Stark, B.P. and A.B. Harrison. 2016. The banded-wing *Moselia* (Plecoptera: Leuctridae) revisited.
Illiesia, 12(09):42-58. Available online: http://illiesia.speciesfile.org/papers/Illiesia12-09.pdf

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THE BANDED-WING *MOSELIA* (PLECOPTERA: LEUCTRIDAE) REVISITED

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ABSTRACT
A new species is proposed for the leuctrid genus *Moselia* Ricker based primarily on scanning electron micrographs of male paraprocts. *Moselia zonata,* sp. n. is recognized from southern Oregon, Nevada and northern California. A diagnosis is provided to assist in identification of adult *M. infuscata* (Claassen) and *M. zonata* sp. n. The distribution of both species is summarized.

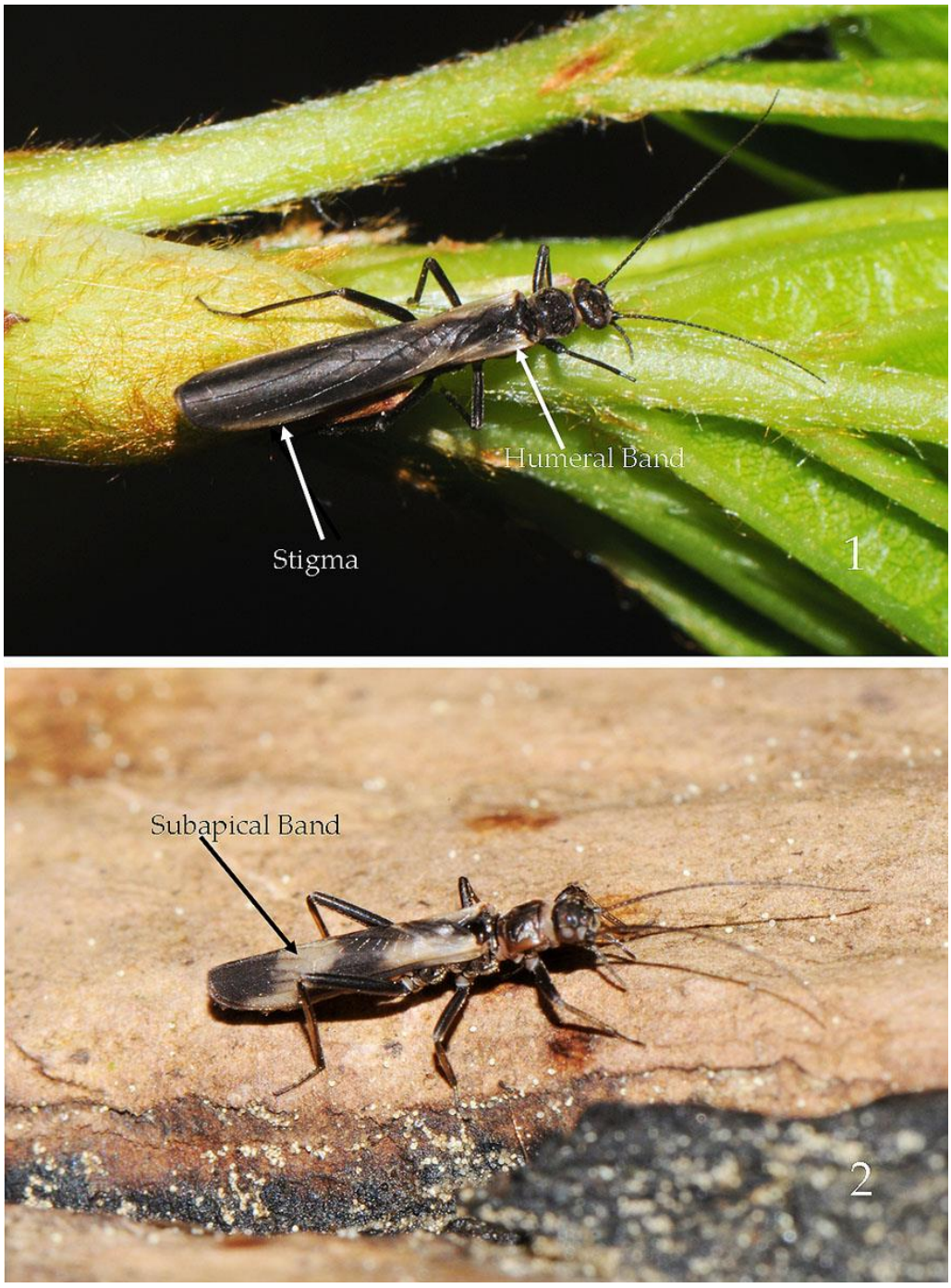
Keywords: Plecoptera, Leuctridae, *Moselia*, new species

INTRODUCTION

Claassen (1923) proposed *Leuctra infuscata* Claassen based on one male and two female specimens from Seattle, Washington, and four additional female specimens from two California sites. He provided figures of the dorsal aspect of the male terminalia of the holotype and a ventral view of the terminalia of one female. These, or slightly modified figures, were used by Needham & Claassen (1925), and an additional figure showing the lateral aspect of the holotype terminalia was also included in this monograph. Ricker (1943) proposed *Moselia* as a new monotypic subgenus for this species. Subsequently, Illies (1966) elevated the group to generic status. Jewett (1959) reported the distribution of the species as "British Columbia to California". At that time specimens were likely available for Oregon, though no records were published until Kerst & Anderson (1974, 1975) provided the Oak Creek, Corvallis, Benton Co., Oregon records. The first record from Nevada was reported by Sheldon (1979). DeWalt et al. (2016) currently indicates the genus is known from British Columbia, California, Nevada, Oregon and Washington.

Recently, Gill et al. (2015) recognized a genetically distinct "banded-wing *Moselia* phenotype" in southern Oregon and northern California. Analysis of DNA barcode sequences (mitochondrial COI gene) for four populations from California and Oregon demonstrated mean genetic distances of 3-6 % across banded and non-banded

specimens. They offered that "…no apparent differences…" in male genitalia existed between the two phenotypes. A comprehensive study of DNA barcodes across the range of *Moselia* is highly desirable, but is beyond the scope of this study. However, we have found strong support for an additional species within the banded-wing populations of *Moselia* through the use of scanning electron microscopy on the paraprocts of both species.



Figs. 1-2. Adult *Moselia* habitus. 1. *M. infuscata*, Oregon, Clackamas Co., Still Creek Campground. 2. *M. zonata*, Oregon, Jackson Co., Sheep Creek, Wagner Gap Road.

MATERIALS AND METHODS

Specimens used for scanning electron microscopy were collected primarily with beating sheets, and archived in 75-80% ethanol. Abdomens were clipped in the apical third and dehydrated through an ethanol series (90 %; 95 %; 100 %). Further dehydration was accomplished using hexamethyldisilizane for an hour, after which specimens were attached to aluminum stubs with double stick copper tape. Male specimens were attached to the stub right profile, while female specimens were attached ventral side up. Eggs of the new species were also examined. Specimens were coated with gold-palladium in a Hummer coater and examined using an Amray 1810D scanning electron microscope. The holotype of the new species is deposited in the United States National Museum of Natural History, Washington, DC (USNM). Other specimens are archived in the Bill P. Stark Collection, Mississippi College, Clinton, Mississippi (BPSC), C.P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado (CSUC), Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah (BYUC), Jonathan J. Lee Collection, Eureka, California (JJLC), or the Richard L. Bottorff Collection, South Lake Tahoe, California (RLBC).

Specimen localities without existing GPS coordinates were georeferenced using ACME Mapper 2.1 (http://mapper.acme.com). All coordinates were converted to decimal degrees to 4-5 significant figures. Specimen data were mapped using ArcGIS version 10.3.1. Specimen data available at: http://illiesia.speciesfile.org/papers/Moselia_specimen_data.csv

