Mayflies of the Southwest: New Species, Descriptions, and Records (Ephemeroptera)[1]

JANET I. KILGORE AND RICHARD K. ALLEN
Department of Biology, California State College, Los Angeles 90032

ABSTRACT

Descriptions and figures of 7 new species are presented: *Paraleptophlebia* ***altana,*** *Thraulodes* ***salinus,*** *Traverella* ***castanea,*** *Leptohyphes* ***baumanni,*** *L.* ***quercus,*** *L.* ***phalarobranchus,*** and *Tricorythodes* ***corpulentus.*** The nymphal stage is described for *Choroterpes inornata* Eaton, *Paralptophlebia memorialis* (Eaton), *Thraulodes brunneus* Koss, and *Tricorythodes minutus* Traver. The male imago is described for *Tricorythodes dimorphus* Allen, and new distributional records extend the known range for *C. inornata, P. memorialis, T. brunneus, Traverella albertana* (McDunnough), *Ephemerella micheneri* Traver, *E. grandis* Eaton, *Tricorythodes condylus* Allen, *T. dimorphus,* and *T. minutus.*

A recent study of mayfly collections from California, Arizona, and New Mexico has revealed several undescribed species, new distributional records of previously described species, and the nymphal stage of species formerly known from only the adult stage. Types of new species are deposited in the California Academy of Sciences, San Francisco. In the accounts dealing with the species, collections made by R. K. Allen are indicated by the initials RKA. Abbreviations for collections in which specimens are deposited are as follows: CSCLA, California State College, Los Angeles; UU, University of Utah, Salt Lake City; RWK, R. W. Koss collection. We thank Richard W. Koss of Johns Hopkins University and George F. Edmunds, University of Utah, for the loan of specimens.

Choroterpes inornata Eaton

This species was described by Eaton in 1892 from adults collected in northern Sonora, Mexico, and Arizona. Peters and Edmunds (1961) reported nymphs from LaPlata Co., Colo., as *Choroterpes* sp., and from the known distribution of *C. inornata* we suggest that these specimens are representatives of this species. Additional collections of nymphs, associated as *C. inornata,* extend the known range into New Mexico, and these records and a description of the nymphal stage follow.

NYMPH.—Length: body 6.0–7.0 mm; caudal filaments 6.0–7.0 mm. General color pale to tan with dark markings. Head pale with 2 irregularly shaped brown maculae on vertex; head with a wide dark transverse band between lateral ocelli; frons with a yellowish triangular macula (Fig. 1); maxillary palpi 3-segmented. Thoracic nota tan with diffuse brown markings; pronotum with a median and paired sublateral dark maculae; mesonotum with dark weblike tracheations at anterolateral corners; femora pale with a large median, and a small subapical brown macula (Fig. 4a, b); femora with scattered setae and spines; tibiae pale with diffuse brown shading; tibiae with marginal spines; tarsal claws with 13–14 marginal denticles (Fig. 4c). Abdominal terga pale with brown markings as in Fig. 1; each abdominal gill with black trachea (Fig. 5a, b); abdominal sterna pale, lateral margins brown. Caudal filaments pale to tan.

Records.—ARIZONA Apache Co., Little Colorado Riv., 4 miles E Eager on Hwy. 73, 22-VI-70, RKA; Gila Co., San Carlos Riv. at San Carlos, 20-VIII-70, RKA; Navajo Co., N. Fk. White Riv. at Whiteriver, 5-VII-64, RKA; Navajo Co., Silver Cr. at Shumway, 6-VII-64, RKA. NEW MEXICO: Catron Co., San Francisco Riv. at Reserve, 22-VII-70, RKA; Colfax Co., Cimarron Riv. at Cimarron, 23-VIII-70, RKA; Grant Co., Sapillo Cr. nr. Lake Roberts on Hwy. 25, 21-VII-70, RKA; San Miguel Co., Windsor Cr. at Cowles, 2-VII-64, RKA. All specimens deposited at CSCLA.

Paraleptophlebia altana, n. sp.

MALE IMAGO.—Length: body 7.0–8.0 mm; fore wing 7.0–8.0 mm; caudal filaments 10.0–11.0 mm. General color reddish-brown. Head reddish-brown; head black between ocelli; ocelli white; upper compound eye white, lower black. Thoracic segments reddish-brown, pleura and bases of legs with black streaks; fore wings hyaline, longitudinal veins reddish; legs reddish; tarsi darker than other leg segments. Abdominal segments reddish-brown, often brown with only a tinge of red; segments 1–8 pale anterolaterally; terga 1–5 usually with a pale median longitudinal stripe margined with thin submedian dark stripes; pleura pale; sternum often with a black posterolateral macula on segments 2–9; segments 1–8 translucent, 9, 10 opaque. Genitalia reddish; penes with a narrow apical median cleft, cleft semicircular at base; penes with V-shaped sublateral notches, and with large laterally projecting lobes (Fig. 6). Caudal filaments dark reddish-brown.

FEMALE IMAGO.—Length: body 9.0–10.0 mm; fore wing 13.0–14.0 mm; caudal filaments 13.0–14.0 mm. Other characters as in male except for usual sexual differences.

NYMPH.—Length: body 9.0–10.0 mm; caudal filaments 9.0–10.0 mm. General color dark brown with light brown and amber markings. Head brown with amber markings; head with amber maculae below median ocellus and around compound eyes; antennae pale; head darker brown between ocelli and on genae; labrum brown. Thoracic nota dark brown; pronotum often with amber submedian maculae; mesonotum often with median anterior and lateral amber maculae; thoracic sterna amber; legs amber; femora am-

[1] The research upon which this report is based was supported by National Science Foundation grants. Received for publication Aug. 2, 1972.

ber, often with a large brown macula; tarsal claws with 14–18 marginal denticles. Abdominal terga dark brown with variable amber markings (Fig. 7); abdominal gills divided nearly to base; gill trachea with numerous branches (Fig. 8); abdominal sterna amber, brown along lateral margins. Caudal filaments brown at base, paler distally.

Types.—Holotype: male imago, Millard Canyon, 2 miles above Altadena, Los Angeles Co., Calif., 10-VII-67, D. L. Collins. Paratopotypes: 21 male imagoes and 5 nymphs, 10/27-VII-67, other data same as holotype, 2 male imagoes in collections California Academy of Sciences, San Francisco, and UU, others in CSCLA. Paratypes: 2 nymphs, Coldwater Canyon, Los Angeles Co., Calif., 12-VII-65, W. P. Vann; 12 nymphs, stream in Cattle Canyon, Los Angeles Co., Calif., 14/27-VI-65, W. P. Vann; 1 nymph, Little Dalton Canyon, Los Angeles Co., Calif., 14-

