

GENERIC REVISIONS OF MAYFLY NYMPHS  
II. *THRAULODES* IN NORTH AND CENTRAL AMERICA (LEPTOPHLEBIIDAE)<sup>1</sup>

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**Abstract**

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The 26 North and Central American species of *Thraulodes* are discussed, and synonymies and other pertinent data are presented for all species. On the basis of nymphal gill characters two groups of related species are recognized. *Thraulodes brunneus*, *T. speciosus*, *T. sp. A*, *T. sp. B*, and *T. sp. G* are included in the *brunneus*-group, and *T. gonzalesi*, *T. lunatus*, *T. packeri*, *T. salinus*, *T. zonalis*, *T. sp. C*, *T. sp. D*, *T. sp. E*, and *T. sp. F* form the *gonzalesi*-group. The 14 species of nymphs are included in an illustrated key and on distribution maps, and the account of each includes complete synonymy, nymphal description, and collection records. Nymphs designated as *Thraulodes* spp. A, B, C, D, E, F, and G are described, and new descriptions are presented for nymphs of *T. packeri* and *T. zonalis*.

Part I of these generic revisions (Allen 1973) dealt with the genus *Traverella*. This series will make available keys and descriptions by which the aquatic stages of Ephemeroptera can be identified and organized. The treatment of each species includes a name, or an informal epithet (e.g. A, B, C), a nymphal description or diagnosis, collection records, and biological data when available. In addition, an illustrated key to the nymphs and distribution maps are presented. Described adults whose nymphs are unknown are included with complete synonymy, known geographic distribution, and other pertinent data.

In the accounts that follow dealing with the species, collections made by the senior author are indicated by the initials RKA. Collections deposited at California Academy of Sciences are designated by the initials CAS, those at the University of Utah by UU, those at North Texas State University, Denton, by NTS, and collections without designation are deposited at California State University, Los Angeles.

Genus *THRAULODES* Ulmer

*Thraulodes* Ulmer 1919: 33; Ulmer 1920: 116; Ulmer 1921: 263; Needham & Murphy 1924: 40; Traver 1935: 551; Traver 1944: 11; Traver 1946: 428; Demoulin 1955: 16; Traver 1964: 33; Traver & Edmunds 1967: 351.

*Thraulodes* is confined to the New World, is austral in origin, and the most northern limit of the genus is in the Lower North Temperate Zone (between 30° and 40° N. latitude; see Allen and Brusca, 1973). Collection records are from Arizona, New Mexico, and Texas in North America north of Mexico. The most northern record of the genus is near Flagstaff, Ariz. (ca. 35°12' N. lat.).

The genus was erected by Ulmer based on a male imago of *Thraululus laetus* Eaton, 1883, from Columbia. There are at present 46 described species included in *Thraulodes*, of which 26 are known from North and Central America. *Thraulodes arizonicus* McDunnough, *T. brunneus* Koss, *T. salinus* Kilgore & Allen, and *T. speciosus* Traver were described from the southwestern United States; *T. gonzalesi* Traver & Edmunds from Texas and Mexico; *T. ephippiatus* Traver & Edmunds, *T. humeralis* Navás, *T. lunatus* Traver & Edmunds, *T. mexicanus* (Eaton), and *T. spangleri* Traver & Edmunds from Mexico; and *T. centralis* Traver, *T. hilaris* (Eaton), *T. hilaroides* Traver, *T. irretitus* Navás, *T. lepidus* (Eaton), *T. packeri* Traver &

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Edmunds, *T. prolongatus* Traver, *T. valens* (Eaton), and *T. zonalis* Traver & Edmunds from Central America. Seven additional species of nymphs from North and Central America are described herein.

The taxonomy of *Thraulodes* is based on the adult stage and the nymph of the type-species has never been described. The description of the nymphal stage was first published by Needham and Murphy (1924) from two specimens collected in Peru, as *Thraulodes* sp.? nymph. The next published description of a nymph was 20 years later when Traver (1944) described two species collected in Brazil as *Thraulodes* sp. A and *Thraulodes* sp. B. Demoulin (1955) described another nymph from Brazil as *Thraulodes* sp. larva, and Traver and Edmunds (1967) described the nymphs of six species from North, Central, and South America. The nymph of *T. packeri* was reared to the male imago stage while those of *T. daidaleus* Thew, *T. gonzalesi*, *T. lunatus*, *T. traverae*, and *T. zonalis* were associated with the described male imagos. Mayo (1969) reared the nymph of *T. speciosus*, and Kilgore and Allen (1973) described *T. salinus* from the nymphal stage, and associated the nymph of *T. brunneus*. *Thraulodes* spp. A, B, C, D, E, F, and G, described herein, are known only from the nymphal stage. At present only 20 of the 46 described species of *Thraulodes* are known from the nymphal stage.

**Nymphal stage. General characteristics.** Body moderately flattened. Head rectangular, as wide as long; frons with dark transverse band between lateral ocelli; labrum with shallow emargination (Fig. 7) and not as wide as head (Fig. 1); maxillary palpi bearing long setae (Fig. 3); mandibles as in Figs. 4–5; labium as in Fig. 6. Pronotum and head subequal in width; femora moderately flattened with anterior and marginal spines and setae; tarsal claws with marginal row denticles (Figs. 14, 16, 18). Abdomen flattened ventrally, convex dorsally; abdominal gills present segments 1–7, largest segments 3–4, smallest segment 7; gills bilamellate, similar shape all segments; gill lamellae symmetrical or asymmetrical, wide or narrow, with or without lateral trachea. Caudal filaments shorter than terminal filament.

**Systematics.** The gill types of *Thraulodes* nymphs are of taxonomic importance. The gills of some species are narrow, symmetrical, tapering gradually along the posterior margin to the apex and are without lateral trachea. In others, the gills are wide, asymmetrical, tapering abruptly along the posterior margin to the apex, and are usually with lateral trachea. Needham and Murphy (1924) describe the gills of the nymph from Peru as being graduated in length, becoming smaller to the rearward, but do not discuss gill symmetry. Traver (1944) described the Brazilian species as having narrow, lanceolate gills without lateral tracheation. She also stated that the first and middle gills are longer and the posterior are progressively shorter. She does not discuss symmetry, but her illustrations indicate that the gills are symmetrical. Demoulin (1955) does not discuss either gill width or symmetry, but his illustrations indicate the gills of his Brazilian species are asymmetrical. Traver and Edmunds (1967) note that structural variation exists in the gills of *Thraulodes* and describe variations in width, length of tip beyond main gill apex, and size variance from gills 1 to 7, but do not discuss gill symmetry. Their illustrations, however, indicate the gills of *T. gonzalesi* and *Thraulodes* sp. (Campos Novas, Brazil) are symmetrical, while those of *Thraulodes* sp. (Santa Clara Brook, Brazil) and *Thraulodes* sp. (Bocaina, Brazil) are asymmetrical. Mayo (1969) does not discuss gill symmetry, but figures of *T. speciosus* show them to have wide, asymmetrical gills, and gills on specimens we have assigned as this species agree with her figures. On the basis of gill types, the nymphs of the North and Central American *Thraulodes* are included in two species-groups as follows: (1) the *brunneus*-group, and (2) the *gonzalesi*-group. The *brunneus*-group includes *T. brunneus*, *T. speciosus*, *Thraulodes* sp. A, *Thraulodes* sp. B, and *Thraulodes* sp. G.

The *gonzalesi*-group includes *T. gonzalesi*, *T. lunatus*, *T. salinus*, *Thraulodes* sp. C, *Thraulodes* sp. D, *Thraulodes* sp. E, and *Thraulodes* sp. F.

The characters most useful in distinguishing the species in the nymphal stage are as follows: (1) the shape, width, and presence or absence of lateral tracheation of abdominal gills; (2) color pattern of abdominal terga; (3) degree of development and number of spines and setae on femora; and (4) number and shape of denticles on tarsal claws.

The following key will serve to distinguish the nymphs of the North and Central American species of *Thraulodes*.

#### KEY TO THE SPECIES

1. Gills asymmetrical, tapering abruptly along posterior margin to apex (Figs. 8, 10); gills with or without lateral trachea; gills wide, length-to-width ratio 4:1 to 5:1 ..... *brunneus*-group, 2
- Gills symmetrical, tapering gradually along posterior margin to apex (Fig. 11); gills without lateral trachea; gills narrow to moderately narrow, length-to-width ratio 7:1 to 15:1 ..... *gonzalesi*-group, 6
- 2(1). Known distribution Arizona and(or) New Mexico ..... 3
- Known distribution Texas, Mexico, and(or) Central America ..... 4
- 3(2). Abdominal terga 1-9 with dark transverse posterior band and black sublateral maculae (Fig. 9); fore femora with long, dorsal, marginal spines, spines subequal tibia width ..... *brunneus*
- Abdominal terga with pale triangular-shaped macula on tergum 5, and often 8, usually dark sublateral maculae on terga 3-6 (Fig. 12), without dark transverse band; fore femora with short, dorsal, marginal spines, spines shorter tibia width ..... *speciosus*
- 4(2). Abdominal gills suffused with black, only margins pale; lateral trachea present or absent, often obscured by gill coloration (Fig. 8); abdominal terga with narrow posterior pink to dark transverse band, 5-7 often with dark median macula and sublateral paired maculae on 2-7 ..... sp. A
- Abdominal gills pale, only trachea darkened; lateral trachea present as in Fig. 10; abdominal terga pale with extensive reddish-brown markings (Fig. 19), or abdominal terga brown with pale and black maculae (Fig. 20) ..... 5
- 5(4). Abdominal terga pale with extensive reddish-brown markings (Fig. 19); femora robust, less than 3 times longer than wide, with long setae and subapical reddish-brown macula (Fig. 13); tarsal claws with small denticles, apical denticle longest (Fig. 14) ..... sp. B
- Abdominal terga brown with pale and black maculae (Fig. 20); femora delicate, more than 3 times longer than wide, without subapical macula (Fig. 15); tarsal claws with large and small denticles, median denticle largest (Fig. 16) ..... sp. G
- 6(1). Abdominal terga 1-8 pale with brown inverted U-shaped marking (Fig. 1); known distribution Arizona and(or) New Mexico ..... *salinus*
- Abdominal terga variable in color, without inverted U-shaped marking; known distribution Texas, Mexico, and(or) Central America ..... 7
- 7(6). Abdominal terga black, often with brown median, longitudinal stripe (Fig. 2); tarsal claws with single large apical denticle (Fig. 18); femora with distinct subapical transverse band (Fig. 17) ..... sp. F
- Abdominal terga pale to brown, not black, often with complex dark markings (Figs. 21-27); tarsal claws without large apical denticle, denticles nearly subequal; femora often with dark apical macula, without distinct band ..... 8
- 8(7). Abdominal terga 1-8 with complex dark markings (Fig. 21) ..... *gonzalesi*
- Abdominal terga without complex dark markings, with brown posterior transverse band, large or small sublateral maculae, or without distinct markings (Figs. 22-27) ..... 9
- 9(8). Abdominal terga 2-6 with distinct, oblique markings (Fig. 22), crescent-shaped markings (Fig. 23), or triangular shaped markings (Fig. 24) ..... 10
- Abdominal terga 2-6 with only small sublateral maculae or dots, without distinct sublateral markings (Figs. 25-27) ..... 12

