

THE LEPTOPHLEBIIDAE OF NEW CALEDONIA (EPHEMEROPTERA)

PART I. — INTRODUCTION AND SYSTEMATICS

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RÉSUMÉ

Tous les exemplaires d'Éphéméroptères collectés en Nouvelle-Calédonie sont des Leptophlebiidae appartenant à des espèces et des genres nouveaux.

Ce travail est le premier d'une série sur la systématique, la phylogénie, la biogéographie et l'écologie des Leptophlebiidae de Nouvelle-Calédonie.

Il traite des genres Lepeorus n. g. et Lepegenia n. g. avec une description des espèces.

INTRODUCTION

The only published record of Ephemeroptera from New Caledonia lists 2 male imagos and 1 female subimago collected by Miss L. E. CHEESMAN from Nouméa on 2 August 1949. KIMMINS (1953) doubtfully identified these specimens as? *Atalophlebia* sp. We have examined this material and the 2 male imagos represent one new species and genus while the 1 female subimago represents another new species and genus. All 3 specimens will be discussed later in this series of papers.

In June 1965, we received from Professor Dr. F. STARMÜHLNER a collection of mayfly nymphs from New Caledonia. All specimens were Leptophlebiidae and none were identifiable to known species and genera in the world.

This collection prompted one of us (WLP) to request from the National Geographic Society, Washington, D. C., funds to collect and rear mayflies in New Caledonia. All mayfly specimens obtained

on this trip were again Leptophlebiidae, except for 2 adult specimens of *Pseudocloeon?* from Rivière Bleue. These 2 specimens will be discussed later in this series of papers.

This paper is the first in a series on the systematics, phylogeny, biogeography, and ecology of the Leptophlebiidae of New Caledonia. The study is based on all known mayfly specimens from New Caledonia.

LOCALITIES

This work includes specimens from 115 localities in New Caledonia. To decrease the length of the series of papers, all specimens given in the systematics sections are listed by original field number only. All localities used in this study are listed below with their original field number. All vials with specimens studied include a full locality label and original field number.

As a large number of localities are used in this work, it is useful to discuss general distributions of species by arbitrary geographical subdivisions of New Caledonia. These geographical subdivisions do not entirely correspond to biological subdivisions of New Caledonia, and biological subdivisions will be discussed later.

New Caledonia is defined for purposes of general distributions of species as the main island or « Grande Terre » only, even though administratively New Caledonia includes the Grande Terre, Ile des Pins, Archipel des Belep, and the Récif d'Entrecasteaux (Le BORGNE, 1964). The three geographical subdivisions of Grande Terre as defined here are: the Southern Region, the West Coast, and the East Coast.

The Southern Region includes the southern one-fourth of the main island and corresponds generally to the large southern peridotite and serpentine geologic area. The West Coast includes the southwestern half of the northern three-quarters of the main island. The inner boundary of the West Coast is a line of high mountain peaks along the longitudinal axis of the main island. The East Coast includes the northeastern half of the northern three-quarters of the main island.

The Ile des Pins is defined as the fourth major subdivision. While the Archipel des Belep has freshwater streams, no Ephemeroptera have been collected on the archipelago and it is not considered here. The remaining areas of New Caledonia and Dependencies have no freshwater streams and are also not considered here.

LOCALITIES OF W. L. AND J. G. PETERS,
G. F. EDMUNDS, JR. AND W. M. BECK, JR.

This list includes all localities collected during the 1972 trip financed by the National Geographic Society. The collectors' names have been omitted as each person collected various groups at each locality. However, the locality labels for all types of Ephemeroptera give the specific collector of the specimens. Further, on all locality labels the locality number is suffixed with an « e » if the specimens were collected by G. F. EDMUNDS, Jr., or with a « b » if collected by W. M. BECK, Jr. No suffix is added to the locality number if the specimens were collected by W. L. and J. G. Peters. All suffixes have been dropped from locality numbers listed herein.

N12. S. Branch, Dumbéa Riv., 12 km NE of Dumbéa. 31m. 21 °C. 6-IX-1972.

N13. Nondoué Riv., 12 km NW of Dumbéa. 31m. 18 °C. 6-8-IX-1972.

N14. Stream, Val de l'Hermitage, 1km NE of Terr. Route 1. 76m. 18 °C. 7-IX-1972.

N15. Trib. of Karionan Riv., 5 km NNW of Païta. 122m. 18 °C. 10-IX-1972.

N16. Ouen Koh Riv., Col d'Amieu Forest Station. 366m. 18 °C. 13-IX-1972.

N17. Stream, headwaters of Fonwhary Riv., 1.3 km SE of Col d'Amieu on Terr. Route 5. 412m. 16.5 °C. 14-15-IX-1972.

N18. Stream, headwaters of Fonwhary Riv., 4 km SE of Col d'Amieu on Terr. Route 5. 183m. 17 °C. 15-IX-1972.

N19. Ba Quinoré Riv., 3 km NE of Col d'Amieu Forest Station on Terr. Route 5. 259m. 18 °C. 15-IX-1972.

N20. Sarraméa Riv., Sarraméa. 31m. 16-IX-1972.

N21. Stream on Eaux et Forêts road, NW of Col d'Amieu. 412m. 16-IX-1972.

N22. Stream on Mt. Pouédihi, 17 km W of Ouénarou Forest Station on Eaux et Forêts road. 190m. 19 °C. 21-IX-1972.

N23. Stream, Ouénarou Forest Station. 137m. 21-22-IX-1972.

N24. Roadside ditch, 6.4 km NW of Ouénarou Forest Station, on Eaux et Forêts road. 137m. 22-IX-1972.

N25. Stream on Mt. Pouédihi, Bon Secours, 7 km NW of Ouénarou Forest Station, on Eaux et Forêts road. 153m. 20.5 °C. 22-IX-1972.

N26. Riv. des Pirogues, 2.5 km SW of Col de Ouénarou, on Terr. Route 2. 137m. 20.5 °C. 23-IX-1972.

N27. Stream on Pic Mourange, Camp des Travaux Publics on Terr. Route 2. 153m. 20 °C. 24-29-IX-1972.

N28. Nondoué Riv., 12 km NW of Dumbéa. 31m. 28-IX-1972.

N29. Hôtel Lantana, Anse-Vata, Nouméa. 3m. 1-X-1972.

N30. Ile des Pins: Kuto Forest Station. 3m. 2-3-X-1972.

N31. Ile des Pins: Grotte d'Oumagne. 15m. 20.5 °C. 3-6-X-1972.

N32. Ile des Pins: Stream, Wapan. 15m. 3-X-1972.

N33. Ile des Pins: Stream on Pic Meunier. 80m. 27 °C. 3-X-1972.

N34. Stream, Val de l'Hermitage, 1 km NE of Terr. Route 1. 76m. 19 °C. 10-X-1972.

N35. Trib. of Karionan Riv., 5 km NNW of Païta. 122m. 19 °C. 11-12-X-1972.

N36. Ponérihouen Forest Station, Ponérihouen. 31m. 16-X-1972.

N37. Stream on Mt. Aoupinié, 22 km SW of bridge at Ponérihouen on Goa road. 458m. 18-19 °C. 17-21-X-1972.

N38. Stream, 21 km W of junc. of Tchamba Riv. road & Terr. Route 3, on Tchamba Riv. road. 61m. 28 °C. 18-X-1972.

N39. Stream, 16 km W of junc. of Tchamba Riv. road & Terr. Route 3, on Tchamba Riv. road. 46m. 22 °C. 18-X-1972.

N40. Nérihouen Riv., Goa, 13.5 km SW of bridge at Ponérihouen. 31m. 24 °C. 18-20-X-1972.

N41. Poema Riv., Kavatch-Hienghène Forest Station, Station Castex. 46m. 24.5 °C. 23-29-X-1972.

N42. Stream on Mt. Gaata, 4.3 km NW of Station Castex. 76m. 19 °C. 22-29-X-1972.

N43. Hienghène Riv., Tindo. 122m. 24 °C. 25-X-1972.

N44. Stream below Cascade de Ouaina, Cap Colnett, 1.4 km NW of Galarino. 6m. 22 °C. 27-X-1972.

N45. Ouen Koh Riv., Col d'Amieu Forest Station. 366m. 21 °C. 31-X-1972.

N46. Stream on Eaux et Forêts road, NW of Col d'Amieu. 412m. 18 °C. 31-X-1972.

N47. Stream, headwaters of Fonwhary Riv., 1.3 km SE of Col d'Amieu on Terr. Route 5. 412m. 18 °C. 31-X-1972.

N48. Anse-Vata, Nouméa. 3m. 3-XI-1972.

N49. Stream, Ouénarou Forest Station. 137m. 5-XI-1972.

N50. Stream on Mt. Pouédihi, 15 km W of Ouénarou Forest Station, on Eaux et Forêts road. 153m. 19.5 °C. 5-XI-1972.

N51. Riv. Bleue at bridge on Eaux et Forêts road. 21 km NW of Ouénarou Forest Station. 165m. 19 °C. 6-7-XI-1972.

N52. Stream on Mt. Pouédihi, Bon Secours, 7 km NW of Ouénarou Forest Station, on Eaux et Forêts road. 153m. 8-10-XI-1972.

N53. Stream on Mt. Pouédihi, 16.5 km W of Ouénarou Forest Station, on Eaux et Forêts road. 190m. 8-10-XI-1972.

N54. Trib. of Karionan Riv., 5 km NW of Paita. 122m. 20.5 °C. 14-XI-1972.

N55. Stream on Pic Mouirange, Camp des Travaux Publics on Terr. Route 2. 153m. 23 °C. 15-XI-1972.

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With the exception of the two localities given below, all localities collected by Prof. Dr. STARMÜHLNER are listed in STARMÜHLNER (1968). Physical and chemical data for these localities are given in STARMÜHLNER (1968) and additional data on most localities also appear in STARMÜHLNER (1970). In the text of this paper, these localities are preceded by « FNK. »

FNK6. Fluss Dumbéa, oberer Mittellauf, ca. 1 km flussabwärts von FNK10, 11, 13, Peridotit, Uferregion. Keine nähere Fundortangaben! Leg.: F. Starmühlner. 12-VII-1965.

GNK30. Fluss Thy, Mittellauf, ca. 3 km flussabwärts von FNK56-57, Übergang vom Urwald in Niaouli-Savanne, bzw. Serpentin-Macchie ; Schiefer, Granit, Peridotit, leg.: G Weninger. 5-VIII-1965.

LOCALITY OF PROF. DR. J. ILLIES

J12. Stream at Col d'Amieu. 478m. 17.5 °C. 13-14-IX-1966.

LOCALITY OF MISS L. E. CHEESMAN

Cl. Nouméa. 2-VIII-1949.

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SYSTEMATICS

The following terms and procedures used in the descriptions of the imagos and nymph require further explanation. The lengths of the body and fore wings of the male and female imagos are given as the total observed variation within a genus or subgenus. Venational terminology used is as given in PETERS and EDMUNDS (1970). Each segment of the fore legs of the male imago is compared to the length of the fore tibiae and expressed as a ratio. The average length in millimeters of the fore tibiae is given in parentheses. In the figures of the labia of the genera, the ventral surface is shown on the right hand side of the drawing, and the dorsal surface is shown on the left. All illustrations in this series of papers have been prepared by one of us (JGP).

In the discussion of each newly established genus, the genus is distinguished from all other known genera of Leptophlebiidae. As the New Caledonian genera will be established in a series of papers,

it is difficult to distinguish a particular genus from its most closely related genus as the latter may be established in a later paper of the series. Therefore each newly established genus will only be distinguished from its closest relative known in the literature. A later paper in this series will discuss the phylogeny and relationships of all New Caledonian genera of the Leptophlebiidae.

Abbreviations for collections in which specimens are deposited are: FAMU, Florida A&M University; UU, University of Utah; BPBM, Bernice P. Bishop Museum, Honolulu; O.R.S.T.O.M., Office de la Recherche Scientifique et Technique Outre-Mer, Nouméa; CTFT, Centre Technique Forestier Tropical, Nouméa; NMNH, National Museum of Natural History, Washington, D.C.; and BM(NH), British Museum (Natural History), London.