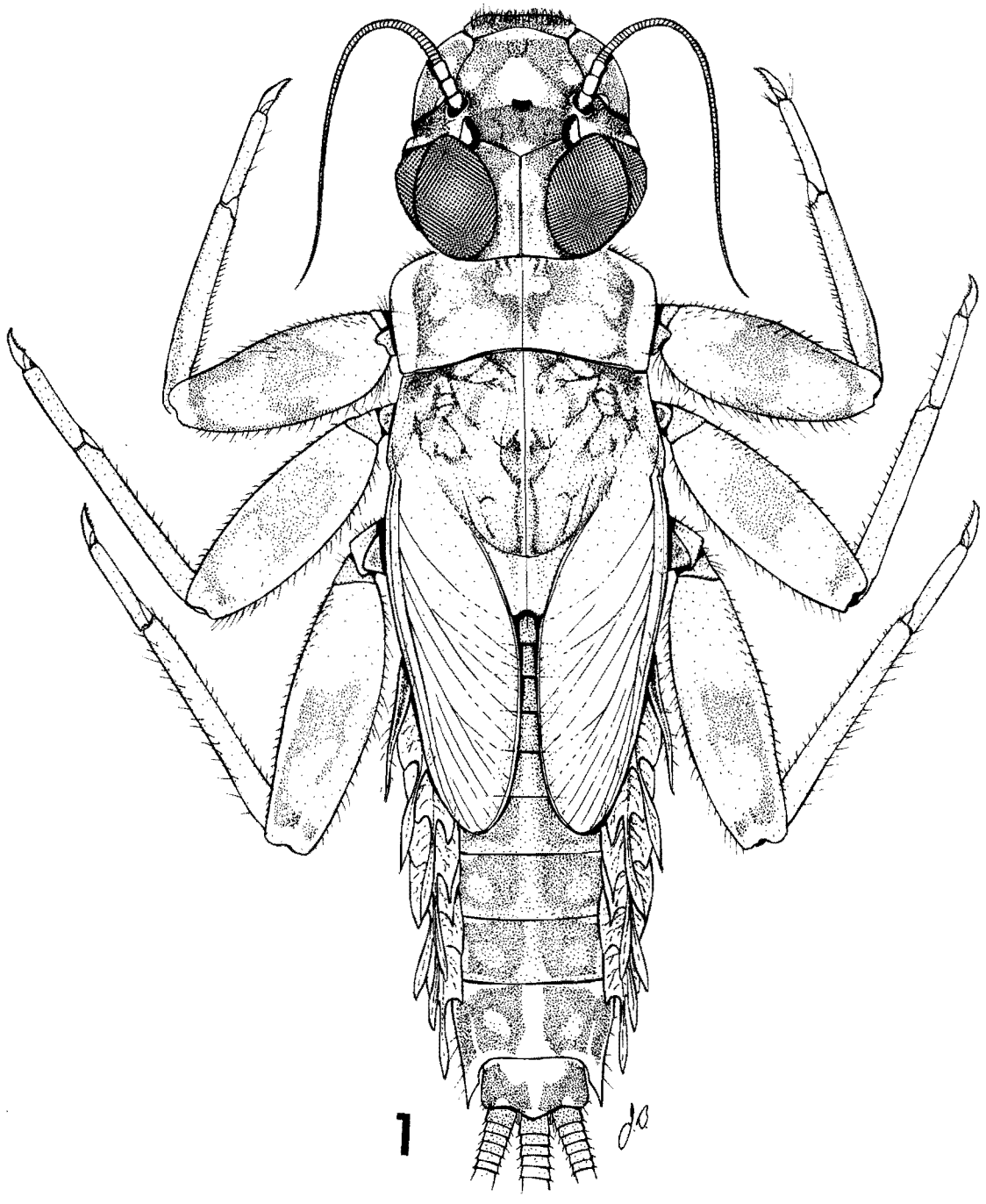

FIG. 1.—*C. inornata,* mature male nymph, dorsal view.

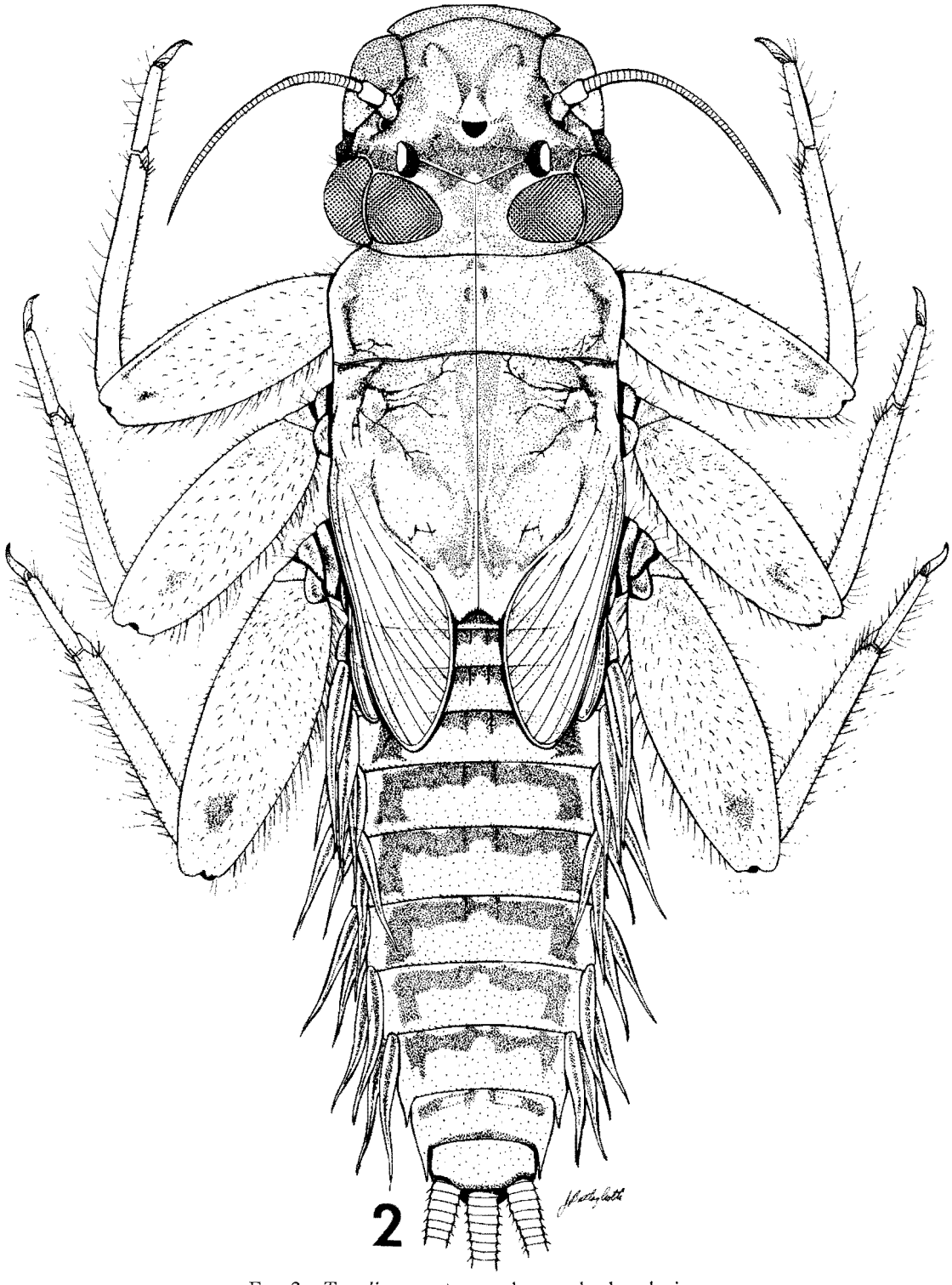

FIG. 2.—*T. salinus*, mature male nymph, dorsal view.

VI-65, W. P. Vann; 33 nymphs, W. Fk. San Gabriel Riv., Los Angeles Co., Calif., 23-VI-65, W. P. Vann; 6 nymphs, Little Rock Canyon at Little Cedars, Los Angeles Co., Calif., 15-V-68, D. L. Collins; 19 nymphs, San Antonio Canyon, Los Angeles Co., Calif., 13-VI-65, W. P. Vann. All paratypes in CSCLA.

Etymology.—The name of this species is from the Latin word altanus meaning south-southwest wind.