- 10(9). Abdominal terga with wide oblique markings (Fig. 22); gill length-to-width ratio 7:1 . . . . . sp. E  
 – Abdominal terga with crescent-shaped (Fig. 23), or triangular-shaped (Fig. 24) sublateral maculae; gill length-to-width ratio 10:1 . . . . . 11  
 11(10). Abdominal terga with crescent-shaped maculae (Fig. 23); gills pale, median trachea black; known distribution central to northern Mexico (Fig. 31) . . . . . *lunatus*  
 – Abdominal terga with triangular-shaped maculae (Fig. 24); gills suffused with black; known distribution central Mexico to Panama (Fig. 31) . . . . . sp. C  
 12(9). Abdominal terga with distinct posterior transverse band or narrow stripe, with or without distinct sublateral maculae (Figs. 26–27); gills moderately narrow, length-to-width ratio 7:1 to 12:1 . . . . . 13  
 – Abdominal terga without distinct posterior band, with small dark posterior sublateral dots (Fig. 25); gills narrow, length-to-width ratio 15:1 . . . . . *packeri*  
 13(12). Abdominal terga 1–9 with wide posterior band (Fig. 26); gills suffused with black; body length 8.0–9.0 mm; gills length-to-width ratio 7:1 . . . . . *zonalis*  
 – Abdominal terga 1–9 with narrow sub-median, disjunct, posterior stripe, and 2–6 often with black sublateral maculae (Fig. 27); gills pale, median trachea black; body length 5.0–6.0 mm; gills length-to-width ratio 10:1 to 12:1 . . . . . sp. D

## BRUNNEUS-GROUP

This species-group is characterized as follows: (1) gills wide, width greater than one-fourth length; (2) gills asymmetrical, tapering gradually along anterior margin, abruptly along posterior from base to apex (Figs. 8, 10); and (3) lateral trachea present or absent.

*Thraulodes brunneus* Koss

*Thraulodes brunneus* Koss 1966: 91; Traver & Edmunds 1967: 362; Kilgore & Allen 1973: 325 (nymph).

This species was described from a single male imago collected in southwestern New Mexico by Koss (1966). Traver and Edmunds (1967) redescribed the male imago, and the nymphal stage was described by Kilgore and Allen (1973) from nymphs collected in Arizona and New Mexico. The association of the nymphs and the male imago appears almost certain as both possess the same abdominal color pattern, and the nymphs were collected near the type locality.

**Nymph.** Length: body 7.5–8.5 mm; caudal filaments 10.0–11.0 mm. General color brown with dark brown and black markings. Head pale; mouthparts as in Figs. 3–7. Thoracic nota brown with black markings; pronotum with anterolateral black maculae; mesonotum with black vein-like markings at anterolateral corners; legs light brown; femora with apical ventral black macula; fore tibia pale with subapical black band and small basal black macula; tarsal claws with 6–7 large apical and 5–6 small basal denticles. Abdominal terga brown with dark brown posterior band and posterolateral triangular dark brown markings (Fig. 9); gills wide, middle abdominal gills length-to-width ratio 4:1 to 5:1; gills with lateral trachea; gills black, obscuring lateral trachea, gill margins pale. Caudal filaments light brown.

**TYPE LOCALITY.** 14 mi. N. Silver City, Grant Co., New Mexico.

**TYPE DEPOSITION.** University of Utah, Salt Lake City.

**DISTRIBUTION.** *Thraulodes brunneus* (Fig. 31) is known from central Arizona (34°34' N. lat.) to southwestern New Mexico (ca. 32°47' N. lat.).

**RECORDS.** ARIZONA: *Gila Co.* Haigler Cr. on Rd. 200, 19–VII-70, RKA; Christopher Cr., Christopher Creek Campground, 13–VI-74, B. Stark (UU). *Cochise Co.* Cave Cr., Chiricahua Mtns., 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.

**HABITAT.** *Thraulodes brunneus* nymphs have been collected only in June and July between 5240 and 6400 ft elevation in streams with water temperature between 66° and 71°F.

***Thraulodes speciosus* Traver**

*Thraulodes speciosus* Traver 1934: 201; Traver 1935: 552; Traver & Edmunds 1967: 379; Mayo 1969: 103 (nymph).

*Thraulodes arizonicus* Traver & Edmunds 1967: 361 (in part, nymph *nec* adult); Mayo 1969: 109.

This species was described from 2 male and 2 female imagos collected in southwestern Arizona. The nymphal stage was described by Mayo (1969), and the nymph tentatively associated as *T. arizonicus* by Traver and Edmunds (1967) is that of *T. speciosus*.

**Nymph.** Length: body 8.0–9.0 mm; caudal filaments 13.0–14.0 mm. General color light brown to brown. Head unicolorous brown. Thoracic nota unicolorous brown; legs brown with black markings; femora with black subbasal macula; tarsal claws with 6–7 large apical and 5–6 small basal denticles. Abdominal terga light brown to brown with variable pale markings, and often with dark sublateral maculae on terga 3–6; terga 1–3 often light brown; terga 4–6 with pale triangular macula at midline; terga 6–8 often with diffuse pale macula; tergum 9 sometimes pale; tergum 10 often rimmed with black along posterior margin (Fig. 12); gills wide, middle abdominal gills length-to-width ratio 4:1; gills with lateral trachea. Caudal filaments light brown.

**TYPE LOCALITY.** Rustler Park, Chiricahua Mtns., Cochise Co., Arizona.

**TYPE DEPOSITION.** California Academy of Sciences, No. 3733, San Francisco.

**DISTRIBUTION.** This species is restricted to a narrow latitudinal range in Arizona and New Mexico, and nymphs are known to occur with those of *T. brunneus* in some localities (Fig. 29).

**RECORDS.** ARIZONA: *Coconino Co.* Oak Cr. Canyon, Sedona, 23-V-51, no other data (UU); W. Fk. Oak Cr., Mayhew Lodge, 23-VI-51, S. Preece (UU). *Greenlee Co.* Black Riv., Apache Natl. For., 24-VI-37, Tarzwell (UU). *Cochise Co.* Stream nr. Portal, II-VI-60, V. K. Mayo (UU). *Yavapai Co.* Beaver Cr. at Beaver Cr. R. S., Coconino Natl. For., 7-VII-64, RKA. *Gila Co.* Haigler Cr. on For. Serv. Rd. 200, 19-VII-70, RKA; E. Verde Riv. on Hwy 87, 18/19-VII-70, RKA.

**HABITAT.** Nymphs of this species have been collected between May and July in streams between 5000 and 6000 ft elevation with water temperatures near 70°F.

***Thraulodes* sp. A**

*Thraulodes* sp. A is the only North and Central American species in which the gills of the nymphal stage are with or without lateral trachea. Nymphal specimens have been examined and re-examined, and individuals with and without lateral gill trachea were compared for differences in other taxonomic characters. None have been found. The possession or absence of lateral gill trachea does not appear to be subspecific, as intergrades for this character have not been collected. The presence or absence of lateral gill trachea also does not appear to be environmental as nymphs with or without trachea were collected together in 13 of 21 localities. Nymphs without lateral trachea were collected alone only in three localities, and nymphs with lateral trachea were collected alone only in five.

**Nymph.** Length: body 8.0–9.5 mm; caudal filaments 9.0–10.0 mm. General color pale to light brown with pink, purple, or black markings. Head pale. Thoracic nota pale to light brown usually with pink, purple, or black markings around margins pro- and mesonotum; legs pale with pink, purple, or black markings; femora pale with subbasal macula; tarsal claws with 5–7 large apical and 3–4 small basal denticles. Abdominal terga pale to light brown with pink, purple, or black markings; terga 1–9 usually with thin posterior transverse stripe; terga 5–7 sometimes with

median pink, purple, or black median macula; terga 2–7 usually with pink, purple, or black sublateral maculae; terga 6–8 often with dark median macula; gills wide, middle abdominal gills with length-to-width ratio 5:1; gills with or without lateral trachea; gills dark with pale lateral margins (Fig. 8); sternum 7 usually with pink, purple, or black median macula. Caudal filaments pale.

**DISTRIBUTION.** This species has a wide latitudinal distribution (Fig. 29) and is known to occur from near Tegucigalpa, Honduras (ca. 14°05' N. lat.) northward to near Guadalajara, Mexico (ca. 20°30' N. lat.).

**RECORDS.** HONDURAS: Rio Clarrita at San Morano on Hwy to Escuela Panam. Agric., 29-X-68, RKA. *Dept. El Paraiso.* Stream ca. 8 km. E. Danli, 29-VII-64, J. S. Packer (UU); Stream 38 km. E. Zamorano on Hwy 4, 29-VIII-64, J. S. Packer (UU). *Dept. Francisco Morazan.* Stream 10 mi. E. Guaimaca, 6-XI-64, J. S. Packer (UU). MEXICO: *Guerrero.* Trib. Rio Papagayo nr. Tierra Colorado, 16-XI-68, RKA. *Jalisco.* Stream 9 mi. S. Rio Grande de Santiago, 17-X-68, RKA; Rio Pasion at Tizpan El Alto, 16-X-68, RKA; Stream at Hacienda Guadalupe, 17-X-68, RKA. *Michoacan.* Rio Turundeo on Hwy 15 nr. Tuxpan, 4-VII-66, RKA. *Mexico.* Stream 9 mi. E. Morelia on Hwy 15, 5-VII-66, RKA. *Morelos.* Rio Amacuzac at Huajintlan on Hwy 95, 29/30-VII-66, RKA. *Oaxaca.* Stream 10 mi. N. Huajuapán de Leon, 7-XI-68, RKA; Stream at Oaxaca, 28-VII-66, RKA; Rio Atoyac at Ayoquezco, 22-X-68, RKA; Stream 15 mi. N. Ayoquezco, 20-X-68, RKA; Rio Grande, 3 mi. S. Guelatao, 6-XI-68, RKA. *Vera Cruz.* Stream 5 mi. S. Ciudad Mendoza, 7-XI-68, RKA; Rio Paso de Ovejas at Paso de Ovejas, 10-XI-68, RKA; Rio Jamapa, 3 mi. E. Coscomatepec, 14-VII-66, RKA; Rio Carranza, 20 mi. S. Nautla, 10-XI-68, RKA; Rio San Marcos at Apantilla, 3 mi. SE Villa A. Camacho, 12-XI-68, RKA.

**HABITAT.** *Thraulodes* sp. A nymphs have been collected in July, August, October and November in streams between 500 and 6600 ft elevation, and in water with a wide temperature range. Known stream temperatures vary between 65° and 86°F, with the higher temperatures recorded at lower elevations (500 ft = 86°F) and lower temperatures at higher elevations (6400 ft = 65°F).

### *Thraulodes* sp. B

**Nymph.** Length: body 7.0–8.0 mm; caudal filaments 10.0–11.0 mm. General color pale with reddish-brown markings. Head pale. Thoracic nota pale, often with irregular reddish-brown lines; legs pale; legs robust, femora less than 3 times longer than wide (Fig. 13); femora with subapical reddish-brown macula; tibiae and tarsi pale; tarsal claws with 6–7 denticles, first apical denticle largest (Fig. 14). Abdominal terga pale with reddish-brown markings; terga 1–3 with reddish-brown transverse band; terga 4–5 pale with sublateral reddish-brown maculae; terga 6–8 with reddish-brown submedian markings (Fig. 19); terga 9–10 pale; gills wide, middle abdominal gills length-to-width ratio 3:1; gills with lateral trachea; gills pale. Caudal filaments pale with brown annulations.

**DISTRIBUTION.** *Thraulodes* sp. B is known only from Mexico (Fig. 30) and occurs from Chiapas (ca. 16°05' N. lat.) to Nuevo Leon (25°40' N. lat.).

**RECORDS.** MEXICO: *Chiapas.* Stream 7 mi. N. Arriaga on Hwy 190, 23-X-68, RKA. *Guerrero.* Rio Balsas between Iguala and Chilpancingo on Hwy 95, 16-XI-68, RKA. *Mexico D. F.* Stream 15 mi. S. Chalco, 20-X-68. *Morelos.* Rio Amacuzac at Huajintlan on Hwy 95, 29/30-VII-66, 14-XI-68. *Nuevo Leon.* Rio Salinas at Cienega de Flores, 25-XI-68, RKA. *Oaxaca.* Rio Atoyac at Ayaquezco, 22-X-68, RKA. *Vera Cruz.* Stream 5 mi. S. Ciudad Mendoza, 7-XI-68, RKA. *Zacatecas.* Rio Juchipila at Juchipila, 18-X-68, RKA.

**HABITAT.** *Thraulodes* sp. B nymphs have been collected in July, October, and November from streams between 1400 and 6700 ft elevation and in water with temperatures between 54° and 80°F.

***Thraulodes* sp. G**

**Nymph.** Length: body 5.5–6.5 mm; caudal filaments 4.5–5.5 mm. General color brown with pale and black markings. Head brown, pale around compound eyes and ocelli; frons penciled with black. Thoracic nota brown, mesonotum with distinctive pale T-shaped macula; legs pale; legs thin and delicate, femora more than 3 times longer than wide (Fig. 15); tarsal claws with 7–10 denticles, median denticle largest (Fig. 16). Abdominal terga brown with pale and black markings; terga 2–6 with pale medioposterior macula; terga 2–8 with black sublateral transverse streaks on posterior margin; terga 8–9 often with sublateral black pencilings; tergum 10 light brown (Fig. 20); gills wide, middle abdominal gills length-to-width ratio 3:1; gills with lateral trachea; gills pale, trachea black. Caudal filaments pale.

**DISTRIBUTION.** This species (Fig. 30) is known only from the state of Chiapas (16°45' N. lat.) in southern Mexico.

**RECORD.** MEXICO: *Chiapas*. Rio Laventa, 10 mi. E. Cintalapa, 20-VII-66, RKA.

**HABITAT.** This species is known from a single locality at 2000 ft elevation and in water with a temperature of 74°F.

## GONZALES-GROUP

This species-group is characterized as follows: (1) gills moderately narrow to narrow, width less than one-fourth length; (2) gills symmetrical, tapering gradually along both anterior and posterior margins to apex (Fig. 11); and (3) lateral trachea absent.

***Thraulodes gonzalesi* Traver & Edmunds**

*Thraulodes gonzalesi* Traver & Edmunds 1967: 366.

This species was described from male and female imagos, and associated nymphs collected in Texas and northern Mexico. The imagos of *T. gonzalesi* retain a vestige of the nymphal dorsal abdominal color pattern and this association appears to be correct.

**Nymph.** Length: body 9.5–10.5 mm; caudal filaments 11.0–12.0 mm. General color pale to light brown with dark markings. Head pale with dark markings. Thoracic nota pale to light brown with diffuse tan shading; pronotum often with black streak along middorsal suture; mesonotum with pale U-shaped line; legs unicolorous yellow; tarsal claws with 4–5 large apical and 5–7 small basal denticles. Abdominal terga 1–8 pale to light brown with large dark submedian maculae (Fig. 21); gills narrow, middle abdominal gills length-to-width 7:1 to 8:1; gills pale. Caudal filaments yellow to tan with brown annulations.

**TYPE LOCALITY.** Gonzales, Texas.

**TYPE DEPOSITION.** University of Utah, Salt Lake City.

**DISTRIBUTION.** *Thraulodes gonzalesi* has a moderately wide latitudinal distribution (Fig. 29) as specimens have been collected from central Texas (ca. 31°50' N. lat.) to northeastern Mexico (ca. 29°00' N. lat.).

**NEW RECORDS.** MEXICO: *Chihuahua*. Rio Concho at Ojinaga, 28-VII-70, RKA. *Nuevo Leon*. Rio Sabinas at Sabinas Victoria, 4-VIII-70, RKA; Rio Pilon at Montemorelos, 5-VIII-70, RKA; Rio Sabinas at Villa Aldama, 4-VIII-70, RKA; Rio Salinas at Cienega de Flores, 25-XI-68, RKA; Rio Salinas at Sabinas Hidalgo, 25-XI-68, RKA. *Tamaulipas*. Rio Frio, 20-XII-36, L. Berner (UU); Rio Guayalayo at Llera, 6-VIII-70, RKA; Rio San Marcos at Ciudad Victoria, 6-VIII-70, RKA; Rio Corona N. Ciudad Victoria, 27-XI-68, RKA. TEXAS: *Blanco Co.* Grape Cr., Rd. 1320, 9-VI-73, R. G. McClure (NTS); *Pedernales Riv.*, Hwy 1320, 9-VI-73, R. G. McClure (NTS). *Bosque Co.* Bosque Riv. at Clifton, 10-VIII-70, RKA. *Brewster Co.* Rio Grande at Lijitas, 29-VII-70, RKA. *Caldwell Co.* San Marcos Riv., 6 mi. E. Luling off Hwy 80, 9-VIII-70, RKA. *Gonzales Co.* Guadalupe Riv., 12 mi. S. Luling on Hwy 80, 9-VIII-70, RKA. *Kerr Co.* Guadalupe Riv., 28-VII-73, M. Peters (NTS). *Kimball*

Co. Llano Riv. S. London on Hwy 385, 31-VII-70, RKA; S. Fk. Llano Riv., 12 mi. S. jct. on Hwy 377, 31-VII-70, RKA. *Kinney Co.* Pinto Cr., Hwy 90, 10-VI-73, R. G. McClure (NTS). *Presidio Co.* Rio Grande, 10 mi. E. Redford, 29-VII-70, RKA. *Real Co.* Rio Frio at Rio Frio, 2-VIII-70, RKA. *Uvalde Co.* Rio Sabinal at Utopia, 2-VIII-70, RKA; Rio Frio at Cancan on Hwy 127, 1-VIII-70, RKA. *Val Verde Co.* Rio Grande at Del Rio, 10-VIII-70, RKA. *Victoria Co.* San Antonio Riv., 20 mi. S. Victoria on Hwy 77, 8-VIII-70, RKA. *Williamson Co.* San Gabriel Riv., 1 mi. S. Jonah on Farm Rd. 1660, 10-VIII-70, RKA. *Wilson Co.* Sibole Cr., 4 mi. W. Stockdale on Hwy 97, 9-VIII-70, RKA.

**HABITAT.** Nymphs of *T. gonzalesi* have been collected from May to July and in December. The immature stage of this species appears to be restricted to streams at lower elevations (between 500 and 3000 ft elev.) and to warmer water (between 72° and 88°F.).

### ***Thraulodes lunatus* Traver & Edmunds**

*Thraulodes lunatus* Traver & Edmunds 1967: 370.

This species was described from a single male imago and associated nymphs from northern Mexico. Additional nymphs collected in northern Mexico match the description presented by Traver and Edmunds (1967) and are herein included as this species.

**Nymph.** Length: body 6.0–7.0 mm; caudal filaments 14.0–15.0 mm. General color pale with brown and black markings. Head pale. Thoracic nota tan, often with vein-like black markings at anterolateral corners; legs pale with black markings; fore femora with small black apical macula; fore tibiae with subapical black band and small basal macula; tarsal claws with 6–7 large apical and 8–10 small basal denticles. Abdominal terga 2–6 pale with reddish-brown to black crescent-shaped sublateral maculae (Fig. 23); terga 8–9 with small anterior black macula; tergum 10 pale; gills narrow, middle abdominal gills length-to-width ratio 10:1; gills pale, trachea black. Caudal filaments pale with brown annulations.

**TYPE LOCALITY.** 44 mi. N. Ciudad Victoria, Tamaulipas, Mexico.

**TYPE DEPOSITION.** University of Utah, Salt Lake City.

**DISTRIBUTION.** *Thraulodes lunatus* is known only from a narrow latitudinal area in northern Mexico (Fig. 31) from Nuevo Leon (ca. 25°40' N. lat.) to Zacatecas (ca. 21°25' N. lat.).

**NEW RECORDS.** Mexico: *Nuevo Leon.* Rio Pilon at Montemorelos, 5-VIII-70, RKA; Rio Salinas at Cienega de Flores, 25-XI-68, RKA. *Tamaulipas.* Rio Guayalayo at Llera, 6-VIII-70, RKA; Rio Purificacion nr. Hidalgo, 25-XI-68, RKA. *Zacatecas.* Rio Juchipila at Juchipila, 18-X-68, RKA.

**HABITAT.** *Thraulodes lunatus* has been collected in the nymphal stage from August to November in streams between 400 and 4200 ft elevation and in water with temperatures between 72° and 88°F.

### ***Thraulodes packeri* Traver & Edmunds**

*Thraulodes packeri* Traver & Edmunds 1967: 372.

This species was described from a small series of male and female imagos reared from nymphs collected in Honduras. Additional material from Honduras, collected by J. S. Packer, was compared with the nymphal description by Traver and Edmunds (1967) and with cast skins of the reared type series, and they are herein assigned to this species.

**Nymph.** Length: body 6.5–7.5 mm; caudal filaments 7.0–8.0 mm. General color light brown to brown with dark brown markings. Head light brown. Thoracic nota light brown to brown, often with dark brown and pale markings; pronotum with dark brown median longitudinal markings, and often with sublateral dark brown maculae; mesonotum with pale median



longitudinal stripe, submedian V-shaped marking, and marginal dark spot at wing base; legs pale with brown and dark markings; femora pale with two light brown transverse bands; fore tibiae with dark apical transverse band; tarsal claws with 6–7 large apical and 5–6 small basal denticles. Abdominal terga brown with pale lateral margins and small dark dots; terga 3–6 brown with paired posterior sublateral dark dots; terga 3–7 usually with large pale sublateral maculae; terga 8–10 pale to brown (Fig. 25); gills narrow, middle abdominal gills length-to-width ratio 15:1. Caudal filaments pale with brown annulations.

TYPE LOCALITY. Rio Blanco, 2 mi. N. Caracol, Dept. Cortez, Honduras.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. This species is known from several localities in Honduras (Fig. 31) and a single locality in southern Mexico.

NEW RECORDS. HONDURAS: *Dept. Choluteca*. Stream ca. 16 mi. E. Jicaró-Galan on Panam. Hwy, 10-X-64, J. S. Packer (UU); Nacaome Riv. at Nacaome Br. on Panam. Hwy, 10-X-64, J. S. Packer (UU); Stream jct. Hwy 2 and Marcouia Rd., 10-X-64, J. S. Packer (UU). *Dept. Comayagua*. Humaya Riv., El Rosario, 20-X-64, J. S. Packer (UU). *Dept. El Paraíso*. Yeguaré Riv. on Hwy to Escuela Panam. Agric., 15-VII-64, J. S. Packer (UU); Stream ca. 8 km. E. Danli, 29-VIII-64, (UU); Rio Guauambre at jct. Hwy 4, 50 km. E. Danli, 3-IX-64, J. S. Packer (UU). *Dept. Francisco Morazan*. Stream 6.5 mi. from jct. Hwys 3 & 5, 7-XII-64, J. S. Packer (UU); Rio Choluteca nr. La Venta, jct. Hwy. 3, 7-XI-64, J. S. Packer (UU). *Dept. Olancho*. Rio Teleca, 6 mi. E. Juticalpa on Hwy 3, 6-XI-64, J. S. Packer (UU); Rio Juticalpa, 10 mi. W. Juticalpa, 6-XI-64, J. S. Packer (UU). MEXICO: *Chiapas*. Stream at Arriaga, 22-VII-65, P. J. Spangler (UU).

### *Thraulodes salinus* Kilgore & Allen

*Thraulodes salinus* Kilgore & Allen 1973: 325.

This species of *Thraulodes* was described from a series of nymphs collected in central Arizona. The male and female imago are at present undescribed.

**Nymph.** Length: body 5.0–6.0 mm; caudal filaments 5.0–6.0 mm. General color yellow to light brown with brown markings. Head yellow with numerous black maculae. Thoracic nota light brown with black markings; mesonotum with black vein-like lines at anterolateral corners; legs yellow; femora with black basal macula; tarsal claws with 6–7 large apical and 4–5 small basal denticles. Abdominal terga 1–8 yellow with brown inverted U-shaped marking; terga 9–10 yellow with posterior black transverse band (Fig. 1); abdominal gills narrow, middle abdominal gills length-to-width ratio 10:1; gills pale. Caudal filaments pale.

TYPE LOCALITY. Salt River on Hwy 288, Gila Co., Arizona.

TYPE DEPOSITION. California Academy of Sciences, San Francisco.

DISTRIBUTION. This species is known only from the type locality (Fig. 28).

HABITAT. Nymphs which constitute the type series were collected from a large rapidly flowing river with a bottom type of large rocks and a water temperature of 78°F. The altitude at the collection site is 2700 ft.

### *Thraulodes zonalis* Traver & Edmunds

*Thraulodes zonalis* Traver & Edmunds 1967: 383.

This species was described from a single male imago and a short series of associated nymphs from the Canal Zone.

**Nymph.** Length: body 8.0–9.0 mm; caudal filaments 10.0–11.0 mm. General color brown. Head brown. Thoracic nota brown, often with irregular dark markings; legs brown with dark markings; fore femora brown with subapical ventral dark streak; middle and hind femora brown; fore tibiae with apical dark transverse band; middle and hind tibiae brown; tarsi brown; tarsal claws with 5–7 large apical and 6–8 basal denticles. Abdominal terga brown with dark markings;

terga 1-9 with posterior dark transverse bands, bands especially demarcated 5-9; terga 3-6 often with sublateral black maculae (Fig. 26); gills moderately narrow, middle abdominal gills length-to-width ratio 7:1; gills suffused with black. Caudal filaments light brown.

TYPE LOCALITY. Rio Guanabano, 3 mi. N. Ft. Clayton on Chiva-Chiva Rd., Panama.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. This species has a narrow latitudinal distribution in Central America (Fig. 29), from the Canal Zone to Costa Rica (between 8° and 10° N. lat.).

NEW RECORDS. COSTA RICA: San Jose, 12 mi. N. San Isidro, 30-VII-63, G. G. Musser (UU); Rio Sarapiquí, Heredia, Puerto, 10-VII-62, G. G. Musser (UU). PANAMA: *Darien Prov.* Rio Tacarcuna, 30-V-63, W. P. Murdoch (UU).

### *Thraulodes* sp. C

NYMPH. Length: body 6.0-7.0 mm; caudal filaments 9.5-10.5 mm. General color tan to brown with dark brown and black markings. Head tan with numerous brown maculae. Thoracic nota brown with penciled dark markings; legs tan with black markings; femora with diffuse brown shading and black, median, longitudinal line on anterior surface; femora often with black submarginal macula on anterior surface; tibiae tan, often with black apical transverse band; tarsi pale; tarsal claws with 6-8 large apical and 3-4 small basal denticles. Abdominal terga brown with dark markings; terga 2-8 usually with black transverse dark posterior band and with anterior submedian triangular-shaped maculae (Fig. 24); gills narrow, middle abdominal gills length-to-width ratio 10:1; gills suffused with black, margins pale. Caudal filaments pale with brown annulations.

DISTRIBUTION. This species (Fig. 31) is known from Panama (ca. 8°50' N. lat.) to southern San Luis Potosi (ca. 21°10' N. lat.).

RECORDS. HONDURAS: Rio Clarrita at San Morano on Rd. to Escuela Panam. Agric., 29-X-68, RKA; Stream 4 mi. Honduras/El Salvador border, 30-X-68, RKA. *Dept. Atlántida*. Stream at bridge S. Tela on Hwy 9, 9-X-64, J. S. Packer (UU). *Dept. Choluteca*. Stream nr. Choluteca on Panam. Hwy, no date, J. S. Packer (UU). *Dept. Comayagua*. Salguapa Riv., bridge on Hwy 1, 17-X-64, J. S. Packer (UU); Rio Humuya, El Rosario, 20-X-64, J. S. Packer (UU). *Dept. Cortes*. Rio Chamelecon at Chamelecon, 18-X-64, J. S. Packer (UU). *Dept. El Paraíso*. Rio Yeguaré, Escuela Agric. Panam., 26-X-64, J. S. Packer (UU); Stream nr. Santa Maria, 3-IX-64, J. S. Packer (UU); Stream ca. 8 mi. E. Danli, 29-VIII-64, J. S. Packer (UU). *Dept. Francisco Morazan*. Rio Choluteca nr. La Venta at jct. Hwy 3, 7-XI-64, J. S. Packer (UU); Stream on Hwy 5, 6.5 mi. from jct. Hwys 3 and 5, 7-XII-64, J. S. Packer (UU). *Dept. Olancho*. Rio Juticalpa, 10 mi. W. Juticalpa, 6-XI-64, J. S. Packer (UU); Stream on Hwy 3, W. Campamento Galera, 7-XI-64, J. S. Packer (UU). MEXICO: *Chiapas*. Stream at Santa Isabel, 12 mi. N. Arriaga on Hwy 190, 23-X-68, RKA; Rio Tapa nr. Ishuatan, 18-VII-66, RKA. *San Luis Potosí*. Rio Moctezuma at Tamazunchale, 8/9-VII-66, RKA. *Tabasco*. Rio Grifalva at Teapa, 18-VII-66, RKA. *Vera Cruz*. Rio Tecolapan nr. Santiago Tuxtla on Hwy 180, 16-VII-66, RKA; Rio Paso de Ovejas at Paso de Ovejas, 10-XI-68, RKA. PANAMA: Rio Cabuya, 1 mi. E. Tocumen Airport, 10-IX-63, W. L. Peters & C. M. Keenan (UU).

HABITAT. The nymphs of *Thraulodes* sp. C appear to be restricted to lower elevations as specimens have been collected only from sea-level to 3000 ft elevation. Stream temperatures are generally warm, between 70° and 80°F, and nymphal collections have been made from July to November.

### *Thraulodes* sp. D

NYMPH. Length: body 5.0-6.0 mm; caudal filaments 9.5-11.0 mm. General color pale with tan and dark markings. Head pale. Thoracic nota pale, suffused with tan; legs pale with dark markings; fore femora with black ventral, subapical macula; fore tibiae with dark subapical

transverse band; tarsal claws with 5-6 large apical and 3-4 small basal denticles. Abdominal terga light brown with dark markings; terga 1-10 with thin dark transverse submedian line along posterior margin; terga 1-6 often with dark posterior sublateral maculae (Fig. 27); gills narrow, length-to-width ratio 10:1 to 12:1; gills pale, trachea black. Caudal filaments light brown with dark annulations.

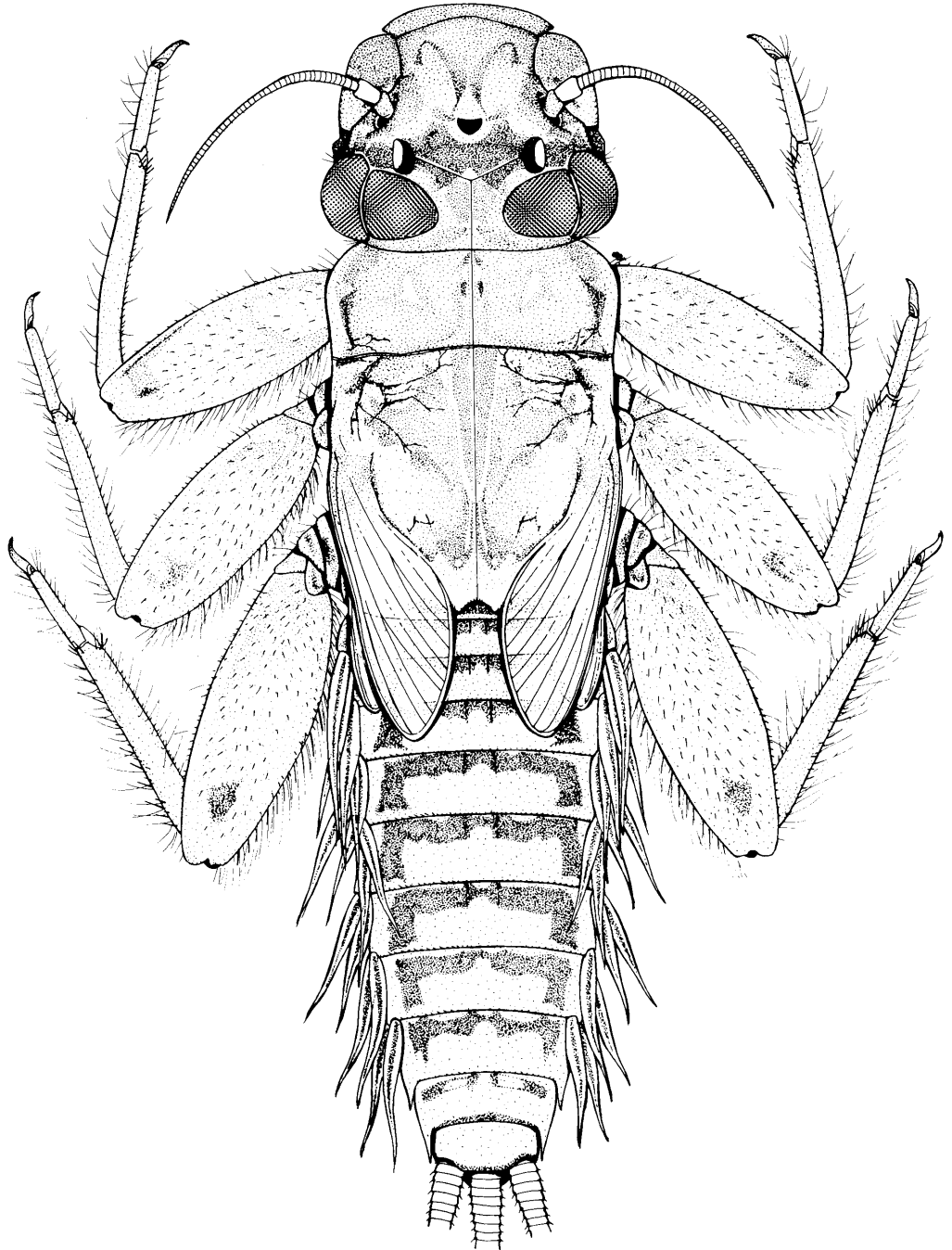


FIG. 1. *Thraulodes salinus*, mature nymph, dorsal view.

**DISTRIBUTION.** *Thraulodes* sp. D (Fig. 28) is known to occur from Honduras (ca. 14°05' N. lat.) to northern Mexico (ca. 18°50' N. lat.).

**RECORDS.** HONDURAS: *Dept. Comayagua*. River, 3 mi. N. Taulabe on Hwy 1, 20-X-64, J. S. Packer (UU). *Dept. El Paraíso*. Stream 29 km. E. Zamorano on Hwy 3, 29-VIII-64, J. S. Packer (UU); Stream ca. 3 km. E. Danli, 29-VIII-64, J. S. Packer (UU); Stream 8 km. E. Danli, 29-VIII-64, J. S. Packer (UU); Stream nr. Santa Maria, 3-IX-64, J. S. Packer (UU); Rio Yeguaré at Escuela Agric. Panam., 26-X-64, J. S. Packer (UU). *Dept. Francisco Morazan*. Stream 10 mi. E. Guaimaca on Hwy 3, 6-XI-64, J. S. Packer (UU). MEXICO: *Chiapas* Rio Huitla, 14 mi. N. Tapachula, 1-XI-68, RKA; Stream 7 mi. N. Arriaga on Hwy 190, 20-VII-66, RKA. *Morelos*. Rio Amacuzac at Huajintlan on Hwy 95, 14-XI-68, RKA. *Nayarit*. Acaponeta, 24-XI-48, H. B. Leech (CAS). *San Luis Potosí*. Rio Moctezuma at Tamazunchale, 9-VII-66, RKA; Trib. Rio Axtla, 2 mi. N. Matlapa, 9-VII-66, RJ. RKA. *Tamaulipas*. Rio Corona N. Ciudad Victoria, 25-XI-68, RKA. *Vera Cruz*. Rio Piedras Negras at Piedras Negras nr. Poza Rica, 12-XI-68, RKA; Rio Paso de Ovejas at Paso de Ovejas, 10-XI-68, RKA; Rio Carranza, 20 mi. S. Nautla, 10-XI-68, RKA; Rio San Marcos at Apapantilla, 3 mi. SE Villa A. Camacho, 12-XI-68, RKA; Rio Jamapa, 3 mi. E. Coscomatepec, 14-VII-66, RKA.

**HABITAT.** *Thraulodes* sp. D nymphs are much like those of *Thraulodes* sp. C as most known records occur below 1000 ft elevation. Nymphal specimens have been collected between 200 and 4600 ft elevation, in a wide range of water temperatures (between 62° and 80°F), and were recorded between July and November.

#### *Thraulodes* sp. E

**Nymph.** Length: body 9.0–10.0 mm; caudal filaments 18.0–19.0 mm. General color pale to brown with dark brown to black markings. Head pale to light brown with dark brown submedian maculae on vertex and frons. Thoracic nota pale to brown with irregular dark brown and black markings; legs pale to light brown with dark markings; femora with subbasal and subapical ventral maculae; tibiae and tarsi unicolorous; tarsal claws with 5–6 apical and 6–7 basal denticles. Abdominal terga pale to brown with dark brown markings; terga 1–10 with black posterior transverse band; tergum 1 dark brown; terga 2–6 with paired wide oblique sublateral dark brown to black maculae (Fig. 22); terga 7–8 with small lateral paired maculae; gills narrow, middle abdominal gills length-to-width ratio 7:1; gills suffused with black, trachea black; gills without lateral trachea. Caudal filaments pale with dark annulations.

**DISTRIBUTION.** This species is known only from a single locality (Fig. 28) in Costa Rica (9°50' N. lat.).

**RECORD.** COSTA RICA: Cartago, 24-VI-62, G. G. Musser (UU).

#### *Thraulodes* sp. F

**Nymph.** Length: body 5.5–6.5 mm; caudal filaments 5.0–6.0 mm. General color dark brown with brown markings. Head dark brown. Thoracic nota brown with complex dark brown; legs brown with dark brown markings; femora brown with dark brown transverse apical band (Fig. 17); tibiae and tarsi brown; tarsal claws with 1 large apical and 13–19 small basal denticles (Fig. 18). Abdominal terga dark brown with pale lateral margins, and often with median longitudinal brown stripe (Fig. 2); gills narrow, middle abdominal gills length-to-width ratio 10:1 to 12:1; gills pale, trachea black. Caudal filaments brown.

**DISTRIBUTION.** This species has a narrow latitudinal distribution (Fig. 30) from Guatemala (ca. 14°38' N. lat.) to Vera Cruz, Mexico (ca. 19°11' N. lat.).

**RECORDS.** GUATEMALA: Stream nr. Tecpan at km. 103, 23-VIII-66, RKA. MEXICO: *Vera Cruz*. Stream 5 mi. S. Ciudad Mendoza, 7-XI-68, RKA.

### Unassigned Species

Eleven North and Central American species, *T. arizonicus*, *T. centralis*, *T. ephippiatus*, *T. hilaris*, *T. hilaroides*, *T. humeralis*, *T. irrititus*, *T. lepidus*, *T. mexicanus*, *T. prolongatus*, *T. spangleri*, and *T. valens*, are unknown from the nymphal stage and cannot be assigned to species-group.

#### *Thraulodes arizonicus* McDunnough

*Thraulodes arizonicus* McDunnough 1942: 117; Traver & Edmunds 1967: 361 (in part, adult nec nymph); Mayo 1969: 109.

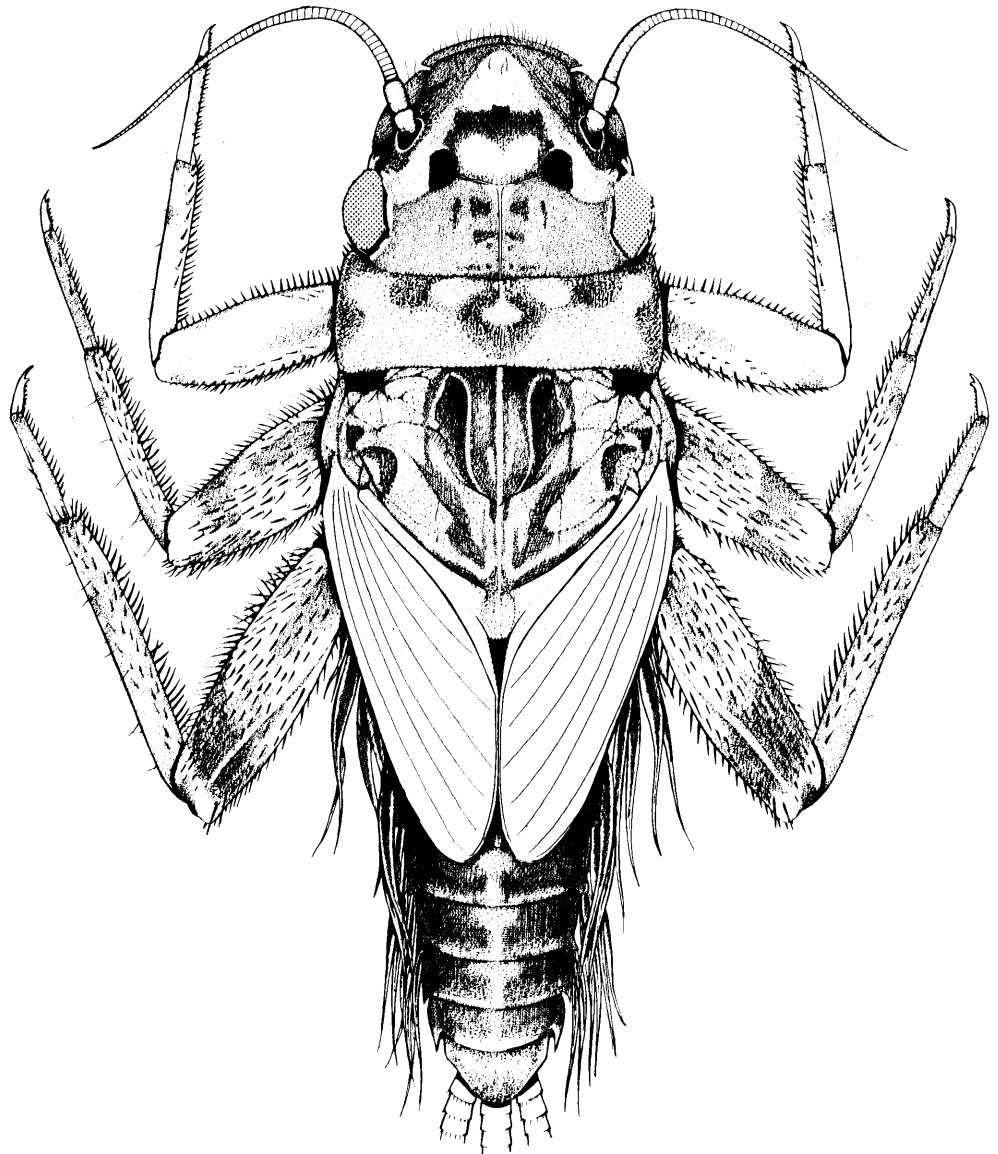


FIG. 2. *Thraulodes* sp. F, mature nymph, dorsal view.

McDunnough (1942) described this species from male imagos collected in central Arizona. Traver and Edmunds (1967) associated, and described, the nymphal stage from specimens collected near the type locality, but Mayo (1969) questioned the placement of these nymphs as *T. arizonicus*. "Nymphs which were taken at Oak Creek Canyon near Sedona, Coconino County, Arizona, 23 June 1951, were tentatively described by Traver and Edmunds (1967) as belonging to the species *Thraulodes arizonicus* McDunnough. These are very similar to the nymphs of *T. speciosus* . . ." "The only difference between the spines of the two series seems to be between the small grooved spines on dorsal surfaces of femora." Examination reveals that the nymphs described as *T. arizonicus* by Traver and Edmunds (1967) and discussed by Mayo (1969), are unquestionably the immature stage of *T. speciosus*.

NYPH. Unknown.

TYPE LOCALITY. Oak Creek Canyon nr. Flagstaff, Arizona.

TYPE DEPOSITION. Canadian National Collection, No. 5322, Ottawa, Ont.

DISTRIBUTION. This species has been reported only from the type locality (ca. 35°12' N. lat.).

*Thraulodes centralis* Traver

*Thraulodes centralis* Traver 1946: 432; Traver & Edmunds 1967: 363.

This species was described from a small series of male imagos collected in Costa Rica.

NYPH. Unknown.

TYPE LOCALITY. Rio Pedregoso, Costa Rica.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. This species is known only from the type locality (ca. 9°60' N. lat.).

*Thraulodes ehippiatus* Traver & Edmunds

*Thraulodes ehippiatus* Traver & Edmunds 1967: 364.

This species was described from a single male imago collected in southern Mexico.

NYPH. Unknown.

TYPE LOCALITY. Ocosingo, Chiapas, Mexico.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. *Thraulodes ehippiatus* is known only from the type locality (ca. 18°23' N. lat.).

*Thraulodes hiliaris* (Eaton)

*Thraulodes hiliaris* Eaton 1892: 9.

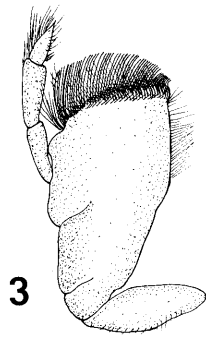
*Thraulodes hiliaris* Ulmer 1919: 34; Ulmer 1920: 116; Kimmins 1934: 345; Ulmer 1943: 22; Kimmins 1960: 302; Traver & Edmunds 1967: 366.

Eaton (1892) described *T. hiliaris* from a male and female imago collected in Guatemala.

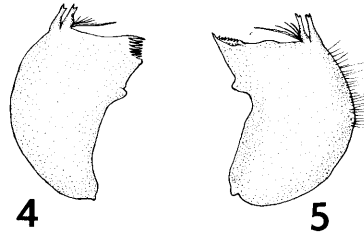
NYPH. Unknown.

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FIGS. 3-18. 3-7, mouthparts, *Thraulodes brunneus*: 3, maxilla; 4, left mandible; 5, right mandible; 6, labium; 7, labrum. 8-18, nymphal structures of *Thraulodes*: 8, *T. sp. A*, tracheal gills 1, 4, 7; 9, *T. brunneus*, abdomen, dorsal view; 10, *T. sp. B*, tracheal gills 1, 4, 7; 11, *T. sp. D*, tracheal gills 1, 4, 7; 12, *T. speciosus*, abdomen, dorsal view; 13, *T. sp. B*, femur; 14, *T. sp. B*, tarsal claw; 15, *T. sp. G*, femur; 16, *T. sp. G*, tarsal claw; 17, *T. sp. F*, femur; 18, *T. sp. F*, tarsal claw.

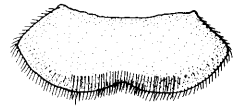


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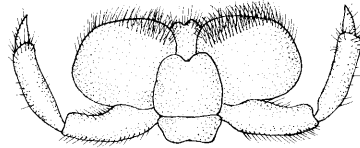


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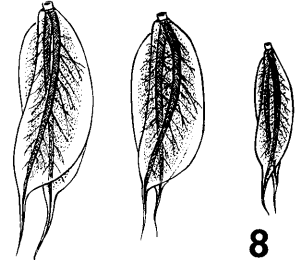
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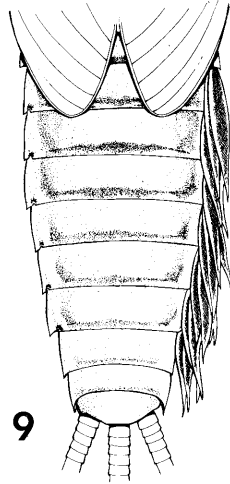
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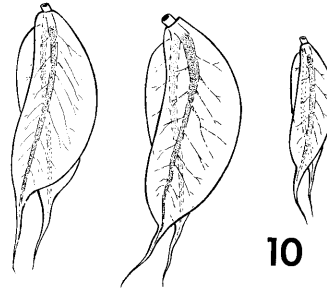
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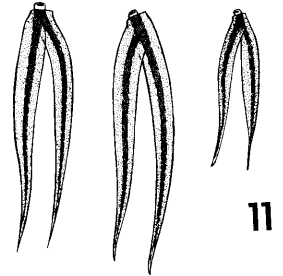
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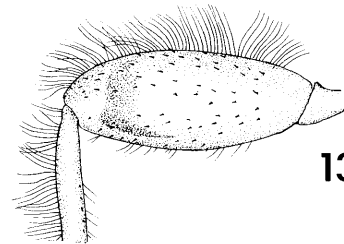
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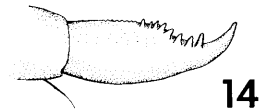
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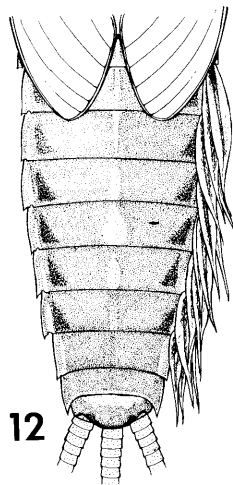
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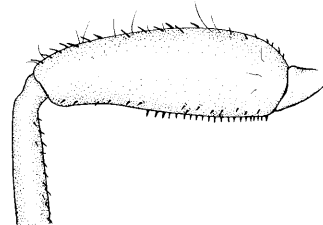
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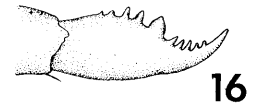
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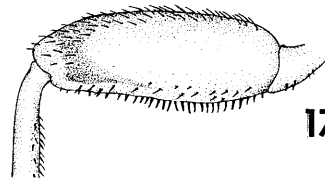
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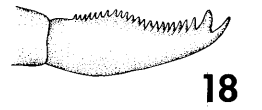
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18

TYPE LOCALITY. San Juan, Vera Paz, Guatemala.

TYPE DEPOSITION. Godwin and Salvin Collection, British Museum (Nat. Hist.), London.

DISTRIBUTION. Ulmer (1919) doubtfully reported specimens as this species from Costa Rica.

*Thraulodes hilaroides* Traver

*Thraulodes hilaroides* Traver 1946: 433; Traver & Edmunds 1967: 367.

This species was described from a single male imago collected in Costa Rica in the same locality as *T. centralis* Traver.

NYMPH. Unknown.

TYPE LOCALITY. Rio Pedregoso, Costa Rica.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. *Thraulodes hilaroides* is known only from the type locality.

*Thraulodes humeralis* Navás

*Thraulodes humeralis* Navás 1935: 101.

This species was described from single male and female imagos collected in Mexico.

NYMPH. Unknown.

TYPE LOCALITY. Salle, Mexico.

TYPE DEPOSITION. Paris Museum.

DISTRIBUTION. This species is known only from the type locality.

*Thraulodes irretitus* Navás

*Thraulodes irretitus* Navás 1924: 67.

This species was described from a male and female imago collected in Central America.

NYMPH. Unknown.

TYPE LOCALITY. Costa Rica.

TYPE DEPOSITION. Paris Museum.

DISTRIBUTION. This species is based on specimens collected at an unknown locality in Costa Rica, and specimens assignable to this species have not been collected since the original description.

*Thraulodes lepidus* (Eaton)

*Thraulodes lepidus* Eaton 1884: 109; Eaton 1892: 116.

*Thraulodes lepidus* Ulmer 1919: 34; Ulmer 1920: 116; Kimmins 1934: 343; Traver 1946: 431; Kimmins 1960: 303.

*Thraulodes lepida* Ulmer 1943: 22.

*Thraulodes pedregoso* Traver 1946: 430; Traver & Edmunds 1967: 369 (= *lepidus*).

This species was described from 3 male and 1 female imagos collected in Panama, and a series of male and female imagos from Costa Rica, which were the basis of the name *T. pedregoso*.

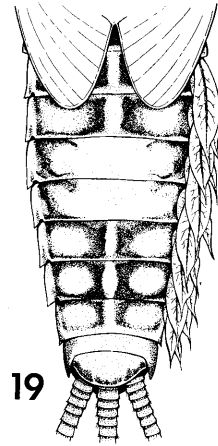
NYMPH. Unknown.

TYPE LOCALITY. Chiriqui, Panama.

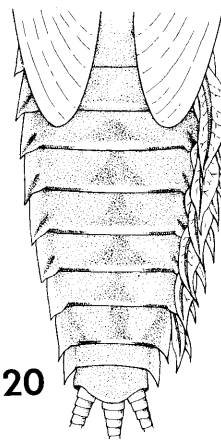
TYPE DEPOSITION. McLachlan Museum.

DISTRIBUTION. This species is known from Panama to Costa Rica, and Eaton (1884) questionably assigned a specimen from Guatemala to this species.

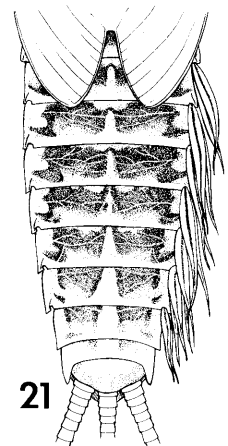




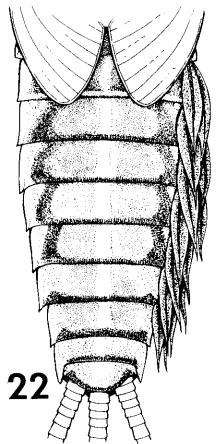
19



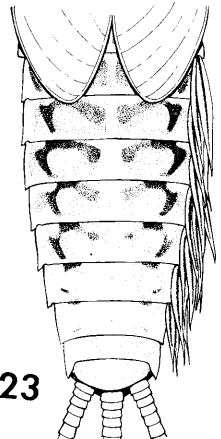
20



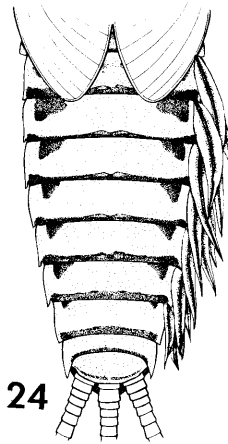
21



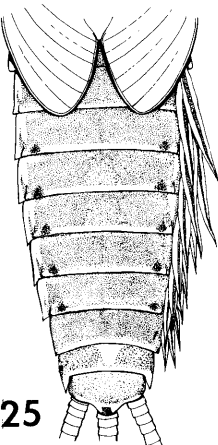
22



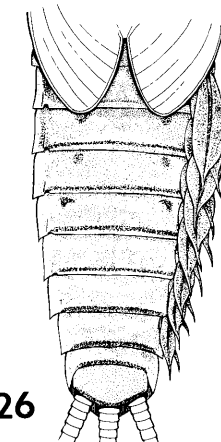
23



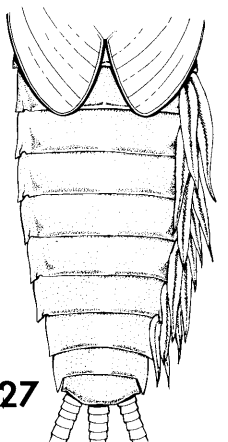
24



25

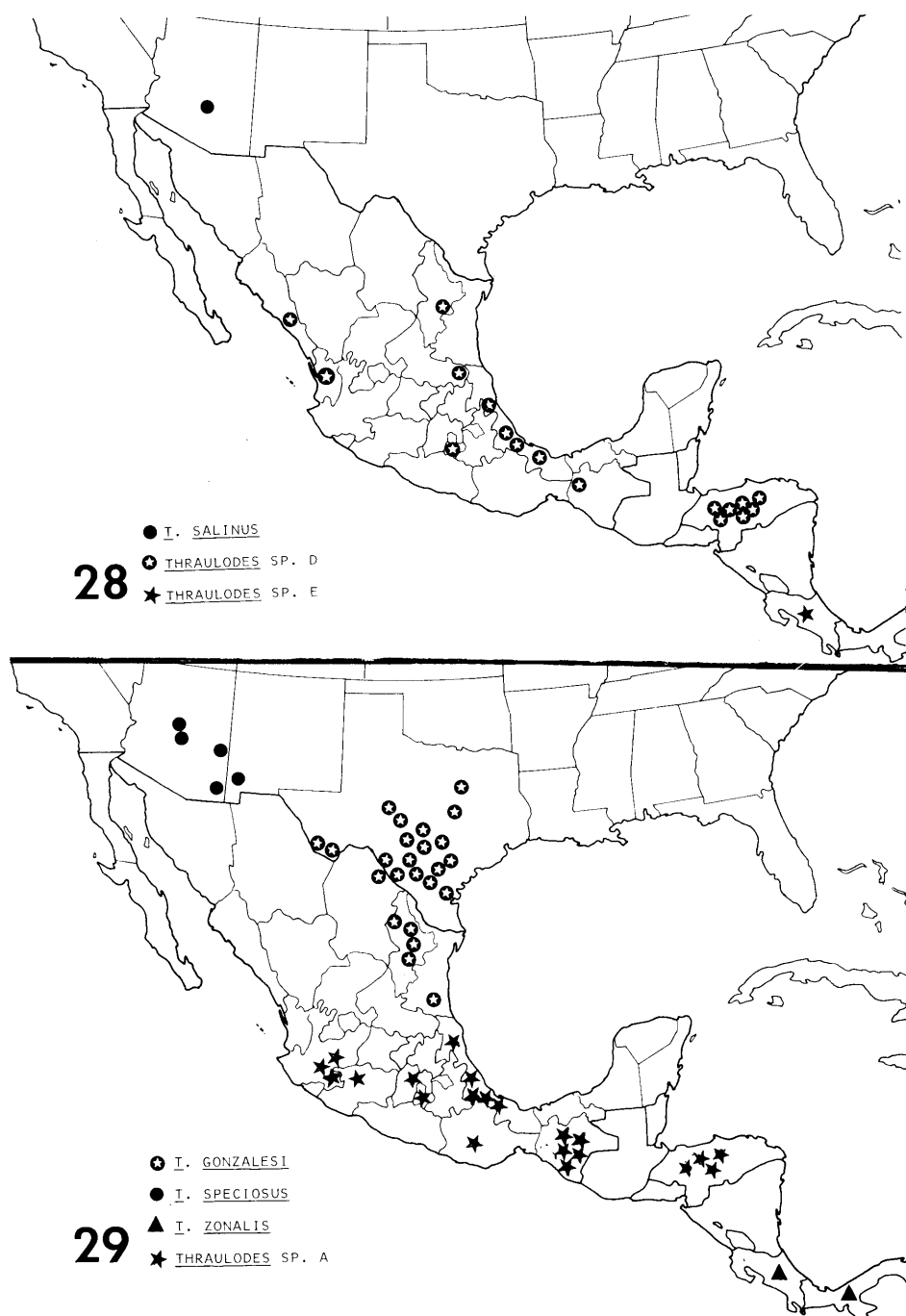


26

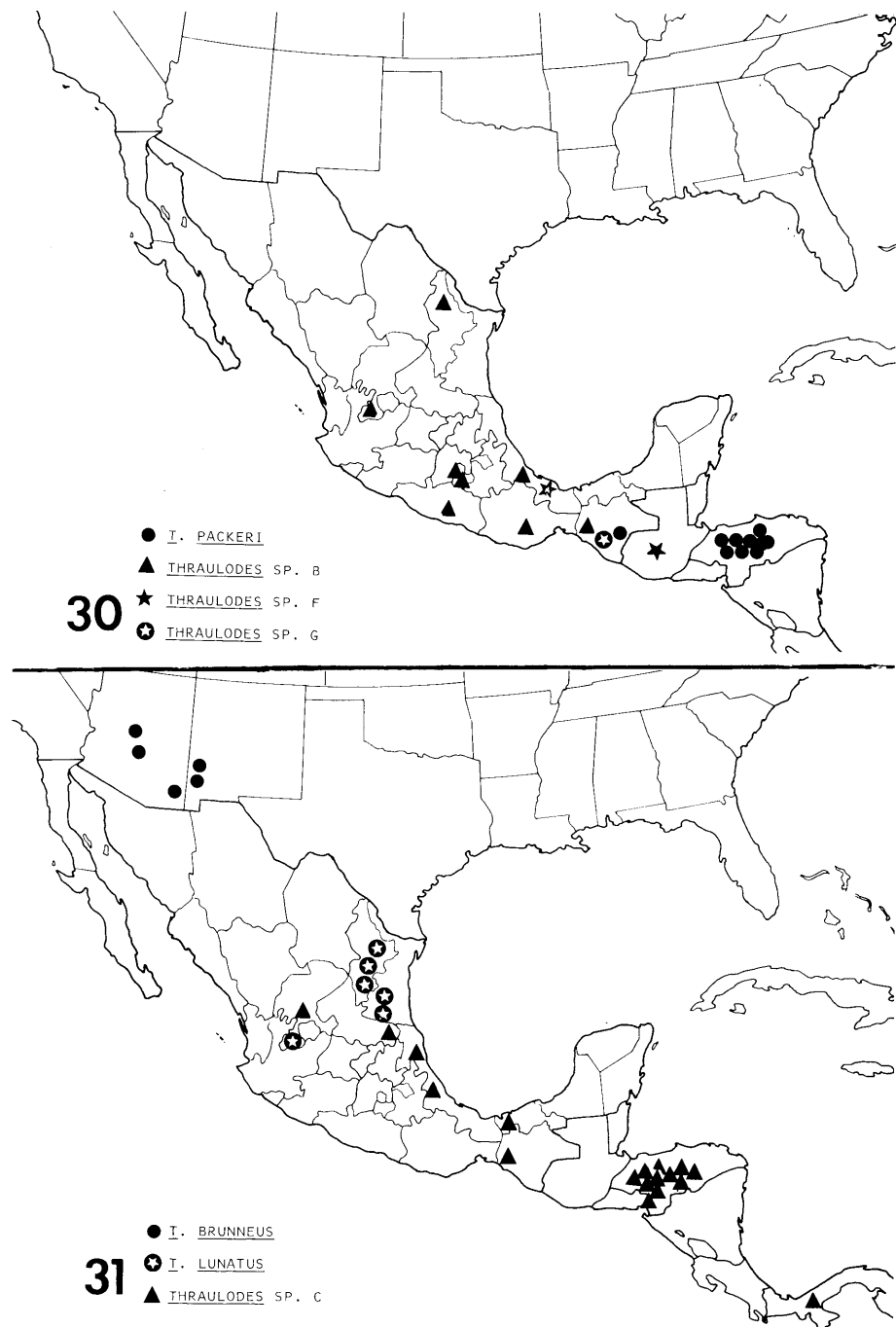


27

FIGS. 19-27. Abdomens, dorsal view, of *Thraulodes* nymphs. 19, *T. sp. B*; 20, *T. sp. G*; 21, *T. gonzalesi*; 22, *T. sp. E*; 23, *T. lunatus*; 24, *T. sp. C*; 25, *T. packeri*; 26, *T. zonalis*; 27, *T. sp. D*.



FIGS. 28–29. Distribution of *Thraulodes* in North and Central America. 28, *T. salinus*, *T. sp. D*, and *T. sp. E*; 29, *T. gonzalesi*, *T. speciosus*, *T. zonalis*, and *T. sp. A*.



Figs. 30–31. Distribution of *Thraulodes* in North and Central America. 30, *T. packeri*, *T. sp. B*, *T. sp. F*, and *T. sp. G*; 31, *T. brunneus*, *T. lunatus*, and *T. sp. C*.

*Thraulodes mexicanus* (Eaton)

*Calliarcys* (provisional) *mexicanus* Eaton 1883: pl. 13. fig. 1.

*Thraulodes mexicanus* Eaton 1884: 109; Eaton 1892: 8.

*Thraulodes mexicanus* Ulmer 1919: 34; Kimmins 1960: 303; Demoulin 1963: 1; Traver & Edmunds 1967: 371.

This species was described from a male and female imago collected from an unknown locality in Mexico.

NYPH. Unknown.

TYPE LOCALITY. Mexico.

TYPE DEPOSITION. Brussels Museum.

DISTRIBUTION. Unknown.

*Thraulodes prolongatus* Traver

*Thraulodes prolongatus* Traver 1946: 434; Traver & Edmunds 1967: 375.

*Thraulodes prolongatus* was described from 2 male and 1 female imagos collected from the same locality as the types of *T. centralis* and *T. hilaroides* in Costa Rica.

NYPH. Unknown.

TYPE LOCALITY. Rio Pedregoso, Costa Rica.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. This species is known only from the type locality.

*Thraulodes spangleri* Traver & Edmunds

*Thraulodes spangleri* Traver & Edmunds 1967: 377.

This species was described from a long series of male and female imagos collected in southern Mexico.

TYPE LOCALITY. Arriaga, Chiapas, Mexico.

TYPE DEPOSITION. University of Utah, Salt Lake City.

DISTRIBUTION. *Thraulodes spangleri* is known only from the type locality.

*Thraulodes valens* (Eaton)

*Thraulodes valens* Eaton 1892: 9.

*Thraulodes valens* Ulmer 1919: 34; Ulmer 1920: 116; Kimmins 1934: 344; Ulmer 1943: 26; Traver & Edmunds 1967: 382.

This species was described from 2 male and 1 female imagos collected in Panama.

NYPH. Unknown.

TYPE LOCALITY. Boquete, Calder, Volcan de Chiriqui, Panama.

TYPE DEPOSITION. Godman and Salvin Collection, British Museums (Nat. Hist.), London.

DISTRIBUTION. This species is known only from the type locality, but Ulmer (1919) questionably reported subimagos from Costa Rica as this species.

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