Lepeorus, new genus

(Fig. 1-3, 7-94)

IMAGO. Length of ♂: body, 8.0-14.1 mm; fore wings, 8.9-14.5 mm. Length of ♀: body, 7.9-15.6 mm; fore wings, 9.8-19.0 mm. Eyes of ♂ meet on meson of head, upper portion circular-shaped dorsally, lower portion 3/4 length of upper portion (Fig. 43-44); eyes of ♀ separated on meson of head by a length 3 times as great as maximum width of an eye. Wings (Fig. 7-14): maximum width of fore wings 1/3 maximum length of fore wings; vein R_s of fore wings forked less than 1/4 to 1/4 of distance from base to margin; vein MA forked less than 1/2 to a little more than 1/2 of distance from base to margin, fork symmetrical; vein MP_2 attached at base to veins MP_1 and CuA with a cross vein (Fig. 7), attachment of vein MP_2 to MP_1 less than 1/3 to 1/3 of distance from base to margin, base of vein MP_2 equidistant between veins MP_1 and CuA to nearer to vein CuA; vein ICu_1 attached to veins CuA and CuP with a cross vein, remainder of Cu-A area as in Fig. 7; cross veins numerous. Costal margin of hind wings convex (Fig. 8-9), with concavity located 1/2 distance from base; apex of wings acute, rounded; cross veins few. Legs: ratios of segments of ♂ fore legs, 0.65-0.56: 1.00 (3.20-5.00 mm): 0.06-0.05: 0.30-0.25: 0.25-0.20: 0.20-0.16: 0.13-0.10. Claws of a pair dissimilar, one apically hooked (Fig. 15), other obtuse, pad-like. Male genitalia (Fig. 16-42): segment 2 of forceps equal to length of segment 3, segment 2 of forceps 1/7 to 1/6 length of segment 1, apex of segment 3 blunt; base of forceps broad, its inner margin forms an angular bend near middle of forceps; length of styliger plate along median line 1/4 to 1/3 maximum width, posterior margin of styliger plate (Fig. 29-42) with paired small submedian protuberances (Fig. 21, 26, 32-33, 37-42) to median shallow cleft (Fig. 30-31); penes fused except for

apical 1/5, penes broad except broader near base, apex of each penis lobe with an apical or subapical bulbous lobe, each penis lobe with a semicircular row of spines near base of apical bulbous lobe, apex of spines pointed towards apex of penis lobes (Fig. 16-28). Female with a genital extension extended to the anterior third of abdominal segment 8 (Fig. 62-63). Ninth sternum of ♀ shallowly cleft apically (Fig. 64). Terminal filament a little longer than cerci.

MATURE NYMPH. Head prognathous. Antennae a little longer than maximum length of head. Mouthparts (Fig. 70-74): labrum greatly expanded laterally; dorsal hair on labrum as in Fig. 72; submedian and anterior areas of hair ventrally. Clypeus as in Fig. 72. Left mandible as in Fig. 70. Lingua of hypopharynx with well developed lateral processes, paired submedian longitudinal row of long hair on internal dorsal surface, apex of submedian lobes with internal submarginal rack-like processes, anterior margin deeply cleft; superlingua as in Fig. 73 with a row of hair along anterior margin, lateral margins blunt. Segment 2 of maxillary palpi a little longer than length of segment 1; segment 3 of palpi 3/4 to 2/3 length of segment 2, triangular; a V-shaped ridge near the ventral, inner, anterolateral margin of maxillae; hair on maxillae as in Fig. 71. Labium as in Fig. 74; segment 2 of palpi 2/3 to a little less than length of segment 1; segment 3 of palpi a little less than 1/2 length of segment 2, triangular; paraglossae ventral to glossae. A row of short hair on dorsal mid-line of abdomen, row divides into 2 parallel submedian rows on mesonotum, hair on mesonotum often appears irregularly spaced, 2 rows divergent near anterior half of pronotum and continue along inner margin of eyes (Fig. 1); a row of short hair on dorsum of all 3 caudal filaments and extends length of filaments although reduced to a single long hair at margin of each segment over apical 4/5 of filaments. Legs (Fig. 75-88): maximum width of tibiae a little larger than maximum width of tarsi (Fig. 76-77), tibiae in cross section triangular (Fig. 76); outer margin of femora indented near apex so tibiae can draw partially into femur (Fig. 75); apex of claws hooked and narrow, denticles on claws variable (Fig. 78-88), 1 row or 2 to 3 groups of short, variable denticles. Gills (Fig. 1-2, 65-69): gills on segments 1-7 and together form a suction cup disc on venter of abdomen (Fig. 2); each gill consists of a single plate-like lamella, heavily sclerotized at base and along main trunk of tracheae, each gill thick except along margin, margin thin and fringed (Fig. 66-67); gills 1 laterally expanded and meet along mid-line of sternum 1 (Fig. 2, 65); gills 7 folded longitudinally and curved under to meet along mid-line of sternum 7 (Fig. 2, 68-69);

main trunk of tracheae short, thick, and along median line of lamellae; tracheal branches greatly branched; tracheae pigmented to hyaline. Posterolateral spines on abdominal segments 2-7, spines progressively larger anteriorly, except spine on segment 2 a little smaller; blunt posterolateral projections on abdominal segments 8-9 (Fig. 3). Terminal filament longer than cerci.

Etymology. *lepeorus*, an arbitrary combination of letters. Masculine.

TYPE SPECIES. *Lepeorus goyi*, new species.

DISCUSSION. *Lepeorus* can be distinguished from all genera of the Leptophlebiidae by the following combination of characters. In the imagos: (1) the Cu-A area of the fore wings possesses 2 long intercalaries (Fig. 7); (2) maximum width of fore wings is 1/3 maximum length of fore wings (Fig. 7); (3) costal margin of hind wings is convex with concavity located 1/2 distance from base of wing (Fig. 8-9); (4) apex of each penis lobe of the male genitalia has an apical or subapical, bulbous lobe (Fig. 16-28); and (5) female possesses a genital extension which is extended to the anterior third of abdominal segment 8 (Fig. 62). In the nymphs: (1) abdominal gills are plate-like and occur on segments 1-7; together gills form a suction cup disc on venter of abdomen (Fig. 1-2); (2) a row of short hair occurs on dorsal mid-line of abdomen and thorax; row forks near posterior margin of pronotum (Fig. 1); (3) posterolateral spines occur on abdominal segments 2-7 (Fig. 1-3); (4) width of labrum is greatly expanded past lateral margins of clypeus (Fig. 72); and (5) outer margin of mandibles is strongly curved at right angles (Fig. 70).

Lepeorus appears to be most closely related to *Lepegenia* and can be distinguished from it by the following combination of characters. In the nymphs: (1) abdominal gills 1 are greatly expanded ventrally and meet on venter of abdomen (Fig. 1-2, 65); (2) posterolateral spines occur on abdominal segments 2-7 and blunt projections on 8-9 (Fig. 3); (3) segment 3 of labial palpi is less than 1/2 length of segment 2 (Fig. 74); (4) left mandible is as in Fig. 70; and (5) claws are variable, with a single irregular row to 2 to 3 groups of variable denticles (Fig. 78-88).

Superficially, *Lepeorus* appears to be closely related to *Deleatidium* from New Zealand and *Kirrara* from Australia as the nymphs all have abdominal gills modified into suction discs. However, in a later paper we will discuss data that show such a gill modification has independently derived in the 3 geographical areas.

The penes of the male genitalia of *Lepeorus* are weakly sclerotized and sometimes distorted in microscopic preparations. Therefore, we have includ-

ed figures of the apical portion of the penes drawn from free-floating specimens (Fig. 17-20, 22-25, 27-28).

KEY TO THE SPECIES OF *Lepeorus*, NEW GENUS

IMAGOS

1. Abdominal terga 1-8 with a solid black or blackish-brown color pattern (Fig. 58-59); median line of terga pale (Fig. 58), pale with submedian dark longitudinal dashes (Fig. 59), or pale with large pale median areas on terga 4-5 as in Fig. 1..... *L. thierryi*
- Abdominal terga 1-8 with a mottled brown to blackish-brown color pattern (Fig. 45-49, 53-55); median line of terga covered with mottled pattern (Fig. 46-49, 53-54), or terga yellowish-brown with only scattered brown mottles (Fig. 45, 55)..... 2
2. Abdominal terga 1-7 with mottled brown to blackish-brown color distributed evenly over dorsum of terga, except posteromedian and posterior margin of terga paler, intensity of color on median line same as that on other portions of each tergum (Fig. 53-55); for wings of ♂ with large dark macula in bullar region, usually extended over 3-2 cross veins between Sc and R₁ (Fig. 7, 13-14); posterior margin of styliger plate of ♂ with paired submedian protuberances (Fig. 21, 37-40)..... *L. calidus*, 3
- Abdominal terga 1-7 with mottled brown to blackish-brown color distributed over dorsum of terga in patterns (Fig. 45-49), patterns range from very dark solid mottles with heavy median line (Fig. 48-49) to submedian semi-rectangular pale areas in posterior 1/2 to 5/6 of terga and heavy median line only in apical portion of terga (Fig. 45-46); fore wings of ♂ with medium-sized to small macula in bullar region, usually extended over 1-2 cross veins between Sc and R₁ (Fig. 10-12); posterior margin of styliger plate of ♂ smooth or with irregular small protuberances (Fig. 16, 29-31, 34-36), exceptionally with small paired protuberances (Fig. 32-33)..... *L. goyi*, 4
3. Sternum 2 with darker brown or reddish-brown markings and open cloverleaf pattern on median area as in Fig. 57; fore wings of ♂ with heavy brown clouds surrounding cross veins in costal cells of basal half of wings (Fig. 14)..... *L. calidus calidus*
- Sternum 2 with darker markings in anterior area only, not as above; fore wings of ♂ with light brownish clouds surrounding cross veins in costal cells of basal half of wings (Fig. 13)..... *L. calidus notialis*
4. Sterna 1-6 with lateral black markings as in Fig. 52; darker blackish median line extended through abdominal terga 1-5 (Fig. 48-49); pale submedian semi-rectangular areas absent or occur on posterior half of terga 4-6 (Fig. 48-49); posterior margin of styliger plate of ♂ with irregular form or small protuberances (Fig. 33-36).
..... *L. goyi australis*
- Sterna 1 or 1-2 only with lateral black markings; darker median line extended from apical portion to through apical half of terga 1-5 (Fig. 45-46); pale submedian semi-rectangular areas occur posteriorly on more than 1/2 to about 5/6 of terga 4-6 (Fig. 45-46); posterior margin of styliger plate of ♂ smooth (Fig. 16, 29-31)
..... *L. goyi goyi*

MATURE NYMPHS

1. Abdominal terga 1-8 with solid blackish-brown to black color without mottles, patterns similar to Fig. 1, 58-59; abdominal gills solid gray-black to black (Fig. 67-68); found on vertical rock faces in waterfalls. . . . *L. thierryi*
- Abdominal terga 1-8 with mottled brown to blackish-brown color, color patterns similar to Fig. 45-49, 53-55; abdominal gills whitish with light to heavy mottled gray or gray-black color (Fig. 65-66); found in cool or warm rocky rivers and streams. 2
2. Abdominal terga with mottled brown to blackish-brown color distributed over terga in patterns (as in Fig. 45-49); tibiae unicolorous to brown and faded toward apex; found in cool streams. *L. goyi*, 3
- Abdominal terga with mottled brown to blackish-brown color distributed evenly over dorsum of terga (as in Fig. 53-55), without patterns, without heavy median line, without pale submedian semi-rectangular areas; tibiae banded (Fig. 89-91); found in warm streams *L. calidus*, 4
3. Sterna 1-6 with lateral black markings (Fig. 92-94); heavy blackish median line extended to near posterior margin of terga 1-5, pale submedian semi-rectangular areas absent or occur only posteriorly on terga 4-6 as in Fig. 48-49; southern in distribution. *L. goyi australis*
- Sterna 1-2 only with lateral black markings; blackish median line not extended to near posterior margin of terga 1-5, pale submedian semi-rectangular areas occur over more than 1/2 of terga 4-6 as in Fig. 45-46; northern in distribution. *L. goyi goyi*
4. Middle 1/2 to 1/3 of tibiae brown, apical portion pale, distal portion pale (Fig. 89) or faded toward femora (Fig. 90); denticles on claws occur in 2 groups, an apical group of 3 and a submedian group of 4-5 denticles (Fig. 84-85); northern in distribution. *L. calidus calidus*
- Tibiae brown, apical 1/7 to 1/9 pale (Fig. 91), distal portion sometimes faded toward femora; denticles on claws in one row of 8-9 irregularly sized denticles, middle denticles generally smaller (Fig. 87-87); southern in distribution. *L. calidus notialis*

Note: Abdominal color patterns are the principal characters used to differentiate species of *Lepeorus*. Secondary characters should be used with caution and with reference to the descriptions and discussions of variation for species and subspecies. All 3 species can coexist in one river and adults hatching later in the emergence season of *L. goyi* will overlap with early emerging adults of *L. calidus*. *L. goyi* and *L. calidus* occasionally venture onto rock faces where they are collected with *L. thierryi*. Thus, ecological and distributional characters can only be used to supplement other key characters.

