The Nymphs of North and Central American *Leptohyphes* (Ephemeroptera: Tricorythidae)[1]

RICHARD K. ALLEN[2]
California State University, Los Angeles 90032

ABSTRACT

The 36 described species of North and Central American *Leptohyphes* are discussed, and synonymies and other pertinent data are presented for all. Characters allow the North and Central American nymphs to be placed in species-groups; *L. dicinctus* and *L. melanobranchus* in the *dicinctus*-group, and all other described nymphs in the *apache*-group. Accounts are given for the 27 valid species known from the nymphal stage, including an illustrated key, synonymies, description or diagnosis, distribution and new collection records, and maps. *L. baumanni* is regarded as a synonym of *L. mirus*, *L. consortis* of *L. sabinas*, *L. lumas* of *L. hispidus*, and *L. phalarobranchus* of *L. packeri*. *L. michaeli*, *L. paraguttatus*, *L. succinus*, and *L. vescus* are described from nymphs collected in Texas; *L. piraticus*, *L. vulturnus*, and *L. zelus* from nymphs collected in Honduras.

Leptohyphes Eaton is confined to the New World, is austral in origin, and the most northern limits of the genus are in the Middle North Temperate Zone (between 30°–40° N. latitude; see Allen and Brusca 1973b). Collection records are reported from near Paraña, Argentina (31°45′ S. latitude) to the Potomac River, Md., in eastern North America (39°18′ N. latitude) and the Virgin River, Utah, in western North America (37°06′ N. latitude).

Leptohyphes was established in 1882 by Eaton for *L. eximius* based upon a single female adult collected in Argentina, and *L. brevissimus* from Guatemala. The male adult was not described until 1919, when Ulmer reported *L. petersoni* from Argentina and Brazil, and *L. costaricanus* from Costa Rica. The nymph was unknown until 1924, when Needham and Murphy described a specimen from Guatemala as *Leptohyphes* No. 1. The 1st generic record for North America was reported by Burks (1953), based upon male and female adults collected in San Antonio, Tex. Traver (1958b) published descriptions and names for the adults of 4 species from Mexico and Costa Rica, and Packer (1966) reported the genus from Honduras. Allen (1967) described the nymphs of 9 North and Central American species, Allen and Roback (1969) published new North American records of the genus, and Brusca (1972) described a new species from Mexico. Allen and Brusca (1973a) published nymphal descriptions of 10 Mexican and Central American species, and Kilgore and Allen (1973) described and named the nymphs of 3 additional species from western North America. Nymphal descriptions of 7 additional species are presented in the following treatment. The total number of names that have been applied to the North and Central American *Leptohyphes* is 36.

The genus is a dominant element in the mayfly fauna of the southwestern United States, Mexico, and Central America. Twelve species have been described or reported from North America north of Mexico as follows: *Leptohyphes apache* Allen from Ariz. and N.M.; *L. mirus* Allen from Ariz. and Tex.; *L. phalarobranchus* Kilgore & Allen, *L. quercus* Kilgore & Allen, and *L. baumanni* Kilgore & Allen from Ariz.; *L. dolani* Allen from Tex., Ga., and S.C.; *L. packeri* Allen from Ariz. and Tex. to Honduras; *L. robacki* Allen from S.C. and Md.; and *L. michaeli* n. sp., *L. paraguttatus* n. sp. *L. succinus* n. sp., and *L. vescus* n. sp. from Tex. Fourteen species, including *L. packeri*, have been described or reported from Mexico as follows: *Leptohyphes sabinas* Traver is known from Nuevo Leon, Tamaulipas, and Veracruz; *L. berneri* Traver, *L. consortis* Allen & Brusca, *L. ferruginus* Allen & Brusca; *L. hispidus* Allen & Brusca; and *L. pilosus* Allen & Brusca from Veracruz; *L. dicinctus* Allen & Brusca; *L. lestes* Allen & Brusca, and *L. zalope* Traver from Guerrero; *L. spiculatus* Allen & Brusca from Morelos; *L. brunneus* Allen & Brusca from Oaxaca, Jalisco, Chiapas and Morelos; *L. lumas* Allen & Brusca from Chiapas, Veracruz, Oaxaca, and Tabasco; *L. packeri* from Nuevo Leon, Tamaulipas, Nayarit, Mexico, Veracruz, and Oaxaca; and *L. alleni* Brusca from Oaxaca. The 14 species known from Central America are as follows: *Leptohyphes brevissimus* Eaton, *L. castaneus* Allen, *L. melanobranchus* Allen & Brusca, and *L. brunneus* from Guatemala; *L. hispidus* from El Salvador and Guatemala; *L. packeri*, *L. musseri* Allen, and *L. zelus* n. sp. from Honduras and Guatemala; *L. ferruginus*, *L. piraticus* n. sp. and *L. vulturnus* n. sp. from Honduras; *L. priapus* Traver and *L. costaricanus* Ulmer from Costa Rica; *L. murdochi* Allen from Panamá; and *L. nanus* Allen from the Canal Zone.

Careful examination of the types of the North and Central American *Leptohyphes* reveals that 4 names are primary synonyms. *Leptohyphes baumanni* is a synonym of *L. mirus*, *L. consortis* of *L. sabinas*, *L. lumas* of *L. hispidus*, and *L. phalarobranchus* of *L. packeri*. The total number of valid North and Central American *Leptohyphes* is 32.

The taxonomy of most mayfly genera is based on the adult stages, but in *Leptohyphes* the nymphal stage is of primary taxonomic importance as only 5

[1] This is Part IV of a series of papers on the nymphs of North and Central American Ephemeroptera. Parts I, II, and III are Allen 1973b, Allen and Brusca 1978, and Cohen and Allen 1978, respectively.

[2] The research and writing upon which this report is based was supported by National Science Foundation grants. Received for publication Feb. 21, 1978.

0013-8746/78/0071-0537$00.75/0

species, *L. berneri, L. brevissimus, L. priapus, L. sabinas,* and *L. zalope,* are known from adults in North and Central America.

Institutions where specimens are deposited are indicated by the following abbreviations: California Academy of Sciences, CAS; The Academy of Natural Sciences of Philadelphia, ANSP; North Texas State Univ., NTS; Southwest Texas State Univ., SWTS; and the Univ. of Utah, UU. Specimens without designation are deposited in the collection of California State Univ., Los Angeles, and in the accounts dealing with the species, collections made by the author are indicated by the initials RKA.

Genus *Leptohyphes* Eaton

Leptohyphes Eaton 1882: 208; Eaton 1883: 140; Ulmer 1919: 46; Needham and Murphy 1924: 32; Traver 1935: 187, 198; Traver 1944: 15; Burks 1953: 55; Traver 1958a: 497; Traver 1958b: 81; Packer 1966: 9; Allen 1967: 350; Allen and Roback 1969: 372; Allen and Brusca 1973a: 83; Kilgore and Allen 1973: 327; Allen 1973: 363.

Bruchella Návas 1920: 56; Demoulin 1952: 281; Traver 1958a: 494 (=*Leptohyphes*).

NYMPH

General Characters.—Small mayflies, body 1.5–7.5 mm in length. Head hypognathous, without frontal shelf or genal projections; vertex usually glabrous, often with setae, spots, or spicules; head with or without occipital tubercles, tubercles usually absent; antennae long, more than 1.5 times head width; compound eyes both sexes usually small, eyes male large in some species; lateral ocelli small or large, median ocellus small; labrum wider than long, often with shallow emargination on ventral margin and row setae on anterior surface (Fig. 7); mandibles with well-developed canines and molar surfaces (Fig. 4–5); maxillae conical with well-developed apical teeth; maxillary palpi absent to well-developed with 1, 2, or 3 segments (Fig. 3); labium small, glossae and paraglossae nearly completely fused; labial palpi 3-segmented (Fig. 6). Thoracic nota without tubercles, often with irregular surface; thoracic nota glabrous, with setae, spots, or spicules; legs short and thickset; 1st leg shortest, 3rd longest; anterior surface fore femora with median transverse band spines, spines variable in shape and degree of development (Fig. 22b–25b); middle and hind femora often with setae (Fig. 38b, 41b), or row transverse spines and scattered spines on anterior surface (Fig. 22a–25a); middle and hind femora often expanded, with protuberances, and marginal spines set in elevated sockets (Fig. 23b); all femora usually with dorsal or ventral rows spines or setae as in Fig. 38, 41; tibiae and tarsi usually with one or more longitudinal rows spines (Fig. 31–32); tarsal claws with marginal or submarginal rows denticles, number and shape denticles and claws variable (Fig. 45–46); males with metathoracic wing pad, females without. Abdominal terga usually without tubercles, occasionally with small, blunt median tubercles or elevations on middle segments (Fig. 1); abdominal terga glabrous, with setae or spicules, and occasionally long spines; abdomen with short or well-developed posterolateral projections on segments 7–9 (Fig. 19–21); lamellate tracheal gills on segments 2–6, gill one operculate and elongate-oval to oval (Fig. 8–9). Caudal filaments and body usually subequal in length; terminal filament and lateral cerci well-developed and subequal in length; caudal filaments with whorls apical spines each segment, without long setae.

Discussion.—The genus may be characterized in the nymphal stage (Fig. 1–2) by the following characters: (1) body sprawling, stout, with thickset legs; (2) operculate gill on segment 2 elongate-oval to oval; and (3) fore femora with median transverse row short or long heavy spines. The nymphs of *Leptohyphes* are most often confused with those of *Tricorythodes* Ulmer. The morphological structures used to distinguish the nymphs of these genera are usually well defined; however, some North American *Tricorythodes,* of the *curvatus*-group, have thickset legs and bluntly triangular operculate gills which appear to be oval in shape. The following key will serve to distinguish the nymphs of these genera.

KEY TO THE GENERA

1. Operculate gill elongate-oval to oval (Fig. 8–9); fore femora with transverse band of moderately long to short robust spines (Fig. 12–13) ..... *Leptohyphes*

   Operculate gill triangular (Fig. 10), or subovate (Fig. 11); fore femora with transverse band of long delicate setae (Fig. 14) ..... *Tricorythodes*

SYSTEMATICS

On the basis of the presence or absence of dorsal abdominal tubercles and long spines, and the arrangement of the denticles on the tarsal claws, the nymphs of the North and Central American *Leptohyphes* are placed into 2 species-groups as follows: (1) the *dicinctus*-group; and (2) the *apache*-group. The *dicinctus*-group includes the species *L. dicinctus* and *L. melanobranchus.* The *apache*-group includes the species *L. alleni, L. apache, L. brunneus, L. castaneus, L. dolani, L. ferruginus, L. hispidus, L. lestes, L. michaeli, L. mirus, L. murdochi, L. nanus, L. packeri, L. paraguttatus, L. pilosus, L. piraticus, L. quercus, L. robacki, L. sabinas, L. spiculatus, L. succinus, L. vescus, L. vulturnus,* and *L. zelus.* The nymphal stage of *L. berneri, L. brevissimus, L. costaricanus, L. priapus,* and *L. zalope* is not known.

The characters most useful in distinguishing the species in the nymphal stage of *Leptohyphes* are as follows: (1) shape of femora and presence or absence of marginal spines and setae; (2) relative length of fore and hind femora; (3) shape and length of fore femoral spines; (4) number and arrangement of denticles on tarsal claws; (5) degree of development of abdominal posterolateral projections; (6) shape and coloration of operculate gill; (7) color pattern on head, thorax, legs, operculate gills, and abdomen; and (8) possession or absence of spines, tubercles, spicules, spots, or setae on head, body, and legs.

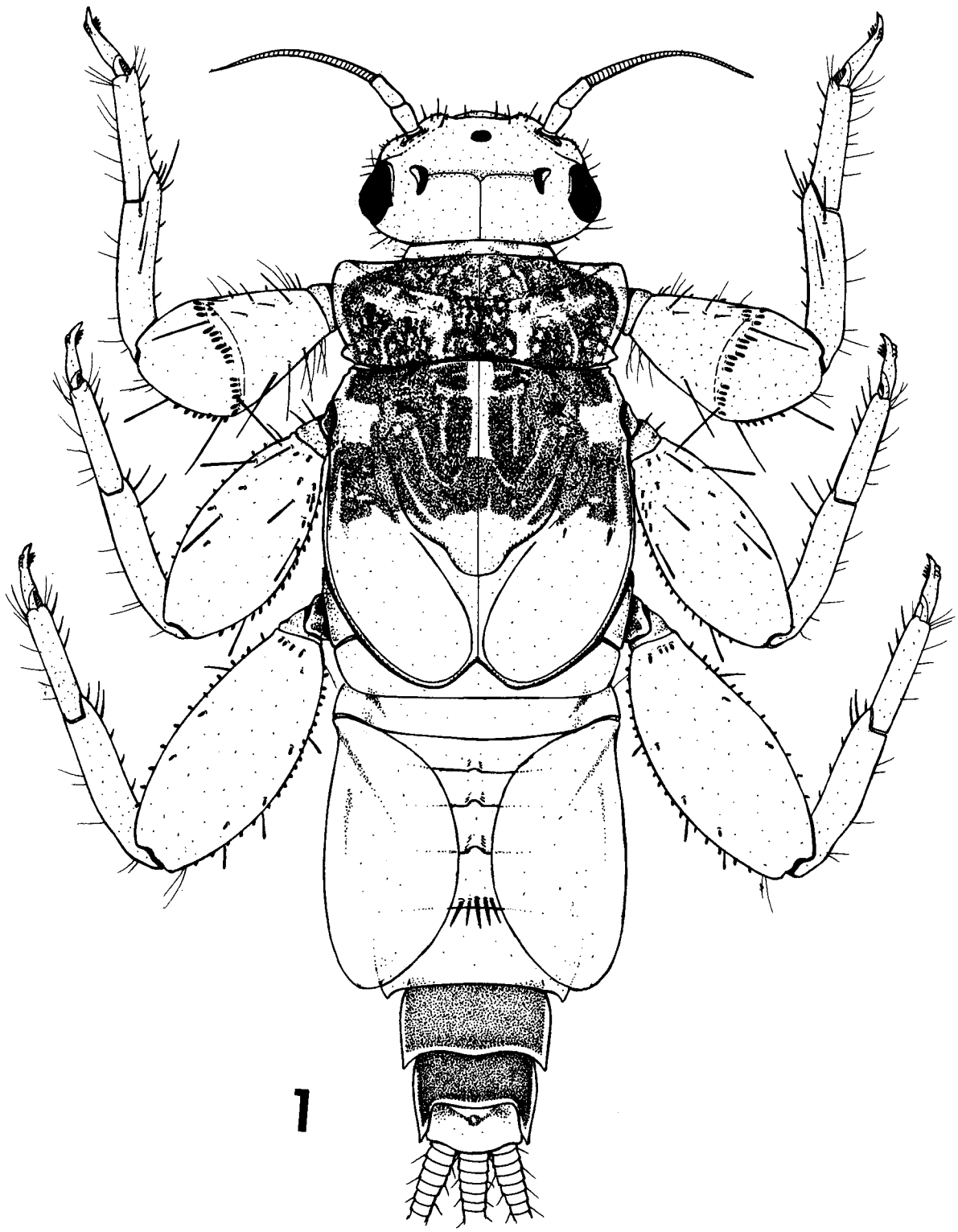


FIG. 1.—*Leptohyphes dicinctus*, mature nymph, dorsal view.

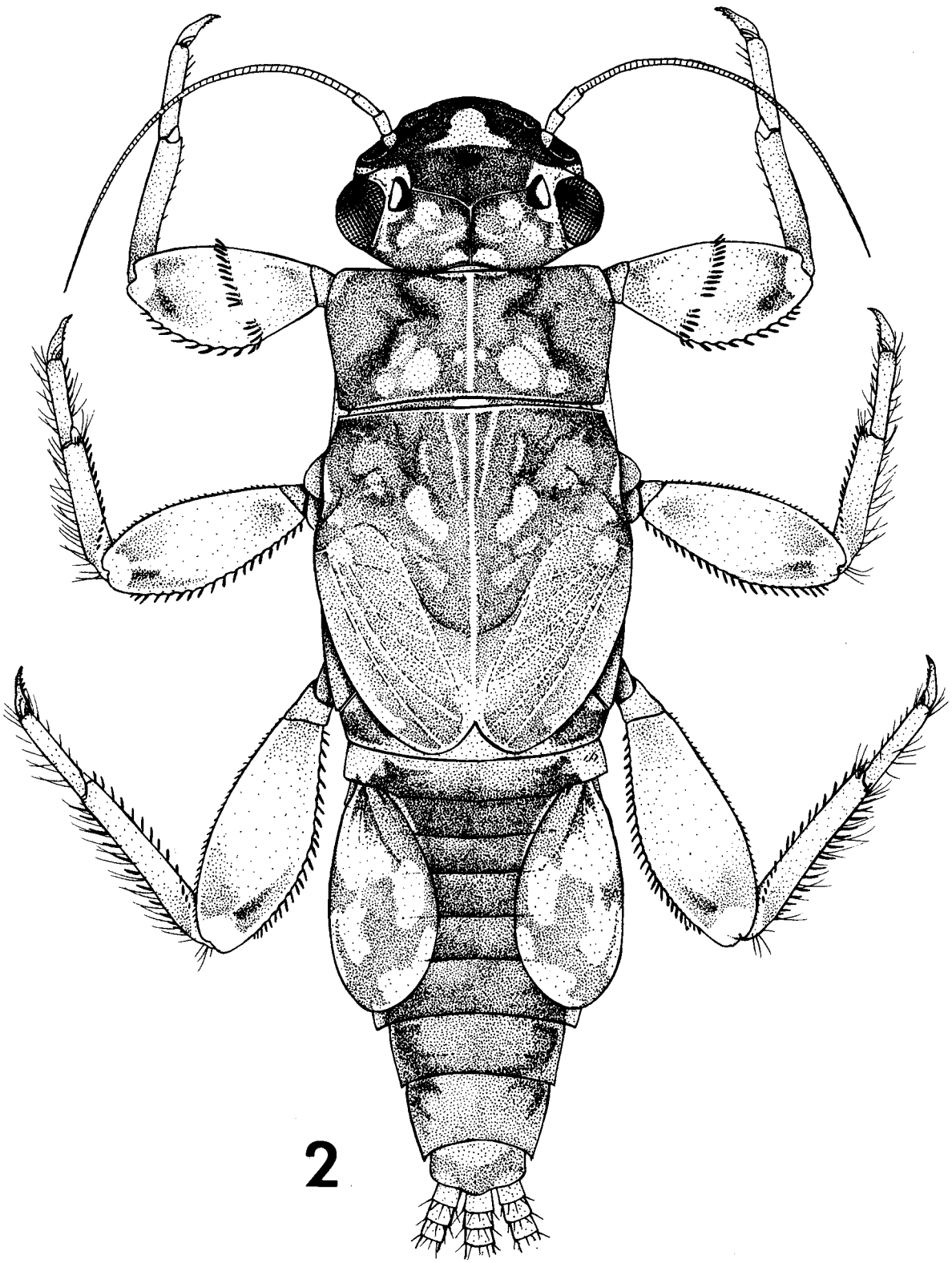


FIG. 2.—*Leptohyphes packeri*, mature nymph, dorsal view.

The following key will serve to distinguish the nymphs of the 27 species of North and Central American *Leptohyphes*.

KEY TO THE NYMPHS

1. Abdominal terga with elevated carina on middle segments and terga 6 or 7 with moderately long to long spines (Fig. 1, 15–16); tarsal claws with double row submarginal denticles near apex (Fig. 17) ..... *dicinctus*-group, 2
Abdominal terga without elevated carina on middle segments and terga 6–7 without long spines, often with short spines on middle segments as in Fig. 39–40; tarsal claws without double row submarginal denticles near apex, often with single submarginal denticle (Fig. 18) ..... *apache*-group, 3

2(1). Body pale, pronotum, anterior portion mesonotum, and abdominal segments 8–9 black (Fig. 1); abdominal tergum 6 with moderately long spines (Fig. 1, 16); fore femora with transverse elevated ridge (Fig. 12a) and short spines (Fig. 12b); operculate gills pale; femora unicolorous pale ..... *dicinctus*
Body unicolorous brown; abdominal tergum 7 with long spines (Fig. 15); fore femora without elevated ridge (Fig. 13a) and long spines (Fig. 13b); operculate gills pale with numerous black maculae; femora pale with submedian maculae ..... *melanobranchus*

3(1). Abdominal terga 7–8 or 7–9 with well-developed posterolateral projections (Fig. 19–21) 4
Abdominal terga 7–9 without well-developed posterolateral projections as in Fig. 39–40 .. 7

4(3). Abdominal terga 7–8 with well-developed posterolateral projections (Fig. 20); femoral spines long and bifurcated (Fig. 22c); ventral (leading) margin femora concave (Fig. 22a, b) ..... *robacki*
Abdominal terga 7–9 with well-developed posterolateral projections (Fig. 19–21); femoral spines short and entire as in Fig. 23c; ventral (leading) margin femora convex as in Fig. 23a, b 5

5(4). Fore femora nearly twice as long as broad as in Fig. 22b; tarsal claws with 9–12 marginal and 1 submarginal denticle; hind dorsal femoral spines not in marginal sockets as in Fig. 24b–25b; known geographic distribution Arizona (Fig. 53–54) 6
Fore femora nearly long as broad (Fig. 23b); tarsal claws with only 1–3 marginal denticles; hind dorsal femoral spines in elevated sockets (Fig. 23a); known geographic distribution southeastern U. S. and Tex. (Fig. 51) ..... *dolani*

6(5). Abdominal terga with long posterolateral projections segment 9, extending beyond posterior margin segment 10 as in Fig. 19; anterior surface femora suffused with black, without macula, and numerous spines (Fig. 24); maxillary palpi absent; body 6–7 mm in length ..... *quercus*
Abdominal terga with short posterolateral projections segment 9, extending only to posterior margin segment 10 (Fig. 21); anterior surface femora with black rectangular macula and few spines (Fig. 25); maxillary palpi 1-segmented; body 4–5 mm in length ..... *mirus*

7(3). Operculate gills brown with large pale maculae (Fig. 28) ..... *packeri*
Operculate gills variable in color, not brown with pale maculae as in Fig. 29–30 8

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

9(8). Abdominal terga 1–6 with dark median longitudinal line (Fig. 26); maxillary palpi 1-segmented ..... *michaeli*
Abdominal terga unicolorous, suffused with black, or with black maculae, without dark median longitudinal line; maxillary palpi 2–3 segmented 10

10(9). Abdominal terga 2–4 with black maculae in form letter "V" (Fig. 27) ..... *paraguttatus*
Abdominal terga 2–4 unicolorous, suffused with black or with black maculae, maculae not in form letter "V" 11

11(10). Body thin and delicate; tarsal claws with 5–6 marginal and 4–6 submarginal denticles as in Fig. 45; maxillary palpi 2-segmented .. *vescus*
Body robust; tarsal claws with only marginal denticles, often with single submarginal denticle as in Fig. 46; maxillary palpi 3-segmented 12

12(11). Body and legs suffused with purple-black; body length 6.0–7.0 mm; known geographic distribution central Tex. (Fig. 52) ..... *succinus*
Body and legs with dark markings, not suffused with purple-black; body length 4.5–5.5 mm; known geographic distribution Ariz./N.M. (Fig. 51) ..... *apache*

13(8). Head, body and femora covered with numerous small pale spots (Fig. 31–33) 14
Head, body and femora without small pale spots 15

14(13). Middle and hind femora with distinct apical concavity, middle and hind tibiae without long inner marginal spines (Fig. 31b); operculate gill suffused with brown (Fig. 29); known geographic distribution Panamá (Fig. 54) ..... *murdochi*
Middle and hind femora without apical concavity, middle and hind tibiae with long inner marginal spines (Fig. 32b); operculate gill with dark basal macula (Fig. 30); known geographical distribution SW Mexico (Fig. 52) ..... *alleni*

15(13). Head vertex pale or red, without dark markings and frons with distinct wide, black band between compound eyes as in Fig. 34 16
Head vertex with dark markings and frons with indistinct narrow line, or without black band between compound eyes as in Fig. 35–36, 48–49 17

16(15). Head, body and femora red, and covered with fine spicules as in Fig. 35; known geographic distribution Honduras (Fig. 53) .. .. *piraticus*

Head, body and femora pale, and without fine spicules as in Fig. 36; known geographic distribution SW Mexico (Fig. 54) ..... *lestes*

17(15). Head, thoracic nota (Fig. 37), and legs (Fig. 38) with long hairlike setae ..... *pilosus*
Head and thoracic nota without long hairlike setae, with short inconspicuous setae; legs with or without long setae (Fig. 41–42) ...18

18(17). Posterior margin abdominal terga 2–9 with distinct submedian and sublateral small spines as in Fig. 39 19
Posterior margin abdominal terga 2–9 with only inconspicuous spicules, or glabrous as in Fig. 40 20

19(18). Abdominal terga 2–9 with small, distinct black spot as in Fig. 40 ..... *vulturnus*
Abdominal terga 2–9 with black transverse band and sublateral maculae (Fig. 39) .. *zelus*

20(18). Head, thoracic nota, or abdominal terga with numerous fine spicules as in Fig. 35 21
Head, thoracic nota and abdominal terga without spicules, with short setae, or glabrous ..22

21(20). Abdominal terga with dark median macula (Fig. 40); femora pale with fine setae (Fig. 41); pronotum with paired sublateral maculae near anterior margin; operculate gill pale, without basal spine ..... *spiculatus*
Abdominal terga with dark transverse band, and often with median and sublateral maculae (Fig. 43); femora with black markings and spicules (Fig. 42); pronotum without sublateral maculae; operculate gill with dark apical macula, with basal spine ..... *hispidus*

22(20). Head, body, operculate gill, and legs red .... *ferruginus*
Head, body, operculate gill, and legs pale to brown 23

23(22). Tarsal claws with 4–7 marginal and 4–7 submarginal denticles near apex (Fig. 45); maxillary palpi 2-segmented ..... *nanus*
Tarsal claws with 3–7 marginal, and often single submarginal denticle near apex as in Fig. 46; maxillary palpi 3-segmented 24

24(23). Abdomen yellow, terga 6–9 with distinct sublateral, submedian and median black maculae (Fig. 44); head with thin black line between lateral ocelli (Fig. 47); middle and hind femora with black macula (Fig. 48) .... *musseri*
Abdomen brown, terga 6–8 without distinct sublateral, submedian and median maculae, with only inconspicuous brown maculae; head without thin black line between lateral ocelli; middle and hind femora without maculae 25

25(24). Frons with large median brown macula between compound eyes (Fig. 49) ..... *brunneus*
Frons without large pale median macula between compound eyes 26

26(25). Abdominal terga brown with dark brown markings; tarsal claws with 4–6 marginal and 1 submarginal denticles (Fig. 46); known geographic distribution western Mexico (Fig. 53) ..... *sabinas*
Abdominal terga unicolorous brown; tarsal claws with 5–7 marginal denticles (Fig. 50); known geographic distribution Central America (Fig. 53) ..... *castaneus*

In the following verification table to the nymphal stages, under the heading "Tarsal claw-type," the arrangement of denticles is of 4 general patterns as follows: (1) the *alleni*-type in which only marginal denticles are present (Fig. 50); (2) the *brunneus*-type in which marginal denticles and a single submarginal subapical denticle is present (Fig. 18, 46); (3) the *michaeli*-type in which marginal denticles and a palisade of submarginal subapical denticles are present (Fig. 45); and (4) the *dicinctus*-type in which marginal denticles and a double row of submarginal subapical denticles are present (Fig. 17). The heading "Gill spine" refers to the presence or absence of a basal spine on the operculate gills (Fig. 28–30). The percentage under the heading "Fore femora/hind femora" is the length of the fore femur compared to the length of the hind femur. The heading "P-L proj." refers to the possession or absence of posterolateral projections on the abdominal terga, and the figures under "Body length" are in mm. Abbreviations included in the table are as follows: Ariz. = Arizona; C. America = Central America; E = eastern; N. Mex. = New Mexico; seg. = segment(s); SE = southeastern; S = south; SW = southwestern; and U.S. = United States.

dicinctus-group

The characters which distinguish this species-group are as follows: (1) the tarsal claws possess a row of marginal denticles and 2 paired rows of submarginal denticles near the apex (Fig. 17); (2) middle abdominal segments are produced into a median elevated ridge; and (3) the 6th–7th abdominal terga bears a transverse row of long spines (Fig. 15–16).

Leptohyphes dicinctus Allen & Brusca

Leptohyphes dicinctus Allen and Brusca 1973a: 83.

