

NEW SPECIES AND RECORDS OF *EPHEMERELLA* (*EPHEMERELLA*) IN WESTERN NORTH AMERICA (Ephemeroptera: Ephemerellidae)¹

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ABSTRACT

Descriptions and figures are presented for *Ephemerella altana* n. sp. and *E. rama* n. sp. New records extend the ranges of *E. maculata* Traver, *E. mollitia* Seemann, *E. inermis* Eaton, and *E. aurivillii* (Bengtsson). Revised keys and new distribution maps are presented for the western North American species.

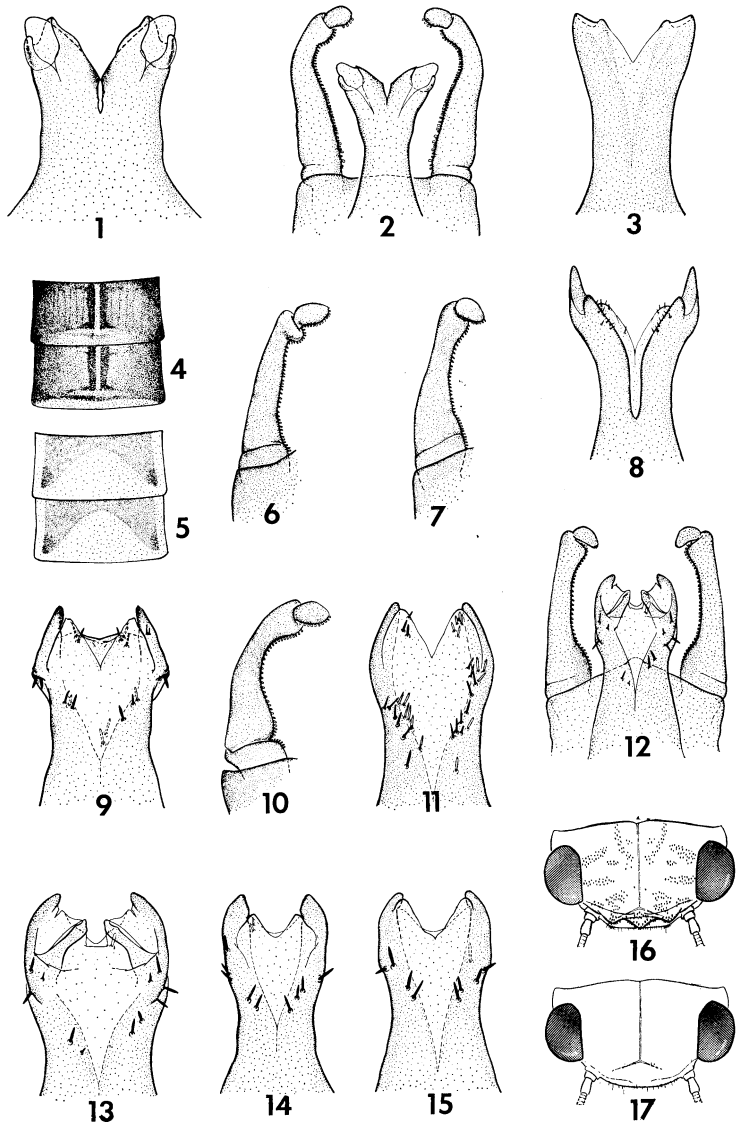
The subgenus *Ephemerella* s. s. of *Ephemerella* was revised in 1965 by Allen and Edmunds and included seven western North American species. In 1966, Jensen and Edmunds described the nymph of an eighth species, *E. alleni*, from Idaho, Montana, and Wyoming, and recently two additional undescribed species of this subgenus were discovered, *Ephemerella rama* n. sp., known from only a single male imago collected in Nevada, and *E. altana* n. sp. known from nymphs and male imagoes collected in Arizona and New Mexico. Also, since the 1965 revision, new records have been discovered of *E. inermis* Eaton, *E. maculata* Traver, *E. mollitia* Seemann, and *E. aurivillii* (Bengtsson), and the ranges of these species have been increased. This paper presents descriptions of the new species, and new distribution maps and revised keys to the western North American species.