***Lepeorus goyi*, new species**

(Fig. 10-12, 15, 16-20, 29-36, 43-52, 62-66, 78-83, 92-94)

MALE IMAGO (in alcohol). Length: body, 8.0-

11.3 mm; fore wings, 9.5-12.0 mm. Upper portion of eyes red-brown, lower portion gray-black (Fig. 44). Head light yellowish-brown; carinae and mouthparts black to uniformly washed with black. Antennae light yellowish-brown, articulations darker, washed with brownish-black. Basal half of ocelli black, apical half brownish-white. Thorax light yellowish-brown, carinae darker, sutures paler; prothorax uniformly washed with dark brown, carinae darker; anterior half to posterior margin of metathorax uniformly washed with dark brown, pleurae and lateral margins of mesonotum dark brown, carinae darker, areas around base of legs and fore and hind wings darker; mesobasisternum and mesofurcasternum washed with dark brown, lateral arms of mesofurcasternum yellowish-brown. Legs light yellowish-brown; coxae washed with dark brown; prothoracic femora darker, majority of prothoracic femora lightly washed with brown except at apex, dorsal surface of femora washed with black especially along carinae; prothoracic tarsal segment 5 darker, apex of prothoracic tibiae, tarsi, and claws dark brown. Wings (Fig. 10-12): longitudinal and cross veins of fore and hind wings light yellowish-brown to brown, faded near posterior margin of wings especially in Cu-A area of fore wings; membrane of fore and hind wings hyaline, except cells C and Sc of fore wings translucent yellowish-brown, more translucent in apical 1/3 and basal 1/2 of cells; cross veins in cells C, Sc, and R₁ surrounded with narrow brownish clouds, clouds in cells Sc and R₁ fused near bulla. Abdomen: light yellowish-brown; terga 1-7 to 9 washed with mottled dark brown patterns as in Fig. 45-49, median line darker (Fig. 48-49) to median line darker in apical portion of terga 1-5 (Fig. 45-46); terga 1-7 to 9 with dark brown sublateral marks as in Fig. 50-51; spiracles and tracheae hyaline; sterna 1 or 1-2 with brown marks as in Fig. 52, sterna 1-7 with to without dark brown to black, submedian, oblique marks as in Fig. 52. Genitalia (Fig. 16-20, 29-36): light yellowish-brown; posterior margin of styliger plate smooth to smooth with median indentation, irregular protuberances or small paired submedian protuberances (Fig. 29-36); apical appendages on penis lobes inwardly to apically directed (Fig. 16-20). Caudal filaments pale, dark brown annulations at articulations.

FEMALE IMAGO (in alcohol). Length: body, 7.9-12.5 mm; fore wings, 10.5-15.3 mm. Eyes brownish-black. Head light yellowish-brown, carinae and mouthparts black. Antennae light yellowish-brown, flagellum paler. Basal half of ocelli black, apical half light grayish-white. Color and marks of thorax and legs as in ♂ imago. Wings: color and marks as in ♂ imago, except membrane in cells C and Sc

of fore wings darker and clouds around cross veins less distinct. Abdomen: color and marks as in ♂ imago; genital extension light yellowish-brown. Caudal filaments: color and marks as in ♂ imago.

MATURE NYMPH (in alcohol). Head: dorsum dark brown, carinae darker, sutures paler; venter pale. Thorax: dorsum dark brown, carinae darker, sutures paler, uniformly washed with mottled dark brown near carinae to entire dorsum; venter pale, ganglia washed with black. Legs: dorsum of femora dark brown, a small pale dorsal macula near base and apex and a large pale dorsal macula near middle of femora; apex of tibiae, tarsi, and claws brown to dark brown; remainder of legs yellowish-brown to light brown, tibiae sometimes faded toward apex; 2-5 large subequal-sized basal denticles, 1-2 small median denticles, and 3-4 large, progressively larger, apical denticles on claws, median denticles widely separated from basal and apical denticles to all denticles about equal spaced (Fig. 78-83). Abdomen: color and marks as in ♂ and ♀ imagos. Gills: dorsum mottled gray to gray-black, border pale, tracheae pale (Fig. 65-66); venter pale, border paler, tracheae whitish-hyaline. Caudal filaments brown, annulations at articulations darker.

Etymology. Species is named in honor of Mr. F. Goy, Director, Service des Eaux et Forêts, Nouméa.

DISCUSSION. *Lepeorus goyi* can be distinguished from the other species of *Lepeorus* by the following combination of characters. In the imagos: (1) abdominal terga 1-7 have a mottled brown to blackish-brown color pattern distributed over dorsum of terga in patterns; patterns range from solid mottled pattern with heavy median line (Fig. 49) to pale submedian semi-rectangular areas near posterior margin (Fig. 48) to posterior 1/2 to 5/6 (Fig. 45-47) of terga 4-6 and darker median line in apical portion of terga 1-5 (Fig. 45-46); (2) wings of ♂ have a small to medium-sized macula in bullar region (Fig. 10-12); (3) apical appendages of penis lobes of ♂ are inwardly to apically directed (Fig. 16-20); and (4) posterior margin of styliger plate of ♂ is smooth to indented to irregular to with small paired submedian protuberances (Fig. 29-36). In the nymphs: (1) color pattern of abdominal terga is as described for imagos (Fig. 45-49); (2) tibiae are unicolorous to unicolorous and slightly faded toward apex; and (3) abdominal gills are whitish with a light to heavy mottled gray to gray-black color pattern.

Lepeorus goyi is polytypic and consists of 2 subspecies, *L. g. goyi* known from the West Coast and East Coast and *L. g. australis* known from the Southern Region. Distinguishing characters for both subspecies are given below.

Intergrades have been collected from the following localities: 34 nymphs, 4 ♂ imagos, 2 ♀ imagos, No. N13; 37 nymphs, 4 ♂ imagos, 1 ♀ imago, No. N28. These specimens are deposited in the collections of FAMU and UU. These adult and nymphal intergrades can be distinguished by: (1) the abdominal tergal color pattern has a heavy median line and pale semi-rectangular areas on the posterior half of terga 4-5 (Fig. 47), and (2) black, oblique marks occur on sterna 1-4 to 7. A few specimens of *L. goyi goyi* were collected from these localities. The subspecies also show some overlap at localities No. N26 and N27, but there the majority of specimens clearly belong to *L. goyi australis* on the basis of the abdominal tergal color pattern.

The known distribution of *L. g. australis* corresponds to the Southern Region, while *L. g. goyi* is known from the remainder of the island. Intergrades from the Nondoué River occur just outside the southwestern boundary of the Southern Region and the zone of overlap between the two subspecies probably corresponds to the boundary of the Southern Region at lower elevations.

Nymphal specimens from localities No. FNK102 and No. FNK103 do not represent either subspecies. The abdominal tergal color pattern is similar to that of *L. g. australis*, but the venter has no color pattern. It is not known if these specimens represent another subspecies of *L. goyi* or a related species. All specimens are deposited in the collections at FAMU.

Lepeorus goyi goyi, new subspecies

(Fig. 11-12, 16-18, 29-31, 43-46, 50, 65-66, 78-79)

MALE IMAGO (in alcohol). Legs light yellowish-brown; coxae washed with dark brown; prothoracic femora darker, majority of prothoracic femora lightly washed with brown except at apex; prothoracic tarsal segment 5 darker, apex of prothoracic tibiae, tarsi and claws dark brown. Abdomen: light yellowish-brown; terga 1-7 washed with mottled dark brown as in Fig. 45-46, median line darker on at least apical portion of terga 1-5 (Fig. 45-46), terga 1-7 with darker brown sublateral marks as in Fig. 50, pale submedian areas on posterior 1/2 to 5/6 of dorsum of terga 4-5 as in Fig. 45-46; spiracles and tracheae hyaline; sterna 1 or 1-2 with median marks and with dark brown to black submedian oblique marks, sterna 3-7 without marks. Genitalia: light yellowish-brown; posterior margin of styliger plate smooth to smooth and indented (Fig. 16, 29-31); apical appendages on penis lobes inwardly directed (Fig. 16-17).

FEMALE IMAGO (in alcohol). Color and marks of legs as in ♂ imago. Abdomen: color and marks

as in ♂ imago, except median marks on sterna 1-2 sometimes extend to sternum 3.

MATURE NYMPH (in alcohol). Legs: dorsum of femora dark brown; a small, pale, dorsal macula near base and apex and a large, pale, dorsal macula near middle of femora; tibiae yellowish-brown and faded toward apex to light brown, apical margin brown; tarsi brown, progressively darker apically; claws brown; 2-3 large subequal-sized basal denticles, 1-2 small median denticles, and 3-4 large, progressively larger, apical denticles on claws, median denticles widely separated from basal and apical denticles. Abdomen: color and marks as in ♂ and ♀ imagos.

Specimens. Holotype ♂ imago, No. N42; allotype ♀ imago No. N42; paratypes: 1 ♀ subimago, No. N 13; 119 nymphs, 1 ♂ imago, 3 ♀ imagos, 3 ♂ subimagos, 1 ♀ subimago, No. N14; 119 nymphs, 1 ♂ imago, No. N15; 28 nymphs, 1 ♂ imago, 1 ♀ imago, No. N16; 58 nymphs, 3 ♂ imagos, 1 ♀ imago, 1 ♀ subimago, No. N17; 13 nymphs, No. N18; 86 nymphs, 15 ♂ imagos, 6 ♀ imagos, No. N19; 4 nymphs, No. N20; 5 nymphs, No. N21; 1 nymph, No. N26; 1 nymph, 1 ♀ imago, 1 ♀ subimago, No. N27; 2 nymphs, No. N28; 74 nymphs, 8 ♂ imagos, 9 ♀ imagos, No. N34; 258 nymphs, 9 ♂ imagos, 15 ♀ imagos, 7 ♂ subimagos, No. N35; 346 nymphs, 3 ♂ imagos, 7 ♀ imagos, 2 ♂ subimagos, 2 ♀ subimagos, No. N37; 5 nymphs, No. N38; 1 nymph, No. N41; 76 nymphs, 10 ♂ imagos, 2 ♀ imagos, 3 ♂ subimagos, 4 ♀ subimagos, No. N42; 7 nymphs, No. N43; 20 nymphs, No. N44; 4 nymphs, No. N46; 7 nymphs, 2 ♂ imagos, No. N47; 131 nymphs, 7 ♂ imagos, 8 ♀ imagos, 2 ♂ subimagos, No. N54; 4 nymphs, No. FNK4; 42 nymphs, No. FNK30; 66 nymphs, No. FNK42; 160 nymphs, No. FNK57; 129 nymphs, No. FNK59; 28 nymphs, No. FNK62; 10 nymphs, No. FNK63; 81 nymphs, No. FNK79; 2 nymphs, No. FNK82; 11 nymphs, No. FNK85; 2 nymphs, No. FNK86; 1 nymph, No. FNK95; 7 nymphs, No. FNK100; 32 nymphs; No. FNK121. All types are in alcohol. Association of the nymphs and adults is by rearing. All types are deposited in the following collections: holotype, allotype, 842 nymphal paratypes, 24 ♂ paratypes, 21 ♀ paratypes, 6 ♂ subimaginal paratypes, and 3 ♀ subimaginal paratypes at FAMU; 842 nymphal paratypes, 25 ♂ paratypes, 22 ♀ paratypes, 7 ♂ subimaginal paratypes, and 3 ♀ subimaginal paratypes at UU; 64 nymphal paratypes, 2 ♂ paratypes, 2 ♀ paratypes, 1 ♂ subimaginal paratype, and 1 ♀ subimaginal paratype each at BPBM, O.R.S.T.O.M., CTFT, and NMNH.

DISCUSSION. *Lepeorus goyi goyi* can be distinguished from *L. goyi australis* by the characters given above. Adults and nymphs from localities along the West Coast are generally lighter than those from the East Coast. The largest and lightest specimens are from Val d'Hermitage (localities No. N14 and N34); specimens from Col d'Amieu tend toward the darker East Coast form, those from around Païta are usually lighter, but most localities exhibit a great deal of variation within populations. Some late season specimens from near Païta (No. N54) have a light brown median line,

light brown mottles within the pale submedian area, and dark brown anterior and lateral mottles on abdominal terga 4-7. These specimens are included in paratypes of *L. goyi goyi* because of the overall pattern of the abdominal terga and the smooth styliiger plate of the male imago, unique to this subspecies.

BIOLOGY. *Lepeorus goyi goyi* occurs along the West Coast and East Coast in small streams to large rivers. Nymphs were found in streams with water temperatures of 16.5 °C-28 °C and at about 6-458 m. Most mature nymphs were collected in streams with water temperatures of 18 °C-19 °C.

Nymphs cling to the sides, undersides, or tops of large rocks to boulders in the fastest portions of streams and rivers. They orient themselves heading upstream and can move quickly against fast water, but they are poor swimmers. Nymphs do not vibrate the gills.

Nymphs emerge to subimagos at dark and molt to imagos the next day. Subimagos are abundant at light traps. Male imagos swarm in large companies of 100 or more at sunset and at about 9-10 m above the water surface.

Lepeorus goyi australis, new subspecies

(Fig. 10, 19-20, 33-36, 48-49, 51-52, 80-83, 92-94)

MALE IMAGO (in alcohol). Legs light yellowish-brown; coxae washed with dark brown; prothoracic femora darker, majority of prothoracic femora lightly washed with brown except at apex, dorsal surface of femora washed with black especially along carinae; prothoracic tarsal segment 5 darker, apex of prothoracic tibiae, tarsi, and claws dark brown. Abdomen: light yellowish-brown; terga 1-7 to 9 washed with mottled dark brown as in Fig. 48-49, median line darker (Fig. 48-49), terga 1-7 to 9 with darker brown to black sublateral marks as in Fig. 51, pale submedian areas absent or cover less than posterior half of terga 4-5 as in Fig. 48; spiracles and tracheae hyaline; sterna 1-2 with brown marks as in Fig. 52; sterna 1-7 with dark brown to black, submedian, oblique marks as in Fig. 52. Genitalia: light yellowish-brown; posterior margin of styliiger plate with median protuberance (Fig. 36) to median hump (Fig. 34-35) to small submedian protuberances (Fig. 33); apical appendages on penis lobes apically (Fig. 19) or inwardly directed.

FEMALE IMAGO (in alcohol). Color and marks of legs as in ♂ imago. Abdomen: color and marks as in ♂ imago.

MATURE NYMPH (in alcohol). Legs: dorsum of femora dark brown, a small pale dorsal macula

near base and apex and a large pale dorsal macula near middle of femora, apex of all tibiae, tarsi, and claws dark brown, remainder of legs light brown; claws variable, usually 4-5 large subequal-sized basal denticles, 1-2 small median denticles, and 3-4 large, progressively larger, apical denticles on claws, all denticles about equal spaced (Fig. 80-83). Abdomen: color and marks as in ♂ and ♀ imagos.

SPECIMENS. Holotype ♂ imago, No. N27; allotype ♀ imago, No. N27; paratypes: 31 nymphs, No. N22; 4 nymphs, No. N23; 41 nymphs, 1 ♂ imago, No. N25; 76 nymphs, 6 ♂ imagos, 12 ♀ imagos, 1 ♂ subimago, 1 ♀ subimago, No. N27; 2 nymphs, No. N28; 13 nymphs, 1 ♀ imago, No. N50; 286 nymphs, 2 ♂ imagos, 10 ♂ subimagos, 7 ♀ subimagos, No. N51; 33 nymphs, No. N52; 8 nymphs, 1 ♂ imago, 2 ♀ imagos, 3 ♂ subimagos, No. N53; 14 nymphs, 1 ♂ imago, 1 ♀ subimago, No. N55; 1 nymph, No. FNK10, 11, 13; 10 nymphs, No. FNK18, 19, 20; 90 nymphs, No. FNK23-24; 105 nymphs, No. FNK25-26; 17 nymphs, No. FNK31-32; 12 nymphs, No. FNK55; 2 nymphs, No. FNK74. All types are in alcohol. Association of the nymphs and adults is by rearing. All types are deposited in the following collections: holotype, allotype, 313 nymphal paratypes, 3 ♂ paratypes, 5 ♀ paratypes, 5 ♂ subimaginal paratypes, and 4 ♀ subimaginal paratypes at FAMU; 133 nymphal paratypes, 3 ♂ paratypes, 6 ♀ paratypes, 5 ♂ subimaginal paratypes, and 5 ♀ subimaginal paratypes at UU; 31 nymphal paratypes, 1 ♂ paratype, 1 ♀ paratype, and 1 ♂ subimaginal paratype each at BPBM, O.R.S.T.O.M., CTFT, and NMNH.

Etymology. auster, L., meaning south.

DISCUSSION. *Lepeorus goyi australis* can be distinguished from *L. goyi goyi* by the characters given above. The ♂ imagos of *L. goyi australis* show variation in the shape of the posterior margin of the styliiger plate (Fig. 33-36) and in having either apically (Fig. 19) or inwardly directed appendages at the apex of the penis lobes. Claws of the nymphs show a number of variations (Fig. 80-83). The sternal markings on the abdomen are lightest in specimens from the stream near Camp des Travaux Publics (Fig. 92), heaviest in those from tributaries of Rivière Blanche (Fig. 94), and intermediate in specimens from Rivière Bleue (Fig. 93); the dorsal abdominal pattern is lighter in specimens from Rivière Bleue (Fig. 48) than in those from tributaries of the Rivière Blanche (Fig. 49) with both forms found at the stream near Camp des Travaux Publics. The clouds surrounding the cross veins and the macula in the bullar area of the fore wings of ♂ imagos are generally quite light in *L. goyi australis* (Fig. 10), but there are exceptions. Wing markings can also be lighter in the southern form of *L. calidus*, so the wing character is of dubious value to key species from the Southern Region, particularly those from localities near Camp des Travaux Publics (No. N27, N55).

In addition, we have individual specimens from localities around the Rivière Bleue and Rivière Blanche which cannot be assigned to any species. They may represent other variations of *L. goyi australis*, or other species. These specimens are deposited at FAMU and UU.

BIOLOGY. *Lepeorus goyi australis* is common in the streams and rivers in the Southern Region of the island. Nymphs were found in streams with water temperatures of 18 °C-23 °C and at 5-300 m elevation. Mature nymphs were most common in streams with water temperatures of 19 °C-20 °C.

Nymphs cling to the sides, undersides, or tops of large rocks to boulders in the fastest portions of streams and rivers. They orient themselves heading upstream and can move quickly against fast water. Nymphs emerge to subimagos at dark and subimagos are abundant at light traps.

Lepeorus calidus, new species

(Fig. 7-9, 13-14, 21-25, 37-40, 53-57, 84-87, 89-91)

MALE IMAGO (in alcohol). Length: body, 8.3-10.7 mm; fore wings, 8.9-12.0 mm. Upper portion of eyes red-brown, lower portion gray-black. Head yellowish-brown, uniformly washed with black. Antennae light yellowish-brown, articulations washed with brownish-black. Basal half of ocelli black, apical half grayish-white. Thorax light yellowish-brown, carinae darker, sutures paler; prothorax and metathorax uniformly washed with brown or black, carinae darker; pleurae and lateral margins of mesonotum brown to black, carinae darker, areas around bases of legs and fore and hind wings darker, mesobasisternum and mesofurcasternum washed with dark brown. Legs light yellowish-brown; coxae irregularly washed with black; prothoracic femora darker, uniformly washed with darker brown, dorsal surface of femora washed with black especially along carinae; apex of tibiae, apex of prothoracic tarsal segments, and claws on all legs brown to black. Wings: longitudinal and cross veins of fore and hind wings light yellowish-brown to brown, faded near posterior margin of wings especially in Cu-A area of fore wings; membrane of fore and hind wings hyaline, except cells C and Sc of fore wings translucent yellowish-brown, more translucent in apical 1/3 and basal 1/2 of cells; cross veins in cells C, Sc, and R₁ surrounded with brownish clouds, clouds faded in apical 1/3 of cells, clouds in cells Sc and R₁ fused near bulla. Abdomen: light yellowish-brown; terga 1-7 washed with mottled brown to blackish-brown (Fig. 53-55), terga 1-6 with darker black sublateral marks as in Fig. 56; sterna 1-2 with brown markings to sterna 1-4 with a brown to red-brown color pattern

as in Fig. 57, pattern faded or not faded on sterna 3 and 4. Genitalia (Fig. 21-25): light yellowish-brown; posterior margin of styliger plate with paired, submedian protuberances (Fig. 21, 37-40); subapical, median appendage on penis lobes apically directed (Fig. 21-22, 24). Caudal filaments pale, dark brown annulations at articulations.

FEMALE IMAGO (in alcohol). Length: body, 8.2-10.8 mm; fore wings, 9.8-13.5 mm. Eyes brownish-black. Head light yellowish-brown, carinae black. Antennae light yellowish-brown, flagellum paler, annulations washed with brown. Basal half of ocelli black, apical half white. Color and marks of thorax and legs as in ♂ imago, except dark marks darker, black marks on femora absent. Wings: color and marks as in ♂ imago, except membrane in cells C and Sc of fore wings darker, marks less distinct. Abdomen: color and marks as in ♂ imago, except mottled dark marks darker; genital extension light yellowish-brown. Caudal filaments: color and marks as in ♂ imago.

MATURE NYMPH (in alcohol). Head: dorsum mottled black, carinae darker, sutures paler; venter pale. Thorax: dorsum mottled black, carinae darker, sutures paler; venter pale, ganglia and margins of mesobasisternum washed with black. Legs: dorsum of femora dark brown, a small pale dorsal macula near base and apex and a large pale dorsal macula near middle of femora, to dorsum of femora dark brown, irregularly washed with black, especially along carinae; tibiae dark brown, except at base and apex to apex only (Fig. 89-91); apical margin of tibiae, tarsi and claws dark brown; claws with 4-5 large subequal-sized basal denticles and 3 large apical denticles, progressively larger apically, 2 groups of denticles widely separated (Fig. 84-85), to a row of 8-9 unequal, equal-spaced denticles on claws, apical denticle largest (Fig. 86-87). Abdomen: terga 1-7 dark mottled brownish-black, color pattern as in ♂ and ♀ imago, terga 8-10 pale; venter pale, darker brown marks on sterna 1-4, marks pale and indistinct, ganglia lightly washed with black. Gills: dorsum mottled gray to gray-black, border pale, tracheae hyaline; venter pale, border paler, tracheae whitish hyaline. Caudal filaments brown, annulations at articulations darker.

