

## *The Leptophlebiidae : Atalophlebiinae of New Caledonia (Ephemeroptera)*

### *Part IV. — Systematics*

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#### ABSTRACT

*This is the fourth in a series of papers on the Leptophlebiidae (Ephemeroptera) of New Caledonia. Kariona new genus is described from nymphs and adults; Papposa new genus is described only from nymphs.*

KEY WORDS : Ephemeroptera — Systematics — New Caledonia.

#### RÉSUMÉ

*Ce travail est le quatrième d'une série sur des Leptophlebiidae (Ephemeroptera) de Nouvelle-Calédonie. Le genre nouveau Kariona a été décrit à partir de stades nymphaux et adultes ; Papposa, genre nouveau, a été décrit seulement à partir des nymphes.*

MOTS-CLÉS : Éphéméroptères — Systématique — Nouvelle-Calédonie.

#### INTRODUCTION

This paper is the fourth in a series on the systematics, phylogeny, biogeography, and ecology of the Leptophlebiidae of New Caledonia. Part I of this series (PETERS, PETERS and EDMUNDS, 1978) lists all localities, methods, and acknowledgments. Part II (PETERS and PETERS, 1980) and part III (PETERS and PETERS, 1981) give a portion of the systematics.

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#### **Kariona**, new genus

(Fig. 1, 3-20, 26-27, 30-33)

IMAGO. Length of ♂: body, 9.8-10.1 mm; fore wings, 9.9-10.3 mm. Length of ♀: body, 13.0 mm; fore

wings, 14.8 mm. Eyes of ♂ separated on meson of head by a distance equal to width of a lateral ocellus, dorsally upper portion circular-shaped, lower portion of eyes 3/4 length of upper portion (Fig. 9-10); eyes of ♀ separated on meson of head by a length 4 times as great as maximum width of an eye. Wings (Fig. 3-6): maximum width of fore wings more than 1/3 (Fig. 3) to less than 1/2 (Fig. 6) maximum length of fore wings; vein Rs of fore wings forked less than 1/5 (♂) to 1/4 (♀) of distance from base to margin; vein MA forked 1/2 of distance from base to margin, fork symmetrical, distal portion of vein MA sagged posteriorly; vein MP<sub>2</sub> attached at base to vein MP<sub>1</sub> and CuA with a cross vein (Fig. 3, 6), attachment of vein MP<sub>2</sub> to MP<sub>1</sub> more than 1/4 (♂) to 1/3 (♀) of distance from base to margin, base of vein MP<sub>2</sub> equidistant from veins MP<sub>1</sub> and CuA; base of vein ICu<sub>1</sub> attached to vein CuP, a cross vein attached between vein CuA and near base of vein ICu<sub>1</sub>, remainder of Cu-A area as in Fig. 3, 6; cross veins numerous. Costal projection of hind wings convex (Fig. 4-5), apex located more than

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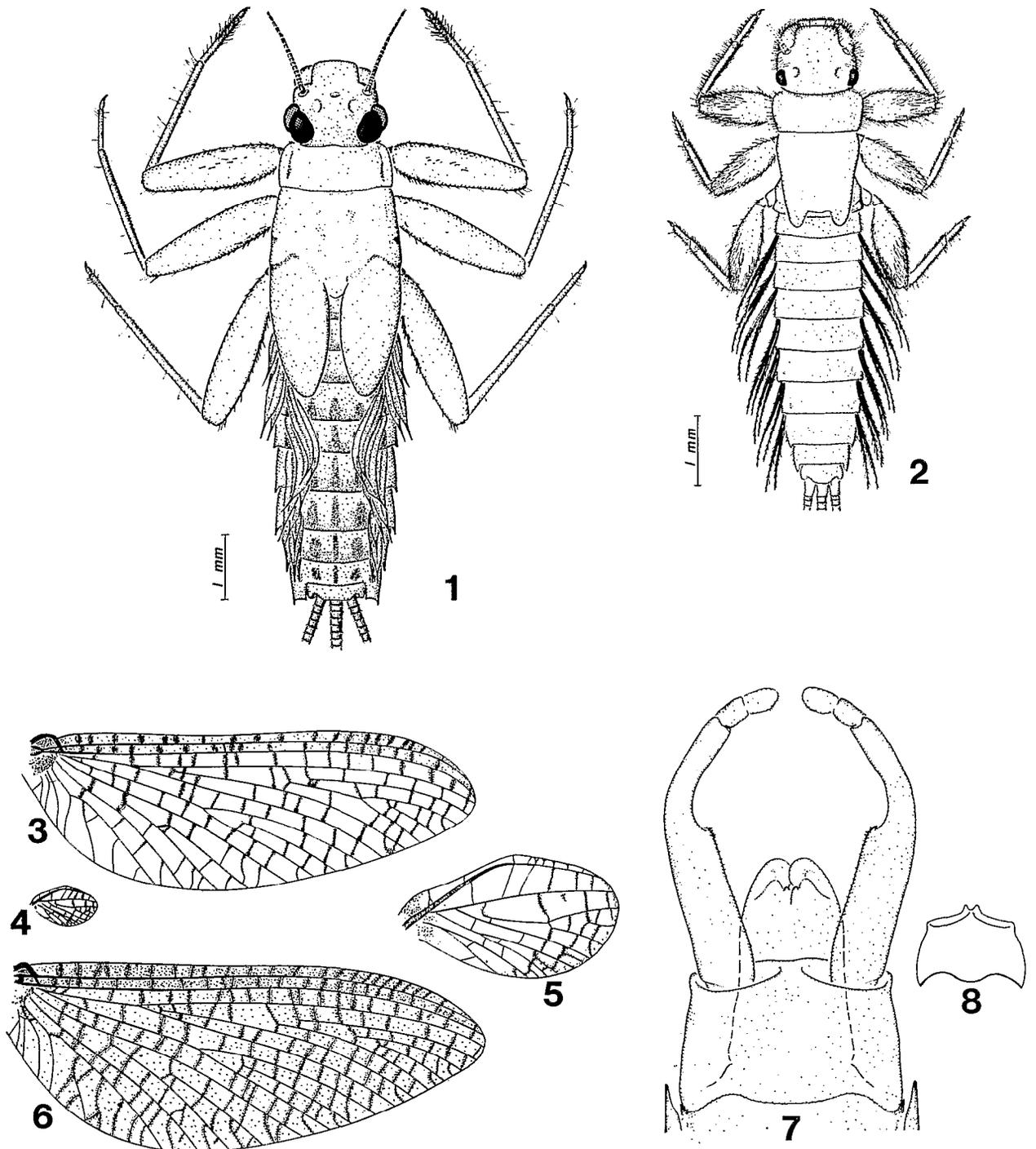


FIG. 1. — mature ♂ nymph of *Kariona quinata*. FIG. 2. — nymph of *Papposa hirsuta*. FIG. 3-8. — *Kariona quinata*, imago: 3-5, fore wing, hind wing, hind wing enlarged of ♂; 6, fore wing of ♀; 7-8, ventral view of genitalia with variation in styliiger plate of ♂

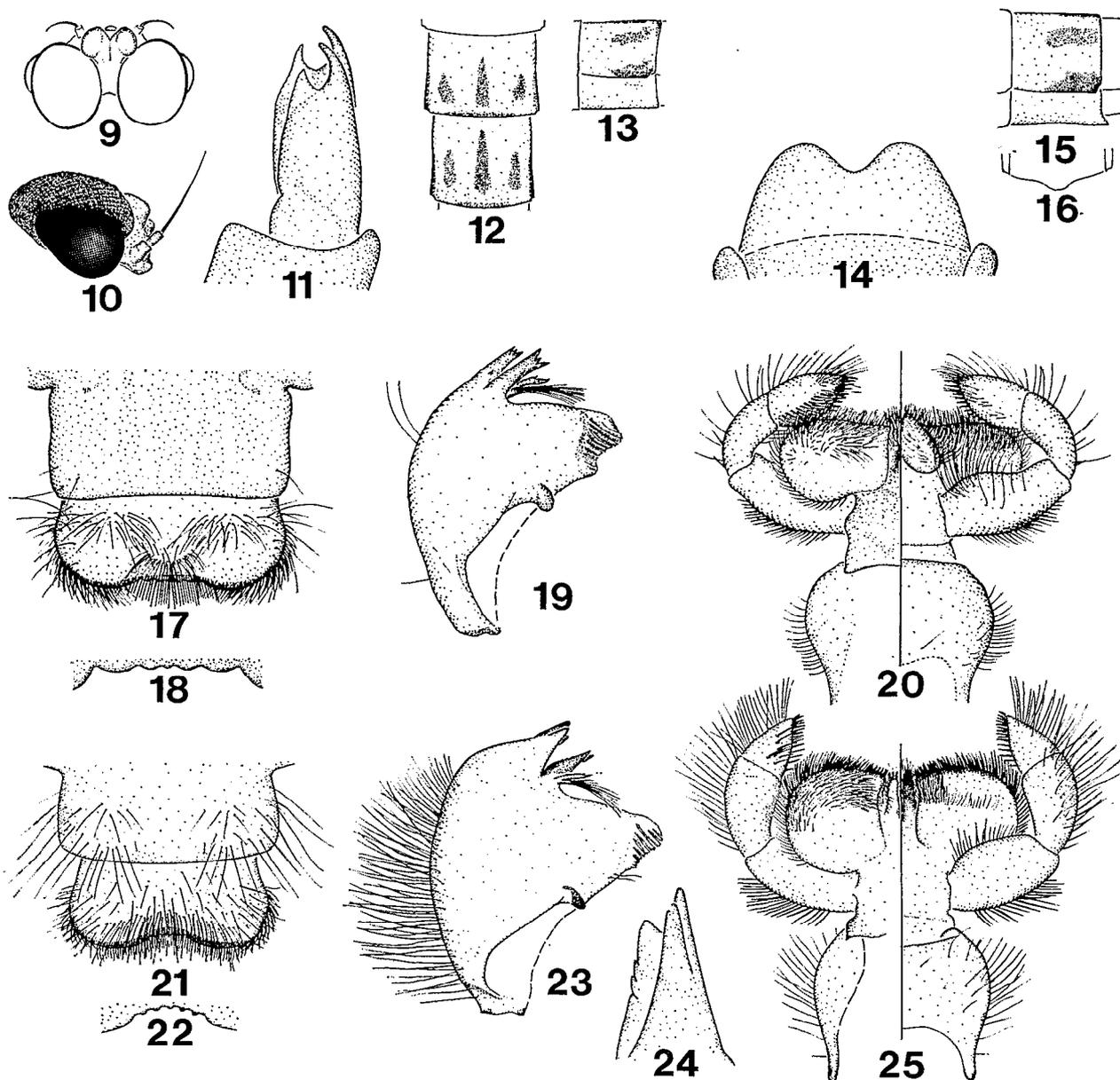


FIG. 9-16. — *Kariona quinata*, imago: 9-10, dorsal outline and lateral view of eye of ♂; 11, fore claw of ♂; 12, dorsal view of abdominal terga 5-6 of ♂; 13, lateral view of abdominal segment 5 of ♂; 14, 9th sternum of ♀; 15-16 lateral view and ventral outline of margin of abdominal segment 7 of ♀

Fig. 17-25. — Mouthparts of nymph: 17-20, *Kariona quinata*; 21-25, *Papposa hirsuta*. 17-18, 21-22, clypeus and labrum with detail of anteromedian emargination of labrum; 19, 23, left mandible; 24, detail of outer incisor of right mandible; 20, 25, labium (dorsum on left, venter on right)

1/2 distance from base; apex of wings rounded; cross veins few. Legs: ratios of segments in ♂ fore legs, 0.56:1.00 (4.50 mm): 0.02:0.30:0.30:0.20:0.09. Claws of a pair similar, both apically hooked (Fig. 11) with an opposing hook. Male genitalia (Fig. 7-8): segments 2 and 3 of forceps equal in length, segment 2 of forceps 1/8 length of segment 1, apex of segment 3 rounded; base of forceps broad, its inner margin forming an angular bend near middle of forceps, apical 1/2 of forceps curved dorsally; length of styliger plate along median line longer than 1/2 maximum width; penes fused except at apex, penes broad except broader at base, apex of each penis lobe rounded. Margin of sternum 7 of ♀ distinctly rounded with a small medial extension (Fig. 15-16). Ninth sternum of ♀ deeply cleft apically (Fig. 14). Terminal filament a little longer than cerci.

**MATURE NYMPH.** Head prognathous. Antennae broken off and missing at a length equal to 1 1/2 times maximum length of head. Mouthparts (Fig. 17-20, 26-27): dorsal hair on labrum as in Fig. 17, submedian and anterior areas of hair ventrally; anteromedian emargination with 5 rounded denticles (Fig. 18). Clypeus as in Fig. 17. Left mandible as in Fig. 19, molar area cup-shaped with serrations around edge. Lingua of hypopharynx with well developed lateral processes, paired submedian row of long hair on internal dorsal surface, apex of submedian lobes with short hair, anterior margin of lingua deeply cleft; superlingua as in Fig. 27, with a row of hair along anterior margin, lateral margins blunt. Segment 2 of maxillary palpi a little shorter than segment 1; segment 3 of palpi subequal to length of segment 2, triangular; hair on maxillae as in Fig. 26. Labium as in Fig. 20; segment 2 of palpi 3/4 length of segment 1; segment 3 of palpi a little shorter than length of segment 2, triangular, bulbous; glossae curved over ventrally, glossae ventral to paraglossae. Long sparse hair on entire body. Legs (Fig. 30-31): outer margin of femora indented near apex so tibiae can draw partially into femora (Fig. 30); apex of claws hooked and narrow, denticles on claws progressively larger apically. Gills (Fig. 32): gills on segments 1-7 alike; dorsal and ventral portions of lamellae lanceolate, long, abruptly tapered near apex; main trunk of tracheae along median line of lamellae, tracheal branches absent; main trunk of tracheae and lamellae lightly pigmented. Posterolateral spines on abdominal segments 6-9, spines progressively larger posteriorly, all spines blunt as in Fig. 33. Terminal filament a little longer than cerci.

**ETYMOLOGY.** Karionan, based on type locality. Feminine.

**TYPE SPECIES.** *Kariona quinata*, new species.

**DISCUSSION.** *Kariona* can be distinguished from all genera of the Leptophlebiidae by the following combination of characters. In the imagos: (1) costal margin of hind wings is convex (Fig. 4-5); apex is located more than 1/2 distance from base of wings; (2) claws of a pair are similar, both apically hooked (Fig. 11) with an opposing hook; (3) penes of ♂ genitalia lack appendages and are almost entirely fused (Fig. 7); and (4) margin of sternum 7 of ♀ is distinctively rounded with a small medial extension (Fig. 15-16). In the nymph: (1) glossae of labium are curved over ventrally (Fig. 20); (2) inner margin of segment 3 of labial palpi has a row of thick heavy spines (Fig. 25); (3) gills on abdominal segments 1-7 are alike, both the dorsal and ventral portions of the lamellae are lanceolate, long (Fig. 32); and (4) posterolateral spines occur on abdominal segments 6-9 and are blunt (Fig. 33).

*Kariona* does not appear to be closely related to any other Leptophlebiidae in New Caledonia or to any established genus in the family. *Kariona* does appear to be closely related to a genus from Madagascar which is unrecorded in the literature and could be related to several species of Australian "*Atalophlebia*". However, *Kariona* can be distinguished from these by the following combination of characters. In the imagos: (1) claws of a pair are similar, both apically hooked (Fig. 11) with an opposing hook; (2) penes of ♂ genitalia lack appendages and are almost entirely fused (Fig. 7); and (3) margin of sternum 7 of ♀ is distinctively rounded with a small medial extension (Fig. 15-16). In the nymph: (1) gills on abdominal segments 1-7 are alike; both the dorsal and ventral portions of the lamellae are lanceolate, long (Fig. 32); (2) posterolateral spines occur on abdominal segments 6-9 and are blunt (Fig. 33); and (3) denticles on claws are progressively larger apically (Fig. 31).

The styliger plate of the ♂ genitalia of a few specimens from locality No. N35 possesses paired, submedian protuberances (Fig. 8).

Because of the small series of nymphs, the legs were not sectioned. Generally, the maximum width of the tibiae is a little greater than that of the tarsi and the tibiae appear flattened.

#### ***Kariona quinata*, new species**

(Fig. 1, 3-20, 26-27, 30-33)

**MALE IMAGO** (in alcohol). Upper portion of eyes dark reddish-brown, lower portion light blackish-brown (Fig. 9-10). Head light yellowish-brown. Antennae light yellowish-brown, flagellum paler. Basal half of ocelli brown, apical half white. Thorax

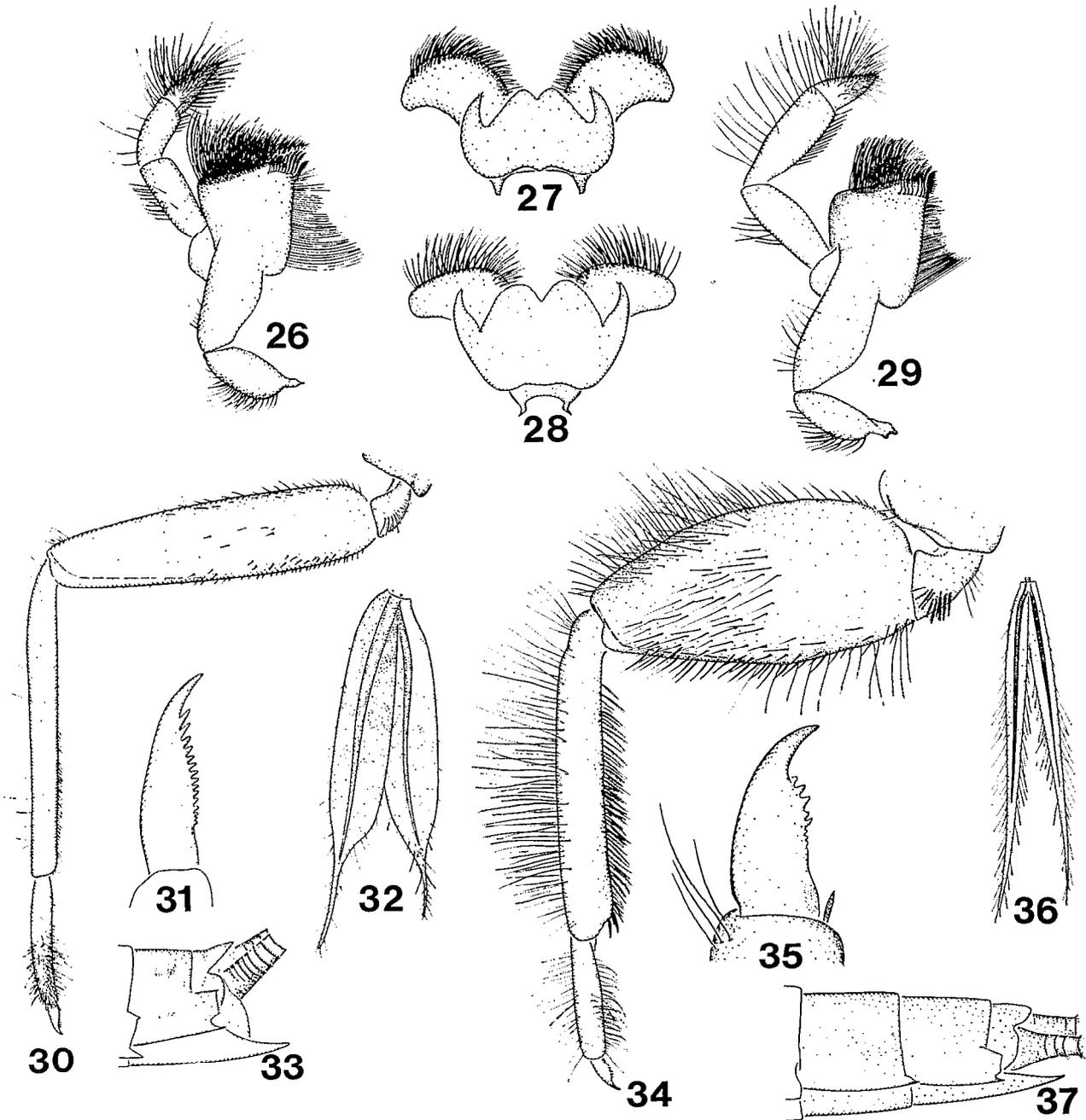


FIG. 26-37. — Nymph: 26-27, 30-33, *Kariona quinata*; 28-29, 34-37, *Papposa hirsuta*. 26, 29, ventral view of right maxilla; 27-28, hypopharynx; 30, 34, fore leg; 31, 35, fore claw; 32, 36, gill 4; 33, 37, lateral view of abdominal segments 8-10 (37) or 9-10 (33)

yellowish-brown, carinae darker, sutures paler; area around outer parasidal sutures, lateral areas of pronotum and mesoscutellum, and pleural areas dorsal to leg bases darker brown. Legs light yellowish-brown, tarsi paler. Wings (Fig. 3-5): longitudinal veins of fore and hind wings light brown, cross veins of fore and hind wings dark brown and surrounded with dark brown clouds, clouds narrow in posterior half of fore wings and basal half of hind wings, except cross veins anterior to costal projection of hind wings light brown with no dark brown clouds; membrane of fore and hind wings hyaline, except apical 1/3 of cells C and Sc of fore wings translucent light brown; membrane at base of fore and hind wings and apex of hind wings brown. Abdomen: light yellowish-brown; a dark blackish-brown, narrow, transverse band on posterior margin of terga 1-7, band faded on terga 4-7; median, submedian, and lateral dark blackish-brown bars on posterior half of terga 1-9 (Fig. 12-13), median bar faded on terga 1-3, submedian and lateral bars shorter on tergum 9; spiracles dark brown, tracheae hyaline. Genitalia (Fig. 7): light yellowish-brown. Caudal filaments light yellowish-brown, annulations at articulations darker.

**FEMALE IMAGO** (in alcohol). Eyes brownish-black. Head light yellowish-brown. Antennae light yellowish-brown, flagellum paler. Basal half of ocelli brown, apical half white. Color and marks of thorax as in ♂ imago. Legs light yellowish-brown. Wings (Fig. 6): longitudinal veins of fore and hind wings light yellowish-brown, cross veins of fore and hind wings dark brown and surrounded with dark brown clouds; membrane hyaline, light brown, except apical 1/3 of cells C and Sc of fore wings translucent, base of fore and hind wings darker. Abdomen: color and marks as in ♂ imago, except submedian and lateral bars on tergum 1 fused; a small median blackish-brown macula on tergum 10. (Caudal filaments broken off and missing.)

**MATURE NYMPH** (in alcohol). Head: light yellowish-brown. Thorax: light yellowish-brown, base of fore and hind wing pads blackish-brown. Legs: light yellowish-brown. Abdomen: color and marks as in ♂ and ♀ imagos, except posterior transverse band on abdominal terga 1-7 indistinct. Gills (Fig. 32): membrane gray, darker near middle; main trunk of tracheae light black, faded apically. Caudal filaments light yellowish-brown.

**SPECIMENS.** Holotype ♂ imago, No. N35; allotype ♀ imago, No. N35; paratypes: 2 nymphs, No. N15; 2 ♂ imagos, 1 ♂ subimago, No. N35; 1 nymph, No. N53. All types are in alcohol. Association of the nymph and adults is by the abdominal color pattern on specimens from the same locality. All types are

deposited in the following collections: holotype, allotype, 1 nymphal paratype at FAMU; 1 nymphal paratype, 1 ♂ paratype at UU and BPBM, 1 ♂ subimaginal paratype at O.R.S.T.O.M.

**ETYMOLOGY.** *quini*, Gr., meaning five.

**BIOLOGY.** *Kariona quinata* was found only at localities No. N15, N35, and N53. Nymphs from a tributary of the Rivières Karionan (No. N15 and N35) were collected from September 10 to October 11-12 with a water temperature of 18.3-18.9 °C. All adults obtained were collected in October 11-12. Later, November 14, water temperature of 20.5 °C, no nymphs or adults were collected.

Nymphs were found burrowed into coarse sand in quiet pool-like areas. All adults were collected at light. Early arrivals at the light trap were imagos and subimagos arrived later. No swarming was observed.

### **Papposa**, new genus

(Fig. 2, 21-25, 28-29, 34-37)

**IMAGO.** Unknown.

**MATURE NYMPH.** Head prognathous. Antennae 2 1/2 times maximum length of head. Mouthparts (Fig. 21-25, 28-29): dorsal hair on labrum as in Fig. 21; submedian areas of hair ventrally; antero-median margin deeply cleft, 5 small denticles on anteromedian cleft (Fig. 22). Clypeus as in Fig. 21. Left mandible as in Fig. 23. Lingua of hypopharynx with well developed lateral processes, paired submedian row of long hair on internal dorsal surface, anterior margin of lingua deeply cleft; superlingua as in Fig. 28, with row of hair along anterior margin, lateral margins rounded. Segment 2 of maxillary palpi a little longer than length of segment 1; segment 3 of palpi a little shorter than 1/2 length of segment 2, triangular; hair on maxillae as in Fig. 29. Labium as in Fig. 25; segment 2 of palpi a little shorter than length of segment 1; segment 3 of palpi 1/2 length of segment 2, triangular, broad; paraglossae ventral to glossae. Sparse long hair over entire body. Legs (Fig. 34-35): outer margin of femora indented near apex so tibiae can draw partially into femora (Fig. 34); apex of claws hooked and narrow, basal 3-5 denticles small, progressively larger; apical 5 denticles larger, not equal sized (Fig. 35). Gills (Fig. 36): gills on segments 1-7 alike; gills deeply forked and 2 portions of lamellae overlap, each portion long, slender and smoothly tapered to apex, lateral margins of both lamellae with long hair; main trunk of tracheae forked near base of gills and each branch along median line of each

portion of lamellae; main trunk darkly pigmented. Posterolateral spines on abdominal segments 6-9, spines progressively larger posteriorly, apex of posterolateral spines on segment 9 blunt (Fig. 37). Terminal filaments a little longer than cerci.

ETYMOLOGY. pappos, Gr., meaning hairy. Feminine.

TYPE SPECIES. *Papposa hirsuta*, new species.

DISCUSSION. *Papposa* can be distinguished from all genera of the Leptophlebiidae by the following combination of characters in the nymphs: (1) inner margin of segment 3 of labial palpi has a row of thick heavy spines (Fig. 25); (2) glossae of labium are flat (Fig. 25); (3) abdominal gills are deeply forked and 2 portions are long, slender and smoothly tapered to apex (Fig. 36); and (4) basal 3-5 denticles on claws are small and progressively larger; apical 5 denticles are larger and not equal sized (Fig. 35).

*Papposa* appears to be most related to "*Zephlebia*" *cruentata* from New Zealand as defined by Towns and Peters (1980), but can be distinguished from it by the following combination of characters in the nymph: (1) outer margins of mandibles are nearly straight except for abrupt obtuse curve below outer incisor (Fig. 23); (2) abdominal gills are deeply forked and 2 portions are long, slender and smoothly tapered to apex (Fig. 36); (3) posterolateral spines occur on abdominal segments 6-9; apex of posterolateral spines on segment 9 is blunt (Fig. 37); and (4) basal 3-5 denticles on claws are small and progressively larger; apical 5 denticles are larger and not equal sized (Fig. 35).

Because of the small series of nymphs, the legs were not sectioned. Generally, the maximum width of the tibiae is about 2 times the maximum width of the tarsi and the tibiae appear flattened.

It is not normally our practice to establish new genera on species known only from the nymphs.

However, *Papposa* is so distinctive we feel it is important to add the genus to this work.

***Papposa hirsuta*, new species**

(Fig. 2, 21-25, 28-29, 34-37)

MALE IMAGO. Unknown.

FEMALE IMAGO. Unknown.

NYPH (in alcohol). Head light brown, venter paler; vertex washed lightly with darker brown as in Fig. 2. Thorax: light brown, venter paler; lateral margins of nota darker. Legs: light brown, apex of tibiae with a darker brown, thin, transverse band on dorsal surface. Abdomen: light brown; lateral margins of terga 1-8 darker brown as in Fig. 37. Gills (Fig. 36): membrane translucent, gray, tracheae black. Caudal filaments light brown.

SPECIMENS. Holotype ♂ immature nymph, No. N22; paratypes: 2 nymphs, No. N27; 1 nymph, No. FNK35. All types are in alcohol. All types are deposited in the following collections: holotype and 1 nymphal paratype at FAMU; 2 nymphal paratypes at UU.

ETYMOLOGY. hirsutus, L., meaning hair.

BIOLOGY. *Papposa hirsuta* has been collected along the East Coast and Southern Region in small to large streams. Nymphs were found in streams with water temperatures of 18.6-20 °C and at about 153 m elevation. All nymphs were immature.

Nothing is known about the habits of this species. However, all 4 nymphs are heavily encrusted with silt. The nymphs may burrow into silt.

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## APPENDIX

Figures of *Kariona quinata* were made from specimens collected at the type locality and from No. N15 (FIG. 1, 17-20, 26-27 30-33). Most figures of *Papposa hirsuta* were prepared from a specimen collected at FNK35, except FIG. 36 from N22.