RESULTS AND DISCUSSION

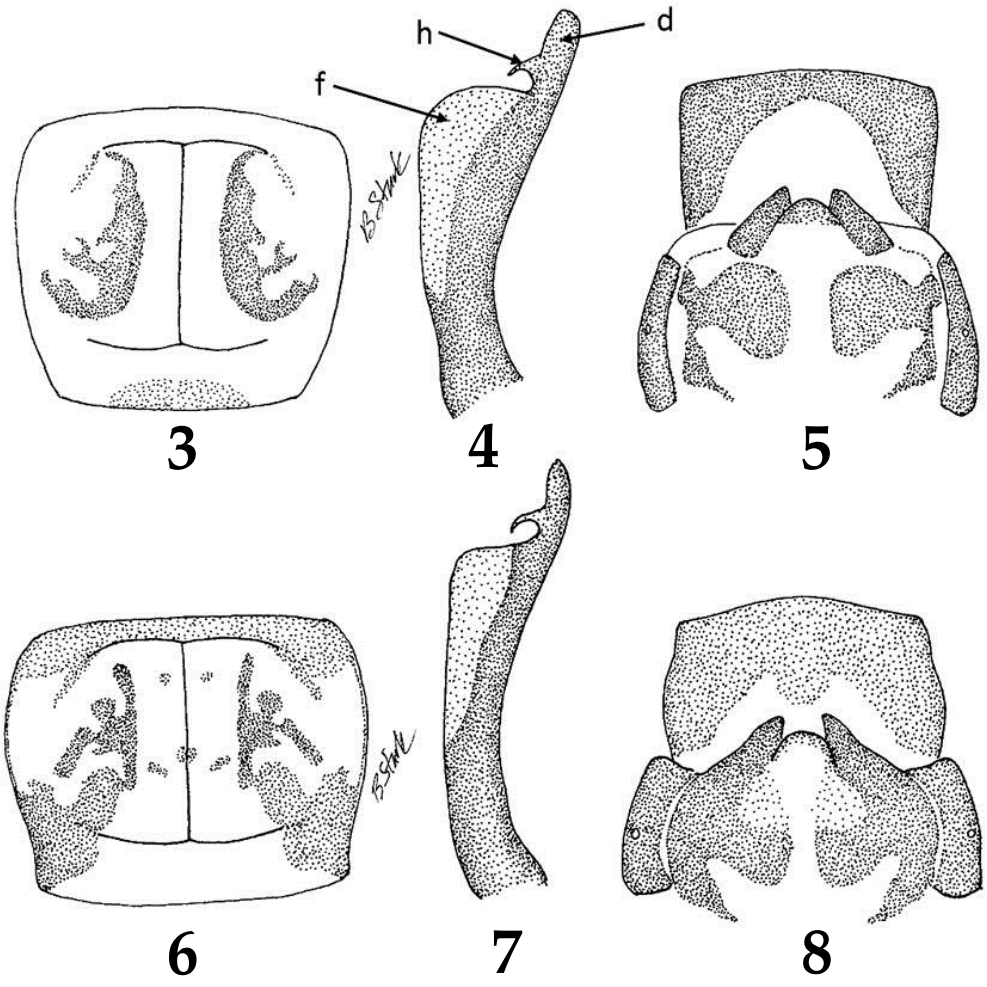
Moselia zonata Stark & Harrison, sp. n.

Banded-wing Needlefly
(Figs. 2, 3-8, 9-40, 42, 52)

http://lsid.speciesfile.org/urn:lsid:Plecoptera.speciesfile.org:TaxonName:492220

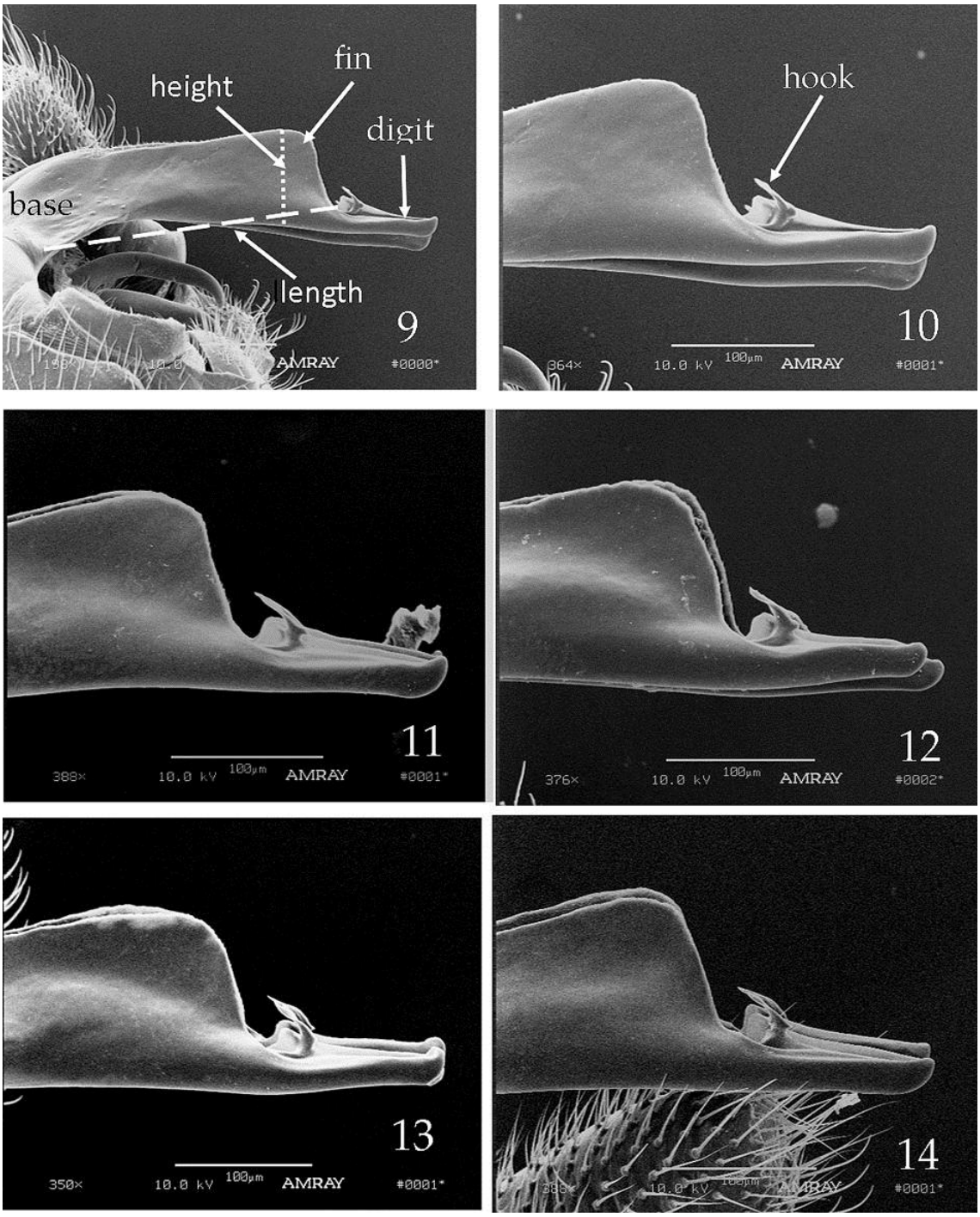
Moselia infuscata: Gill et al., 2015: 593 (in part), "Banded-wing phenotype", population 1

Material examined. Holotype ♂, **OREGON, Jackson Co.**, Sheep Creek, Wagner Gap Road, NFD 22 Rd, 10.5 miles SW Talent, 42° 06.442'N, 122° 47.921'W, 22 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone (USNM). Paratypes: **CALIFORNIA: Butte Co.**, Butte Creek, Humboldt Rd, above Colby Creek, 40.11138° N, 121.49526° W, 25 May 2014, B.C. Kondratieff, C.J. Verdone, 15♂, 9♀ (CSUC), 1♂ SEM. **Del Norte Co.**, small falls into Patrick Creek, 41° 54.321' N, 123° 51.357' W, 24 May 2014, B. Stark, A.B. Harrison, 1♀ (BPSC). **Humboldt Co.**, tributary of Willow Creek, 2.7 miles E Berry Summit, Hwy 299, 19 May 1998, S.W. Szczytko, B. Stark, C.R. Nelson, I. Sivec, 5♂, 14♀ (BYUC). 2♀ SEM. tributary of Willow Creek, 2.5 miles E of Berry Summit, 19 May 1998, B. Stark, I. Sivec, C.R. Nelson, S.W. Szczytko, 2♂, 1♀ (BPSC), 4♂, 5♀ (BYUC). tributary of Willow Creek, 0.5 miles E of Cedar Creek, Hwy 299, 25 April 1987, R.W. Baumann, B. Stark, C.R. Nelson, S. Wells, 8♂, 5♀ (BPSC), 15♂, 15♀ (BYUC), 3♂, 1♀ SEM. tributary of Ruby Creek, first stream E of highway crossing, 22 April 1993, G.R. Fiala, 41♂, 25♀ (BYUC), 1♂ SEM. small creek N of Fish Lake, 24 April 1987, R.W. Baumann, B. Stark, C.R. Nelson, S. Wells, 15♂, 10♀ (BYUC), 1♂ SEM. small stream, 0.5 miles E Cedar Creek, Hwy 299, 25 April 1987, B. Stark, R.W. Baumann, C.R. Nelson, S. Wells, 8♂, 5♀ (BPSC), 2♂ SEM. Prairie Creek, Prairie Creek Redwoods State Park, Drury Parkway at trailhead, 41° 24.459' N, 124° 01.827' W, 25 May 2014, B. Stark, A.B. Harrison, 1♂ (BPSC), 1♂ SEM. tributary Prairie Creek, 10.6 miles N Orick, 22 May 1982, B. Stark, D. Ziegler, 1♂ (BPSC). **Siskiyou Co.**, small stream, 41.90335° N, 123.90345° W, 19 April 2013, C. Kerst, 3♂, 1♀ (CSUC), 1♂ SEM. **Tehama Co.**, South Fork Calf Creek, Hwy 32 at FR 27N06, 26 April 2010, B.C. Kondratieff, R.W. Baumann, 8♂, 2♀ (CSUC) 1♂ SEM. **Trinity Co**., Bidden Creek, W of Cedar Flat, Hwy 299, 25 April 1987, R.W. Baumann, B. Stark, C.R. Nelson, S. Wells, 4♂, 8♀ (BYUC), 1♂ SEM. unknown stream, Hwy 36, Mile 12.12, South Fork Mountain, approximate co-ordinates 40.39366° N, 123.41517° W, 2 May 2014, J.J. Lee, 5♂, 6♀ (JJLC), 1♂, 1♀ SEM. **OREGON: Curry Co.**, Fly Catcher Spring, 12 miles E Hwy 101, Hunter Creek Rd, 42° 22' N, 124° 18' W, 9 June 2005, R.W. Baumann, B.C.