Abbreviations for collections in which specimens are deposited are as follows: CAS, California Academy of Sciences, San Francisco; CSCLA, California State College at Los Angeles; SGJ, Stanley G. Jewett, Portland, Oregon; UA, University of Alaska, College; UI, University of Idaho, Moscow; and UU, University of Utah, Salt Lake City.

Ephemerella altana n. sp.

MALE IMAGO (in alcohol). Length: body 7.0-8.0 mm; forewing 7.0-8.0 mm. General color red to reddish tan. Head reddish brown; ocelli pale; upper portion of compound eyes red, lower portion black. Thorax tan, suffused with red; pleural sutures pale, margined with black; legs tan; femora with a thin red macula; length of foreleg in millimeters: femur = 1.3; tibia = 2.6; tarsus I = 0.1; tarsus II = 0.9; tarsus III = 0.8; tarsus IV = 0.6; tarsus V = 0.3; wings hyaline. Abdomen red; abdominal terga red with dark red longitudinal submedian stripes and a pale median line (Fig. 4); pleural margins of

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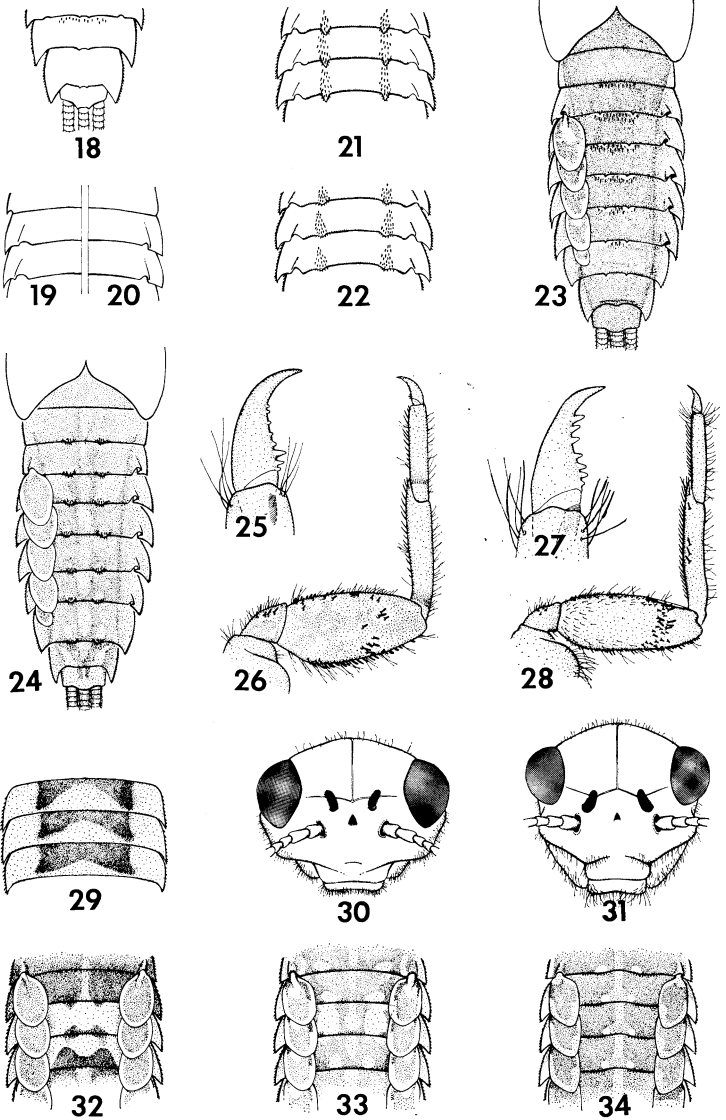
FIGS. 1-2. *Ephemera altana*, adult: 1, penes; 2, male genitalia. Fig. 3. *E. maculata*, adult penes. Fig. 4. *E. altana*, adult abdominal terga 3-4. Fig. 5. *E. maculata*, adult abdominal sterna 3-4. Figs. 6-7. Adult genital forceps: 6, *E. infrequens*; 7, *E. inermis*. Figs. 8-9. Adult penes: 8, *E. aurivillii*; 9, *E. infrequens*. Fig. 10. *E. maculata*, adult genital forceps. Fig. 11. *E. mollitia*, adult penes. Figs. 12-13. *E. rama*, adult: 12, male genitalia; 13, penes. Figs. 14-15. Adult penes: 14, *E. lacustris*; 15, *E. inermis*. Figs. 16-17. Nymphal heads: 16, *E. verruca*; 17, *E. aurivillii*.

terga with dark brown markings; abdominal sterna tan, suffused with red at lateral margins and with a large median, circular, macula on segments 3-7. Penes without dorsal and ventral spines; each penis lobe with a round apical protuberance enclosed in a sheath (Fig. 1); second segment of genital forceps incurved at apex and without a sub-apical constriction (Fig. 2). Caudal filaments pale with dark brown annulations.

FEMALE IMAGO. Unknown.

MATURE NYMPH. Length body 6.5-7.5 mm; caudal filaments 4.0-6.0 mm. General color reddish brown. Head light brown with irregular dark brown markings on vertex; frons brown; without paired occipital tubercles. Thoracic notum light brown with irregular reddish brown to brown markings; lateral margins of pronotum pale; legs light brown with brown markings (Fig. 26); femora light brown with variable dark brown markings; tibiae light brown, often with a thin darker brown band at apex; tarsi light brown, often with a thin darker brown band at apex; tarsal claws with 6-10 denticles (Fig. 25). Abdominal terga with blunt, paired, dorsal, submedian tubercles on segments 3-8, tergum 2 often with small tubercles (Fig. 24); all abdominal terga with numerous small spicules; terga color variable, usually tan with brown or reddish brown markings, or brown suffused with red; abdominal segments 4-9 with distinct posterolateral projections; abdominal sterna light brown, usually suffused with red. Caudal filaments light brown with dark brown annulations.

TYPES. *Holotype*: Male imago, East Fork White River at Rock Creek Rangers Station, Fort Apache Indian Reservation, Apache Co., Arizona, 5 and 6-VII-64, R. K. Allen (CAS). Paratopotypes: 2 male imagoes, 28 nymphs, and 1 nymphal cast skin, 5 nymphs at CAS and UU, remainder at CSCLA. Paratypes: ARIZONIA. Apache Co., E. Fk. White River, 3 mi. N. Rock Creek Rangers Station, Ft. Apache Indian Res., 6-VII-64, 17 nymphs; Diamond Creek on Highway 73, Ft. Apache Indian Res., 6-VII-64, 3 nymphs; Paradise Creek on Highway 73, Ft. Apache Indian Res., 6-VII-64, 2 nymphs; E. Fk. Little Colorado River, E. Fk. Camp, Apache Natl. For., 3-VII-64, 2 nymphs; Navajo Co., N. Fk. White River nr. Alcheshy Natl. Fish Hatchery, 17-V-64, S. G. Jewett, Jr., 23 nymphs (SGJ); N. Fk. White River at White River, Apache Indian Res., 5-VII-64, 1 nymph. NEW MEXICO. Colfax Co., Moreno Creek, 5 mi. N. Eagle Nest, 1-VII-64, 4 nymphs; Mora Co., Mora River at Mora, 1-VII-64, 26 nymphs; San Miguel Co., Pecos River at Pecos, 2-VII-64, 59 nymphs; Taos Co., Rio Pueblo, 1 mi. S. Penasco, Carson Natl. For., 1-VII-64, 10 nymphs; Rio Hondo at jct. with Rio Grande on Highway 111, 30-VI-64, 3 nymphs; Rio Grande at jct. with Rio Hondo on Highway 111, 30-VI-64, 3 nymphs; Rio Hondo on Highway 3, 30-VI-64, 3 nymphs. All collected by R. K. Allen (CSCLA) except as otherwise noted.



