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Redescription of the *Allomyia renoa* (Milne) female and association and description of the male and larva (Trichoptera: Apataniidae)

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Abstract. *Allomyia renoa* (Milne, 1935) (Trichoptera: Apataniidae) was described from six females. The male association is verified in this paper. The original type locality information is limited: "Reno, Nev., '78, Morrison". An *Allomyia* Banks population found at Mount Rose in Washoe County, Nevada, was compared to the *A. renoa* type material and found to be the conspecific. Figures, descriptions and distribution of male, female, pupal and larval *A. renoa* are provided.

Key words. Caddisfly, California, distribution, morphology, Nevada, Sierra Nevada Mountains, taxonomy.

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Introduction

Banks (1916) proposed *Allomyia* to accommodate *Apatania tripunctata* Banks (1900). Currently, there are 29 described species of *Allomyia*, 11 from the Palearctic Region and 18 from North America (Ruiter and Nishimoto 2019; Morse 2020). *Allomyia renoa* (as *Algonquina*) was the second *Allomyia* species described from North American and is based on six females that were in the collection of the Museum of Comparative Zoology (MCZ). As the description of *A. renoa* was based solely on adult female specimens, it has presented a taxonomic anomaly.

While Milne (1935) indicated that he deposited the holotype female (type #21026) and two paratype females at the MCZ, the MCZ actually has the holotype and three paratype females in its possession (Farnum personal communication 2018). The remaining Milne paratypes were ultimately acquired by the Illinois Natural History Museum (INHS). The collection information for the type series consists only of "Reno, Nev., '78, Morrison." H.K. Morrison (1854-1885) was undoubtedly the collector.

Ruiter et al. (2014) summarized the history and collection records for *A. renoa*. Reno Nevada is an unlikely locality for this typically high-altitude genus, and, after numerous years of unsuccessful collections by the first author in the Reno area and the Sierra Nevada Mountains west of Reno, *Allomyia* larvae were located in an alder meadow spring-stream complex about 0.66 km NNW of the Mount Rose Highway summit (Nevada State Route 431).

Materials and Methods

Material from the following institutions were examined:

C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins (CSUC)
DE Ruiter personal collection, Grants Pass, Oregon (DERPC)
DR Givens personal collection, Fort Collins, Colorado (DRGPC)
Illinois National History Survey, Champaign, Illinois (INHS)
Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ)

Abbreviations for terms used in the Materials Examined sections are as follows:

M = male
F = female
L = larva
P = pupa

Pupae were collected and reared using the metamorphotype method (Milne 1938). The pharate female was compared to *A. renoa* paratype material and found to be identical. Since the original type locality is indeterminate, the Mt. Rose locality was selected as the topotype locality to assist future studies with this genus, and a male was selected and deposited at the MCZ. This locality was selected because the Mt. Rose locality is within an area of Washoe County, Nevada, which was traveled extensively in the 1800s for timber production used in the Nevada mining industry. It is likely that the access created by the timber and mining industry provided access for collectors. The transcontinental railroad, completed through the Sierra Nevada Mountains in 1868, would have also provided access to insect collectors near Reno. However, the railroad location followed the Truckee River canyon at much lower elevations in Nevada and we did not locate *Allomyia* specimens in that area.

A list of abbreviations used in the figures follows:

ifa = inferior appendages (paired)
ima = intermediate appendages
endp= endophallic plates
par = paramere
ph = phallus
spr= supragenital plate
spr.sct = spermathecal sclerite
ssc.o spermathecal opening
sl = spike-like setae; sharp, inflexible, black to translucent
IXt = tergum of abdominal segment IX
Xt = tergum of abdominal segment X
IIIa-VIIa = anterior-dorsal abdominal hook plates
Vp = posterior-dorsal abdominal hook plates

Descriptions

Allomyia renoa (Milne, 1935)

Diagnosis. Based on the three-part apical segment of the male inferior appendage, this species belongs to the *picoides* group of Ross (1950) along with *A. cidoipes* (Schmid, 1968) and *A. picoides* (Ross, 1950). Schmid's cidoipes species moniker is an obvious anagram of picoides. Ross (1950) correctly concluded that the *A. renoa* female was most closely related to *A. picoides*. *Allomyia renoa* males are easily separated from *A. cidoipes* and *A. picoides* by the broadly separated, narrow, curved ventral rami of the apical inferior appendage of *A. renoa*, which are most apparent in ventral view.

Redescription. Male (Fig. 1–5): Length 7–9 mm (N = 4). Fresh specimens dark brown in 85% ethyl alcohol (ETOH). Forewing length 7 mm, forewings with pale spots at stigma, just prior to base of forked t3, and arculus. Forewings uniformly clothed with short dark brown setae; hind wings clothed with short black setae. Vertex of head fuscus. Antennae with 41–45 segments; antennae scapes with long, black setae. Basal segment of labial palps with long, black setae. Thoracic nota fuscus. Legs brown; tibiae, tarsi of pro- meso- and metathoracic legs with paired short spines. Segment IX annular, narrow, widest ventromesally and above insertion of inferior appendage. Inferior appendage with basal and apical segments. Basal segment broadly rounded in lateral view, taller than long; with a pair of long, mesally flattened styles originating ventromesally at base, extending beyond apex of basal segment, curved downward throughout, may be sinuous, tapered near apex to acute, downward curved point. Apical segment of inferior appendage consists of three pairs of apical rami. Dorsal rami relatively narrow in lateral view, wider in dorsal view, originating dorsally, subequal to two smaller rami, with stout black, peg-like setae on apical third of ventral surface. Mesal and ventral rami finger-like and curving slightly dorsad throughout length; both with a few black, peg-like setae near apices. Segment X in dorsal view with distal margin apically cleft, tapering to blunt apices, directed posteriorly. Intermediate appendages large, thumb-like, directed laterad. Phallic organ (Fig. 4–5) consists of the phallus sheathed in an endophallic plate, and bordered by paired parameres. Parameres long, thin; apices acute, curved downward throughout in lateral view. Aedeagus mostly membranous, inflated mid-length, with endophallic plate acutely bifid in ventral view.

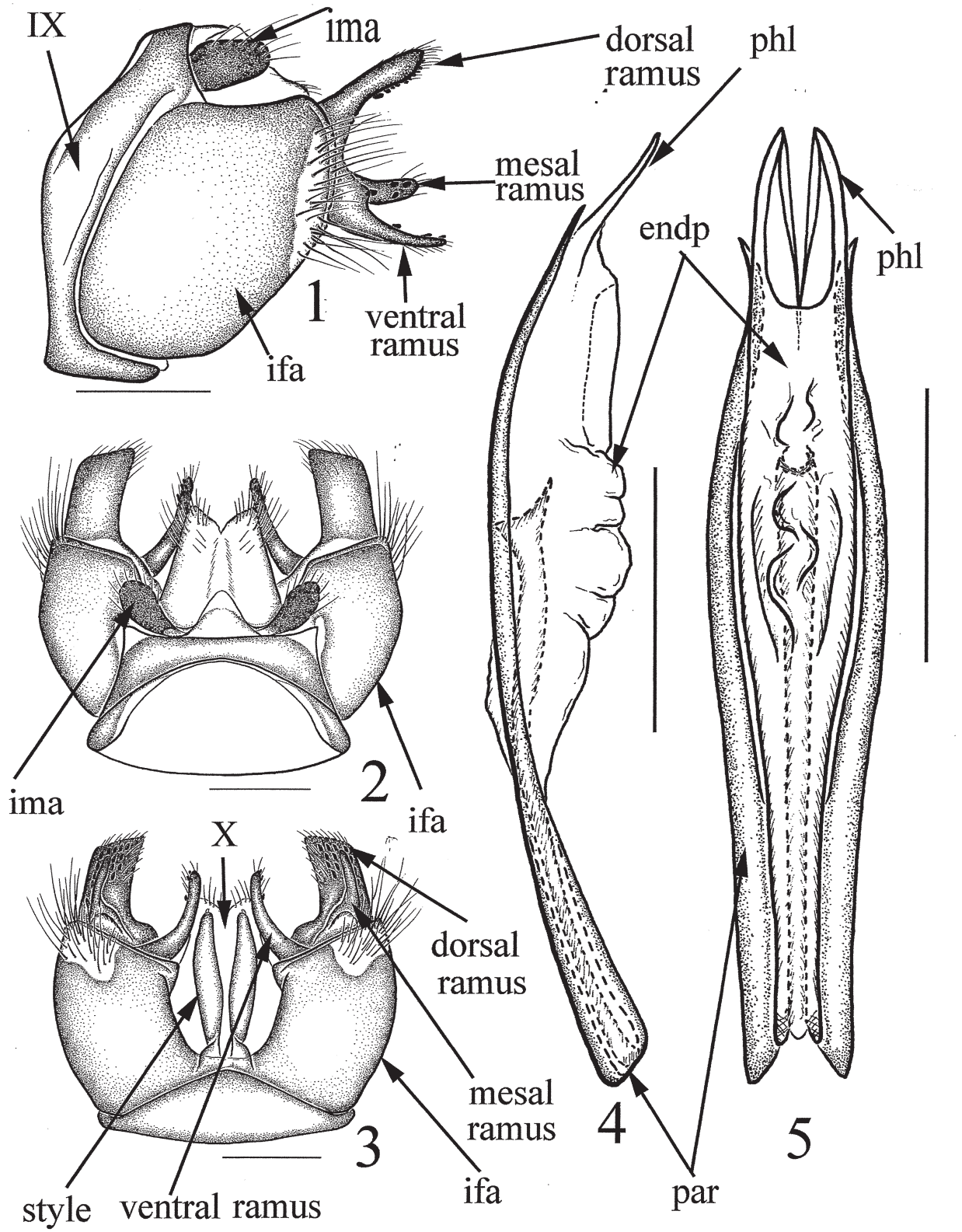
Female (Fig. 6–7): Length 7and 9 mm (N = 2). Forewing length 7.5 mm. Genitalia generally similar in structure to those of other *Allomyia* females. Tergum IX separated from sternum IX; fused with segment X near apex, divided to mid-length mesally; in lateral view, base of segment IX longer than tall; dorsal margin tapering abruptly to fused, truncate segment X. In lateral view, sternum IX consisting of setate, quadrate lobe, slightly taller than long; in ventral view triangular, separated mesally from vaginal scale. Vaginal scale three-part, with mesal lobe rectangular, transversely striated, slightly upturned at apex, extending to apex of segment IX lateral lobes; lateral lobes of vaginal scale digitate, curved around base and sides of mesal lobe, smoothly rounded at apex. Supragenital plate long and narrow with smoothly rounded apex. Internal vaginal apparatus (spermatheca) with two parts, ventral part consisting of round, membranous sac in ventral view, likely extensible; dorsal part a keyhole-like sclerotized structure (spermathecal opening).

Pupa (Fig. 8): Length mature pupa 7 and 8 mm (N = 2). Pharate adult with head, thoracic nota blackish-brown. Female antennae extend to anterior margin of abdominal segment VIII. Mandibles reddish-brown, tapering anterad forming a single acute tooth. Lateral line fringe commences on posterior margin of abdominal segment V, extending to anterior margin of segment VII, curving ventrad. Hook plates dark brown, on dorsal abdominal segments III–VII. Pairs of hook plates present anteriorly on segments III–VII; posteriorly on segment V. Hook plate Vp ellipsoidal to circular. Hook plates IIIa each with 5 hooks; IVa with 4 hooks; Va with 3 to 4 hooks; Vp with 14–22 hooks; VI with 5 hooks; VII with 5 hooks. Hook plates IIIa–VIIa with hooks directed posterad; hook plates Vp with hooks directed anterad. Anterior hook plates IIIa–VIIa each with anterior directed stem. Apical process with 2 translucent processes directed posterad.

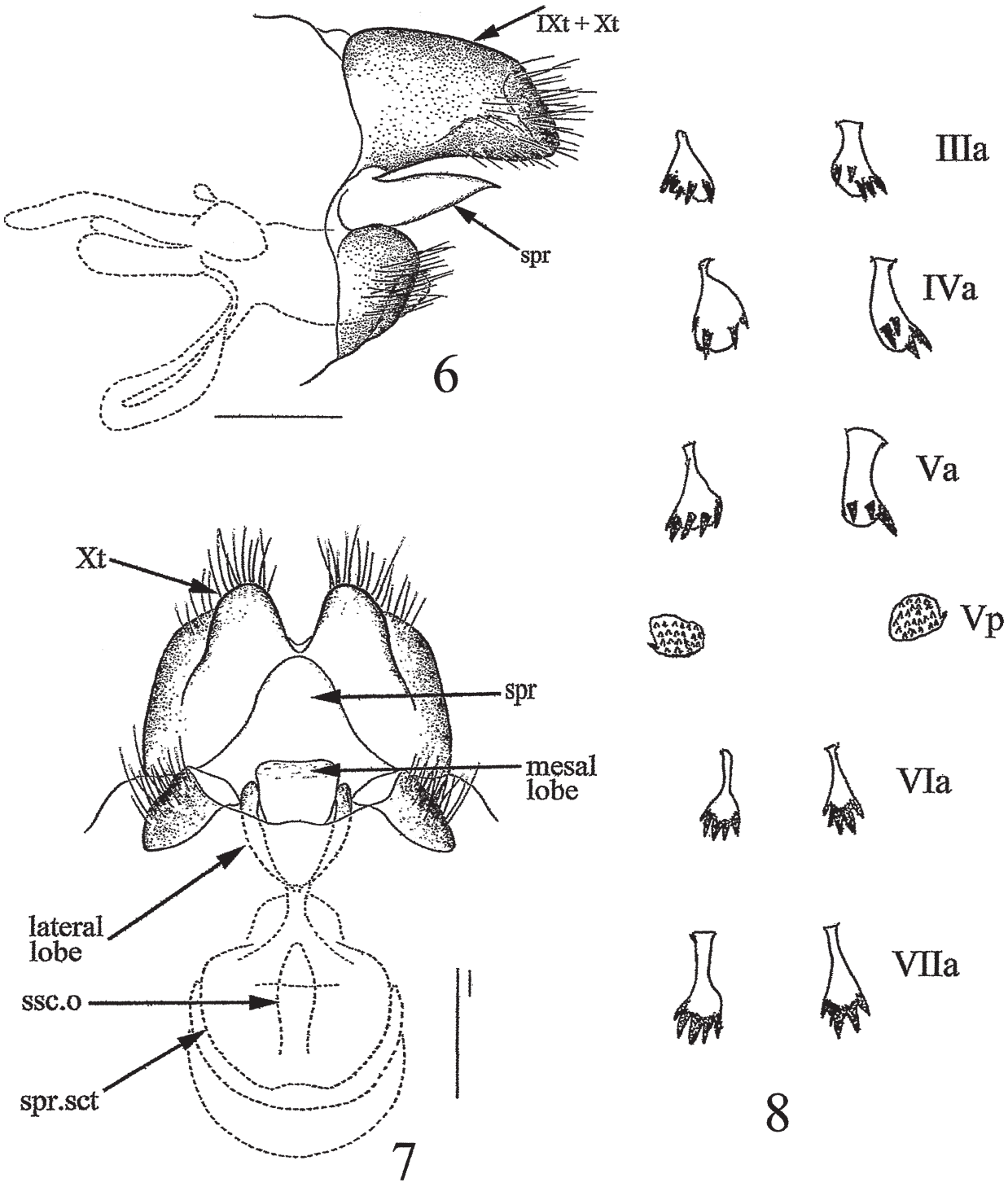
Larva (Fig. 9–13): Mature larvae 7–13 mm (N = 18).

Head: Head dorsally flattened; dark brown dorsally (in ETOH), paler laterally with no obvious muscle scars; complete carina surrounding dorsal surface; slightly wider than long with eyes located laterally at widest point; eyes located at dorsal margin in lateral view; antennae located closer to mandible than eye; dorsum of head within carina deeply concave, appearing bowl-like, surface with pebbled texture, and entire margin of carina with very short blunt projections. Labrum dark brown, with anterior area yellowish with straw colored setal tufts arising from lateral margins. Mandibles black, without mesal teeth, apically rounded, mesal margins with tuft of white setae.

Thorax: Pronotum with lightly pebbled texture, light brown with dark margin; dark muscle scars present on posterior third; strongly convex, in lateral view with most inflated area near posterior margin; without transverse furrow in anterior third; very few setae present on pronotum, but with fringe of dorsal very fine pale setae (may appear absent). Mesonotum light brown with dark area in posterior lateral corners, lightly pebbled, with setae clearly separated into three setal areas (sa). S*a1* discrete consisting of 1 to 2 setae, *sa3* discrete with about 3 to 4 long setae; *sa2* not discrete, in broad area with a dozen or more scattered setae. Primary setae in positions *sa1*, *sa2*, *sa3* black, long and slender. Secondary setae in *sa2* position black, long and slender (10–15 setae). Metanotal



Figures 1–5. *Allomyia renoa* (Milne). Male genitalia, scale line = 0.2 mm. **1)** Lateral. **2)** Dorsal. **3)** Ventral. **4–5)** Male phallus. **4)** Lateral. **5)** Ventral. Abbreviations: ifa = inferior appendage (paired); ima = intermediate appendage; par = paramere; phl = phallus; IX = segment IX; X = Tergum X.



Figures 6–8. *Allomyia renoa* (Milne). **6–7)** Female genitalia, scale line = 0.2 mm. **6)** Lateral. **7)** Ventral. **8)** Pupal hook plates. Abbreviations: spr = supragenital plate; spr.sct = spermathecal sclerite; ssc.o = spermathecal opening; IXt = tergum IX; Xt = tergum X; III–VII = abdominal terga III through VII; a = anterior; p = posterior.

sa1 sclerites inconspicuous, small, with 4–8 setae; *sa2* sclerites small, brown, with about 7–12 setae, *sa3* sclerites long, narrow, parenthesis shaped, with 12–20 long, slender black setae on anterior portion. Epimeron of metathoracic legs extends ventrad curving beneath coxae. Epimeron with 18–21 long, slender black setae; episternum with 8–17 long, slender black setae. Prosternum with short brown prosternal horn and light brown prosternal sclerite.

Legs: Dark brown; profemora with short, translucent spike-like setae. Pro- meso- and metathoracic trochanters with short, translucent spike-like setae. Procoxae with black primary setae in position 1. Pro- meso- and metatrochanters with black primary setae in positions 2 and 3. Pro- and meso femora with black primary setae in positions 2 and 3; metafemora with black primary setae in positon 4. Pro- meso- and metatarsi with black primary setae in position 2. Pro-meso- and metatibiae with black primary setae in position 3. Meso and metanotal coxae and trochanter without brush of fine setae on ventroapical margin; femora with accessory setae on both anterior and posterior surfaces.

Abdomen: Dorsum of abdominal segment I with 6–18 long, slender black setae laterad to dorsal hump; lateral humps with 4–8 long, slender, black setae; sternum of abdominal segment I with about 40 long, slender, black setae. Abdominal segment II with short, slender black setae in *sa2* position. Dorsum of segments III–V appears to be consistently glabrous; segment VI with short, slender black setae in *sa2* position; segment VII with short, slender black setae in *sa2* position and a single long, slender black seta located laterad; segment VIII with long, slender black setae in position *sa2*. Dorsum of abdominal segment IX with brown sclerite bearing 10 long, black slender setae along posterior margin; sclerite ellipsoidal in form; posterior margin convex; anterior margin straight; lateral margins rounded. Abdomen with single pairs of gills, dorsally and ventrally on segments III–VI in posterior position; gills may be lacking on dorsum of abdominal segments V and VI. Ventral chloride epithelia present on segments III–VII; dorsal chloride epithelia absent. Lateral sclerite of anal claw brown, slightly crenulate mesally; with 4 long, black slender setae; sole plate brown with single, long, slender seta; anal claw with small accessory hook and a single black seta.

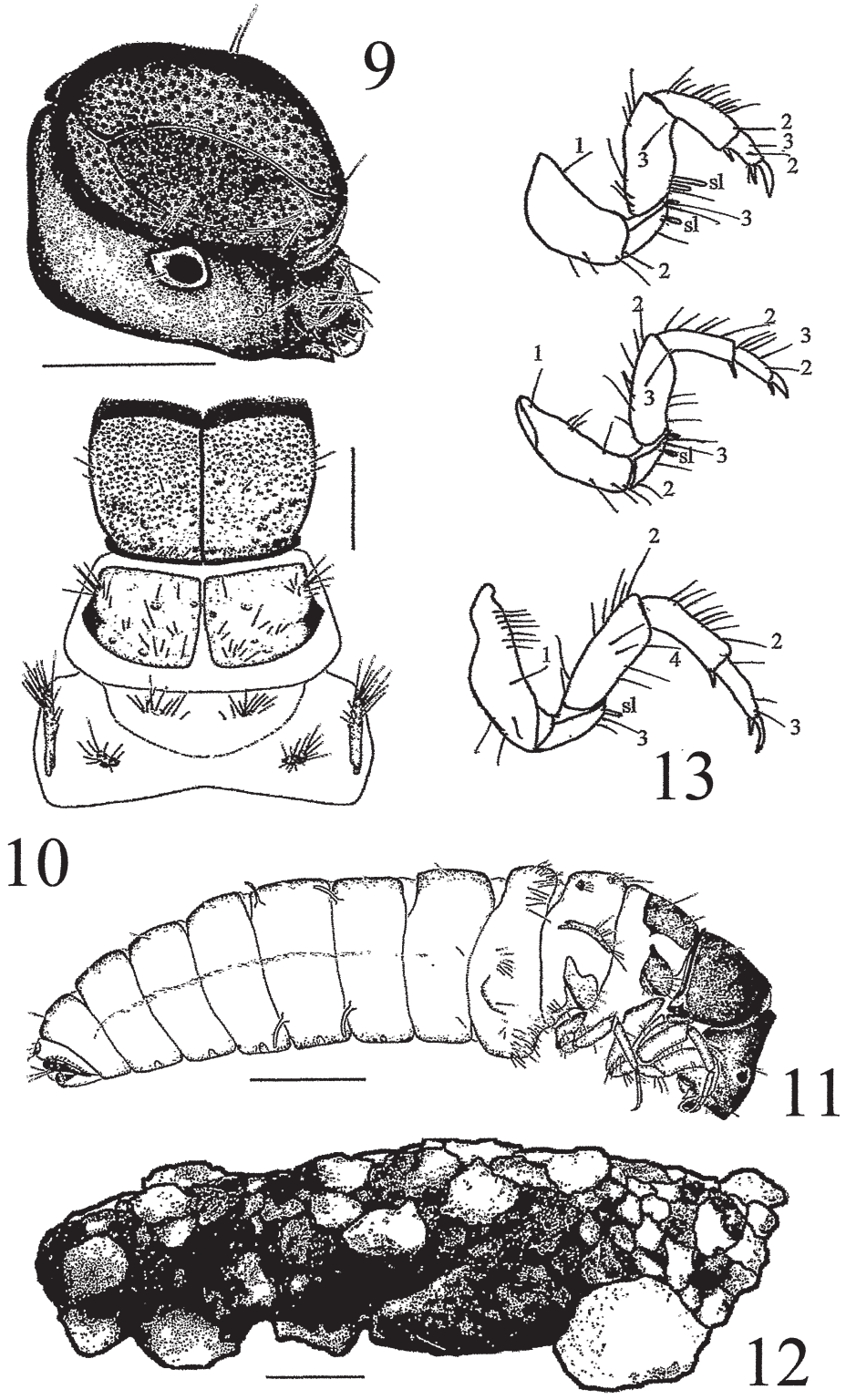
Case: Larval and pupal cases similar, slightly tapered and curved in lateral view, consisting primarily of small sand grains with a few larger stones incorporated, especially laterally at pupation. Posterior end of case membranous with circular hole to allow for flow of water through case.

Material Examined. Specimens examined include: **California.** Collections made by DR Givens at Lassen Volcanic National Park (LVNP), Shasta and Tehama Counties, deposited CSUC. Shasta County, King's Creek LVNP, (Hwy. 89), 40.45952 −121.46954, 28.2 km S of NW entrance to LVNP (HWY. 89); 21-vii-2012, 4 L; 27-vii-2012, 16 L, 01-viii-2012, 1M, 3F, 28 L; 27-v-2013, 1F; 30-vi-2013, 2M, 2F, 2 L; 11-vii-2013, 2 L; 19-vii-2013, 2 P, 6 L; 09-ix-2013, 6 L. King's Creek at King's Creek Picnic Site, 40.46133 −121.47683, 28 km S of NW entrance to LVNP, 11-vii-2013, 1 L; 19-vii-2013, 1 L. Small tributary flowing into King's Creek in upper meadow, 28.2 km S of NW entrance to LVNP, 28-vi-2013, 2F, 1 P, 1 L; 29-vi-2013, 2 L; 09-ix-2013, 1 L. Small creek at Paradise Meadow, LVNP, 13-vii-2013. Tehama County, small snowmelt creek 5.47 km N of SW of LVNP entrance (Hwy. 89), 01-vii-2013, 1M. **Nevada.** Washoe County, tributary to Galena Creek, about 820.2 m northwest of Mount Rose Ski Area well pad, near Highway 431, Mt. Rose Highway, 39.31948 −119.89963, 27-vi-2017, J. Lee and D. Ruiter collectors, 1 M (INHS); 27-vi-2017, 1 M, 1 F (MCZ), 1 M, 1F (DERPC).

Discussion

The association of the male and larvae of *Allomyia renoa* allows positive identification of other populations. Ruiter et al. (2014) discussed the status of the type locality. Givens (2014) discussed the possibility of his Lassen Volcanic National Park collections being *A. renoa* in addition to Burdick's Lassen Park specimen. As part of Burdick (2010), Shannon Bickford provided a figure of the California "*A. cidoipes*" male from the Sagehen Creek Basin (Nevada County). With our positive male association for *A. renoa* from the Mount Rose population, an examination of those specimens collected in Lassen Volcanic National Park by Givens and the Sagehen Creek specimen figured by Burdick and Bickford showed they were also *A. renoa*.

In a series of papers, Erman discussed the habitat preferences for Sierra Nevada range collections determined as *A. cidoipes* (Erman 1989, 1992; Erman and Erman 1992). Erman (1997) concluded the Sierra Range



Figures 9–13. *Allomyia renoa* (Milne). Larva. **9)** Head, oblique view, scale line = 0.5mm. **10)** Thorax, dorsal view, scale line = 1.0 mm. **11)** Lateral view, scale line = 1.0 mm. **12)** Larval case, lateral view, scale line = 1.0 mm. **13)** Right pro-, meso- and metathoracic legs. Abbreviation: sl= spike-like setae.

specimens previously determined as *A. cidoipes* were, in fact, a new species and indicated a manuscript was in preparation to describe this new species. That manuscript was not completed (Erman, personal communication 2002). The *Allomyia* populations discussed by Erman have now also been determined to be *A. renoa*. The Erman papers provide the best discussion of habitat and life history available for any species of *Allomyia*.

Based on collections to date, populations of *A. renoa* are known from high altitude springs and spring-fed streams at elevations ranging from 2051–2682 m. Water temperatures taken in 2011 to 2013, from June to September in Lassen Volcanic National Park ranged from 2.22–7.22 °C. Distribution ranges from Lassen Volcanic National Park, California, south to the Lake Tahoe, California/Nevada, area. These may be the limits of actual distribution, although more likely reflect limited collection in these fairly isolated areas during the early season emergence period. The deeply concave dorsal surface of the *A. renoa* larval head should now allow for a better understanding of the species' distribution. No other known *Allomyia* larvae have the larval head so distinctly concave. Emergence of adults in Lassen Volcanic National Park occurred in late June to early July.

Immature *Allomyia renoa* are apparently distributed throughout the small substrates in streams/springs where it is found. The topotype habitat channel width ranges from 10 meters during peak snow melt to less than a meter in width during low flow periods. Depth ranged from 2–20 cm. Larvae and pupae were occasionally found laterally at the substrate/water line of the larger rocks present in the small steams. However, the majority of larvae and pupae were found by placing a small "kick-net" downstream of a "riffle" composed of 1 to 2 cm pebbles and disturbing the substrate with a stick. While occasionally attached to the larger, fist sized rocks in the small streams, pupae, like larvae, are more frequently randomly scattered within the finer substrates, but unattached to surrounding substrates.

The primary taxonomic differences between *Allomyia* females are contained in the shapes and proportions of the IX and X segment lobes, supragenital plate, vulval scale, vaginal vestibule and vaginal apparatus (see Schmid 1998, fig. 277–278). A peculiarity of the genus is a two-part vaginal apparatus, which is distinct in lateral view. The dorsal portion is the strongly sclerotized, keyhole-like, vaginal apparatus typically figured in ventral view illustrations. A ventral sac-like structure also appears as circular striations in a few illustrations (e.g., Ross 1950, fig. 10). This ventral sac-like structure is fibrous and possibly musculated. It appears to be easily over-cleared during specimen preparation and therefore overlooked and not drawn in many illustrations. This sac-like structure, being flexible, is also found in different positions in different specimens, and therefore, careful attention must be made during examination and interpretation.

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