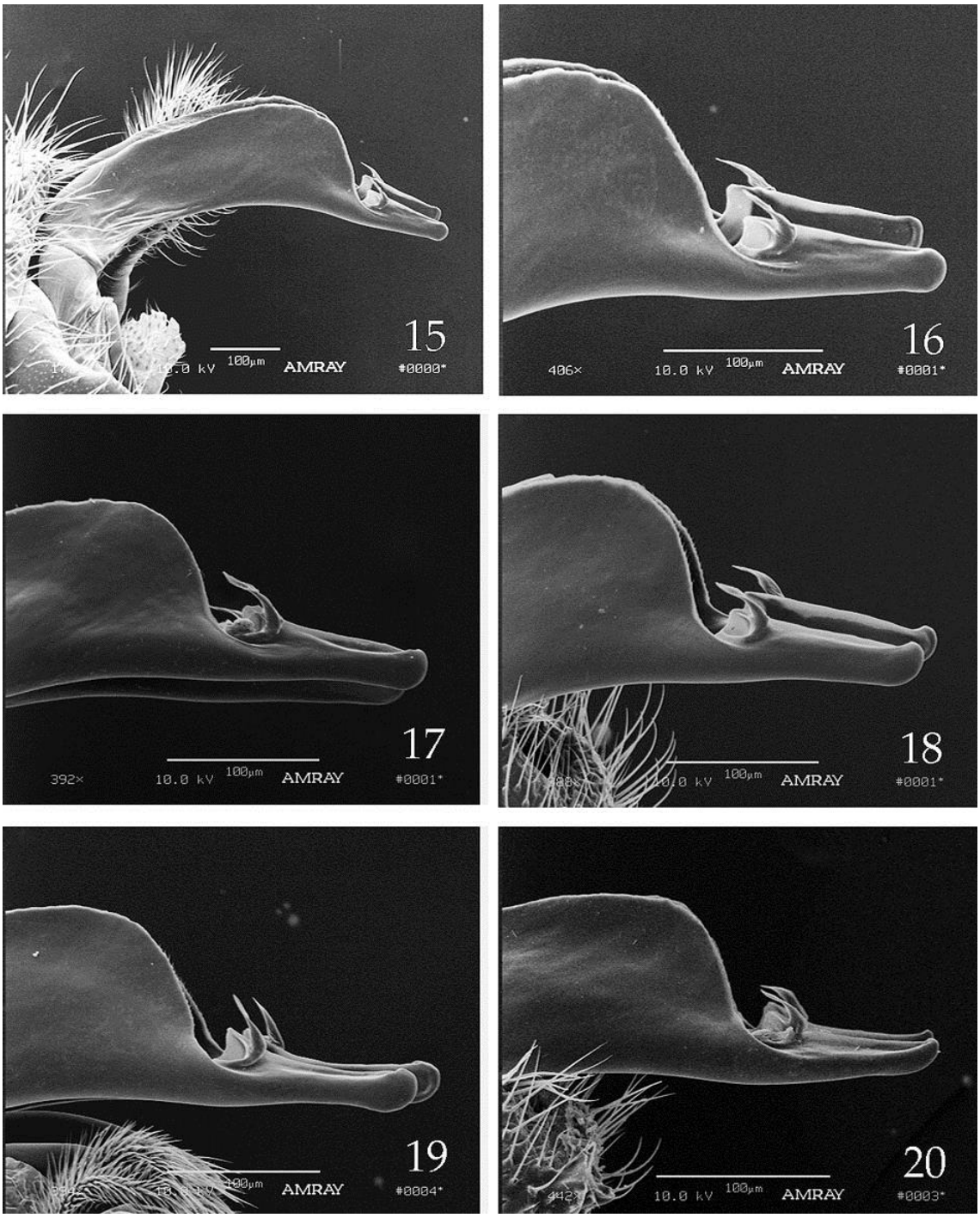


Figs. 3-8. *Moselia zonata* structures, 3-5, California, Humboldt Co., 0.5 miles E Cedar Creek, Hwy 299. 3. Adult pronotum. 4. Right male paraproct, lateral aspect (d = digit, f = fin, h = hook). 5. Female abdominal sterna 8-9. 6-8, California, Plumas Co., Domingo Springs. 6. Adult pronotum. 7. Right male paraproct, lateral aspect. 8. Female abdominal sterna 8-9.

Kondratieff, 10♂, 13♀ (BYUC), 2♂ SEM. **Jackson Co.**, Ashland Ski Road seeps, 2.5 miles W Interstate Highway 5, 9 June 2004, B. Stark, R.W. Baumann, 8♂, 17♀ (BPSC), 1♂, 1♀ SEM. Jim Creek, Wagner Gap Road, NFD 22 Rd, 11.1 miles SW Talent, 42.10609 N, 122.7874 W, 22 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone, 1♂, 1♀ (BPSC), 4♂, 2♀ (CSUC), 1♂ SEM. Sheep Creek, Wagner Gap Road, NFD 22 Rd, 10.5 miles SW Talent, 42.11254 N, 122.7858 W, 22 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone, 4♂, 2♀ (BPSC), 4♀ (CSUC), 1♂ SEM. Split Rock Creek, Wagner Creek Road, 12.4 miles SW Talent, 42.17018 N, 122.784174 W, 22 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone, 2♂, 1♀ (BPSC), 6♀ (CSUC), 1♂ SEM. Wagner Creek, Wagner Gap Road, 5.9 miles SW Talent, 42.17018 N, 122.784174 W, 22 May 2014, B.C. Kondratieff, B. Stark, J.C. Sandberg, C.J. Verdone, 9♂, 5♀ (CSUC). **Josephine Co.**, Lake Creek and seeps along NF-070,42.09274 N, 123.37444 W, 21 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone, 1♂ (BPSC).



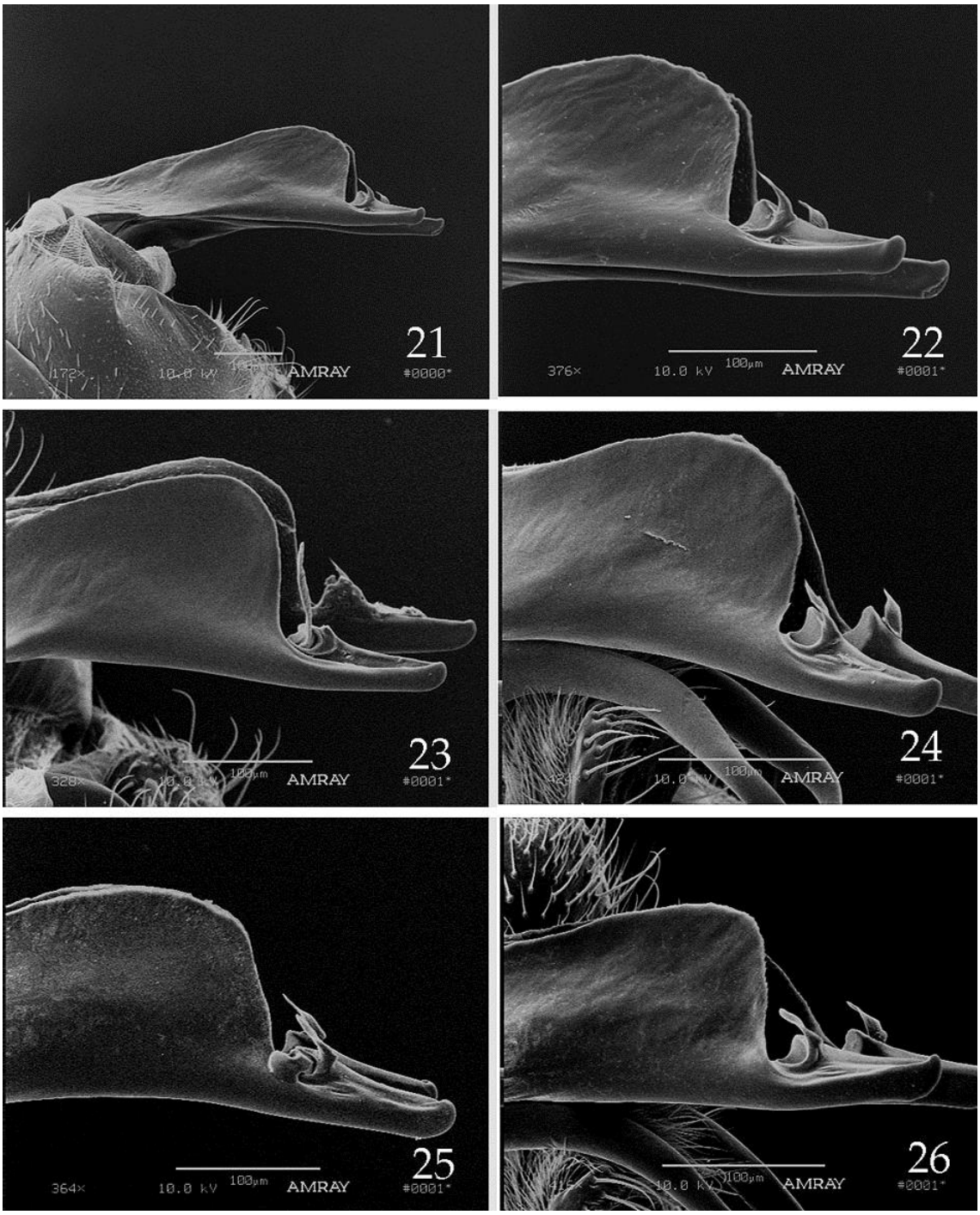
Figs. 9-14. *Moselia zonata* right paraproct, lateral aspect. 9. Big Springs, Mt. Shasta, California. 10. Big Springs, Mt. Shasta, Siskiyou Co., California. 11. Black Butte Spring, Siskiyou Co., California. 12. Domingo Springs, Plumas Co., California. 13. Old Boundary Spring, Shasta Co., California. 14. Tributary Big Chico Creek, Butte Co., California.