Remarks.—The penes of *P. altana* are very similar

to those of *P. associata* (McDunnough) (1924) and *P. quisquilla* Day (1952), both described from central California. The male imago of *P. altana* is easily distinguished from imagoes of the other 2 species by the reddish-brown thorax and abdomen. The abdomen of *P. associata* is brown, and the fore wings are amber. The wings of *P. quisquilla* are translucent, like those of *P. altana,* but the abdominal segments are yellow and washed with black. The male imago of *P. altana* is further distinguished from these and all other described species by the structure of the penes lobes (Fig. 6). Likewise, the nymphs are distin-

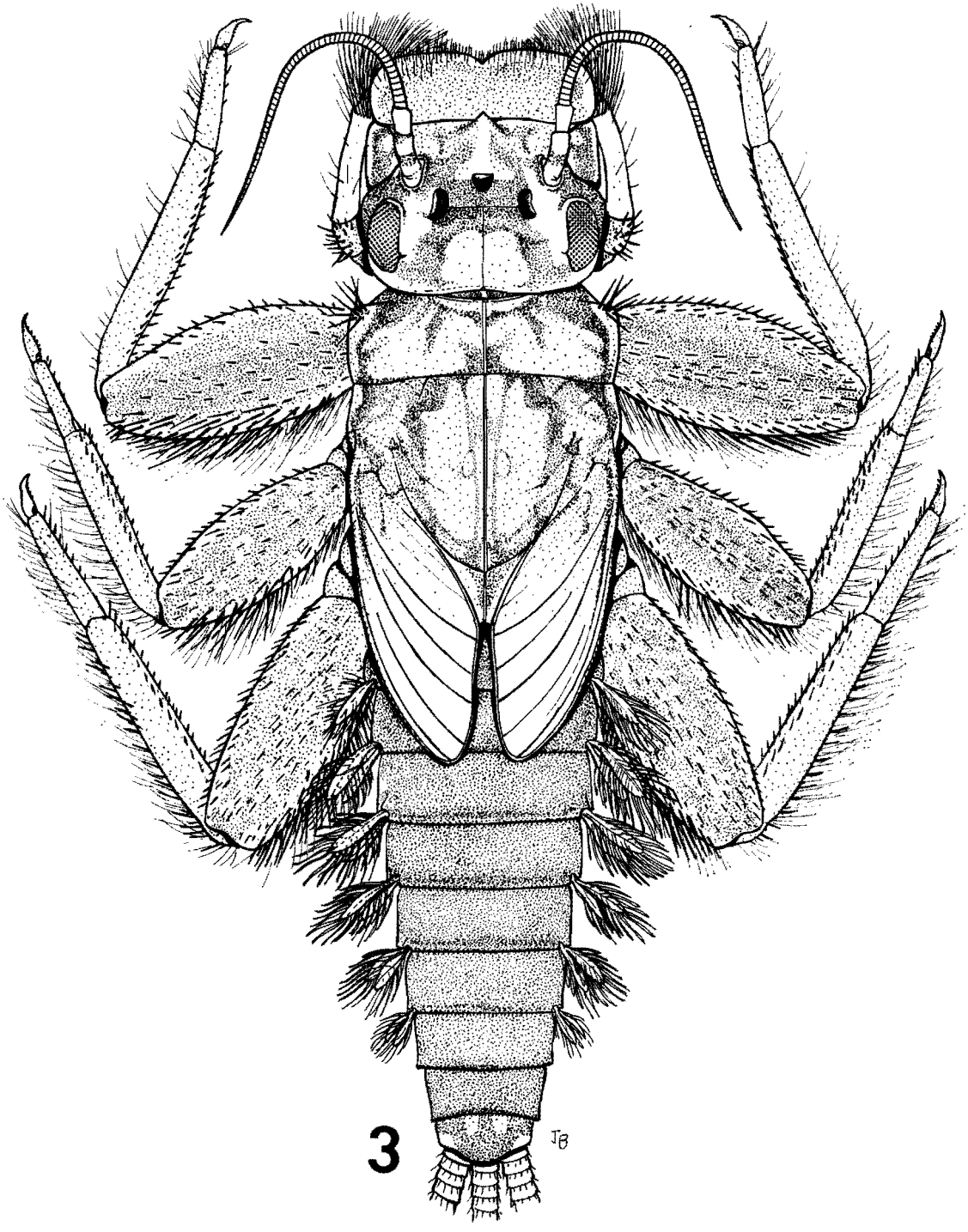

FIG. 3.—*T. castanea,* mature female nymph, dorsal view.

guished from the other known *Paraleptophlebia* nymphs by the reddish color of the body, by the deeply bifurcated gills, and by the lack of mandibular tusks.

Paraleptophlebia memorialis (Eaton)

This species was described from California as *Leptophlebia pallipes* by Hagen in 1874. Eaton (1884) rejected the name as a secondary homonym and renamed the species *L. memorialis*. The species is widely distributed in western North America. Specimens have been reported from southern Alberta and British Columbia, Oregon, Utah, Idaho, and northern New Mexico. Nymphal collections from the southwestern United States extend the known range into Arizona and southern New Mexico. These records and a description of the nymphal stage follow .

NYMPH.—Length: body 6.0–7.0 mm; caudal filaments broken. General color pale to yellow with light brown to reddish-brown markings. Head light brown to reddish-brown with pale to yellow maculae on frons, labrum emarginate with marginal spines, maxillary palpi 3-segmented. Thorax light brown to reddish-brown; mesonotum with paired yellow submedian maculae; legs yellow; femora with few spines on anterior surface, many spines on dorsal margin; tibiae with 2 clusters of apical spines; tarsal claws with 15–17 marginal denticles. Abdominal terga light brown to reddish-brown with pale to yellow markings; terga 1–9 with pale margins and with variable pale to yellow maculae, some specimens with median, submedian, and sublateral maculae as in Fig. 10, others with only submedian maculae as in Fig. 11; abdominal gills divided ⅓ from base; gill trachea with numerous branches (Fig. 9); abdominal sterna unicolorous yellow to brown. Caudal filaments yellow to brown.

Records.—ARIZONA: Apache Co., Hall Cr. on Hwy. 373, 3-VII-64, RKA; Gila Co., Christopher Cr. on Hwy. 160, 19-VII-70, RKA; Greenlee Co., Blue Riv. at Clifton, 4-VII-64, RKA. NEW MEXICO: Catron Co., Whitewater Riv. at Whitewater Campground, 22-VII-70, RKA; Lincoln Co., creek at Pine Lodge, 24-VII-70, RKA. All specimens deposited at CSCLA.

Thraulodes brunneus Koss

Koss (1966) described this species from a male imago collected in Grant Co., N. Mex. Collections of *Thraulodes* from Arizona and New Mexico include nymphs that are herein associated as the aquatic stage of this species. A description of the nymph, and new distributional records follow.

NYMPH.—Length: body 6.5–7.5 mm; caudal filaments 10.0–11.0 mm. General color pale to yellow with light brown and dark brown markings. Head pale with transverse black maculae between lateral ocelli; labrum slightly emarginate with marginal setae; maxillary palpi 3-segmented. Thoracic nota pale with dark markings; pronotum with lateral black markings; mesonotum with dark brown weblike tracheations at anterolateral corners; legs pale with variable diffuse brown pigmentation; fore femora with apical and basal ventral black maculae on anterior surface as in Fig. 12 a; middle and hind femora with apical black maculae as in Fig. 12 b; femora with marginal setae and spines; femora with scattered long pointed spines on anterior surface as in Fig. 13; fore tibiae with apical black band; middle and hind tibiae without markings; tarsal claws with 6–7 large apical denticles, and 5–6 small basal denticles as in Fig. 12c. Abdominal terga 1–9 yellow, each with a brown posterior band and a posterolateral triangular brown marking (Fig. 15); tergum 10 usually unicolorous yellow; abdominal gills with black diffuse pigment obscuring lateral trachea; gills wide, width to length 1:5 (Fig. 17); gills 1–4 subequal in length; gills 5–7 decreasing in length posteriorly. Caudal filaments pale with brown annulations.

Records.—ARIZONA: Gila Co., Haigler Cr. on Road 200, 19-VII-70, RKA; Cochise Co., Cave Cr. Chiricahua Mts., 28-VI-66, RKA; Yavapai Co., Beaver Cr. at Beaver Creek, 7-VII-64, RKA. NEW MEXICO: Grant Co., Sapillo Cr. nr. Lake Roberts on Hwy. 25, 21-VII-70, RKA. All specimens deposited at CSCLA.

Thraulodes salinus, n. sp.

NYMPH.—Length: body 5.0–6.0 mm; caudal filaments 5.0–6.0 mm. General color pale to light brown with brown and black markings. Head pale with black markings, head with a black transverse band between compound eyes (Fig. 2); antennae pale; labrum brown, slightly emarginate, with anterior rows of setae; maxillary palpi 3-segmented. Thoracic nota pale to light brown with black markings; pronotum pale to light brown with sublateral black maculae, and often small submedian spots; mesonotum pale to light brown with weblike black tracheations at anterolateral corners (Fig. 2); legs pale; femora each with a black subapical macula; femora with scattered short, blunt spines on anterior surface (Fig. 14); tibiae yellow, with scattered marginal setae; tarsal claws with 6–7 large apical denticles and 4–5 small basal denticles. Abdominal terga pale to light brown with brown and black markings; terga 1–8 pale to light brown each with a U-shaped marking, marking often disjunct medially; tergum 9 with an anterior black band; terga 9 and 10 with a posterior black margin (Fig. 2); abdominal gills without lateral trachea and lamellar pigmentation (Fig. 18); gills narrow, width to length ratio 1:8; gills 1–4 subequal in length; gills 5–7 decreasing in length posteriorly; abdominal sterna pale to light brown. Caudal filaments pale with brown annulations.

Types.—Holotype: mature male nymph, Salt River on Highway 288, Gila Co., Ariz., 20-VII-70, RKA. Paratopotypes: 4 male and 3 female nymphs, same data as holotype, in collection CSCLA.

Etymology.—The name of this species is from the Latin word salinus meaning of salt, and is based upon the type locality, the Salt River.

Remarks.—The nymph of *T. salinas* is distinguished from those of the other described *Thraulodes* from the southwestern United States by the abdominal color pattern, by the shape of the femoral spines, and by the character of the gills. The abdominal terga of *T. salinus* have inverted U-shaped markings

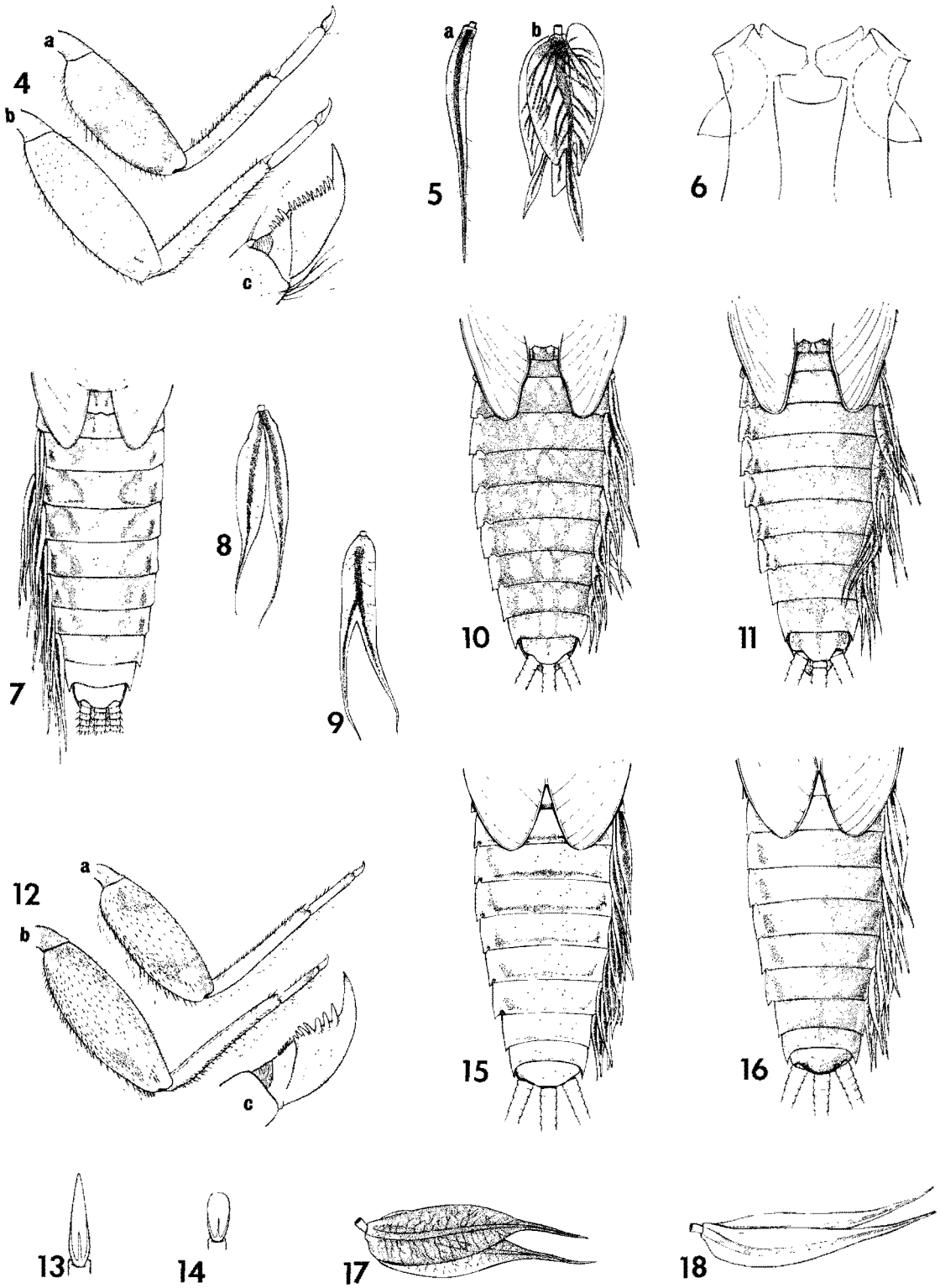

FIG. 4, 5.—*C. inornata,* nymph. 4 a, Leg 1, dorsal view; 4 b, leg 3, dorsal view; 4 c, tarsal claw; 5 a, b, abdominal gills 1 and 3 respectively. FIG. 6–8.—*P. altana.* 6, male penes, dorsal view; 7, abdominal terga, nymph; 8, abdominal gill 3, nymph. FIG. 9–11.—*P. memorialis,* nymph. 9, Abdominal gill 3; 10, 11, abdominal terga. FIG. 12–18.—*Thraulodes* spp., nymphs. 12 a, *T. speciosus,* leg 1, dorsal view; 12 b, same, leg 3, dorsal view; 12 c, same, tarsal claw; 13, same, femoral spine; 14, *T. salinus,* femoral spine; 15, *T. brunneus,* abdominal terga; 16, *T. speciosus,* abdominal terga; 17, same, abdominal gill 3; 18, *T. salinus,* abdominal gill 3.

(Fig. 2), the markings of *T. brunneus* are U-shaped (Fig. 15), and the terga of *T. speciosus* are brown with a pale median macula and sublateral dark brown maculae (Fig. 16). The abdominal gills are narrow with a width to length ratio of 1:8, and the gills are without lateral tracheation (Fig. 18). The gills of the other species, *T. arizonicus* McDunnough (1942), *T. brunneus,* and *T. speciosus* Traver (1934), are wide with a width to length ratio of 1:3–1:5, and the gills are with lateral tracheation as in Fig. 17. *T. salinus* is further distinguished by the possession of short, blunt spines on the anterior surface of the femora (Fig. 14), compared to long and pointed spines on the femora of the other species, as in Fig. 13.

Traverella albertana (McDunnough)

T. albertana was described by McDunnough (1931), as *Thraulus,* from Alberta, Canada. Additional records have been reported from Saskatchewan, northeastern Utah, southwestern Wyoming, and Idaho. Recent collections from Arizona included specimens which constitute a range extension for the species, and a new generic record for the State.

New Records.—ARIZONA: Gila Co., East Verde Riv. on Road 406, 10 miles E Payson, 19-VII-70, RKA; Salt Riv. on Hwy. 288, 20-VII-70, RKA; Greenlee Co., Blue Riv. at Clifton, 4-VII-64, RKA; Yavapai Co., Verde Riv. at Camp Verde, 18-VII-70, RKA. All specimens deposited at CSCLA.

Traverella castanea, n. sp.

NYMPH.—Length: body 8.0–10.0 mm; caudal filaments 11.0–12.0 mm. General color light brown to brown with dark brown and black to pale markings. Head brown with black and pale markings; head usually with a pale median occipital macula, and with paired pale maculae mesad from compound eyes; labrum slightly emarginate; maxillary palpi with 6 subapical rings of long setae; frontoclypeus with a moderately developed median tubercle (Fig. 3). Thoracic nota light brown to reddish-brown pale and darker brown markings; legs light brown with dark spines; femora covered with numerous short spines; fore femora with 100–120 spines on anterior surface (Fig. 19); middle and hind femora with 130–150 spines on anterior surface; tibiae with long setae on outer margin; tarsal claws with 8–9 large apical denticles, and 5–6 small basal denticles. Abdominal terga unicolorous yellow to brown (Fig. 3); tracheal gills yellow with diffuse black or reddish-brown pigmentation; gill tracheae black; gills on segments 1 and 2 subequal in length; gills on segments 3–7 decreasing in length posteriorly; abdominal sterna pale. Caudal filaments pale with dark annulations.

Types.—Holotype: mature nymph, East Fork Gila River on Highway 527, Grant Co., N. Mex., 21-VII-70, RKA. Paratopotypes: 104 nymphs, same data as holotype, 5 nymphs each in the Canadian National Collection, Ottawa; the California Academy of Sciences, San Francisco; and UU; others in CSCLA. Paratypes: 53 nymphs, W. Fk. Gila Riv. on Hwy. 527, Grant Co., N. Mex., 21-VII-70, RKA; 9 nymphs, Gila Riv. nr. Cliff on Hwy. 180, Grant Co., N. Mex., 21-VII-70, RKA; 1 nymph, San Francisco Riv. at Glenwood, Catron Co., N. Mex., 21-VII-70, RKA; 5 nymphs, East Verde Riv. on Road 406, 10 miles E Payson, Gila Co., Ariz., 19-VII-70, RKA; 3 nymphs, N. Fk. White Riv. at Whiteriver, Navajo Co., Ariz., 5-VII-64, RKA; 25 nymphs, Verde Riv. at Verde Valley, Yavapai Co., Ariz., 18-VII-70, RKA; 7 nymphs, Oak Cr. nr. Cornville, Yavapai Co., Ariz., 17/18-VII-70, RKA. All paratypes in CSCLA.

Etymology.—The name of this species is from the Latin word castanea meaning Chestnut.

Remarks.—The ranges of *T. albertana* and *T. castanea* overlap in central Arizona, and nymphs of both have been collected from the same locality. The adults of *T. castanea* are unknown, but the nymphs are easily distinguished from those of *T. albertana* by the following combination of characters: (1) the abdominal terga of *T. castanea* are unicolorous brown, whereas those of *T. albertana* have distinctive markings (Fig. 3, 21); (2) the anterior surface of the femora of *T. castanea* possesses numerous spines, the femora of *T. albertana* have only a few spines (Fig. 19, 20); and (3) the frontoclypeal tubercle of *T. castanea* is moderately developed (Fig. 3), while the tubercle of *T. albertana* is poorly developed.

Ephemerella (Serratella) micheneri Traver

Traver (1934) described this species from the San Gabriel Mountains in southern California, and Allen and Edmunds (1963) extended the known range in the southwestern United States into central Arizona and northwestern New Mexico. Recent collections from these States further extend the range into southern Arizona and New Mexico, and into eastern New Mexico.

Records.—ARIZONA: Gila Co., Haigler Cr. on Road 200, 19-VII-70, RKA (CSCLA); Pinal Co., Kelvin, 7-V-69, R. W. Koss and A. V. Provonsha (RWK); Yavapai Co., Oak Cr. at Red Rock Crossing, 7/8-VII-64, RKA (CSCLA). NEW MEXICO: Catron Co., Negrito Cr., 2 miles W Reserve, 4-VII-64, RKA (CSCLA); Colfax Co., Ponil Cr., 1 mile E Cimarron, 23-VIII-70, RKA (CSCLA); Grant Co., Little Cr., N Silver City on Route 160, 10-VII-69, R. W. Koss, W. P. McCafferty, and A. V. Provonsha (RWK); Rio Arriba Co., Rio Brazos at Brazos, 14-VII-69, R. W. Koss, W. P. McCafferty, and A. V. Provonsha (RWK).

Ephemerella (Drunella) grandis Eaton

Eaton (1884) described this species from Colorado, and Allen and Edmunds (1962) reported records from central Arizona and northern New Mexico. Recent collections have extended the range of *E. grandis* into southern Arizona and south-central New Mexico.

Records.—ARIZONA: Graham Co., Grant Cr. on Hwy. 366, Pinaleno Mtns., 20-VII-70, RKA (CSCLA). NEW MEXICO: Lincoln Co., Rio Ruidoso, 2 miles W Ruidoso, 2-VII-70, RKA (CSCLA).

Leptohyphes baumanni, n. sp.

MALE NYMPH.—Length: body 4.0–5.0 mm; caudal filaments 2.0–3.0 mm. General color light brown with dark brown markings. Head brown; compound eyes

large; lateral ocelli large; maxillary palpi 2-segmented, distal segment reduced. Thoracic nota light brown with irregular dark brown markings; pronotum with blunt, anterolateral projections; legs yellow with black markings; fore femora unicolorous yellow (Fig. 22 a); middle and hind femora yellow with 3 black maculae (Fig. 22 b); fore femoral band of spines as in Fig. 22 a; hind femora 25% longer than fore femora; tibiae each with a black basal macula; tarsi each with an apical macula; tarsal claws each with 7–9 marginal denticles and a single submarginal denticle near apex (Fig. 22 c). Abdominal terga yellow to light brown with dark markings; terga 1–6 with a black transverse band, terga 7–10 each with a black median and paired black lateral maculae; abdominal terga with poorly developed posterolateral projections; operculate gills pale with black markings; operculate gills without a basal spine; abdominal sterna light brown to chestnut brown. Caudal filaments pale.

FEMALE NYMPH.—Length: body 4.5–5.5 mm; caudal filaments 2.0–3.0 mm. General color pale to light brown. Compound eyes small. Other characters as in male except for usual sexual differences.

Types.—Holotype: mature male nymph, Sonoita Creek, Highway 82 near Patagonia, Santa Cruz Co., Ariz., 20-V-70, R. W. Bauman. Allotype: mature female nymph, same data and deposition as holotype. Paratopotypes: 7 male and 3 female nymphs, 4 male and 2 female nymphs in collection RWK, others in CSCLA.

Etymology.—This species is named in honor of R. W. Baumann, the collector.

Remarks.—*L. baumanni* is the second known species of *Leptohyphes* from North America that exhibits secondary sexual dimorphism. The other species, *L. mirus* Allen, also described from Arizona, is known from only the nymphal stage. *L. mirus* is a distinctive species as the nymphs have well-developed posterolateral projections on abdominal segments 7–9; whereas, the nymphal abdomen of *L. baumanni* is without well-developed posterolateral projections. These species are further distinguished by the color on the operculate gills, by the arrangement and degree of development of spines on femora, and by the dentition on tarsal claws.

Leptohyphes quercus, n. sp.

FEMALE NYMPH.—Length: body 6.5–7.5 mm; caudal filaments 3.5–4.5 mm. General color brown with dark brown markings. Head brown with dark brown markings; lateral ocelli small; maxillary palpi absent. Thoracic nota brown with irregular dark brown markings; pronotum with moderately pointed, anterolateral projections; legs yellow to brown with black markings; each fore femur with a large black macula; middle and hind femora with a marginal large black macula (Fig. 23 b); femora with scattered spines on anterior surface (Fig. 23); fore femoral band of spines as in Fig. 23 a; hind femora 20% longer than fore femora; tibiae with marginal spines and setae (Fig. 23); tarsal claws with 10–12 marginal denticles and a single submarginal denticle near apex (Fig. 23 c). Abdominal terga brown with dark brown markings; terga often with a dark brown anterior transverse band and posterolateral brown triangular maculae; abdominal segments 7–9 with well-developed posterolateral projections (Fig. 24); operculate gills pale with black markings, without a basal spine; abdominal sterna brown. Caudal filaments brown.

Type.—Holotype: mature nymph, Oak Creek, Pine Flat Campground, Coconino Co., Ariz., 9-IV-68, R. W. Koss and R. W. Bauman.

