



STUDIES ON SWELTSA TOWNESI AND A NEW SPECIES, SWELTSA SALIX, FROM NORTHERN CALIFORNIA (PLECOPTERA: CHLOROPERLIDAE)

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ABSTRACT

Sweltsa townesi is redescribed and refigured using scanning electron micrographs and available records are provided from its known range in the Sierra Nevada Mountains of California and Nevada. *Sweltsa salix* sp. n. from the Klamath River drainage in the Coast Range and the upper Sacramento River drainage of California is described for the male and female, and compared with its closest congener, *S. townesi*.

Keywords: Plecoptera, stonefly, Chloroperlidae, *Sweltsa*, new species, Sierra Nevada and Coast Range, California and Nevada

INTRODUCTION

Stark et al. (2009) listed 23 *Sweltsa* species from western North America. Of these, two species were recently added. Stark and Baumann (2007) described *S. yurok* from northwestern California and Kondratieff and Baumann (2009) added *S. durfeei* from the northern Rocky Mountains. Several stonefly species have been described from tributaries of Willow Creek in Humboldt Co., California – part of the greater Klamath-Trinity River system - since 1987 (Baumann and Lauck 1987; Nelson and Baumann 1990; Stark and Baumann 2001; Baumann and Lee 2007; Baumann and Lee 2009; Baumann and Kondratieff 2009). Therefore, it was not surprising to discover an undescribed *Sweltsa* from the mainstem of Willow Creek. Further study of material from northern California showed this new stonefly occurs in additional tributaries of the Klamath and Trinity Rivers and the McCloud River, historically a tributary of the Pit River in the upper Sacramento

River drainage (Pacific Gas and Electric Company 1962). *Sweltsa salix* sp. n. is similar in appearance to *S. townesi* (Ricker). In this paper, we describe *S. salix*, redescribe *S. townesi*, and compare the two species using SEM images.

MATERIAL AND METHODS

Specimens were studied from the following collections: Brigham Young University Collection (BYUC), Provo, Utah; C.P. Gillette Museum of Arthropod Diversity (CSUC), Fort Collins, Colorado; United States National Museum (USNM) Washington, D.C.; Richard Bortorff Collection (RLBC), Placerville, California; and Jonathan Lee Collection (JJLC), Eureka, California.

Adult characters were studied using a WILD M8 stereomicroscope and a PHILIPS XL30 ESCM FEG scanning electron microscope at Brigham Young University, Provo, Utah. Adult and larval characters were studied using a ZEISS Stemi SV11 stereomicroscope in Eureka, California.

