

Mayflies (Ephemeroptera: Tricorythidae) of the Southwestern United States and Northern Mexico

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Ann. Entomol. Soc. Am. 80: 35-40 (1987)

ABSTRACT Species of *Leptohyphes* Eaton and *Tricorythodes* Ulmer from the southwestern United States and northwestern Mexico are reviewed. The nymphal stage of *Tricorythodes explicatus* (Eaton), type of the genus, is described and as a result the subgenera *Tricorythodes*, n. subg. and *Homoleptohyphes*, n. subg. are erected for *Tricorythodes condylus* Allen and *T. dimorphus* Allen, respectively. The subgenus *Homoleptohyphes* is divided into the *dimorphus*- and *corpulentus*-groups. Description of a new species, *L. tarsos*, Allen & Murvosh is presented, and collection records extend the known range of *T. explicatus*, *T. minutus* Traver, *T. corpulentus* Allen, *L. ferruginus* Allen & Brusca, *L. mirus* Allen, and *L. packeri* Allen. A distribution map is included for *T. explicatus* and *T. minutus*.

KEY WORDS Ephemeroptera, taxonomy, distribution, Tricorythidae, new subgenus

A RECENT collection study of mayflies in northwestern Mexico revealed the previously undescribed nymphal stage and new distribution records of *Tricorythodes explicatus* (Eaton), the type of the genus, which now makes it possible to describe new subgenera and species-groups in the family. This, and previous collection studies, also includes the discovery of a new species of *Leptohyphes*, and new distribution records of *T. minutus* and three species of *Leptohyphes* Eaton. Illustrations were prepared by the senior author and collections are labeled R.K.A. and C.M.M. Types are deposited in the California Academy of Sciences, San Francisco.

Family Tricorythidae

Genus *Leptohyphes* Eaton

There are now six described species of *Leptohyphes* known from the southwestern United States and northwestern Mexico.

Leptohyphes apache Allen

Distribution. This species is known from southern Arizona and New Mexico to southwestern Utah.

Leptohyphes ferruginus Allen & Brusca

Distribution. This species was described from Honduras and is now known to occur as far north as Sonora and Arizona.

New Records. ARIZONA: Gila County, East Verde River on Rd. 406, 16.6 km E of Payson, 19-VII-1970, R.K.A. MEXICO: Sonora, Rio Sonora,

3.3 km SE of Route 21, between Uras and Mazahui, 14-I-1983, R.K.A. and C.M.M.

Remarks. In the key to the species in Allen (1978), couplet 8 reads as follows:

- 8(7). Known geographic distribution North America north of Mexico (fig. 51-54) 9
- Known geographic distribution Mexico and Central America (fig. 51-54) 13

Now that this species is known from Arizona, this couplet no longer has utility. When keying nymphs of this species from the Southwest, one will come to an impasse at couplet 12; when this happens, proceed to couplet 13. Nymphs of *L. ferruginus* are readily distinguished from those of all other species by the red color of the body and gills, but often the color has faded to a pale pink. Faded specimens are distinguished from all others by the following combination of characters: 1) claws are the *brunneus*-type with 6-7 median and 1 subapical denticles; 2) the body possesses distinctive short spicules; 3) the operculate gills have a basal spine; and 4) the head, thorax, and abdomen are without markings.

Leptohyphes mirus Allen

Distribution. This species is now known from Chihuahua to Sonora and from southern Arizona to northwestern Texas.

New Records. MEXICO: Chihuahua, Rio Sativo at Gral Trias on Hwy. 16, 13-VIII-1977, R.K.A.; Rio San Pedro at Meoqui on Hwy. 45, 14-VIII-1977, R.K.A. Sonora, Rio Altas at Tubutama, 13-I-1983, R.K.A. and C.M.M.; Rio Bavispe, 5 km SW of Colonia Moralia at dam, 12-I-1983, R.K.A. and C.M.M. Sinaloa, stream, 1.6 km W of El Viola, 18-I-1983, R.K.A. and C.M.M.; Rio Baluarte at Rosario (23°N lat.), 18-I-1983, R.K.A. and C.M.M.

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Leptohyphes packeri Allen

Distribution. This species was described from Honduras and is now known to occur in northern Mexico, Texas, and Arizona.

New Records. MEXICO: Chihuahua, Rio San Pedro at Meoqui on Hwy. 45, 4-VIII-1977, R.K.A. Nuevo Leon, Rio Pasqueria at Cadereyta, off Hwy. 40, 16-VIII-1977, R.K.A. San Luis Potosi, Rio Axtla at Terrazas, 4 km E of Hwy. 85, 18-VIII-1977, R.K.A. Sonora, stream, 21.1 km N Hwy. 11 nr. Movas, 15-I-1983, R.K.A. and C.M.M.; Rio Cuchujaqui, 16.3 km SE of Alamos, 16-I-1983, R.K.A. and C.M.M.; stream, 1.6 km N of El Viola, 18-I-1983, R.K.A. and C.M.M. Sinaloa, Rio Baluarte at Rosario, 18-I-1983, R.K.A. and C.M.M.; Rio Elota on Hwy 15 nr. Elota, 18-I-1983, R.K.A. and C.M.M.

Leptohyphes quercus Kilgore & Allen

Distribution. This species is known only from the type locality in Arizona.

Leptohyphes tarsos Allen & Murvosh, n. sp.

Mature Nymph. Length: body 3.0–4.0 mm; caudal filaments 2.5–3.5 mm. General color light brown. Head brown, mottled with pale dots, distinctive black markings form occiput to posterior margin of compound eyes, and black mark between compound eyes and median ocellus; maxillary palpi 3-segmented; mandibles with delicate spines on outer margin. Thoracic nota light brown to brown, without distinctive markings; fore femora with moderately long spines; femoral band of spines moderately long; fore femora with ventral spines; fore tibiae and tarsi with spines on inner margins; middle and hind femora with short spines on dorsal and ventral margins, and anterior surface with scattered short spines; middle and hind tibiae and tarsi with spines on inner and outer margins; hind femora 35% longer than fore femora; claws with 4–6 median and 1 subapical denticles. Abdominal terga light brown to brown; terga 1–7 or 2–7 with indistinct small brown median macula; segments 7–9 without posterolateral projections; operculate gills pale, suffused with brown, without marginal spines, but with basal spine; abdominal sterna pale. Caudal filaments pale.

Types. *Holotype.* Mature female nymph, Rio Cuchujaqui, 16.3 km SE of Alamos, Sonora, Mexico, 16-I-1983, R.K.A. and C.M.M. *Paratopotypes.* Six female nymphs, same data as holotype.

Remarks. In keying nymphs of *L. tarsos* in Allen (1978), one either comes to an impasse at couplet 26, or the nymphs will key to *L. sabinas* Traver, known only from eastern Mexico. Nymphs of this species are distinguished from *L. sabinas*, and all other described species, by the distinctive markings around the compound eyes and by the brown median macula on the abdominal terga. Nymphs of *L. sabinas* are without a marking on

the head, have a triangular macula on the pronotum, the abdominal terga have a pale median transverse line and pale margins, and the species are geographically isolated. The distribution of *L. sabinas* is eastern Mexico, Nuevo Leon to Veracruz, not western Mexico as stated in Allen (1978).

Genus *Tricorythodes* Ulmer

This genus was erected by Ulmer (1920) to accommodate *Tricorythus explicatus* (Eaton, 1892), which he designated as the type of the genus. Because the nymphal stage of *T. explicatus* was undescribed, Allen (1977) divided the genus into two species-groups, the *albilineatus*-group and the *curvatus*-group. The discovery of the nymphal stage of the type allows the elevation of these species-groups to subgeneric status, as it belongs to the *albilineatus*-group. The genus is now divided into *Tricorythodes* s.s.; *Tricorythyphes*, n. subg. and *Homoleptohyphes*, n. subg. The nymphs of *T. allectus* (Needham), *T. atratus* McDunnough, *T. fictus* Traver, *T. peridius* Traver, *T. stigiatus* McDunnough, and *T. texanus* Traver are undescribed.

Subgenus *Tricorythodes* Ulmer

Nymph. Head without frontal shelf and genal projections; maxillary palpi 2- or 3-segmented. Femoral band of spines moderately long, delicate to heavy (Fig. 1 and 3); fore femora only 20–40% as broad as long; operculate gills triangular, anteromesal corner rather sharply angled (Fig. 2).

Type Species. *Tricorythodes (Tricorythodes) explicatus* (Eaton).

The subgenus is presently composed of the following 10 species: *T. albilineatus* Berner, *T. barbatus* Allen, *T. bullus* Allen, *T. cristatus* Allen, *T. explicatus*, *T. minutus* Traver, *T. notatus* Allen & Brusca, *T. ocellus* Allen & Roback, *T. sordidus* Allen, and *T. ulmeri* Allen & Brusca.

Tricorythodes (T.) explicatus (Eaton)

McDunnough (1931) reported this species from Ft. Davis, Tex.; Yellowstone National Park, Wyo.; Prince Albert National Park, Saskatchewan; and southern Alberta. The Wyoming, Alberta, and Saskatchewan specimens are unquestionably *T. minutus*, and the Texas specimens are probably *T. explicatus*. Traver (1935) reported a female imago from Ft. Davis, she questioned McDunnough's identification of the Alberta specimens, and she reported specimens as questionably being *T. explicatus* from Cimarron Canyon and Therma, N. Mex. The known distribution of this species (Fig. 9) suggests that these northern New Mexico specimens are *T. minutus*.

The type locality of this species may be the Rio Sonora, as this is the only river in Sonora in which

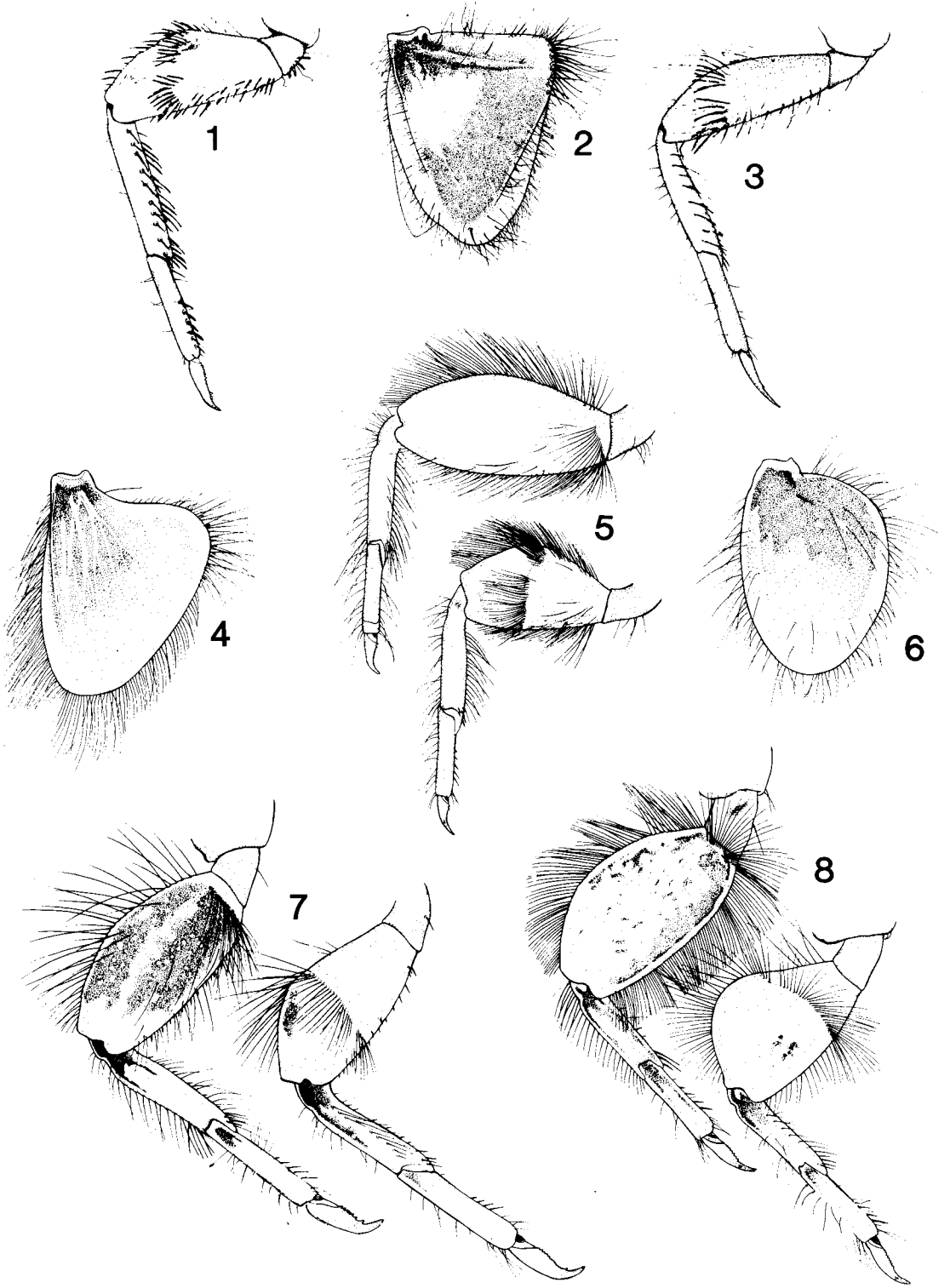


Fig. 1-8. Nymphal structures of *Tricorythodes*. (1) *T. explicatus* fore leg, (2) *T. explicatus* operculate gill, (3) *T. minutus* fore leg, (4) *T. condylus* operculate gill, (5) *T. condylus* fore and hind legs, (6) *T. dimorphus* operculate gill, (7) *T. dimorphus* fore and hind legs, (8) *T. corpulentus* fore and hind legs.

all three of Eaton's species, *Choroterpes inornata*, *Isonychia intermedia*, and *T. explicatus* were collected together.

Mature Nymph. Length: 4.0–7.0 mm; caudal filaments 2.5–4.0 mm. Head brown, without distinctive markings, occiput usually darker brown; outer head margin below compound eye with cluster of long spines; clypeus with transverse row of long spines; mandible outer margin with long spines; maxillary palpi 2-segmented, apical segment poorly developed. Thoracic nota pale to brown; pronotum pale to brown, usually with dark sublateral lateral maculae; legs pale to brown, tibiae base with black macula; coxae with marginal spines; fore femora with row of long spines on ventral margin; fore femoral subapical band of spines interrupted; long spines from femoral band to apex (Fig. 1); middle and hind femora with long spines on anterior surface and dorsal and ventral margins; fore and middle tibiae with double row of numerous long spines on inner margin, outer margin with setae; hind tibiae with double row of long spines on inner margin, outer margin with single row of long spines; all tarsi with single row on inner margin; claws with 10–14 marginal denticles. Abdominal terga 1–9 pale to brown with black transverse marking; tergum 10 pale; abdominal segments 7–9 without posterolateral projections; posterior margins of terga 1–9 with transverse row of long setae; operculate gills black with large pale macula (Fig. 2). Caudal filaments pale.

New Records. MEXICO: Sonora, 12 nymphs, stream, 21.1 km N of Hwy. 11 nr. Movas, 15-I-1983, R.K.A. and C.M.M.; 4 nymphs, stream at Hacienda Cochelesi, 41.6 km SE of Agua Prieta, 12-I-1983, R.K.A. and C.M.M.; 13 nymphs, Rio Bavispe, 5 km SW of Colonia Moralia at dam, 12-I-1983, R.K.A. and C.M.M.; 12 nymphs, Rio Altas at Tubutama, 13-I-1983, R.K.A. and C.M.M.; 11 nymphs, Rio Sonora, 3.3 km SE of Rt. 21, between Uras and Mazacahui, 14-I-1983, R.K.A. and C.M.M. Sinaloa, 1 nymph, stream, 1.6 km N of El Viola, 18-I-1983, R.K.A. and C.M.M.; 5 nymphs, Rio Evora Mocorita nr. Mocorita on Hwy. 21, 17-I-1983, R.K.A. and C.M.M.

Remarks. The nymphs of this species are distinguished from those of *T. minutus* by the length and number of spines on the legs, but generally the spines on the head and body are also longer and more numerous. The following key will serve to distinguish the nymphs of these species:

1. Fore and middle tibiae with double row long heavy spines on inner margin; hind tibiae with double row long heavy spines on inner margin; tibial spines numerous (60–70); all tarsi with short, heavy spines on inner margin (Fig. 1) *explicatus* (Eaton)
- Fore and middle tibiae without spines on inner margin; hind tibiae with single row of long delicate spines on inner margin; tibial spines moderate in number (30–35); fore

and middle tarsi without spines, hind tarsi with row of short spines on inner margin (Fig. 3) *minutus* Traver

Tricorythodes (T.) minutus Traver

The nymph of this species was described by Kilgore & Allen (1973).

We have examined specimens from >100 localities, of which the following are marginal and representative.

New Records. ALBERTA: McLeod River at Whitecourt, 30-VIII-1965, R.K.A. CALIFORNIA: Siskiyou County, Scott River, 3.3 km NW of Scott Bar, 5-VIII-1967, R.K.A. Sonoma County, Sonoma Cr., 29-IV-1950, W. C. Day. Mono County, East Fk. of Walker River below dam, 17-VII-1952, W. C. Day. Los Angeles County, San Gabriel River, 17-XI-1965, R.K.A. COLORADO: Mesa County, Grand Junction, 5-X-1979, J. V. Ward. IDAHO: Bonner County, Priest River, 8.3 km N of Priest River, 10-VIII-1963, G. F. Edmunds. MONTANA: Dawson County, Yellowstone River, 4-IX-1975, R. L. Newell. NEVADA: Elko County, Starr Cr., 3.3 km S of Hwy. 40, 23-IX-1957, R.K.A. and G. F. Edmunds. Churchill County, canal nr. Fallon, 22-IX-1957, R.K.A. and G. F. Edmunds. Washoe County, Truckee River at Verdi, 21-IX-1957, R.K.A. and G. F. Edmunds. OREGON: Benton County, Willamette River at Corvallis, 29-VII-1954, R.K.A. and G. F. Edmunds. Deschutes County, Deschutes River, 8.3 km NW of Bend on Hwy. 20, 30-VII-1954, R.K.A. and G. F. Edmunds. Malheur County, Malheur River at Vale, no other data. Union County, Grande Ronde River, 10 km W of La Grande, 7-IX-1954, R.K.A. and G. F. Edmunds. UTAH: Washington County, Virgin River, Zion National Park, 9-VII-1964, R.K.A. Salt Lake County, Holliday, 23-VIII-1950, G. F. Edmunds. WASHINGTON: Grays Harbor County, Wyanoochee Road. nr. Montasano, 2-IX-1957, R.K.A. and G. F. Edmunds. Spokane County, Little Spokane River at Spokane, 13-VI-1957, R.K.A.

Subgenus *Tricorythodes* Allen & Murvosh, n. subg.

Nymph. Body 4.0–5.0 mm. Head with frontal shelf and genal projections; maxillary palpi 3-segmented. Femoral band subapical spines long and delicate (Fig. 5); fore femora 40–50% as broad as long. Operculate gill triangular, antero-mesal corner rounded (Fig. 4).

Type Species. *Tricorythodes (Tricorythodes) condylus* Allen.

Tricorythodes papayanicus Dominquez, from Argentina, may be assignable to this subgenus.

Tricorythodes (T.) condylus Allen

Distribution. This species is known only from Arizona and southwestern New Mexico.

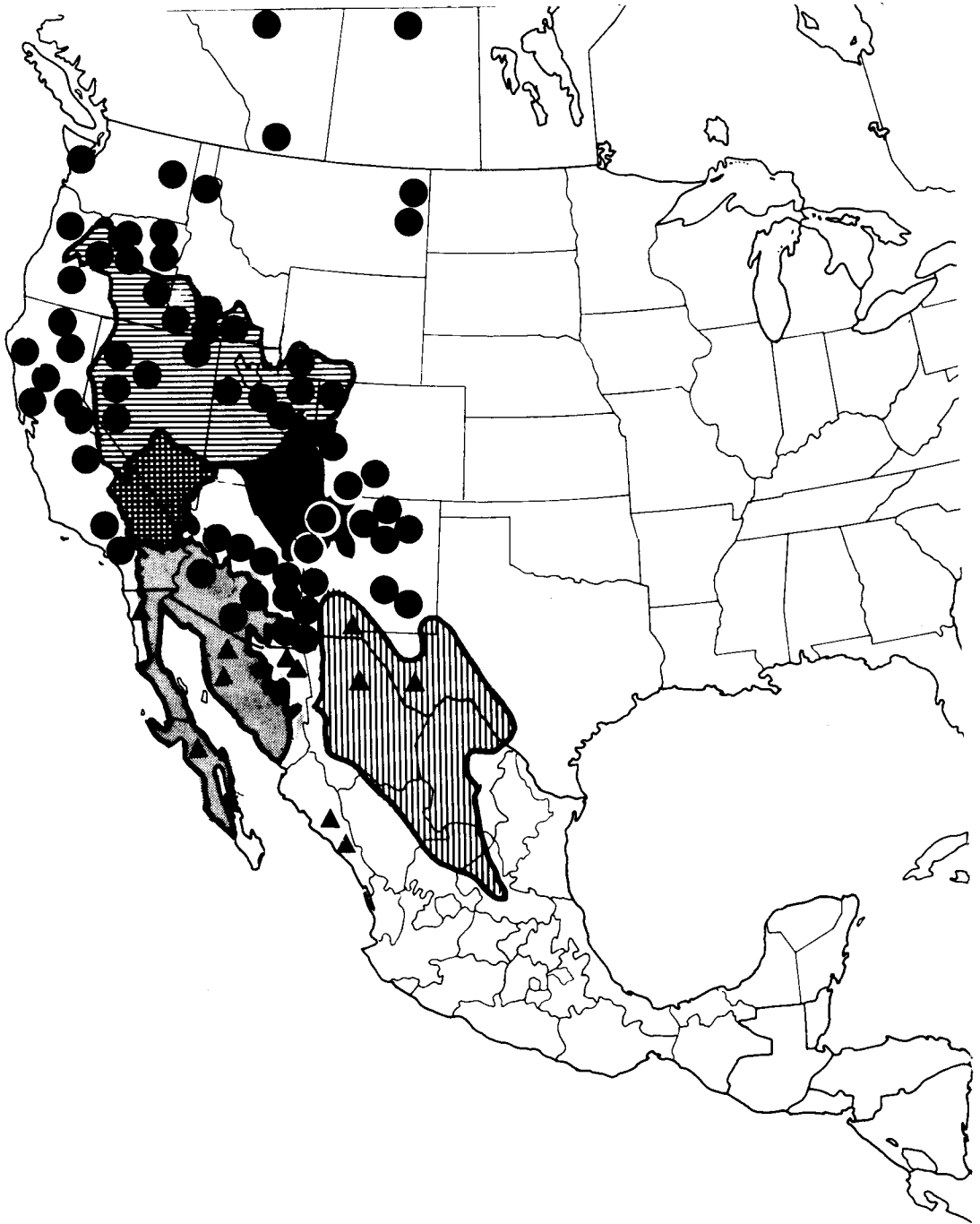


Fig 9. Distribution of *T. explicatus* and *T. minutus* in western North America. Shaded areas represent western deserts from north to south as follows. ▨, Great Basin Desert; ■, Painted Desert; ▩, Mojave Desert; ▩, Sonoran Desert; ▨, Chihuahuan Desert. ▲, *T. explicatus*; ●, *T. minutus*.

Subgenus *Homoleptohyphes* Allen & Murvosh,
n. subg.

Nymph. Body 2.5–6.0 mm. Head without frontal shelf or genal projections; maxillary palpi 1-segmented or absent. Femoral band of subapical

spines long and delicate (Fig. 7 and 8); fore femora 50–70% as broad as long. Operculate gill obovate (Fig. 6).

Type Species *Tricorythodes (Homoleptohyphes) dimorphus* Allen.

This subgenus is composed of four species, which

are divided into the *dimorphus*- and *corpulentus*-groups.

dimorphus-group

Two species, *T. (H.) dimorphus* Allen and *T. (H.) curvatus* Allen, known only from Arkansas, are included in this group. Nymphs are distinguished from those of the *corpulentus*-group by possessing 1-segmented maxillary palpi, femora with sparse and irregularly spaced marginal spines (Fig. 7), and claws with median denticles and a single subapical denticle.

Tricorythodes (H.) dimorphus Allen

Distribution. This species has a disjunct distribution. It is known from southern California and eastern Arizona and New Mexico.

corpulentus-group

This group includes two species, *T. (H.) corpulentus* Kilgore & Allen and *T. (H.) edmundsi* Allen, known from northern Utah and northeastern Mexico. Nymphs are distinguished from those of the *dimorphus*-group by possessing maxillae that are without palpi, femora with numerous, regularly spaced spines (Fig. 8), and claws with median denticles and paired subapical denticles.

Tricorythodes (H.) corpulentus Allen

Distribution. This species is known only from southern New Mexico.

Acknowledgment

We thank Steve Van Vactor, who assisted with the field collections. Travel funding was provided by grants from the Univ. of Nevada, Las Vegas Museum of Natural History, and the Marjorie Barrick Committee on Faculty Development.

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Received for publication 12 February 1986; accepted 31 July 1986.