Etymology.—The name of this species is from the Latin word quercus meaning oak, and is based upon the type locality, Oak Creek.

Remarks.—*L. quercus* is similar to *L. mirus* and *L. dolani* Allen in having well-developed posterolateral projections on segments 7–9. This species is distinguished from these and all other North American *Leptohyphes*, by the degree of development of the posterolateral projections, by the shape of the fore femora, by the number and arrangement of the spines on the fore femora, by the abdominal color pattern, and by the degree of development and the number of denticles on the tarsal claws.

Leptohyphes phalarobranchus, n. sp.

MALE NYMPH.—Length: body 4.5–5.5 mm; caudal filaments 3.5–4.5 mm. General color yellow with light brown markings. Head yellow with a brown band between lateral ocelli; lateral ocelli large; maxillary palpi 3-segmented. Thoracic nota yellow with diffuse light brown markings; pronotum without anterolateral projections; legs yellow; fore femoral band of spines as in Fig. 25 a; hind femora 20% longer than fore femora; anterior surface of middle and hind femora without spines (Fig. 25 b); tarsal claws with 6–7 basal marginal denticles, and 3–4 submarginal denticles near apex (Fig. 25 c). Abdominal terga unicolorous yellow to light brown; abdominal segments 7–9 without posterolateral projections; operculate gills light brown with 3 pale maculae, and a black basal macula (Fig. 26), without basal spine; abdominal sterna light brown. Caudal filaments light brown.

Type.—Holotype: mature nymph, Big Sandy River at Wikieup, Mohave Co., Ariz., 24-VIII-69, R. W. and D. W. Koss.

Etymology.—The name of this species is from the Greek words phalaros meaning white-spotted, and branchos meaning gill.

Remarks.—This species is readily distinguished from all other North American *Leptohyphes* by having a pale body color, and 3 pale spots on the operculate gills. All other described North American species assigned to this genus are either dark in color, or pale with distinctive dark markings.

Tricorythodes condylus Allen

This species was described by Allen (1967) from adults and nymphs collected in central Arizona. Recent collections have extended the range of this species into southern New Mexico.

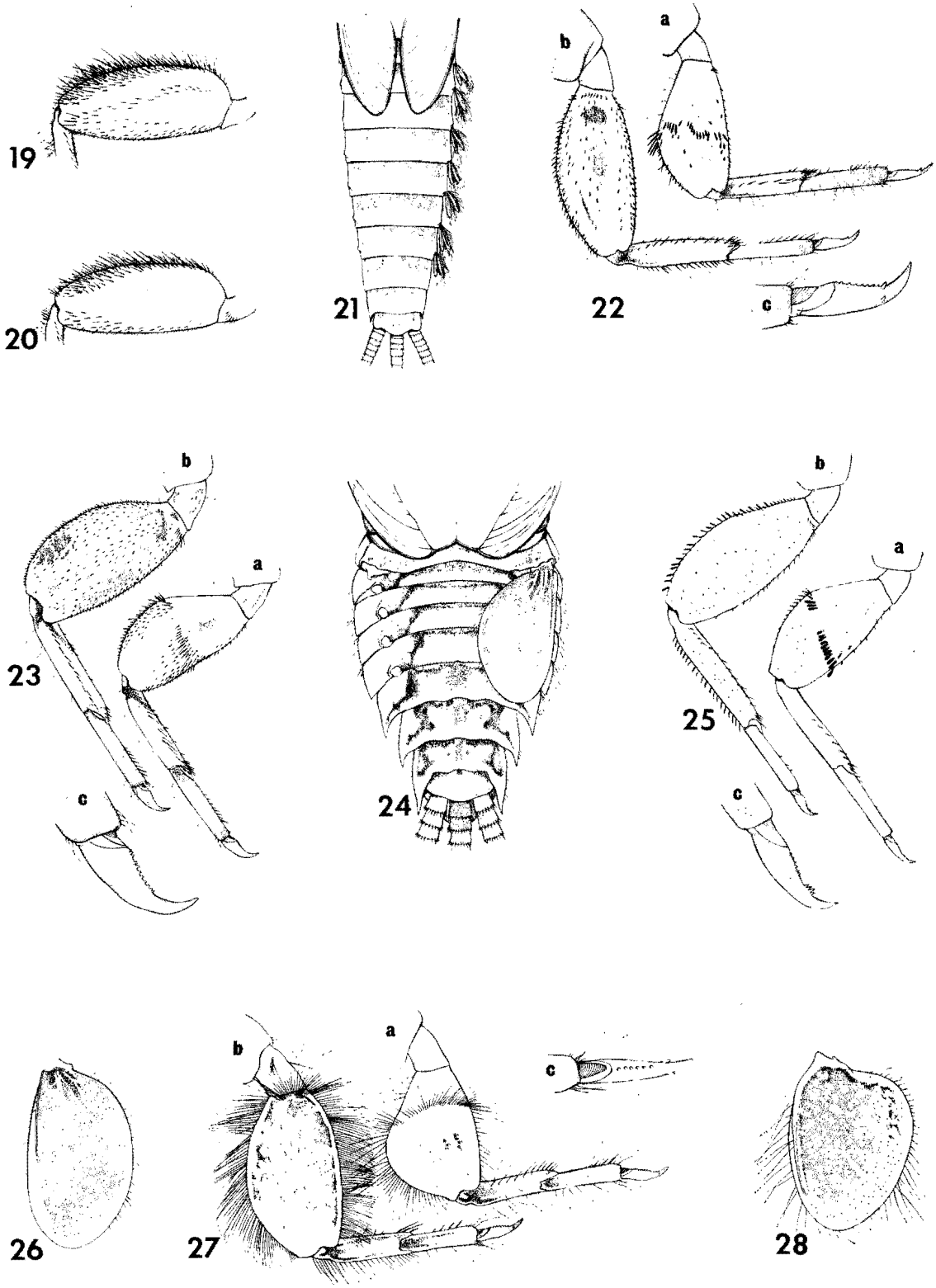

FIG. 19–21.—*Traverella* spp. 19, *T. castanea,* fore femur, dorsal view; 20, *T. albertana,* fore femur, dorsal view; 21, same, abdominal terga. FIG. 22–26.—*Leptohyphes* spp. 22 a, *L. baumanni,* leg 1, dorsal view; 22 b, same, leg 3, dorsal view; 22 c, same, tarsal claw; 23 a, *L. quercus,* leg 1, dorsal view; 23 b, same, leg 3, dorsal view; 23 c, same, tarsal claw; 24, same, abdominal terga, 25 a, *L. phalarobranchus,* leg 1, dorsal view; 25 b, same, leg 3, dorsal view; 25 c, same, tarsal claw; 26, same, abdominal gill 1. FIG. 27, 28.—*T. corpulentus.* 27 a, Leg 1, dorsal view; 27 b, leg 3, dorsal view; 27 c, tarsal claw; 28, abdominal gill 1.

Records.—NEW MEXICO: Catron Co., W. Fk. Gila Riv. at Gila Natl. Mon., 8-VII-69, R. W. Koss, W. P. McCafferty and A. V. Provonsha (RWK); Grant Co., Sapillo Cr. nr. Lake Roberts on Hwy. 25, 21-VII-70, RKA (CSCLA).

Tricorythodes dimorphus Allen

T. dimorphus was described by Allen (1967) from nymphs collected in central Arizona and northern New Mexico. Recent collections have extended the known distribution into southern Arizona and New Mexico, and nymphs from the San Gabriel Mountains of southern California have been reared to adults. A description of the male imago, and new distribution records follow.

MALE IMAGO.—Length: body 4.0–5.0 mm; fore wing 4.0–5.0 mm. General color dark brown. Head black; compound eyes large. Thorax black; legs pale to brown with black markings; femora pale to brown; tibiae pale to brown with a black apical macula; tarsi pale; wings hyaline; longitudinal veins dark, subcostal vein darker than others. Abdominal terga brown; terga 1–6 with black markings at posterolateral margins; terga 7 and 8 with black markings at posterolateral margins and anterolateral margins pale; terga 9 and 10 black; genital forceps brown; penes fused ⅔ to apex; penes as in Fig. 31. Caudal filaments pale.