FIGS. 18-24. Nymphal abdomens: 18, *E. verruca*, terga 8-10; 19, *E. aurivillii*, left half terga 2-4; 20, *E. altana*, right half terga 2-4; 21, *E. aurivillii*, terga 3-5; 22, *E. aurivillii*, terga 3-5; 23, *E. alleni*, whole abdomen; 24, *E. altana*, whole abdomen. Fig. 25, *E. altana*, nymphal claw; Fig. 26, *E. altana*, nymphal foreleg; Fig. 27, *E. alleni*, nymphal claw; Fig. 28, *E. alleni*, nymphal foreleg. Fig. 29, *E. maculata*, nymphal abdominal sterna 3-5. Figs. 30-31. Nymphal heads: 30, *E. maculata*; 31, *E. inermis*. Figs. 32-34. Nymphal abdomens: 32, *E. lacustris*, terga 3-5; 33, *E. mollitia*, terga 3-5; 34, *E. inermis*, terga 3-5.

REMARKS. The penes of *E. altana* male imagoes are of the *needhami*-type, and the absence of dorsal or of ventral spines or both suggests a relationship of this species to *E. maculata* Traver. The male imago of *E. altana* may be distinguished from *E. maculata* and all other species with *needhami*-type penes, by a subapical curvature of the second segment of the genital forceps, and by the presence of a sheath enclosing each penis lobe (Figs. 1-2). As one male imago was reared, the adult and nymphal stages of *E. altana* are positively associated.

The nymphs of *E. altana* may be confused with those of *E. inermis* where they occur together in Arizona and New Mexico. The nymphs of *E. inermis* are without paired, dorsal, abdominal tubercles, but some specimens have small protuberances on the middle abdominal segments (Fig. 34). The nymphs of *E. altana* are readily distinguished from those of *E. inermis* and all other western North American *Ephemerella* s. s., by the following combination of characters: (1) small size (body 6.5-7.5 mm.); (2) legs with femoral markings and weak transverse tibial and tarsal bands; (3) abdomen without distinct posterolateral spine on segment 3; and (4) paired dorsal abdominal tubercles blunt (Fig. 24).

BIOLOGY. The nymphs of *E. altana* were collected among rocks and gravel in moderately flowing streams with summer daytime grab temperatures between 62° and 70°F. Two male imagoes were collected as they danced over the White River at 9:00 AM in bright sunlight at a temperature of 78°F.

Ephemerella rama n. sp.

MALE IMAGO (in alcohol). Length: body 10.0-11.0 mm; forewing 10.5-11.5 mm. General color brown. Head brown; ocelli pale; bases of ocelli black; upper portion of compound eyes orange, lower portion black. Thorax chocolate brown; pleural sutures pale; legs brown; length of forelegs in millimeters: femur = 2.0; tibia = 2.5; tarsus I = 0.3; tarsus II = 1.2; tarsus III = 1.3; tarsus IV = 0.8; tarsus V = 0.4; wings hyaline, suffused with brown; primary longitudinal veins brown, crossveins and intercalaries hyaline. Abdomen brown. Penes with 11 dorsal and 1 ventral spine; position of spines as in Fig. 13; each penis lobe with a median chitinized ramus; penis lobes short, lateral margins rounded; second segment of genital forceps without an apical constriction (Fig. 12). Caudal filaments broken.

FEMALE IMAGO. Unknown.

NYMPH. Unknown.

Holotype: Male imago, Reno, Nevada, 4-IV-59, F. D. Parker (CAS).

REMARKS. The penes of *E. rama* are of the *invaria*-type. The shape of the second segment of the genital forceps and the shape and armature of the penes places this species in close relationship to *E. inermis* Eaton. *Ephemerella rama* is the only described western North

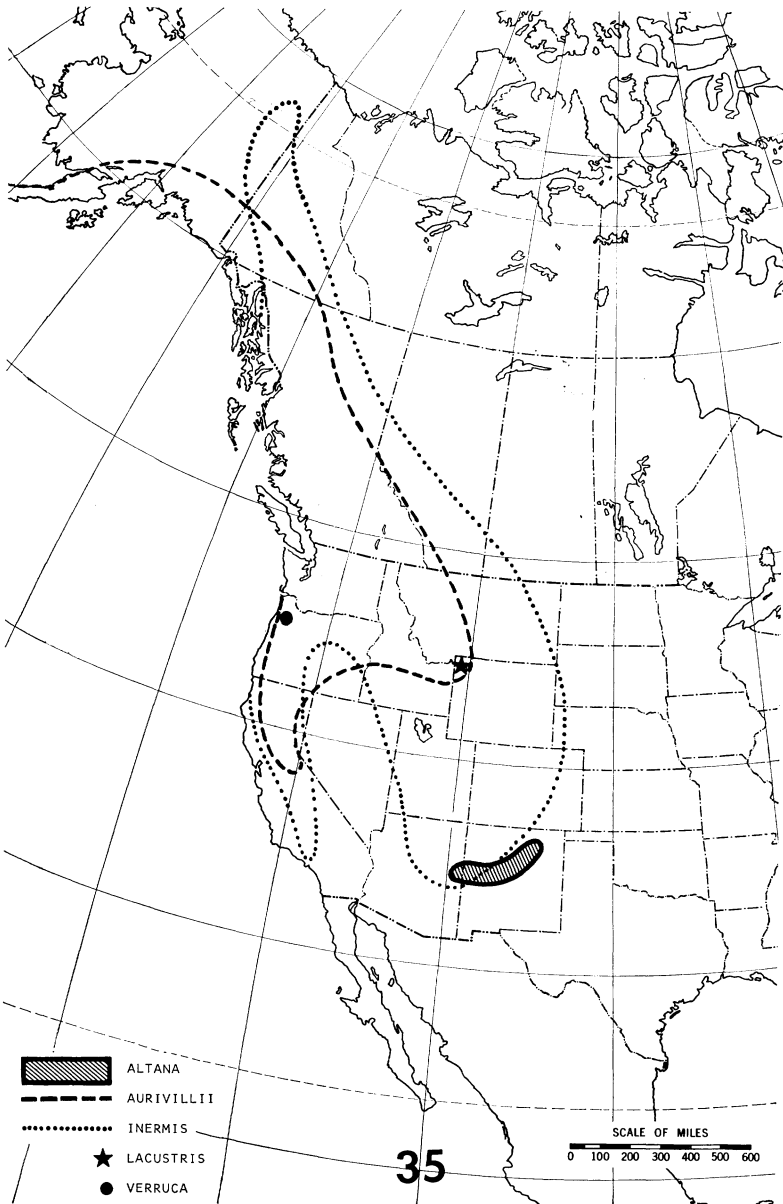


FIG. 35. Distribution map of *Ephemera altana*, *E. aurivillii*, *E. inermis*, *E. lacustris*, and *E. verruca*.

American *Ephemerella* s. s. unknown in the nymphal stage; whereas the adult stages of *E. alleni* Jensen and Edmunds and *E. verruca* Allen and Edmunds are undescribed. It is not probable that *E. rama* is the adult of either of the latter species as the nymphs of both have close affinity to *E. aurivillii*, with *needhami*-type penes. *Ephemerella rama* may be distinguished from *E. inermis* and all other known species of the subgenus by possessing a median chitinized ramus on each penis lobe (Figs. 12-13).

Ephemerella inermis Eaton

This species has a widespread distribution in western North America, and it is known from central Alaska austrad to California, Arizona, and New Mexico. The distribution map published by Allen and Edmunds (1965) indicates that *E. inermis* ranges into southern California; however, the record of this range extension was omitted from their locality records. A recent collection from the San Gabriel Mountains substantiates this distribution. A recent record also extends the range of this species northward in Alaska (Fig. 35).

Locality Records. ALASKA: McManus Creek, 60 mi. NE Fairbanks, 23-VIII-66, L. Boddis (UA). CALIFORNIA: Los Angeles Co., Santa Anita Creek, Chantry Flat, Santa Anita Canyon, 28-III-67, R. K. Allen (CSCLA).

Ephemerella aurivillii (Bengtsson)

Ephemerella aurivillii has a holarctic distribution, and it is widely distributed in western North America. Allen and Edmunds (1965) reported this species from the Pribilof Islands in the Bering Sea and southeastern Alaska austrad to Montana, Oregon, Washington, and Central California. New records extend the range of this species to central Idaho and northern Wyoming (Fig. 35).

Locality Records. IDAHO: Bonner Co., Pack River, 2 mi. N. Colburn, 26-III-65, Alan V. Nebeker (UU); Kootenai Co., Coeur d' Alene, 19-IV-54, A. G. Lewis (UI); Latah Co., Potlatch Creek, 3 mi. N. Bovill, 7-V-65, E. Richard Logan (UI); Adams Co., 2 mi. E. Meadows, 21-IX-63, Steve L. Jensen (UU); Lemhi Co., N. Fk. Salmon River nr. Gibbonville, 11 to 16-VII-64, Charles R. Whitt, Ivan T. Thornton, and John K. Adams (UU); Opal Creek, 18 mi. W. Cobalt, 12 to 23-VII-64, Ivan T. Thornton and John K. Adams (CSCLA); Panther Creek, 22-VII-64, Charles R. Whitt (UU). WYOMING: Gibbon River, Virginia Cascades, 12-VI-63, E. R. Vincent (UU).

Ephemerella maculata Traver

Ephemerella maculata, previously known from only the Coast Ranges of California, is now known to occur in the Sacramento Valley and the Sierra Nevada Mountains (Fig. 36).

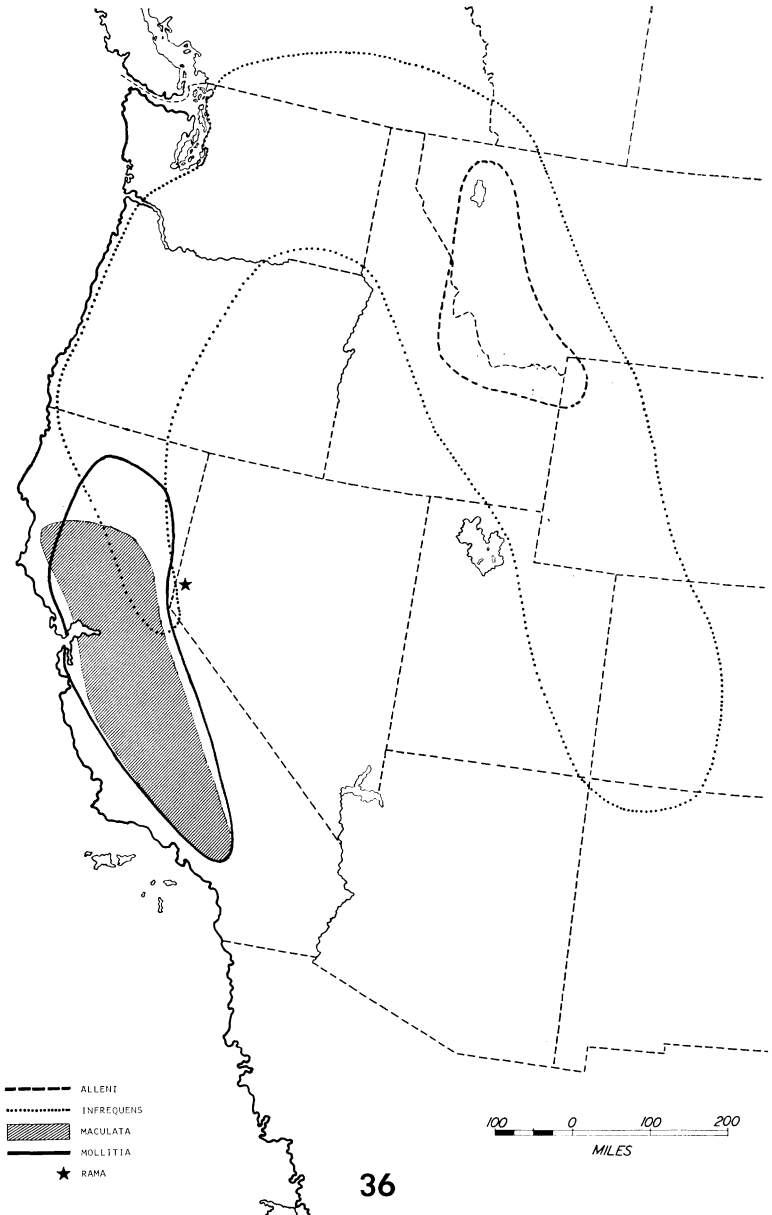


FIG. 36. Distribution map of *Ephemerella alleni*, *E. infrequens*, *E. maculata*, *E. mollitia*, and *E. rama*.

Locality Records. CALIFORNIA: Alameda Co., Niles Canyon, 8-V-49, W. C. Day (CAS); Amador Co., Ione, 1-IV-50, W. C. Day (CAS); Colusa Co., Junction of State Highways 16 and 20, 26-IV-53, W. C. Day (CAS); Contra Costa Co., San Ramon Creek, 30-V-51, W. C. Day (CAS); Glenn Co., Stoney Creek, 21-IV-51, W. C. Day (CAS); Lake Co., Middle Creek, 4.5 mi. N. Upper Lake, 28-V-49, W. C. Day (CAS); Napa Co., Capell Creek, 20-V-50, W. C. Day (CAS).

Ephemerella mollitia Seemann

Allen and Edmunds (*op. cit.*) reported this species from Fall River, California, but this locality could not be found on available state maps and was not included in the species distribution. It is now known that Fall River is in Shasta County in northern California. The following records fill in this previous known disjunct distribution (Fig. 36).

Locality Records. CALIFORNIA: Amador Co., Sutter Creek, 1-IV-50, W. C. Day (CAS); Ione Road, 9 mi. W. Jackson, 1-IV-50, W. C. Day (CAS); Lake Co., St. Helena Creek, 12-IV-52, W. C. Day (CAS); Napa Co., Sage Creek, 9-IV-52, W. C. Day (CAS); Plumas Co., Feather River, Mohawk, 30-V-48, W. C. Day (CAS); San Mateo Co., Pescadero Creek, 7-V-50, H. B. Leech (CAS); Santa Clara Co., Smith Creek, Mt. Hamilton, 7-IV-51, W. C. Day (CAS); Sonoma Co., Sonoma Creek, 31-III-56, W. C. Day (CAS).

Keys to the Western North American Species of *Ephemerella* s. s.

Male Imagoes²

- | | | |
|-------|---|----------------------|
| 1. | Penes without spines (Figs. 1-3) | 2 |
| | Penes with spines (Figs. 8-9, 11-15) | 3 |
| 2(1). | Abdominal sterna 2-7 with brown, notched, rectangular markings (Fig. 5); apex of each penis lobe flat (Fig. 3); second segment of genital forceps bowed (Fig. 10) | <i>maculata</i> |
| | Abdominal sterna 2-7 suffused with red, without rectangular markings; apex of each penis lobe rounded (Fig. 1); second segment of genital forceps incurved at apex (Fig. 2) | <i>altana</i> n. sp. |
| 3(1). | Penes with long apical lobes and a deep median notch; penes with dorsal and median spines (Fig. 8) | <i>aurivillii</i> |
| | Penes with short apical lobes and a shallow median notch; penes with dorsal and ventral spines (Figs. 9, 11-15) | 4 |
| 4(3). | Inner margin of second segment of genital forceps constricted subapically as in Fig. 6 | 5 |
| | Inner margin of second segment of genital forceps expanded subapically as in Fig. 7 | 6 |

² Male imagoes of *E. alleni* Jensen & Edmunds, and *E. verruca* Allen and Edmunds are unknown.