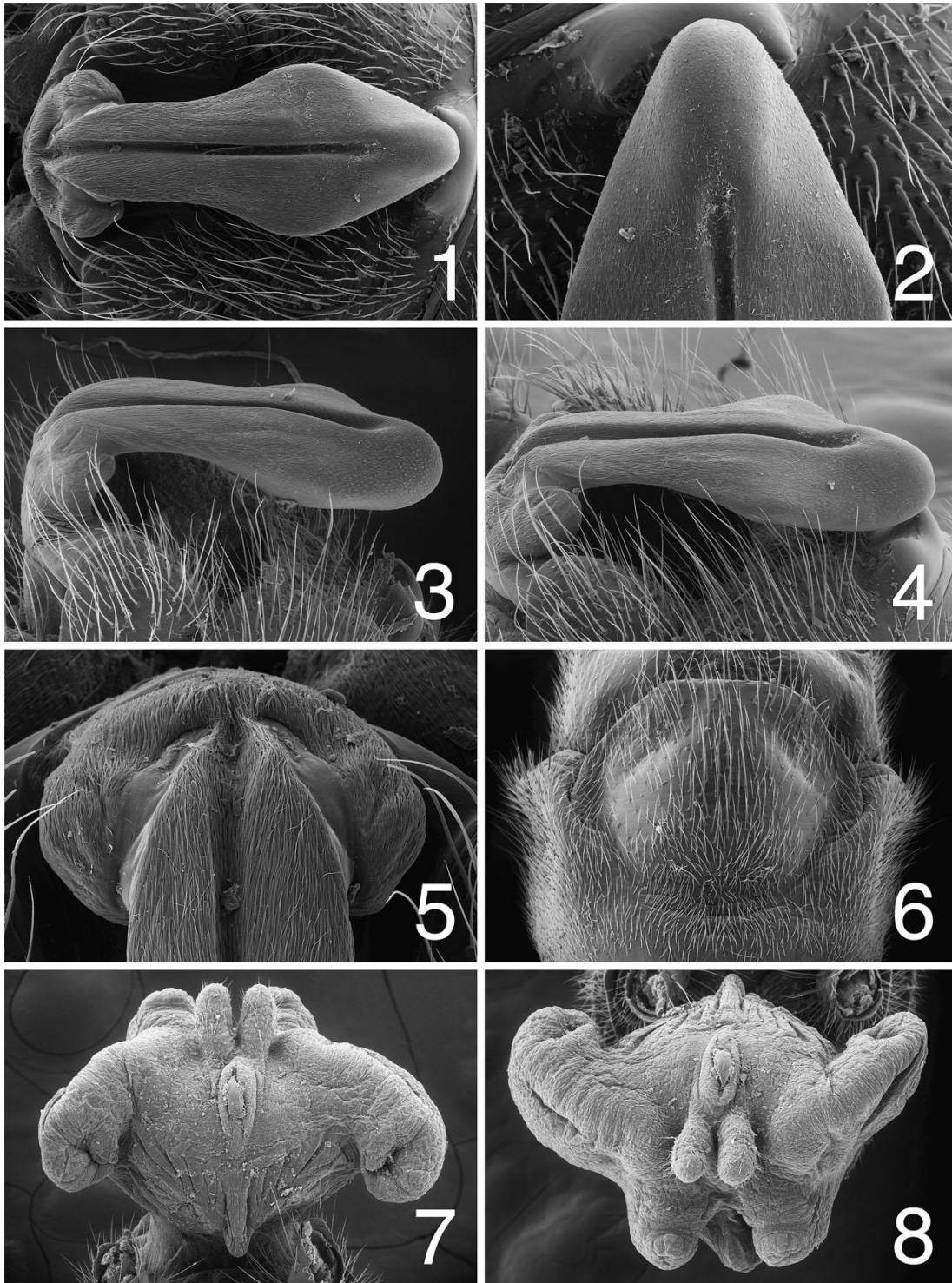
***Sweltsa townesi* (Ricker)**

(Figs. 1-8)

Alloperla (*Sweltsa*) *townesi* Ricker 1952:184. Holotype ♂, Dardanelle (Tuolumne Co.) California.

Material examined. CALIFORNIA: Alpine Co., West Fork Carson River, Hwy 88, Blue Lakes Road, 5 mi. NE Carson Pass, 12-VII-1995, R.L. Bottorff, 5♂, 2♀ (RLBC); West Fork Carson River, Hope Valley Campground, 21-VI-2006, R.W. Baumann & B.C. Kondratieff, 5♂, 3♀ (BYUC); West Fork Carson River, Kit Carson Campground, 21-VI-2006, R.W. Baumann & B.C. Kondratieff, 19♂, 14♀ (BYUC); West Fork Carson River, Hwy 88, Sorensens, 12-VII-1995, R.L. Bottorff, 1♂, 2♀ (RLBC); West Fork Carson River, Blue Lakes Road, Hope Valley, 5 mi. SW Sorensens, 27-VII-1995, R.L. Bottorff, 4♂, 5♀ (RLBC); Pleasant Valley Creek, SW Markleeville, 21-VI-2006, R.W. Baumann & B.C. Kondratieff, 1♂, 6♀ (BYUC); Willow Creek, 4 mi. N Sorensens, 27-VII-1995, R.L. Bottorff, 1♂, 4♀ (RLBC); Wolf Creek, Wolf Creek Campground, 21-VI-2006, R.W. Baumann & B.C. Kondratieff, 4♂, 3♀ (BYUC). **El Dorado Co.,** Silver Fork American River, 2 mi. N Kyburz, 1-VI-1990, Eichlin & Kinnee, 1♂ (BYUC); Silver Fork American River, Silver Fork Campground, 19-VI-2009, R.W. Baumann & B.C. Kondratieff, 6♂, 8♀ (BYUC); North Fork Cosumnes River, Capps Crossing, 6 mi. E Grizzly Flat, 31-V-1981, R.L. Bottorff, 2♂, 2♀ (RLBC); 18-VI-2009, Baumann, Kondratieff & Bottorff, 3♂, 16♀ (BYUC); North Fork Cosumnes River, Meiss Ranch, 10 mi. E Grizzly Flat, 14-VII-1982, R.L. Bottorff, 5♂, 6♀ (RLBC); North Fork Cosumnes River, Sciaroni Crossing, 2 mi. N Grizzly Flat, 4-VI-1982, R.L. Bottorff, 5♂, 1♀ (RLBC); North Fork Cosumnes River, Sweeneys Crossing, 3 mi. E Somerset, 9-V-1986, R.L. Bottorff, 1♂, 3♀ (RLBC); Steely Fork, Cosumnes River, near Grizzly Flat, 31-V-2000, Terry & Winkler, 8♂, 8♀ (BYUC); Station Creek, NE Packsaddle Pass, 19-VI-2009, R.W. Baumann & B.C. Kondratieff, 8♂, 4♀ (BYUC); tributary, Silver Creek, Wrights Lake, 19-VI-2009, R.W. Baumann & B.C. Kondratieff, 1♂, 2♀ (BYUC); South Fork Silver Creek, Silver Creek Campground, 19-VI-2009, R.W. Baumann & B.C. Kondratieff, 9♂, 13♀ (BYUC). **Nevada Co.,** Kiln Creek, Sagehen Creek Campground, 23-VI-2009, R.W. Baumann & B.C. Kondratieff, 9♂, 5♀ (BYUC); Prosser Creek, Hwy 89,

N Truckee, 24-VI-2009, Baumann, Kondratieff & Szczytko, 1♂ (BYUC); Rattlesnake Creek, Woodchuck Flat Campground, 22-VI-2009, Baumann, Kondratieff & Szczytko, 22♂, 15♀ (BYUC); Sagehen Creek, Sagehen Creek Biological Station, 30-VI-1965, A.L. Sheldon, 10♂, 26♀ (BYUC); 24-VI-1980, Baumann, Stanger & Clark, 41♂, 25♀ (BYUC); 19-VI-1985, R.W. Baumann & C.R. Nelson, 2♂, 2♀ (BYUC); 23-VI-2009, R.W. Baumann & B.C. Kondratieff, 43♂, 37♀ (BYUC); (23-24)-VI-09, J.J. Lee, 12♂, 5♀ (JJLC); Truckee River, above Truckee, 17-VI-2009, R.W. Baumann & B.C. Kondratieff, 1♂, 1♀ (BYUC). **Mono Co.,** Browning Creek, Hwy 108, Leavitt Meadow Campground, 26-VI-1980, Baumann, Stanger and Clark, 10♂, 9♀ (BYUC); West Fork Walker River, Hwy 108, Sonora Bridge Campground, 26-VI-1980, Baumann, Stanger & Clark, 4♂, 2♀ (BYUC). **Placer Co.,** Bear Creek, Alpine Meadows, 24-VI-2009, Baumann, Kondratieff & Szczytko, 14♂, 15♀, (BYUC); South Fork Bear Creek, near Lake Tahoe, 16-VII-2001, I. Chan, 1♀ (BYUC); Blackwood Creek, W Kaspian, near Lake Tahoe, 19-VI-2009, R.W. Baumann & B.C. Kondratieff, 9♂, 6♀ (BYUC); Middle Martis Creek, Hwy 267, near Lake Tahoe, 24-VI-1980, Baumann, Stanger and Clark, 2♂, 2♀ (BYUC); Martis Creek, Hwy 267, south of Truckee, 24-VI-1980, Baumann, Stanger and Clark, 1♀ (BYUC); Onion Creek, Onion Creek Experimental Forest, 22-VI-2009, Baumann, Kondratieff & Szczytko, 4♂, 5♀ (BYUC); Shirttail Creek, 18-V-1983, Baumann, Mower & Whiting, 3♂, 8♀ (BYUC). **Plumas Co.,** Benner Creek, Benner Creek Campground, 6 mi. N Chester, 25-VI-1980, Baumann, Stanger & Clark, 3♂, 1♀ (BYUC); Domingo Spring, Domingo Spring Campground, 8-VI-2004, R.W. Baumann & B.P. Stark, 1♂ (BYUC); North Fork Feather River, Feather River Meadows, 25-V-2007, R.W. Baumann & B.C. Kondratieff, 1♀ (BYUC); Little Grizzly Creek, Hwy 112, SE Taylorsville, 30-V-1991, R.W. Baumann & B.P. Stark, 5♂, 1♀ (BYUC); Mosquito Creek, jct. North Fork Feather River, 5 mi. S Caribou, 25-VI-1980, Baumann, Stanger & Clark, 2♀ (BYUC); Schneider Creek, University of California Forestry Camp, Meadow Valley, 2-VI-1984, C.A. Miles, 2♂, 2♀ (BYUC); Warner Creek, Warner Creek Campground, 5 mi. NW Chester, 25-VI-1980, Baumann, Stanger & Clark, 1♀ (BYUC). **Shasta Co.,** North Fork Battle Creek, Hwy 44, E Shingletown, 25-V-2007, R.W. Baumann & B.C. Kondratieff, 1♂, 1♀ (BYUC); Hat Creek, Hwy 89, Honn Campground,



Figs. 1-8. *Sweltsa townesi*, male and female genitalia and aedeagus. 1. epiproct, dorsal, S F Stanislaus River, CA; 2. epiproct, apex, dorsal, S F Stanislaus River, CA; 3. epiproct, lateral, Galena Creek, NV; 4. epiproct, dorsolateral, S F Stanislaus River, CA; 5. epiproct, base, dorsal, S F Stanislaus River, CA; 6. female, subgenital plate, ventral, S F Stanislaus River, CA; 7. aedeagus, dorsal, Galena Creek, NV; 8. aedeagus, terminal, Galena Creek, NV.

25-V-2007, R.W. Baumann & B.C. Kondratieff, 2♂ (BYUC, CSUC); Hatchet Creek, Hwy 299, Moose Camp Road, 24-V-2007, R.W. Baumann & B.C. Kondratieff, 9♂, 16♀ (BYUC); Roaring Creek, Big Bend Road, N Wengler, 24-V-2007, R.W. Baumann & B.C. Kondratieff, 9♂, 9♀ (BYUC). **Sierra Co.**, Cottonwood Creek, Cottonwood Creek Campground, 24-VI-1980, Baumann, Stanger & Clark, 1♂ (BYUC); South Branch Dog Creek, Dog Valley, 20-VI-2006, R.W. Baumann & B.C. Kondratieff, 5♀ (BYUC); 21-VI-2009, R.W. Baumann & B.C. Kondratieff, 3♂, 5♀ (BYUC); Indian Creek, Hwy 49, S Indian Hills, 17-VI-2009, R.W. Baumann & B.C. Kondratieff, 7♀ (BYUC); Little Truckee River, Hwy 89, S Sierraville, 24-VI-1980, Baumann, Stanger & Clark, 1♂, 1♀ (BYUC); North Yuba River, Hwy 49, near Yuba Pass, 24-VI-1980, Baumann, Stanger & Clark, 8♂, 2♀ (BYUC). **Tehama Co.**, Battle Creek, Hwy 36, Battle Creek Campground, 30-V-1991, R.W. Baumann & B.P. Stark, 5♂ (BYUC); North Fork Battle Creek, Hwy A-6, SW Shingletown, 26-IV-1987, Baumann, Stark, Nelson & Wells, 1♀ (BYUC); South Fork Battle Creek, Hwy A-6, SW Shingletown, 26-IV-1987, Baumann, Stark, Nelson & Wells, 1♀ (BYUC); North Fork Deer Creek, Hwy 36, 2-VII-1975, D.G. Denning, 1♂, 1♀ (BYUC). **Tuolumne Co.**, Eagle Creek, Hwy 108, Dardanelle, 26-VI-1980, Baumann, Stanger & Clark, 2♂, 4♀ (BYUC); Niagara Creek, Hwy 108, Niagara Creek Campground, 26-VI-1980, Baumann, Stanger & Clark, 1♂, 2♀ (BYUC); Rush Creek, Rush Creek Campground, near Harden Flats, 27-VI-1980, Baumann, Stanger & Clark, 1♀ (BYUC); South Fork Stanislaus River, Hwy 108, Strawberry, 26-VI-1980, Baumann, Stanger & Clark, 4♂, 4♀ (BYUC); 4-VII-1989, N.D. Penny, 1♂, 3♀ (BYUC); stream, jct. Middle Fork Stanislaus River, Deadman Campground, 26-VI-1980, Baumann, Stanger & Clark, 2♂ (BYUC); stream, Hwy 108, Eureka Valley Campground, 26-VI-1980, Baumann, Stanger & Clark, 3♂ (BYUC). **NEVADA: Douglas Co.**, Genoa Creek, W Genoa, 16-VI-2009, R.W. Baumann & B.C. Kondratieff, 11♂, 15♀. **Washoe Co.**, creek, near Lake Tahoe, 5-VII-1947, C.P. Alexander, 2♀ (USNM); Galena Creek, Hwy 431, near Galena Summit, 20-VI-2006, R.W. Baumann & B.C. Kondratieff, 13♂, 7♀ (BYUC); Thomas Creek, Thomas Creek Trailhead, south of Reno, 16-VI-2009, R.W. Baumann & B.C. Kondratieff, 23♂, 16♀

(BYUC); Whites Creek, Whites Creek Trailhead, S Reno, 16-VI-2009, R.W. Baumann & B.C. Kondratieff, 42♂, 36♀ (BYUC).

Male. General body color yellow with brown markings. Head yellow, ocellar rings dark brown; brown mark forward of anterior ocellus to frontal margin masking center of M line; brown behind eyes. Pronotum wider than long, yellow with dark brown margins and rugosities. Abdomen with dark brown median stripe from tergum 1 to the anterior half of tergum 8. Lateral brown marks anteriorly on at least segments 1-4; anteromedial transverse, anteriorly sclerotized, scalloped ridge on tergum 9, often with unevenly crenulate margin. Epiproct tip chocolate brown; in dorsal aspect (Fig. 1) spatulate, ca. twice as long as greatest width; narrowing slightly from base then gradually widening to its greatest width at 2/3 length before narrowing to a bluntly pointed apex (Fig. 2); narrow median groove running from base to near apex (Figs. 1, 2, 5). In lateral aspect (Figs. 3, 4) narrow at base with club shaped apex; dorsal margin nearly straight with slight dip where median groove terminates, before rising to a club-shaped apex; ventral margin nearly straight in basal 1/3, becoming declivent at ca. 45°, then recurved to apex. Aedeagus membranous (Figs. 7, 8), tubular basally, expanded abruptly into thick, semicircular, plate-like process, with horn-like lateral extensions; dorsal margin bearing paired finger-like lobes medially, with an elongate covered orifice below the lobes (Figs. 7, 8) much like *Sweltsa exquisita* (Frison) in Kondratieff and Baumann (2009) Figs. 8, 9.

Female. General body color and markings similar to male but median brown mark on tergum 8 mostly restricted to anterior margin. Subgenital plate roughly hexagonal (Fig. 6), usually darker than surrounding sterna, hirsute, elevated anteriorly and centrally, posterior margin straight to slightly emarginate, extending at least ½ over sternum 9.

Distribution. *Sweltsa townesi* is well distributed in the heart of the Sierra Nevada near Lake Tahoe. It extends northward to Tehama County and southward to the Yosemite region but does not cross to the east slope of the Sierra except near Lake Tahoe in Nevada. *Sweltsa resima* Surdick replaces *S. townesi* on the east slope of the Sierra Nevada near Mount Whitney and ranges east to the White Mountains and southwest to Sequoia National Park.

Sweltsa salix sp. n.

(Figs. 9-16)

Material examined. Holotype ♂ from California, Humboldt Co., Willow Creek, East Fork Willow Creek Campground, 19-V-08, J.J. Lee. Paratypes: - **CALIFORNIA: Humboldt Co.**, Willow Creek, Hwy 299, East Fork Willow Creek Campground, 22-VI-1985, R.W. Baumann, C.R. Nelson & M. L. Whiting, 2♂, 1♀ (BYUC); 2-VI-2007, J.J. Lee, 3♂, 13♀ (BYUC); 5-VI-07, J.J. Lee, 4♂, 2♀ (JJLC); 19-V-08, J.J. Lee, 21♂, 10♀ (BYUC, JJLC); 25-V-09, J.J. Lee, 1♂, 3 nymphs, 1♂, 6♀ reared, 26-28-V-09 (JJLC); spring, East Fork Willow Creek Campground, 19-V-08, J.J. Lee, 1♂ (JJLC); 28-V-2008, J.J. Lee, 2♂, 3♀ (JJLC). **Siskiyou Co.**, McCloud River, Fowlers Campground, 6-VI-1965, S.G. Jewett, Jr., 2♂, 2♀ (BYUC); McCloud River, Hwy 89, Falls of the McCloud River, 25-V-2007, R.W. Baumann & B.C. Kondratieff, 103♂, 61♀, (BYUC, CSUC); Scott River, Scott River Road, Bridge Flat, J.J. Lee, 1♂ (BYUC). **Trinity Co.**, East Weaver Creek, East Weaverville Campground, 6-VI-2005, R.W. Baumann & B.C. Kondratieff, 1♂, 4♀ (BYUC). Holotype deposited at the California Academy of Sciences.

Male. Macropterous; body length 6.5–8 mm, forewing length 6.5–7.5 mm. General color dusky yellow with brown markings. Head yellow, ocellar rings dark brown, brown M mark forward of anterior ocellus evident to varying degrees. Pronotum wider than long, margin dark brown, widest laterally, brown rugosities lateral of median line. Meso-metanota with dark U mark. Abdominal terga 1–8 with median brown stripe, stripe terminates on tergum 8 as an oval mark on anterior one-half; lateral dark patches anteriorly on segments 1–4; anteromedial transverse, anteriorly sclerotized, scalloped ridge on tergum 9 (Figs. 11,12). In dorsal aspect (Figs. 9,11) epiproct tip spatulate, chocolate brown, length more than twice greatest width, median shallow channel at base gradually widens anteriorly (Fig. 13), anteromedial carina divides channel at midpoint, carina terminating as a raised knob short of apex (Figs. 10–12). In lateral aspect (Fig. 12) epiproct tip narrow at base expanding to a bulbous club distally, dorsal margin appearing slightly convex in proximal two-thirds before sloping upwards (carinate process) forming the apical club, ventral margin appearing

nearly straight before sloping upwards to form apical club. Aedeagus membranous (Figs. 15, 16), tubular basally, roughly triangular in dorsal aspect, posterolateral lobes appear slightly infolded, posteromedial margin with pair of small, elongate finger-like lobes, dorsal face bearing transverse, striate ridge, peaked medially, ventral face with median basal lobe and pair of smaller distolateral lobes.