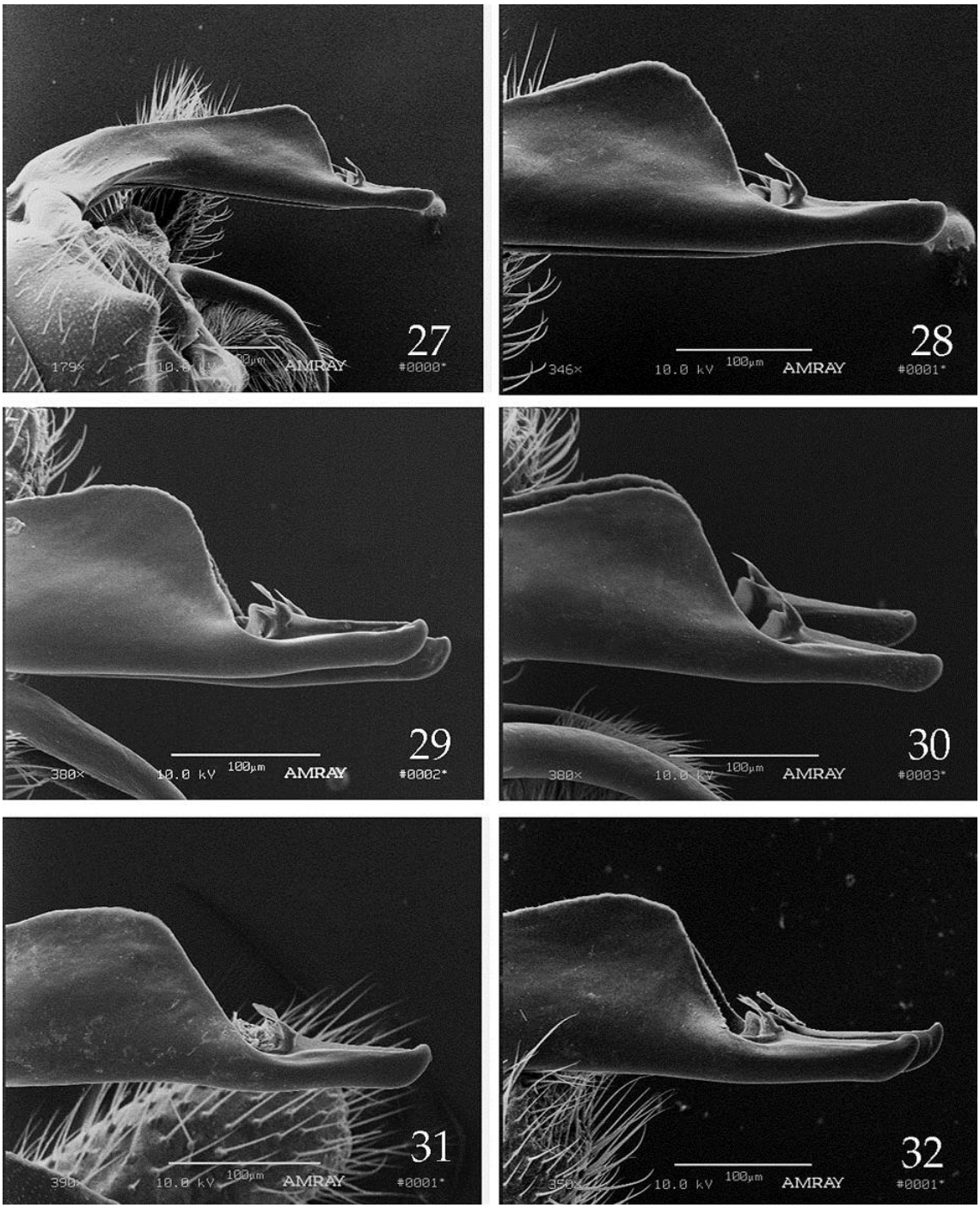
Figs. 15-20. *Moselia zonata* right paraproct, lateral aspect. 15. Oregon, Jackson Co., Split Rock Creek, Wagner Creek Rd. 16. Oregon, Jackson Co., Split Rock Creek, Wagner Creek Rd. 17. Oregon, Jackson Co., Jim Creek, Wagner Gap Rd. 18. Oregon, Jackson Co., Ashland Ski Rd seeps. 19. Oregon, Jackson Co., Sheep Creek, Wagner Gap Rd. 20. Oregon, Curry Co., Fly Catcher Spring.

Additional specimens: CALIFORNIA: Alpine Co., Willow Creek, 6 miles NW Woodfords, 38.827053 N, 119.9033331 W, 27 July 1995, R.L. Bottorff, 1♂(RLBC), 1♂SEM. **Butte Co.**, spring tributary Big Chico Creek, Hwy 32, 40° 08′ N, 121° 40′ W, 26 April 2010, R.W. Baumann, B.C. Kondratieff, 12♂, 7♀ (BYUC), 2♂SEM. **El Dorado Co.**, Bendorf Spring, NE Grizzly Flat, 3 May 1995, R.L. Bottorff, 7♂, 2♀ (RLBC), 1♂ SEM. tributary North Cosumnes River, 11 miles E Grizzly Flat, 38.64018 N, 120.31283 W, 30 June 1986, R.L. Bottorff, 1♂ (RLBC), 1♂ SEM. North Fork Cosumnes River, Sciaroni Crossing, 3 miles N Grizzly Flat, 38.669092 N, 120.533568 W, 20 April 1981, R.L. Bottorff, 1 ♂ (RLBC). **Glenn Co.**, spring fed creek, 3 miles above Salt Creek, 15 March 1984, J. Stanger, 3♂, 1♀ (BYUC), 2♂SEM. **Mendocino Co.**, Caspar Creek, Jackson Demonstration State Forest, 18 May 1998, B. Stark, C.R. Nelson, S.W. Szczytko, I. Sivec, 1♂, 1♀ (BPSC), damaged paraprocts. Irish Gulch, 1 mile above Hwy 1, 39° 01.37′ N, 123° 59.57′ W, 7 April 2006, L.D. Bottorff, 1♂, 3♀ (RLBC), 1♂SEM. **Mono Co.**, west source spring on E North Canyon Creek, ca. 7.6 miles ESE Mono Mills, 37.8591 N, 118.8216 W, 1 August 1998, M. Myers, 1♂ (BYUC). **Nevada Co.**, spring on Sagehen Creek, Sagehen Creek Biological Station, 39.43° N, 120.25° W, 20 June 2009, R.W. Baumann, B.C. Kondratieff, 9♂, 13♀, 2♂SEM. **Plumas Co.**, Domingo Springs, Feather River Rd/Old Red Bluff Rd, 40° 21.672′ N, 121° 20.842′ W, 26 May 2014, B. Stark, A.B. Harrison, 14♂, 6♀ (BPSC), 1♂SEM. same site, 8 June 2004, B. Stark, R.W. Baumann, 8♂, 16♀ (BPSC). same site, 25 May 2007, B.C. Kondratieff, R.W. Baumann, 12♂, 13♀ (CSUC). **Shasta Co.**, East Fork Hat Creek, Hwy 89, Lassen Volcanic National Park, 8 June 2004, B. Stark, R.W. Baumann, 1♂(BPSC), 1♂ SEM. Old Boundary Spring, Lassen Volcanic National Park, 8 June 2004, B. Stark, R.W. Baumann, 31♂, 8♀ (BPSC), 1♂SEM. **Siskiyou Co.**, Big Springs, Mt. Shasta City Park, 41° 19.692′ N, 122° 19.605′ W, 8 June 2004, B. Stark, R.W. Baumann, 2♂, 2♀ (BPSC), 1♂ SEM. Black Butte Springs, 41° 23.667′ N, 122° 21.626′ W, 23 May 2014, B. Stark, B.C. Kondratieff, J.B. Sandberg, C.J. Verdone, 3♂, 1♀ (BPSC), 1♂ SEM. **Tehama Co.**, Bluff Falls, Hwy 89, 8 June 2004, B. Stark, R.W. Baumann, 1♂(BPSC), 1♂SEM, damaged paraprocts. **Trinity Co.**, East Fork Trinity Creek at campground, 40.77229° N, 122.92150° W, 17 April 2014, C. Kerst, 2♂, 2♀ (CSUC). **NEVADA: Douglas Co.**, Corsser Creek, Hwy 207, Kingsbury Glade, 38.94806 N, 119.85004 W, 16 May 2013, R.L. Bottorff, 2♂ (RLBC), 2♂ SEM. Edgewood Creek, Stateline, 38.96315 N, 119.92562 W, 6 June 2014, R.L. Bottorff, 1♂ (RLBC). **Elko Co.**, Jarbidge Mountains, springbrook, 10 July 1999, A.L. Sheldon, 5♂, 7♀ (BYUC), 1♂SEM. **Humboldt Co.**, Road Creek, E side Santa Rosa Range, 13 miles N Paradise Valley, 41.67881 N, 117.33959 W, 13 June 2013, R.L. Bottorff, 2♂(RLBC), 2♂SEM. Left tributary, Rebel Creek, Santa Rosa Range, 28 June 1999, A.L. Sheldon, 18♂, 9♀ (BYUC), 2 ♂ SEM. Singas Creek, Singas Creek Campground, W Paradise Valley, Santa Rosa Range, 41° 41′ N, 117° 64′ W, 15 June 2009, R.W. Baumann, B.C. Kondratieff, 12♂, 8♀ (BYUC), 2♂SEM. Summer Camp Creek, Summit Lake Mountain, 1 July 1999, A.L. Sheldon, 3♂, 4♀ (BYUC), 2♂SEM. **Washoe Co.**, small stream from Marlette Lake, Hwy 28, 24 June 2009, B. Stark, C.R. Nelson, A.B. Harrison, K.C. Nye, 3♂, 8♀ (BPSC), 1♂SEM. Ophir Creek, Mt. Rose Hwy, Tahoe Meadows, 39.30118 N, 119.92132 W, 29 July 2013, L.D. Bottorff, R.L. Bottorff, 1♂(RLBC), 1♂SEM. Rock Creek, Granite Range, 2 July 1999, A.L. Sheldon, 5♂, 8♀ (BYUC), 2♂SEM. Whites Creek, Whites Creek Trailhead, Rd 047, 39.38° N, 119.85° W, 16 June 2009, R.W. Baumann, B.C. Kondratieff, 14♂, 5♀(BYUC), 2♂ SEM. **OREGON: Jackson Co.**, McDonald Creek, NFD 22 Rd, 22 May 2014, B.C. Kondratieff, C.J. Verdone, 1♂(CSUC).

Adult habitus. Male forewing length 5.0-5.5 mm (n = 17), female 6.5 mm (n = 9). General body color dark brown, dorsum of head brown except for a transverse pale band extending behind ocelli between compound eyes. Pronotal disc mostly pale but with dark brown sutures; anterior and posterior sutures extend about 2/3 of pronotal width; on either side of median suture an irregular pale-brown, gnome, or somewhat C-shaped rugosity occurs (Figs. 3, 6). Wings brown, but with conspicuous pale humeral markings, and many specimens with an irregular broad pale band extending across wings from stigma to stigma (Fig. 2). Tibiae mostly pale along posterior margin but with dark bands at the distal and proximal margins.



Figs. 21-26. *Moselia zonata* right paraproct, lateral aspect. 21. California, Humboldt Co., 0.5 miles E Cedar Creek, Hwy 299. 22. California, Humboldt Co., 0.5 miles E Cedar Creek, Hwy 299. 23. California, Humboldt Co., 2.7 miles E Berry Summit, Hwy 299. 24. California, Humboldt Co., Tributary Ruby Creek, Hwy 299. 25. California, Humboldt Co., small creek N Fish Lake. 26. California, Trinity Co., Bidden Creek, Hwy 299.



Figs. 27-32. *Moselia zonata* right paraproct, lateral aspect. 27. Nevada, Washoe Co., Whites Creek. 28. Nevada, Washoe Co., Whites Creek. 29. Nevada, Washoe Co., Ophir Creek. 30. Nevada, Douglas Co., Corsser Creek. 31. Nevada, Elko Co., Jarbidge Mountains. 32. Nevada, Humboldt Co., Summer Camp Creek.

Male genitalia (n=41). Typical of the genus in most respects, but paraprocts are relatively short and the fin is relatively tall (Figs. 4, 7, 9-32, 39-40, 42). Paraproct body extending from base to fin apex 335-395 µm; greatest paraproct height across fin apex 120-148 µm; posterior margin of fin and much of paraproct body pale, anterior and basal margin of paraproct body sclerotized, dark brown. Apical digit of the paraprocts 125-142 µm in length.

Female subgenital plate (n = 6). Median lobe parabolic, partially projecting over tips of heavily sclerotized, blade-like, smooth lateral lobes. Sternum 8 with dark pigment interrupted on midline; sternum 9 sclerotized around lateral and posterior margins, but membranous in the area posterior to the subgenital plate (Figs. 5, 8, 33-36).

Egg. Elongate oval, without collar. Micropyles not detected. Chorionic surface covered with large, hexagonal follicle cell impressions comprised of thin outer walls and a depressed floor bearing clusters of smaller hexagonal units (Figs. 37-38).

Larva. Unknown.

Etymology. The species name refers to the conspicuous, transverse pale band near the apex of the wings in many specimens. The proposed common name is "Banded-wing Needlefly" (Stark et al., 2012).

Diagnosis. Male and female adult specimens can often be distinguished from those of *M. infuscata* by the apical pale band across the wings (Fig. 2), however, many specimens apparently lack this marking and it is more conspicuous in fresh specimens. The banded-wing character appears to be restricted to *Moselia* populations in the Humboldt/Trinity county area of northern California and the Jackson/Josephine/Curry county area of southern Oregon. Other California and Nevada specimens examined in this study did not display the banded-wing character. In addition, males have a broad, subapical, wing-like expansion (= fin) on the anterior paraproct margin (Figs. 9-32), and the paraproct body, extending from the paraproct base to the base of the apical digit, is approximately 335-395 µm (419-500 µm for *M. infuscata*). The paraproct fin is smoothly curved along the posterior margin from its junction near the hook through the point of greatest fin height; the greatest height of this structure ranges from approximately 120-148 µm (92-127 µm for *M. infuscata*). Fin shape varies among the specimens examined from an almost perpendicular (Figs. 22, 23, 26) to a more slanted profile of the apical fin margin relative to the longitudinal axis of the paraprocts (Figs. 9-11, 27-32), however, fin shape is relatively uniform at a given location. These data appear to be consistent with the DNA data reported by Gill et al. (2015) for these populations. The distribution of the species encompasses northern California, northern and northwestern Nevada, and extreme southwestern Oregon at the California border (Fig. 52).

Gill et al. (2015) reported 3% mean sequence divergence for the CO1 gene between specimens we determine as this species from Split Rock Creek, Jackson Co., Oregon, and those from Big Springs, Mt. Shasta City Park, Siskiyou Co., California. They reported the same level of differentiation between the Big Springs, Mt. Shasta City Park population and specimens from Butte Co., California. Specimens from these three populations each have relatively high paraproct fins (Figs. 33-35) and relatively short paraprocts. In addition, the mean sequence divergence between these three populations and those from Big Spring, Sierra Co., California that we determined as *M. infuscata*, is 6% (Gill et al. 2015). Unfortunately, no genetic data are available for the Oregon and Washington populations of *M. infuscata,* or for the Nevada populations of *M. zonata.*

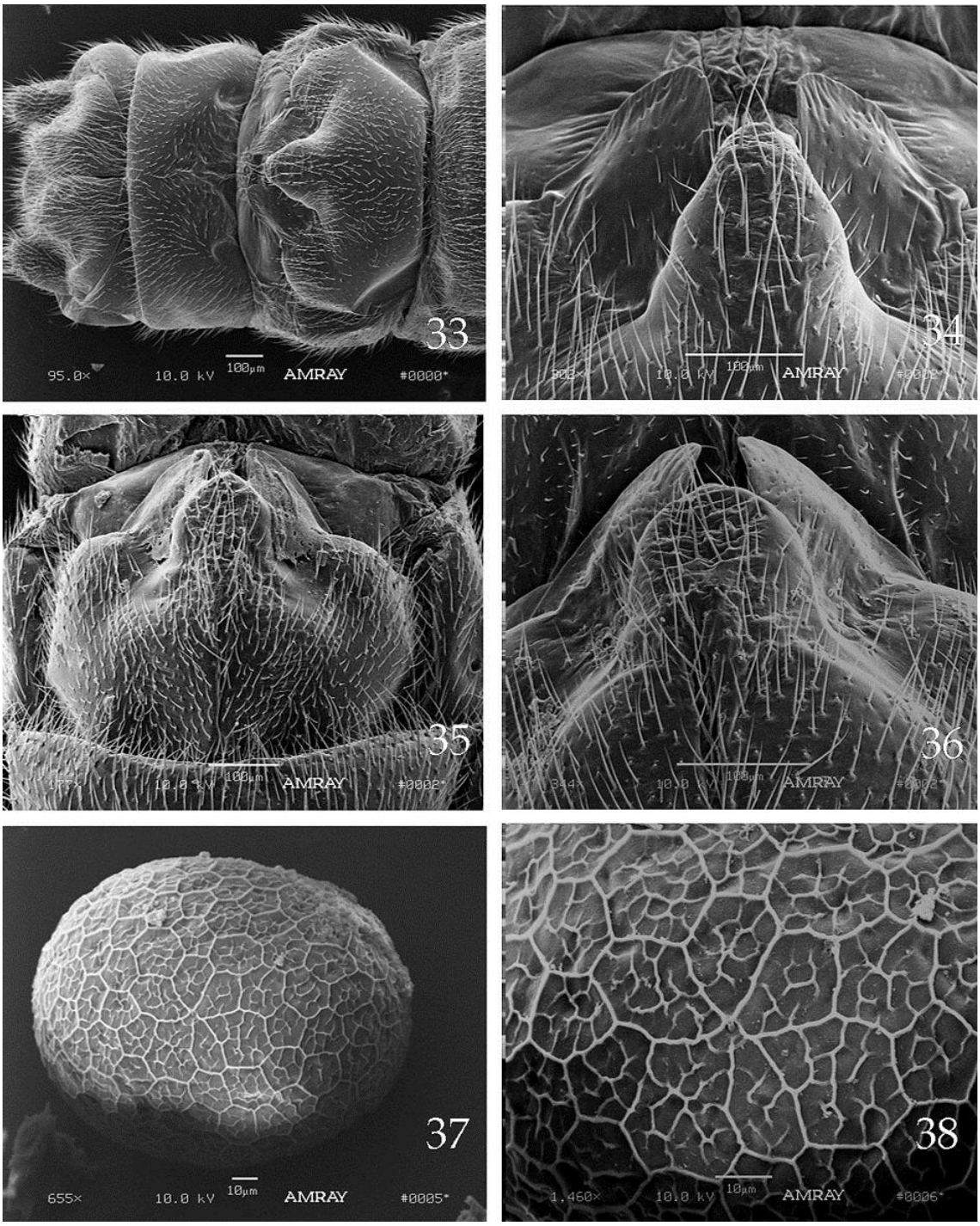
***Moselia infuscata* (Claassen)**

Hairy Needlefly

(Figs. 1, 41, 43-52)

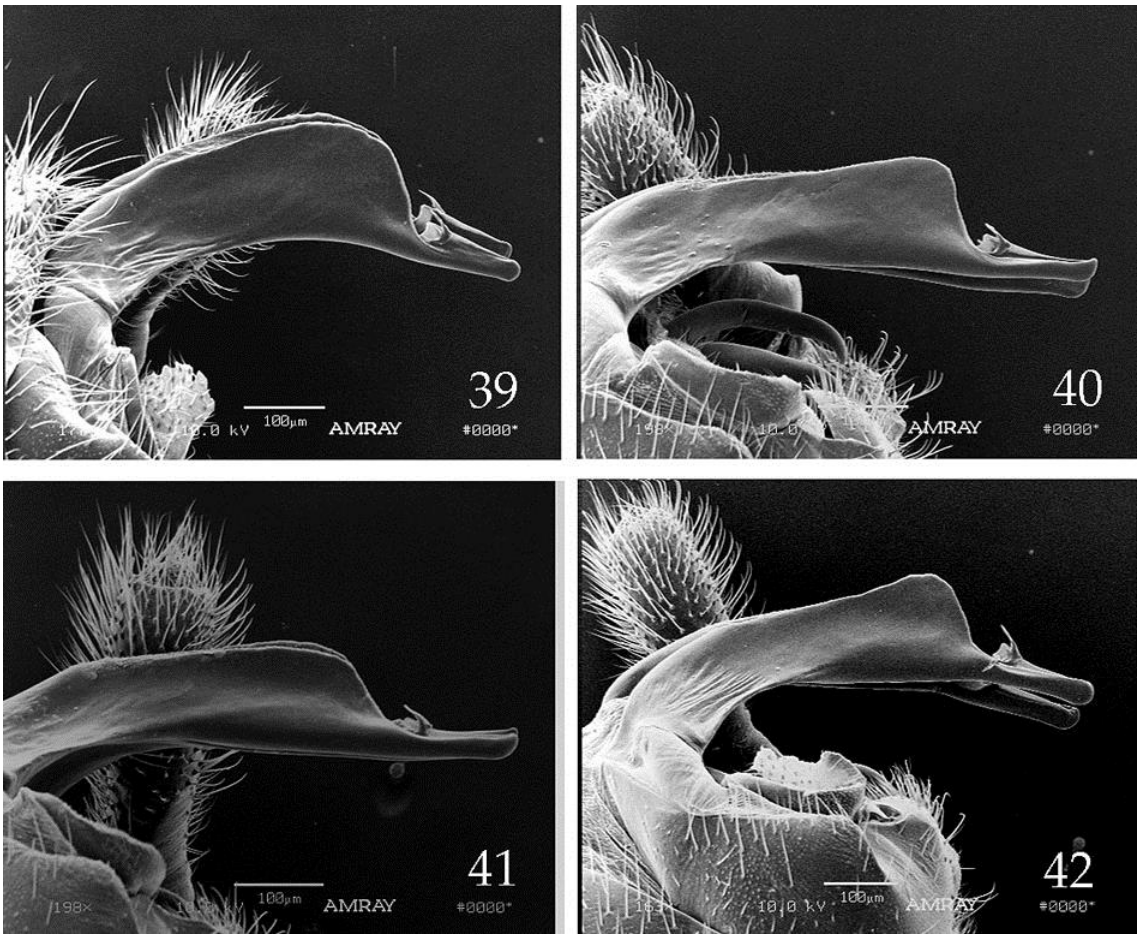
http://lsid.speciesfile.org/urn:lsid:Plecoptera.speciesfile.org:TaxonName:4315

Leuctra infuscata Claassen, 1923:262. Holotype ♂ (Cornell University Collection), Seattle, Washington (Fig. 13 holotype ♂, Fig. 14 ♀)
Leuctra infuscata: Needham & Claassen, 1925:230, (Plate 43, Figs. 3, 5 holotype ♂, Fig 4 ♀)
Leuctra (*Moselia*) *infuscata*: Ricker, 1943:81
Moselia infuscata: Illies, 1966:112

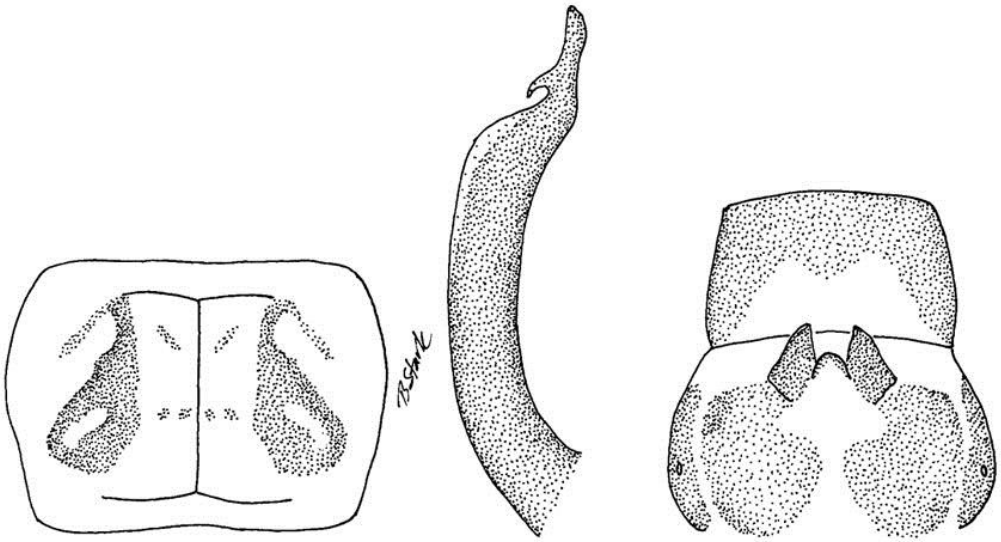


Figs. 33-38. *Moselia zonata* female subgenital plate and eggs. 33. Abdominal terminalia, ventral, Ashland Ski Road, Jackson Co., Oregon. 34. Subgenital plate detail, Ashland Ski Road, Jackson Co., Oregon. 35. Subgenital plate detail, 2.7 miles E Berry Summit, Humboldt Co., California. 36. Subgenital plate detail, Domingo Springs, Plumas Co., California. 37. Egg, Domingo Springs, Plumas Co., California. 38. Chorionic detail, Domingo Springs, Plumas Co., California.

Material examined. CALIFORNIA: Sierra Co., Big Spring, Hwy 49, near Bassetts, 21 June 2009, B. Stark, A.B. Harrison, K.C. Nye, 5♂, 2♀ (BPSC), 1♂ SEM. **OREGON: Benton Co.**, Parker Creek, Mary's Peak, 1.5 mile W FR 3010, 18 May 1982, B. Stark, D. Ziegler, 5♂, 3♀ (BPSC), 1♂ SEM. Same site, 26 June 1985, B. Stark, 10♂, 5♀ (BPSC), 1♂ SEM. Yew Creek, Mary's Peak Rd, 1 June 2000, B. Stark, I. Sivec, M.C. Zúñiga, 2♂ (BPSC), 1♂ SEM. **Clackamas Co.**, Still Creek Campground, off Hwy 26, 45° 18.024' N, 121° 44.101' W, 2 June 2000, B. Stark, I. Sivec, M.C. Zúñiga, 1 ♂ (BPSC). Same site, 17 May 2014, B. Stark, A.B. Harrison, 14♂, 7♀ (BPSC), 1♂ SEM. **Deschutes Co.**, Tumalo Falls springs, 11 June 2004, B. Stark,

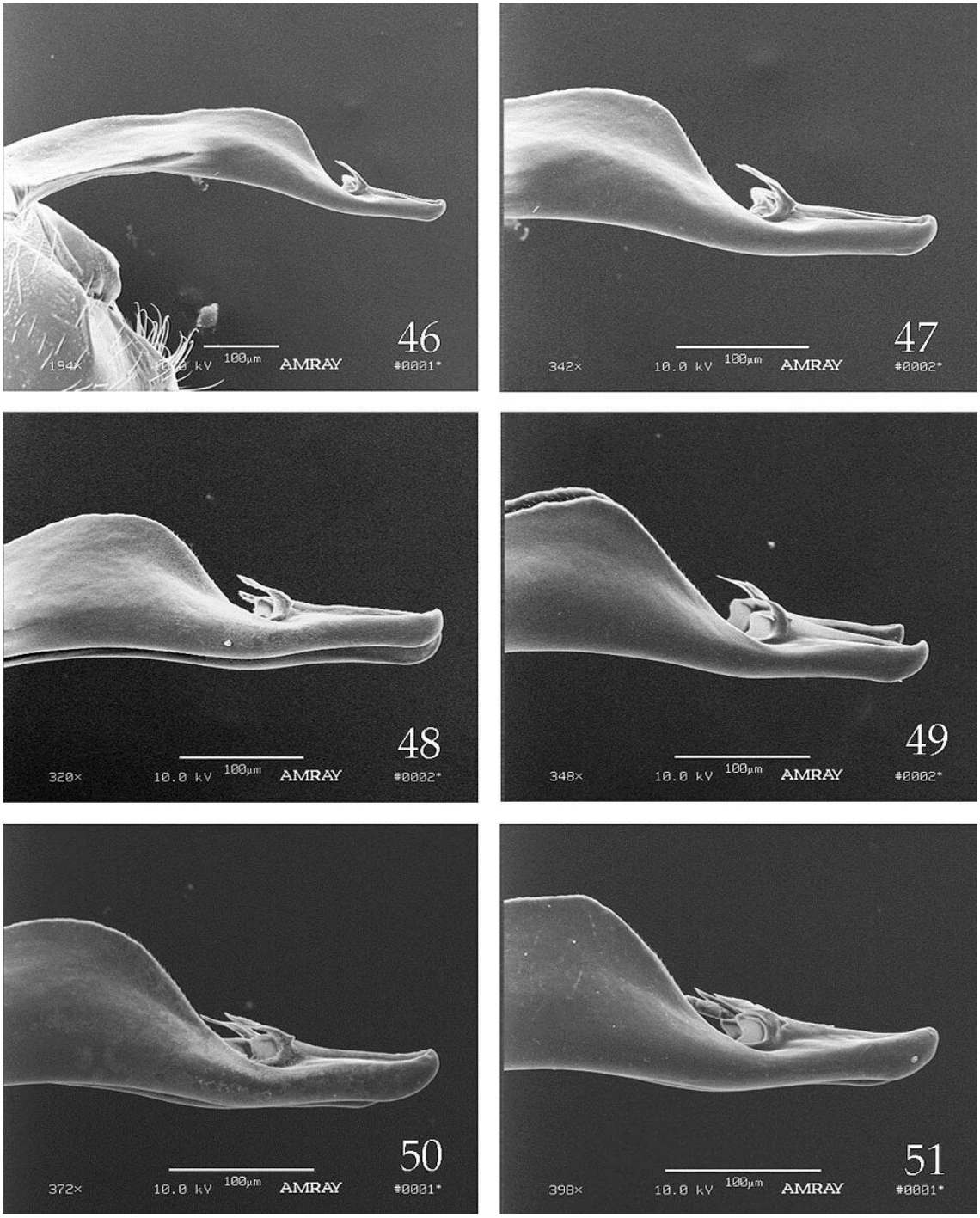


Figs. 39-42. *Moselia* right paraprocts from four populations studied by Gill et al. (2015). The same group designations used by Gill et al. are used here. 39. Group 1, Split Rock Creek, Jackson Co., Oregon, specimens with banded wings. 40. Group 2, Big Springs, Mt. Shasta City Park, Siskiyou Co., California, specimens without banded wings. 41. Group 3, Big Springs, Hwy 49, Sierra Co., California, specimens without banded wings. 42. Group 4, Butte Creek, Butte Co., California, specimens without banded wings. Group 1, group 2 and group 4 specimens each have large fins and a mean genetic distance of 0.03 from the other two groups, and each of these three groups have a mean genetic distance of 0.06 from small fin specimens of group 3. Specimens in groups 1, 2 and 4 are placed as *M. zonata* sp. n. and those in group 3 are placed as *M. infuscata.*



Figs. 43-45. *Moselia infuscata* structures, Oregon, Deschutes Co., Black Pine Spring, 8 miles SW Sisters. 43. Adult pronotum. 44. Right male paraproct, lateral aspect. 45. Female abdominal sterna 8-9.

R.W. Baumann, 32♂, 12♀ (BPSC), 4♂SEM. Black Pine Spring, off FR 16, 8 miles SW Sisters, 11 June 2004, B. Stark, R.W. Baumann, 16♂, 15♀ (BPSC), 1♂, 1♀ SEM. **Douglas Co.**, Muir Creek, Hwy 230, 19 May 1982, B. Stark, D. Ziegler, 2♂ (BPSC), 1♂ SEM. **Jackson Co.**, Whiskey Springs, Whiskey Springs Campground, W of Mt. McLoughlin, 9 June 2004, B. Stark, R.W. Baumann, 15♂, 11♀ (BPSC), 1♂, 1♀ SEM. **Jefferson Co.**, Headwater spring of Metolius River, 12 June 2004, B. Stark, R.W. Baumann, 1♂(BPSC), 1♂ SEM. **Klamath Co.**, springs on Seven Mile Creek, 12 June 1964, J. Schuh, 71♂, 10♀ (BYUC), 2♂SEM. **Lane Co.**, Alder Springs, Alder Springs Campground, Hwy 242, 12 June 2004, B. Stark, R.W. Baumann, 30♂, 7♀ (BPSC), 1♂SEM. **Linn Co.**, small tributary North Santiam River, 0.5 miles W Bruno Mountain Rd, Hwy 22, 44° 41.439′ N, 121° 59.667′ W, 18 May 2014, B. Stark, 3♂, 7♀ (BPSC), 2♂SEM. Willis Creek seeps, Marion Forks Rd, FR 2255, 44° 35.902′ N, 121° 56.031′ W, 18 May 2014, B. Stark, 11♂, 13♀ (BPSC), 1♂ SEM. **Multnomah Co.**, Wahkeena Creek, 29 March 1984, G.R. Fiala, 4♂ (BYUC), 1♂ (SEM). **WASHINGTON: Chelan Co.**, seep at White Pine Campground, Hwy 2, 14 June 2004, B. Stark, R.W. Baumann, 2♂, 5♀ (BPSC), 1♂, 1♀ SEM. Minotaur Creek, 11 mi W Wenatchee Lake, 19 June 1976, J.R. Wood, 4♂, 1♀ (BYUC), 1♂ SEM. **Clallam Co.**, Unnamed creek, Hurricane Ridge, Heart of Hills Rd, 47.98729 N, 123.43860 W, 28 May 2014, J.J. Lee, 16♂, 8♀ (JJLC), 2♂ SEM. **Cowlitz Co.**, Alder Creek, tributary North Fork Toutle River, 24 March 1987, G.R. Fiala, 4♂, 1♀ (BYUC), 2♂ SEM. **Kittitas Co.**, creek entering Keechelus Lake, Hwy 10, 1 mile S Gold Creek, 7 June 1969, R.W. Baumann, 1♂(BYUC), 1♂SEM. **Okanogan Co.**, Doe Creek, FR 150, 16 miles N Winthrop, 19 June 1995, G. MacKenzie, 1♂, 2♀ (BYUC), 1♂ SEM. **Pierce Co.**, St. Andrews Creek, Westside Rd, Mt. Rainier National Park, 28 June 1985, B. Stark, 1♂(BPSC), 1♂SEM. Same site, 13 July 1979, B. Stark, K.W. Stewart, 1♂(BPSC), 1♂SEM. Mt. Rainier National Park, 29 June 1981, K.W. Stewart, W.D. Shepard, 1♂, 4♀ (BYUC), 1♂SEM. Mt. Rainier



Figs. 46-51. *Moselia infuscata* right paraproct, lateral aspect. 46. Washington, Chelan Co., White Pine Campground. 47. Washington, Chelan Co., White Pine Campground. 48. Oregon, Benton Co., Yew Creek. 49. Oregon, Deschutes Co., Black Pine Spring. 50. Oregon, Lane Co., Alder Spring. 51. Oregon, Linn Co., Willis Creek seeps.

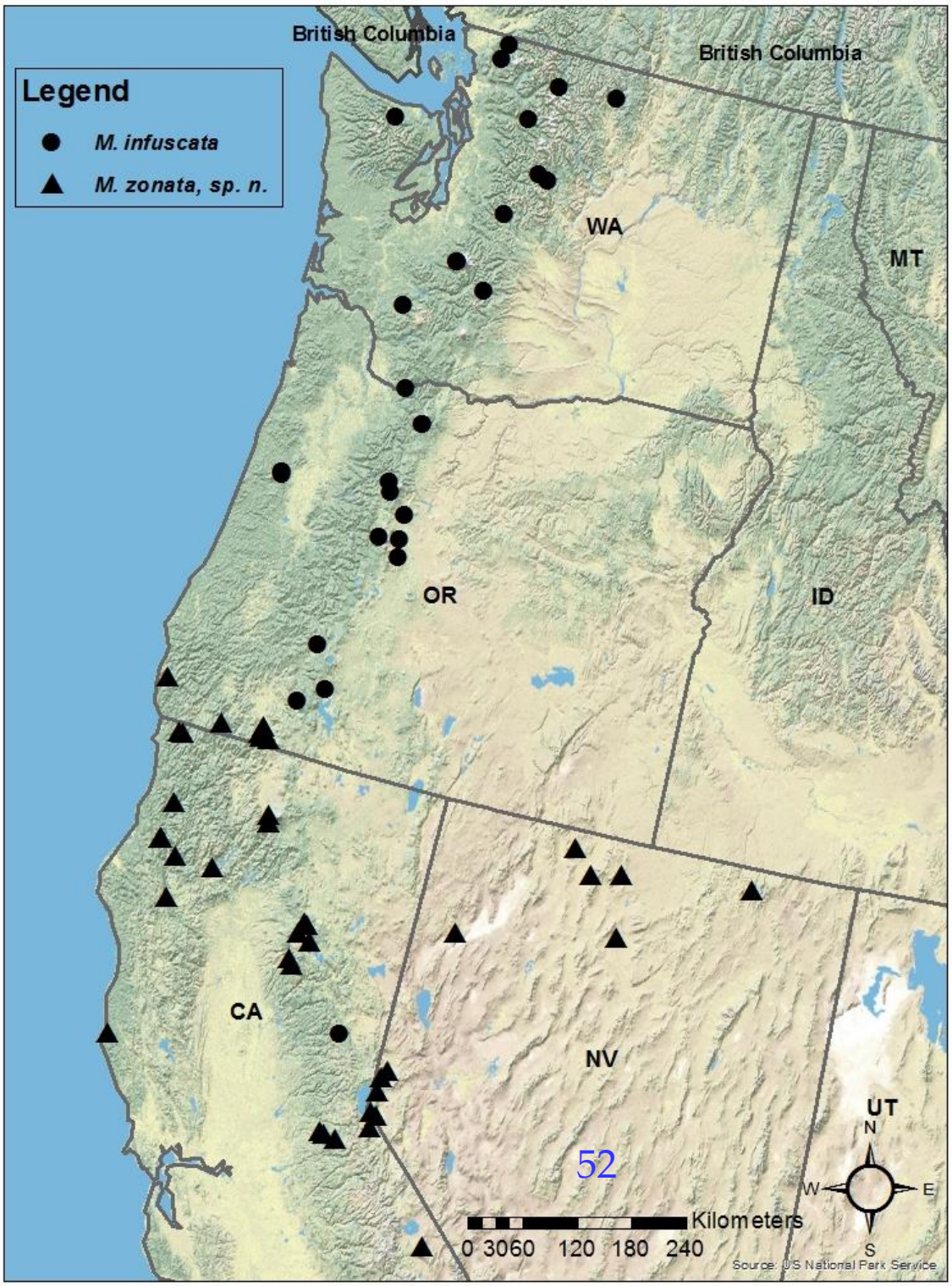


Fig. 52. Distribution of *Moselia* species in the Pacific Northwest. Published records of *M. infuscata* from British Columbia were not included because no specimens were available for this study.

National Park, 17 June 2004, B.C. Kondratieff, Schmidt, 1♂ (CSUC), 1♂ SEM. **Snohomish Co.**, unnamed creek, 1.6 miles off FR 23 on FR 29, 11 miles SE Darrington, 9 June 1994, G. MacKenzie, 1♂, 4♀ (BYUC), 1♂ SEM. **Whatcom Co.**, Boulder Creek, Maple Falls, 17 April 1968, 7♂, 4♀ (BYUC), 2♂ SEM. Heislers Creek, North Fork Rd, 28 April 1995, G. MacKenzie, 6♂, 3♀ (BYUC), 1♂ SEM. Thunder Creek, 9 miles E Newhalem, 27 May 1994, G. Kraft, 2♂ (BYUC), 1♂ SEM. **Yakima Co.**, South Fork Clear Creek, White Pass, Hwy 12, 15 June 2004, B. Stark, R.W. Baumann, 1♂, 2♀ (BPSC), 1♂ SEM.

Adult habitus. Male forewing length 6.0-6.5 mm (n = 16), female 6.5-7.0 mm (n = 8). General body color dark brown, head brown on occiput and frons, but with a pale transverse band extending between compound eyes behind ocelli. Pronotum mostly pale brown, but with sutures dark brown, and with a large brown rugose area on either side of median suture (Fig. 43). Wings brown with conspicuous pale humeral and stigmatic markings, but subapical transverse pale band absent (Fig. 1). Tibiae almost entirely dark brown and without bands.

Male genitalia (n = 35). Typical of the genus but paraprocts long and slender with fin poorly developed and mostly sclerotized (Figs. 41, 44, 46-51). Paraproct body extending from base to fin apex 425-475 μm in length; greatest paraproct height across fin apex 94-125 μm. The apical digit on the paraprocts ranges from 138-154 μm in length.

Female subgenital plate (n = 2). Median lobe small, parabolic and poorly sclerotized. Large, heavily sclerotized lateral lobes triangular and broadly joined to posterolateral area of sternum 8 forming a continuous sclerotized margin. Median field of plate unsclerotized along a longitudinal stripe. Sternum 9 unsclerotized in a small area posterior to projecting subgenital plate (Fig. 45).

Egg. Unknown.

Larva. Described by Ricker (1943) and Stewart & Stark (1988, 2002).

Diagnosis. This species lacks the pale wing bands found in most *M. zonata* and males have longer and narrower paraprocts than other *Moselia*. All specimens examined from Oregon (except Curry, Josephine and most of Jackson counties) and Washington represent this species (Fig. 52). See additional discussion above. Females of the two species overlap in subgenital plate structure and cannot be reliably distinguished without the pale wing band character.

ACKNOWLEDGEMENTS

We thank Richard W. Baumann (Monte L. Bean Life Science Museum, Brigham Young University), Richard L. Bottorff (South Lake Tahoe, California), Jonathan J. Lee (Eureka, California), and Boris C. Kondratieff (C.P. Gillette Museum of Arthropod Diversity, Colorado State University) for the loan or gift of *Moselia* specimens used in this study. We also thank the following individuals who accompanied us on collecting trips to *Moselia* sites: Richard W. Baumann, Richard L. Bottorff, Boris C. Kondratieff, C. Riley Nelson, Kelly C. Nye, John B. Sandberg, Ignac Sivec, Kenneth W. Stewart, Stanley W. Szczytko, and Chris J. Verdone.

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Submitted 21 July 2016, Accepted 26 August 2016, Published 13 September 2016

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