- 5(4). Lateral margins of penis lobes nearly straight; penes with 2-11 dorsal and 4-11 ventral spines (fig. 9) *infrequens*
 Lateral margins of penis lobes incurved; penes with 15-20 dorsal and 15-20 ventral spines (Fig. 11) *mollitia*
- 6(4). Penis lobes with a median chitinized ramus (Figs. 12-13) *rama* n. sp.
 Penis lobes without a median ramus (Figs. 14-15) 7
- 7(6). Mesothoracic notum deep chocolate brown; foreleg 9-10 mm in length; penes with 8-12 dorsal and 1-4 ventral spines usually arranged as in Fig. 14 *lacustris*
 Mesothoracic notum olive-brown; foreleg 6-7 mm in length; penes with 3-14 dorsal and 1-9 ventral spines usually arranged as in Fig. 15 *inermis*

Mature Nymphs³

1. Abdominal terga with well-developed, paired, submedian tubercles on middle abdominal segments (Figs. 21-24) 2
 Abdominal terga without tubercles, but often with small protuberances on middle abdominal segments (Fig. 34) 5
- 2(1). Front of head with 3 spiculate wart-like tubercles (Fig. 16); abdominal tergum 10 with small, sharp, submedian tubercles (Fig. 18) *verruca*
 Front of head without tubercles (Fig. 17); abdominal tergum 10 without submedian tubercles 3
- 3(2). Abdominal segment 3 with distinct posterolateral projections (Fig. 19); abdominal terga 1-9 with moderately long, sharp, heavily spiculated tubercles (Fig. 21), or abdominal terga 3-7 with small, blunt, heavily spiculated tubercles (Fig. 22); body usually more than 11 mm. in length *aurivillii*
 Abdominal segment 3 without distinct posterolateral projections as in Fig. 20; abdominal terga 3-8, and often 2-9, with small acute or blunt tubercles (Figs. 23-24); body usually less than 10 mm in length 4
- 4(3). Abdominal terga with small, acute tubercles (Fig. 23); fore femora with numerous subapical spines (Fig. 28); tarsal claws with well-developed denticles (Fig. 27); mature nymph 9.5-11.5 mm in length *alleni*
 Abdominal terga with small, blunt tubercles (Fig. 24); fore femora with few subapical spines (Fig. 26); tarsal claws with poorly developed denticles (Fig. 25); mature nymph 6.5-7.5 mm in length *altana* n. sp.
- 5(1). Abdominal sterna 2-7 with brown, notched, rectangular markings (Fig. 29); front of head much broader than long (fig. 30) *maculata*

³ The nymph of *E. rama* n. sp. is unknown.

- Abdominal sterna without rectangular markings; head as long as broad (Fig. 31) 6
- 6(5). Abdominal segment 3 with distinct posterolateral projections as in Fig. 19; tarsal claws usually with more than 11 denticles .. 7
- Abdominal segment 3 without distinct posterolateral projections as in Fig. 20; tarsal claws usually with less than 8 denticles 8
- 7(6). Abdominal terga brown with large pale patches on middle and posterior segments (Fig. 32); femora pale with a median brown macula; nymphs inhabit lakes; known only from Wyoming (Fig. 35) *lacustris*
- Abdominal terga brown with paired, submedian pale spots (Fig. 33); femora brown with irregular pale markings; nymphs inhabit streams; known only from California (Fig. 36) *mollitia*
- 8(6). Abdominal terga usually dark brown to black with well-marked submedian pale spots and a median stripe (Fig. 34); body usually robust; abdominal posterolateral projections comparatively short; forelegs less than 3 mm in length *inermis*
- Abdominal terga usually brown with variable pale markings, often indistinct pale spots present; body usually slender; posterolateral projections comparatively long; foreleg more than 3 mm in length *infrequens*

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