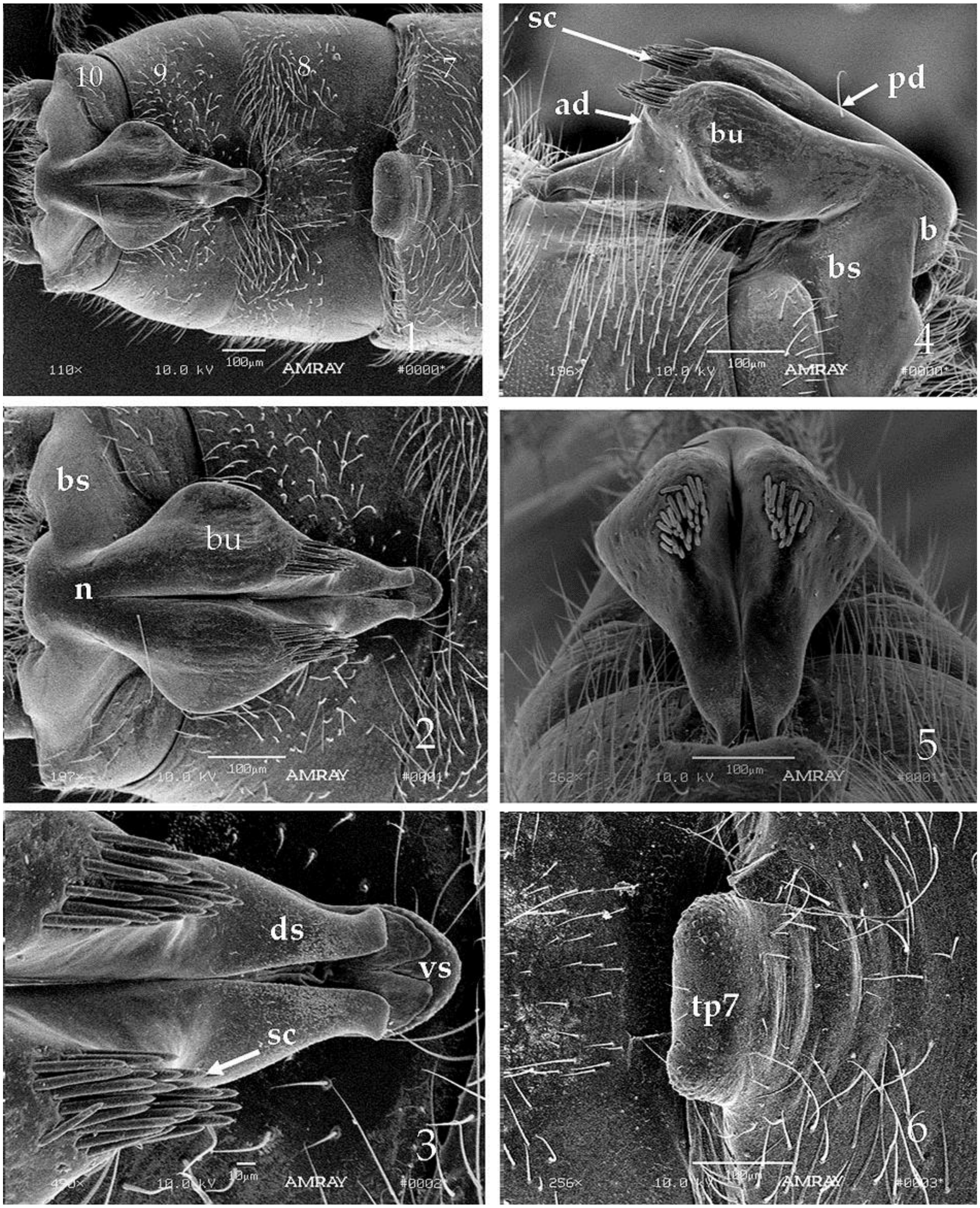
Arsapnia decepta Banks, 1897:22. Type series (4 specimens), Fort Collins [Larimer Co.], Colorado (Museum of Comparative Zoology)
Capnia decepta: Claassen, 1924:43.
http://lsid.speciesfile.org/urn:lsid:Plecoptera.speciesfile.org:TaxonName:4975

Capnia barbata Frison, 1944:153. Holotype ♂ (Illinois Natural History Survey), Longmont [Larimer Co.], Little Thompson River, Colorado (Synonymy Nelson & Baumann, 1989)
http://lsid.speciesfile.org/urn:lsid:Plecoptera.speciesfile.org:TaxonName:4976

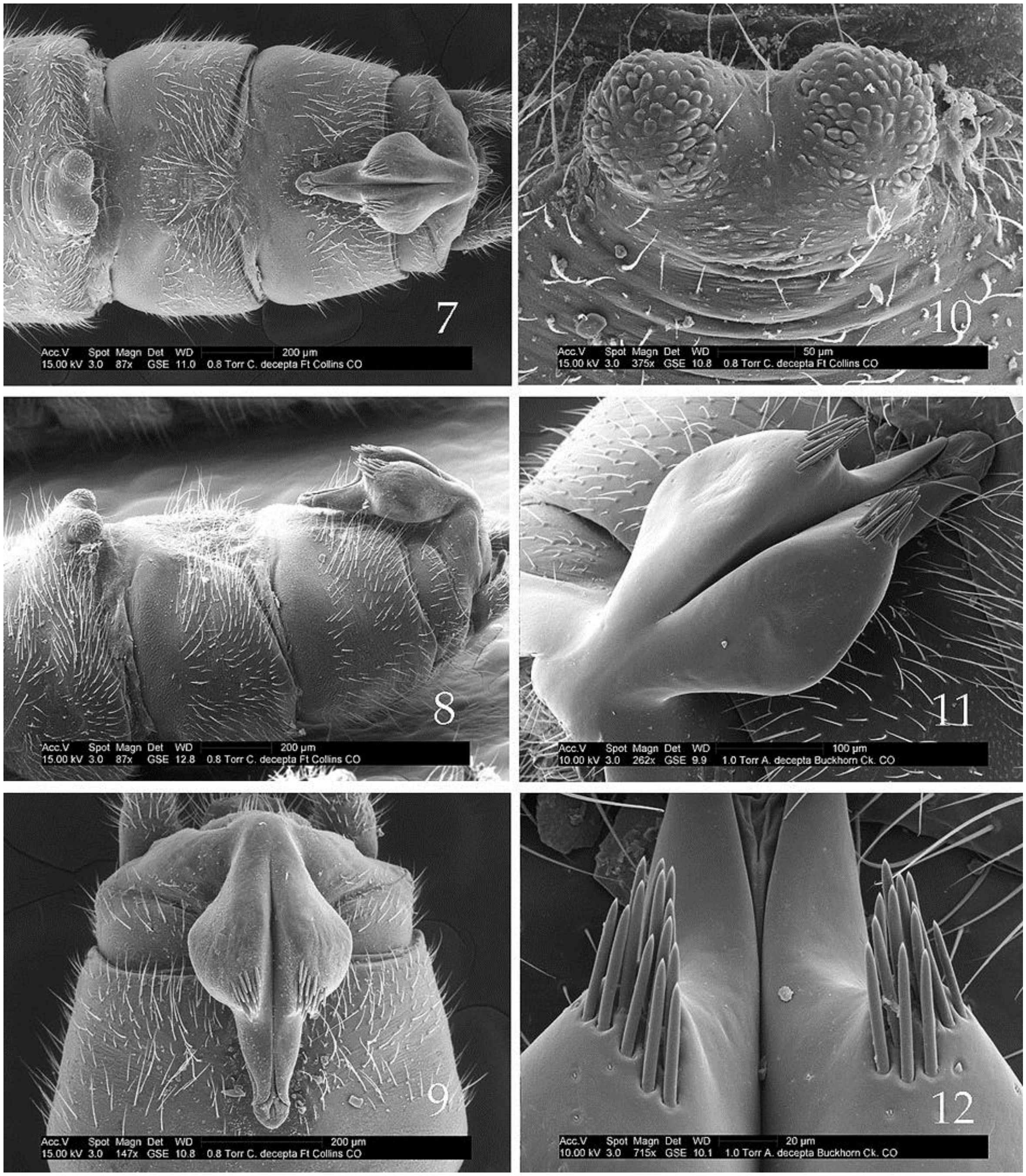
Colorado Populations
(Figs.1-12)

Material examined. USA: Colorado: Boulder Co., Gregory Creek, Gregory Canyon Trail, 39.9977, -105.2997, 2 February 2015, C. Verdone, 3♂ (CSUC). Larimer Co., Buckhorn Creek, 5 mi above Masonville, 40.5723, -105.4504, 16 March 1991, B.C. Kondratieff, 46♂, 9♀ (CSUC). Cedar Creek, Cedar Creek Road, Forest Road 128, 5.1 miles northeast of Drake, 40.6603, -105.2902, 12 April 2014, B.C. Kondratieff, T.P. Belcher, 100+ ♂, 100+ ♀ (BYUC). Redstone Canyon, 40.5870, -105.2659, 24 January 1986, B.C. Kondratieff, 12♂, 18♀ (CSUC). Tributary Spring Creek, Fort Collins, 40.5645, -105.1587, 15 February 1986, B.C. Kondratieff, 12♂, 3♀ (CSUC).

Male epiproct (n = 8). Length 468-528 µm, width at midlength 236-303 µm; greatest width slightly posterior to midlength. Body of epiproct bearing a pair of expansive median bulbs, forming convex ear-like lobes on either side of median groove near midlength (Figs. 1-2, 7, 11). Width across neck 91-111 µm. Narrow median groove extends from posterior margin of posterior declivity to epiproct apex, becoming wider near apex (Figs. 2-5, 7, 9, 11). On either side of groove a cluster (12-24) of thick, spine-like setae occurs near origin of anterior declivity (Figs.1-5, 7-9, 11-12). Ventral epiproct



Figs. 1-6. *Arsapnia decepta* male reproductive structures, Redstone Creek, Larimer Co., Colorado. 1. Abdominal terga 7-10. 2. Epiproct, dorsal. 3. Epiproct apex, dorsal. 4. Epiproct, lateral. 5. Epiproct, anterodorsal. 6. 7th tergal process, anterodorsal. (ad = anterior declivity; b = base; bs = basal strut; bu = bulb; ds = dorsal sclerite; n = neck; pd = posterior declivity; sc = setal spine cluster; tp7 = tergal process of segment 7; vs = ventral sclerite).



Figs. 7-12. *Arsapnia decepta* male reproductive structures, 7-10. tributary of Spring Creek, Larimer Co., Colorado, 11-12. Buckhorn Creek, Larimer Co., Colorado. 7. Abdominal terga 7-10. 8. Abdominal segments 7-10, lateral. 9. Male, terminalia, dorsal. 10. 7th tergal process, anterodorsal. 11. Epiproct, dorsal. 12. Epiproct setal clusters.

sclerite extends 40 μm beyond tips of outwardly hooked apices of dorsal sclerite (Figs. 3, 11). Lateral margins of epiproct slightly sinuate between bases of spine-like setae and apex (Figs. 2, 5, 9, 11); lateral aspect of epiproct (Figs. 4, 8) shaped somewhat like a duck head.

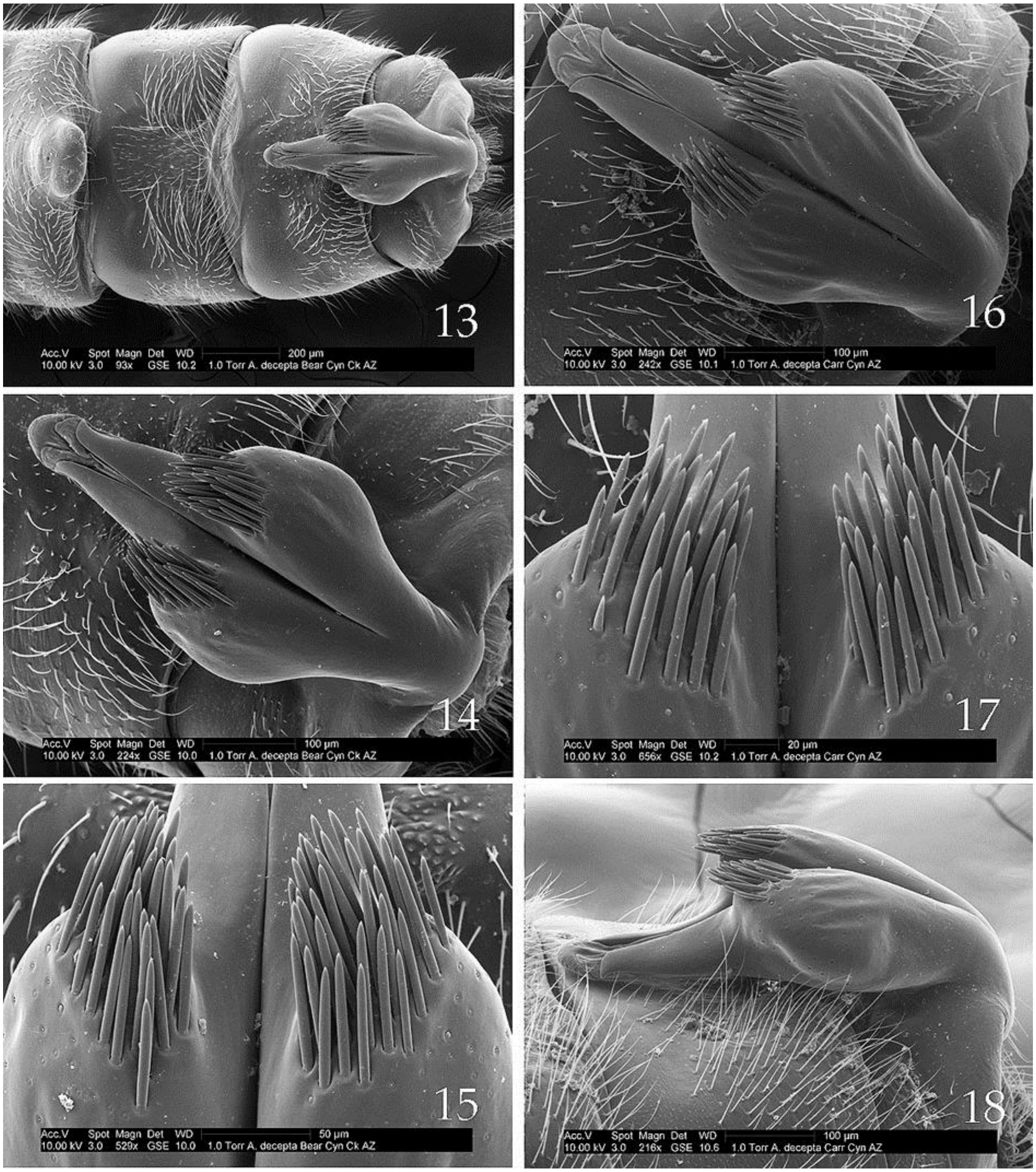
Tergal process. A single, mound-shaped process on tergum 7 with dorsal margin entire (Figs. 1, 6), or bearing a shallow dorsal concavity (Fig.10); lateral margins converging only slightly from anterior aspect; process bears lateral patches of small scale-like structures. Width of process across anterior margin 172-231 μm; width greater than median height.

Comments. The type locality of *A. decepta*, given as "Ft. Collins, Col." by Banks (1897), remains an unspecified site. The specimens listed from "Redstone Canyon" in Larimer Co. were taken from a stream that forms part of the Big Thompson River drainage perhaps 5-7 km southwest of the Fort Collins city limits and the specimens listed from "tributary Spring Creek" were collected in the city limits of Fort Collins from a tributary which enters the Cache la Poudre River; we regard the latter group of specimens as topotypes for this species. Colleagues at Colorado State University have records of several hundred specimens collected from sites in Boulder, Douglas, Fremont, Jefferson, Larimer and Pueblo counties (pers. comm. B.C. Kondratieff), and Stark et al. (1973) reported the species (as *Capnia barbata*) from Littleton in Arapahoe Co. and from the Little Thompson River in Boulder Co. Most Colorado records that we have seen are from sites along the Front Range, but the next nearest sites where populations are known to occur are in the Sangre de Cristo Range of southern Colorado and northern New Mexico (B.C. Kondratieff, pers. comm.; Jacobi & Baumann 1983). The nearest sites to the Front Range where our specimens were collected are Eagle Creek and Rio Bonito in Lincoln Co., New Mexico.

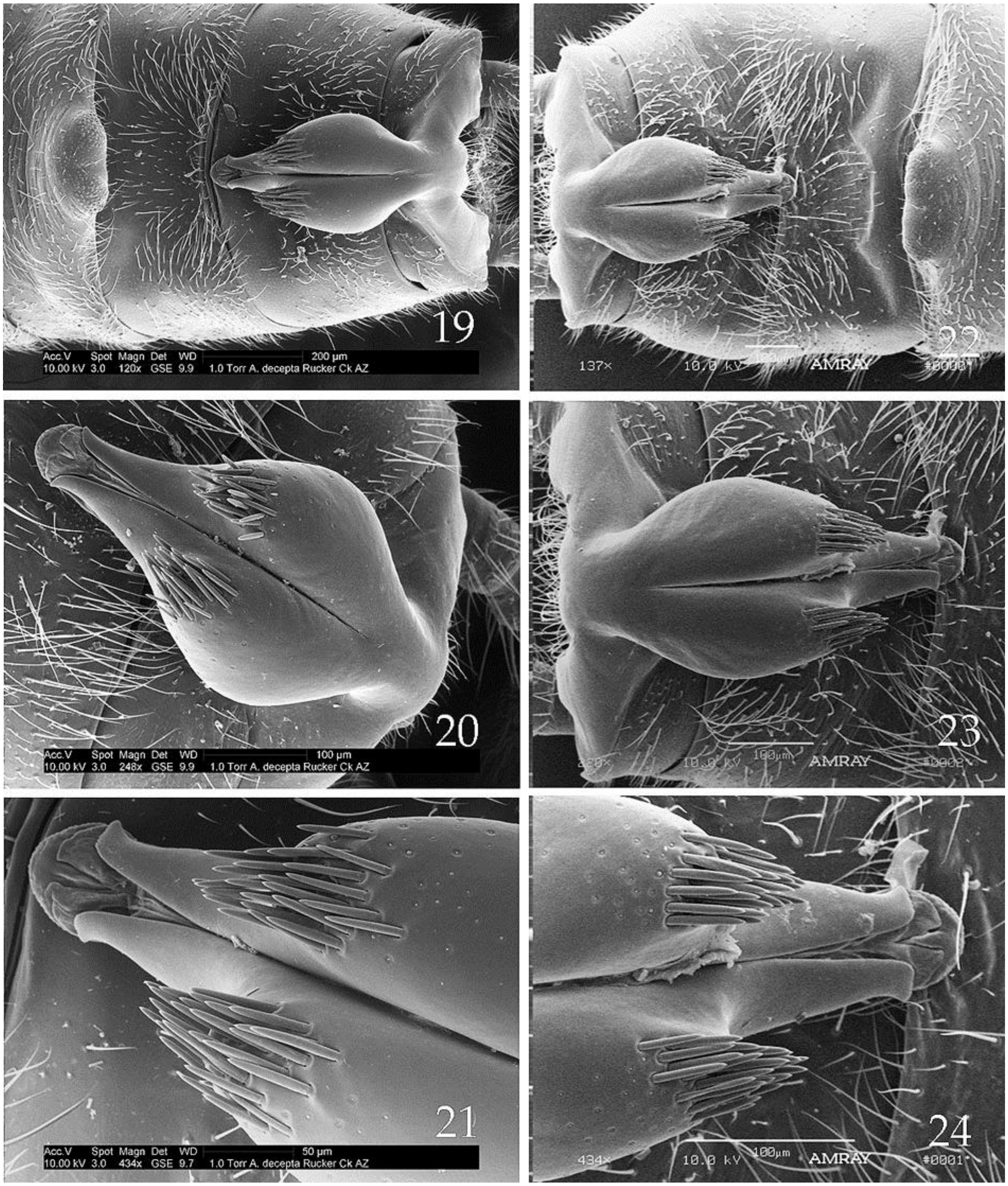
The epiproct of specimens from Gregory Creek, Boulder Co. have the greatest width (300-303 μm) of any specimens examined in the study and the length of all but two of the Front Range specimens exceeds the mean length for the entire sample (mean = 487.9 μm) (Tables 1-5, Figs. 1-3). The general shape of the apical third of the epiproct is intermediate between that of Rio Bonito specimens and those of Eagle Creek (Figs. 3, 51-54), however, they are more similar to the Eagle Creek specimens (Fig. 51) that share the longer, more exposed apex.

Table 1. Epiproct and 7th tergal process characteristics for Colorado specimens of *Arsapnia decepta*.

County	Site	Epiproct Length μm	Epiproct Width μm	# Left Setae	# Right Setae	T7 Process μm	Length/ Width Ratio
Boulder	Gregory Creek (n=2)	524-527	300-303	17-18	17-20	188	1.74-1.75
Larimer	Buckhorn Creek (n=1)	477	236	14	12	200	2.02
Larimer	Cedar Creek (n=2)	468	257	14	14	172	1.82
Larimer	Redstone Canyon (n=2)	525	285	19	24	198	1.86
Larimer	Tributary Spring Creek (n=1)	528	272	16	14	231	1.94



Figs. 13-18. *Arsapnia decepta* male reproductive structures, 13-15. Bear Canyon, Pima Co., Arizona, 16-18. Carr Canyon, Cochise Co., Arizona.13. Abdominal terga 7-10. 14. Epiproct, dorsal. 15. Setal spine clusters, dorsal. 16. Epiproct, dorsal. 17. Setal spine clusters, dorsal. 18. Epiproct, lateral.



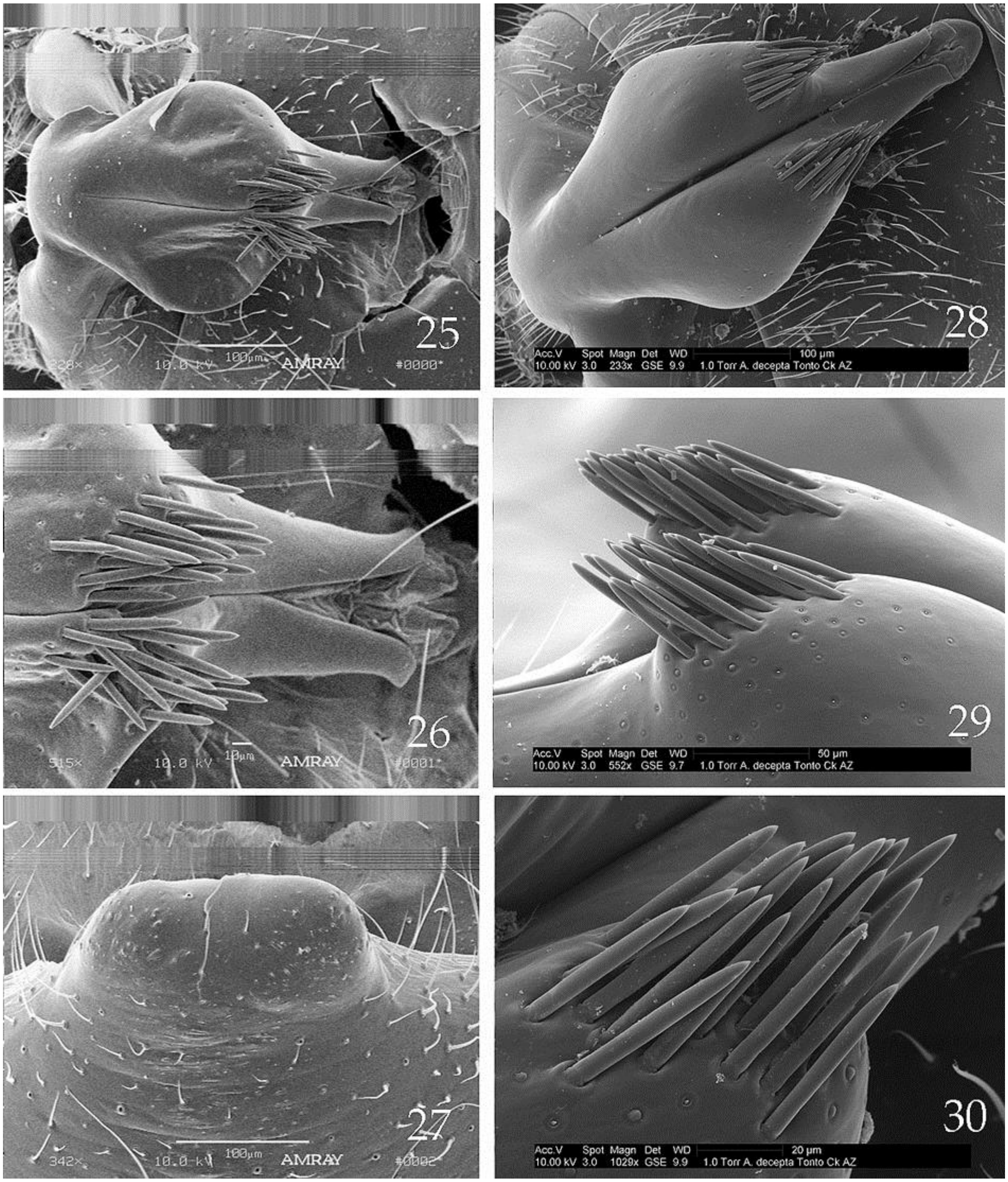
Figs. 19-24. *Arsapnia decepta* male reproductive structures, 19-21. Rucker Creek, Chiricahua Mountains, Cochise Co., Arizona, 22-24. Cave Creek, Chiricahua Mountains, Cochise Co., Arizona. 19. Abdominal terga 7-10. 20. Epiproct, dorsal. 21. Epiproct apex and setal spine clusters, dorsal. 22. Abdominal terga 7-10. 23. Epiproct dorsal. 24. Epiproct apex and setal spine cluster.

Arizona Populations
(Figs. 13-45)

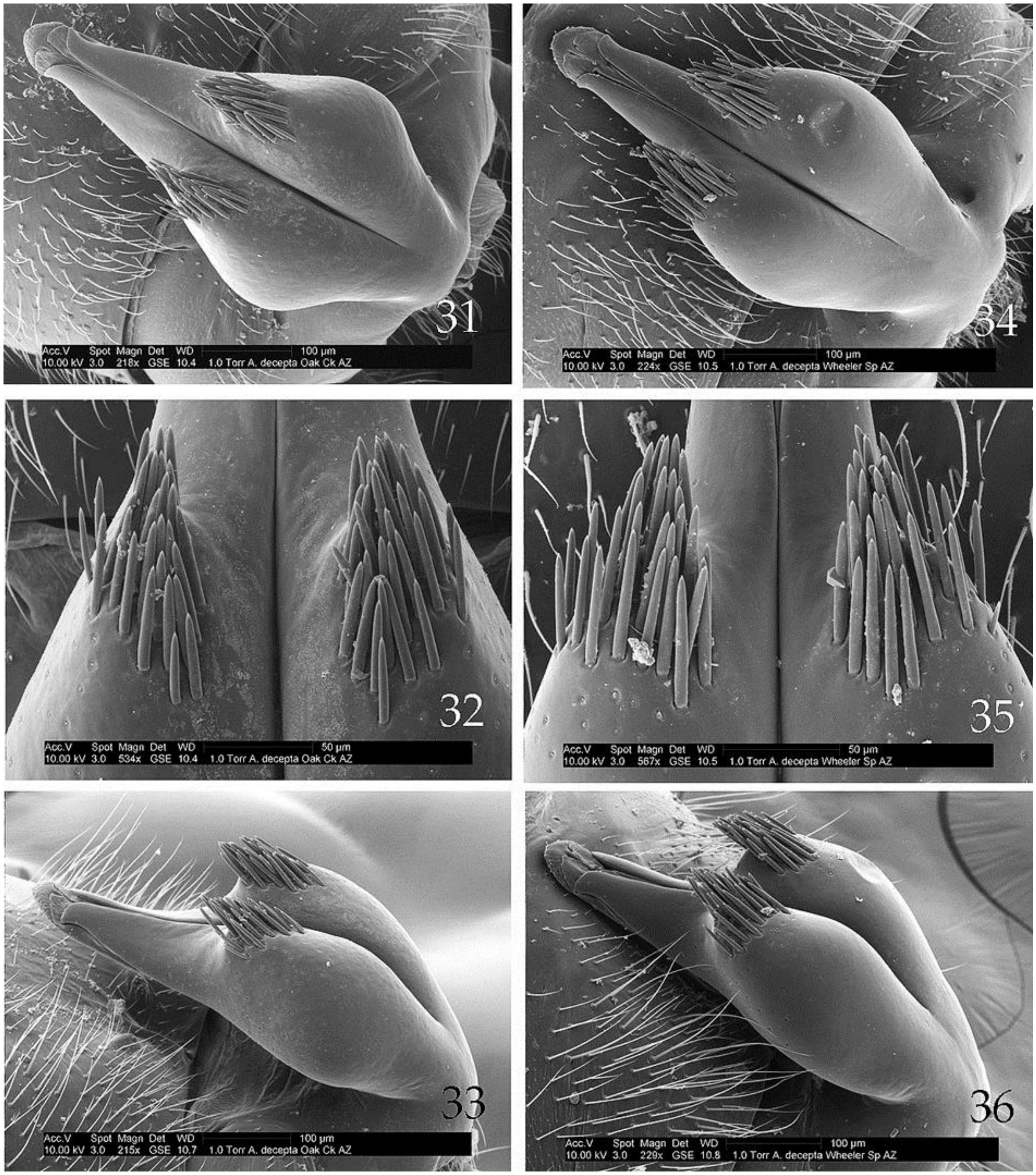
Material examined. USA: Arizona: Cochise Co., Cave Creek, Southwest Research Station, Chiricahua Mountains, 5400′, 31.8854, -109.2073, 3 January 1972, V. Roth, 3♂, 1♀ (BYUC). Rucker Creek, Camp Rucker Campground, Chiricahua Mountains, 31.7615, -109.3695, 17 January 1984, R.W. Baumann, C.R. Nelson, 6♂, 2♀ (BYUC). Carr Creek, Carr Canyon, Huachuca Mountains, 34.4476, -110.2821, 17 January 1984, R.W. Baumann, C.R. Nelson, 7♂, 5♀ (BYUC). Coconino Co., Oak Creek, Hwy 89A, above junction of West Fork Oak Creek, 35.0012, -111.7377, 20 January 1988, R.W. Baumann, B.C. Kondratieff, C.R. Nelson, B.J. Sargent, 20♂, 15♀ (BYUC). Gila Co., Christopher Creek, Hwy 260, Christopher Creek Campground, 34.3110, -111.0244, 13 June 1974, B. Stark, 1♂, 1♀ (specimens from spider web, BPSC). Tonto Creek, above junction of Horton Creek, Upper Tonto Creek Campground, 34.3235, -111.2924, 14 January 1984, R.W. Baumann, C.R. Nelson, 18♂, 14♀ (BYUC). Graham Co., Twilight Creek, Turkey Flat, Pinaleño Mountains, 32.6310, -109.8187, 2 March 1984, C.R. Nelson, 3♂, 1♀ (BYUC). Mohave Co., Wheeler Spring, Hualapai Mountain Park, Pine Basin Area, near Kingman, 35.0850, -113.8759, 20 January 1984, R.W. Baumann, C.R. Nelson, 28♂, 13♀ (BYUC). Pima Co., Bear Canyon Creek, Bear Canyon Campground, Santa Catalina Mountains, 32.3276, -110.7328, 19 January 1984, R.W. Baumann, C.R. Nelson, 14♂, 10♀ (BYUC). Santa Cruz Co., Gardner Creek, Santa Rita Mountains, 31.8258, -110.7734, 17 January 1984, R.W. Baumann, C.R. Nelson, 9♂, 2♀ (BYUC).Yavapai Co., Lynx Creek, above Lynx Lake, near Prescott, 34.5145, -112.3812, 20 January 1988, R.W. Baumann, C.R. Nelson, 4♂, 9♀ (BYUC).

Table 2. Epiproct and 7th tergal process characteristics for Arizona specimens of *Arsapnia decepta.*

County	Site	Epiproct Length µm	Epiproct Width µm	# Left Setae	# Right Setae	T7 Process µm	Length/ Width Ratio
Cochise	Cave Creek SWRS (n=1)	478	239	20	20	229	2.00
Cochise	Carr Canyon (n=1)	541	245	30	25	-	2.21
Cochise	Rucker Creek (n=1)	462	248	27	25	-	1.86
Coconino	Oak Creek (n=1)	578	278	27	29	-	2.08
Gila	Christopher Creek (n=1)	459	265	15	16	172	1.73
Gila	Tonto Creek (n=2)	511-524	260-263	23-27	24-28	-	1.95-2.00
Graham	Turkey Creek (n=1)	524	247	28	28	-	2.12
Mohave	Wheeler Spring (n=2)	561	256	20-28	18-24	-	2.19
Pima	Bear Canyon (n=1)	549	262	31	34	194	2.09
Santa Cruz	Gardner Creek (n=2)	438-452	200	18-22	20-26	-	2.19-2,29
Yavapai	Lynx Creek (n=1)	511	263	26	30	-	1.94



Figs. 25-30. *Arsapnia decepta* male reproductive structures. 25-27. Christopher Creek, Gila Co., Arizona (damaged). 28-30. Tonto Creek, Gila Co., Arizona. 25. Epiproct, dorsal. 26. Epiproct apex and setal spine clusters, dorsal. 27. 7th tergal process, anterodorsal. 28. Epiproct, dorsal. 29. Epiproct bulbs and setal spine clusters, oblique lateral. 30. Right setal cluster, posterodorsal.



Figs. 31-36. *Arsapnia decepta* male reproductive structures. 31-33. West Fork Oak Creek, Coconino Co., Arizona, 34-36. Wheeler Spring, Hualapi Mountain Park, Mohave Co., Arizona. 31. Epiproct, dorsal. 32. Epiproct setal spine clusters, dorsal. 33. Epiproct, dorsolateral. 34. Epiproct, dorsal. 35. Epiproct setal spine clusters, dorsal. 36. Epiproct, dorsolateral.

Male epiproct (n = 14). Length 438-578 µm, width 200-278 µm (Table 2). Shape and general structure similar to those of other populations examined (Figs. 13, 18, 19, 22, 33, 36, 39, 42, 45). Setal spines in clusters of 15-34 (Figs. 14-17, 20-21, 23-26, 28-32, 34-35, 37-38, 40-41, 43-44). Neck width 100-144 µm (Figs. 11, 14, 16, 20, 23, 28, 31, 34, 37, 40, 43).

Tergal process (n = 3). Tergum 7 bears a broad, sometimes mesally notched, dorsal process (Figs. 13, 19, 22, 27), and tergum 6 bears a smaller mesal process on one specimen from the Chiricahua Mountains. Dorsolateral margins bearing a few knob-like scales. Width across anterior margin 172-229 µm.

Comments. The first Arizona records for *A. decepta* are attributed to Jewett (1966) (as *C. barbata*), and Stewart et al. (1974) show plots of six sites (also as *C. barbata*) in five Arizona counties (Apache, Cochise, Gila, Pima, and Yavapai). Our specimens represent populations from eight counties (Cochise, Coconino, Gila, Graham, Mohave, Pima, Santa Cruz and Yavapai) and the following natural regions: the Mogollon Rim, Oak Creek Canyon and Yavapai Hills in central Arizona, the Hualapai Mountains in west central Arizona, and the Chiricahua, Huachuca, Pinaleño, Santa Catalina and Santa Rita Mountains in southeastern Arizona. Nelson & Baumann (1987a) provided SEM micrographs for specimens collected in Ramsey Canyon, Huachuca Mountains, Cochise Co., Arizona.

This sample of Arizona specimens includes males with the three longest epiprocts (578 µm, Oak Creek Canyon; 561 µm, Wheeler Spring; 549 µm, Bear Canyon) in the entire sample, and all fell within the 95% confidence interval (247.2 ± 13.1 µm) in epiproct width. In addition, the 9 highest counts of setal spines per cluster (27-34) were recorded from these Arizona specimens. The greatest number of setal spines (31 left, 34 right) were recorded on a Bear Canyon (Pima Co.) specimen.

Nevada Population
(Figs. 46-48)

Material examined. USA: Nevada: Clark Co., Deer Creek, Deer Creek Picnic Area, Hwy 158, Spring Mountains, near Las Vegas, 36.3144, -115.6212, 21 January 1984, R.W. Baumann, C.R. Nelson, 1♂, 3♀ (BYUC).

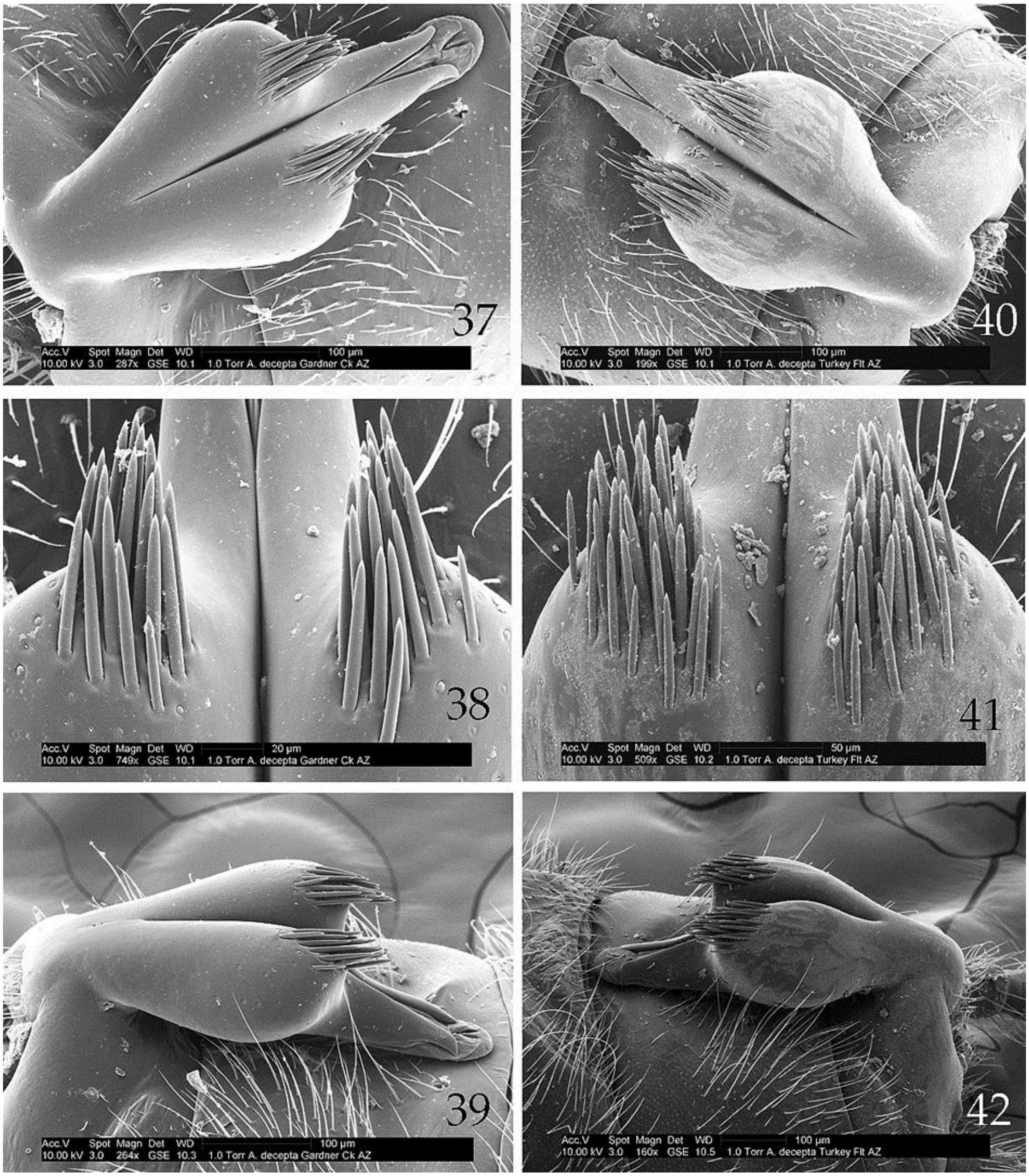
Table 3. Epiproct and 7th tergal process characteristics for Nevada specimens of *Arsapnia decepta*.

County	Site	Epiproct Length µm	Epiproct Width µm	# Left Setae	# Right Setae	T7 Process µm	Length/ Width Ratio
Clark	Deer Creek (n=1)	379	157	31	30	185	2.41

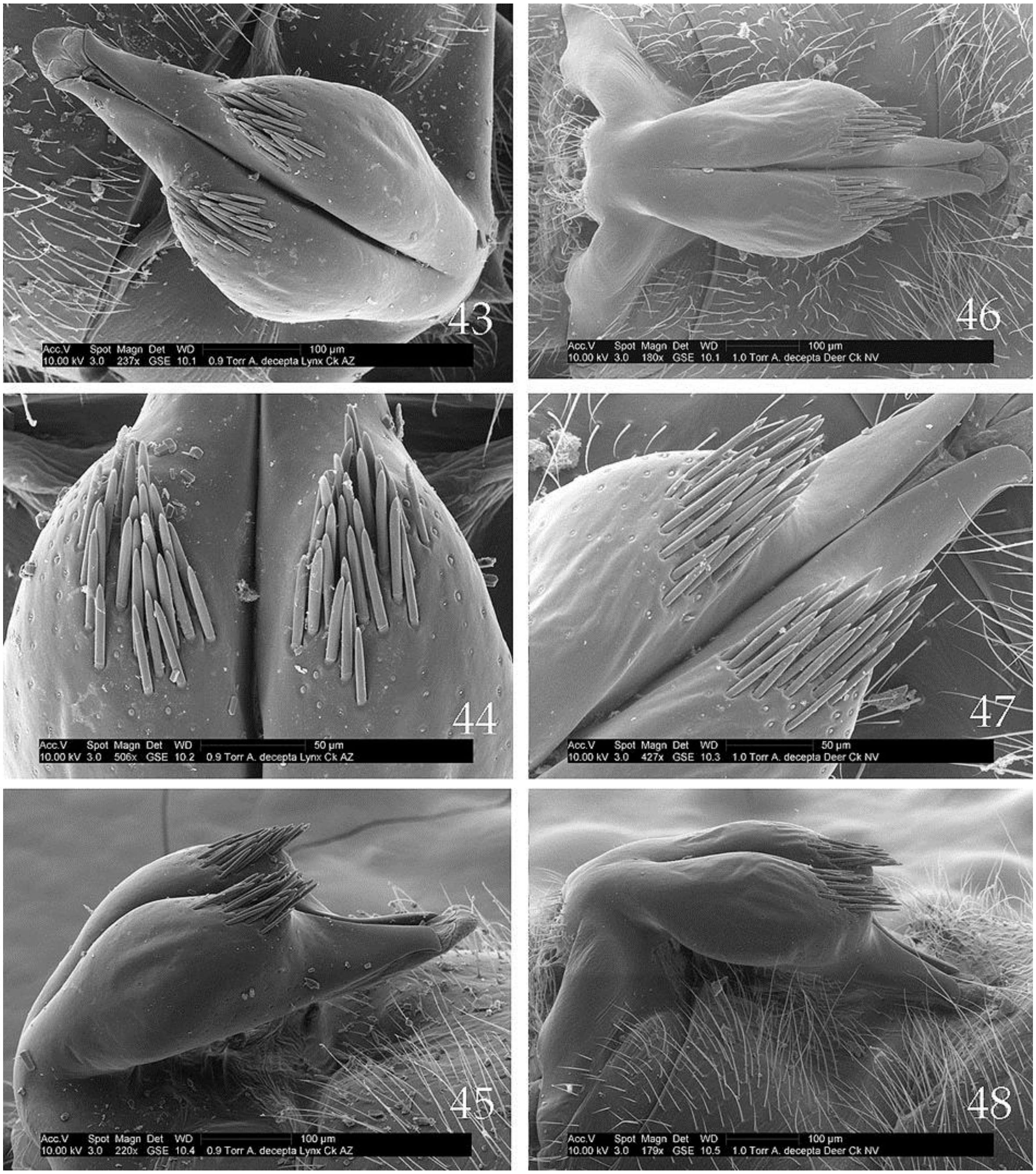
Male epiproct (n = 1). Length 379 µm, width 157 µm (Table 3). Shape and general structure similar to those of other specimens, but smaller and with higher setal spine counts. Setal spines in clusters of 30-31 located anterior of midlength and on either side of median groove (Figs. 46-48). Neck width 135 µm.

Tergal process. Tergum 7 bearing a broad dorsal process, 185 µm in width; dorsal margin concave; lateral prominences covered with small scale-like structures.

Comments. The Spring Mountains represent the only known site where *A. decepta* specimens have been collected in Nevada (Nelson & Baumann 1989). We examined a single male specimen from Deer Creek at its junction with Hwy 158. As Figs. 46-48 and Tables 1-5 indicate, the epiproct of this specimen is shorter and more slender than other specimens examined, and also has one of the highest setal spine counts we encountered, second only to the Bear Canyon specimens from Arizona.



Figs. 37-42. *Arsapnia decepta* male reproductive structures. 37-39. Gardner Creek, Santa Rita Mountains, Santa Cruz Co., Arizona. 40-42. Twilight Creek, Pinaleño Mountains, Graham Co., Arizona. 37. Epiproct, dorsal. 38. Epiproct setal spine clusters, dorsal. 39. Epiproct, dorsolateral. 40. Epiproct, dorsal. 41. Epiproct setal spine clusters, dorsal. 42. Epiproct, dorsolateral.



Figs. 43-48. *Arsapnia decepta* male reproductive structures. 43-45. Lynx Creek, Yavapai Co., Arizona. 46-48. Deer Creek, Spring Mountains, Clark Co., Nevada. 43. Epiproct, dorsal. 44. Epiproct setal spine clusters, dorsal. 45. Epiproct, dorsolateral. 46. Epiproct, dorsal. 47. Epiproct setal spine clusters, dorsal. 48. Epiproct, dorsolateral.

New Mexico Populations
(Figs. 49-60)

Material examined. USA: New Mexico: Catron Co., Leggett Canyon Creek, Leggett Canyon, Hwy 180, south of Luna, 33.7076, -108.8938, 13 January 1987, R.W. Baumann, B.C. Kondratieff, B.J. Sargent, 7♂, 1♀ (BYUC). Grant Co., Gila River, Hwy 180, south of Cliff, 32.9451, -108.6069, 13 January 1987, R.W. Baumann, B.C. Kondratieff, B.J. Sargent, 1♂, 1♀ (BYUC). Lincoln Co., Eagle Creek, Rt. 532, south of Sierra Vista, 33.3925, -105.6885, 11 March 1996, B. Stark, 7♂, 5♀ (BPSC). Lincoln Co., Rio Bonito, below Bonito Lake, Bonito Lake Road, 33.4516, -105.6953, 11 March 1996, B. Stark, 31♂, 37♀ (BPSC).

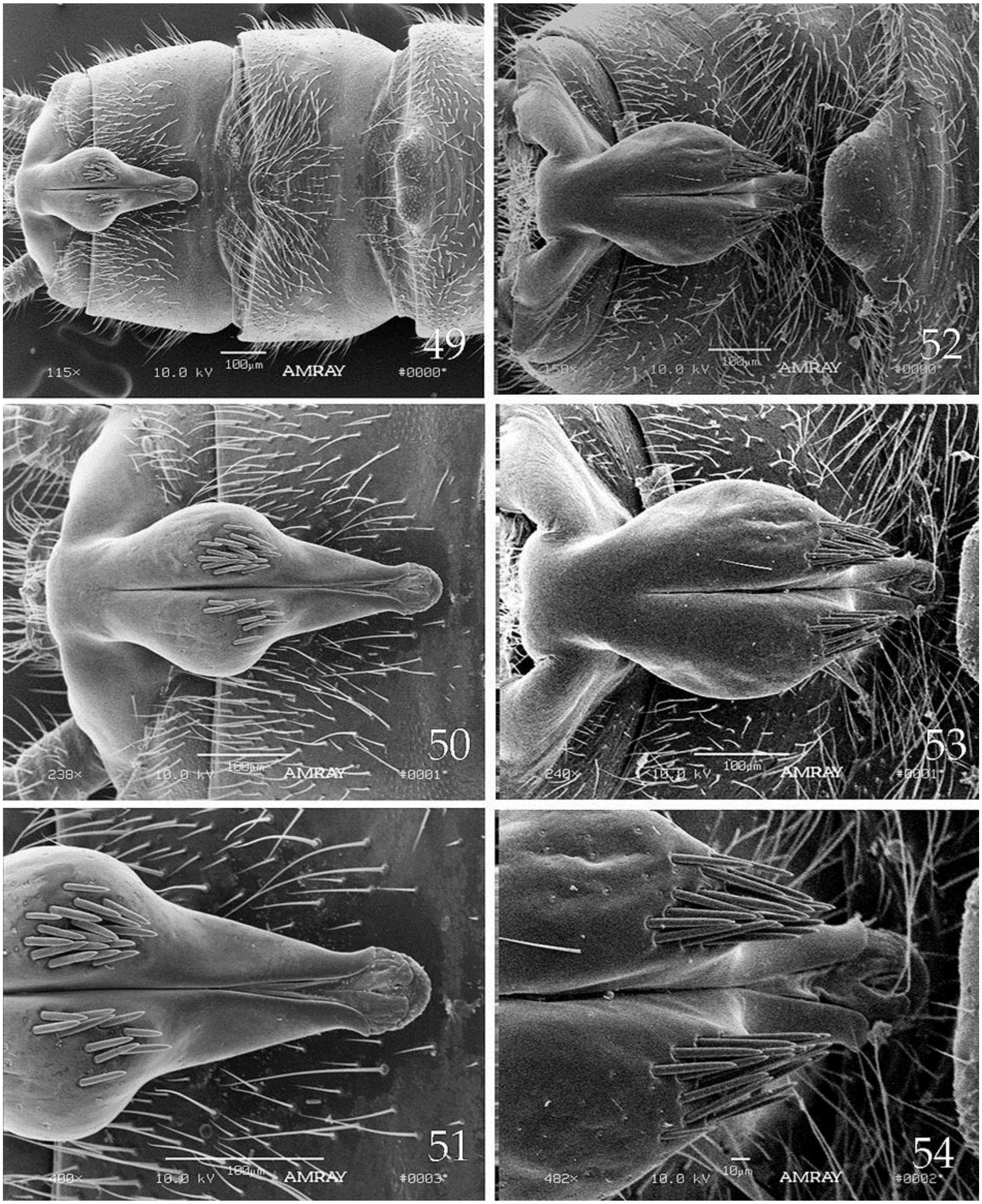
Male epiproct (n = 12). Length 412-562 µm, width 180-269 µm (Table 4). Shape and general structure as in other populations. Setal spines in clusters of 10-21, located near midlength and on either side of median groove (Figs. 51, 54, 55-60). Neck width 105-130 µm.

Tergal process. Bearing a slight notch on the posteromedian margin (Fig. 49-52, 57-58), and with lateral margins moderately convergent. Dorsolateral lobes on either side of notch covered with conical tubercles. Width of process across anterior margin 100-192 µm.

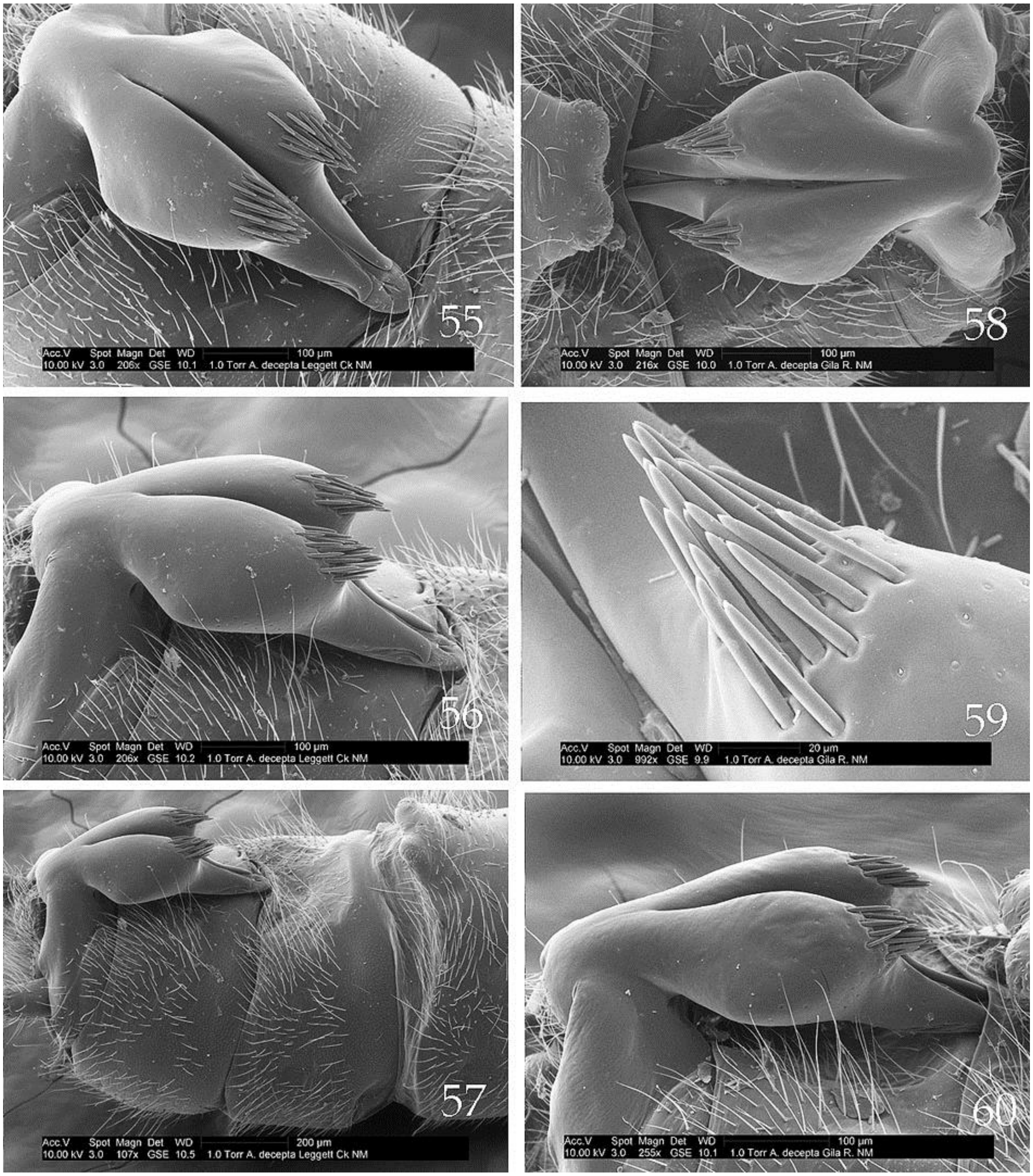
Comments. *Arsapnia decepta* has been reported (as *Capnia decepta* or *C. barbata*) from numerous sites in 12 counties of New Mexico (Jacobi & Baumann 1983, Jacobi & Cary 1986, Jacobi & Cary 1996, Jacobi et al. 2005). The collecting sites listed above include specimens from two streams that are in the Rio Hondo drainage in Lincoln Co. Despite the close proximity of these two sites, the epiprocts from Eagle Creek specimens are shorter and narrower than those from Rio Bonito (Table 4), but the Eagle Creek specimens have an apex that is longer and narrower than those from Rio Bonito (compare Figs. 50 with 53, and 51 with 54). Among the specimens illustrated with micrographs (Figs. 49-54), the Eagle Creek specimens show asymmetrical setal spine counts of 10-17 left and 10-15 right (Table 4). The counts for both of these ranges are also the lowest observed for any *A. decepta* population. This could be related to the smaller epiproct size for Eagle Creek specimens, or may simply reflect the small sample size for all populations examined. As indicated in Table 4, epiproct size and setal spine counts for Catron and Grant county specimens are more similar to those from adjacent states than to the Eagle Creek specimens.

Table 4. Epiproct and 7th tergal process characteristics for New Mexico specimens of *Arsapnia decepta.*

County	Site	Epiproct length µm	Epiproct Width µm	# Left Setae	# Right Setae	T7 Process µm	Length/ Width Ratio
Catron	Leggett Canyon Creek (n=1)	562	269	17	21	-	2.08
Grant	Gila River (n=1)	468	237	-	20	168	1.97
Lincoln	Eagle Creek (n=3)	412-413	180-200	10-17	10-15	146-168	2.06-2.29
Lincoln	Rio Bonito (n=7)	436-483	217-244	12-19	12-18	100-192	1.84-2.02



Figs. 49-54. *Arsapnia decepta* male reproductive structures. 49-51. Eagle Creek, Lincoln Co., New Mexico. 52-54. Rio Bonito, Lincoln Co., New Mexico. 49. Abdominal terga 7-10. 50. Epiproct, dorsal. 51. Epiproct apex and setal spine clusters. 52. Abdominal terga 7-10. 53. Epiproct, dorsal. 54. Epiproct apex and setal spine clusters.



Figs. 55-60. *Arsapnia decepta* male reproductive structures. 55-57. Leggett Canyon Creek, Catron Co., New Mexico. 58-60. Gila River, Grant Co., New Mexico. 55. Epiproct, dorsal. 56. Epiproct, dorsolateral. 57. Abdominal segments 7-10, lateral. 58. Epiproct and 7th tergal process, dorsal. 59. Right setal cluster, dorsal. 60. Epiproct, dorsolateral.

Mexico Populations
(Figs. 61-66)

Material examined. MEXICO: Baja California: Arroyo La Corona, Sierra San Pedro Martir National Park, 16 January 1988, R.W. Baumann, B.C. Kondratieff, C.R. Nelson, B.J. Sargent, 1 pharate ♂ larva (dissected), 4♀, 4 larvae. **Chihuahua:** Cañon de Agua, Bowman Ranch, near Colonia Juarez, 22 January 1987, B.C. Kondratieff, B.J. Sargent, T. Bowman, 2♂, 4♀ (BYUC).

Male epiproct (n=2). Length not estimated due to specimen condition and orientation (Figs. 61, 64; Table 5). Width 238 µm. Shape and general features similar to other specimens examined. Setal spines in clusters of 13-18 (Table 5, Figs. 61-66). Neck width 93 µm (Fig. 64).

Tergal process. Not visible in available figures.

Comments. Only two male specimens were available for SEM study (Table 5) including a pharate male collected in Baja California and dissected by B.C. Kondratieff from the larval skin. Unfortunately, only six SEM images were prepared due to specimen condition and orientation (Figs. 61-66). Despite the poor condition and orientation of these specimens, their epiprocts display the same general shape and the typical setal spine clusters found among other populations. The Baja California population should be re-examined with molecular data and with a more complete set of morphological data, and compared with California specimens of *A. coyote* when suitable material is available. The epiproct of *A. coyote* is similar, but distinct from A. *decepta* morphologically (see Figs. 67-72), and Heinold et al. (2014) also support recognition of *A. coyote* as a valid species based on molecular barcode data. The Chihuahua population exhibits a narrow neck width (93 µm) more consistent with *A. coyote*, but with respect to epiproct width, the specimen is more similar to *A. decepta.*

Table 5. Epiproct and 7th tergal process characteristics for Mexican specimens of *Arsapnia decepta*.

Mexican State	Site	Epiproct Length µm	Epiproct Width µm	# Left Setae	# Right Setae	T7 Process µm	Length/ Width Ratio
Baja California	Arroyo La Corona (n=1)	-	-	15	13	-	-
Chihuahua	Cañon de Agua (n=1)	-	238	18	15	157	-

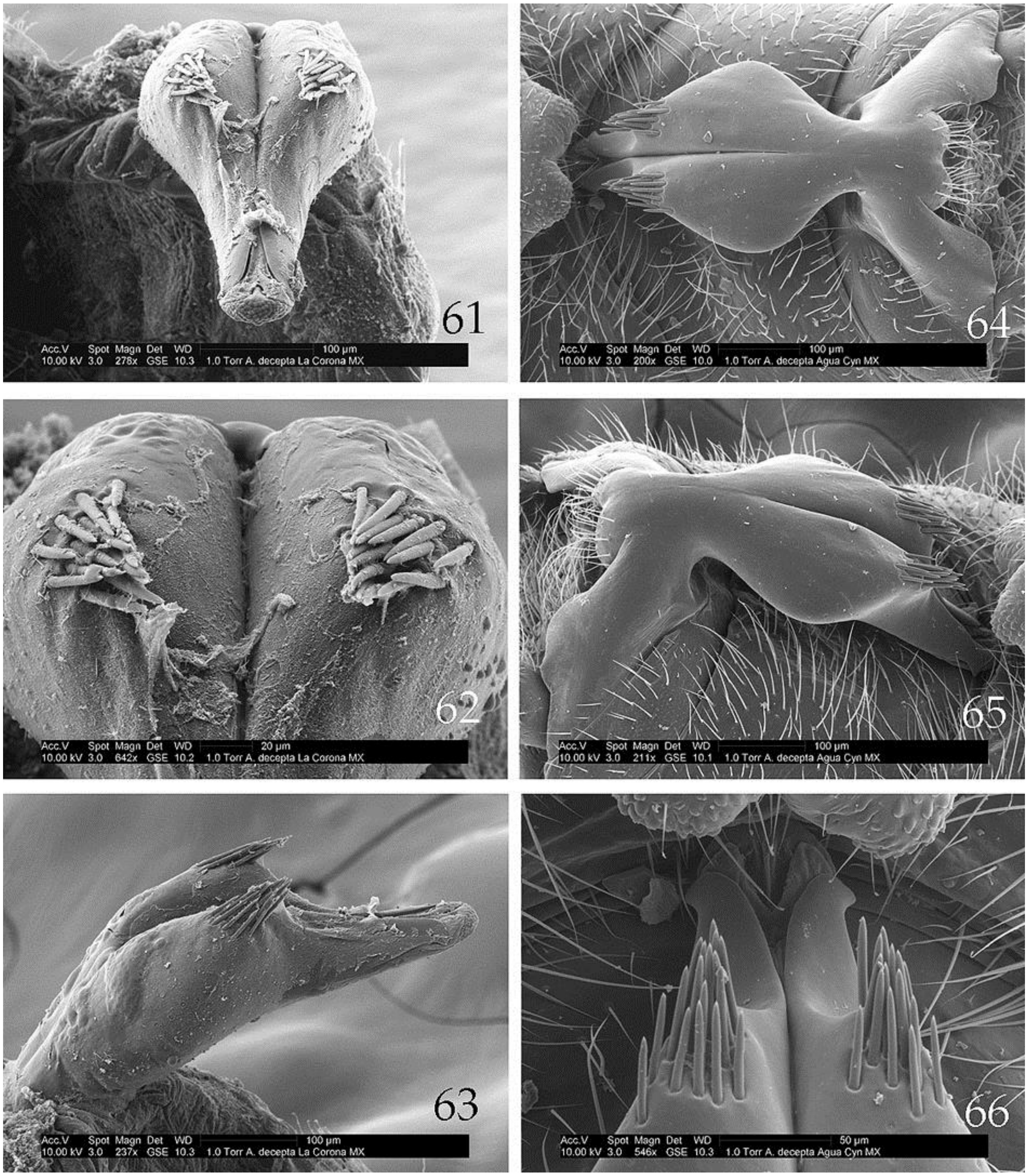
***Arsapnia coyote* (Nelson & Baumann)**
Coyote Snowfly
(Figs. 67-72)

Capnia coyote Nelson & Baumann, 1987b:487. Holotype ♂, (United States National Museum), Little Rock Creek, Cooper Canyon Campground, San Gabriel Mountains, Los Angeles Co., California
http://lsid.speciesfile.org/urn:lsid:Plecoptera.speciesfile.org:TaxonName:4978

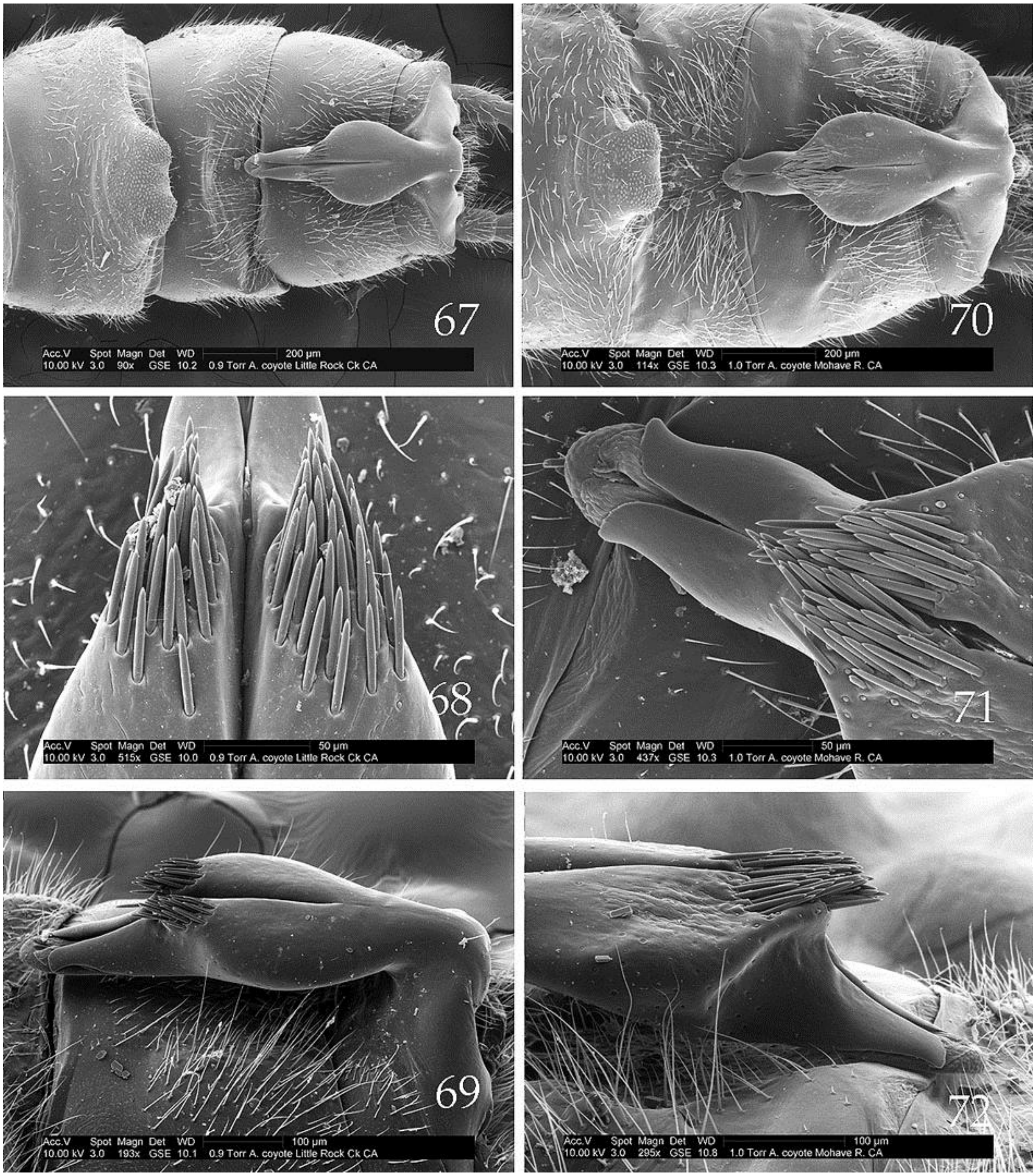
Arsapnia coyote: Murányi, Gamboa & Orci, 2014:14
http://lsid.speciesfile.org/urn.lsid:Plecoptera.speciesfile.org:TaxonName:465452

Material examined. USA: California: Los Angeles Co., Little Rock Creek, Cooper Canyon Campground, San Gabriel Mountains, 31 March 1981, R.W. Baumann, J. Stanger, 3♂ (BYUC). San Bernardino Co., East Fork of West Fork before Mohave River above Silverwood Lake, 9 January 1988, R.W. Baumann, C.R. Nelson, 1♂ (BYUC).

Male epiproct (n = 2). Length 575-618 µm, width at midlength 223-236 µm, Body of epiproct expanded into convex ear-like lobes near midlength (Figs. 67, 70). Width across neck 67-83 µm. Shape and



Figs. 61-66. *Arsapnia decepta* male reproductive structures, 61-63. Arroyo La Corona, Sierra San Pedro Martir National Park, Baja California. 64-66. Cañon de Agua, Bowman Ranch, near Colonia Juarez, Chihuahua. 61. Epiproct, anterodorsal. 62. Epiproct, setal spine clusters, anterodorsal. 63. Epiproct, lateral. 64. Epiproct, dorsal. 65. Epiproct, oblique lateral. 66. Epiproct apex and setal spine clusters, dorsal.



Figs. 67-72. *Arsapnia coyote* male reproductive structures. 67-69. Little Rock Creek, Los Angeles Co., California.70-72. Mohave River, San Bernardino Co., California. 67. Abdominal segments 7-10, dorsal. 68. Epiproct apex and setal spine clusters. 69. Epiproct, oblique lateral. 70. Abdominal segments 7-10, dorsal. 71. Epiproct apex and setal spine clusters. 72. Epiproct apex, lateral.

general structure similar to those of populations of *A. decepta* examined. Left side setal spines in clusters of 25-28, and 28-32 on the right.

Tergal process (n = 2). Bearing a slight to moderate notch of posteromedian margin (Figs. 67-70). Dorsolateral lobes bearing patches of small conical tubercles. Width of process across anterior margin 200-280 µm.

Comments. *Arsapnia coyote* is presently considered an endemic to southern California and the sister species of *A. decepta* (Nelson & Baumann 1987b). The two species overlap in many morphological features including epiproct width and setal spine counts, however two of the three longest epiprocts among specimens studied are of this species, and the epiproct length/width ratios (2.58 and 2.61 respectively, Table 6) for these two specimens are the highest observed. Nelson & Baumann (1987b) distinguished the two species, in part, by virtue of a flatter dorsal epiproct surface and smaller epiproct depth (compare Figs. 69 and 72 with Figs. 4 and 18). Recently, Heinold et al. (2014) supported recognition of *A. coyote* as a distinct species based on their report of an average genetic divergence of 1.9% between males of *A. coyote* and *A. decepta.*

Table 6. Epiproct and 7th tergal process characteristics for California specimens of *Arsapnia coyote.*

County	Site	Epiproct Length µm	Epiproct Width µm	# Left Setae	# Right Setae	T7 Process µm	Length/ Width Ratio
Los Angeles	Little Rock Creek (n =1)	575	223	28	32	280	2.58
San Bernardino	Mohave River (n = 1)	618	236	25	28	200	2.61

DISCUSSION

Arsapnia decepta is a common winter-emerging species of the Southwestern United States and adjacent areas of Mexico. Many populations exist in relative isolation, consequently significant variation in male reproductive structures occurs. Much of this variation centers around epiproct length, width and setal spine counts for the left and right epiproct clusters. Setal spine counts for left side clusters range from 10 to 31 and right side clusters range from 10 to 34 in our samples. The lowest counts occurred among three individuals from Eagle Creek and Rio Bonito, New Mexico with clusters of 23, 25 and 25 total setal spines (10,13; 12,13; 10,15), and other relatively low counts were observed for Buckhorn Creek, Colorado (14,12), and Cedar Creek, Colorado (14,14). The highest setal spine counts were from Bear Canyon, Arizona (31,34) and Deer Creek, Nevada (31,30) specimens. Total setal spine counts ranged from 40-65 for Arizona specimens, 26-43 for Colorado specimens, and 23-35 for New Mexico specimens. *Arsapnia coyote* setal spine counts (53-60) were within the range of Arizona *A. decepta* specimens.

Arsapnia decepta epiprocts ranged from 379-578 µm in length (mean = 487.9 ± 19.4), but seven of the eight longest epiprocts were from Arizona (524-578 µm) or Colorado (525-528 µm). Only two of the New Mexico specimens had epiproct lengths greater than 500 µm. The epiproct lengths for the two specimens of *A. coyote* we examined were 575 and 618 µm. These lengths exceeded all but one of the *A. decepta* specimens. The two species overlap in setal spine counts and in epiproct length, however the epiproct depth character noted by Nelson & Baumann (1987b, 1989), although not easily measured with SEM, appears to be a reliable morphological character for distinguishing *A. decepta* and *A. coyote*. This paper is not a revision or a complete geographical study of *A. decepta* and *A. coyote* as presently known. Instead it is an overview of specimens from states in the United States and Mexico where specimens have been selected that show variation in epiproct structure. Complete museum records of these species are not recorded and only those specimens that were used for SEM study are included. Thus, the inclusion of a map showing the complete geographical distributions of these species is left for zoographical studies in the future.

ACKNOWLEDGEMENTS

We appreciate Boris Kondratieff, Colorado State University, C. Riley Nelson, Brigham Young University, and B.J. Sargent for their assistance in collecting *Arsapnia* specimens. We also thank Boris for rearing the mature nymphs from Baja California, for the loan of specimens from the Colorado Front Range, and for help in locating references. We also thank Denise Mason for her assistance in preparing micrographs for specimens from Redstone Canyon, Colorado and Rio Bonito, New Mexico.

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Submitted 10 March 2017, Accepted 7 April 2017, Published 1 May 2017

Hosted and published at the University of Illinois, Illinois Natural History Survey, Champaign, Illinois, U.S.A.