Etymology. *calidus*, L., meaning warm.

DISCUSSION. *Lepeorus calidus* can be distinguished from the other species of *Lepeorus* by the following combination of characters. In the imagos: (1) abdominal terga 1-7 have a mottled brown to blackish-brown color pattern distributed evenly over dorsum of terga; mottled color at median line is same as that on other portions of each tergum (Fig. 53-55);

(2) fore wings of ♂ have a large dark macula in bullar region (Fig. 7, 13-14); and (3) apical appendages of penis lobes of ♂ are apically directed (Fig. 21-22, 24) and posterior margin of styliger plate has 2 submedian protuberances (Fig. 21, 37-40). In the nymphs: (1) color pattern of abdominal terga is as described for imagos (Fig. 53-55); (2) tibiae are banded, with middle 1/3 to 8/9 dark and apex pale (Fig. 89-91); and (3) abdominal gills are whitish with a light to heavy mottled gray to gray-black color pattern.

Lepeorus calidus is polytypic and consists of 2 subspecies, *L. c. calidus* known from the West Coast and East Coast and *L. c. notialis* known from the Southern Region. Distinguishing characters for both subspecies are given below.

***Lepeorus calidus calidus*, new subspecies**

(Fig. 7-9, 14, 21-23, 37-38, 53-54, 56-57, 84-85, 89-90)

MALE IMAGO (in alcohol). Legs light yellowish-brown; coxae irregularly washed with black; prothoracic femora darker, washed with darker brown; apex of tibiae, apex of prothoracic tarsal segments, and claws on all legs dark brown. Abdomen: light yellowish-brown; terga 1-7 washed with mottled dark brown to black (Fig. 53-54), terga 1-6 with darker black, sublateral marks as in Fig. 56; spiracles and tracheae hyaline; sterna 1-4 with a brown or red-brown color pattern as in Fig. 57, pattern faded on sterna 3 and 4.

FEMALE IMAGO (in alcohol). Color and marks of legs as in ♂ imago, except dark marks darker. Abdomen: color and marks as in ♂ imago, except mottled dark color darker.

MATURE NYMPH (in alcohol). Legs: dorsum of femora dark brown, a small pale dorsal macula near base and apex and a large pale dorsal macula near middle; tibiae banded, brown in middle 1/3 to 1/2, pale at base and apex (Fig. 89-90); tarsi and claws dark brown; claws with 4-5 large subequal-sized basal denticles, 3 large apical denticles, apical denticles progressively larger apically, 2 groups of denticles widely separated (Fig. 84-85). Abdomen: terga 1-7 dark mottled brownish-black, color pattern as in ♂ and ♀ imagos, terga 8-10 pale; venter pale, darker brown marks on sterna 1-4, marks pale and indistinct.

SPECIMENS. Holotype ♂ imago, No. N42; allotype ♀ imago, No. N42; paratypes: 112 nymphs, 2 ♂ imagos, 3 ♀ imagos, 1 ♀ subimago, No. N16; 11 nymphs, No. N17; 25 nymphs, No. N19; 3 nymphs, No. N20; 2 nymphs, No. N21; 8 nymphs, 1 ♂ imago, No. N37; 13 nymphs, No. N38; 1 ♀ imago, No. N39; 7 ♂ imagos, 8 ♀ imagos, 2 ♀ subimagos, No. N40; 7 nymphs, 9 ♂ imagos, 12 ♀ imagos, 2 ♂ subimagos, 1 ♀ subimago, No. N41; 7 nymphs, 6 ♂ imagos, 5 ♀ imagos, 5 ♂ sub-

magos, 1 ♀ subimago, No. N42; 18 nymphs, No. N43; 2 nymphs, 1 ♂ subimago, No. N47; 18 nymphs, No. FNK42; 1 nymph, No. FNK53; 120 nymphs, 1 ♀ imago, No. FNK62; 42 nymphs, No. FNK66; 257 nymphs, No. FNK67; 80 nymphs, No. FNK68; 15 nymphs, No. FNK79; 102 nymphs, No. FNK80; 38 nymphs, No. FNK82; 34 nymphs, No. FNK84; 70 nymphs, No. FNK86; 21 nymphs, No. FNK88-89; 128 nymphs, No. FNK94; 26 nymphs, No. FNK100; 279 nymphs, No. FNK105; 36 nymphs, No. FNK107; 90 nymphs, No. FNK111; 29 nymphs, No. FNK120; 17 nymphs, No. FNK121; 3 nymphs, No. J12. All types are in alcohol. Association of the nymph and adult is by the abdominal color pattern on specimens from the same locality. All types are deposited in the following collections: holotype, allotype, 613 nymphal paratypes, 8 ♂ paratypes, 11 ♀ paratypes, 4 ♂ subimaginal paratypes, and 2 ♀ subimaginal paratypes at FAMU; 610 nymphal paratypes, 9 ♂ paratypes, 11 ♀ paratypes, 4 ♂ subimaginal paratypes, and 3 ♀ subimaginal paratypes at UU; 107 nymphal paratypes, 2 ♂ paratypes, and 2 ♀ paratypes each at BPBM, O.R.S.T.O.M., CTFT, and NMNH.

DISCUSSION. *Lepeorus calidus calidus* can be distinguished from *L. calidus notialis* by the characters given above. The darkness and distinctness of the adult and nymphal abdominal color pattern of *L. calidus calidus* varies among localities. In specimens from the East Coast, the lateral arms of the mesofurcasternum have distinct brown marks, but these are absent from specimens from the Col d'Amieu area and the West Coast. In ♀ imagos from the Castex area on the East Coast, the sternal color pattern is a reddish-brown and extends to sternum 6; this red color is less evident in ♂ imagos.

BIOLOGY. *Lepeorus calidus calidus* occurs throughout the West Coast and East Coast in small streams to large rivers. Nymphs were found in streams with water temperatures of 16.5 °C-28 °C, and at about 2-458 m elevation. Most mature nymphs were collected in streams and rivers with water temperatures of 22 °C-24.5 °C. In this situation, nymphs cling to the sides and underside of large rocks and boulders in the fastest portions of streams and rivers. In cooler streams, nymphs were sometimes found out of the current and both young and mature nymphs were occasionally collected in marginal deposits of leaf litter. Nymphs orient themselves upstream and can move quickly against fast water.

Nymphs emerge to subimagos at dark and molt to imagos the next day. Subimagos are abundant at light traps.

***Lepeorus calidus notialis*, new subspecies**

(Fig. 13, 24-25, 39-40, 55, 86-87, 91)

MALE IMAGO (in alcohol). Legs light yellowish-brown; coxae irregularly washed with black; prothoracic femora darker, uniformly washed with darker brown, dorsal surface of femora washed

with brown especially along carinae; apex of tibiae, apex of prothoracic tarsal segments, and claws on all legs brown. Abdomen: light yellowish-brown; terga 1-7 uniformly washed with mottled brown to brownish-black (Fig. 55), terga 1-6 with darker sublateral marks, spiracles and tracheae hyaline; sterna 1-2 washed with brown marks, those on sternum 2 faint and occur only near anterior margin.

FEMALE IMAGO (in alcohol). Color and marks of legs as in ♂ imago, except darker. Abdomen: color and marks as in ♂ imago, except mottled brown or black marks darker.

MATURE NYMPH (in alcohol). Legs: dorsum of femora dark brown, irregularly washed with black especially along carinae, tibiae dark brown to brown, except at apex (Fig. 91), tarsi and claws dark brown; a row of 8-9 unequal-sized, equal-spaced denticles on claws, apical denticle largest (Fig. 86-87). Abdomen: terga 1-7 dark mottled brownish-black, color pattern as in ♂ and ♀ imagos, terga 8-10 pale; venter pale, brown marks on sterna 1-2, marks pale and indistinct on sternum 2.

SPECIMENS. Holotype ♂ imago, No. N27; allotype ♀ imago, No. N27; paratypes: 7 nymphs, No. N14; 6 nymphs, No. N23; 14 nymphs, No. N25; 9 nymphs, No. N26; 56 nymphs, 8 ♂ imagos, 23 ♀ imagos, 4 ♂ subimagos, 7 ♀ subimagos, No. N27; 1 nymph, No. N28; 2 nymphs, No. N52; 1 ♀ imago, No. N53; 5 nymphs, No. N55; 10 nymphs, No. FNK4; 1 nymph, No. FNK5; 33 nymphs, No. FNK10, 11, 13; 17 nymphs, No. FNK18, 19, 20; 6 nymphs, No. FNK22; 48 nymphs, No. FNK23-24; 19 nymphs, No. FNK25-26; 2 ♀ imagos, 12 nymphs, No. FNK55; 6 nymphs, No. FNK72; 164 nymphs, No. FNK74. All types are in alcohol. Association of the nymphs and adults is by the abdominal color pattern on specimens from the same locality. All types are deposited in the following collections: holotype, allotype, 135 nymphal paratypes, 1 ♂ paratype, 8 ♀ paratypes, 2 ♂ subimaginal paratypes, and 3 ♀ subimaginal paratypes at FAMU; 135 nymphal paratypes, 2 ♂ paratypes, 8 ♀ paratypes, 1 ♂ subimaginal paratype, and 4 ♀ subimaginal paratypes at UU. 35 nymphal paratypes, 1 ♂ paratype, and 1 ♀ paratype each at BPBM, O.R.S.T.O.M., CTFT, and NMNH.

Etymology. *notialis*, G., meaning south.

DISCUSSION. *Lepeorus calidus notialis* can be distinguished from *L. calidus calidus* by the characters given above. The darkness and distinctness of the adult and nymphal color patterns of *L. calidus notialis* varies among localities. It is darkest in tributary streams of Rivière Blanche and Rivière Bleue and lightest at the stream near Camp des Travaux Publics. Occasional specimens from southern localities have a claw which looks like that figured for *L. calidus calidus* and the banding on the tibiae sometimes approaches that in Fig. 90.

We have a few nymphs from the Southern Region (locality No. FNK74) which will key to *L. calidus notialis* because of the tibiae and claws, but the mottled color pattern on the terga is almost entirely absent. These nymphs may represent a light variation of this subspecies or another species, so they have not been included with the paratypes of *L. calidus notialis*. All specimens are deposited at FAMU.

BIOLOGY. *Lepeorus calidus notialis* occurs throughout the Southern Region in small streams to large rivers. Nymphs were found in streams with water temperatures of 17 °C-23 °C and at about 5-153 m elevation. Most mature nymphs were collected in streams and rivers with water temperature of 20 °C and large growths of algae.

Nymphs cling to the side and underside of large rocks to boulders in the faster portions of streams and rivers. Nymphs orient themselves heading upstream and can move quickly against fast water. They emerge to subimagos at dark and molt to imagos the next day. Subimagos are abundant at light traps.

Lepeorus thierryi, new species

(Fig. 1-3, 26-28, 41-42, 58-61, 67-77, 88)

MALE IMAGO (in alcohol). Length: body, 10.5-14.1 mm; fore wings, 11.1-14.5 mm. Upper portion of eyes red-brown, lower portion brownish-black. Head yellowish-brown, dorsum uniformly washed with black. Pedicel and scape of antennae yellowish-brown, washed with black; flagellum pale, brown marks at annulations. Basal half of ocelli black, apical half brownish-white. Thorax light yellowish-brown, carinae darker, sutures paler; prothorax uniformly washed with black, carinae darker; pleurae and lateral margins of mesonotum and metanotum black, carinae darker, areas around base of legs and fore and hind wings darker, mesobasisternum washed with black. Legs light yellowish-brown; coxae washed with black; prothoracic femora darker, an irregular, brown macula on majority of femora except at apex; apex of prothoracic tibiae and claws on all legs brown. Wings: longitudinal and cross veins of fore and hind wings light yellowish-brown to brown, faded near posterior margin of wings especially in Cu-A area of fore wings; membrane of fore and hind wings hyaline, except cells C and Sc of fore wings translucent yellowish-brown, more translucent in apical 1/3 and basal 1/2 of cells; cross veins in cells C, Sc, and R₁ surrounded with narrow brown clouds, clouds faded in apical 1/3 of cells, clouds in cells Sc and R₁ fused near bulla. Abdomen: light yellowish-brown; terga 1-8 with a solid brownish-black to black color pattern as in Fig. 58-59 (or Fig. 1), median of

terga 1-3 and 7 and 8 almost entirely brownish-black to black; spiracles and tracheae hyaline; sterna 1-4 with a brownish-black color pattern as in Fig. 61, pattern faded on sterna 3 and 4. Genitalia (Fig. 26-28): light yellowish-brown; posterior margin of styliger plate with paired submedian protuberances (Fig. 26, 41-42); apical appendages on penis lobes inwardly directed (Fig. 26-27). Caudal filaments pale, black annulations at articulations.

FEMALE IMAGO (in alcohol). Length: body, 10.0-15.6 mm; fore wings, 12.2-19.0 mm. Eyes brownish-black. Head light yellowish-brown, carinae black. Antennae light yellowish-brown, flagellum paler. Basal half of ocelli black, apical half white. Color and marks of thorax and legs as in ♂ imago, except dark marks darker. Wings: color and marks as in ♂ imago, except membrane in cells C and Sc of fore wings darker, entire cells uniformly translucent. Abdomen: color and marks as in ♂ imago, except dark marks darker; genital extension light yellowish-brown. Caudal filaments: color and marks as in ♂ imago.

MATURE NYMPH (in alcohol). Head: dorsum black, carinae darker, sutures paler; venter pale. Thorax: dorsum black, carinae darker, sutures paler; venter pale, ganglia washed with black. Legs: dorsum dark brown, a small pale macula near base, middle, and apex of femora; tibiae light brown to brown; apex of tarsi darker, venter pale; claws with 5-6 large unequal-sized basal denticles, 1-2 small median denticles, and 2 large unequal apical denticles, apical denticle largest (Fig. 88). Abdomen (Fig. 1-2): terga dark brownish-black to black, color pattern similar to ♂ and ♀ imagos. Gills: dorsum solid gray-black to black, border paler, tracheae a little darker; venter pale, border darker, tracheae whitish. Caudal filaments brown, annulations at articulations darker.

SPECIMENS. Holotype ♂ imago, No. N17; allotype ♀ imago, No. N17; paratypes: 1 nymph, No. N14; 119 nymphs, 7 ♂, 1 ♂ subimago, 5 ♀, 1 ♀ subimago, No. N17; 11 nymphs, No. N18; 16 nymphs, No. N21; 5 nymphs, No. N22; 1 nymph, No. N27; 1 nymph, 2 ♀, No. N37; 10 nymphs, 1 ♂, 1 ♀, No. N41; 11 nymphs, 2 ♂, No. N42; 1 nymph, No. N43; 3 nymphs, No. N44; 17 nymphs, No. N46; 115 nymphs, No. N47; 7 nymphs, 1 ♀, No. N50; 7 nymphs, No. FNK53; 1 nymph, No. FNK93; 2 nymphs, No. FNK94; 22 nymphs, No. FNK98; 2 nymphs, No. FNK102; 2 nymphs, No. FNK103; 1 nymph, No. FNK104. All types are in alcohol. Association of the nymphs and adults is by rearing. All types are deposited in the following collections: holotype, allotype, 101 nymphal paratypes, 5 ♂ paratypes, 1 ♂ subimaginal paratype, 4 ♀ paratypes, and 1 ♀ subimaginal paratype at FAMU; 103 nymphal paratypes, 5 ♂ paratypes, and 4 ♀ paratypes at UU; 34 nymphal paratypes, 1 ♂ paratype, and 1 ♀ paratype at BPBM; 34 nymphal paratypes at O.R.S.T.O.M., CTFT, and NMNH.

Etymology. Species is named for Mr. Azais Thierry, CTFT, Col d'Amieu.

DISCUSSION. *Lepeorus thierryi* can be distinguished from the other species of *Lepeorus* by the following combination of characters. In the imagos: (1) abdominal terga 1-7 to 9 have a solid, unmottled, dark brownish-black to black color pattern, usually with narrow pale median line to pale patterns over median area of terga 4-5 to terga 3-6 (Fig. 58-59, or as in Fig. 1); (2) fore wings of ♂ have a large dark macula in bullar region; and (3) apical appendages of penis lobes of ♂ are inwardly directed (Fig. 26-27) and posterior margin of styliger plate has paired submedian protuberances (Fig. 26, 41-42). In the nymphs: (1) color pattern of abdominal terga is as described for imagos (Fig. 1, 58-59); (2) tibiae are unicolorous; and (3) abdominal gills are a solid gray-black to black color, borders parler (Fig. 67-68).

Color patterns of *L. thierryi* are variable. Specimens from localities No. FNK102, No. FNK103, and No. FNK104 are lighter than other specimens and the dark color on the abdominal terga is not as extensive. Specimens from the northern area of the East Coast and from the Southern Region are smaller than those from Col d'Amieu. Specimens from the area around Col d'Amieu generally have a more closed color pattern as in Fig. 58, or pale open areas on terga 4-5 (Fig. 1) sometimes extended onto abdominal terga 3-6. Specimens from more northern areas have dark marks running sublateral to the median line (Fig. 59) with marks very faded to heavy, and narrow to broad. This pattern also occurs on specimens from the Southern Region, although there the sublateral lines are often absent on terga 4-5.

BIOLOGY. *Lepeorus thierryi* appears to be distributed throughout New Caledonia wherever suitable habitat is found. Nymphs were found in streams with water temperatures of 16.5 °C-24.5 °C and at about 10-458 m elevation; however, the species was most abundant in streams with water temperatures of 16.5 °-18 °C.

Nymphs were collected only on vertical rock faces in waterfalls or very steep streams. Nymphs orient themselves upstream. They were often seen out of the stream on damp rock which received some spray from the falling water, but moved rapidly back into the current at any movement or shadow.

Nymphs move out of the water onto the vertical rock slab to emerge immediately after dark (about 1830 h). They moved to the edge of the damp area so that the nymphal exuvia was left on damp rock while the emergent subimago rested on dry rock.

Subimagos then walked up the rock before flying upward. Subimagos were readily attracted to light traps, but no adult swarms were observed. Subimagos molted to imagos in one day.

Lepegenia, new genus

(Fig. 4-6, 95-105)

IMAGO. Unknown.

MATURE NYMPH. Head prognathous. Antennae equal to a little longer than maximum length of head. Mouthparts (Fig. 101-105): labrum greatly expanded laterally (Fig. 103); dorsal hair on labrum as in Fig. 103; lateral areas of hair ventrally. Clypeus as in Fig. 103. Left mandible as in Fig. 101. Lingua of hypopharynx with well developed lateral processes, apex of processes with dense short fine hair, paired submedian longitudinal row of long hair on internal dorsal surface, apex of submedian lobes with a rake-like process, anterior margin deeply cleft (Fig. 104); superlingua as in Fig. 104, with a row of hair along anterior margin, lateral margins blunt. Segment 2 of maxillary palpi a little longer than length of segment 1; segment 3 of palpi a little shorter than length of segment 2, triangular; a V-shaped ridge near the ventral, inner anterolateral margin of maxillae; hair on maxillae as in Fig. 102. Labium as in Fig. 105; segment 2 of palpi $3/5$ length of segment 1; segment 3 of palpi $2/3$ length of segment 2, triangular; paraglossae ventral to glossae. A row of short hair on dorsal mid-line of abdomen, row divides into 2 parallel, submedian rows on mesonotum, 2 rows widely divergent near anterior half of pronotum and continue along inner margin of eyes (Fig. 5); a row of short hair on dorsum of all 3 caudal filaments and extends entire length of each caudal filament although reduced to single long hair at margin of each segment over apical $4/5$ of filament. Legs (Fig. 95-98): maximum width of tibiae $1\ 1/3$ times larger than maximum width of tarsi (Fig. 96-97), tibiae in cross section triangular (Fig. 96); outer margin of femora indented near apex so tibiae can draw partially into femora (Fig. 95); apex of claws hooked and narrow, denticles on claws progressively larger apically, except 5 small denticles near base of claws (Fig. 98). Gills (Fig. 5-6, 99-100): gills on segments 1-7 and together form a suction cup along sides of abdomen (Fig. 6); each gill consists of a single plate-like oblong lamella, each gill with a heavily sclerotized unpigmented brace extended almost entire length of lamella, inner margin of gills 1 expanded near base and circular in shape as in Fig. 99; main trunk of tracheae near median line of lamella (Fig. 99-100), basal $2/3$ of main trunk pigmented, tracheae on inner side of main trunk branched, pigmented, tracheae on

outer side of main trunk not well developed and unpigmented. Posterolateral spines on abdominal segments 2-9, spines progressively larger posteriorly, spines on abdominal segments 2-7 apically indented and give appearance of double spines (Fig. 4). Terminal filament $1/3$ longer than cerci.

Etymology. *Lepegenia*, an arbitrary combination of letters. Feminine.

TYPE SPECIES. *Lepegenia lineata*, new species.

DISCUSSION. *Lepegenia* can be distinguished from all genera of the Leptophlebiidae by the following combination of characters. In the nymphs: (1) abdominal gills are plate-like and occur on segments 1-7; together gills form a suction cup along sides of abdomen (Fig. 5-6); (2) a row of short hair occurs on dorsal mid-line of abdomen and row divides into 2 parallel, submedian rows on mesonotum; 2 rows are widely divergent near anterior half of pronotum and continue along inner margin of eyes; a row of short hair occurs on dorsum of all 3 caudal filaments and extends entire length of each caudal filament (Fig. 5); (3) posterolateral spines occur on abdominal segments 2-9, spines on abdominal segments 2-7 are apically indented and give appearance of double spines (Fig. 4); (4) width of labrum is greatly expanded past lateral margins of clypeus (Fig. 103); and (5) outer margin of mandibles is strongly curved at right angles (Fig. 101).

Lepegenia appears to be most closely related to *Lepeorus* and can be distinguished from it by the following combination of characters. In the nymphs: (1) abdominal gills 1 are circular in shape (Fig. 99) and do not extend under venter of abdomen (Fig. 5-6); (2) posterolateral spines occur on abdominal segments 2-9, spines on abdominal segments 2-7 are apically indented and give appearance of double spines (Fig. 4); (3) segment 3 of labial palpi is $2/3$ length of segment 2 (Fig. 105); (4) mandible is as in Fig. 101; and (5) denticles on claws are progressively larger apically, except 5 small denticles are near base of claws (Fig. 98).

It is not normally our practice to establish new genera on species known only from the nymph. However, *Lepegenia* is so distinctive we feel it is important to add the genus to this work.

Lepegenia lineata, new species

(Fig. 4-6, 95-105)

MALE IMAGO. Unknown.

FEMALE IMAGO. Unknown.

MATURE NYMPH (in alcohol). Length of body: male, 4.7-5.2 mm; female 5.8-6.8 mm. Head brown, venter paler; a black transverse band between eyes, paired black submedian maculae near vertex. Thorax: brown, venter paler; irregular black marks on notum as in Fig. 5, sterna washed with dark brown near ganglia, ganglia dark brown. Legs: brown, ventral surface paler; femora with a narrow, longitudinal, dorsal, darker brown bar extended along apical half of femora except at apex; a large dorsal pale macula near apex, middle, and base of femora; apical half of tarsi and claws often darker (Fig. 95). Abdomen: light brown; tergum 1 uniformly washed with black, terga 2-9 washed with black as in Fig. 5; sternum 1 uniformly washed with dark brown, sterna 2-9 washed lightly with dark brown as in Fig. 6, sternum 9 paler, ganglia washed lightly with black. Gills (Fig. 99-100): membrane gray, opaque, except hyaline along outer margin; tracheae black. Caudal filaments light brown.

SPECIMENS. Holotype ♂ mature nymph, No. FNK63; paratypes: 2 nymphs, No. N27; 1 nymph, No. N28; 1 nymph, No. FNK55; 61 nymphs, No. FNK63; 4 nymphs, No. FNK74; 3 nymphs, No. FNK75. All types are in alcohol. All types are deposited in the following collections: holotype and 26 nymphal paratypes at FAMU; 26 nymphal paratypes at UU; 5 nymphal paratypes each at BPBM, O.R.S.T.O.M., CTFT, and NMNH.

Etymology. *Lineatus*, L., meaning line.

BIOLOGY. *Lepegenia lineata* has been collected along the East Coast and the Southern Region in large streams to small rivers. Nymphs were found in streams with water temperatures of 18.2 °C-20.9 °C and at about 5-153 m elevation. Most nymphs were collected at locality No. FNK63 with a water temperatures of 19.2 °C.

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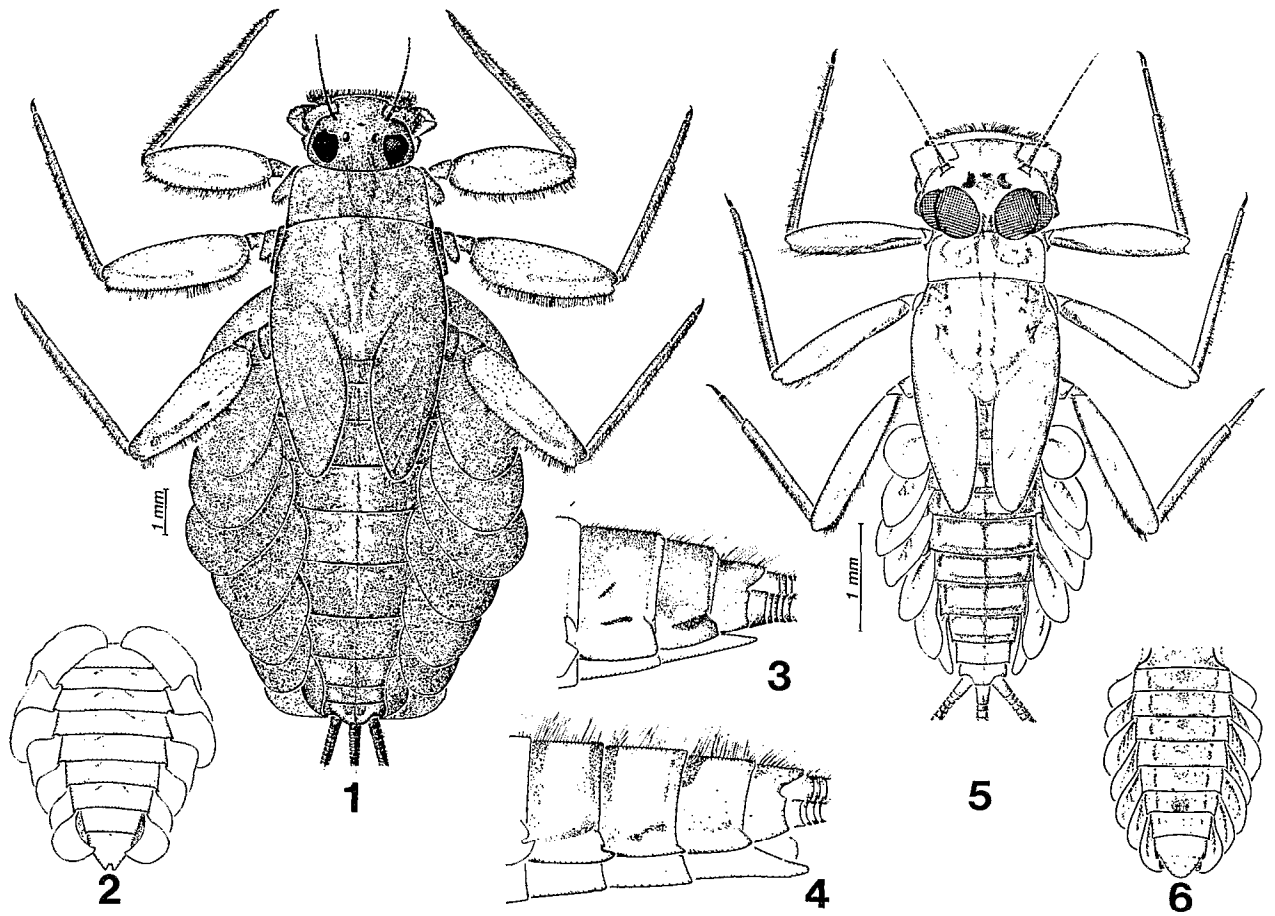


Fig. 1-3.—*Lepeorus thierrii* nymph: 1, mature female; 2, abdominal sterna 1-10; 3, lateral view of abdominal segments 8-10.
 Fig. 4-6.—*Lepegenia lineata* nymph: 4, lateral view of abdominal segments 7-10; 5, mature male; 6, abdominal sterna 1-10.

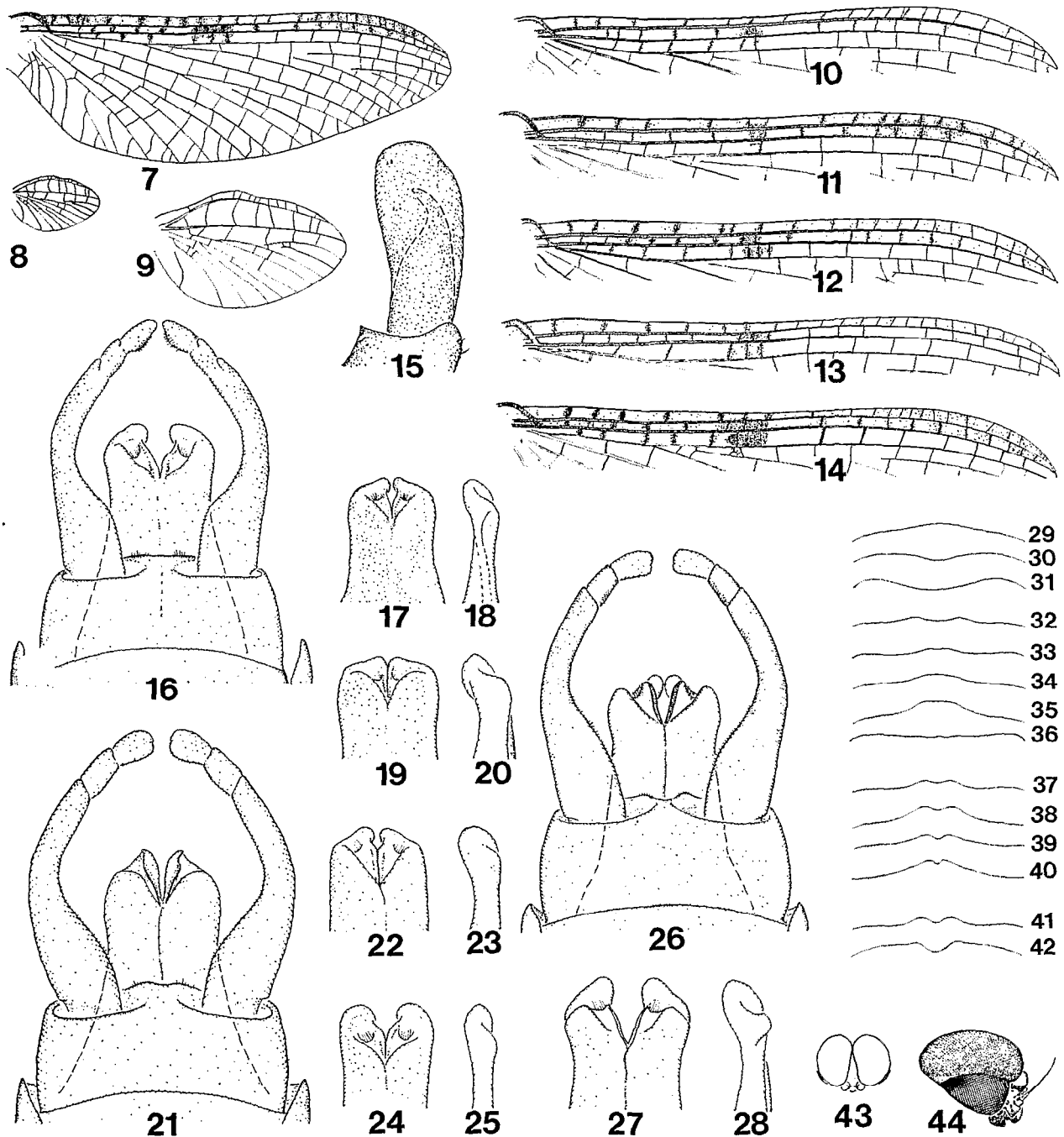


Fig. 7-44.—*Lepeorus*, male imago. Fig. 7-9, *L. calidus calidus*: 7, fore wing; 8, hind wing; 9, hind wing enlarged. Fig. 10-14, costal margin of fore wing: 10, *L. goyi australis*; 11-12, *L. goyi goyi*; 13, *L. calidus notialis*; 14, *L. calidus calidus*. Fig. 15, fore claw of *L. goyi*. Fig. 16-28, ventral view of genitalia with ventral and lateral views (venter on right) of apical half of lobes of penes: 16-18, *L. goyi goyi*; 19-20, *L. goyi australis*; 21-23, *L. calidus calidus*; 24-25, *L. calidus notialis*; 26-28, *L. thierryi*. Fig. 29-42, outline of posterior margin of styliger plate of genitalia: 29-31, *L. goyi goyi*; 32, *L. goyi* (intergrade); 33-36, *L. goyi australis*; 37-38, *L. calidus calidus*; 39-40, *L. calidus notialis*; 41-42, *L. thierryi*. Fig. 43-44, dorsal outline and lateral view of eyes of *L. goyi goyi*.

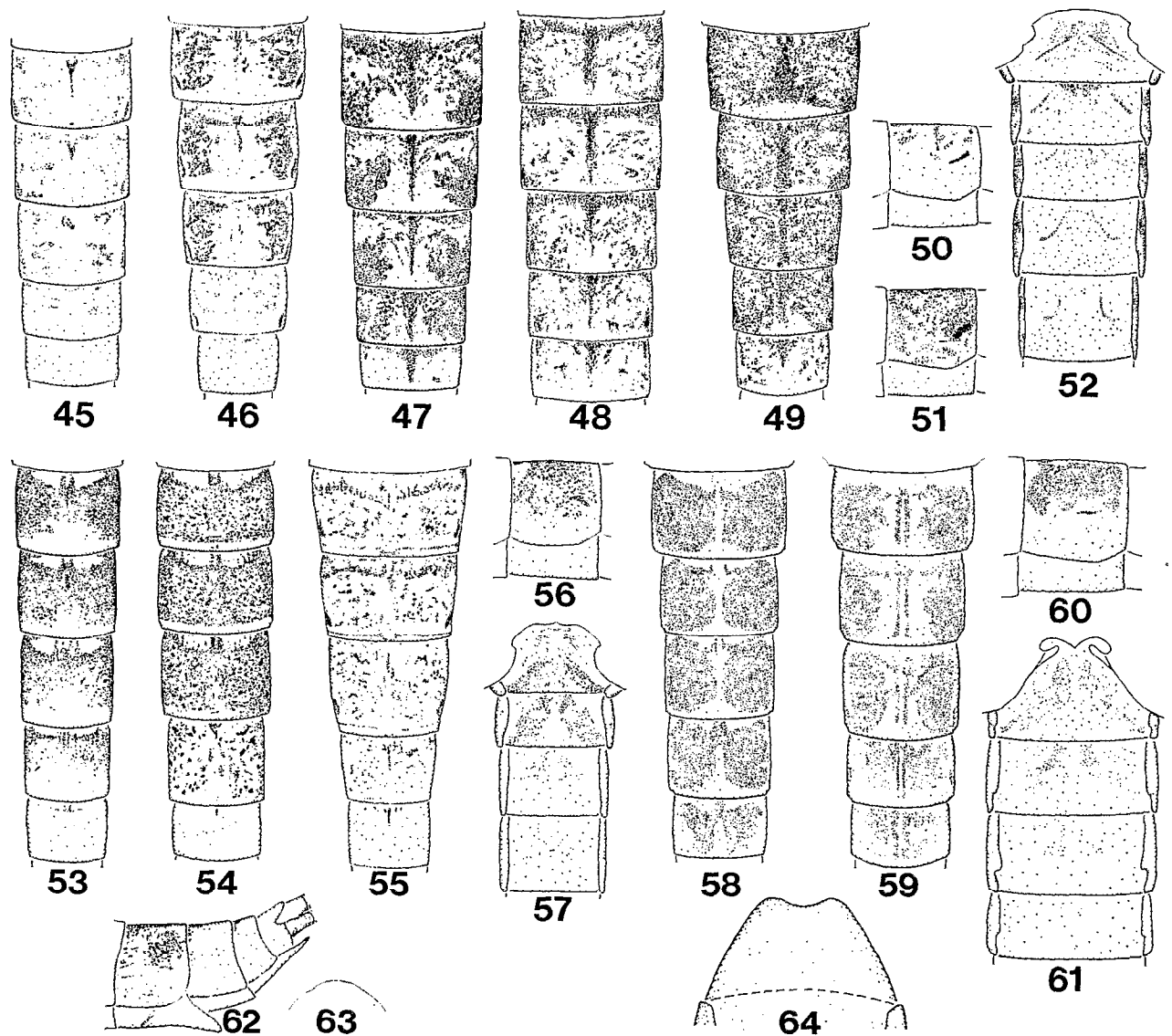


Fig. 45-61.—*Lepeorus*, abdominal segments of male imago. Fig. 45-49, terga 4-8: 45-46, *L. goyi goyi*; 47, *L. goyi* (intergrade); 48-49, *L. goyi australis*. Fig. 50-51, lateral view of segment 5: 50, *L. goyi goyi*; 51, *L. goyi australis*. Fig. 52, sterna 1-6 of *L. goyi australis*. Fig. 53-55, terga 4-8: 53-54, *L. calidus calidus*; 55, *L. calidus notialis*. Fig. 56-57, *L. calidus calidus*; 56, lateral view of segment 5; 57, sterna 1-4. Fig. 58-61, *L. thierryi*: 58-59, terga 4-8; 60, lateral view of segment 5; 61, sterna 1-4.

Fig. 62-64.—*Lepeorus goyi*, female imago: 62, lateral view of abdominal segments 7-10; 63, margin of abdominal sternum 7; 64, abdominal sternum 9.

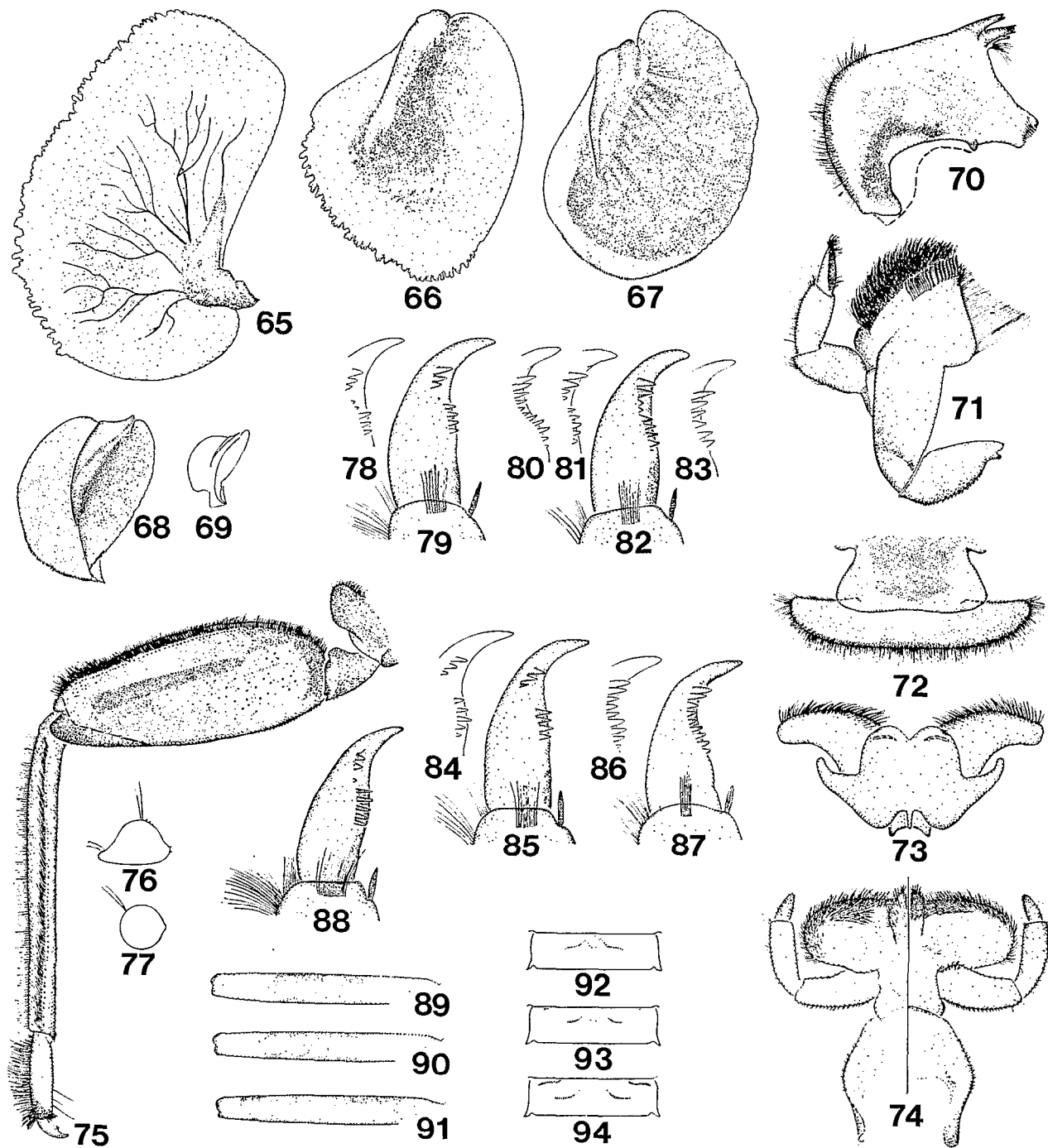


Fig. 65-94.—*Lepeorus*, nymph. Fig. 65-66, *L. goyi goyi*: 65, gill 1; 66, gill 4. Fig. 67-77, *L. thierryi*: 67, gill 4; 68-69, gill 7 with variation; 70, left mandible; 71, ventral view of right maxilla; 72, clypeus and labrum (reduced to .75 in proportion to other mouthparts); 73, hypopharynx; 74, labium; 75, fore leg; 76-77, cross section of tibia and tarsus. Fig. 78-88, fore claw with outlines of variation: 78-79, *L. goyi goyi*; 80-83, *L. goyi australis*; 84-85, *L. calidus calidus*; 86-87, *L. calidus notialis*; 88, *L. thierryi*. Fig. 89-91, tibia: 89-90, *L. calidus calidus*; 91, *L. calidus notialis*. Fig. 92-94, abdominal sternum 5 *L. goyi australis*.

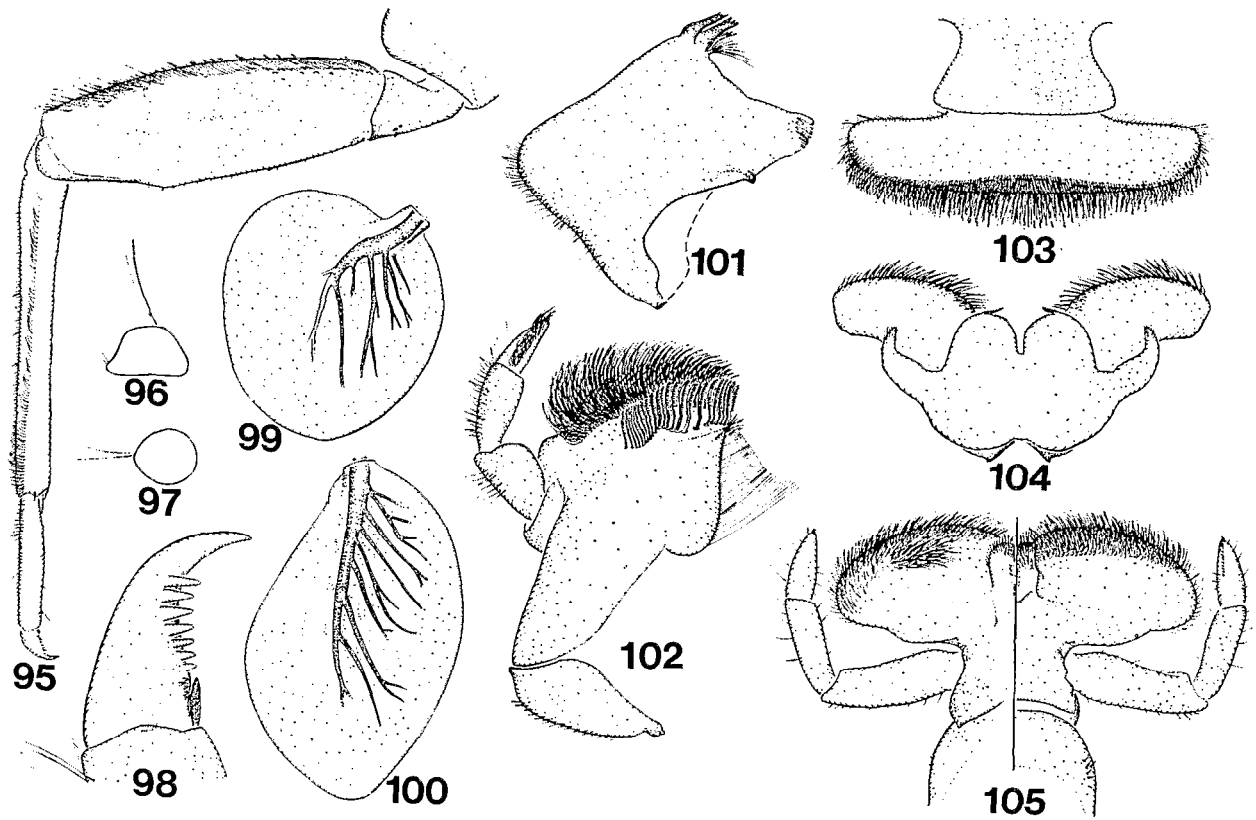


Fig. 95-105.—*Lepegenia lineata* nymph: 95, fore leg; 96-97, cross section of tibia and tarsus; 98, fore claw; 99, gill 1; 100, gill 4; 101 left mandible; 102, ventral view of right maxilla; 103, clypeus and labrum (reduced to .75 in proportion to other mouthparts) 104, hypopharynx; 105, labium.

APPENDIX

Localities from which Figures were prepared

Species	Locality Number	Figure Number
<i>Lepeorus goyi goyi</i>	N14	11, 65-66, 79
	N34	31, 45, 50
	N35	30
	N37	29, 78
	N42	12, 16-18, 46
	N43	43-44
<i>L. goyi</i> (intergrade).....	N13	15, 32, 47, 62-64
<i>L. goyi australis</i>	N22	10, 33, 81-82, 94
	N25	49, 51-52
	N27	34, 83, 92
	N51	19-20, 35-36, 48, 80, 93
<i>L. calidus calidus</i>	N14	90
	N16	7-9, 38, 54, 57, 85, 89
	N17	21
	N24	84
	N40	14, 37, 53, 56
	N42	22-23
<i>L. calidus notialis</i>	N27	13, 24-25, 39, 55, 86, 91
	N55	40
	FNK4	87
<i>L. thierryi</i>	N17	1, 26-28, 42, 58, 60-61, 70-74, 88
	N18	3
	N42	59
	N47	2, 66-69, 75-77
<i>Lepegenia lineata</i>	N28	4, 98, 101-105
	FNK63	5, 95-97
	FNK75	6, 99-100