Mature 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 and white with white maculae (Fig. 1); legs pale; femora with short spines (Fig. 12b); fore femora with transverse elevated ridge (Fig. 12a); marginal spines middle and hind femora in elevated sockets; hind femora 20% longer than fore femora; tarsal claws with 4 marginal and 2 rows 4–6 submarginal denticles (Fig. 17). Abdominal segments 1–7 pale, segments 8–9 black, segment 10 pale; abdominal terga 3–6 with median elevated tubercle, and transverse row moderately long spines tergum 6 (Fig. 16); operculate gill pale without basal spine. Caudal filaments pale.

Type Locality.—Trib. Rio Papagayo nr. Tierra Colorado, Guerrero, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—Known only from the type locality (Fig. 52).

Habitat.—The small type series were collected from a moderately large river at an elevation of 500 ft and a water temperature of 86°F.

Verification Table

Species	Distribution	Gill spine	Fore femora/ hind femora (%)	Maxillary palpi	Tarsal claw-type	P-L Proj.	Body length
1. *alleni*	SW Mexico	Yes	50	3-seg.	*alleni*	No	4.0–5.0
2. *apache*	Ariz./N. Mex.	No	35	3-seg.	*alleni*	No	4.5–5.5
3. *brunneus*	SW Mexico to C. America	Yes	40	3-seg.	*brunneus*	No	5.5–6.5
4. *castaneus*	C. America	Yes	35	3-seg.	*alleni*	No	5.0–7.0
5. *dicinctus*	W Mexico	No	20	1-seg.	*dicinctus*	No	3.0–4.0
6. *dolani*	SE U.S.	?	30	2-seg.	*alleni*	7–9	3.0–4.0
7. *ferruginus*	S Mexico to C. America	Yes	30	3-seg.	*brunneus*	No	4.0–5.0
8. *hispidus*	S Mexico to C. America	Yes	40	3-seg.	*brunneus*	No	4.5–5.5
9. *lestes*	SW Mexico to C. America	Yes	30	3-seg.	*brunneus*	No	3.5–4.5
10. *melanobranchus*	C. America	No	0	1-seg.	*dicinctus*	No	3.0–4.0
11. *michaeli*	Tex.	No	40	1-seg.	*michaeli*	No	3.0–4.0
12. *mirus*	Ariz./Tex.	No	40	1-seg.	*brunneus*	7–9	4.0–5.0
13. *murdochi*	C. America	Yes	55	3-seg.	*alleni*	No	5.5
14. *musseri*	C. America	No	55	3-seg.	*alleni*	No	5.0–7.0
15. *nanus*	C. America	No	35	2-seg.	*michaeli*	No	2.5–3.5
16. *packeri*	SW U.S. to C. America	No	30	3-seg.	*michaeli*	No	3.5–4.5
17. *paraguttatus*	Tex.	No	20	2-seg.	*michaeli*	No	4.0–5.0
18. *pilosus*	S Mexico	Yes	35	3-seg.	*brunneus*	No	4.0–5.0
19. *piraticus*	C. America	Yes	35	3-seg.	*brunneus*	No	5.0–6.0
20. *quercus*	Ariz.	No	20	absent	*brunneus*	7–9	6.0–7.0
21. *robacki*	SE U.S.	?	20	1-seg.	*alleni*	7–8	3.0–4.0
22. *sabinas*	E Mexico	Yes	40	3-seg.	*brunneus*	No	4.5–5.5
23. *spiculatus*	S Mexico	No	40	3-seg.	*brunneus*	No	5.0–6.0
24. *succinus*	Tex.	No	40	3-seg.	*brunneus*	No	6.0–7.0
25. *vescus*	Tex.	No	25	2-seg.	*michaeli*	No	3.0–4.0
26. *vulturnus*	C. America	Yes	35	3-seg.	*brunneus*	No	3.0–4.0
27. *zelus*	C. America	Yes	35	3-seg.	*brunneus*	No	4.0–5.0

Leptohyphes melanobranchus Allen & Brusca

Leptohyphes melanobranchus Allen and Brusca 1973a: 85.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 2.0–3.0 mm. General color pale with black markings. Head pale with intricate black pattern; maxillary palpi 1-segmented. Thoracic nota pale with black markings; legs pale with black markings; femora pale with large black submedian macula; femora with long spines (Fig. 13b); fore femora without elevated ridge (Fig. 13a); marginal spines middle and hind femora in elevated sockets; hind femora subequal to fore femora; tarsal claws with 4 marginal and 2 rows 2–3 submarginal denticles. Abdominal terga pale with transverse black band; terga 3–7 with median elevated tubercle, and transverse row long spines tergum 7 (Fig. 15); operculate gill pale with large black macula, without basal spine (Fig. 8). Caudal filaments pale.

Type Locality.—Rio Cartaga, between Esquintla and Taxisco, Guatemala.

Type Deposition.—CAS, San Francisco.

Distribution.—Known only from the type locality (Fig. 52).

Habitat.—The specimen upon which this name is based was collected from a small stream at an elevation of 1200 ft in water with a temperature of 60°F.

apache-group

The characters which distinguish this species-group are as follows: (1) the tarsal claws possess a row of marginal denticles and often a single submarginal apical denticle (Fig. 18); (2) middle abdominal segments are not produced into a median elevated ridge; and (3) the 6th–7th abdominal terga are without a transverse row of long spines.

Leptohyphes alleni Brusca

Leptohyphes alleni Brusca 1971: 146.

Mature Nymph.—Length: body 4.0–5.0 mm; caudal filaments 4.5–5.5 mm. General color tan to reddish-brown with gray to black markings with numerous pale spots; body robust. Head with black markings

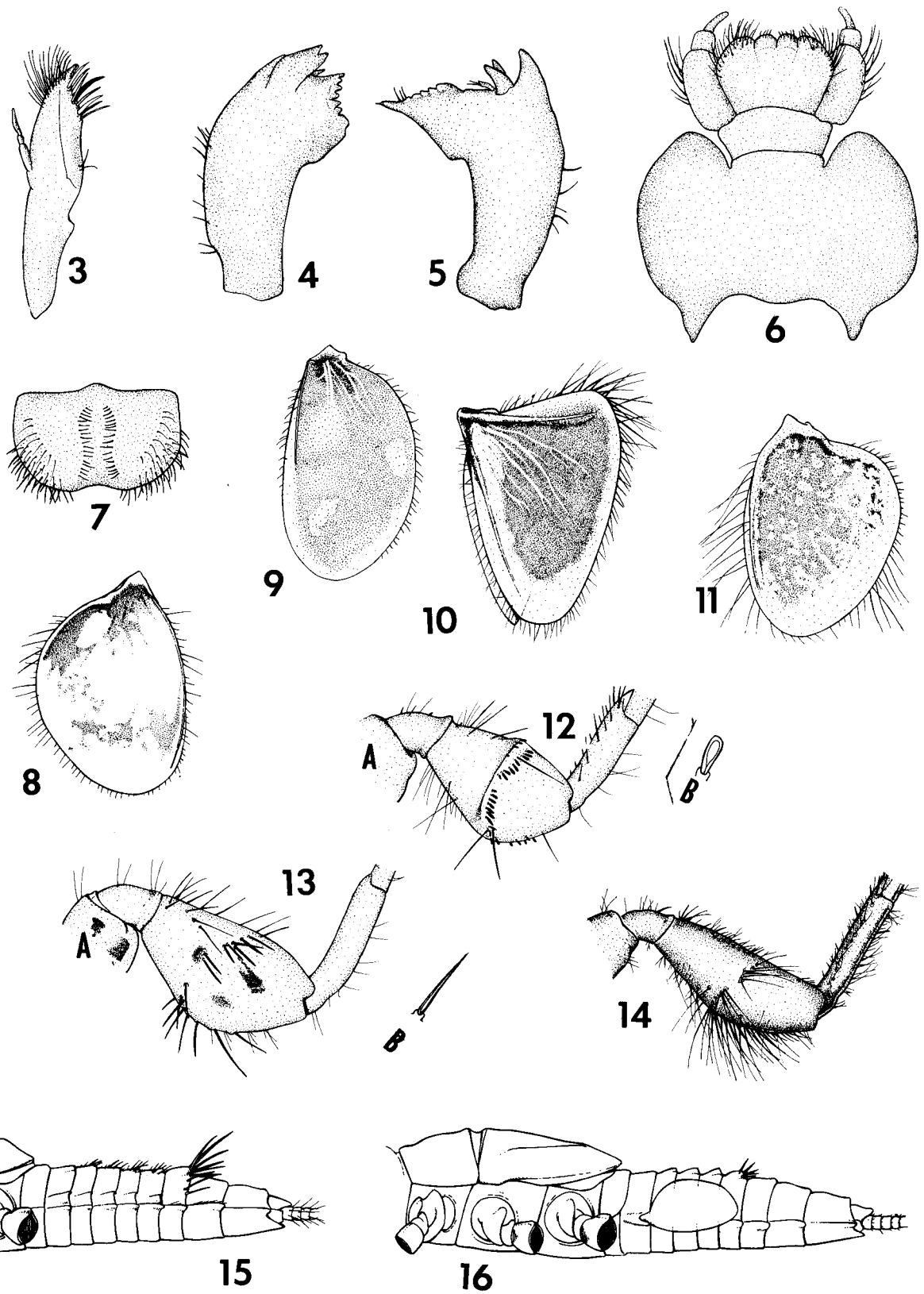


FIG. 3–16.—3–7.—*Leptohyphes apache,* nymphal mouthparts. 3, maxilla; 4, left mandible; 5, right mandible; 6, labium; 7, labrum. 8–11.—Nymphal operculate gills. 8, *L. melanobranchus;* 9, *L. mirus;* 10, *Tricorythodes minutus;* 11, *T. corpulentus.* 12–16.—Nymphal parts. 12, *L. dicinctus,* a, fore femur; b, femoral spine; 13, *L. melanobranchus,* a, fore femur; b, femoral spine; 14, *T. minutus,* fore femur; 15, *L. melanobranchus* nymphal abdomen, lateral view; 16, *L. dicinctus,* nymphal thorax and abdomen, lateral view.

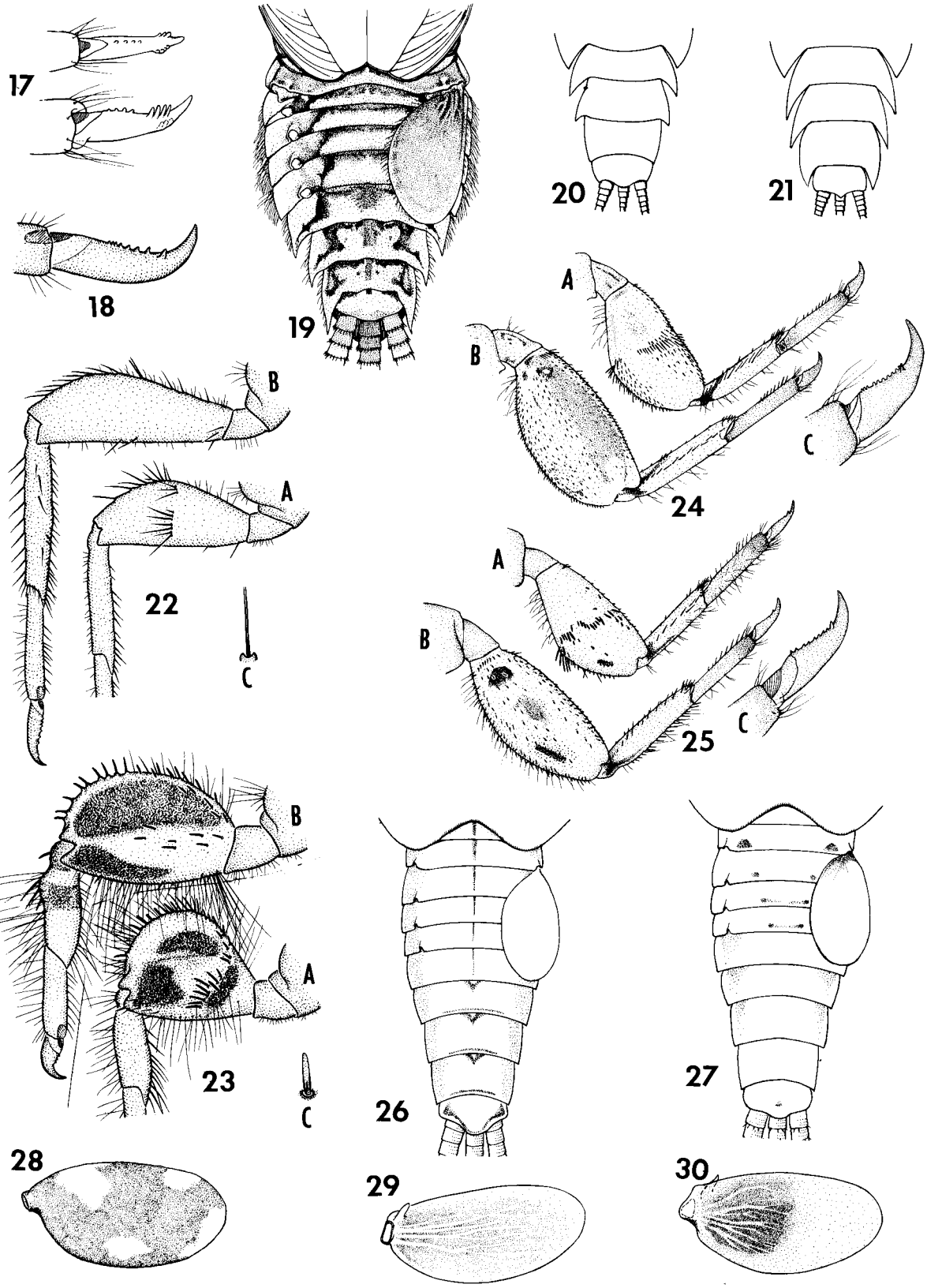


FIG. 17–30.—17–18.—Nymphal tarsal claws. 17, *L. dicinctus;* 18, *Leptohyphes* sp. 19–21.—Nymphal abdomens, dorsal view. 19, *L. quercus;* 20, *L. robacki;* 21, *L. dolani.* 22–25.—Nymphal legs. 22, *L. robacki,* a, fore; b, hind; c, femoral spine; 23, *L. dolani,* 24, *L. quercus,* a, fore; b, hind; c, tarsal claw; 25, *L. mirus,* a, fore; b, hind; c, tarsal claw. 26–27.—Nymphal abdomens, dorsal view. 26, *L. michaeli;* 27, *L. paraguttatus.* 28–30.—Nymphal operculate gills. 28, *L. packeri;* 29, *L. murdochi;* 30, *L. alleni.*

and pale spots (Fig. 33); frons with black band between compound eyes; maxillary palpi 3-segmented. Thoracic nota brown with variable gray markings and numerous pale spots; legs reddish-brown; femora with numerous pale spots (Fig. 32a, b); fore femora spines as in Fig. 32c; marginal spines middle and hind femora in elevated sockets; hind femora 50% longer than fore femora (Fig. 32a, b); ventral (leading) margin middle and hind femora convex apical half (Fig. 30b); tibiae middle and hind femora with long spines along inner margin (Fig. 32b); tarsal claws with 3–4 marginal denticles (Fig. 32d). Abdominal terga reddish-brown with numerous pale spots; terga 2–9 with diffuse black band; operculate gill pale at apices and along margins, dark at base, with basal spine (Fig. 30). Caudal filaments brown with pale annulations.

Type Locality.—Stream, 10 mi N. Huajuapan de Leon, Oaxaca, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—Known only from the type locality (Fig. 52).

Remarks.—*Leptohyphes alleni* is closely related to *L. murdochi* as the nymphs of both species possess numerous small pale spots on the head, body, and appendages. The former was collected in southern Mexico in Nov. and the latter in Panamá in May. They would appear to be seasonally and geographically isolated, and morphologically distinct. It appears that they are either recently evolved species, or subspecies.

Leptohyphes apache Allen

Leptohyphes apache Allen 1967: 352.

Mature Nymph.—Length: body 4.5–5.5 mm; caudal filaments 4.0–5.0 mm. General color light brown to brown with dark brown markings; body robust. Head brown with irregular dark brown markings; maxillary palpi 3-segmented (Fig. 3), other mouthparts as in Fig. 4–7. Thoracic nota brown with irregular dark brown markings; femora with moderately long spines; femora tan often with apical marking; hind femora 35% longer than fore femora; tarsal claws with 4–6 marginal denticles. Abdominal terga light brown with irregular dark brown markings, terga 1–9 often with median pale stripe; operculate gill brown, pale apically; without basal spine; abdominal sterna light brown, 1–7 often with median dark brown macula. Caudal filaments light brown, usually with dark brown basal annulation.

Type Locality.—North Fork White Riv, White River, Ft. Apache Indian Reservation, Navaho Co., Ariz.

Type Deposition.—CAS, San Francisco.

Distribution.—This species has a restricted distribution in the southwest in southern Utah, Ariz., and N. Mex. (Fig. 52).

Records.—ARIZONA: *Navajo Co.* Stream, 8 mi N. White River; White Riv 4 mi N. White River. *Yavapai Co.* Beaver Cr at Beaver Creek Ranger Station. NEW MEXICO: Taylor Creek, Santa Fe Natl. Forest. UTAH: Virgin Riv, Zion's Natl. Park. *Greenlee Co.* San Francisco Riv at Clifton.

New Records.—ARIZONA: *Gila Co.* San Carlos Riv. at San Carlos, 20-VII-70, RKA; Salt Riv on Hwy 288, 20-VII-70, RKA; E. Verde Riv on Rd. 406, 10 mi E. Payson, 19-VII-70, RKA; E. Verde Riv on Hwy 87, 18/19-70, RKA. *Pinal Co.* Aravaipa Cr., 14-III-76, D. Bruns. *Yavapai Co.* Oak Cr nr. Cornville, 18-VII-70, RKA; Oak Cr at Red Rock Crossing, 17-18-VII-70, RKA; Verde Riv at Verde Valley, 18-VII-70, RKA; Verde Riv at Camp Verde, 18-VII-70, RKA. NEW MEXICO: *Catron Co.* San Francisco Riv at Glenwood, 21-VII-70, RKA. *Grant Co.* E. Fk. Gila Riv on Hwy 527, 21-VII-70, RKA.

Leptohyphes brunneus Allen & Brusca

Leptohyphes brunneus Allen and Brusca 1973a: 85.

Mature Nymph.—Length: body 5.5–6.5 mm; caudal filaments 5.0–6.0 mm. General color light brown with brown to reddish-brown markings; body robust. Head light brown with large brown macula between lateral ocelli (Fig. 47); maxillary palpi 3-segmented. Thoracic nota light brown, suffused with brown; legs tan, suffused with brown; femora unicolorous light brown; femora with moderately long spines; hind femora 40% longer than fore femora; tarsal claws with 4–6 marginal denticles and 1 submarginal denticle near apex. Abdominal terga unicolorous light brown; operculate gill light brown, with basal spine; abdominal sterna light brown. Caudal filaments pale, often with single brown basal annulation.

Type Locality.—Stream, 15 mi N. Ayoquezco, Oaxaca, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—*Leptohyphes brunneus* is known from southcentral and southwestern Mexico, and Guatemala (Fig. 53).

Records.—MEXICO: *Chiapas.* Stream 7 mi N. Arriaga on Hwy 190. *Jalisco.* Rio La Pasion at Tizapan El Alto. *Morelos.* Rio Amacuzac, Huajintlan on Hwy 95.

New Record.—GUATEMALA: Rio Latoma at km 182 on Hwy 2, 24-X-68, RKA.

Habitat.—Mature nymphs of *L. brunneus* have been collected in July and Oct. which suggests that adults emerge from late summer–late fall. Nymphs collected in July were from a stream at an elevation of 3200 ft and a water temperature of 64°F. Those collected in Oct. were from streams at elevations between 1400 and 6700 ft with water temperatures between 54° and 78°F. Nymphs of this species occur in the same habitat as *L. hispidus* and *L. spiculatus.*

Leptohyphes castaneus Allen

Leptohyphes castaneus Allen 1967: 354.

Mature Nymph.—Length: body 5.0–7.0 mm; caudal filaments 5.5–6.5 mm. General color light brown with dark brown markings; body robust. Head light brown with irregular dark brown markings; maxillary palpi 3-segmented. Thoracic nota brown with variable dark brown markings; legs brown; femora with moderately

long spines; hind femora 35% longer than fore femora; tarsal claws with 5–7 marginal denticles. Abdominal terga unicolorous brown; terga with short spines; operculate gill pale, brown at base, with basal spine; abdominal sterna brown. Caudal filaments light brown, often with brown basal annulations.

Type Locality.—Sololá, Panajachel, Guatemala.

Type Deposition.—UU, Salt Lake City.

Distribution.—Known only from the type locality (Fig. 53).

Remarks.—The immature stage of *L. castaneus* possesses a brown abdomen like that described by Ulmer (1919) for the adult of *L. costaricanus*. It is possible that, when rearing studies have been completed, these forms may be found to be synonymous.

Leptohyphes dolani Allen

Leptohyphes dolani Allen 1967: 351; Allen and Roback 1969: 376.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 1.5–2.5 mm. General color brown with black markings; body robust. Head brown, with row long setae along lateral margins and across clypeallabial suture; occiput black; maxillary palpi 2-segmented. Thoracic nota brown with black markings; pronotum with median, longitudinal row short setae; pronotum and mesonotum margined with long setae; legs brown with black markings; femora with irregularly-shaped black maculae; femora with moderately long spines in elevated sockets and long setae; hind femora 30% longer than fore femora (Fig. 23); tarsal claws with 1–3 marginal denticles. Abdominal terga brown with black markings; tergum 1 with row 6 black maculae; terga 2–6 with paired submedian and sublateral black maculae; terga 7–10 with paired submedian longitudinal black stripes; terga with long setae; segments 7–9 with well-developed posterolateral projections (Fig. 21); operculate gill pale with black maculae; abdominal sterna 2–9 brown with paired sublateral black dots. Caudal filaments brown.

Type Locality.—Dikes above Ellenton, Station 1, Savannah Riv, S.C.

Type Deposition.—ANSP.

Distribution.—The distributional range of this species is based on disjunct records (Fig. 52). Specimens are known from the type locality in S.C. (ca. 33°29′ N. latitude) to southern Tex. (ca. 28°49′ N. latitude).

Records.—GEORGIA: Savannah Riv; Brigham's Landing. SOUTH CAROLINA: Savannah Riv above Little Hell's Landing. TEXAS: Guadelupe Riv, nr. Victoria.

New Record.—TEXAS: *Victoria Co.* Guadalupe Riv, 3 mi below Dupont Plant nr. Bloomington, 4/10-IX-50; 19/21-VIII-52, T. Dolan IV (ANSP).

Leptohyphes ferruginus Allen & Brusca

Leptohyphes ferruginus Allen and Brusca 1973a: 88.

Mature Nymph.—Length: body 4.0–5.0 mm; caudal filaments 3.5–4.5 mm. General color red to reddish-brown; body robust. Head red with irregular black markings; maxillary palpi 3-segmented. Thoracic nota red to reddish-brown; pronotum with black sublateral maculae; nota covered with fine spicules; legs red; femoral spines moderately long; hind femora 30% longer than fore femora; tarsal claws with 6–7 marginal and 1 submarginal denticles. Abdominal terga red to reddish-brown; terga with scattered spines; operculate gill red, margins pale, with basal spine; abdominal sterna pink. Caudal filaments pale, often with dark annulation near base.

Type Locality.—Rio San Marcos at Apapantilla, Veracruz, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—This species is known from eastern Mexico and Honduras (Fig. 51).

New Record.—HONDURAS: *Dept. Choluteca.* Stream ca. 16 mi E. Jicaro-Gilan on Panam. Hwy, 10-X-64, J. S. Packer (UU).

Habitat.—Nymphs have been collected from a moderately large river at 700-ft elevation in water 66°F.

Leptohyphes hispidus Allen & Brusca

Leptohyphes hispidus Allen and Brusca 1973a: 88.

Leptohyphes lumas Allen and Brusca 1973a: 91. NEW SYNONYMY.

Mature Nymph.—Length: body 4.5–5.5 mm; caudal filaments 5.0–7.0 mm. General color brown with dark markings; body robust. Head with spicules as in Fig. 35; maxillary palpi 3-segmented. Thoracic nota with spicules; legs brown with dark markings; femora usually with black subapical macula; hind femora with pale longitudinal band, dorsal and ventral black longitudinal lines (Fig. 42); hind femora 40% longer than fore femora; (Fig. 42); tarsal claws with 3–6 marginal and 1 submarginal denticles. Abdominal terga brown with dark brown transverse band; terga 3–6 usually with median and paired sublateral maculae mesad to gills (Fig. 43); abdominal terga with spicules; operculate gill pale with brown apical macula, with basal spine; abdominal sterna light brown, often suffused with black and with median and sublateral dark maculae. Caudal filaments brown, often with dark brown basal annulations.

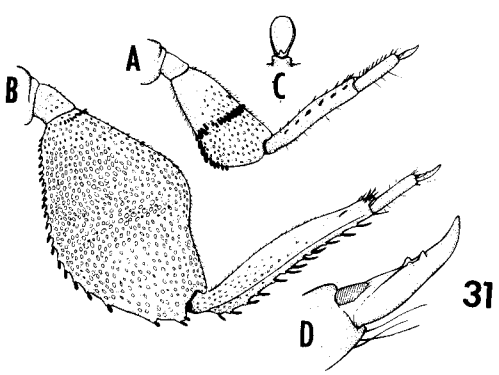
Type Locality.—Stream, 5 mi S. Ciudad Mendosa, Veracruz, Mexico.

Type Deposition.—CAS, San Francisco.

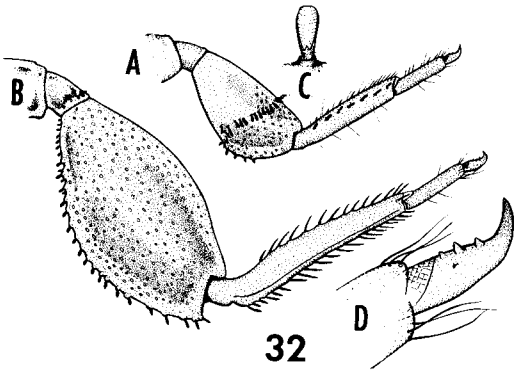
Distribution.—*Leptohyphes hispidus* is widely distributed in southern Mexico and has been reported from the states of Chiapas, Veracruz, Tabasco, and Oaxaca (Fig. 54). New records extend the range to El Salvador and Guatemala.

Records.—MEXICO: *Chiapas.* Stream 7 mi N. Arriaga on Hwy 190; Stream at Santa Isabel, 12 mi NW Arriaga on Hwy 190; Rio Teapa nr. Ishuatan; Rio Huitla, 14 mi N. Tapachula. *Oaxaca.* Rio Grande, 3 mi S. Gualatao. *Tabasco.* Rio Grifalva at Teapa. *Veracruz.* Rio Jamapa, 3 mi NE Coscomatopec; Rio Tecolapan, Santiago Tuxtla on Hwy 180; Rio San Marcos at Apapantilla, 3 mi SE Villa A. Camacho.

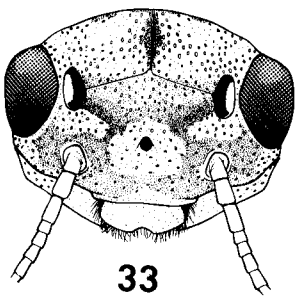
New Records.—EL SALVADOR: Rio Mizeta, 27 mi W. La Libertad, 28-X-68, RKA. GUATEMALA: Rio Latoma at km 182 on Hwy #2, 24-X-68, RKA.



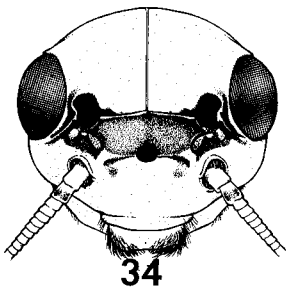
31



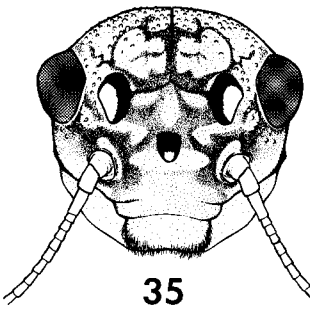
32



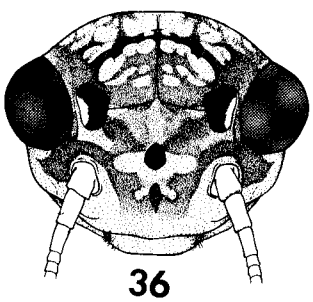
33



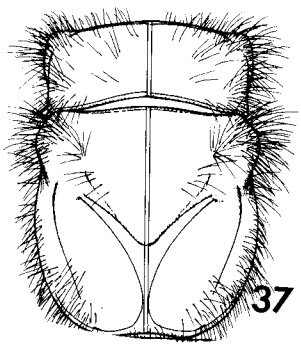
34



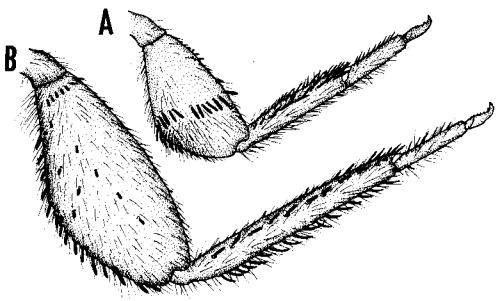
35



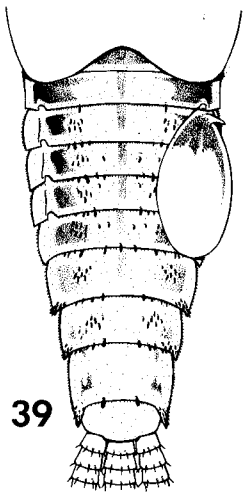
36



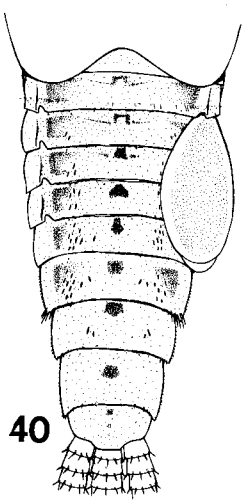
37



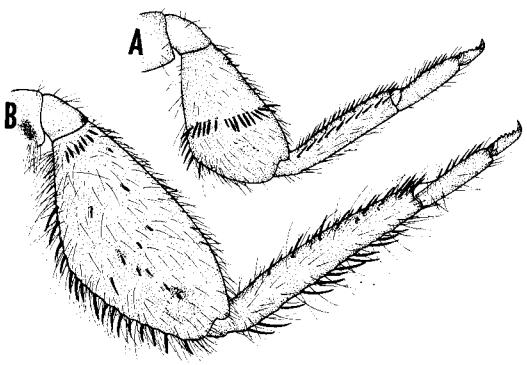
38



39



40



41

FIG. 31–41.—31–32.—Nymphal parts, a, fore leg; b, hind leg; c, femoral spine; d, tarsal claw. 31, *L. murdochi;* 32, *L. alleni.*. 33–36.—Nymphal heads, frontal view. 33, *L. alleni;* 34, *L. lestes;* 35, *L. hispidus;* 36, *Leptohyphes zelus.* 37–38.—Nymphal parts, *L. pilosus.* 37, thoracic nota; 38, legs, a, fore; b, hind. 39–40.—Nymphal abdomens, dorsal view. 39, *L. zelus;* 40, *L. spiculatus.* 41.—Nymphal legs, *L. spiculatus,* a, fore; b, hind.

MEXICO: *Veracruz.* Tenndido Riv, 3 km N. El Fortín (Fortín de las Flores), 1-VI-55, R. B. Selander (UU).

Habitat.—Nymphs have been collected from streams between sea level and 5100-ft elevation in water between 64°–78°F. Specimens have been collected from July–Oct., which suggests an emergence period of at least 4 mo.

Remarks.—The specimens upon which the names *L. lumas* and *L. hispidus* were based were distinguished, originally, by minor morphological characters. A careful re-examination of the types suggests that these nominal species are one. *Leptohyphes lumas* is placed as a primary junior synonym of *L. hispidus.*

Leptohyphes lestes Allen & Brusca

Leptohyphes lestes Allen and Brusca 1973a: 89.

Mature Nymph.—Length: body 3.5–4.5 mm; caudal filaments 3.5–4.5 mm. General color yellow to light brown with black markings; body robust. Head pale with distinct black transverse band between compound eyes (Fig. 34); maxillary palpi 3-segmented. Thoracic nota yellow to light brown with diffuse dark longitudinal streak; femora with moderately long spines; hind femora 30% longer than fore femora; tarsal claws with 5–6 marginal and 1 submarginal denticles. Abdominal terga yellow to light brown with diffuse black markings; operculate gill pale, light brown in basal ⅓, with basal spine; abdominal sterna pale. Caudal filaments pale with brown annulation near base.

Type Locality.—Rio Papagayo nr. Tierra Colorado, Guerrero, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—This species is known from southwestern Mexico and Honduras (Fig. 54).

New Record.—HONDURAS: *Dept. Choluteca.* Nacaome Riv at Nacaome bridge on Panam. Hwy, 10-X-64, J. S. Packer (UU).

Habitat.—Mature nymphs were collected from a stream at an elevation of 500 ft and a water temperature of 86°F.

Remarks.—The nymph of this species is similar to that of *L. piraticus* as both possess a distinctive black band between the compound eyes and *brunneus*-type tarsal claws. These species are distinguished by color and other characters, and their phylogenetic relationship is uncertain. The type localities of *L. lestes* is close to that of *L. zalope* (adults only) in the state of Guerrero, and the nymph of *L. lestes* eventually may be found to be the immature stage of *L. zalope.*

Leptohyphes michaeli Allen n. sp.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 3.0–4.0 mm. General color brown. Head brown; lateral ocelli large; maxillary palpi 1-segmented, with apical spine. Thoracic nota brown; legs light brown to brown; fore femora with long spines; femora without ventral spines; middle and hind tibiae with numerous long spines on outer margin; hind femora 40% longer than fore femora; tarsal claws with 4–6 marginal and palisade 5–6 subapical denticles near apex. Abdominal terga light brown; terga 1–6 with dark, fine longitudinal median line (Fig. 26); terga 7–9 with diffuse dark median macula; operculate gill pale, suffused with black, and without basal spine; abdominal sterna pale. Caudal filaments brown.

Type.—Holotype: mature nymph, North Fork Guadalupe Riv, 4 mi W. Hunt, Kerr Co., Tex. (Fig. 54), 27-VII-73, Michael Peters, in collection CAS, San Francisco.

Remarks.—This species has a small delicate body and distinguished from all other North and Central American species by this character, and the combination of the number of denticles on the tarsal claws and the thin longitudinal marking on abdominal terga 1–6.

Etymology.—This species is named in honor of Michael Peters, SWTS, San Marcos.

Leptohyphes mirus Allen

Leptohyphes mirus Allen 1967: 353.

Leptohyphes baumanni Kilgore and Allen 1973: 327. NEW SYNONYMY.

The small series of nymphs upon which this species was based was poorly preserved, and additional nymphal material from Ariz. and Tex. reveal characters which were omitted from the original description.

Mature Male Nymph.—Length: body 4.0–5.0 mm; caudal filaments 2.5–3.5 mm. General color brown with pale, dark brown, black and red markings; body robust. Head brown; compound eyes large; ocelli large; maxillary palpi 1-segmented with long apical spine. Thoracic nota brown with irregular black markings; pronotum with anterolateral projections; legs pale to brown with black and dark brown markings; femora pale with longitudinal dark rectangular marking (Fig. 25a, b); tibiae and tarsi pale with dark brown apical markings; middle and hind femora with subbasal black suffusion; fore femoral band of spines moderately long; hind femora 40% longer than fore femora (Fig. 25a, b); tarsal claws with 9–11 marginal and 1 submarginal denticles. Abdominal terga brown with indistinct black markings; terga 2–6 brown with indistinct black transverse markings; terga 7–9 with paired sublateral black markings; abdominal segments 7–9 with well-developed posterolateral projections, posterior projection segment 9 produced only to posterior margin segment 10 (Fig. 21); operculate gill light brown, suffused with dark brown, often with red macula at apex, without basal spine; abdominal sterna pale with median dark markings. Caudal filaments brown.

Mature Female Nymph.—Length: body 5.0–6.0 mm; caudal filaments 3.0–4.0 mm. General color dark brown with black markings. Compound eyes small. Thoracic nota dark brown with irregular black markings. Abdominal terga dark brown with black markings, markings darker and more extensive than in male. Other characters as in male except for usual sexual differences.

Type Locality.—Rio Blanco, Ariz.

Type Deposition.—UU, Salt Lake City.

Distribution.—*Leptohyphes mirus* is known only from 2 localities in Ariz. and one in Tex. (Fig. 54).

Records.—ARIZONA: *Santa Cruz Co.* Sonoita Cr Hwy 82 nr. Patagonia.

New Record.—TEXAS: *Jeff Davis Co.* Limpia Canyon, Hwy 17, N. Ft. Davis, 14-V-73, R. G. McClure (NTSU).

Remarks.—*Leptohyphes mirus* was described from a small series of poorly preserved male and female nymphs collected in Ariz. in 1937. The type series of *L. baumanni* was described from a small series of nymphs also collected in Ariz. The nymphs of both exhibit sexual dimorphism, and a careful comparison of morphological characters reveals that these nominal species are the same. *Leptohyphes baumanni* is placed as a primary junior synonym of *L. mirus.*

Leptohyphes murdochi Allen

Leptohyphes murdocki Allen 1967: 355.

Leptohyphes murdochi, Edmunds et al. 1976: 254 (emended name).

Mature Nymph.—Length: body 5.5 mm; caudal filaments 6.0 mm. General color dark brown with numerous pale spots; body robust. Head brown with numerous pale spots as in Fig. 33; frons with black band between compound eyes; maxillary palpi 3-segmented. Thoracic nota brown with irregular light brown markings and numerous pale spots; legs unicolorous brown, femora with numerous pale spots; marginal spines middle and hind femora in elevated sockets; hind femora 55% longer than fore femora (Fig. 31a, b); ventral (leading) margin middle and hind femora concave apical half (Fig. 31a, b); tibiae without long spines along inner margin (Fig. 31a); tarsal claws with 2–3 marginal denticles (Fig. 31c). Abdominal terga dark brown with numerous pale spots; terga 2–9 dark brown, posterior margins light brown; operculate gill suffused with brown with pale margins, with basal spine; abdominal sterna brown. Caudal filaments brown with black basal annulation.

Type Locality.—Rio Tocarcuna, Darien Prov., Panamá.

Type Deposition.—UU, Salt Lake City.

Distribution.—Known only from the type locality (Fig. 54).

Remarks.—*Leptohyphes murdochi* appears to be most closely related to *L. alleni* as the nymphs of both possess small pale spots on the head, body and legs. The phylogenetic relationship cannot be ascertained until more extensive collections are made of both species.

Leptohyphes musseri Allen

Leptohyphes musseri Allen 1967: 353.

Mature Nymph.—Length: 5.0–7.0 mm; caudal filaments 6.0–7.0 mm. General color yellow with black markings; body robust. Head yellow with black markings; occiput yellow, narrow black line between compound eyes (Fig. 47); maxillary palpi 3-segmented. Thoracic nota yellow with variable black markings; legs yellow with black markings; fore femora with subapical black macula; middle and hind femora with subapical black macula and basal black line (Fig. 48); hind femor 55% longer than fore femora; tarsal claws with 3–7 marginal denticles. Abdominal terga yellow to light brown with black markings; terga 1–5 usually with black transverse band, and often black median maculae; terga 6–9 often with median black macula and submedian and sublateral black maculae (Fig. 44); operculate gill pale, dark at base, without basal spine. Caudal filaments pale with black basal annulations.

Type Locality.—Sololá, Panajachel, Guatemala.

Type Deposition.—UU, Salt Lake City.

Distribution.—This species is known only from Honduras and Guatemala (Fig. 51).

New Records.—HONDURAS: *Dept. El Paraiso.* Stream 38 km E. Zamorano on Hwy #4, 31-X-64, J. S. Packer (UU); Rio Guayambre on Hwy #4, 50 km E. Danli, 29-VIII-64, J. S. Packer (UU); Trib. Rio Guayambre, 3-IX-64, J. S. Packer (UU). *Dept. Olancho.* Rio Telica, 6 mi E. Juticalpa on Hwy #3, 6-XI-64, J. S. Packer (UU). *Dept. Comayagua.* Stream, 5 mi S. Comayagua on Hwy #1, 17-X-64, J. S. Packer (UU). *Dept. Choluteca.* Stream ca. 16 mi E. Jicaro-Galán, 10-X-64, J. S. Packer (UU).

Leptohyphes nanus Allen

Leptohyphes nanus Allen 1967: 355.

Mature Nymph.—Length: body 2.5–3.5 mm; caudal filaments 2.0 mm. General color yellow with black markings; body delicate, long and thin. Head yellow, black band between lateral ocelli; ocelli large; maxillary palpi 2-segmented. Thoracic nota yellow with black markings; legs unicolorous yellow; femora with moderately long spines; hind femora 35% longer than fore femora; tarsal claws with 4–7 long submarginal denticles. Abdominal terga yellow, suffused with black; terga with scattered setae; operculate gill black, pale apically, without basal spine; abdominal sterna pale. Caudal filaments pale with black basal annulation.

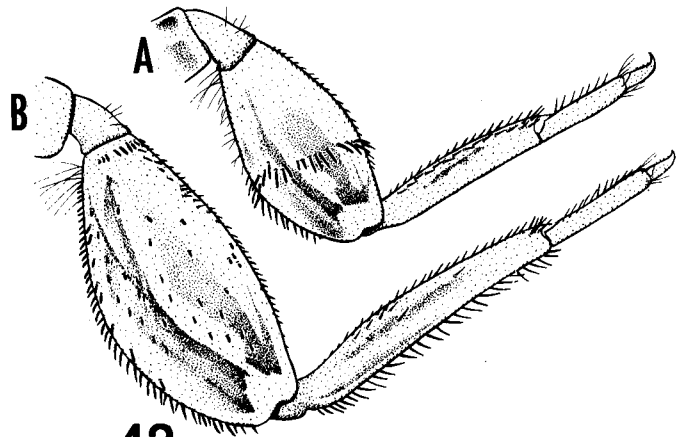
Type Loclity.—Rio Pedro Niqual, Green Park on Madden Road, Canal Zone.

Type Deposition.—UU, Salt Lake City.

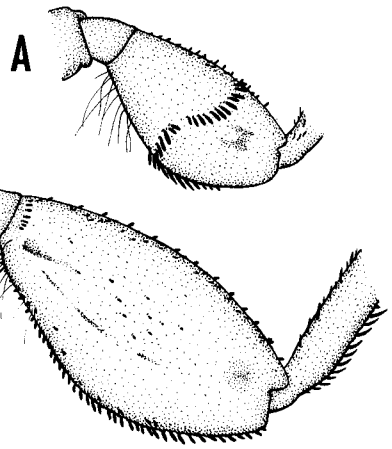
Distribution.—This species is known from the type locality and 3 localities in Honduras (Fig. 52).

New Records.—HONDURAS: *Dept. El Paraiso.* Trib. Rio Guayambre, 50 km E. Danli at jct. Hwy #4, 3-IX-64, J. S. Packer (UU); Stream, 38 km E. Zamorano on Hwy #4, 31-X-64, J. S. Packer (UU).

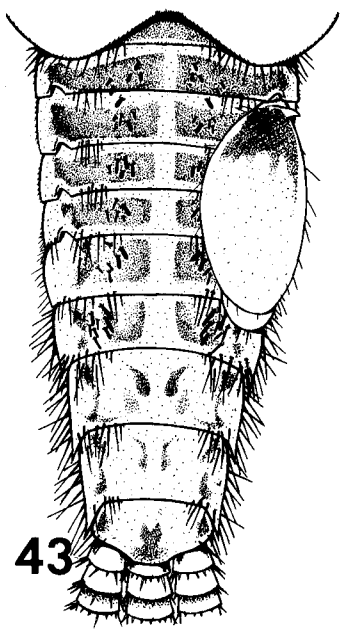
FIG. 42–50.—42–43.—Nymphal parts, *L. hispidus.* 42, legs, a, fore; b, hind; 43, abdomen, dorsal view. 44.—Abdomen, dorsal view, *L. musseri.* 45–46.—Nymphal tarsal claws. 45, *L. nanus;* 46, *Leptohyphes* sp. 47.—Nymphal head, anterior view, *L. musseri.* 48.—Nymphal legs, *L. musseri,* a, fore femora; b, hind femora. 49.—Nymphal head, anterior view, *L. brunneus.* 50.—Nymphal tarsal claw, *Leptohyphes* sp.



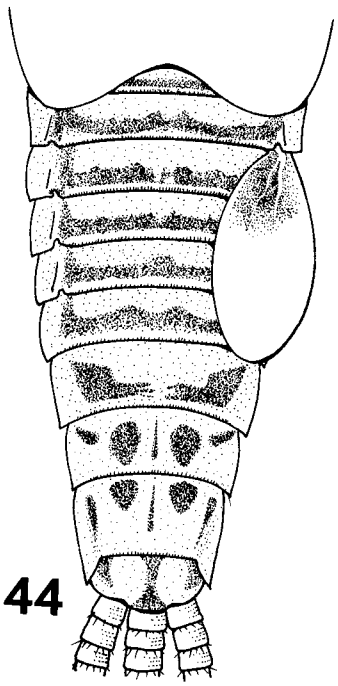
42



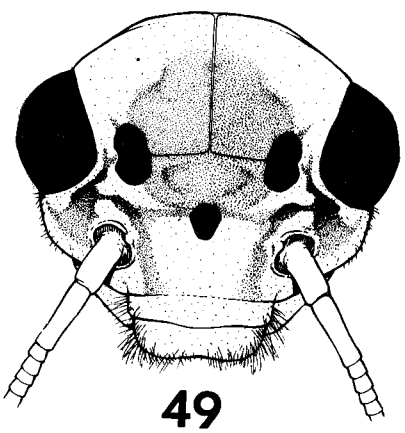
48



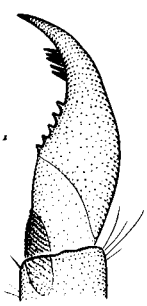
43



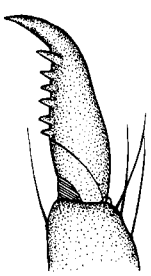
44



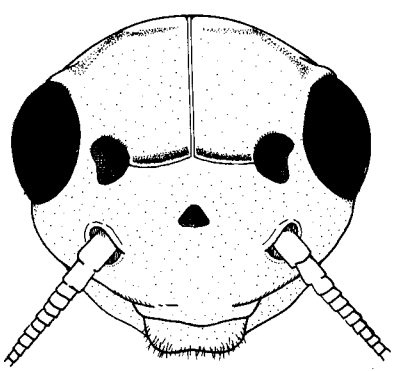
49



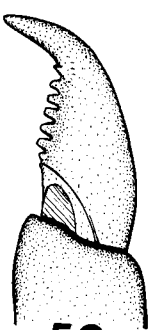
45



46



47



50

Dept. Francisco Morazan. Stream 6.5 mi from jct. Hwy #3 and #5, 7-XI-64, J. S. Packer (UU).

Remarks.—This species and *L. vescus* appear to be cognate species as the nymphal stages are distinguished from each other only by minor morphological characters and geographical distribution.

Leptohyphes packeri Allen

Leptohyphes packeri Allen 1967: 350.
Leptohyphes phalarobranchus Kilgore and Allen 1973: 328. NEW SYNONYMY.

Mature Nymph.—Length: body 3.5–4.5 mm; caudal filaments 3.0–4.0 mm. General color yellow to brown with pale markings; body robust. Head brown, dark band between lateral ocelli, and pale median macula on frons; maxillary palpi 3-segmented. Thoracic nota brown with pale maculae; legs brown with black and pale markings; femora brown with black subapical macula and pale at apices; hind femora 30% longer than fore femora; tarsal claws with 6–12 marginal and 3–4 submarginal denticles. Abdominal terga unicolorous yellow to brown; operculate gill brown with 2–3 large pale maculae without basal spine, (Fig. 28). Caudal filaments light brown.

Type Locality.—Stream, 6.5 mi from jct. Hwys 3 & 5, Dept. Francisco Morazan, Honduras.

Type Deposition.—UU, Salt Lake City.

Distribution.—Leptohyphes packeri has the widest known latitudinal distribution of all described North and Central American species (Fig. 52). Records are known from Honduras (ca. 14°05′ N. latitude) to Tex. (ca. 34°30′ N. latitude), and central Ariz. (ca. 34°50′ N. latitude).

Records.—ARIZONA: *Mohave Co.* Big Sandy Riv at Wikieup. HONDURAS: *Dept. Olancho.* Campamento on Hwy #2 at bridge.

New Records.—GUATEMALA: Rio Petacalpa, 1 mi E. Guatemala/Mexican border, Hwy #2, 24-X-68, RKA. HONDURAS: *Dept. El Paraiso.* Stream, 8 mi E. Danli, 29-VIII-64, J. S. Packer (UU). *Dept. Francisco Morazan.* Stream nr. LaVenta at jct. Hwy #3 and Rio Choluteca, 7-XI-64, J. S. Packer (UU). *Dept. Olancho.* Small stream, 1 mi W. Campemento on Hwy #2, 7-XI-64, J. S. Packer (UU). MEXICO: *Nayarit.* Rio do las Canyas, 8 mi NW Acapneta, 25-X-48, H. B. Leech (CAS). *Nuevo Leon.* Rio Salina, Salinas Vicoria, 4-VIII-70, RKA. *Tamaulipas.* Rio Purificatacion nr. Ciudad Victoria, 85, 6-VII-66, RKA. *Veracruz.* Rio Paso de Ovejas, Paso de Ovejas, 10-XI-68, RKA; Rio Carranza 20 mi S. Nautla, 10-XI-68, RKA. *Oaxaca.* Stream, 10 mi N. Haujuapan de Leon, 7-XI-68, RKA. TEXAS: *Guadelupe Co.* Geronimo Cr., FM 20 Crossing, Mike Peters (SWTS). *Kinney Co.* Los Moras Cr., 1-X-73, R. G. McClure (NTS). *Kimble Co.* S. Fk. Llano Riv, 12 mi S. jct. Hwy 377, 3-VII-70, RKA.

Habitat.—Nymphs have been collected in a variety of running water habitats from small fast flowing streams to large rivers from near sea level (200-ft elevation) to 5400 ft and in water with temperatures between 70°–88°F.

Remarks.—Leptohyphes packeri was described from a series of nymphs collected in Honduras, and was distinguished from all other described species in the genus by possessing a distinctive color pattern on the operculate gills. A similar color pattern was found on a population from Ariz., and they were described and named *L. phalarobranchus* by Kilgore and Allen in 1973. The Ariz. population was distinguished from the former by minor morphological characters and geographic distribution. Collections of *Leptohyphes,* identified as *L. packeri,* from Tex., Mexico, and Guatemala possess characters intermediate between the Honduras and Arizona populations, and *L. phalarobranchus* is unquestionably a junior synonym of *L. packeri.*

Leptohyphes paraguttatus Allen n. sp.

Mature Nymph.—Length: body 4.0–5.0 mm; caudal filaments 3.0–4.0 mm. General color pale with black markings; body robust. Head pale; occiput with complex black pattern; maxillary palpi 2-segmented, apical segment reduced in size. Thoracic nota pale with black markings; pronotum pale with black along anterior margin and diffuse submedian black markings; mesonotum pale, anterior margin with thin black line; legs pale with black markings; femora pale with subapical black macula; tibiae and tarsi pale; fore femora with moderately long spines; femora with ventral spines; hind tibiae with spines on outer margin; hind femora 20% longer than fore femora; tarsal claws with 9–11 marginal and 1–3 submarginal denticles near apex. Abdominal terga pale with black maculae; terga 2–4 pale with paired submedian maculae, maculae closer to midline on posterior segments forming V-shape (Fig. 27); terga 2–8 suffused with black near lateral margins; operculate gill pale, suffused with black and black apical macula, without basal spine; abdominal sterna pale. Caudal filaments pale.

Type.—Holotype: mature nymph, Geronimo Cr., Guadalupe Co., Tex. (Fig. 53). 18-V-73, Michael Peters, in collection CAS, San Francisco.

Remarks.—This species is distinguished from other known *Leptohyphes* nymphs by the combination of pale body color, the number and arrangement of the denticles on the tarsal claws, and the distinctive arrangement of the maculae on abdominal terga 2–4.

Leptohyphes pilosus Allen & Brusca

Leptohyphes pilosus Allen and Brusca 1973a: 91.

Mature Nymph.—Length: body 4.0–5.0 mm; caudal filaments 4.5–5.5 mm. General color pale to light brown; body robust. Head light brown to pale with paired black crescent-shaped maculae medial to lateral ocelli; head with scattered spicules; maxillary palpi 3-segmented. Thoracic nota light brown to pale with brown markings; nota covered with long hair-like setae (Fig. 37); legs pale with black and brown markings; femora with subapical black maculae; femora with scattered spines and long hair-like setae (Fig. 38); hind femora 35% longer than fore femora; tarsal claws with 4–6 marginal and 1 submarginal

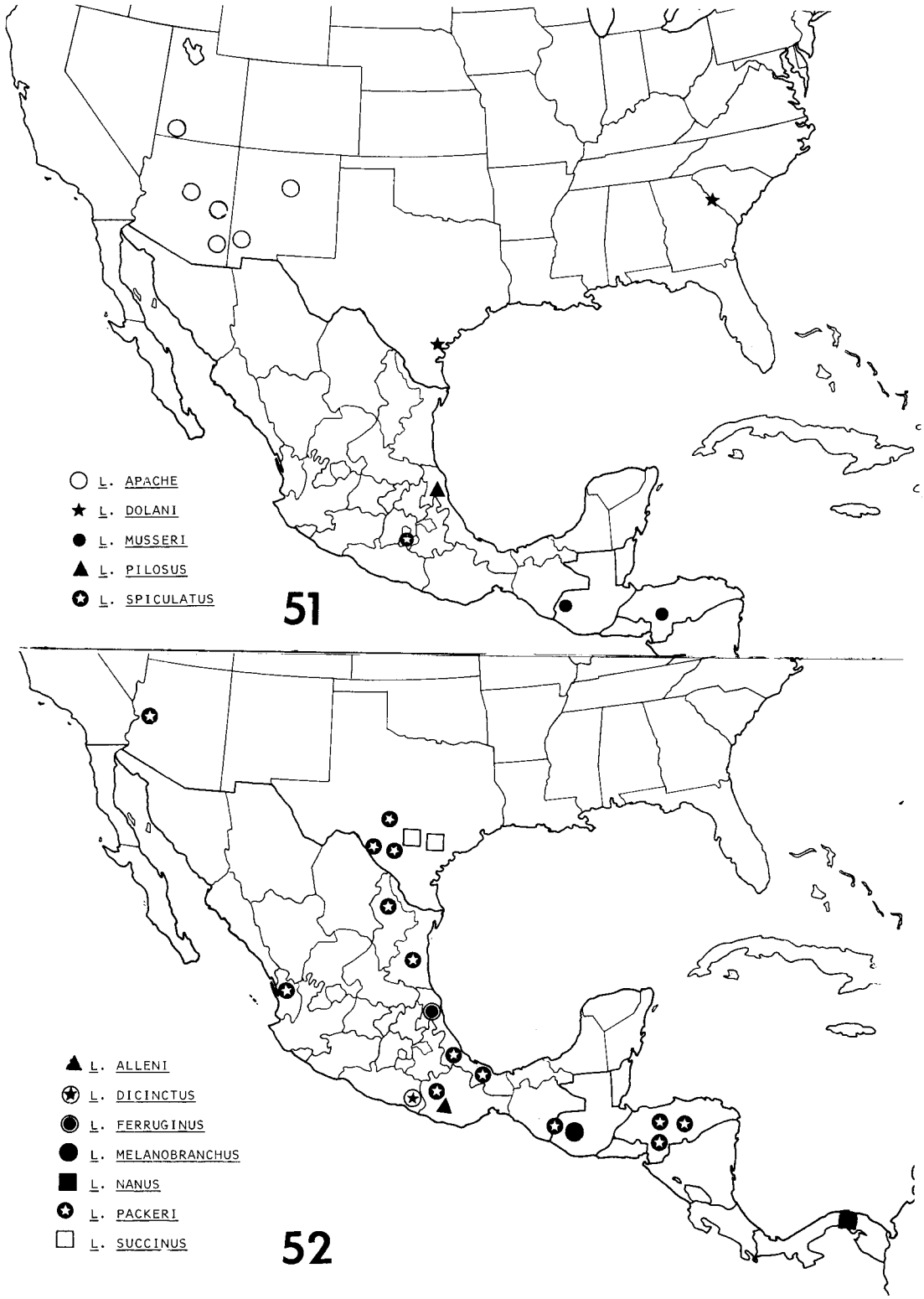


FIG. 51–52.—*Leptohyphes* spp. geographic distribution. 51, *L. apache, L. dolani, L. musseri, L. pilosus,* and *L. spiculatus;* 52, *L. alleni, L. dicinctus, L. ferruginus, L. melanobranchus, L. nanus, L. packeri,* and *L. succinus.*

denticles. Abdominal terga pale to light brown with black median macula on 1–10; terga 1–7 with sublateral black maculae; terga 2–9 with long submedian spines and long hair-like setae; operculate gill gray with pale margins, with basal spine; abdominal sterna pale. Caudal filaments pale, often with brown annulations.

Type Locality.—Rio San Marcos, Apapantilla, 3 mi SE Villa A. Comacho, Veracruz, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—Known only from the type locality (Fig. 51).

Habitat.—The holotype nymph was collected from a stream at an elevation of 700 ft and with a water temperature of 66°F.

Leptohyphes piraticus Allen n. sp.

Mature Nymph.—Length: body 5.0–6.0 mm; caudal filaments 3.5–4.5 mm. General color red with black markings; body robust. Head red with distinct black transverse band between compound eyes as in Fig. 34; head covered with fine spicules; maxillary palpi 3-segmented. Thoracic nota red and covered with fine spicules; legs red; femora red and covered with fine spicules; fore femora with moderately long spines; hind femora 35% longer than fore femora; tibiae and tarsi red; tarsal claws with 5–7 marginal and 1 submarginal denticles. Abdominal terga red and covered with fine spicules; operculate gill pale red, covered with fine spicules, with basal spine; abdominal sterna red. Caudal filaments red.

Type.—Holotype: mature nymph, small stream, Choluteca, ca. 16 mi E. Jicaro-Galán, Pan American Hwy, Dept. Chotuteca, Honduras (Fig. 53), 10-X-64, J. S. Packer, in collection UU, Salt Lake City.

Remarks.—Leptohyphes piraticus superficially resembles *L. lestes,* described from Guerrero, Mexico, as the nymphs of each possess a distinctive black band between the compound eyes. This relationship is apparently superficial as the former bears small spicules on the head, body and femora, and several species of *Leptohyphes* nymphs have a band between the compound eyes.

Leptohyphes quercus Kilgore & Allen

Leptohyphes quercus Kilgore and Allen 1973: 328.

Mature Female Nymph.—Length: body 6.0–7.0 mm; caudal filaments 3.5–4.5 mm. General color brown with dark brown markings; body robust. Head brown with dark brown markings; maxillary palpi absent. Thoracic nota brown with irregular dark brown markings; pronotum with anterolateral projections; legs yellow to brown with black markings; femora black along ventral margin and with dorsal subapical black macula; tibiae and tarsi with black apical macula; hind femora 20% longer than fore femora; tarsal claws with 10–12 marginal and single submarginal denticle near apex. Abdominal terga brown with black markings; terga 2–6 with black transverse band, band directed posteriorly towards lateral margins; terga 7–9 with median black macula, lateral margins black except posterolateral projections; tergum 10 with thin black anterior transverse band; abdominal segments 7–9 with well-developed posterolateral projections, posterior projection on 9 produced beyond posterior margin segment 10 (Fig. 19), operculate gill suffused with black, without basal spine; abdominal sterna brown with paired sublateral black maculae. Caudal filaments brown.

Type Locality.—Oak Cr, Pine Flat Campground, Coconino Co., Ariz.

Type Deposition.—UU, Salt Lake City.

Distribution.—Leptohyphes quercus is known only from 2 localities in Ariz.

New Record.—ARIZONA: *Pinal Co.* Aravaipa Cr, 14-III-76, D. Bruns.

Remarks.—This species and *L. mirus* appear to be cognate species. They are sympatric, possess anterolateral projections on the pronotum, and have posterolateral projections on abdominal segments 7–9. The nymphs are distinguished by the degree of development of the posterolateral projection on segment 9, the coloration on the femora and operculate gill, and the presence or absence of a maxillary palp. *Leptohyphes mirus* exhibits sexual dimorphism, but this phenomenon is unknown in *L. quercus* as the species is known only from female nymphs.

Leptohyphes robacki Allen

Leptohyphes robacki Allen 1967: 351; Allen and Roback 1969: 378.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 1.0–2.0 mm. General color yellow to light brown with black markings; body small and moderately robust. Head yellow to light brown; maxillary palpi 1-segmented with apical seta. Thoracic nota light brown to brown; legs yellow to light brown; femora with long bifurcated spines (Fig. 22c); ventral (leading) margin femora gently concave (Fig. 22a, b); hind femora 20% longer than fore femora; tarsal claws with 6–8 marginal denticles as in Fig. 50. Abdominal terga light brown with black markings; terga 1–8 with paired submedian and sublateral black maculae; segments 7–8 with well-developed posterolateral projections (Fig. 20); operculate gill pale to yellow with scattered black maculae; abdominal sterna yellow to light brown with variable black markings. Caudal filaments yellow to light brown.

Type Locality.—Potomac Riv, Station 21, 4 mi below mouth of Monacacy, Montgomery Co., Md.

Type Deposition.—ANSP.

Distribution.—Leptohyphes robacki appears to be restricted to the eastern United States (Fig. 53), specimens having been reported only from the type locality in Md. (ca. 39°18′ N. latitude) and Savannah River on the S.C.-Ga. border (ca. 33°29′ N. latitude).

Leptohyphes sabinas Traver

Leptohyphes sabinas Traver 1958b: 81.

Leptohyphes consortis Allen and Brusca 1973a: 87 NEW SYNONYMY.

Mature Nymph.—Length: body 4.5–5.5 mm; caudal filaments 5.0–6.0 mm. General color light brown with

brown markings; body robust. Head light brown with irregular black lines; maxillary palpi 3-segmented. Thoracic nota light brown with dark markings; pronotum with dark triangular marking; legs pale, femora with indistinct subapical macula; femoral spines moderately long; hind femora 40% longer than fore femora; tarsal claws with 4–6 marginal and 1 submarginal denticles. Abdominal terga light brown with diffuse brown markings, often with pale median longitudinal line and pale margins; operculate gill pale, darker basally, with basal spine; abdominal sterna pale with paired submedian brown maculae. Caudal filaments pale.

Type Locality.—Park Chapultepec, Sabinas Hidalgo, Nuevo Leon, Mexico.

Type Deposition.—This species is restricted to Mexico, and specimens assigned as *L. sabinas* have been collected from Nuevo Leon to Veracruz (Fig. 53).

Record.—MEXICO: *Veracruz.* Rio San Marcos at Apapantilla, 3 mi SW Villa A. Camacho.

New Records.—MEXICO: *Tamaulipas.* 22/24-XII-40, L. Berner, no other data (UU); Rio Corona N. Ciudad Victoria, 25-XI-68, RKA.

Habitat.—The nymphs from Veracruz were collected in a small stream at an elevation of 700 ft in water 66°F.

Remarks.—Traver (1958b) described this species from male and female subimagoes and a female imago, and designated one subimago (cuticle partially shed) as the type. The nymph of *L. consortis* was collected in Veracruz. Nymphs from the type locality of *L. sabinas* and apparently part of the type series (Sabinas Hidalgo, Nuevo Leon, Mexico, #13-1640-1, L. Berner, and Parque Chapultepec, 4 mi W. Sabinas Hidalgo, 16-XII-40, F. N. Young) were recently found to be indistinguishable from the nymph described as *L. consortis.* The topotype nymphs are associated as *L. sabinas,* and *L. consortis* is placed as a junior synonym of *L. sabinas.*

Leptohyphes spiculatus Allen & Brusca

Leptohyphes spiculatus Allen and Brusca 1973a: 92.

Mature Nymph.—Length: body 5.0–6.0 mm; caudal filaments 6.0–7.0 mm. General color light brown with black markings; body robust. Head covered with spicules as in Fig. 35; maxillary palpi 3-segmented. Thoracic nota light brown with black markings; pronotum with paired submedian black maculae on anterior margin; thoracic nota covered with spicules; legs unicolorous yellow; femora with spicules and long fine setae (Fig. 41); hind femora 40% longer than fore femora; tarsal claws with 4–6 marginal and 1 submarginal denticles. Abdominal terga light brown with black markings; terga 2–9 with median black macula (Fig. 40); terga covered with spicules; operculate gill light brown, without basal spine. Caudal filaments pale, often with basal brown annulations.

Type Locality.—Rio Amacuzac, Huajintlan, Morelos, Mexico.

Type Deposition.—CAS, San Francisco.

Distribution.—Known only from the type locality (Fig. 51).

Habitat.—The type series were collected from a moderately large stream at an elevation of 3200 ft with a water temperature of 64°F.

Leptohyphes succinus Allen n. sp.

Mature Nymph.—Length: body 6.0–7.0 mm; caudal filaments 6.0–7.0 mm. General color light brown to brown with dark brown markings, suffused with purple-black, body large and robust. Head light to dark brown; occiput light brown with fine dark semi-circle and 3 radiating lines, frons brown with pale macula over median ocellus; maxillary palpi 3-segmented. Thoracic nota light brown to brown, often suffused with black; thoracic nota with scattered spicules; legs brown, suffused with purple-black; femora brown, suffused with purple-black and with pale longitudinal band; tibiae brown, suffused with black; tarsi brown; fore femora with moderately short spines; hind femora 40% longer than fore femora tarsal claws with 5–6 marginal and 1 submarginal denticles. Abdominal terga light brown to brown, suffused with purple-black; abdominal terga with scattered spicules; operculate gill dark apically, pale distally, without basal spine; abdominal sterna pale. Caudal filaments light brown, often with dark basal annulations.

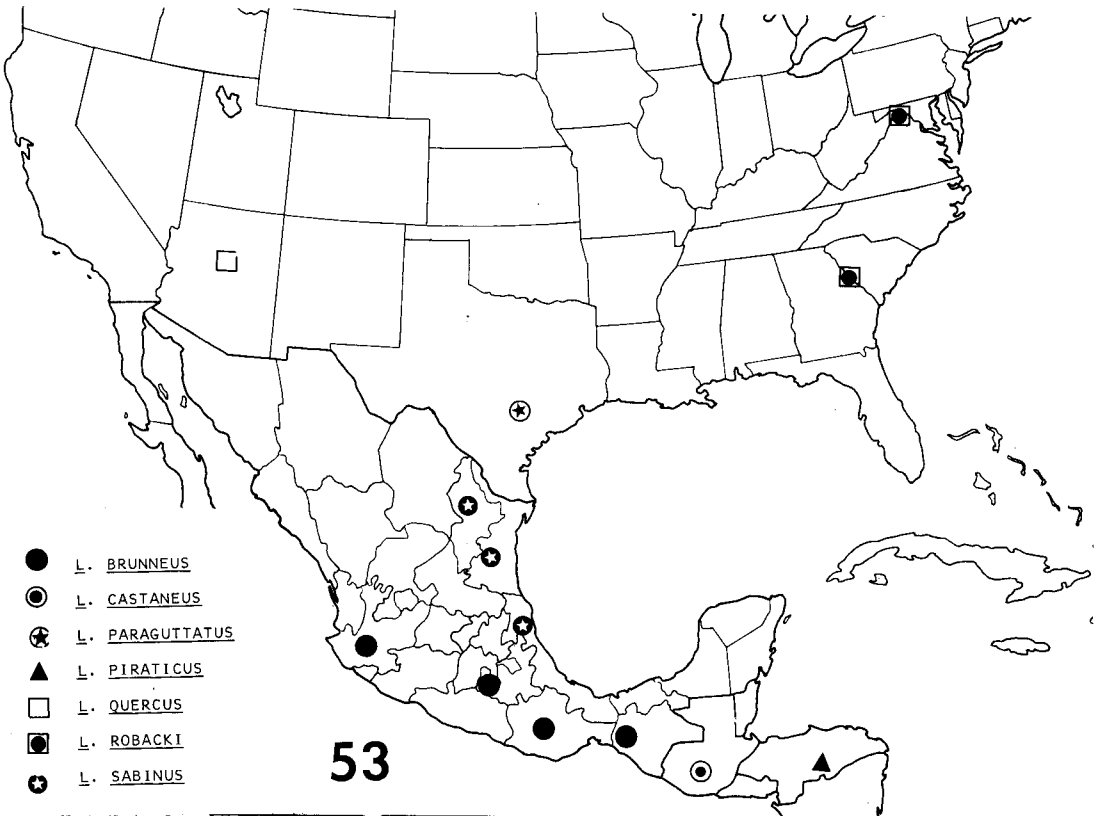
Type.—Holotype: mature nymph, San Marcos River, *Hays Co.,* Tex. (Fig. 52), 3-IV-73, Michael Peters, in collection CAS, San Francisco. Paratopotypes: 3 nymphs, same data as holotype, 8 nymphs, 6-IV-73, other data same as holotype, 3 in collection WTS, San Marcos, 4 each in collection California State Univ., Los Angeles, and CAS. Paratypes: 1 nymph, Guadalupe River, SH 16 crossing, 27-VII-73, Michael Peters; 1 nymph, North Fork Guadalupe River, 4 mi W Hunt, *Kerr Co.,* 27-VII-73, Michael Peters, paratypes in collection WTS.

Remarks.—The nymph of *L. succinus* is large, and distinguished from all other North and Central American species by this character and by the color of the head, body, and appendages.

Leptohyphes vescus Allen n. sp.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 2.0–3.0 mm. General color light brown; body delicate, long and thin. Head light brown with brown markings; maxillary palpi 2-segmented, apical segment small. Thoracic nota light brown, mesonotum with few variable brown markings; legs pale, without markings; fore femora with long spines; middle and hind femora with long spines on outer margin; hind femora 25% longer than fore femora; tarsal claws with 5–6 marginal and palisade 4–6 submarginal denticles near apex as in Fig. 46. Abdominal terga light brown; terga 4–9 with suffused brown median macula; tergum 9 with dark posterior transverse line; operculate gill suffused with black, without basal spine; operculate gill oblong, long and narrow; abdominal sterna pale. Caudal filaments light brown.

Type.—Holotype: mature nymph, Rio Sabinal at



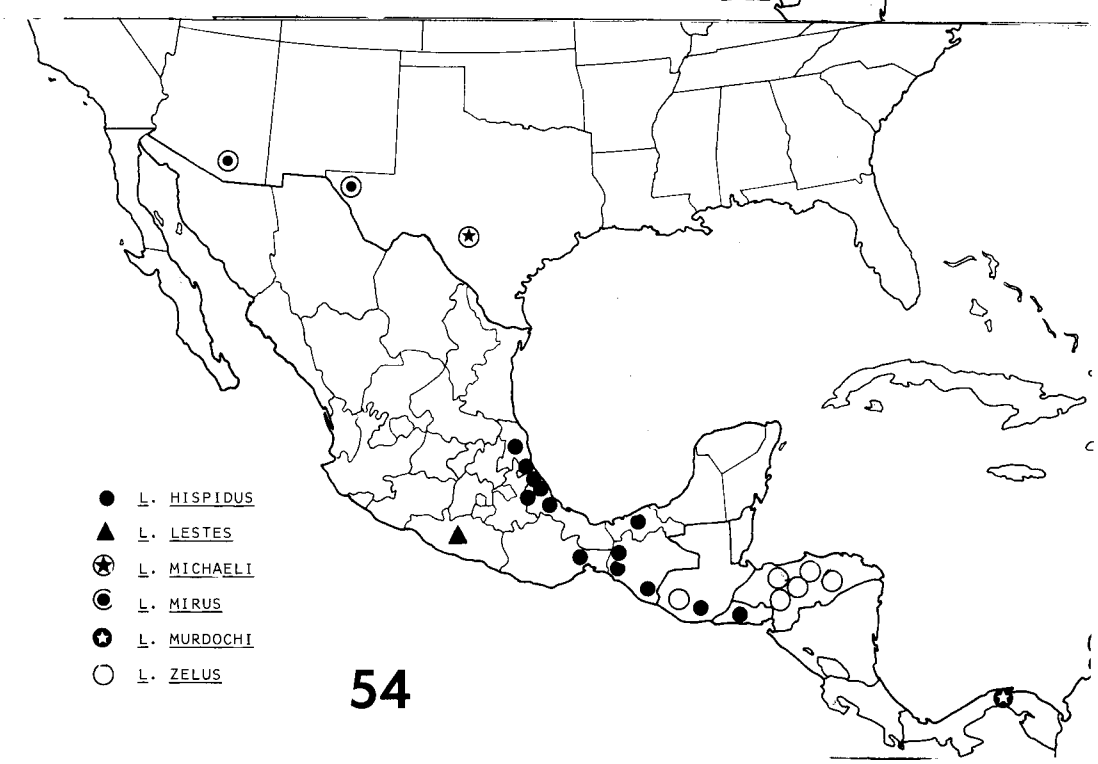


FIG. 53–54.—*Leptohyphes* spp. geographic distribution. 53, *L. brunneus, L. castaneus, L. paraguttatus, L. piraticus, L. quercus, L. robacki,* and *L. sabinus;* 54, *L. hispidus, L. lestes, L. michaeli, L. mirus, L. murdochi,* and *L. zelus.*

Utopia, *Uvalde Co.*, Tex., 2-VIII-68, RKA, in collection CAS, San Francisco.

Remarks.—The nymphs of *L. vescus* and *L. nanus* have many characters in common and appear to be cognate species. Both are small in size with a delicate body, have 2-segmented maxillary palpi, *michaeli*-type tarsal claws, and without a spine at the base of the operculate gill. They differ in body color, other morphological characters, and geographic distribution.

Leptohyphes vulturnus Allen n. sp.

Mature Nymph.—Length: body 3.0–4.0 mm; caudal filaments 3.0–4.0 mm. General color tan to light brown with black and brown markings; body moderately robust. Head pale with dark markings, diamond-shaped macula between ocelli; maxillary palpi 3-segmented. Thoracic nota unicolorous tan; legs tan; middle and hind femora with small subbasal and subapical black streaks; fore femora with moderately long spines; middle and hind tibiae with numerous long spines on outer margin; hind femora 35% longer than fore femora; tarsal claws with 5–6 marginal and 1 submarginal denticle near apex. Abdominal terga tan; terga 2–9 with small black median spot; terga 2–9 with spicules, and posterior margins with submedian and sublateral stout spines as in Fig. 37; operculate gill tan with apical black macula, and with basal spine; abdominal sterna pale. Caudal filaments pale with few brown annulations.

Type.—Holotype: mature nymph, Rio Blanco, at bridge on Hwy #1, 2 mi N. Carcol, *Dept. Cortes,* Honduras, 18-X-64, J. S. Packer, in collection UU, Salt Lake City.

Remarks.—The nymphs of this species are distinguished from all other known North and Central American *Leptohyphes* as the abdominal terga possess stout spines on posterior margins and a median black spot.

Leptohyphes zelus Allen n. sp.

Mature Nymph.—Length: body 4.0–5.0 mm; caudal filaments 4.5–5.5 mm. General color light brown to brown with dark brown markings. Head brown with complex dark brown markings (Fig. 36); head without spicules; maxillary palpi 3-segmented. Thoracic nota brown with irregular dark brown markings; nota with spicules; legs light brown with dark markings; femora light brown with indistinct apical macula; hind femora 35% longer than fore femora; tarsal claws with 2–4 marginal and 1 submarginal denticles. Abdominal terga brown with black transverse bands and sublateral maculae; terga 2–9 with spicules and posterior margins with submedian and sublateral stout spines (Fig. 39); operculate gills pale with dark apical macula, with basal spine; abdominal sterna pale. Caudal filaments brown.

Types.—Holotype: mature nymph. Large river, 3 mi N. Taulabe on Hwy #1, *Dept. Comayagua,* Honduras, 20-X-64, J. S. Packer, in collection UU, Salt Lake City. Paratopotypes: 5 nymphs, same data as holotype, 3 in collection California State Univ., Los Angeles, remainder in collection UU. Paratypes: GUATEMALA: 36 nymphs, Rio Latoma at km 182 on Hwy #2, 24-VII-66, RKA. HONDURAS: *Dept. El Paraiso.* 10 nymphs, Rio Yeguare, Escuela Agricola Panamerica, 26-X-64, J. S. Packer; 2 nymphs, small stream ca. 3 km E. Danli, 29-VIII-64, J. S. Packer; 5 nymphs, stream ca. 8 km E. Danli, 29-VIII-64, J. S. Packer; 4 nymphs, Rio Clarrita at San Morano on Hwy to Escuela Agricola Panamerica, 29-X-68, RKA; 1 nymph, Trib. Rio Cuayambre, 50 mi E. Danli at jct. Hwy #4, 3-IX-64, J. S. Packer. *Dept. Olancho.* 8 nymphs, stream 1 mi W. Campamento Galera turn-off on Hwy #3, 7-XI-64, J. S. Packer. *Dept. Cortes.* 1 nymph, Rio Chamelecon, Chamelecon, 18-X-64, J. S. Packer; 3 nymphs, Rio Blanco, 2 mi N. Carcol at bridge on Hwy #1, 8-X-64, J. S. Packer. *Dept. Francisco Morazan.* 2 nymphs, stream 6.5 mi from jct. Hwy #3 and #5, 7-XI-64, J. S. Packer; 1 nymph, stream nr. La Venta at jct. Hwy #3 and Rio Choluteca, 7-XI-64, J. S. Packer; 4 nymphs, small stream 10 mi E. Guaimaca on Hwy #3, 6-XI-64, J. S. Packer. *Dept. Comayagua.* 1 nymph, Rio Humuya, 1 mi N. Comayagua at bridge, 17-X-64, J. S. Packer; 1 nymph, stream 5 mi S. Comayagua on Hwy #1 at bridge, 17-X-64, J. S. Packer. Paratypes collected by J. S. Packer are in collection UU, Salt Lake City. This species is known only from Guatemala and Honduras (Fig. 54).

Leptohyphes berneri Traver

Leptohyphes berneri Traver 1958b: 84.

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

Type Locality.—Metlac, Veracruz, Mexico.

Type Deposition.—UU, Salt Lake City.

Remarks.—Traver (op. cit) distinguished this species from other described *Leptohyphes* adults only by color characters and it is doubtful that the nymph of this species can be associated. Four species of unassociated nymphs, *L. ferruginus, L. hispidus, L. packeri,* and *L. pilosus,* are known to occur in Veracruz, and any of the above may eventually be found to be the nymph of *L. berneri.*

Leptohyphes brevissimus Eaton

Leptohyphes brevissimus Eaton 1892: 12; Needham and Murphy 1924: 32; Kimmins 1934: 347, Traver 1958b: 88.

This species was described from 3 female adults collected in Guatemala.

Type Locality.—Zapote, Guatemala.

Type Deposition.—British Museum (Natural History), London.

Remarks.—Eaton's description is brief and incomplete as follows: Adult (dried)—female. Body dark pitch-brown; femur and remainder of tibiae impure white; seta white; body 2; wing 4.5–5.5; setae 2 mm. Kimmins (1934) designated a cotype from Eaton's material, but it is questionable if the male adult or the nymph can ever be assigned as this species.

Leptohyphes costaricanus Ulmer

Leptohyphes costaricanus Ulmer 1919: 45; Needham and Murphy 1924: 32.

Type Locality.—San Jóse, Costa Rica.

Type Deposition.—Hamburg Museum, Germany.

Remarks.—This species, as is the case with most *Leptohyphes* described from the adult stage, is characterized by color characters. It is distinguished from *L. priapus,* also described from Costa Rica, by its darker color, and the nymph of *L. castaneus* may eventually be found to be the nymphal stage.

Leptohyphes priapus Traver

Leptohyphes priapus Traver 1958b: 86.

This species was described from a long series of male adults collected in Central America.

Type Locality.—Rio Pedregoso, Costa Rica.

Type Deposition.—UU, Salt Lake City.

Remarks.—Traver (op cit.) characterized this species as reddish-brown, and this color serves to distinguish it from all other described adult *Leptohyphes.*

Leptohyphes zalope Traver

Leptohyphes zalope Traver 1958b: 58.

This species was described from a small series of male adults collected in southern Mexico.

Type Locality.—Bridge on Rio Zalope, 4 mi S. Rio Papagayo, Guerrero, Mexico.

Type Deposition.—UU, Salt Lake City.

Remarks.—The nymphs upon which the name *L. piraticus* is based may eventually be found to be the immature stage of *L. zalope.*

ACKNOWLEDGMENT

Grateful appreciation is expressed to S. S. Roback (Academy of Natural Sciences of Philadelphia); G. F. Edmunds, Jr. (Univ. of Utah); M. Peters (Southwest Texas State Univ.); H. B. Leech and P. H. Arnaud, Jr. (California Academy of Sciences); and K. W. Stewart (North Texas State Univ.) for the loan of specimens.

REFERENCES CITED

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

1973a. New species of *Leptohyphes* Eaton (Ephemeroptera: Tricorythidae). Pan-Pac. Entomol. 49: 363–72.

1973b. Generic revisions of mayfly nymphs. I. *Traverella* in North and Central America (Leptophlebiidae). Ann. Entomol. Soc. Am. 66: 1287–95.

Allen, R. K., and R. C. Brusca. 1973a. New species of Leptohyphinae from Mexico and Central America (Ephemeroptera: Tricorythidae). Can. Entomol. 105: 83–95.

1973b. The known geographic distribution of the Mexican mayfly genera in North America (Insecta: Ephemeroptera). E. J. Brill, Leiden, Holland, 49–63.

1978. Generic revisions of mayfly nymphs. II. *Thraulodes* in North and Central America (Leptoplebiidae). Can. Entomol. 110: 413–33.

Allen, R. G., and S. S. Roback. 1969. New species and records of New World Leptohyphinae (Ephemeroptera: Tricorythidae). J. Kans. Entomol. Soc. 42: 372–9.

Brusca, R. C. 1971. A new species of *Leptohyphes* from Mexico (Ephemeroptera: Tricorythidae). Pan-Pac. Entomol. 47: 146–8.

Burks, B. D. 1953. The mayflies, or Ephemeroptera, of Illinois. Bull. Ill. Nat. Hist. Surv. 26 (Art. 1): 216 pp.

Cohen, S. D., and R. K. Allen. 1978. Generic revisions of mayfly nymphs. III. *Baetodes* in North and Central America (Baetidae). J. Kans. Entomol. Soc. 51: 253–69.

Demoulin, G. 1952. Un faux Baetidae, *Bruchella* Navas (Insectes: Ephemeropteres). Bull. Ann. Soc. Entomol. Belg. 88: 281–5.

Eaton, A. E. 1882. An announcement of new genera of the Ephemeridae. Entomol. Mon. Mag. 18: 207–8.

1883–1888. A revisional monograph of recent Ephemeridae, or mayflies. Trans. Linn. Soc. London Sec. Ser. Zool. 3: 352 pp.

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

Edmunds, G. F., Jr., S. L. Jensen, and L. Berner. 1976. The Mayflies of North and Central America Univ. Minn. Press, 330 pp.

Kilgore, J. I., and R. K. Allen. 1973. New species, descriptions, and records of southwestern mayflies (Ephemeroptera). Ann. Entomol. Soc. Am. 66: 321–32.

Kimmins, D. E. 1934. Notes on the Ephemeroptera of the Godman and Salvin collection, with descriptions of two new species. Ann. Mag. Nat. Hist. (Ser. 10) 14: 338–53.

Navás, L. 1920. Insectos sudamaericanos (la,2a y 3a serie). Ann. Soc. Cient. Argent. XC, p. 33.

Needham, J. G., and H. E. Murphy. 1924. Neotropical mayflies. Bull. Lloyd Libr. 24, Entomol. Ser. 4: 1–79.

Packer, J. S. 1966. A preliminary study of the mayflies of Honduras. Ceiba 12: 1–10.

Traver, J. R. 1935. Part II. Systematic, p. 237–739. *In:* Needham, Traver, and Hsu, The Biology of Mayflies. Comstock Publ. Co., Ithaca, N. Y., 739 pp.

1944. Notes on Brazilian mayflies. Bol. Mus. Nacional, Brazil, Nova Ser. Zool. 22: 1–53.

1958a. The subfamily Leptohyphinae (Ephemeroptera: Tricorythidae). Part I. Ann. Entomol. Soc. Am. 51: 491–503.

1958b. Some Mexican and Costa Rican mayflies. Bull. Brooklyn Entomol. Soc. 53: 81–9.

Ulmer, G. 1919. Neue Ephemeropteren. Arch. Naturg. 85: 1–80.

Reprinted from the
ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA