

NEW SPECIES OF LEPTOHYPHINAE FROM MEXICO AND
CENTRAL AMERICA (EPHEMEROPTERA: TRICORYTHIDAE)¹

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Abstract

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Descriptions and figures are presented for *Leptohyphes dicinctus*, *L. melano-branchus*, *L. brunneus*, *L. consortis*, *L. ferruginus*, *L. hispidus*, *L. lestes*, *L. lumas*, *L. pilosus*, *L. spiculatus*, *Tricorythodes notatus*, and *T. ulmeri* from Mexico and Central America.

An assemblage of mayfly nymphs collected in Mexico and Central America by the senior author included 12 new species of Leptohyphinae. Types are deposited in the collection of the California Academy of Sciences, San Francisco, and the illustrations were prepared by Jerry J. Battagliotti, California State College, Los Angeles.

Genus *Leptohyphes* Eaton

The genus was first reported from Central America by Eaton in 1892 when he described *L. brevissimus* from Guatemala. Subsequently, Ulmer (1919) described *L. costaricanus* from Costa Rica; Traver (1958) described *L. priapus* from Costa Rica and reported *L. sabinas* Traver from Honduras; and Allen (1967) described *L. castaneus* from Guatemala, *L. murdocki* from Panama, *L. musseri* from Guatemala and Honduras, *L. nanus* from the Canal Zone and Honduras, and *L. packeri* from Honduras. *Leptohyphes melanobranchus* is described herein from Guatemala and 10 species are now known to occur in Central America.

Leptohyphes was not reported from Mexico until 1958 when Traver described *L. bernerii*, *L. zalope*, and *L. sabinas*. Brusca (1971) described *L. alleni*, and the 10 new species described in this report brings the number of Mexican species to 14. The total number of described species in the genus now stands at 56.

***Leptohyphes dicinctus* n. sp.**

NYMPH. Length: body 3.0-4.0 mm; caudal filaments 2.5-3.5 mm. General color pale and black. Head pale without markings; maxillary palpi 1-segmented. Thorax black with small white maculae; base of wing pads black, pale distally; legs pale, without markings; femora with short spines (Fig. 2c), and with scattered long spines (Fig. 2a-b); fore femoral band of spines (Fig. 2a); fore femora with a transverse elevated ridge; anterior surface middle and of hind femora with only a basal, transverse row of short spines, and with a few short spines along dorsal and ventral margins (Fig. 2b); hind femora 20% longer than fore femora; fore tibiae with rows of spines on inner margin; middle and hind tibiae with only apical spines; tarsal claws with 4 marginal denticles, and two rows of 4-6 submarginal denticles near apex (Fig. 12). Abdominal segments 1-7 pale; segments 8-9 black; tergum 10 pale; abdominal terga with median elevated tubercles on segments 3-7, and a transverse row of short spines on tergum 7 (Fig. 1); operculate gills pale, without markings; operculate gills without a basal spine. Caudal filaments pale.

TYPES. Holotype: mature female nymph, tributary Rio Papagayo near Tierra Colorado, Guerrero, Mexico, 16-XI-68, R. K. Allen. Paratopotype: female nymph, same data as holotype, in collection California State College, Los Angeles.

¹The research upon which this report is based was supported by National Science Foundation.

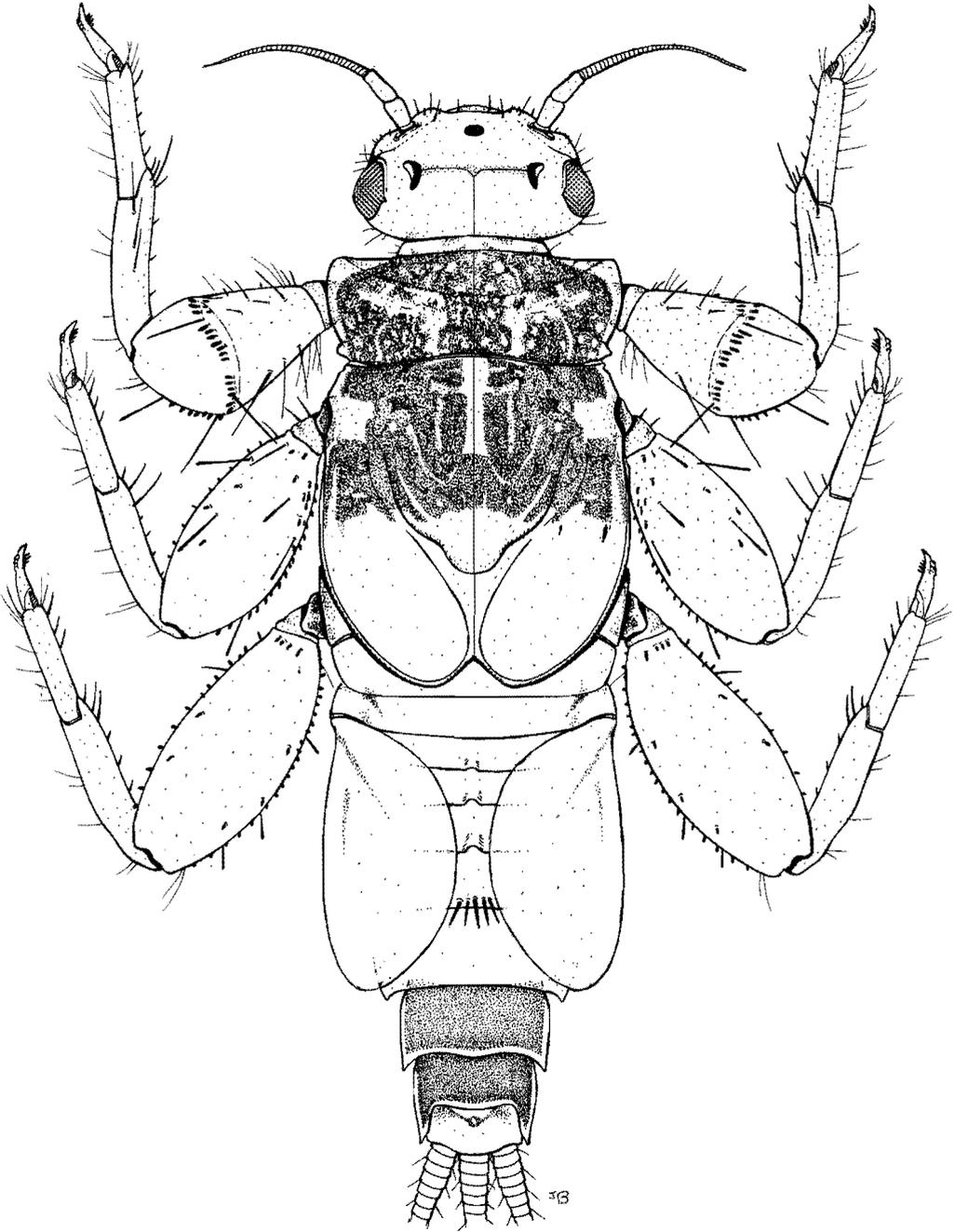


FIG. 1. *Leptohyphes dicinctus*, mature nymph, dorsal view.

REMARKS. *Leptohyphes dicinctus* is closely related to *L. melanobranchus* n. sp. as they have several distinctive characters in common. The nymphs of both have a unique tarsal claw with a row of marginal denticles and two rows of submarginal denticles near the apex; both have elevated median tubercles on the middle abdominal segments; and both have a transverse row of spines on the posterior margin of the seventh tergum. The nymphs of this species are distinguished from *L. melanobranchus* by having the thoracic segments and the eighth and ninth abdominal segments marked with black, by having unicolorous legs, and by having a ridge on the fore femora.

ETYMOLOGY. The name of this species is from the Greek words *dis*, meaning TWO, and *cinctus*, meaning GIRDLE.

HABITAT. Specimens of this striking nymph were collected in southwestern Mexico from a moderately large river with an elevation of 500 ft and a water temperature of 86°F. *Leptohyphes dicinctus* was collected with *L. lestes* n. sp., and these species share the same type locality.

***Leptohyphes melanobranchus* n. sp.**

NYPH. Length: body 3.0–4.0 mm; caudal filaments 2.0–3.0 mm. General color pale with black markings. Head pale with an intricate black pattern; maxillary palpi 1-segmented. Thoracic nota pale with black markings; legs pale with black markings; femora pale with a large black submedian macula; femora with moderately long sharp spines (Fig. 3a), and with numerous long spines (Fig. 3a–b); fore femoral band of spines as in Fig. 3a; fore femora without an elevated ridge; anterior surface of middle and hind femora with only a basal, transverse row of long spines, and without scattered spines (Fig. 3b); hind and fore femora subequal in length; tibiae pale, without markings; fore tibiae without rows of spines on inner margin; middle and hind tibiae with rows of marginal spines on inner margin; tarsal claws with 4 marginal denticles, and two rows of 1–3 submarginal denticles, near apex (Fig. 13). Abdominal terga pale, each with a black transverse band; abdominal terga with median elevated tubercles on segments 3–7, and a transverse row of long spines on tergum 7 (Fig. 27); operculate gills pale with numerous large black maculae (Fig. 26); operculate gills without a basal spine; abdominal sterna pale with diffuse black markings. Caudal filaments pale.

TYPES. Holotype: mature female nymph, Rio Cartaga, between Esquintla and Taxisco, Guatemala, 25-X-68, R. K. Allen.

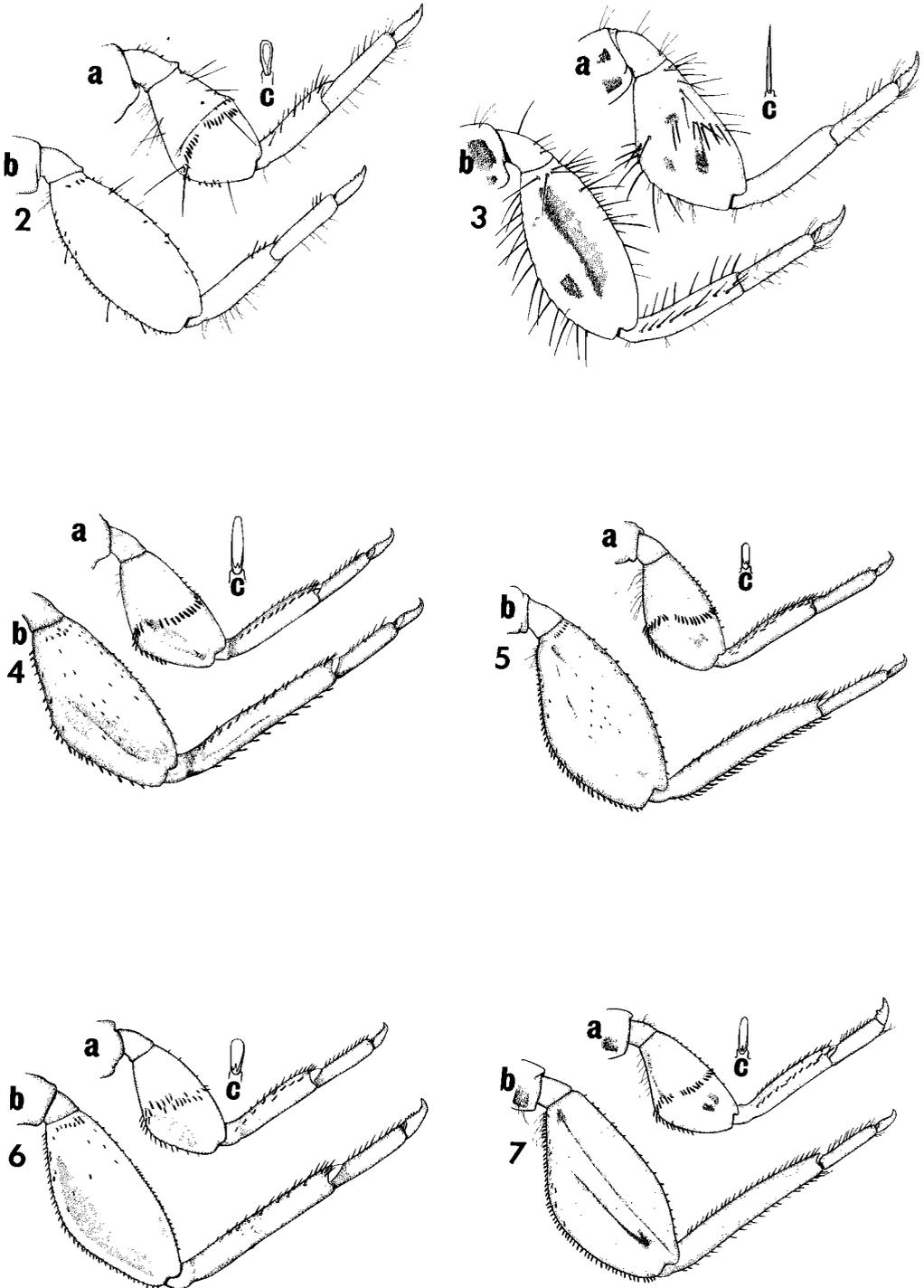
REMARKS. The characters of the tarsal claws and the abdominal terga are unique in *L. melanobranchus* and *L. dicinctus*, and they appear to have evolved from a common ancestor. These species may constitute a separate subgenus within *Leptohyphes*, but this designation is withheld pending additional nymphal specimens and reared male imagoes. *Leptohyphes melanobranchus* nymphs are most easily distinguished from *L. dicinctus* by the coloration on the body, legs, and operculate gills, and by the number and degree of development of the spines on the body and appendages.

ETYMOLOGY. The name of this species is from the Greek words *melanos* meaning BLACK, and *branchos* meaning GILL.

HABITAT. This species was collected in a small stream at an elevation of 1200 ft, and with a water temperature of 80°F.

***Leptohyphes brunneus* n. sp.**

NYPH. Length: body 5.5–6.5 mm; caudal filaments 5.0–6.0 mm. General color light brown with brown markings (fully mature nymphs often brown with reddish-brown markings). Head light brown with a large brown macula between lateral ocelli (Fig. 22); maxillary palpi 3-segmented. Thoracic nota light brown, suffused with brown; legs light brown, suffused with brown; femora unicolorous light brown, or light brown with faint brownish maculae; femora



FIGS. 2-7. *Leptohyphes* nymphal structures. (a) right fore leg, (b) right hind leg, (c) fore femoral spine: 2, *L. dicinctus*; 3, *L. melanobranchus*; 4, *L. brunneus*; 5, *L. consortis*; 6, *L. ferruginus*; 7, *L. hispidus*.

with moderately long spines (Fig. 4c); fore femoral band of spines (Fig. 4a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of spines, and with scattered spines (Fig. 4b); hind femora 40% longer than fore femora; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 5-7 marginal denticles (Fig. 14). Abdominal terga unicolorous light brown; terga 1-10 with numerous scattered spines, usually arranged into sublateral rows; operculate gills light brown; operculate gills with a basal spine; abdominal sterna light brown. Caudal filaments pale, often with a single dark brown annulation.

TYPES. Holotype: mature nymph, small stream 15 miles north Ayoquezco, Oaxaca, Mexico, 20-X-68 (elev. 6700 ft; water temp. 54°F), R. K. Allen. Paratopotypes: 10 nymphs, same data as holotype, 2 nymphs in collection University of Utah, Salt Lake City, remainder in collection California State College, Los Angeles. Paratypes: 3 nymphs, Rio La Pasion at Tizapan El Alto, Jalisco, Mexico, 16-X-68 (elev. 5100 ft; water temp. 61°F), R. K. Allen; 1 nymph, stream 7 miles north Arriaga on Highway 190, Chiapas, Mexico, 23-X-68 (elev. 1400 ft; water temp. 78°F), R. K. Allen, 8 nymphs, Rio Amacuzac, Huajintlan, on Highway 95, Morelos, Mexico, 29/30-VII-66 (elev. 3200 ft; water temp. 64°F), all paratypes in collection California State College at Los Angeles.

REMARKS. The nymphal color pattern of *L. brunneus* is light brown with brown to reddish-brown markings, and specimens of this species may be superficially confused with other Mexican species with pale coloration. The best identifying character of *L. brunneus* is a large brown to reddish-brown macula on the frons between the lateral ocelli. Other characters which will serve to distinguish this species from all other *Leptohyphes* are as follows: the shape and arrangement of the denticles on the tarsal claws, the color of the operculate gills, and the arrangement of spines on the femora.

ETYMOLOGY. The name of this species is from the Latin word *brunneus* meaning BROWN.

HABITAT. Mature nymphs of *L. brunneus* have been collected in July and October which suggests that adults emerge from late summer to late fall. Nymphs collected in July were from a stream with an elevation of 3200 ft and a water temperature of 64°F. Those collected in October were from streams at elevations between 1400 and 6700 ft and with water temperatures between 54° and 78°F. *Leptohyphes brunneus* is currently known from central and southern Mexico. Nymphs of this species occur in the same habitat as *L. lumas* n. sp. and *L. spiculatus* n. sp. Specimens of *L. brunneus* and *L. lumas* were collected from the same stream on the same date, whereas specimens of the former species have been collected from the same habitat as *L. spiculatus* but at a different time of the year. *Leptohyphes brunneus* nymphs were collected from the Rio Amacuzac, in Morelos, in July, and *L. spiculatus* nymphs were collected in October.

Leptohyphes consortis n. sp.

NYMPH. Length: body 4.5-5.5 mm; caudal filaments 5.0-6.0 mm. General color light brown. Head pale with irregular black markings; maxillary palpi 3-segmented. Thoracic nota brown with dark markings; pronotum with a triangular dark marking; mesonotum with irregular dark markings; legs light brown; femora light brown with a faint subapical black macula; femora with short spines (Fig. 5c); fore femoral band of spines (Fig. 5a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of small spines, and with scattered small spines (Fig. 5b); hind femora 40% longer than fore femora; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 5-6 marginal denticles (Fig. 15). Abdominal terga light brown with diffused brown markings; terga 2-6 with dark sublateral maculae; terga 7-9 with indistinct sublateral maculae; terga 1-7 with an indistinct median macula (Fig. 30); terga 1-10 with

scattered short spines; operculate gills pale apically, black basally; operculate gills with a basal spine; abdominal sterna pale, without markings. Caudal filaments pale with a dark brown annulation.

TYPES. Holotype: mature nymph, Rio San Marcos at Apantilla, 3 miles southeast Villa A. Camacho, Vera Cruz, Mexico, 12-XI-68, R. K. Allen. Paratopotype: 1 nymph, same data as holotype, in collection California State College, Los Angeles.

REMARKS. *Leptohyphes consortis* does not have a unique distinctive character, as do the nymphs of the other Mexican *Leptohyphes*, but it is easily distinguished from these species by a combination of leg and gill characters. The operculate gills are black in the basal half, and pale distally; the femoral spines are short; and the denticles on the tarsal claws are large and arranged in a unique manner.

ETYMOLOGY. The name of this species is from the Latin word *consors* meaning COMPANION.

HABITAT. Mature nymphs were collected in a small stream at an elevation of 700 ft with a water temperature of 66°F. This species is found in the same habitat as *Leptohyphes ferruginus* n. sp., *L. lumas* n. sp., and *L. pilosus* n. sp.

***Leptohyphes ferruginus* n. sp.**

NYMPH. Length: body 4.0-5.0 mm; caudal filaments 3.5-4.5 mm. General color dark red to reddish-brown with red and black markings. Head red; maxillary palpi 3-segmented. Thoracic nota dark red; pronotum with black sublateral maculae; nota covered with spicules; legs brown with red markings; femora with moderately long spines (Fig. 6c); fore femoral band of spines (Fig. 6a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of spines, and with a few scattered spines (Fig. 6b); hind femora 45% longer than fore femora; tibiae and tarsi brown, tarsi dark apically; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 6-8 marginal denticles (Fig. 16). Abdominal terga red with pale margins; terga with scattered spines arranged in sublateral rows; operculate gills red, margins pale; operculate gill with a basal spine; abdominal sterna pale with small, diffuse red spots. Caudal filaments pale, often with a dark brown to red annulation near base.

TYPES. Holotype: mature nymph, Rio San Marcos at Apantilla, 3 miles southeast Villa A. Camacho, Vera Cruz, Mexico, 12-XI-68, R. K. Allen. Paratopotypes: 6 nymphs, same data as holotype, 2 nymphs in collection University of Utah, Salt Lake City, remainder in collection California State College, Los Angeles.

REMARKS. *Leptohyphes ferruginus* is easily distinguished from all known Mexican species of the genus by the red body color, by the red operculate gill, by the shape of the denticles on the tarsal claws, and by the arrangement and number of spines on the femora.

ETYMOLOGY. The name of this species is from the Latin word *ferrugo* meaning RUSTY.

HABITAT. Nymphs of this species were collected in a moderately sized stream in southern Mexico, and they were found in the same general habitat as three other species of *Leptohyphes*. *Leptohyphes consortis* n. sp., *L. lumas* n. sp., and *L. pilosus* were collected with the above named species from among rocks and debris.

***Leptohyphes hispidus* n. sp.**

NYMPH. Length: body 6.5-7.5 mm; caudal filaments 6.0-7.0 mm. General color brown with black markings. Head pale with irregular brown markings; occiput of head covered with numerous small dark spicules (Fig. 23); maxillary palpi 3-segmented. Thoracic nota brown to reddish-brown; pronotum shaded with black on margins; pronotum with sub-

median black maculae; nota covered with numerous small dark spicules; legs brown; femora with a small black subapical macula; femora covered with numerous small dark spicules; femora with moderately long spines (Fig. 7c); fore femoral band of spines (Fig. 7a); fore femora without an elevated ridge; anterior surface of middle and hind femora without basal or scattered spines (Fig. 7b); hind femora 40% longer than fore femora; tibiae and tarsi light brown; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 3-5 marginal denticles (Fig. 17). Abdominal terga brown to reddish-brown, and with diffuse black shading; abdominal terga with numerous small dark spicules, and without spines; operculate gills brown to reddish-brown; operculate gills with a small basal spine; abdominal sterna pale with a black median macula on segments 1-10. Caudal filaments brown, often with a dark annulation near base.

TYPES. Holotype: mature nymph, stream 5 miles south Ciudad Mendoza, Vera Cruz, Mexico, 7-XI-68, R. K. Allen. Paratopotypes: 33 nymphs, same data as holotype, 5 nymphs in collection University of Utah, Salt Lake City, others in collection California State College, Los Angeles. Paratypes: 11 nymphs, Rio Jamapa, 3 miles northeast Coscomatepec, Vera Cruz, Mexico, 8-XI-68, R. K. Allen, 2 nymphs in collection University of Utah, Salt Lake City, others in collection California State College, Los Angeles.

REMARKS. *Leptohyphes hispidus* is the only Mexican species in the genus with small black spicules on the body and appendages, and it is distinguished from all described species by this character.

ETYMOLOGY. The name of this species is from the Latin word *hispidus* meaning ROUGH.

HABITAT. This species has been collected in streams near 4500 ft elevation, and in water between 60° and 64°F. Other species of *Leptohyphes* which are known to occur in the same streams with the above noted species are *L. brunneus* and *L. lumas* n. sp.

Leptohyphes lestes n. sp.

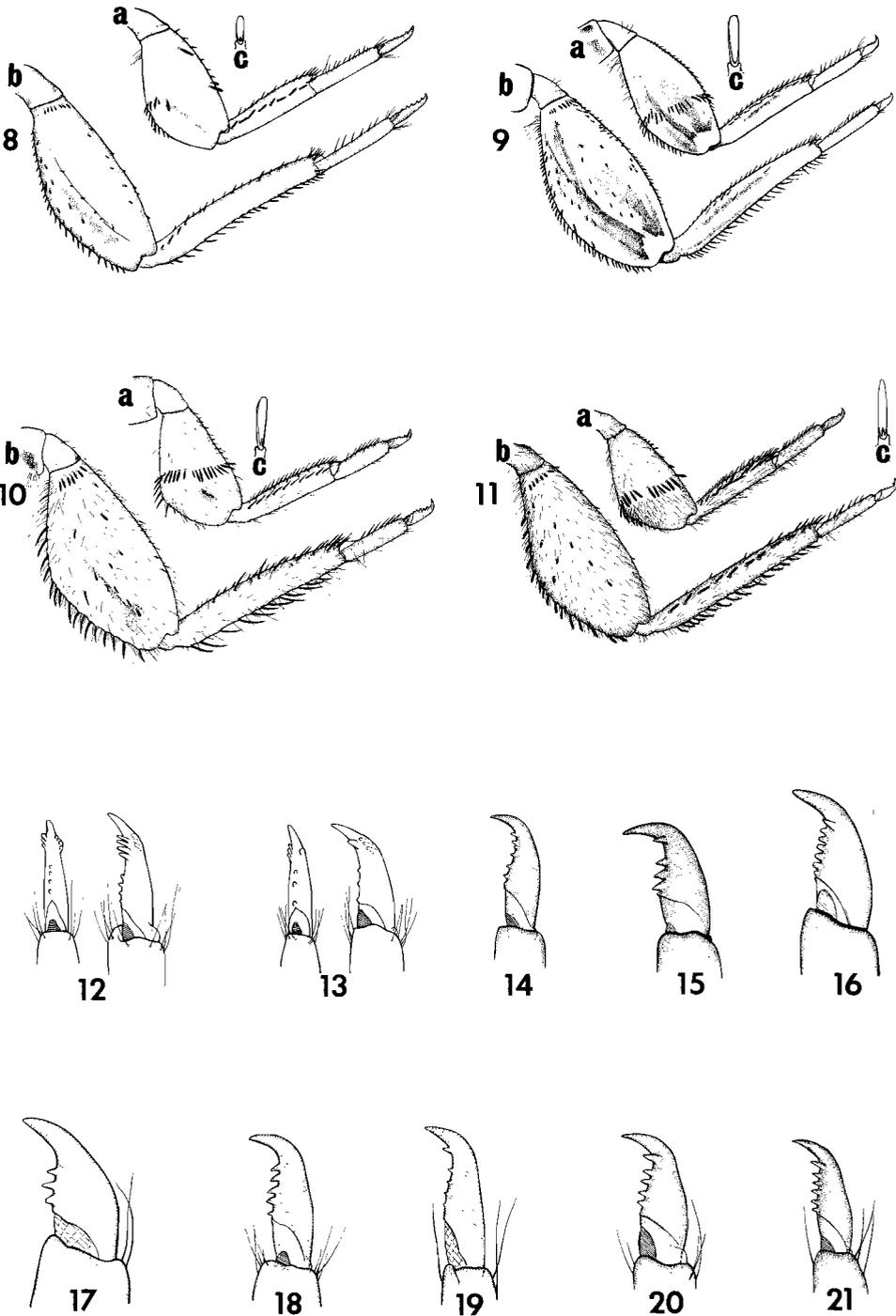
NYMPH. Length: body 3.5-4.5 mm; caudal filaments 3.5-4.5 mm. General color light brown with black markings. Head pale, with a black transverse band between compound eyes (Fig. 24); maxillary palpi 3-segmented. Thoracic nota light brown with diffuse black markings; legs light brown; femora with a diffuse black median streak; femora with short spines (Fig. 8c); femoral band of spines (Fig. 8a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a transverse row of short basal spines, and with scattered spines often arranged in rows (Fig. 8b); hind femora 65% longer than fore femora; tibiae and tarsi light brown; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 5-8 marginal denticles (Fig. 18). Abdominal terga light brown with diffuse black markings; operculate gills pale, light brown in basal one-third; operculate gills with a basal spine; abdominal sterna pale, without markings. Caudal filaments pale with a brown annulation near base.

TYPES. Holotype: mature nymph, tributary Rio Papagayo near Tierra Colorado, Guerrero, Mexico, 16-XI-68, R. K. Allen. Paratopotypes: 2 nymphs, same data as holotype, in collection California State College, Los Angeles.

REMARKS. This Mexican *Leptohyphes* is distinguished easily from all other described species in the genus as the vertex of the head is pale, and there is a distinctive black band between the compound eyes which resembles a mask.

ETYMOLOGY. The name of this species is from the Greek word *lestes* meaning ROBBER.

HABITAT. Mature nymphs were collected from a stream at an elevation of 500 ft, and with a water temperature of 86°F. This species was collected with, and has the same type locality as, *L. dicinctus*.



FIGS. 8-21. *Leptohyphes* nymphal structures. 8-11, (a) right fore leg, (b) right hind leg, (c) fore femoral spine: 8, *L. lestes*; 9, *L. lumas*; 10, *L. pilosus*; 11, *L. spiculatus*. 12-21, tarsal claws: 12, *L. dicinctus*; 13, *L. melanobranchus*; 14, *L. brunneus*; 15, *L. consortis*; 16, *L. ferruginus*; 17, *L. hispidus*; 18, *L. lestes*; 19, *L. lumas*; 20, *L. pilosus*; 21, *L. spiculatus*.

***Leptohyphes lumas* n. sp.**

NYMPH. Length: body 4.0–5.0 mm; caudal filaments 3.5–4.5 mm. General color brown with dark brown markings. Head brown; occiput and frons with an intricate dark brown pattern (Fig. 25); maxillary palpi 3-segmented. Thoracic nota brown with an intricate pattern of dark brown; legs light brown with brown markings; femora light brown with brown markings (Fig. 9a–b); femora with moderately long spines (Fig. 9c); fore femoral band of spines (Fig. 9a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of moderately long spines, and with scattered spines (Fig. 9b); hind femora 40% longer than fore femora; tibiae and tarsi brown; fore tibiae with rows of spines on inner margin; middle and hind tibiae with spines; tarsal claws with 4–5 small marginal denticles (Fig. 19). Abdominal terga brown with pale margins; terga 1–10 with scattered short spines and long paired submedian spines on posterior margin; operculate gills brown with pale margins, gills darker in basal half; operculate gills with a basal spine; abdominal sterna light brown to pale, usually with paired sublateral dark maculae. Caudal filaments brown, often with a dark brown annulation.

TYPES. Holotype: mature nymph, stream 7 miles north Arriaga on Highway 190, Chiapas, Mexico, 20-VII-66, R. K. Allen. Paratopotypes: 16 nymphs, same data as holotype, 2 nymphs in collection University of Utah, Salt Lake City, others in collection California State College, Los Angeles. Paratypes: 8 nymphs, Rio Jamapa, 3 miles northeast Coscomatepec, Vera Cruz, Mexico, 8-XI-68, R. K. Allen; 2 nymphs Rio Tecolapan, Santiago Tuxtla on Highway 180, Vera Cruz, Mexico, 16-VII-66, R. K. Allen; 7 nymphs, stream 7 miles north Arriaga on Highway 190, Chiapas, Mexico, 23-X-68, R. K. Allen; 2 nymphs, Rio Grande, 3 miles south Gualatao, Oaxaca, Mexico, 6-XI-68, R. K. Allen; 3 nymphs, stream at Santa Isabel, 12 miles above Arriaga on Highway 190, Chiapas, Mexico, 23-X-68, R. K. Allen; 2 nymphs, Rio Jamapa, Vera Cruz, Mexico, 14-VII-66, R. K. Allen; 5 nymphs, Rio San Marcos at Apapantilla, 3 miles southeast Villa A. Camacho, Vera Cruz, Mexico, 12-XI-68, R. K. Allen; 4 nymphs, Rio Teapa near Ishuatan, Chiapas, Mexico, 18-VII-66, R. K. Allen; 1 nymph, Rio Grifalva at Teapa, Tabasco, Mexico, 18-VII-66, R. K. Allen; 1 nymph, Rio Huitla, 14 miles north Tapachula, Chiapas, Mexico, 1-XI-68, R. K. Allen. All paratypes in collection California State College, Los Angeles.

REMARKS. The nymphs of this species are dark in color and this character will superficially distinguish *L. lumas* from all other Mexican species. The femora are marked with a distinctive pattern of brown, and the dentition on the tarsal claws is weak.

ETYMOLOGY. The name of this species is derived from the Latin word *lumas* meaning SMOOTH.

HABITAT. The nymph of this species was collected in streams between sea level and 5100 ft elevation in water with temperatures between 64° and 78°F. Mature nymphs have been collected from July to October which suggests that emergence is over at least a 4 month period. *Leptohyphes lumas* nymphs are known to occur in the same habitat as *L. consortis*, *L. ferruginus*, *L. hispidus*, and *L. pilosus* n. sp.

***Leptohyphes pilosus* n. sp.**

NYMPH. Length: body 4.0–5.0 mm; caudal filaments 4.5–5.5 mm. General color light brown. Head light brown with two black crescent-shaped maculae medial to lateral ocelli; head with scattered spicules; maxillary palpi 3-segmented. Thoracic nota light brown with brown markings; pronotum light brown with paired submedian markings near anterior margin; mesonotum light brown, often with variable brown markings; nota covered with long setae (Fig. 28); legs light brown with long setae (Fig. 10a–b); femora light brown with a subapical

black macula; femora with moderately long spines (Fig. 10c); fore femoral band of spines (Fig. 10a); fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of spines, scattered spines, and scattered long setae (Fig. 10b); hind femora 35% longer than fore femora; fore tibiae with rows of spines and long setae on inner margin; middle and hind tibiae with long spines; tarsal claws with 5-6 marginal denticles (Fig. 20). Abdominal terga light brown with a black median macula on terga 1-10; terga 1-7 with black sublateral maculae; terga 2-9 with long dark submedian spines (Fig. 28); operculate gills gray with pale margins; operculate gills with a basal spine (Fig. 28); abdominal sterna light brown. Caudal filaments pale, often with one to many brown annulations.

TYPES. Holotype: mature nymph, Rio San Marcos at Apapantilla, 3 miles southeast of Villa A. Camacho, Vera Cruz, Mexico, 12-XI-68, R. K. Allen.

REMARKS. The nymph of *L. pilosus* possesses long hair-like setae on the thoracic nota and appendages, and it is by this character that this species is most easily distinguished from the nymphs of other described Mexican species.

ETYMOLOGY. The name of this species is from the Greek word *pilos* meaning HAIR.

HABITAT. The holotype nymph of *L. pilosus* was collected from a stream at an elevation of 700 feet and with a water temperature of 66°F. Three species of Mexican *Leptohyphes*, *L. consortis*, *L. ferruginus*, and *L. lumas*, were collected from the same habitat as was *L. pilosus*.

Leptohyphes spiculatus n. sp.

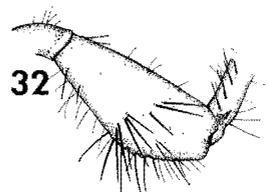
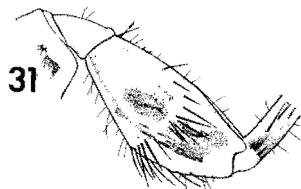
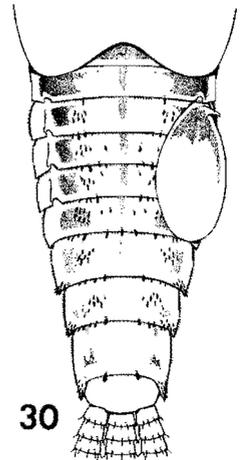
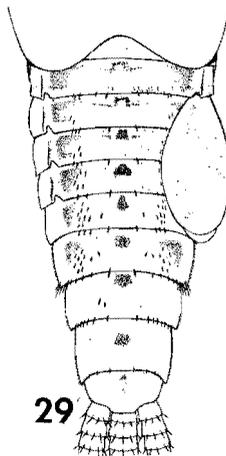
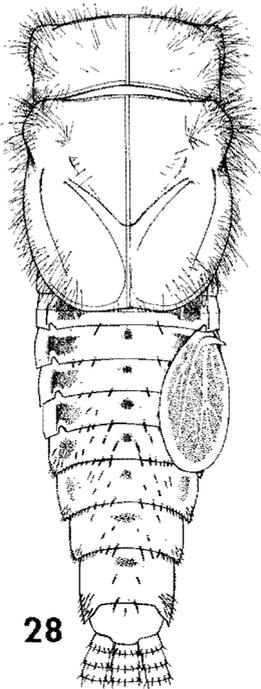
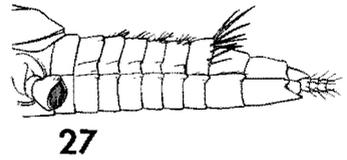
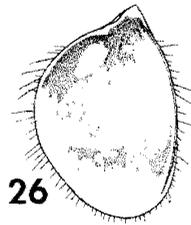
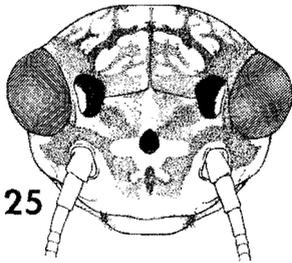
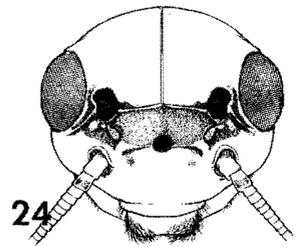
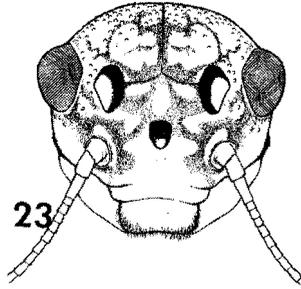
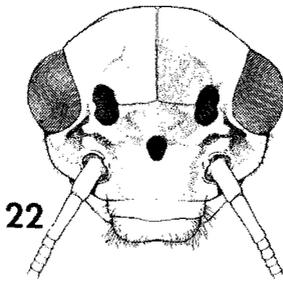
NYPH. Length: body 5.0-6.0 mm; caudal filaments 6.0-7.0 mm. General color light brown with black markings. Head light brown, without markings; head covered with fine spicules; maxillary palpi 3-segmented. Thoracic nota light brown with black markings; pronotum light brown with brown paired sublateral maculae near anterior margin; mesonotum light brown with a brown median macula; nota covered with fine spicules; legs unicolorous light brown; femora with moderately long spines (Fig. 11c); fore femoral band of spines as in Fig. 11a; fore femora without an elevated ridge; anterior surface of middle and hind femora with a basal row of spines, scattered spines, and scattered spicules (Fig. 11b); hind femora 40% longer than fore femora; fore tibiae with rows of spines on inner margin; middle and hind tibiae with long spines; tarsal claws with 4-6 marginal denticles (Fig. 21). Abdominal terga light brown each with a black median macula (Fig. 29); terga 1-7 with paired black sublateral maculae; terga with numerous long spines; terga with scattered spicules; operculate gills light brown; operculate gills without a basal spine. Caudal filaments pale, often with brown annulations.

TYPES. Holotype: mature nymph, Rio Amacuzac at Huajintlan on Highway 95, Morelos, Mexico, 14-XI-68, R. K. Allen. Paratopotypes: 10 nymphs, same data as holotype, 2 nymphs in collection University of Utah, Salt Lake City, others in collection California State College, Los Angeles.

REMARKS. *Leptohyphes spiculatus* nymphs have scattered spicules on the head, body and appendages, and this character serves to distinguish it from other known North and Central American *Leptohyphes*. A more distinctive distinguishing character may be the unique color pattern on the thorax and abdomen. The pronotum bears two sublateral maculae near the anterior margin, the mesonotum has a large median macula, and each abdominal tergum possesses a median macula.

FIGS. 22-30. *Leptohyphes* nymphal structures. 22, *L. brunneus*, head, front view; 23, *L. hispidus*, head, front view; 24, *L. lestes*, head, front view; 25, *L. lumas*, head, front view; 26, *L. melanobranchus*, operculate gill; 27, *L. melanobranchus*, abdominal segments, lateral view; 28, *L. pilosus*, thorax and abdomen, dorsal view; 29, *L. spiculatus*, abdominal segments, dorsal view; 30, *L. consortis*, abdominal segments, dorsal view.

FIGS. 31-32. *Tricorythodes* nymphal structures. 31, *T. notatus*, right fore femur; 32, *T. ulmeri*, right fore femur.



ETYMOLOGY. The name of this species is from the Latin word *spicula* meaning POINT.

HABITAT. Mature nymphs were found in a moderately large stream at an elevation of 3200 ft, and with a water temperature of 64°F. *Leptohyphes brunneus* is known to occur with this species in the Rio Amacuzac.

Genus *Tricorythodes* Ulmer

Tricorythodes explicatus Eaton, 1892, and *T. sordidus*, Allen 1967, are the only described species of the genus known to occur in Central America. The first record of the genus from Mexico was reported by Eaton, in 1892, when he described *T. explicatus* (as *Tricorythus*) from adults collected in northern Sonora. Traver (1959) described *T. mulaiki* and *T. comus* from Guerrero, and *T. angulatus* from Vera Cruz, all from adults, and Allen (1967) described *T. edmundsi* from nymphs collected in Tamaulipas making a total of five Mexican species. Two additional species are herein described from the nymphal stage and the number of Mexican species is seven. Four are known from the adult stage, and three from the nymphal stage. The total number of described *Tricorythodes* now stands at 25.

Tricorythodes notatus n. sp.

NYMPH. Length: body 4.5–5.5 mm; caudal filaments 2.5–3.5 mm. General color light brown to reddish-brown with black markings. Head light brown with variable black markings. Thoracic nota reddish-brown, suffused with black; legs pale with black markings; fore femora with a median and a subapical black macula (Fig. 31); middle and hind femora brown with a median and a subapical black macula, maculae often fused; anterior surface of middle and hind femora with a row of long basal spines, and with scattered long spines; fore femora twice as long as wide; tibiae and tarsi pale, usually with a black basal band; tarsal claws with 9–11 denticles. Abdominal terga light brown to reddish-brown, each with a black transverse band and a median black macula; operculate gills pale, mottled with black; operculate gills subtriangular, angular mesally; abdominal sterna pale to reddish-brown, and with a small black median macula. Caudal filaments pale, often with a black basal annulation.

TYPES. Holotype: mature nymph, Rio Cuautla at Cuautla, Morelos, Mexico, 13-XI-68, R. K. Allen. Paratopotypes: 31 nymphs, same data as holotype, 5 nymphs in collection University of Utah, Salt Lake City, others in collection California State College, Los Angeles. Paratypes: 12 nymphs, stream 10 miles north Huajuapán de León, Oaxaca, Mexico, 7-XI-68, R. K. Allen, in collection California State College, Los Angeles.

REMARKS. *Tricorythodes notatus* is known from Morelia and Oaxaca in southern Mexico near the type localities of the three Traver (*op. cit.*) species, and the nymphs upon which this species is based may eventually be found to be the immature stage of either *T. angulatus*, *T. comus*, or *T. mulaiki*. The nymph of *T. edmundsi* is a distinctive species with subovate gills and a thick band of spines around the fore femora, and cannot be confused with *T. notatus*. The latter species is distinguished from *T. ulmeri* n. sp. by possessing black markings on the femora, and black maculae on the abdominal sterna.

ETYMOLOGY. The name of this species is from the Latin word *nota* meaning MARK.

HABITAT. Mature nymphs have been collected in moderately large streams between elevations of 4500 and 5500 ft. The water temperature of both habitats was 70°F. This species was collected from the same stream, the Rio Cuautla, and in the same sample as *T. ulmeri* n. sp.

Tricorythodes ulmeri n. sp.

NYPH. Length: body 4.0–5.0 mm; caudal filaments 3.5–4.5 mm. General color light brown to reddish-brown with black markings. Head brown to reddish-brown with a diffuse tan macula between compound eyes; head with setae and spicules. Thoracic nota brown to reddish-brown with variable dark markings; thoracic nota with setae and spicules; legs brown; fore femora unicolorous brown (Fig. 32); middle and hind femora brown with a thin black median streak; anterior surface of middle and hind femora with a row of basal spines and without scattered spines, spines only along dorsal surface; fore femora twice as long as wide; tibiae brown with a black basal band; tarsi brown; tarsal claws with 8–11 marginal denticles. Abdominal terga light brown to brown with a transverse black band; operculate gills pale with black markings; operculate gills subtriangular, angular mesally; abdominal sterna unicolorous light brown. Caudal filaments pale.

TYPES. Holotype: mature nymph, Rio Cuautla at Cuautla, Morelos, Mexico, 13-XI-68, R. K. Allen. Paratopotypes: 7 nymphs, same data as holotype, 2 in collection University of Utah, others in collection California State College, Los Angeles.

REMARKS. This species is readily distinguished from the nymph of *T. edmundsi* by the shape of the operculate gill and the arrangement of spines on the fore femora. It is distinguished from *T. notatus* by lacking black markings on the fore femora and abdominal sterna. The nymph of *T. ulmeri*, like the above noted species, may eventually be found to be the immature stage of either *T. comus*, *T. angulatus*, or *T. mulaiki*.

ETYMOLOGY. The name of this species is in honor of the late Professor Georg Ulmer in recognition of his contributions to the knowledge of mayfly taxonomy.

HABITAT. The type locality of this species is at 4600 ft elevation, and had a water temperature of 70°F at the time of collection in mid-October. Specimens of *T. notatus* were collected in the same habitat as the nymphs of *T. ulmeri*.

References

- Allen, R. K. 1967. New species of New World Leptoxyphinae (Ephemeroptera: Tricorythidae). *J. Kans. ent. Soc.* **39**: 350–375.
- Brusca, R. C. 1971. A new species of *Leptoxyphes* from Mexico (Ephemeroptera: Tricorythidae). *Pan-Pacif. Ent.* **47**: 146–148.
- Eaton, A. E. 1892. *Biologia Centrali-Americana*, Insecta, Neuroptera, Ephemeridae. 1–16.
- Traver, J. R. 1958. Some Mexican and Costa Rican mayflies. *Bull. Brooklyn ent. Soc.* **53**: 81–89.
- 1959. The subfamily Leptoxyphinae. II. Five new species of *Tricoxythodes*. *Proc. ent. Soc. Wash.* **61**: 121–131.
- Ulmer, G. 1919. Neue Ephemeropteren. *Arch. Naturgesch.* 1–80.

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