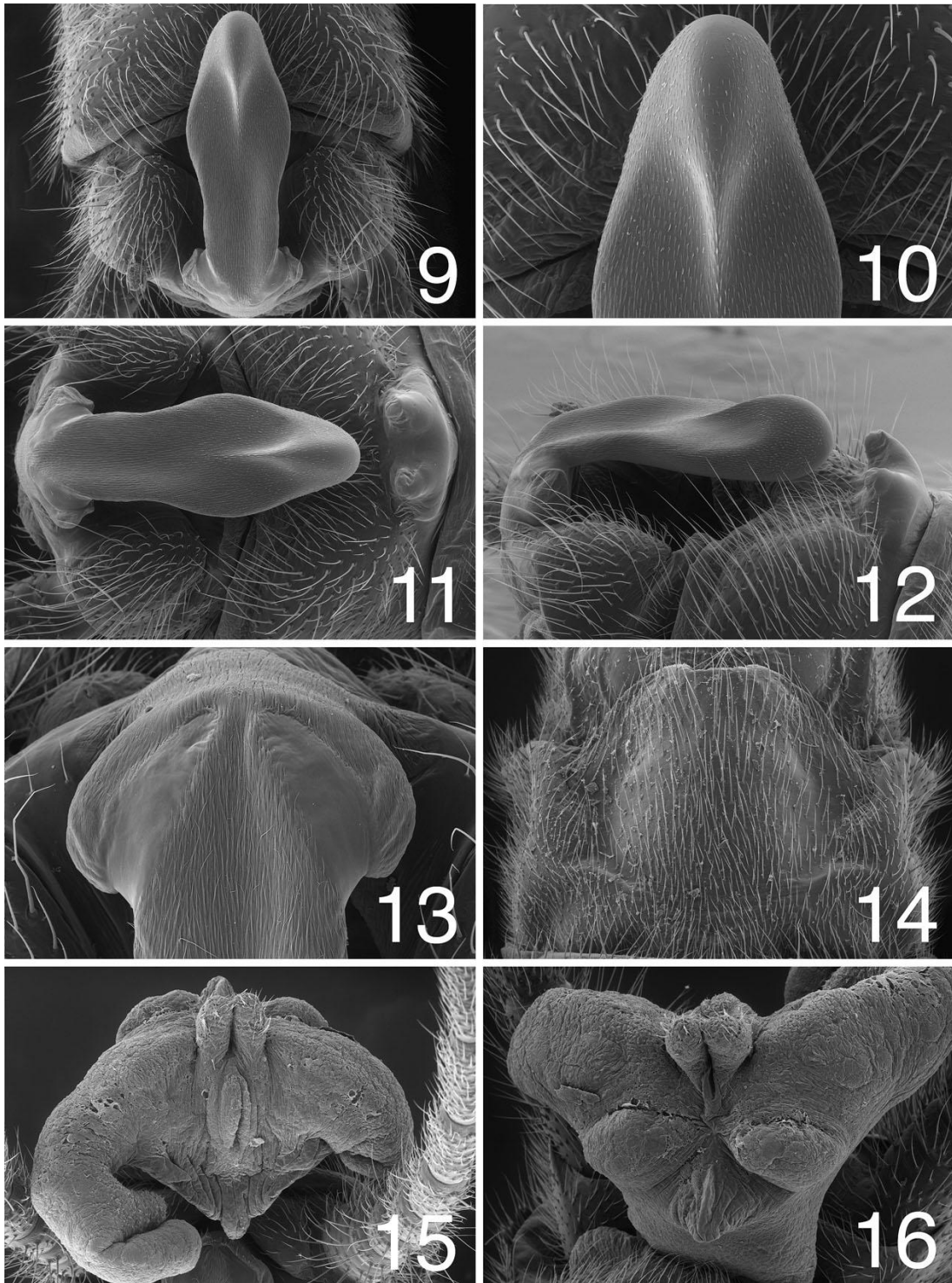
Female. Macropterous; body length 7.5–9 mm; forewing length 8.5–9 mm. General body color and markings similar to male but median brown mark on tergum 8 mostly restricted to anterior margin. Subgenital plate crudely hexagonal (Fig. 14), wider than long, elevated anteriorly and centrally, hirsute, extending at least one-half over sternum 9.

Larva. Characters for mature larva similar to description for *S. townesi* (Stewart and Stark 2005) although M-line centered on anterior ocellus is pale in specimens not exhibiting adult coloration beneath cuticle.

Etymology. The species epithet *salix* is based on the Latin word for willow. This not only has reference to the fact that the types were collected from Willow Creek but also that the adults are often found on streamside willows (*Salix* spp.).

Diagnosis. *Sweltsa salix* is closely related to *S. townesi* but they can be separated by the male epiproct. The epiproct of *S. townesi* possesses a distinct dorsomedial narrow groove extending from the base to near the apex (Figs. 1–5). The epiproct of *S. salix* possesses a broad, shallow dorsomedial channel extending from the base and bisected apically by a carinate knob (Figs. 9–13). The aedeagus of the two species is very similar in shape. Females can not be separated without associated males.

Distribution. Present collection records of *S. salix* indicate an interesting distribution pattern in the California Coast Range. It was collected from Willow Creek and East Weaver Creek, both medium sized tributaries of the Trinity River, and from the Scott River, a small river flowing into the middle Klamath River. *Sweltsa salix* was also collected on the east side of the Sacramento Valley from the McCloud River. We suspect it occurs in medium sized creeks and small rivers throughout the Klamath-Trinity watershed, however, a thorough search of material at BYUC did not produce *S. salix* specimens from streams adjacent to the McCloud River.



Figs. 9-16. *Sweltsa salix*, male and female genitalia and aedeagus. Willow Creek, East Fork Willow Creek Campground, CA. 9. male terminalia, dorsal; 10. epiproct, apex, dorsal; 11. epiproct, dorsal; 12. epiproct, lateral; 13. epiproct, base, dorsal; 14. female, subgenital plate, ventral; 15. aedeagus, dorsal; 16. aedeagus, terminal.

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