Records.—ARIZONA: Cochise Co., Cave Cr., SW. Portal, Chiricahua Mtns., 27-VIII-60, R. W. and D. W. Koss (RWK); Gila Co., East Verde Riv. on Hwy. 87, N. Payson, 8-IV-68, R. W. Koss and R. W. Bauman (RWK). CALIFORNIA: Los Angeles Co., W. Fk. San Gabriel Riv. at Rincon Forest Sta., 14-VI-65, RKA and W. P. Vann (CSCLA). NEW MEXICO: Catron Co., Stream 26 miles N. Glenwood, 13-VII-67, R. W. and D. W. Koss (RWK); Grant Co., Sapillo Cr., nr. Lake Roberts on Hwy. 25, 21-VII-70, RKA (CSCLA); Sierra Co., Rio Grande Riv. below Hot Springs, 22-XII-47, S. Mulaik (UU).

Remarks.—*T. dimorphus* appears to be related to *T. minutus* Traver in the adult stage as the structures of the male genitalia are similar; however, the former is distinguished from the latter, and all other described *Tricorythodes*, by exhibiting sexual dimorphism in the nymphal and adult stages. The male imagoes of *T. dimorphus* and *T. minutus* are further distinguished by the shape of the penes (Fig. 31, 32). The nymph of *T. dimorphus* is easily distinguished from *T. minutus*. The operculate gill of *T. minutus* is triangular (Fig. 37), whereas this structure is subovate in *T. dimorphus* (Fig. 33). The shape of the operculate gill of the latter species suggests a close relationship to *T. edmundsi* Allen and *T. corpulentus*, n. sp. The fore femora width to length ratio is 1:2 in *T. dimorplus* (Fig. 34 a) and 1:1 in *T. edmundsi* and *T. corpulentus* (Fig. 27 a, 29 a) which serves to distinguish *T. dimorphus* from these 2 species. The middle and hind femora of *T. dimorphus* have scattered setae on their anterior surfaces and they are black with pale markings (Fig. 34 b), while those of *T. corpulentus* and *T. edmundsi* are without setae and they are pale with black markings (Fig. 27 b, 29 b). The nymphs of *T. dimorphus* are further distinguished from *T. minutus* by the number and pattern of denticles on the tarsal claws. *T. dimorphus* has 6–8 marginal denticles and a single submarginal denticle near the apex (Fig. 34), and *T. minutus* has 10–12 marginal denticles (Fig. 35 b).

Tricorythodes corpulentus, n. sp.

NYMPH.—Length: body 4.5–5.5 mm; caudal filaments 5.0–6.0 mm. General color pale with dark brown and black markings. Head pale to light brown with dark brown markings on occiput; head with long setae on occiput and frons; maxillary palpi absent, with only a small spine. Thoracic nota yellow with dark brown markings; thoracic nota with moderately long setae; legs yellow with diffuse black markings; fore femora with 2 small maculae; fore femoral band of setae as in Fig. 27 a; fore femora as long as broad; hind femora 35% longer than fore femora; middle and hind femora with diffuse black markings (Fig. 27 b); tibiae and tarsi with black basal maculae; tarsal claws with 5–6 basal marginal denticles and 2 submarginal denticles near apex (Fig. 27 c). Abdominal terga yellow with a broad dark brown transverse band; terga with long setae; terga 7–9 with poorly developed posterolateral projections; operculate gills rounded mesally, with diffuse black markings (Fig. 28). Abdominal sterna pale. Caudal filaments pale.

Type.—Holotype: mature nymph, Middle Fork Gila River at Little Bear Canyon, Catron Co., N. Mex., 10-VII-69, W. P. McCafferty and A. V. Provonsha.

Etymology.—The name of this species is from the Latin word corpulentus meaning fat.

Remarks.—*T. corpulentus, T. edmundsi,* and *T. dimorphus* appear to form a species complex as they have several characters in common. All species possess ovate, operculate gills, and broad fore femora with the band of setae arranged in a semicircular pattern (Fig. 27, 29, 34). These species are distinguished by the following combination of characters: (1) the tarsal claws of *T. corpulentus* have paired subapical denticles (Fig. 27 c), whereas *T. dimorphus* possesses one subapical denticle (Fig. 34), and in *T. edmundsi* they are absent (Fig. 29 c); (2) *T. edmundsi* possesses a black U-shaped marking on the operculate gills (Fig. 30), *T. corpulentus* has diffuse black pigment throughout the gill (Fig. 28), and in *T. dimorphus*, pigmentation is limited to the basal ⅓ of the gill (Fig. 33).

Tricorythodes minutus Traver

This species was described by Traver (1935) from male imagoes collected in northern Utah. The species is common in western North America as it has been reported from central British Columbia, Alberta, and Saskatchewan, to southern California and northern New Mexico. Recent collections from Arizona and New Mexico extend the known range into southern New Mexico and Arizona and marginal records are included hereinafter. The nymphal stage of

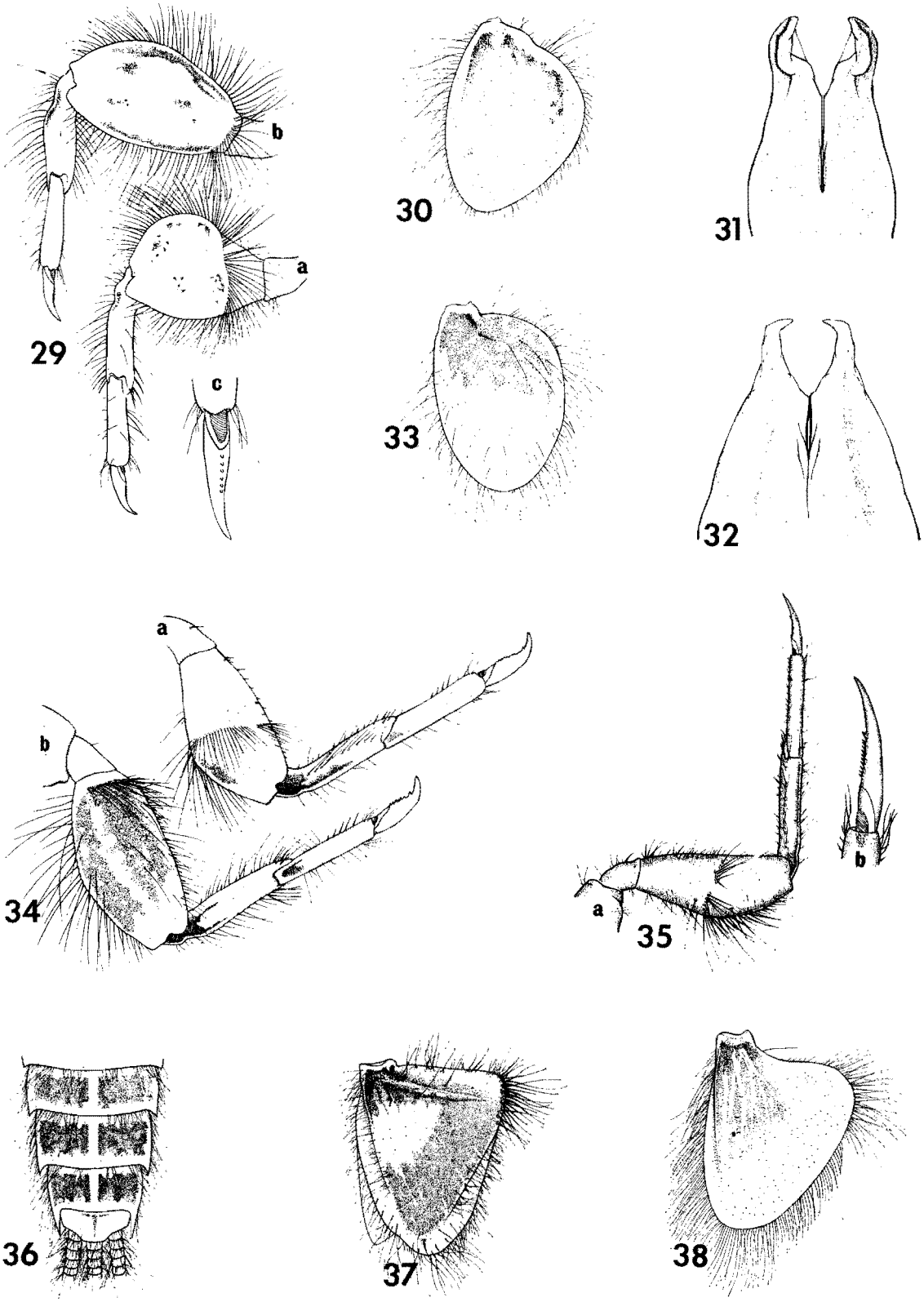

FIG. 29–38.—*Tricorythodes* spp. 29 a, *T. edmundsi*, leg 1, dorsal view; 29 b, same, leg 3, dorsal view; 29 c, same, tarsal claw; 30, same, abdominal gill 1; 31, *T. dimorphus*, male penes, dorsal view; 32, *T. minutus*, male penes, dorsal view; 33, *T. dimorphus*, abdominal gill 1; 34 a, same, leg 1, dorsal view; 34 b, same, leg 3, dorsal view; 35 a, *T. minutus*, leg 1, dorsal view; 35 b, same, tarsal claw; 36, same, abdominal terga 7–10; 37, same, abdominal gill 1; 38, *T. condylus*, abdominal gill 1.

T. minutus is well known to western ephemeropterists, but a formal description of this stage has never been published. A description of the nymph follows.

NYMPH.—Length: body 5.5–6.5 mm; caudal filaments 4.5–5.5 mm. General color pale with dark brown to black markings. Head pale with dark brown markings, with a transverse brown band between lateral ocelli, and with paired submedian brown maculae anterior to median ocellus; maxillary palpi 3-segmented. Thoracic nota pale with variable black markings; nota with scattered setae; legs pale with dark markings; femora unicolorous pale, or with diffuse dark markings; femora with long marginal setae; fore femoral band of setae as in Fig. 35 a; fore feforma twice as long as broad; hind femora 25% longer than fore femora; tibiae pale, each with a black basal macula; tibiae with marginal setae; tarsi pale, each often with a black apical macula; tarsal claws with 10–12 marginal denticles (Fig. 35 b). Abdominal terga pale with dark brown markings, with long marginal setae; terga 1–9 pale with dark brown transverse wide bands interrupted medially by a pale stripe; tergum 10 pale, often with a brown median stripe (Fig. 36); terga 7–9 with well-developed posterolateral projections; operculate gills triangular, pale with black markings (Fig. 37); abdominal sterna pale. Caudal filaments pale.

Records.—ARIZONA: Apache Co., Gooseberry Cr. on Hwy. 73, 6-VII-64, RKA (CSCLA); Coconino Co., Oak Cr. S. Flagstaff, 9-IX-68, R. W. Koss and R. W. Bauman (RWK); Gila Co., San Carlos Riv. at San Carlos, 20-VII-70, RKA (CSCLA); East Verde Riv. on Hwy. 87, N. Payson, 8-IV-68, R. W. Koss and R. W. Bauman (RWK); Graham Co., Gila Riv. at Road to San Jose, 7-VII-68, R. W. Koss, W. P. McCafferty, and A. V. Provonsha (RWK); Navajo Co., N. Fk. White Riv. at Whiteriver, 5-VII-64, RKA (CSCLA); Pinal Co., Gila Riv. at Hayden, 25-VI-66, RKA (CSCLA); Santa Cruz Co., Sonoita Cr. on Hwy. 82, 20-V-70, R. W. Bauman (RWK); Yavapai Co., Verde Riv. above Clarksdale, 6-V-69, R. W. Koss and A. V. Provonsha (RWK). NEW MEXICO: Catron Co., San Francisco Riv. at Reserve, 22-VII-70, RKA (CSCLA); Chaves Co., Rio Penasco, 12-VII-69, R. W. Koss, W. P. McCafferty, and A. V. Provonsha (RWK); Colfax Co., Ponil Cr., 1 mile E Cimarron, 23-VIII-70, RKA (CSCLA); Grant Co., Gila Riv. nr. Cliff, 21-VII-70, RKA (CSCLA); Lincoln Co., Rio Ruidoso at Glencoe, 24-VII-70, RKA (CSCLA); Mora Co., Mora Riv. at Mora, 1-VII-64, RKA (CSCLA); Rio Arriba Co., Rio Chama at Chama, 29-VI-64, RKA (CSCLA); Sandoval Co., E. Fk. Jemez Riv., 20 miles W Los Alamos, 1-IX-69, R. W. and D. W. Koss (RWK); San Juan Co., San Juan Riv. at Shiprock, 28-VI-64, RKA (CSCLA); Sierra Co., Rio Grande Riv. below Hot Springs, 22-XII-47, S. Mulaik (UU); San Miguel Co., Sapello Riv. at Sapello, 14-VII-69, R. W. Koss, W. P. McCafferty, and A. V. Provonsha (RWK); Santa Fe Co., Trib. Rio Grande Riv. at Santuario on Hwy. 520, 1-IX-70, R. W. and D. W. Koss (RWK); Taos Co., Taos Cr. at Sanchez Can., 12 miles N Taos on Hwy. 38, 1-VII-64, RKA (CSCLA).

Remarks.—*T. minutus* and *T. condylus* Allen may form a species complex as each possesses triangular operculate gills. They are distinguished on the basis of the pigmentation of the operculate gill. The gill of *T. minutus* has distinct basal and apical pigmentation (Fig. 37), whereas *T. condylus* has diffuse basal pigmentation only (Fig. 38). These species are most easily distinguished by the presence of head and thoracic tubercules in *T. condylus;* they are absent in *T. minutus.*

REFERENCES CITED

Allen, R. K. 1967. New species of new world Leptohyphinae (Ephemeroptera: Tricorythidae). Can. Entomol. 99: 350–75.

Allen, R. K., and G. F. Edmunds, Jr. 1962. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae). V. The subgenus *Drunella* in North America. Misc. Publ. Entomol. Soc. Am. 3: 147–79.

1963. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) VI. The subgenus *Serratella* in North America. Ann. Entomol. Soc. Am. 56: 583–600.

Day, W. C. 1952. New species and notes on California mayflies (Ephemeroptera). Pan-Pac. Entomol. 28: 17–39.

Eaton, A. E. 1883–88. A revisional monograph of recent Ephemeridae or mayflies. Trans. Linn. Soc. Lond. Sec. Ser. Zool. 3: 1–352.

1892. Biologia Centrali-Americana, Insects, Neuroptera, Ephemeridae, 1–18.

Hagen, H. A. 1874. Report on the Pseudoneuroptera and Neuroptera collected by Lieut. W. L. Carpenter in 1873 in Colorado. Annu. Rep. U.S. Geol. Geog. Surv. Terr. 1873, Pt. III, Zool: 571–606.

Koss, R. W. 1966. A new species of *Thraulodes* from New Mexico. Mich. Entomol. 1: 91–94.

McDunnough, J. G. 1924. New North American Ephemeridae. Can. Entomol. 56: 221–4.

1931. New species of North American Ephemeroptera. Ibid. 63: 82–93.

1942. An apparently new *Thraulodes* from Arizona (Ephemeroptera). Ibid. 74: 117.

Peters, W. L., and G. F. Edmunds, Jr. 1961. The mayflies (Ephemeroptera) of the Navajo Reservoir Basin, New Mexico and Colorado. Univ. Utah Anthropol. Pap. no. 55, Upper Colorado Series, no. 5: 107–11.

Traver, J. R. 1934. New North American species of mayflies (Ephemerida). J. Elisha Mitchell Sci. Soc. 50: 189–254.

1935. II: Systematic, p. 237–739. *In* J. G. Needham, J. R. Traver, and Yin-Chi Hsu [ed.] The Biology of Mayflies. Comstock, Ithaca, N. Y. 759 p.

Reprinted from the
ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA