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CYCLOPOID COPEPODS OF THE GENUS *LICHOMOLGUS* ASSOCIATED WITH OCTOCORALS OF THE FAMILIES XENIIDAE, NIDALIIDAE, AND TELESTIDAE IN MADAGASCAR

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In two previous papers (Humes and Ho, 1968b and 1968c) several new species of *Lichomolgus* were described, all associated with octocorals of the families Nephtheidae and Alcyoniidae in the region of Nosy Bé, in northwestern Madagascar. This paper deals with seven new species associated with the alcyonacean families Xeniidae (*Anthelia, Heteroxenia,* and *Xenia*) and Nidaliidae (*Siphonogorgia*) and with the telestacean family Telestidae (*Telesto* and *Coelogorgia*) from the same geographical area.

All collections were made by A. G. Humes, those in 1960 during an expedition sponsored by the Academy of Natural Sciences of Philadelphia, and those in 1963–64 as part of the U. S. Program in Biology of the International Indian Ocean Expedition.

The study of the specimens has been aided by a grant (GB-5838) from the National Science Foundation of the United States.

All figures have been drawn with the aid of a camera lucida. The letter after the explanation of each figure refers to the scale at which it was drawn. The abbreviations used are: A_1 = first antenna, A_2 = second antenna, MXPD = maxilliped, and P_1 = leg 1.

All descriptions are based on type material. The measurements of the length of the body have been made in all cases from specimens in lactic acid and do not include the setae on

the caudal rami. The lengths of the segments of the first antennae have been measured along their posterior non-setiferous margins.

We are indebted to Mme. A. Tixier-Durivault of the Muséum National d'Histoire Naturelle, Paris, for the identifications of the octocorals collected in 1960, and to Dr. J. Verseveldt, Zwolle, The Netherlands, for the determinations of those collected in 1963–64.

The new copepods described below are as follows:

1. *Lichomolgus verseveldti* new species
   from *Heteroxenia elisabethae* Kölliker.
2. *Lichomolgus triquetrus* new species
   from *Anthelia gracilis* (May).
3. *Lichomolgus glabripes* new species
   from *Xenia umbellata* Lamarck.
4. *Lichomolgus longispinifer* new species
   from *Siphonogorgia pendula* Studer.
5. *Lichomolgus hians* new species
   from *Siphonogorgia pendula* Studer.
6. *Lichomolgus telestophilus* new species
   from *Telesto arborea* Wright and Studer.
7. *Lichomolgus clavatus* new species
   from *Coelogorgia palmosa* Milne Edwards and Haime.

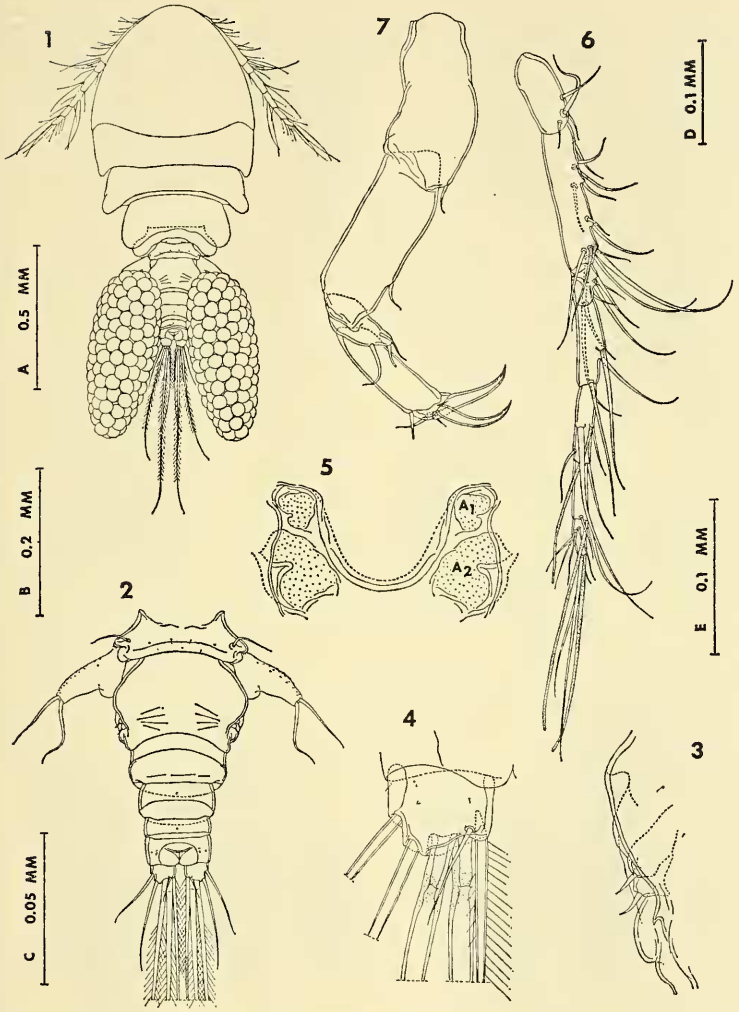
FAMILY LICHOMOLGIDAE KOSSMANN, 1877

Genus *Lichomolgus* Thorell, 1859

Lichomolgus verseveldti new species
Figures 1–26

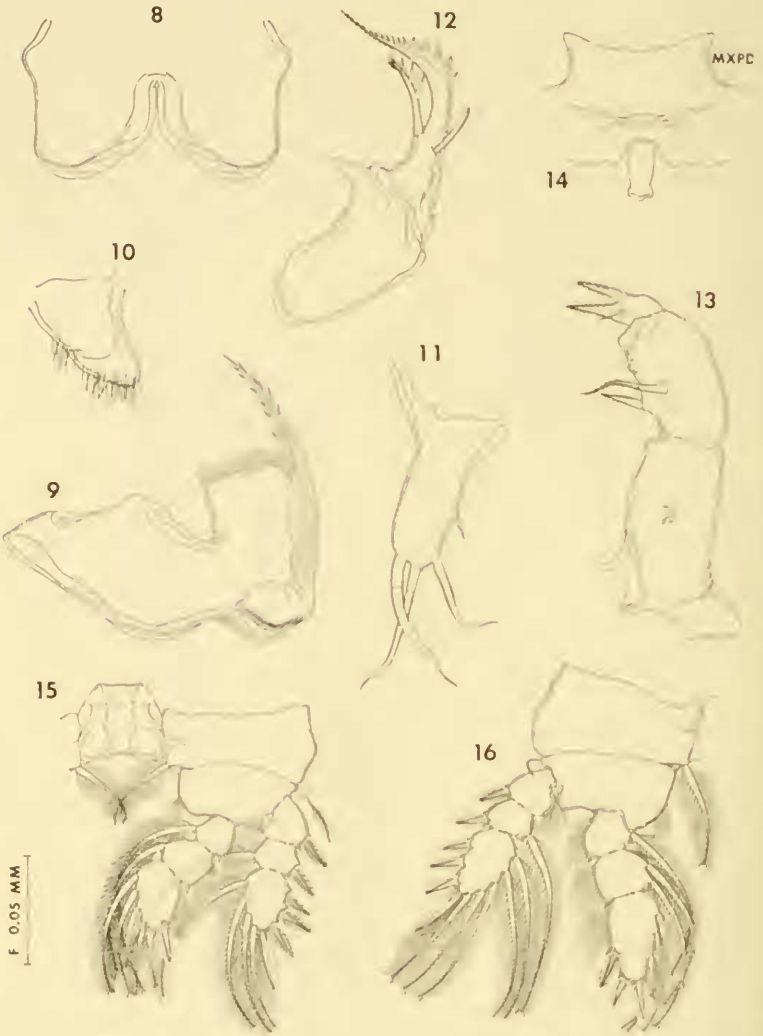
Type material: 92 ♀ ♀, 25 ♂ ♂, and 7 copepodids from colonies of *Heteroxenia elisabethae* Kölliker, in 1 m, Pte. Lokobe, Nosy Bé, Madagascar, collected 13 August 1960. Holotype ♀, allotype, and 81 paratypes (65 ♀ ♀, 16 ♂ ♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

Other specimens (all from *Heteroxenia elisabethae*): 16 ♀ ♀, 4 ♂ ♂, and 3 copepodids, in 1 m, Pte. Lokobe, 12 August 1960; 14 ♀ ♀, 1 copepodid, in 1 m, Pte. Lokobe, 1 November 1960; and 40 ♀ ♀, 25 ♂ ♂, and 3 copepodids, in 1 m, Pte. Ambarionaomby, Nosy Komba, near Nosy Bé, 27 September 1964.

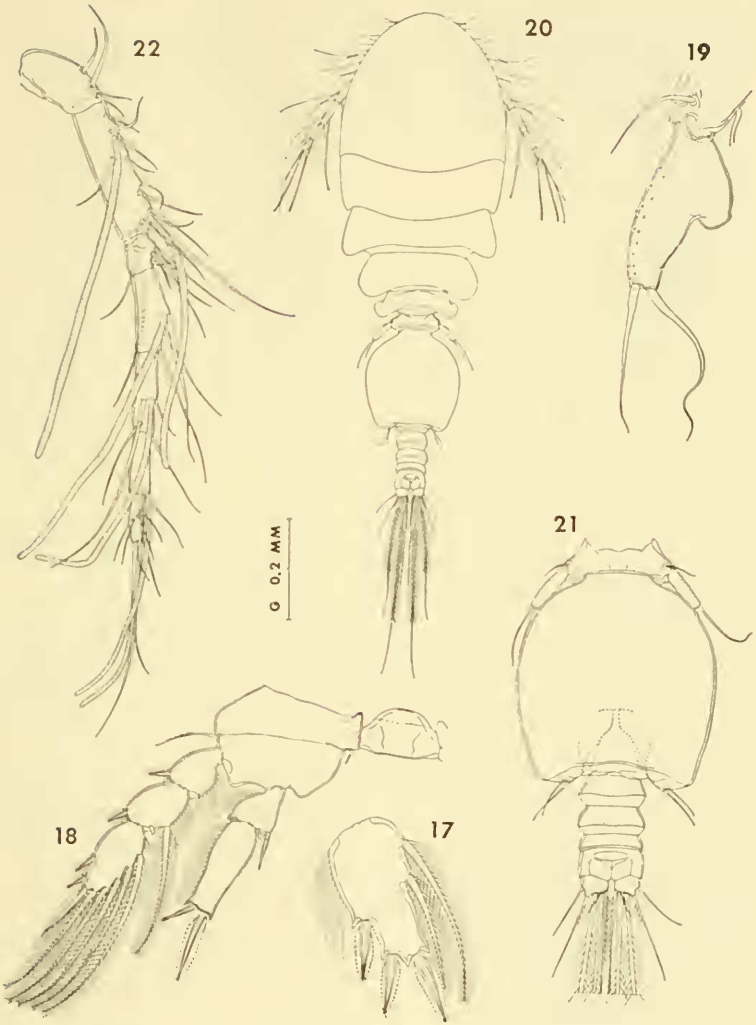


FIGS. 1–7. *Lichomolgus verseveldti*, new species, female: 1, body dorsal (A); 2, urosome, dorsal (B); 3, area of attachment of egg sac, dorsal (C); 4, caudal ramus, dorsal (C); 5, rostral area, ventral (D); 6, first antenna, ventral (D); 7, second antenna, posterior (outer) (E).

Female: Body (fig. 1) with prosome not unusually broadened. Length 1.20 mm (1.12–1.25 mm) and greatest width 0.54 mm (0.51–0.58 mm), based on 10 specimens. Ratio of length to width of prosome 1.47 : 1. Segment of leg 1 distinctly separated from head dorsally by a



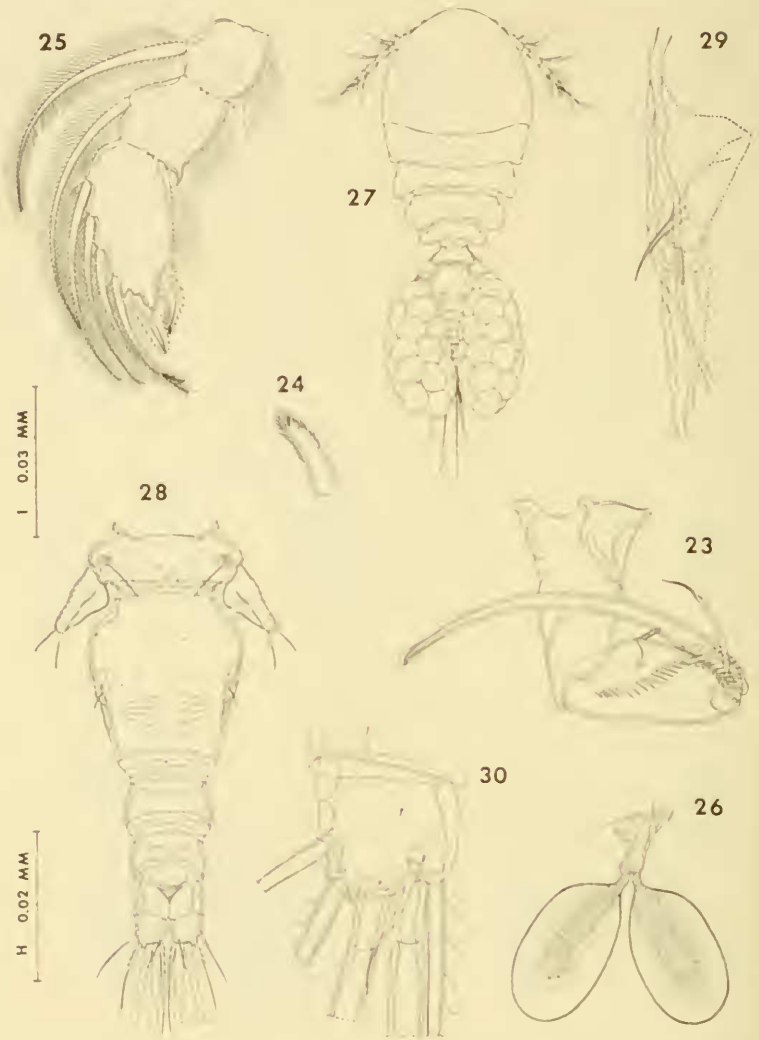
Figs. 8–16. *Lichomolgus verseveldti*, new species, female: 8, labrum, ventral (F); 9, mandible, posterior (C); 10, paragnath, ventral (C); 11, first maxilla, posterior (C); 12, second maxilla, posterior (F); 13, maxilliped, posterior (F); 14, area between maxillipeds and first pair of legs, ventral (D); 15, leg 1 and intercoxal plate, anterior (D); 16, leg 2, anterior (D).



FIGS. 17–22. *Lichomolgus verseveldti*, new species, female: 17, third segment of endopod of leg 3, anterior (E); 18, leg 4 and intercoxal plate, anterior (D); 19, leg 5, dorsal (E). Male: 20, body, dorsal (G); 21, urosome, dorsal (D); 22, first antenna, ventral (E).

transverse furrow. Epimeral areas of segments of legs 1–4 as shown in figure.

Segment of leg 5 (fig. 2) 68 $\mu \times 187$ μ. Between this segment and genital segment a slight ventral intersegmental sclerite. Genital segment



FIGS. 23–30. *Lichomolgus verseveldti*, new species, male: 23, maxilliped, inner (F); 24, outer element on second segment of maxilliped, posterior (H); 25, endopod of leg 1, anterior (C); 26, spermatophores, attached to genital segment of female, lateroventral (B). *Lichomolgus triquetrus*, new species, female: 27, body, dorsal (A); 28, urosome, dorsal (D); 29, area of attachment of egg sac, dorsal (I); 30, caudal ramus, dorsal (I).

only slightly longer than wide, 200 $\mu \times 190$ μ, widest in its anterior half and narrowed posteriorly, where the dorsal surface has two transverse lines simulating a segment but the ventral surface is smooth. Areas of attachment of egg sacs lateral in position just behind widest portion of segment. Each area (fig. 3) bearing two naked setae about 12 μ long. Three postgenital segments 55 $\mu \times 101$ μ, 34 $\mu \times 91$ μ, and 40 $\mu \times 90$ μ, from anterior to posterior.

Caudal ramus (fig. 4) slightly wider than long, 31 $\mu \times 34$ μ in greatest dimensions. Outer lateral seta 86 μ long and naked, pedicellate dorsal seta 33 μ and naked, outermost distal seta 130 μ and naked, innermost distal seta 260 μ with lateral spinules (mostly along inner edge), and the two long median terminal setae 495 μ (outer) and 620 μ (inner), both with strong lateral spinules and both inserted between unornamented dorsal and ventral flaps. A minute setule on proximal outer margin of ramus.

Dorsal surface of prosome without hairs; surface of urosome with only a few hairs and refractile points. Ratio of length of prosome to that of urosome 2.25 : 1.

Egg sac (fig. 1) elongated, 570 $\mu \times 230$ μ, with many eggs, each about 50 μ in diameter.

Rostral area (fig. 5) with a well defined broadly rounded posteroventral margin.

First antenna (fig. 6) 7-segmented, 495 μ long. Lengths of segments: 50 μ (77 μ along anterior margin), 138 μ, 35 μ, 78 μ, 74 μ, 56 μ, and 37 μ respectively. Formula for armature: 4, 13, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae naked.

Second antenna (fig. 7) 4-segmented, last segment moderately elongated, 90 μ along its outer edge, 57 μ along its inner edge, 23 μ wide, bearing distally five small hyaline elements and two slightly unequal claws 55 μ and 46 μ in length. Distalmost of three setae on third segment with a blunt tip. All setae naked.

Labrum (fig. 8) with two posteroventral lobes. Mandible (fig. 9) with basal region distal to constriction showing on its convex margin a scalelike protrusion ornamented with a row of spinules, followed by a serrated fringe, and on its concave margin a row of slender spinules. Flagellum rather short and coarsely barbed. Paragnath (fig. 10) a small hairy lobe. First maxilla (fig. 11) with three long terminal and one short subterminal setae, all naked. Second maxilla (fig. 12) 2-segmented. First segment unarmed, second with a minute setule on its proximal outer (ventral) surface, a surficial posterior seta finely barbed along one edge, an inner (dorsal) distal spine with several large spinules along its distal edge, and the segment produced distally to form a lash with strong teeth along one edge proximally, grading into fine bilateral spinulation distally. Maxilliped (fig. 13) 3-segmented. First segment with a small posterior patch of spinules, second with an inner patch of spinules and two barbed setae, and third with a small naked seta and

two terminal barbed spiniform elements, one without a distinct articulation.

Area between maxillipeds and first pair of legs (fig. 14) not protuberant; a sclerotized line between bases of maxillipeds.

Legs 1–4 (figs. 15–18) with trimerous rami except for endopod of leg 4 which is 2-segmented. Armature as follows (Roman numerals = spines, Arabic numerals = setae):

P_1	protopod	0–1	1–0	exp	I–0	I–1	III,I,4
				end	0–1	0–1	I,5
P_2	protopod	0–1	1–0	exp	I–0	I–1	III,I,5
				end	0–1	0–2	I,II,3
P_3	protopod	0–1	1–0	exp	I–0	I–1	III,I,5
				end	0–1	0–2	I,II,2
P_4	protopod	0–1	1–0	exp	I–0	I–1	II,I,5
				end	0–I	II	

Inner seta on coxa of legs 1–3 long and plumose, but in leg 4 short (17 μ) and naked. Outer margin of coxa of leg 1 showing a slight protrusion. Outer seta on basis short and naked in leg 2, longer and with lateral hairs in other legs. Inner margin of basis with row of hairs in legs 1–3, but naked in leg 4. Three middle spines on exopod of leg 1 with spinules along their proximal edges much stronger than in legs 2–4. Endopod of leg 4 (fig. 18) a little shorter than exopod. First segment 50 $\mu \times 40$ μ (including spiniform processes), with its inner distal element a slender naked spine 36 μ long. Second segment 97 μ (including processes) $\times$ 38 μ (greatest width), its two unequal terminal spines 34 μ (outer), with a slight distal fringe, and 72 μ (inner), with a prominent fringe. Both segments with outer margins haired, and second segment with a row of minute spinules on proximal inner margin and another row near insertions of terminal spines.

Leg 5 (fig. 19) with rather broad free segment, 122 μ long, with its proximal area expanded inwardly, width here being 55 μ. Segment bearing two terminal naked setae 91 μ (outer) and 114 μ (inner) and ornamented with small spinules on its outer surface. Seta on body near base of free segment 66 μ and naked; a few small spinules near its insertion.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 3).

Color in life in transmitted light opaque to translucid, eye red, ovary gray, egg sacs gray.

Male: Body (fig. 20) with prosome a little more slender than in female. Length 0.90 mm (0.86–0.94 mm) and greatest width 0.35 mm (0.33–0.36 mm), based on 10 specimens. Ratio of length to width of prosome 1.79 : 1.

Segment of leg 5 (fig. 21) 33 $\mu \times 106$ μ. No ventral intersegmental sclerite. Genital segment about as long as wide, 203 $\mu \times 195$ μ. Four

postgenital segments 25 $\mu \times 64$ μ, 22 $\mu \times 64$ μ, 17 $\mu \times 62$ μ, and 24 $\mu \times 63$ μ, from anterior to posterior.

Caudal ramus much like that of female, 21 $\mu \times 25$ μ, with a few inner proximal hairs on outermost distal seta.

Dorsal surface of prosome smooth; surface of urosome with a few small hairs as in figure. Ratio of length of prosome to that of urosome 1.62 : 1.

Rostral area as in female.

First antenna (fig. 22) resembling that of female, but with two aesthetes added on second segment and one on fourth segment, so that formula is 4, 13 + 2 aesthetes, 6, 3 + 1 aesthete, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Second antenna like that of female, but with small spinules added on inner surface of first, second, and fourth segments.

Labrum, mandible, paragnath, first maxilla, and second maxilla like those of female. Maxilliped (fig. 23) 4-segmented, assuming that proximal part of claw represents a fourth segment. First segment unarmed. Second segment with two setae, one slender and naked, the other (fig. 24) stout, spiniform, obtusely tipped, and spinulose; and with two rows of moderately long spines. Third segment short and unarmed. Claw slender, 168 μ along its axis including terminal lamella, with a suggestion of division midway along its length, and bearing two proximal setae, that on inner surface long with a finely barbed tip, the other on concave margin short and naked.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with spine and setal formula as in that sex except for last segment of endopod of leg 1 (fig. 25) which is I,I,4. This endopod slightly geniculate. No sexual dimorphism in legs 2 or 3. Endopod of leg 4 as in female.

Leg 5 (fig. 21) with slender free segment 42 $\mu \times 11$ μ, without a proximal expansion. Outer surface with a few minute spinules. Two terminal naked setae 30 μ (inner) and 77 μ (outer). Seta on body near free segment 30 μ and naked.

Leg 6 (fig. 21) a posterolateral flap on ventral surface of genital segment bearing two naked setae 66 μ and 50 μ long.

Spermatophore (fig. 26), attached to female in pairs, elongated, 210 $\mu \times 117$ μ, not including neck.

Color in life as in female.

Etymology: This species is named for Dr. J. Verseveldt, who has identified many octocorals which were the hosts for copepods.

Comparison with related species: There are 40 species of *Lichomolgus* which, like *L. verseveldti*, have two claws on the second antenna and the formula II,I,5 for the third segment of the exopod of leg 4. Thirty-five of these have a seta (usually feathered) on the first segment of the endopod of leg 4, thus differing from the new species. In none of these is the proximal inner expansion (when present) of leg 5 like that in

L. verseveldti. *L. securiger* Humes, 1964, an associate of the nudibranch *Doris mabilla* Abraham in Madagascar, has a fifth leg somewhat resembling that of the new species, but differs in having a long flagellum on the mandible, spinules rather than strong teeth on the lash of the second maxilla, two extremely unequal setae on the second segment of the maxilliped of the female, a feathered seta on the first segment of the endopod of leg 4, relatively short aesthetes on the first antenna of the male, and the free segment of leg 5 in the male being about 2 : 1 instead of about 4 : 1 as in the new species.

The remaining five species in the genus (which similarly have two claws on the second antenna and the formula II,I,5 on the last segment of the exopod of leg 4) have a spine (rather than a seta) on the first segment of the endopod of leg 4, as in the new species. These species, the first five described by Humes and Ho (1968b), associated with nephtheid octocorals in Madagascar, may be distinguished from *L. verseveldti* by the combination of two characters,—the longer claws on the second antenna in both sexes and the form of leg 5 in the female.

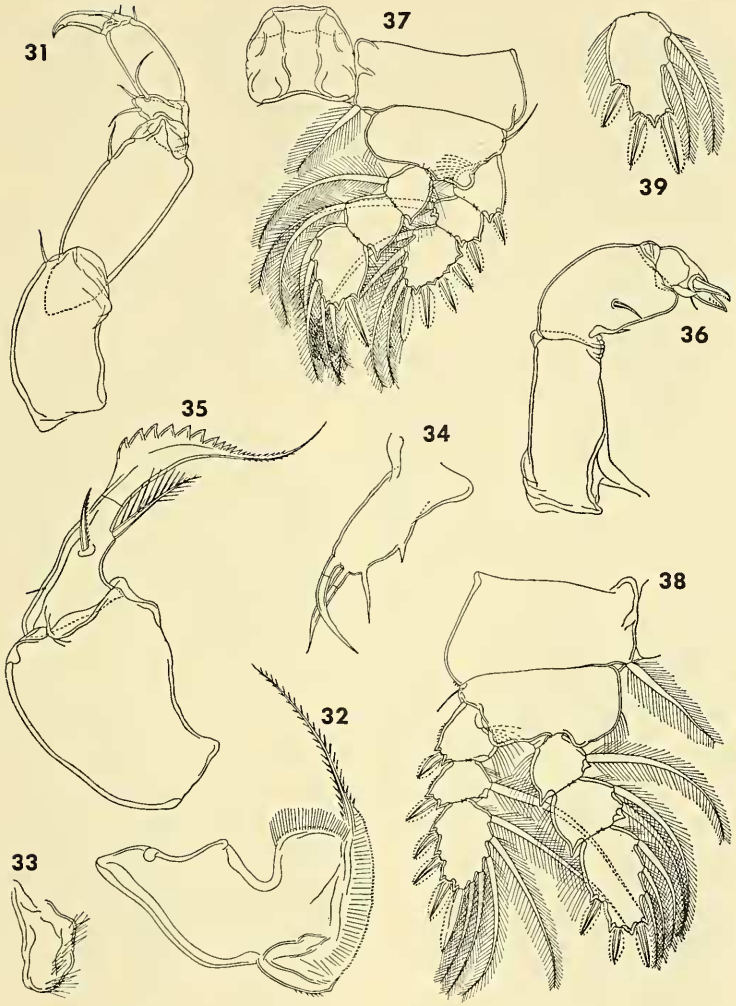
Lichomolgus triquetrus new species
Figures 27–48

Type material: 74♀♀, 27♂♂, and 10 copepodids from *Anthelia gracilis* (May), on stems of *Cymodocea* in 0.5 m, Antsakoabe, Nosy Bé, Madagascar, collected 12 July 1964. Holotype ♀, allotype, and 75 paratypes (55♀♀, 20♂♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

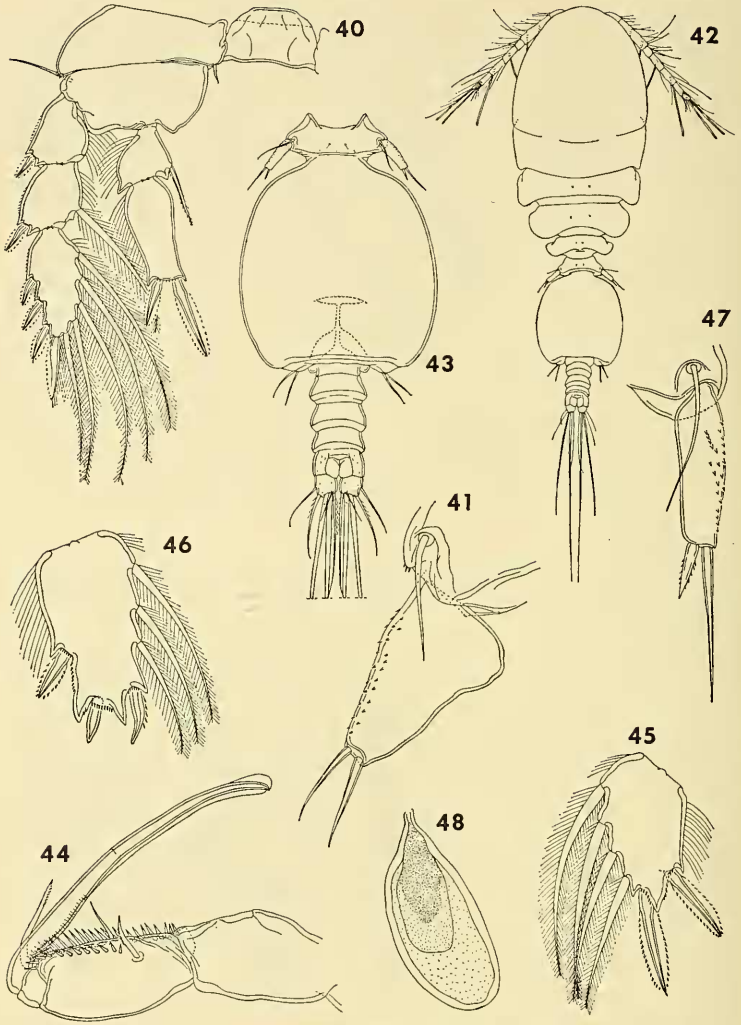
Female: Body (fig. 27) resembling that of *L. verseveldti*. Length 1.12 mm (1.01–1.23 mm) and greatest width 0.45 mm (0.42–0.47 mm), based on 10 specimens. Ratio of length to width of prosome 1.58 : 1. Segment of leg 1 separated from head by a dorsal furrow. Epimeral areas of segments of legs 1–4 as in figure.

Segment of leg 5 (fig. 28) 64 $\mu \times 148$ μ. Between this segment and genital segment a very slight ventral intersegmental sclerite. Genital segment a little longer than wide, 166 $\mu \times 143$ μ, in dorsal view broadest in its anterior third and tapering gradually posteriorly. Areas of attachment of egg sacs situated laterally near middle of segment. Each area (fig. 29) with two naked unequal setae, the longer one 21 μ and attenuated, the shorter one 10 μ with a rather blunt tip. Three postgenital segments 50 $\mu \times 80$ μ, 33 $\mu \times 69$ μ, and 39 $\mu \times 66$ μ, from anterior to posterior.

Caudal ramus (fig. 30) quadrate, 30 $\mu \times 28$ μ in greatest dimensions. Outer lateral seta 52 μ and naked, pedicellate dorsal seta 25 μ and naked, outermost distal seta 68 μ with only a few proximal outer spinules, innermost distal seta 115 μ with inner spinules, and the two long median terminal setae 240 μ (outer) and 385 μ (inner), both naked and both inserted between unornamented dorsal and ventral flaps.



Figs. 31–39. *Lichomolgus triquetrus*, new species, female: 31, second antenna, posterior (outer) (F); 32, mandible, posterior (C); 33, paragnath, ventral (C); 34, first maxilla, anterior (C); 35, second maxilla, posterior (C); 36, maxilliped, posterior (F); 37, leg 1 and intercoxal plate, anterior (E); 38, leg 2, anterior (E); 39, third segment of endopod of leg 3, anterior (E).



Figs. 40–48. *Lichomolgus triquetrus*, new species, female: 40, leg 4 and intercoxal plate, anterior (E); 41, leg 5, dorso-inner (C). Male: 42, body, dorsal (G); 43, urosome, dorsal (D); 44, maxilliped, outer (F); 45, third segment of endopod of leg 1, anterior (C); 46, third segment of endopod of leg 2, anterior (C); 47, leg 5, dorsal (I); 48, spermatophore, as seen inside genital segment of male, dorsal (D).

Dorsal surface of prosome and urosome with a few hairs. Ratio of length of prosome to that of urosome 1.94 : 1.

Egg sac (fig. 27) elongated, 473 $\mu \times 204$ μ, reaching well beyond caudal rami and containing about 22–26 moderately large eggs, each approximately 68 μ in diameter.

Rostral area as in *L. verseveldti.*

First antenna also like that of *L. verseveldti,* with same formula for armature. Lengths of segments: 23 μ (57 μ along anterior margin), 112 μ, 22 μ, 49 μ, 46 μ, 35 μ, and 22 μ respectively. All setae naked. Second antenna (fig. 31) 4-segmented, last segment not greatly elongated, 58 μ along its outer edge, 40 μ along its inner edge, 23 μ wide, bearing distally six small hyaline elements and a single relatively short claw 31 μ along its axis. All setae naked.

Labrum as in *L. verseveldti.* Mandible (fig. 32) with fewer spinules on protrusion of convex margin of basal part distal to constriction and with flagellum longer than in *L. verseveldti.* Paragnath (fig. 33) a small hairy lobe. First maxilla (fig. 34) with four elements as in *L. verseveldti.* Second maxilla (fig. 35) in general like that of *L. verseveldti,* but with inner distal spine of second segment with three rows of slender spinules. Maxilliped (fig. 36) lacking patches of spinules on first and second segments and the two setae on second segment naked and smaller than in *L. verseveldti.*

Area between maxillipeds and first pair of legs as in *L. verseveldti,* but slightly protuberant; a sclerotized line between bases of maxillipeds.

Legs 1–4 (figs. 37–40) segmented as in *L. verseveldti,* and with same spine and setal formula except for leg 4 where exopod is I–0; I–1; III,I,5 and endopod is 0–1; II. Inner seta on coxa of leg 4 short (15 μ) and naked, instead of long and plumose as in legs 1–3. Outer seta on basis short in leg 2, as in *L. verseveldti,* and inner margin of basis naked in leg 4 as in that species. Endopod of leg 4 (fig. 40) shorter than exopod. First segment 40 $\mu \times 39$ μ (including spiniform processes), with inner distal element a seta 38 μ long which is lightly feathered in some specimens and apparently naked in others. Second segment 70 $\mu \times 33$ μ in greatest dimensions including processes, its two unequal terminal fringed spines 35 μ (outer) and 54 μ (inner). Both segments with outer margins haired and second segment with a row of minute spinules near insertions of terminal spines.

Leg 5 (fig. 41) with rather triangular free segment, 63 $\mu \times 39$ μ in greatest dimensions, bearing two relatively short terminal naked setae 29 μ (outer) and 31 μ (inner). Small spinules on outer surface of segment. Seta on body near base of segment 44 μ and naked, a few small spinules near its insertion.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 29).

Color in life in transmitted light translucid except for fine reddish brown speckling, eye red, ovary gray, egg sacs greenish gray.

Male: Body (fig. 42) similar in general form to that of female, but prosome a little more slender. Length 0.89 mm (0.85–0.96 mm) and greatest width 0.29 mm (0.28–0.30 mm), based on 10 specimens. Ratio of length to width of prosome 1.85 : 1.

Segment of leg 5 (fig. 43) 41 $\mu \times 98$ μ. No ventral intersegmental sclerite. Genital segment about as long as wide, 205 $\mu \times 195$ μ. Four postgenital segments 31 $\mu \times 58$ μ, 25 $\mu \times 55$ μ, 23 $\mu \times 52$ μ, and 25 $\mu \times 50$ μ, from anterior to posterior.

Caudal ramus similar to that of female, but smaller, 23 $\mu \times 22$ μ.

Dorsal surface of prosome and urosome with a few hairs. Ratio of length of prosome to that of urosome 1.58 : 1.

Rostral area as in female.

First antenna as in *L. verseveldti*, with three aesthetes added as in that species. Second antenna as in female, without sexual dimorphism.

Labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 44) with two setae on second segment attenuated, one of them with small spinules along one edge, the other naked. Claw 168 μ along its axis including terminal lamella, with its outer proximal surface faintly striated. Otherwise maxilliped similar to that of *L. verseveldti*.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with spine and setal formula as in that sex except for last segment of endopod of leg 1 (fig. 45) which is I,I,4. (One male showed the formula I,5 on both first legs, but the usual condition is I,I,4.) Last segment of endopod of leg 2 (fig. 46) with same formula as in female, but two terminal spines modified. Legs 3 and 4 as in female.

Leg 5 (fig. 47) with an elongated and somewhat rectangular free segment, 33 $\mu \times 10$ μ with nearly parallel sides. Two terminal elements very unequal, the outer one a naked seta 31 μ long, the inner one a delicately barbed spine 12 μ. (In the same male mentioned above which showed the abnormal armature of the last segment of the endopod of leg 1, the fifth leg had the unusual condition of two nearly equal naked setae, as in the female.) Outer surface of segment with small spinules. Seta on body near free segment 30 μ and naked.

Leg 6 (see fig. 43) a posterolateral flap on ventral surface of genital segment bearing two naked setae about 33 μ long.

Spermatophore (fig. 48), seen only inside genital segment of male, elongated with an unusually thick wall.

Color in life as in female.

Etymology: The specific name *triquetrus*, from Latin = three-cornered, triangular, refers to the rather triangular form of the free segment of leg 5 in the female.

Comparison with related species: In six species of *Lichomolgus* the second antenna bears terminally a single claw and a few small hyaline elements and the formula for the last segment of the exopod of leg 4

is III,I,5, as in the new species. All of these differ from *L. triquetrus*, however, in significant respects. In *L. dentipes* Thompson and A. Scott, 1903, there is a large toothlike process on leg 5 of the female. (This species has been redescribed by Humes and Ho, 1968c.) In *L. protentus* Humes and Frost, 1964, the caudal ramus of the female is twice as long as wide, and the formula for the endopod of leg 4 is 0–1; 1,I. In *L. spinipes* (Sewell, 1949) leg 5 of the female is long and curved, and the formula for the endopod of leg 4 is 0–1; 1,I. In *L. squamiger* Humes and Frost, 1964, the areas of attachment of the egg sacs are dorsolateral, the endopod of leg 4 is a little longer than the exopod, and leg 5 in the female is elongated with broad scalelike spines. In the two remaining species, *L. cristatus* and *L. adelphus*, both described by Humes and Ho (1968c), leg 5 in the female is elongated, at least five times longer than wide.

In *L. elegans* Thompson and A. Scott, 1903, the second antenna of the female has a single claw as in the new species. The armature of the exopod of leg 4 is undescribed. (The male is unknown.) This Ceylonese species differs from *L. triquetrus* in the genital segment having "a wedge-shaped notch near the centre on each side," in the second segment of the first antenna being relatively longer, and in the inner distal seta on the first segment of the endopod of leg 4 being longer and more conspicuously feathered.

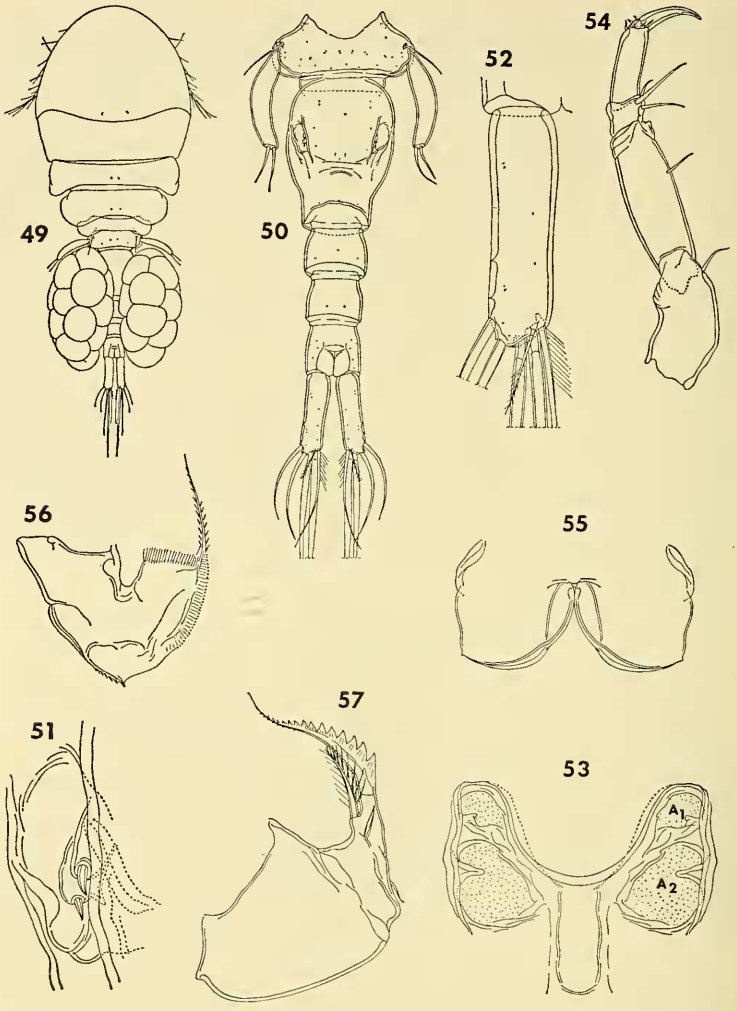
Lichomolgus glabripes new species
Figures 49–68

Type material: 53♀♀, 37♂♂, and 33 copepodids from *Xenia umbellata* Lamarck, in 1 m, Andilana, Nosy Bé, Madagascar, collected 9 August 1963. Holotype ♀, allotype and 69 paratypes (40♀♀, 29♂♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

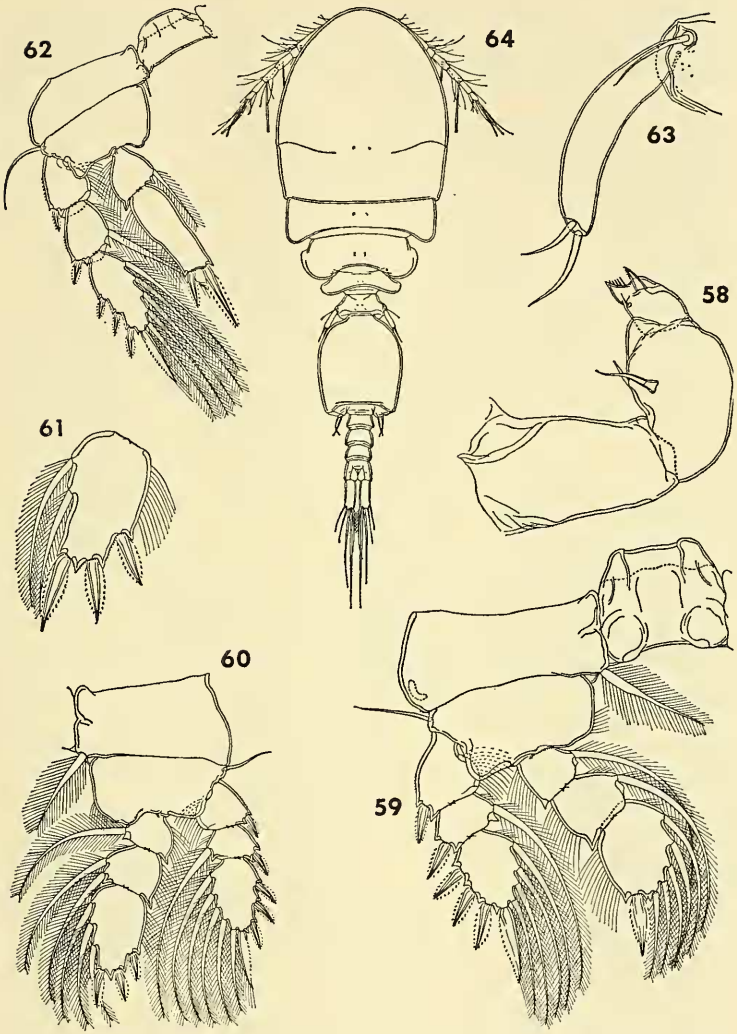
Female: Body (fig. 49) with a moderately slender prosome. Length 1.33 mm (1.26–1.42 mm) and greatest width 0.53 mm (0.51–0.55 mm), based on 10 specimens. Ratio of length to width of prosome 1.46 : 1. Segment of leg 1 separated from head by a dorsal furrow. Epimeral areas of segments of legs 1–4 as in figure.

Segment of leg 5 (fig. 50) 99 $\mu \times 200$ μ. Between this segment and genital segment a short ventral intersegmental sclerite. Genital segment longer than wide, 200 $\mu \times 151$ μ in greatest dimensions, its posterior part in dorsal view somewhat constricted (99 μ wide). Areas of attachment of egg sacs located dorsolaterally just anterior to middle of segment. Each area (fig. 51) with two short naked spiniform setae 7 μ and 4.5 μ long. Three postgenital segments 75 $\mu \times 87$ μ, 62 $\mu \times 78$ μ, and 70 $\mu \times 78$ μ, from anterior to posterior.

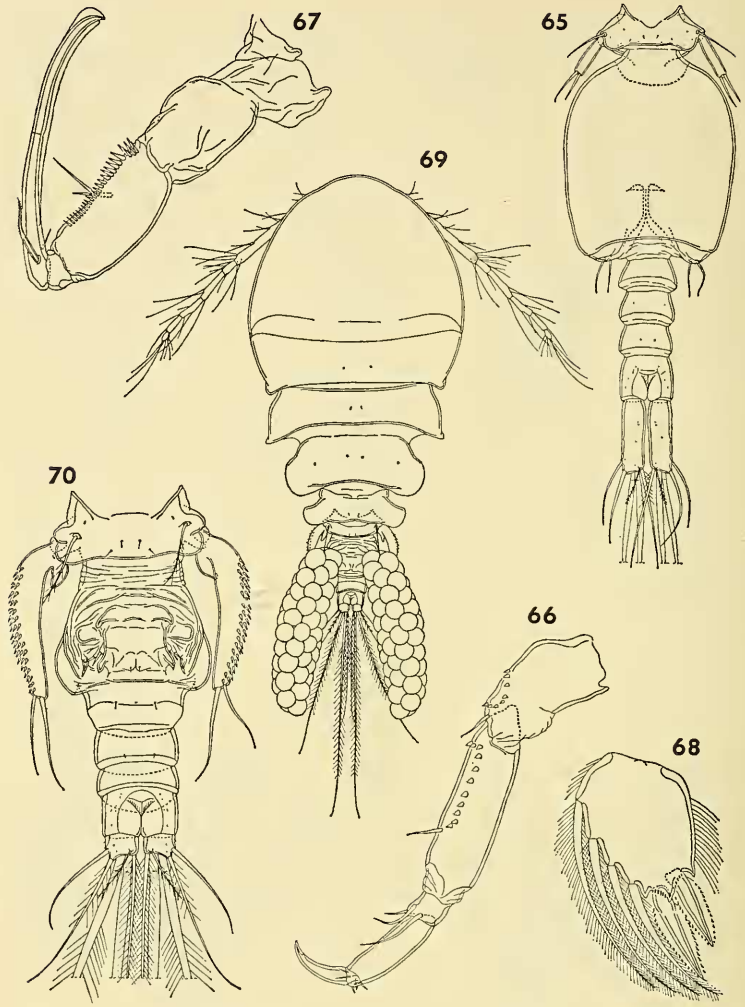
Caudal ramus (fig. 52) elongated, 110 $\mu \times 32$ μ, or 3.4 times longer than wide. Outer lateral seta 112 μ and naked, pedicellate dorsal seta 33 μ and lightly feathered, outermost distal seta 120 μ and naked, inner-



Figs. 49–57. *Lichomolgus glabripes*, new species, female: 49, body, dorsal (A); 50, urosome, dorsal (B); 51, area of attachment of egg sac, dorsal (I); 52, caudal ramus, dorsal (F); 53, rostral area, ventral (E); 54, second antenna, posterior (outer) (E); 55, labrum, ventral (F); 56, mandible, posterior (F); 57, second maxilla, posterior (F).



FIGS. 58–64. *Lichomolgus glabripes*, new species, female: 58, maxilliped, posterior (F); 59, leg 1 and intercoxal plate, anterior (E); 60, leg 2, anterior (D); 61, third segment of endopod of leg 3, anterior (E); 62, leg 4 and intercoxal plate, anterior (D); 63, leg 5, dorsal (E). Male: 64, body, dorsal (G).



FIGS. 65–70. *Lichomolgus glabripes*, new species, male: 65, urosome, dorsal (D); 66, second antenna, posterior (outer) (F); 67, maxilliped, inner (E); 68, third segment of endopod of leg 1, anterior (C). *Lichomolgus longispinifer*, new species, female: 69, body, dorsal (G); 70, urosome, dorsal (E).

most distal seta 130 μ with prominent inner proximal hairs, and the two long median terminal setae 200 μ (outer) and 263 μ (inner), both naked and inserted between an unornamented dorsal flap and a ventral flap with a marginal row of minute spinules.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 1.42 : 1.

Egg sac (fig. 49) elongated oval, 396 $\mu \times$ 220 μ, reaching just beyond anal segment and containing about 15–17 eggs, each approximately 105 μ in diameter.

Rostral area (fig. 53) with broadly rounded posteroventral margin.

First antenna 340 μ long, with segmentation and armature as in *L. verseveldti* and *L. triquetrus*. Lengths of segments: 25 μ (55 μ along anterior edge), 105 μ, 28 μ, 46 μ, 47 μ, 35 μ, and 24 μ respectively. All setae naked. Second antenna (fig. 54) 4-segmented and slender, last segment 61 μ along its outer edge, 44 μ along its inner edge, 18 μ wide, bearing distally six small hyaline elements and a single short claw 40 μ along its axis. All setae naked.

Labrum (fig. 55) with two broad and outwardly angular lobes. Mandible (fig. 56), paragnath, first maxilla, second maxilla (fig. 57), and maxilliped (fig. 58) resembling in major respects those of *L. triquetrus*.

Area between maxillipeds and first pair of legs as in *L. verseveldti*; a sclerotized line between bases of maxillipeds.

Legs 1–4 (figs. 59–62) segmented as in the two previous species, with spine and setal formula as in *L. triquetrus* (exopod of leg 4 being I–0; I–1; III,I,5). Coxa of leg 1 with a sclerotized boss on outer posterior surface. Inner seta on coxa of leg 4 short (20 μ) and naked, instead of long and plumose as in legs 1–3. Inner margin of basis of leg 4 naked, but haired in legs 1–3. Endopod of leg 4 shorter than exopod. First segment 51 $\mu \times$ 43 μ (including spiniform processes), with inner distal feathered seta 66 μ long. Second segment 98 $\mu \times$ 38 μ in greatest dimensions (including processes), its two unequal terminal fringed spines 37 μ (outer) and 64 μ (inner). Both segments with outer margins haired and second segment with a terminal row of minute spinules.

Leg 5 (fig. 63) with a long bowed free segment 135 $\mu \times$ 31 μ in greatest dimensions, without fine ornamentation. Two terminal naked setae 44 μ (outer) and 60 μ (inner). Seta on body near free segment 58 μ and naked. (In ovigerous females leg 5 is held erect so that its curvature fits around the ends of the egg sacs.)

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 51).

Color in life in transmitted light opaque to transparent, eye red, egg sacs gray.

Male: Body (fig. 64) resembling that of female. Length 1.04 mm (1.00–1.07 mm) and greatest width 0.35 mm (0.34–0.35 mm), based on 10 specimens. Ratio of length to width of prosome 1.67 : 1.

Segment of leg 5 (fig. 65) 47 $\mu \times 107$ μ. No ventral intersegmental sclerite. Genital segment longer than wide, 205 $\mu \times 169$ μ. Four postgenital segments 36 $\mu \times 60$ μ, 39 $\mu \times 55$ μ, 31 $\mu \times 52$ μ, and 43 $\mu \times 53$ μ, from anterior to posterior.

Caudal ramus similar to that of female, but relatively shorter, 73 $\mu \times 23$ μ, or 3.17 : 1.

Dorsal surface of prosome and urosome with only a few hairs. Ratio of length of prosome to that of urosome 1.33 : 1.

Rostral area as in female.

First antenna as in female, but with three aesthetes added as in the two previous species. Second antenna (fig. 66) like that of female, but with scalelike spines added on first two segments, those on first segment arranged in an arc.

Labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 67) slender. Second segment bearing a row of spines and two moderately long naked setae. Claw not greatly recurved, 189 μ along its axis including terminal lamella.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with spine and setal formula as in that sex except for last segment of endopod of leg 1 (fig. 68) which is I,I,4. Legs 2–4 as in female, without sexual dimorphism.

Leg 5 (fig. 65) with an elongated straight unornamented free segment, 44 $\mu \times 11$ μ, its two naked terminal setae 30 μ and 33 μ. Naked seta on body near free segment 40 μ.

Leg 6 (fig. 65) a posterolateral flap on ventral surface of genital segment bearing two naked setae 40 μ and 36 μ long.

Spermatophore not observed.

Color in life as in female.

Etymology: The specific name *glabripes*, from Latin *glaber* = without hairs, bald, and *pes* = foot, alludes to the absence of fine ornamentation on leg 5.

Comparison with related species: In seven species of *Lichomolgus* the second antenna bears terminally a single claw and a few small hyaline elements and the formula for the last segment of the exopod of leg 4 is III,I,5, as in *L. glabripes*. Each of these species may, however, be readily differentiated from *L. glabripes*. In *L. dentipes* Thompson and A. Scott, 1903, the free segment of leg 5 in the female has a large toothlike process. In *L. protentus* Humes and Frost, 1964, the armature of the endopod of leg 4 is 0–1; 1,I. In *L. spinipes* (Sewell, 1949) the caudal ramus is wider than long, and the fourth endopod is 0–1; 1,I. In *L. squamiger* Humes and Frost, 1964, the caudal ramus is 1 : 1, and leg 5 of the female bears scales. In *L. cristatus* Humes and Ho, 1968c, the genital segment of the female is wider than long, the mandible has a very short flagellum, and the lash of the second maxilla has a crest of long spinules. In *L. adelphus* Humes and Ho, 1968c, the caudal ramus is about 1 : 1, the genital segment of the female is wider than

long, and leg 5 of the female has scalelike spines. In *L. triquetrus,* described above, the caudal ramus is about 1 : 1, and the free segment of leg 5 is triangular and ornamented with small spines.

L. elegans Thompson and A. Scott, 1903, of which only the female is known, has a single claw on the second antenna. The armature of the exopod of leg 4 is undescribed. However, this Ceylonese species differs from *L. glabripes* in having the caudal ramus about as broad as long, and in the presence of "a wedge-shaped notch near the centre on each side" of the genital segment.

Lichomolgus longispinifer new species
Figures 69–89

Type material: 83 ♀♀, 28 ♂♂, and several copepodids from one colony of *Siphonogorgia pendula* Studer, in 10–12 m, south of Andjiabe, Nosy Komba, near Nosy Bé, Madagascar, collected 30 July 1964. Holotype ♀, allotype, and 80 paratypes (60 ♀♀, 20 ♂♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

Other specimens: 39 ♀♀, 47 ♂♂, and several copepodids from one colony of *Siphonogorgia pendula*, in 20 m, Banc de Dzamandzar, near Nosy Bé, 16 September 1964.

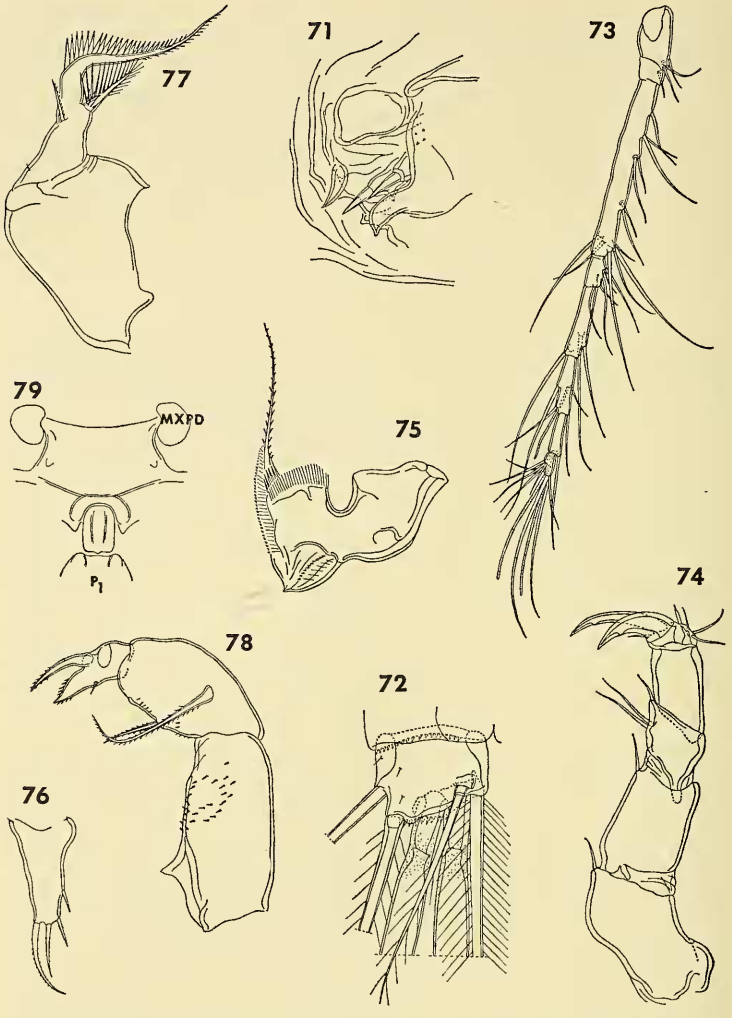
Female: Body (fig. 69) with prosome not much broadened; urosome relatively short. Length 0.88 mm (0.84–0.90 mm) and greatest width 0.43 mm (0.40–0.44 mm), based on 10 specimens. Ratio of length to width of prosome 1.60 : 1. Segment of leg 1 well separated from head dorsally. Epimeral areas of segments of legs 1 and 2 rather angular posteriorly, those of segments of legs 3 and 4 rounded.

Segment of leg 5 (fig. 70) 47 $\mu \times 101$ μ. Between this segment and genital segment no ventral intersegmental sclerite. Genital segment about as long as wide, 104 $\mu \times 101$ μ, in dorsal view gradually broadened from anterior to posterior, then rather abruptly constricted in its posterior fourth. Areas of attachment of egg sacs dorsal in position near midregion of segment. Each area (fig. 71) bearing two naked setae 11 μ and 9 μ long and two pointed processes. Three postgenital segments 26 $\mu \times 56$ μ, 21 $\mu \times 52$ μ, and 28 $\mu \times 51$ μ, from anterior to posterior.

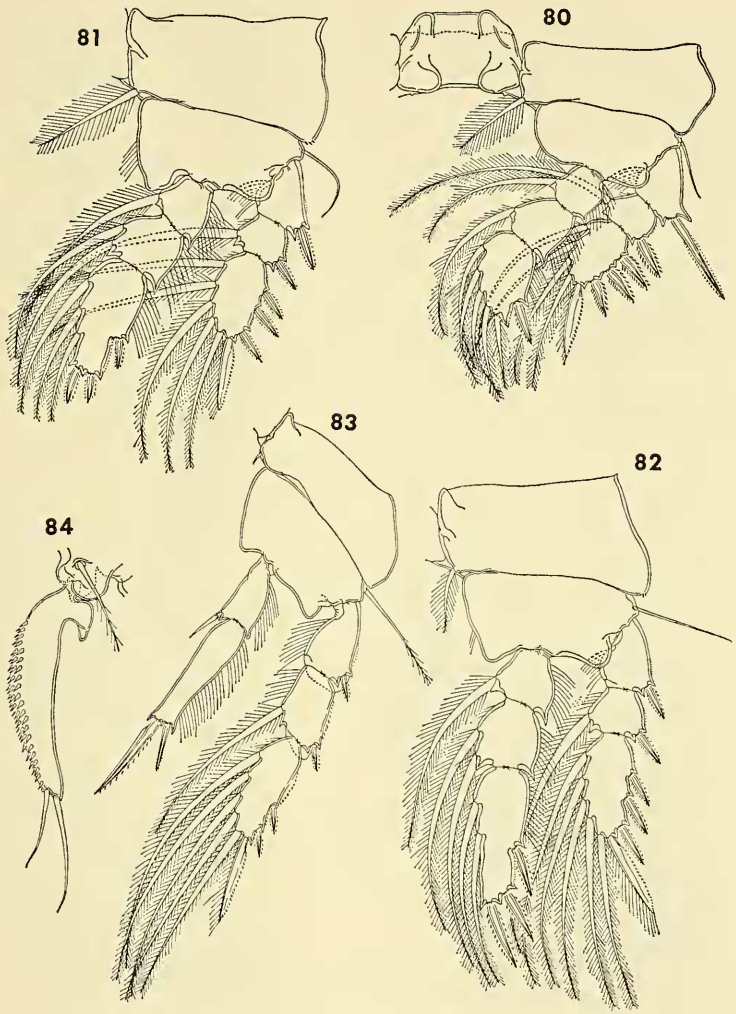
Caudal ramus (fig. 72) a little wider than long, 20 $\mu \times 22$ μ in greatest dimensions. Outer lateral seta 77 μ and naked, pedicellate dorsal seta 66 μ and lightly feathered, outermost distal seta 105 μ with lateral hairs proximally, innermost distal seta 143 μ and similarly haired, and the two long median terminal setae 440 μ (outer) and 495 μ (inner), both strongly haired along their midregions and both inserted between an unornamented dorsal flap and a ventral flap with a marginal row of minute spinules.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 3.33 : 1.

Egg sac (fig. 69) slender and elongated, 363 $\mu \times 101$ μ, reaching far



FIGS. 71–79. *Lichomolgus longispinifer*, new species, female: 71, area of attachment of egg sac, dorsal (I); 72, caudal ramus, dorsal (I); 73, first antenna, dorsal (D); 74, second antenna, anterior (inner) (F); 75, mandible, posterior (C); 76, first maxilla, posterior (C); 77, second maxilla, posterior (C); 78, maxilliped, posterior (C); 79, area between maxillipeds and first pair of legs, ventral (E).

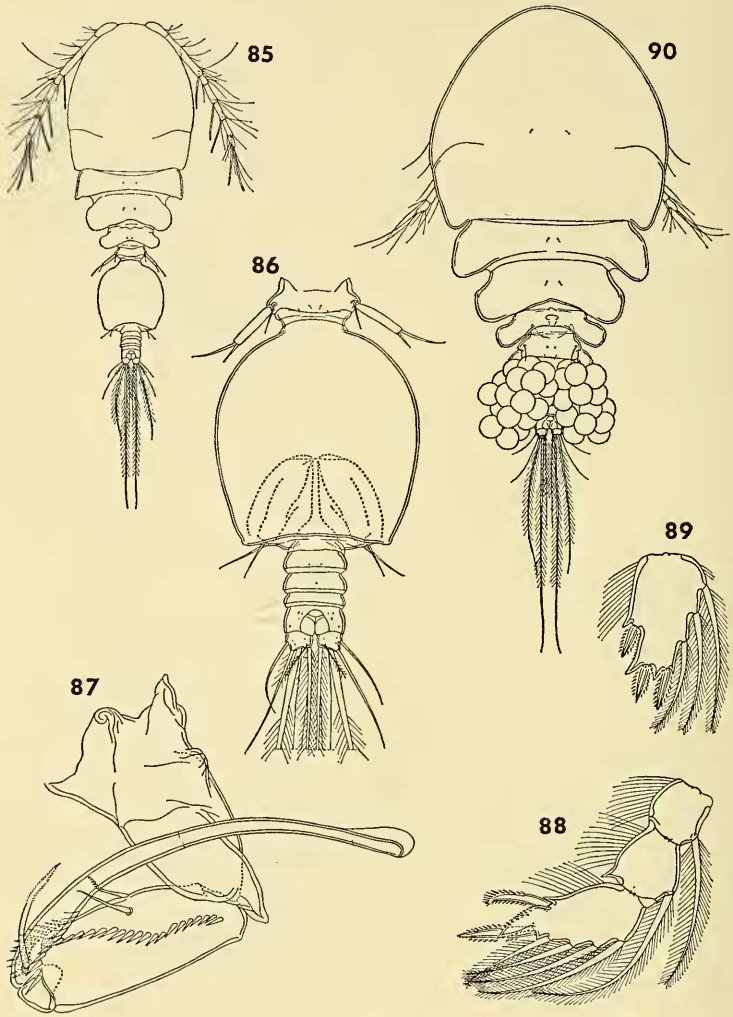


FIGS. 80–84. *Lichomolgus longispinifer*, new species, female: 80, leg 1 and intercoxal plate, anterior (F); 81, leg 2, anterior (F); 82, leg 3, anterior (F); 83, leg 4, anterior (F); 84, leg 5, dorsal (F).

beyond caudal rami and containing many eggs, each about 47 μ in diameter.

Rostral area similar to that in *L. verseveldti* and *L. triquetrus*.

First antenna (fig. 73) long and slender, 437 μ in length, with segmentation and armature as in the three previous species. Lengths of



Figs. 85–90. *Lichomolgus longispinifer*, new species, male: 85, body, dorsal (G); 86, urosome, dorsal (E); 87, maxilliped, postero-inner (C); 88, endopod of leg 1, anterior (C); 89, third segment of endopod of leg 2, anterior (C). *Lichomolgus hians*, new species, female: 90, body, dorsal (G).

segments: 42 μ (65 μ along anterior edge), 164 μ, 27 μ, 68 μ, 55 μ, 37 μ, and 21 μ respectively. All setae naked. Second antenna (fig. 74) 4-segmented, last segment 55 μ along its outer edge, 28 μ along its inner edge, 23 μ wide, bearing distally five short hyaline elements and two short terminal claws, one stout and 39 μ along its axis, the other more slender and 44 μ. All setae naked.

Labrum resembling that of *L. verseveldti*. Mandible (fig. 75) with basal region strongly constricted, the scalelike protrusion on convex side distal to constriction pointed and ornamented with a row of minute spinules. Paragnath as in *L. verseveldti*. First maxilla (fig. 76) with four setae. Second maxilla (fig. 77) similar to that in *L. triquetrus* and *L. glabripes*, but with slender spines instead of strong teeth along terminal lash. Maxilliped (fig. 78) resembling that of *L. verseveldti* but differing in details of ornamentation.

Area between maxillipeds and first pair of legs (fig. 79) slightly protuberant; a sclerotized line between bases of maxillipeds.

Legs 1–4 (figs. 80–83) segmented as in all previous species and with spine and setal formula as in *L. verseveldti*. Inner seta on coxa of leg 4 short (7 μ) and naked. Inner margin of basis of leg 4 naked. First segment of exopod of leg 1 with outer spine unusually long, 44 μ, a little more than twice length of spine on second segment (21 μ). Spinulose fringe on this long spine narrower and more delicate than on more distal spines. Spine on first segment of exopod of leg 2 only slightly longer than others; proximal spine on third segment of this exopod slightly shorter than adjacent spines; lengths of the five outer spines on exopod being 25 μ, 20 μ, 18 μ, 20 μ, and 18 μ, from proximal to distal. Endopod of leg 4 shorter than exopod. First segment 37 μ × 17 μ (including spiniform processes), with a short naked inner distal spinelike element 18 μ long. Second segment 66 μ × 17 μ in greatest dimensions (including processes), its two unequal terminal spines 22 μ (outer) and weakly barbed distally, and 50 μ (inner) with an outer spinulose fringe and an inner narrow smooth lamella. Both segments with outer margins haired and second segment with a terminal row of minute spinules.

Leg 5 (fig. 84) resembling in general form that of *L. cuneipes* Humes and Ho, 1968b. Free segment elongated, 106 μ in greatest length and 21 μ wide near middle. Proximal inner expansion (smaller than in *L. cuneipes*) in the form of a bent thumb. Two terminal naked setae 39 μ (outer) and 56 μ (inner). Outer surface of segment with short spines. Seta on body near free segment 44 μ and lightly feathered.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 71).

Color in life in transmitted light faintly rose or lavender, sometimes translucid, eye red, egg sacs light gray.

Male: Body (fig. 85) with prosome more slender than in female. Length 0.67 mm (0.64–0.70 mm) and greatest width 0.24 mm (0.23–

0.28 mm), based on 10 specimens. Ratio of length to width of prosome 1.76 : 1.

Segment of leg 5 (fig. 86) 34 $\mu \times 59$ μ. No ventral intersegmental sclerite. Genital segment 148 $\mu \times 130$ μ, only a little longer than wide. Four postgenital segments 15 $\mu \times 44$ μ, 15 $\mu \times 44$ μ, 11 $\mu \times 42$ μ, and 17 $\mu \times 44$ μ, from anterior to posterior.

Caudal ramus similar to that of female, 15.5 $\mu \times 19$ μ.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 1.89 : 1.

Rostral area as in female. First antenna like that of female, but with three aesthetes added as in the three previous species. Second antenna similar to that of female, but bearing a few short spinules along inner surface of second and fourth segments.

Labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 87) resembling in general form that of *L. cuneipes* and *L. gentilis* Humes and Ho, 1968b. Claw 142 μ along its axis including terminal lamella.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with same spine and setal formula except for last segment of endopod of leg 1 (fig. 88) which is I,I,4. Leg 2 showing slight sexual dimorphism, with outer terminal spiniform process on third segment of endopod larger than in female and turned outwardly (fig. 89). Legs 3 and 4 as in female, without sexual dimorphism.

Leg 5 (fig. 86) with free segment straight and elongated, 32 $\mu \times 6$ μ, without ornamentation. Two terminal naked setae 29 μ and 14 μ, and seta on body near free segment 20 μ.

Leg 6 (fig. 86) a posterolateral flap on ventral surface of genital segment bearing two naked setae 39 μ and 30 μ.

Spermatophore not observed.

Color in life in transmitted light translucid, eye red.

Etymology: The specific name *longispinifer*, from Latin = bearing a long spine, refers to the unusually long spine on the first segment of the exopod of leg 1.

Comparison with related species: The new species appears to be unique in the genus in having an unusually long outer spine on the first segment of the exopod of leg 1. It may be further separated from all but two species of *Lichomolgus* on the basis of a combination of the following four characters: the second antenna with two short claws, the formula for the last segment of the exopod of leg 4 being II,I,5, the endopod of leg 4 being 0–I; II, and the caudal ramus being nearly quadrate, a little wider than long. The two species which share these features with *L. longispinifer* are *L. cuneipes* Humes and Ho, 1968b, and *L. verseveldti*, described above. In *L. verseveldti*, however, the form of the fifth leg and genital segment in the female is very different and the lash of the second maxilla bears stout teeth rather than slender

spines. The new species seems closely related to *L. cuneipes* (associated with the octocoral *Stereonephthya acaulis* Verseveldt in Madagascar). In *L. cuneipes*, however, all ramal setae are naked, the teeth on the lash of the second maxilla are partly slender and partly stout, the genital segment of the female has a different form, and the fifth leg of the male bears fine ornamentation.

Lichomolgus hians new species
Figures 90–108

Type material: 238 ♀ ♀, 37 ♂ ♂, and several copepodids from one colony of *Siphonogorgia pendula* Studer, in 10–12 m, south of Andjiabe, on the southern shore of Nosy Komba, near Nosy Bé, Madagascar, collected 30 July 1964. Holotype ♀, allotype, and 225 paratypes (200 ♀ ♀, 25 ♂ ♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

Other specimens (also from *Siphonogorgia pendula*): 78 ♀ ♀, 112 ♂ ♂, and several copepodids from one colony, in 20 m, Banc de Dzamandzar, near Nosy Bé, 16 September 1964.

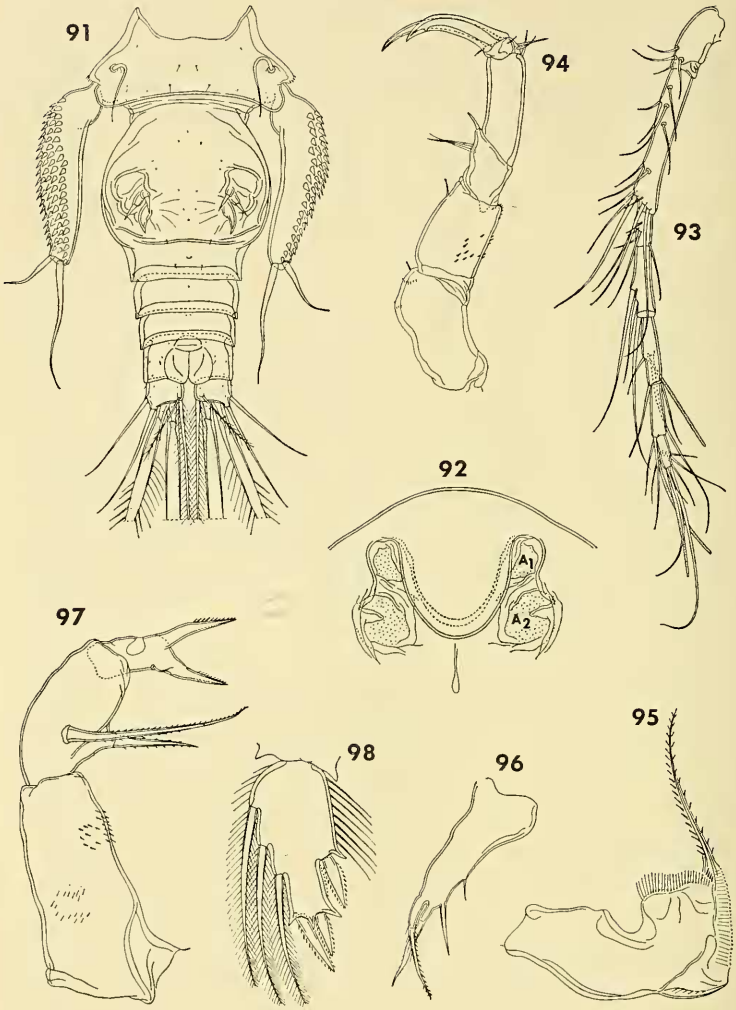
Female: Body (fig. 90) with moderately broadened prosome. Length 0.93 mm (0.86–1.03 mm) and greatest width 0.49 mm (0.46–0.51 mm), based on 10 specimens. Ratio of length to width of prosome 1.37 : 1. Segment of leg 1 separated incompletely from head. Epimeral areas of segments of legs 1–4 as in figure.

Segment of leg 5 (fig. 91) 65 $\mu \times 131$ μ. Between this segment and genital segment a slight ventral intersegmental sclerite. Genital segment 112 $\mu \times 109$ μ, about as long as wide, and resembling that of *L. varirostratus* Humes and Ho, 1968b. Areas of attachment of egg sacs situated dorsally near middle of segment. Each area bearing two naked setae 10 μ and 11 μ long and a prominent unguiform process. Three postgenital segments 29 $\mu \times 67$ μ, 24 $\mu \times 60$ μ, and 26 $\mu \times 57$ μ, from anterior to posterior.

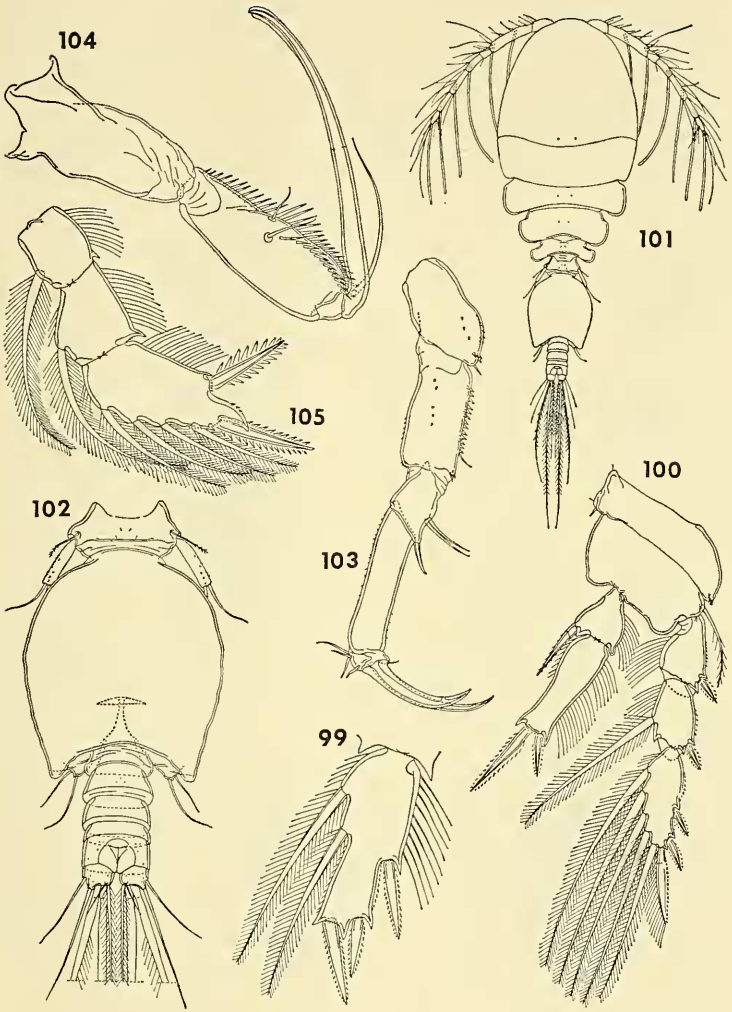
Caudal ramus (fig. 91) quadrate, 23 $\mu \times 24$ μ in greatest dimensions. Outer lateral seta 66 μ long and naked, pedicellate dorsal seta 50 μ and lightly feathered, outermost distal seta 110 μ and naked, innermost distal seta 200 μ with hairs along both sides of its proximal half, and the two long median terminal setae 308 μ (outer) and 440 μ (inner), both with strong lateral spinules (stronger than in *L. longispinifer*) except in distal third, and both inserted between an unornamented dorsal flap and a ventral flap with a marginal row of minute spinules. A minute spinule on proximal outer margin of ramus.

Dorsal surface of prosome and urosome with very few hairs. A small crescentic sclerotization in tergum of segment of leg 4. Ratio of length of prosome to that of urosome 3.23 : 1.

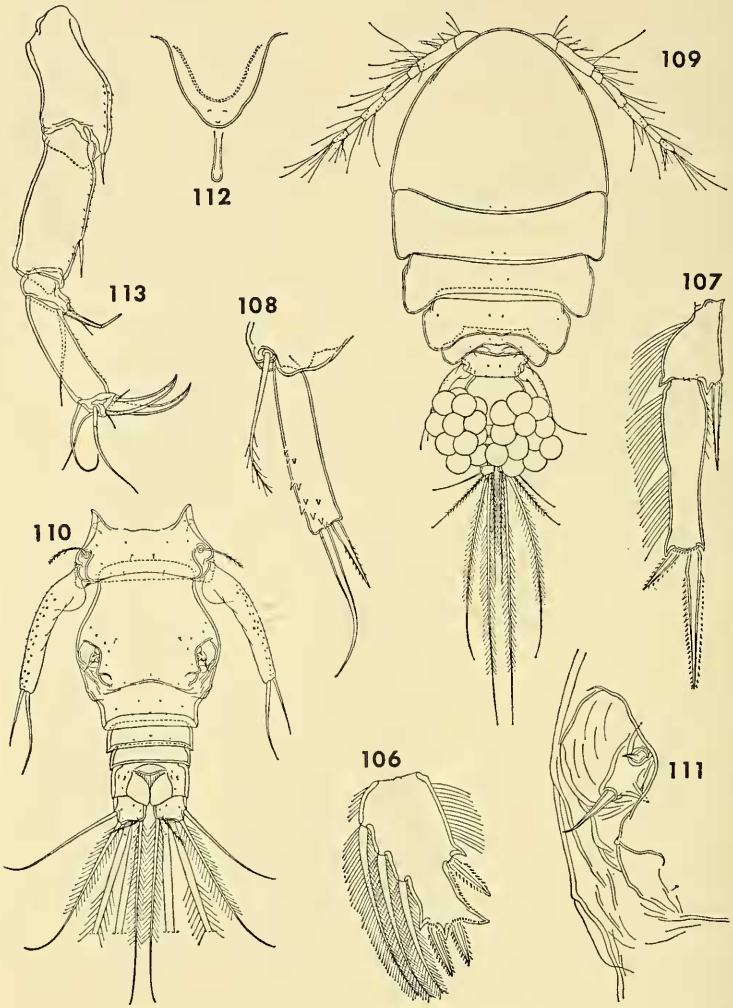
Egg sac seen complete in only one female, where it measured 495 $\mu \times$ 165 μ, reaching almost to ends of ramal setae, and containing many



Figs. 91–98. *Lichomolgus hians*, new species, female: 91, urosome, dorsal (E); 92, rostral area, ventral (D); 93, first antenna, dorsal (D); 94, second antenna, anterior (inner) (E); 95, mandible, posterior (C); 96, first maxilla, posterior (C); 97, maxilliped, postero-inner (C); 98, third segment of endopod of leg 2, anterior (F).



Figs. 99–105. *Lichomolgus hians,* new species, female: 99, third segment of endopod of leg 3, anterior (F); 100, leg 4, anterior (E); Male: 101, body, dorsal (G); 102, urosome, dorsal (E); 103, second antenna, anterior (inner) (F); 104, maxilliped, outer (F); 105, endopod of leg 1, anterior (C).



Figs. 106–113. *Lichomolgus hians*, new species, male: 106, third segment of endopod of leg 2, anterior (C); 107, endopod of leg 4, anterior (C); 108, leg 5, dorsal (I). *Lichomolgus telestophilus*, new species, female: 109, body, dorsal (G); 110, urosome, dorsal (D); 111, area of attachment of egg sac, dorsal (I); 112, rostral area, ventral (D); 113, second antenna, anterior (inner) (E).

eggs about 52 μ in diameter. Egg sacs in other ovigerous females incomplete, as in figure 90.

Rostral area (fig. 92) raised ventrally, with a well defined posteroventral border.

First antenna (fig. 93) 7-segmented, 441 μ long, and slender. Lengths of segments: 40 μ (69 μ along anterior margin), 133 μ, 31 μ, 68 μ, 62 μ, 48 μ, and 30 μ respectively. Formula for armature as in the four previous species. All setae naked.

Second antenna (fig. 94) 4-segmented, last segment 86 μ along its outer edge, 50 μ along its inner edge, 24 μ wide, bearing distally five small hyaline elements and two moderately long unequal claws, the stouter one 65 μ along its axis, the more slender one 78 μ. Third segment with a spiniform seta and two longer slender setae. Groups of small spinules on first and second segments. All setae naked.

Labrum and paragnath as in *L. verseveldti*. Mandible (fig. 95) resembling that of *L. longispinifer*. First maxilla (fig. 96) slender with four elements as in the four previous species. Second maxilla as in *L. varirostratus*. Maxilliped (fig. 97) resembling in general form that of *L. longispinifer*, but the two terminal elements equal and widely divergent, suggesting open blades of scissors.

Area between maxillipeds and first pair of legs as in *L. verseveldti*.

Legs 1–4 segmented as in the four previous species, and spine and setal formula as in *L. verseveldti* and *L. longispinifer*. Inner seta on coxa of leg 4 short (7 μ) and naked. Inner margin of basis of leg 4 naked. Rami of leg 1 as in *L. varirostratus*. Rami of legs 2 and 3 also similar to those in *L. varirostratus*, but last segment of endopod slightly different (figs. 98, 99). Endopod of leg 4 (fig. 100) shorter than exopod. First segment 43 $\mu \times 32$ μ (including processes), with its distal inner finely barbed spine 44 μ long. Second segment 78 μ long (including spiniform processes), its greatest width 32 μ and least width 17.5 μ; its two unequal terminal spines 31 μ (outer) and 57 μ (inner), the fringe on the inner spine more coarsely spinulose on its outer than on its inner margin. Both segments with outer margins haired, second segment with a few weak hairs on proximal half of inner margin and with a terminal row of minute spinules.

Leg 5 (fig. 91) suggesting that of *L. varirostratus*, but differing in details of form and ornamentation. Free segment elongated, 117 $\mu \times 26$ μ in greatest dimensions. Outer surface of segment with many scalelike spines. Two terminal naked setae 41 μ (outer) and 69 μ (inner). Seta on body near free segment about 50 μ and naked.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 91).

Color in life in transmitted light translucid or slightly opaque, eye red, egg sacs light gray.

Male: Body (fig. 101) with prosome more slender than in female. Length 0.73 mm (0.70–0.78 mm) and greatest width 0.28 mm (0.27–

0.29 mm), based on 10 specimens. Ratio of length to width of prosome 1.70 : 1.

Segment of leg 1 (fig. 102) 39 $\mu \times 75$ μ. No ventral intersegmental sclerite. Genital segment 151 $\mu \times 133$ μ, only a little longer than wide, with its lateral margins sometimes slightly irregular. Four postgenital segments 25 $\mu \times 48$ μ, 18 $\mu \times 46$ μ, 11 $\mu \times 45$ μ, and 19 $\mu \times 46$ μ, from anterior to posterior.

Caudal ramus similar to that of female, 20 $\mu \times 20$ μ in greatest dimensions.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 1.90 : 1.

Rostral area as in female. First antenna similar to that of female, but with three aesthetes added as in the four previous species. Second antenna (fig. 103) resembling that of female, but last segment relatively more elongated, its outer margin 82 μ, its inner margin 56 μ, and its width 17 μ, and both margins with minute spinules. Second segment with small spines along inner surface.

Labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 104) slender. Second segment with two naked setae and two rows of spinules. Claw 159 μ along its axis (including terminal lamella), only slightly recurved, its proximal inner surface faintly striated.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with same spine and setal formula except for last segment of endopod of leg 1 (fig. 105) which is I,I,4. Last segment of endopod of leg 2 (fig. 106) showing slight sexual dimorphism, with outer terminal process larger than in female, and bearing minute spinules. Leg 3 entirely as in female. Endopod of leg 4 (fig. 107) with second segment relatively more slender than in female. First segment 31 $\mu \times 21$ μ including processes, its spine 32 μ; second segment 60 μ long, 15.5 μ in greatest width, and 10 μ in least width, its two terminal spines 17 μ (outer) and 47 μ (inner).

Leg 5 (fig. 108) with free segment 35 $\mu \times 8$ μ, bearing two terminal setae, outer 34 μ and naked, inner 16 μ and finely barbed. Surface of segment with a few small spines. Seta on body near free segment 29 μ and lightly feathered.

Leg 6 (fig. 102) a posterolateral flap on ventral surface of genital segment bearing two slender setae 31 μ and 40 μ long.

Spermatophore not observed.

Color in life as in female.

Etymology: The specific name *hians*, from the Latin word *hio* = to stand open or gape, alludes to the two divergent terminal elements on the maxilliped of the female.

Comparison with related species: L. hians may be separated from all but seven species of *Lichomolgus* on the basis of a combination of four characters: the caudal ramus being about as long as wide, the second

antenna having two terminal claws, the formula for the last segment of the exopod of leg 4 being II,I,5, and the formula for the endopod of leg 4 being 0–I; II. Of the remaining species *L. varirostratus* Humes and Ho, 1968b, *L. exilipes* Humes and Ho, 1968b, and *L. gentilis* Humes and Ho, 1968b, have the two claws on the second antenna about as long as or longer than the greatest length of the fourth segment (instead of distinctly shorter than this segment as in the new species), and the outer spine on the last segment of the endopod of leg 1 in the males of these species is differently formed. In *L. fissisetiger* Humes and Ho, 1968b, *L. cuneipes* Humes and Ho, 1968b, *L. verseveldti*, and *L. longispinifer* (both described above) the fifth leg of the female has a distinct proximal inner expansion.

Although in several respects *L. hians* resembles rather closely *L. varirostratus*, particularly in the form of the genital segment in the female, the mandible, the second maxilla, the maxilliped in the female, and legs 1–4, there are many differences between the two species. The distinctions include not only the two features mentioned above, but also (in *L. varirostratus*) the sexual dimorphism in the rostral area, the exact nature of leg 5 in both sexes, and the two unornamented long terminal setae on the caudal ramus.

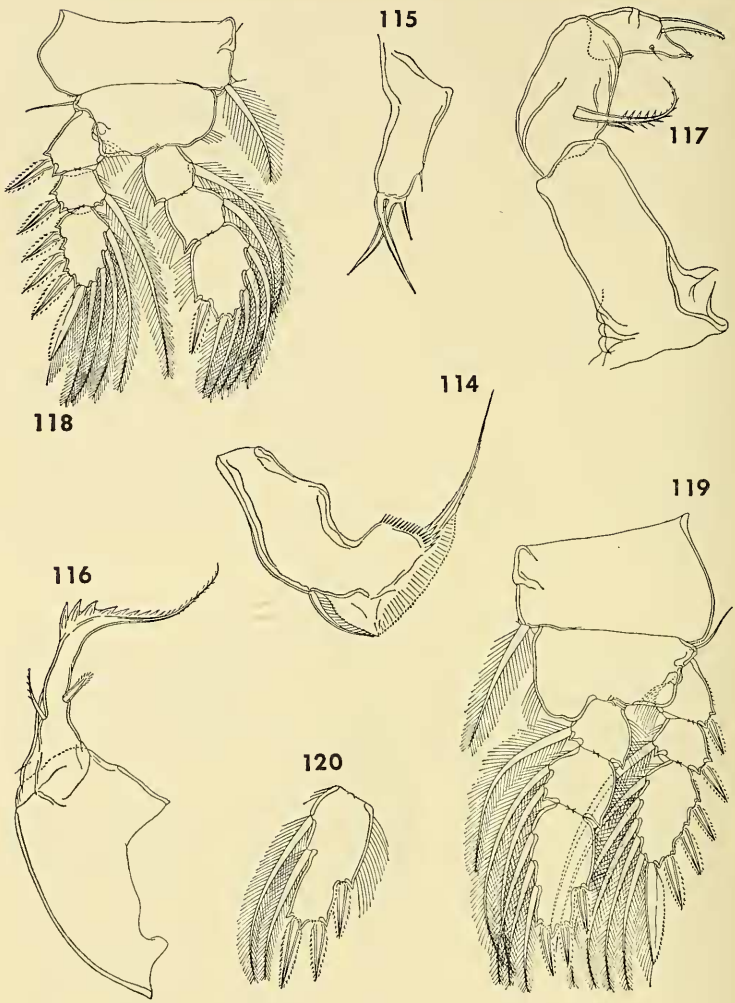
Lichomolgus telestophilus new species
Figures 109–127

Type material: 13♀♀, 22♂♂, and 4 copepodids from one colony of *Telesto arborea* Wright and Studer, in 4 m, northeastern coast of Antany Mora, Isles Radama, Madagascar, 14°06′10″S, 47°45′10″E, collected 30 September 1964. Holotype ♀, allotype and 26 paratypes (9♀♀, 17♂♂) deposited in the United States National Museum, and the remaining paratypes in the collection of A. G. Humes.

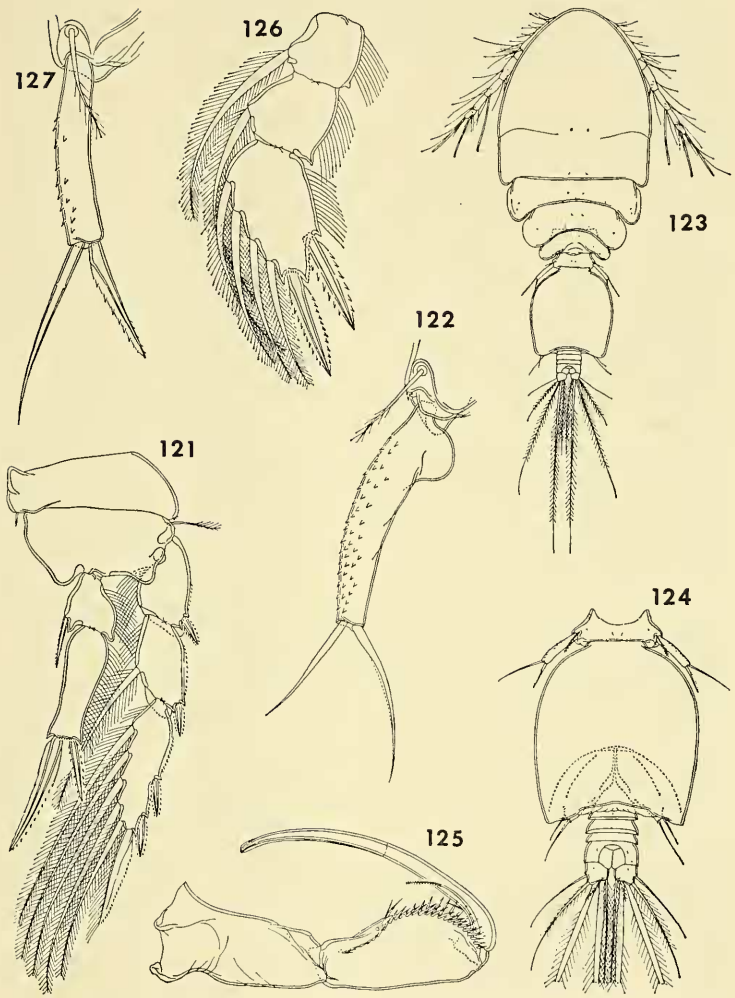
Female: Body (fig. 109) with moderately slender prosome. Length 0.91 mm (0.85–0.95 mm) and greatest width 0.46 mm (0.42–0.50 mm), based on 10 specimens. Ratio of length to width of prosome 1.49 : 1. Segment of leg 1 distinctly separated from head by a transverse furrow. Epimeral areas of segments of legs 1–4 more or less rounded posteriorly.

Segment of leg 5 (fig. 110) 68 $\mu \times 133$ μ. Between this segment and genital segment a weak ventral intersegmental sclerite. Genital segment 138 $\mu \times 133$ μ, about as long as wide and somewhat expanded laterally in its midregion. Areas of attachment of egg sacs located dorsolaterally near middle of segment. Each area (fig. 111) bearing two unequal naked setae 4 μ and 12 μ in length and a small spiniform process. Three postgenital segments 30 $\mu \times 80$ μ, 23 $\mu \times 75$ μ, and 33 $\mu \times 72$ μ, from anterior to posterior.

Caudal ramus (fig. 110) quadrate, 32 $\mu \times 31$ μ in greatest dimensions. Outer lateral seta 104 μ, pedicellate dorsal seta 36 μ, outermost distal seta 151 μ, innermost distal seta 221 μ, and the two long median terminal



FIGS. 114–120. *Lichomolgus telestophilus*, new species, female: 114, mandible, posterior (C); 115, first maxilla, posterior (C); 116, second maxilla, posterior (C); 117, maxilliped, posterior (C); 118, leg 1, anterior (E); 119, leg 2, anterior (E); 120, third segment of endopod of leg 3, anterior (E).



FIGS. 121–127. *Lichomolgus telestophilus*, new species, female: 121, leg 4, anterior (E); 122, leg 5, dorsal (F). Male: 123, body, dorsal (G); 124, urosome, dorsal (D); 125, maxilliped, inner (F); 126, endopod of leg 1, anterior (C); 127, leg 5, dorsal (I).

setae 429 μ (outer) and 529 μ (inner), both inserted between an unornamented dorsal flap and a ventral flap with a marginal row of minute spinules. Ornamentation of these setae similar to that in *L. longispinifer*.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 2.62 : 1.

Egg sacs incomplete on all females collected. Each egg about 43 μ in diameter.

Rostral area (fig. 112) slightly raised ventrally and broadly tongue-shaped.

First antenna 377 μ long, and resembling that of *L. verseveldti*. Lengths of segments: 23 μ (55 μ along anterior margin), 88 μ, 26 μ, 65 μ, 62 μ, 45 μ, and 36 μ respectively. All setae naked. Second antenna (fig. 113) 4-segmented, last segment elongated, 94 μ along its outer edge, 64 μ along its inner edge, and 21 μ wide, bearing distally five hyaline elements and two slightly unequal claws 57 μ and 53 μ in length. One of three setae on third segment angularly bent. All setae naked. Inner surfaces of all four segments with minute spinules.

Labrum as in *L. verseveldti* and *L. hians*. Mandible (fig. 114) rather like that of *L. hians*, but with shorter barbs on flagellum than in that species. Paragnath a small hairy lobe as in *L. verseveldti*. First maxilla (fig. 115) with four naked elements. Second maxilla (fig. 116) somewhat resembling that of *L. verseveldti*, but inner distal spine near base of lash rather blunt and finely barbed, instead of being attenuated and ornamented with large spinules as in that species. Maxilliped (fig. 117) with two setae on second segment very unequal, the larger seta with two rows of erect spinules in its midregion and more finely barbed distally, the smaller seta naked. Third segment with two unequal terminal barbed elements, one without an articulation.

Area between maxillipeds and first pair of legs as in *L. verseveldti*.

Legs 1–4 (figs. 118–121) segmented and armed with spines and setae as in *L. verseveldti*, *L. longispinifer*, and *L. hians*. Inner seta on coxa of leg 4 short (9 μ) and naked. Inner margin of basis of leg 4 naked. Rami of all four legs resembling in general aspects those of *L. fissisetiger* Humes and Ho, 1968b. Endopod of leg 4 (fig. 121) much shorter than exopod. First segment 42 μ × 34 μ (including processes), with its distal inner finely barbed spine 33 μ long and setiform. Second segment 77 μ long (including spiniform processes), its greatest width 33 μ and least width 19 μ; its two unequal terminal fringed spines 45 μ (outer) and 83 μ (inner). Both segments with outer margins haired and second segment with a terminal row of minute spinules.

Leg 5 (fig. 122) suggesting that of *L. fissisetiger*. Free segment elongated, 133 μ in length, width at expansion 42 μ, width distally 21 μ. Two terminal setae 50 μ (outer) and naked and 81 μ (inner) with a slight lamella along its midregion. Outer surface of free segment with many small spines. Seta on body near free segment 46 μ and lightly feathered.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 111).

Color in life in transmitted light slightly opaque, eye red.

Male: Body (fig. 123) resembling in general form that of female. Length 0.75 mm (0.72–0.79 mm) and greatest width 0.31 mm (0.29–0.31 mm), based on 10 specimens. Ratio of length to width of prosome 1.60 : 1.

Segment of leg 5 (fig. 124) 36 $\mu \times 86$ μ. No ventral intersegmental sclerite. Genital segment 174 $\mu \times 161$ μ, only a little longer than wide. Four postgenital segments 15.5 $\mu \times 50$ μ, 14 $\mu \times 52$ μ, 12 $\mu \times 50$ μ, and 20 $\mu \times 53$ μ, from anterior to posterior.

Caudal ramus similar to that of female, 24 $\mu \times 23$ μ in greatest dimensions.

Dorsal surface of prosome and urosome with very few hairs. Ratio of length of prosome to that of urosome 1.91 : 1.

Rostral area as in female. First antenna resembling that of female, but with three aesthetes added as in the five previous species. Second antenna similar to that of female but inner surficial spinules coarser that in that sex.

Labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 125) slender and resembling in most respects that of *L. hians*. Claw 130 μ along its axis including terminal lamella.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented as in female, with same spine and setal formula except for last segment of endopod of leg 1 (fig. 126) which is I,I,4. Legs 2–4 as in female, without sexual dimorphism.

Leg 5 (fig. 127) with free segment 38 $\mu \times 8.5$ μ, bearing two terminal elements, the outer setiform and naked, 48 μ long, the inner spiniform with an outer barbed fringe and a few inner barbules, 25 μ. Surface of segment with a few small spines. Seta on body near free segment 20 μ and lightly feathered.

Leg 6 (fig. 124) a posterolateral flap on ventral surface of genital segment bearing two slender naked setae 24 μ and 55 μ long.

Spermatophore not observed.

Color in life as in female.

Etymology: The specific name *telestophilus* is a combination of the generic name of the host and the Greek word $\phi\iota\lambda os$ = loving.

Comparison with related species: Only four species of *Lichomolgus* have, as in the new species, the following combination of characters: the second antenna with two short claws (shorter than the fourth segment), the third segment of the exopod of leg 4 with the formula II,I,5, the inner distal element on the first segment of the endopod of leg 4 a spine and not feathered, and the dimensions of the caudal ramus in the ratio of about 1 : 1. These are *L. cuneipes* Humes and Ho, 1968b, *L. verseveldti*, *L. longispinifer*, and *L. hians*. All four may be readily distinguished from *L. telestophilus*, however. The free segment of the fifth leg of *L. cuneipes* has a large wedge-shaped expansion. In *L. verseveldti* this segment is relatively short and broad. In *L. longispinifer* the outer spine on the first segment of the exopod of leg 1 is unusually

long. In *L. hians* the two terminal elements on the maxilliped of the female are widely divergent and the two setae on the second segment of this appendage have a different size and ornamentation.

L. telestophilus might at first glance be confused with *L. botulosus* Stock and Kleeton, 1963, from octocorals in the Mediterranean, but the two species are easily separated by the nature of the lash on the second maxilla and the ornamentation of the inner distal element on the first segment of the endopod of leg 4.

Lichomolgus clavatus new species
Figures 128–148

Type material: 22♀♀, 19♂♂, and 1 copepodid from one colony of *Coelogorgia palmosa* Milne Edwards and Haime, in 2 m, near village of Ampasindava, northern end of Nosy Sakatia, near Nosy Bé, Madagascar, collected 8 October 1960. Holotype ♀ allotype, and 35 paratypes (19♀♀, 16♂♂) deposited in the United States National Museum, and the remaining paratypes (dissected) in the collection of A. G. Humes.

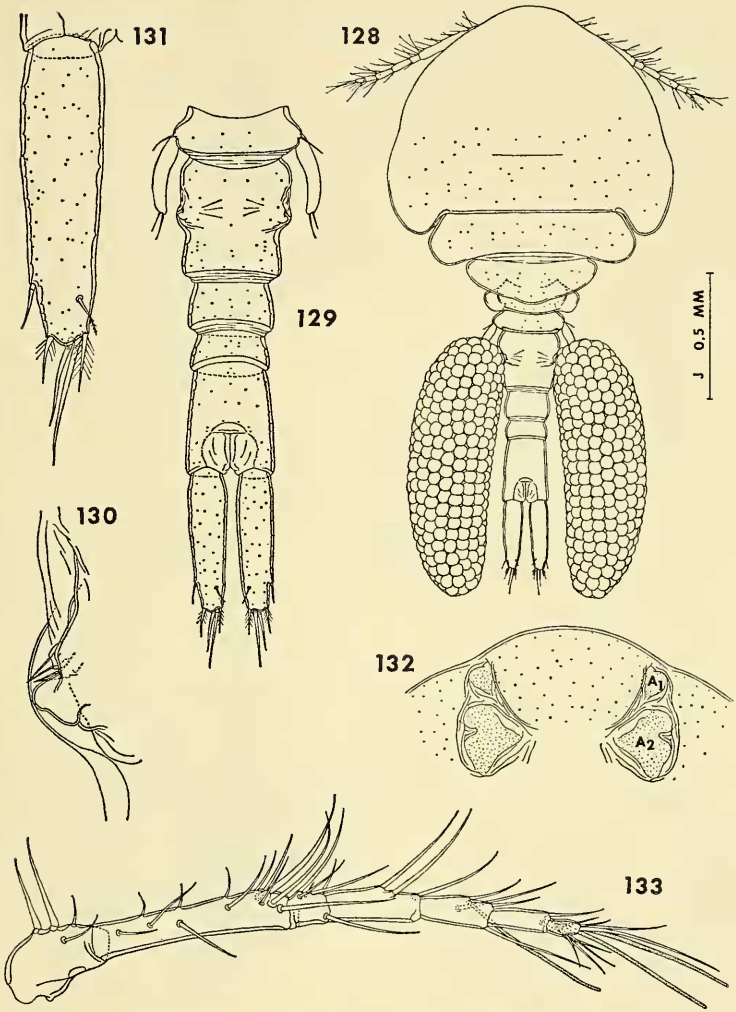
Other specimens (all from *Coelogorgia palmosa*): 3♀♀, 2♂♂, and 2 copepodids from one colony, in 1 m, Ambariobe, near Nosy Bé, 3 November 1960; and 1♂ from one colony, in 1 m, Ambariobe, 17 December 1963.

Female: Body (fig. 128) with broad prosome and slender urosome. Length 2.27 mm (2.19–2.37 mm) and greatest width 1.09 mm (1.01–1.16 mm), based on 10 specimens. Ratio of length to width of prosome 1.08 : 1. Segment of leg 1 almost completely fused with head. Epimeral areas of legs 1–4 as in figure; tergum of segment of leg 3 overlapping segment of leg 4.

Segment of leg 5 (fig. 129) 110 $\mu \times 264$ μ. Between this segment and genital segment no ventral intersegmental sclerite. Genital segment 242 μ long, in dorsal view not expanded laterally, its greatest width 238 μ and its least width in its posterior third 204 μ. Areas of attachment of egg sacs situated laterally in front of middle of segment. Each area (fig. 130) bearing two naked setae about 13 μ long. Three postgenital segments 112 $\mu \times 177$ μ, 78 $\mu \times 164$ μ, and 221 $\mu \times 174$ μ, from anterior to posterior.

Caudal ramus (fig. 131) elongated, 286 $\mu \times 77$ μ in greatest dimensions, or 3.7 times longer than wide. All setae relatively short. Outer lateral seta 42 μ and naked, pedicellate dorsal seta 39 μ and lightly feathered, outermost distal seta 47 μ with lateral hairs proximally, innermost distal seta 61 μ and haired, and the two median terminal setae 85 μ (outer) and 127 μ (inner), both naked and inserted between an unornamented dorsal flap and a ventral flap with a marginal row of minute spinules.

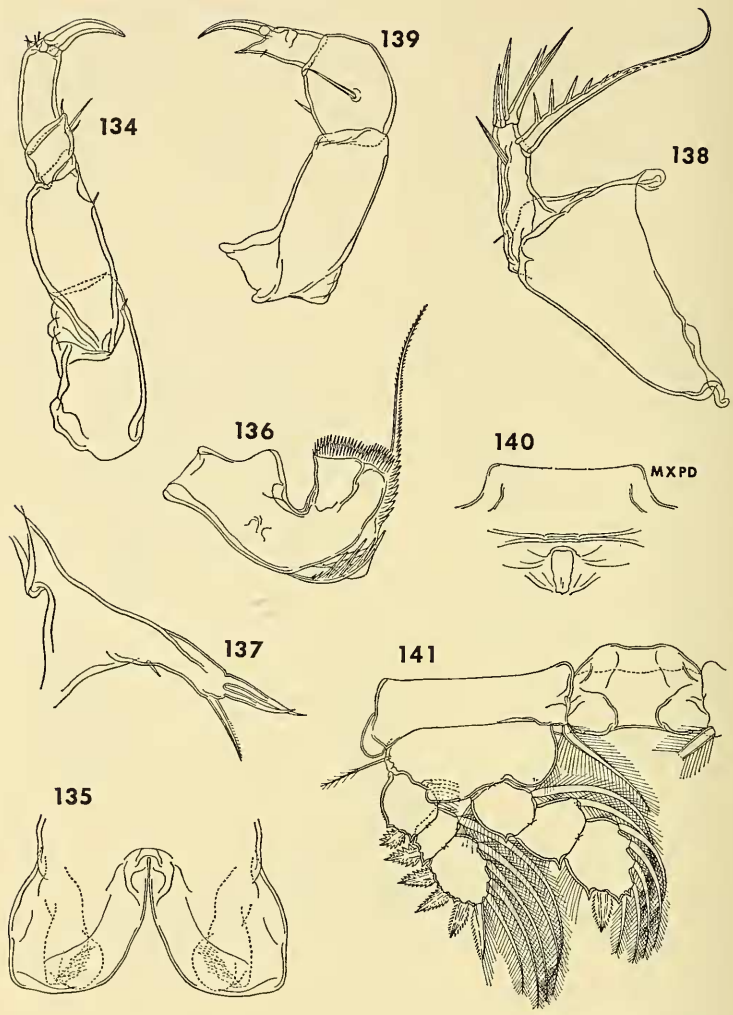
Dorsal surface of prosome and urosome with small refractile points. Ratio of length of prosome to that of urosome 1.18 : 1.



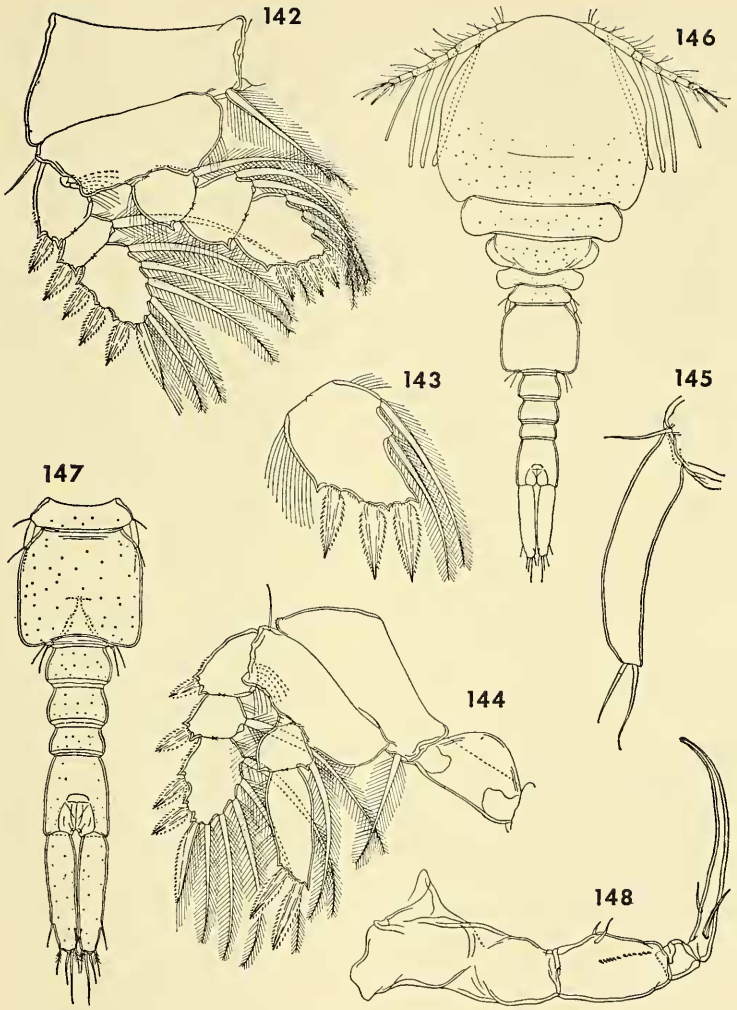
Figs. 128–133. *Lichomolgus clavatus*, new species, female: 128, body, dorsal (J); 129, urosome, dorsal (G); 130, area of attachment of egg sac, dorsal (C); 131, caudal ramus, dorsal (D); 132, rostral area, ventral (G); 133, first antenna, dorsal (D).

Egg sac (seen on only one female) elongated, 1090 $\mu \times 340$ μ, reaching to ends of ramal setae, and containing many eggs, each about 57 μ in diameter.

Rostral area (fig. 132) weakly developed.



Figs. 134–141. *Lichomolgus clavatus*, new species, female: 134, second antenna, anterior (inner) (D); 135, labrum, with paragnaths indicated by dashed lines, ventral (E); 136, mandible, posterior (E); 137, first maxilla, anterior (C); 138, second maxilla, posterior (E); 139, maxilliped, posterior (E); 140, area between maxillipeds and first pair of legs, ventral (B); 141, leg 1 and intercoxal plate, anterior (D).



Figs. 142–148. *Lichomolgus clavatus*, new species, female: 142, leg 2, anterior (D); 143, third segment of endopod of leg 3, anterior (E); 144, leg 4 and intercoxal plate, anterior (D); 145, leg 5, dorsal (E). Male: 146, body, dorsal (A); 147, urosome, dorsal (G); 148, maxilliped, inner (E).

First antenna (fig. 133) 7-segmented, 554 μ long. Lengths of segments: 55 μ (97 μ along anterior margin), 180 μ, 39 μ, 85 μ, 64 μ, 57 μ, and 32 μ respectively. All setae naked. Second antenna (fig. 134) 4-segmented, last segment moderately elongated, 114 μ along its outer edge, 75 μ along its inner edge, and 33 μ wide, bearing distally six small hyaline elements and a claw 72 μ along its axis. All setae naked.

Labrum (fig. 135) rather deeply indented. Mandible (fig. 136) with basal region distal to constriction showing on its convex margin a scalelike sclerotization with a row of long blunt spinules, and on its concave margin a row of spinules interrupted by a sclerotization. Near base of flagellum a dentate fringe (not rather delicately serrated as in many other species). Flagellum elongated and finely barbed. Paragnath (fig. 135) a small hairy lobe. First maxilla (fig. 137) with three long terminal setae and a small subterminal element, the innermost terminal seta finely barbed along one edge. Second maxilla (fig. 138) with first segment unarmed. Second segment with a minute setule on its proximal outer (ventral) surface, a surficial naked seta, an unusually long inner (dorsal) seta bearing a row of erect spinules, and the segment terminating in a relatively short lash bearing two large spines near its base and two spikelike spinules along its midregion. Maxilliped (fig. 139) with two unequal naked setae on second segment; one of the terminal elements long and clawlike.

Area between maxillipeds and first pair of legs as in figure 140.

Legs 1–4 (figs. 141–144) segmented and armed as in *L. verseveldti*, *L. longispinifer*, *L. hians*, and *L. telestophilus*, except that formula for endopod of leg 4 is 0–1; II. Coxa of leg 1 with an outer protuberance. Inner seta on coxa of leg 4 long (112 μ) and feathered, instead of much reduced as in many other species. Inner margin of basis of all four legs with a row of hairs. Outer spines on exopod of leg 1 with unusually strong lateral spinules. Endopod of leg 4 (fig. 144) a little shorter than exopod. First segment 52 μ × 55 μ (including spinous processes), with its distal inner seta long (155 μ) and feathered. Second segment 122 μ × 45 μ (including processes), its tip obliquely truncated; its two terminal fringed spines 60 μ (outer) and 70 μ (inner) in one female, 66 μ and 68 μ in another. Both segments with outer margins haired and second segment with a terminal row of spinules.

Leg 5 (fig. 145) with an elongated unornamented free segment without a proximal inner expansion, 170 μ × 32 μ in greatest dimensions (ratio 5.3 : 1), its two terminal setae 40 μ (outer) and 55 μ (inner). Seta on body near free segment 40 μ. All three setae naked.

Leg 6 probably represented by the two setae near areas of attachment of each egg sac (see fig. 130).

Color in life in transmitted light slightly opaque to transparent, eye red, egg sacs opaque.

Male: Body (fig. 146) with prosome less expanded than in female. Length 1.74 mm (1.60–1.80 mm) and greatest width 0.64 mm (0.58–

0.70 mm), based on 10 specimens. Ratio of length to width of prosome 1.28 : 1.

Segment of leg 5 (fig. 147) 60 $\mu \times 211$ μ. No ventral intersegmental sclerite. Genital segment subquadrate, 244 $\mu \times 252$ μ. Four postgenital segments 86 $\mu \times 133$ μ, 83 $\mu \times 125$ μ, 55 $\mu \times 114$ μ, and 169 $\mu \times 138$ μ, from anterior to posterior.

Caudal ramus similar to that of female, 239 $\mu \times 60$ μ.

Dorsal surface of prosome and urosome with small refractile points as in female. Ratio of length of prosome to that of urosome 1 : 1.

Rostral area as in female. First antenna like that of female, but three long asethetes added (fig. 146) as in six previous species, proximalmost aesthete as long as entire first antenna. Second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 148) slender. Claw 140 μ along its axis.

Area between maxillipeds and first pair of legs as in female.

Legs 1–4 segmented and armed as in female. Leg 1 not showing sexual dimorphism.

Leg 5 (fig. 147) with free segment 62 $\mu \times 14$ μ, without ornamentation, its two terminal setae 38 μ and 43 μ. Seta on body near free segment 36 μ. All three setae naked.

Leg 6 (fig. 147) a posterolateral flap on ventral surface of genital segment bearing two naked setae 39 μ and 47 μ.

Spermatophore not observed.

Color in life as in female.

Etymology: The specific name *clavatus*, a Latin word meaning furnished with nails or spikes, alludes to the spikelike elements on the short lash of the second maxilla.

Comparison with related species: L. clavatus may be distinguished from all other species in the genus by the combination of the following features: the broad prosome and slender urosome, the moderately elongated caudal ramus (3.7 : 1 in the female) with relatively short setae, the second antenna with a single claw, the formula of II,I,5 on the last segment of the exopod of leg 4, a long feathered inner seta on the coxa and on the first segment of the endopod of leg 4, the elongated free segment of leg 5 (5.3 : 1 in the female), and the absence of sexual dimorphism in legs 1–4.

The new species is larger than most *Lichomolgus*. The females of only three other species reach or exceed a body length of 2 mm: *L. gigas* Thompson and A. Scott, 1903 (2 mm), *L. magnificus* Humes, 1964 (3.06 mm), and *L. pterophilus* Stock, 1962 (2.06 mm).

Three features of *L. clavatus* appear to be unique among the species in the genus, as far as they are known. These are: the long blunt spinules on the convex side of the mandible, the short lash with strong spikelike spines on the second maxilla, and the long feathered inner seta on the coxa of leg 4.

Remarks on *Lichomolgus* Associated With Octocorals

Almost one-third of the known species of *Lichomolgus* (34 out of 105) are associated with octocorals,—25 with Alcyonacea, 4 with Pennatulacea, 2 with Stolonifera, 2 with Telestacea, and 1 with Gorgonacea. It seems very probable that the small number of species reported from Gorgonacea reflects not the lack of preference of the copepods for these hosts but rather the very few observations as yet made on lichomolgids associated with them.

Among the species of *Lichomolgus* from octocorals there are several external anatomical features which are worthy of note. Only in this series of species does the endopod of leg 4 have the formula 0–1; 1,I (as in *L. protentus* Humes and Frost, 1964, *L. incisus* Humes and Ho, 1968c, and *L. insolens* Humes and Ho, 1968c). Nine of the species (*L. cuneipes* Humes and Ho, 1968b, *L. exilipes* Humes and Ho, 1968b, *L. fissisetiger* Humes and Ho, 1968b, *L. gentilis* Humes and Ho, 1968b, *L. hians, L. longispinifer, L. telestophilus, L. varirostratus* Humes and Ho, 1968b, and *L. verseveldti*) have this formula as 0–I; II, a condition not found in other *Lichomolgus*, except perhaps in *L. anomalus* A. Scott, 1909. (If Scott's fig. 15, pl. LXVII, is correct, the inner element on the first segment of the endopod of leg 4 is a spine. Such an armature suggests to us that *L. anomalus*, obtained from washings of dredged invertebrates from a depth of 1595 m, was actually associated with an octocoral.) In all 34 species the second antenna is 4-segmented. In five species (*L. aculeatus, L. exilipes, L. fissisetiger, L. gentilis,* and *L. varirostratus*, all described by Humes and Ho, 1968b), the two claws on the second antenna are very long (as long as or longer than the last segment). In two species (*L. cristatus* Humes and Ho, 1968c, and *L. dentipes* Thompson and A. Scott, 1903) the flagellum of the mandible is extremely short and reduced to a small pointed process. In three species (*L. conjunctus* Humes and Ho, 1967c, *L. decorus* Humes and Frost, 1964, and *L. organicus* Humes and Ho, 1967c, the convex margin of the mandible has a prominent toothlike process, replacing the scale-like spinulose area seen in other species.

Two features of these species, the number of claws on the second antenna and the formula for the last segment of the exopod of leg 4, vary without correlation. Hence they are useful in an artificial key, but probably do not indicate natural groups. Eleven species have one claw with the formula II,I,5 in four of them and III,I,5 in seven. Twenty-three species have two claws with II,I,5 in nineteen and III,I,5 in four.

In three species among those from octocorals, *L. trispinosus* Stock, 1959, *L. cristatus* Humes and Ho, 1968c, and *L. singularipes* Humes and Ho, 1968c, males are unknown. In the remaining 31 species sexual dimorphism in the formula for the endopod of leg 1 (I,5 in the female, I,I,4 in the male) occurs in all but four (*L. pteroidis* Della Valle, 1880,

L. pterophilus Stock, 1962, *L. serratipes* Ummerkutty, 1962, and *L. clavatus*).

Characters especially useful in distinguishing the species of *Lichomolgus* associated with octocorals are: the number of claws on the second antenna and their length in relation to the last segment, the length of the flagellum and the nature of the convex margin of the mandible (whether a toothlike process or a spinulose scalelike crest), sexual dimorphism in the formula for the last segment of the endopod of leg 1, the formula for the last segment of the exopod and for the endopod of leg 4, the length to width ratio and the shape of the free segment of leg 5 in the female (presence or absence of a proximal inner expansion), and the length to width ratio and the nature of the armature of the caudal ramus.

Keys to the 52 Species of *Lichomolgus* Known From the Region of Nosy Bé, Madagascar

The following keys include those species not only from octocorals but from all other invertebrate hosts as well. The number of species now known from Madagascar comprises about half of the known species in the genus.

These artificial keys are intended only as aids in identification. In many instances it has been necessary to rely upon qualitative rather than quantitative characters for distinctions. Final determination of a species should be made by reference to the original description and figures, or to actual specimens, if available.

The copepod referred to by Humes and Cressey (1961) as *Lichomolgus oreastriphilus* (Kossmann, 1877), from asteroids at Nosy Bé, is in reality a *Stellicola* and therefore not included in the keys.

The host for *L. protentus* was cited in the original description by Humes and Frost (1964) as *Sarcophyton* sp., but has since been described as *S. globosum* n. sp. by Tixier-Durivault (1966).

Descriptions of several new species of octocorals listed as hosts may be found in the work of Verseveldt (1968).

Females

1. Last segment of exopod of leg 4 with formula II,I,5 2
   Last segment of exopod of leg 4 with formula III,I,5 41
2. Second antenna with 1 claw 3
   Second antenna with 2 claws 20
3. A large sometimes toothlike process on convex margin of mandible 4
   Convex margin of mandible without such a process or at most with 2–4 small digitiform processes 6
4. A setiferous sphere on second segment of second maxilla (from corals, *Pavona angulata, P. danai, P. cactus,* and *P. ?venusta*) ..... *L. actinophorus* Humes and Frost, 1964

Without such a sphere 5

5. Free segment of leg 5 small, 34 $\mu \times 13$ μ, without proximal inner expansion (from coral, *Alveopora* sp.) ..... *L. campulus* Humes and Ho, 1968a

Free segment of leg 5 larger, 90 $\mu \times 22$ μ, with a rounded proximal inner expansion (from coral, *Psammocora contigua*) ..... *L. rhadinus* Humes and Ho, 1967a

6. Convex margin of mandible with 2–4 small digitiform processes ... 7

Convex margin of mandible without such processes 10

7. A prominent posteroventral lobe on first postgenital segment (from corals, *Acropora scherzeriana, A. cytherea,* and *Acropora* sp.) ..... *L. lobophorus* Humes and Ho, 1968a

Without such a lobe 8

8. Segments 3 and 4 of second antenna fused; free segment of leg 5 strongly arched (from coral, *Acropora palifera*) ..... *L. arcuatipes* Humes and Ho, 1968a

Segments 3 and 4 of second antenna not fused; free segment of leg 5 not arched 9

9. Free segment of leg 5 small, 36 $\mu \times 17$ μ, ratio about 2 : 1 (from corals, *Goniopora* sp. and *Porites* sp.) ..... *L. digitatus* Humes and Ho, 1968a

Free segment of leg 5 elongated, 203 $\mu \times 30$ μ, ratio about 6.8 : 1 (from corals, *Porites* sp. cf. *P. andrewsi, P.* sp. cf. *P. nigrescens,* and *Porites* (s.g. *Synaraea*) sp.) ..... *L. prolixipes* Humes and Ho, 1968a

10. Formula for endopod of leg 4 = 0–1; 1,I 11

Formula for endopod of leg 4 = 0–1; II 12

11. Seta on first segment of endopod of leg 4 naked; third segment of maxilliped with swollen membranous outer edge (from octocoral, *Sarcophyton ehrenbergi*) ..... *L. incisus* Humes and Ho, 1968c

Seta on first segment of endopod of leg 4 feathered; third segment of maxilliped without swollen membranous outer edge (from octocoral, *Lobophytum crassum*) ..... *L. insolens* Humes and Ho, 1968c

12. Length exceeding 2 mm (2.19–2.37 mm); inner coxal seta long and feathered (from octocoral, *Coelogorgia palmosa*) ..... *L. clavatus* Humes and Ho, above

Length distinctly less than 2 mm; inner coxal seta much reduced and either naked or at most with minute barbules 13

13. Free segment of leg 5 minute, less than 25 μ long, and not reaching anterior border of genital segment 14

Free segment of leg 5 large, at least 80 μ in length, reaching beyond anterior border of genital segment 15

14. Rostral area broadly rounded and slightly triangular; terminal

setae on caudal ramus haired (from pelecypods, *Asaphis rugosa* and *Standella solanderi*) ..... *L. asaphidis* Humes, 1959
Rostral area forming a long triangular beak; terminal setae on caudal ramus naked (from pelecypod, *Chama iostoma*) ..... *L. chamarum* Humes, 1968

15. Second antenna 3-segmented (third and fourth segments fused) 16
Second antenna 4-segmented 18

16. Prosome broad, about as long as wide, with urosome flexed beneath it; outer spines on exopods of legs 2–4 with smooth lamellae (from corals, *Stylophora pistillata*, S. *mordax*, and *Acropora* sp.) ..... *L. crassus* Humes and Ho, 1968a
Prosome not unusually broad, ratio about 1.3 : 1; urosome held posteriorly; outer spines on exopods of legs 2–4 with finely spinulose lamellae 17

17. Caudal ramus with ratio 9.1 : 1 (from corals, *Stylophora pistillata*, S. *mordax*, and *Acropora* sp.) ..... *L. geminus* Humes and Ho, 1968a
Caudal ramus with ratio 5 : 1 (from corals, *Seriatopora subseriata*, S. *octoptera*, and *Seriatopora* sp.) ..... *L. compositus* Humes and Frost, 1964

18. Caudal ramus as long as wide (from octocoral, *Sarcophyton glaucum*) ..... *L. spathophorus* Humes and Ho, 1968c
Caudal ramus longer than wide 19

19. Free segment of leg 5 with a proximal inner expansion (from sea anemone, *Rhodactis rhodostoma*) ..... *L. simulans* Humes and Ho, 1967b
Free segment of leg 5 without a proximal inner expansion (from sea anemone, *Rhodactis rhodostoma*) ..... *L. politus* Humes and Ho, 1967b

20. Convex margin of mandible with a strong toothlike process 21
Convex margin of mandible without such a process 22

21. Caudal ramus 36 $\mu \times 24\ \mu$ (1.5 : 1); genital segment broadest near middle (from octocoral, *Tubipora musica*) ..... *L. organicus* Humes and Ho, 1967c
Caudal ramus 28 $\mu \times 23\ \mu$ (1.22 : 1); genital segment broadest more posteriorly (from octocoral, *Tubipora musica*) ..... *L. conjunctus* Humes and Ho, 1967c

22. Ratio of caudal ramus distinctly more than 1.5 : 1 23
Ratio of caudal ramus distinctly less than 1.5 : 1, often 1 : 1 or even wider than long 26

23. Longer claw on second antenna longer than greatest length of fourth segment (from octocorals, *Nephthya aberrans*, *N. sphaerophora*, *N. tixierae*, *N. crassa*, and *Litophyton arboreum*) ..... *L. aculeatus* Humes and Ho, 1968b

Longer claw on second antenna shorter than greatest length of fourth segment 24

24. Caudal ramus 3.3 : 1 (from octocorals, *Lemnalia* sp., *L. flava*, *L. elegans*, *L. amabilis*, *L. africana*, and *Paralemnalia thyrsoides*) ..... *L. spinulifer* Humes and Frost, 1964

Caudal ramus about 1.7–1.8 : 1 25

25. Free segment of leg 5 83 $\mu \times 35$ μ, without a proximal inner expansion (from sea anemones, *Stoichactis giganteum* and *Radianthus ritteri*) ..... *L. cuspis* Humes, 1964

Free segment of leg 5 75 $\mu \times 19$ μ, with a proximal inner expansion where width is 31 μ (from zoantharians, *Palythoa tuberculosa* and *P. liscia*) ..... *L. inaequalis* Humes and Ho, 1966

26. Longer claw on second antenna about as long as or longer than greatest length of second segment 27

Longer claw on second antenna shorter than greatest length of second segment 30

27. Two long terminal setae on caudal ramus naked; a prominent unguiform process (twice the length of the setae) on area of attachment of egg sac (from octocorals, *Dendronephthya mucronata*, *D. regia*, *D. stocki*, and *D. kollikeri*) ..... *L. varirostratus* Humes and Ho, 1968b

Two long terminal setae on caudal ramus haired; without such a prominent unguiform process on area of attachment of egg sac .. 28

28. Free segment of leg 5 with a weak proximal inner expansion; longer claw on second antenna distinctly longer than greatest length of fourth segment (143 μ to 130 μ) (from octocorals, *Dendronephthya mucronata*, *D. kollikeri*, *D. stocki*, *Stereonephthya acaulis*, and *S. papyracea*) ..... *L. gentilis* Humes and Ho, 1968b

Free segment of leg 5 with a well developed proximal inner expansion; longer claw on second antenna about as long as greatest length of fourth segment 29

29. Free segment of leg 5 148 μ long; lateral contour of genital segment in dorsal view rounded (from octocorals, *Stereonephthya acaulis*, *S. papyracea*, and *Lemnalia elegans*) ..... *L. fissisetiger* Humes and Ho, 1968b

Free segment of leg 5 172 μ long; lateral contour of genital segment in dorsal view angular rather than rounded (from octocorals, *Dendronephthya mucronata*, *D. regia*, *D. stocki*, and *D. kollikeri*) ..... *L. exilipes* Humes and Ho, 1968b

30. Formula for endopod of leg 4 = 0–I; II 31

Formula for endopod of leg 4 = 0–1; II 35

31. Free segment of leg 4 117 $\mu \times 26$ μ, without a proximal inner expansion (from octocoral, *Siphonogorgia pendula*) ..... *L. hians* Humes and Ho, above

Free segment of leg 5 with a distinct proximal inner expansion .. 32

32. Free segment of leg 5 with a broad rounded expansion 33
Free segment of leg 5 with a pointed expansion, directed distally .. 34
33. Genital segment broadest near middle; free segment of leg 5 rather slender (from octocoral, *Telesto arborea*) ..... *L. telestophilus* Humes and Ho, above
Genital segment broadest anterior to middle; free segment of leg 5 moderately broad (from octocoral, *Heteroxenia elisabethae*) ..... *L. verseveldti* Humes and Ho, above
34. Setae on caudal ramus naked; genital segment broadest near middle; spine on first segment of exopod of leg 1 of usual length (from octocoral, *Stereonephthya acaulis*) ..... *L. cuneipes* Humes and Ho, 1968b
Setae on caudal ramus mostly haired; genital segment broadest posterior to middle; spine on first segment of exopod of leg 1 unusually long (from octocoral, *Siphonogorgia pendula*) ..... *L. longispinifer* Humes and Ho, above
35. Free segment of leg 5 small, less than 50 μ long 36
Free segment of leg 5 large, more than 80 μ long 37
36. Proximalmost outer spine on third segment of exopod of legs 1–3 shorter than others; seta on first segment of endopod of leg 4 very lightly feathered; free segment of leg 5 27 $\mu \times 12$ μ (from octocorals, *Cladiella pachyclados* and *C. krempfi*) ..... *L. hetaericus* Humes and Ho, 1968c
Proximalmost outer spine on third segment of exopod of legs 1–3 not shorter than others; seta on first segment of endopod of leg 4 conspicuously feathered; free segment of leg 5 49 $\mu \times$ 20 μ (from nudibranch, *Phyllidia trilineata*) ..... *L. venustus* Humes, 1959
37. Caudal ramus a little longer than wide, ratio 1.3 : 1 (from nudibranch, *Trevelyana rubromaculata*) ..... *L. sensilis* Humes, 1964
Caudal ramus about as long as wide or a little wider than long .. 38
38. Free segment of leg 5 without a basal expansion 39
Free segment of leg 5 with a proximal inner expansion 40
39. Free segment of leg 5 broad, 81 $\mu \times 34$ μ, with relatively large scalelike spines on outer surface (from octocoral, *Parerythropodium rubiginosum*) ..... *L. singularipes* Humes and Ho, 1968c
Free segment of leg 5 slender, 98 $\mu \times 22$ μ, with small spines on outer surface (from nudibranch, *Phyllidia trilineata*) ..... *L. patulus* Humes, 1959
40. Expansion slight; outer surface of free segment of leg 5 with small spinules (from nudibranchs, *Hexabranchus orbicularis* and *Doridopsis ruber*) ..... *L. commodus* Humes, 1964
Expansion large and rounded; outer surface of free segment of leg 5 smooth (from nudibranch, *Doris mabilla*) ..... *L. securiger* Humes, 1964

41. Second antenna with 1 claw 42
Second antenna with 2 claws 48
42. Formula of endopod of leg 4 = 0–1; 1,I (from octocoral, *Sarcophyton globosum*) ..... *L. protentus* Humes and Frost, 1964
Formula of endopod of leg 4 = 0–1; II 43
43. Caudal ramus distinctly longer than wide (at least 3.5 : 1) 44
Caudal ramus about as long as wide 45
44. Setae on first antenna haired; mandible with an extremely short flagellum; lash of second maxilla with a crest of long spinules (from octocoral, *Sinularia leptoclados*) ..... *L. cristatus* Humes and Ho, 1968c
Setae on first antenna smooth; mandible with moderately long flagellum; without crest of long spinules on lash of second maxilla (from octocoral, *Xenia umbellata*) ..... *L. glabripes* Humes and Ho, above
45. Free segment of leg 5 with an inner expansion 46
Free segment of leg 5 lacking an inner expansion 47
46. Inner expansion in the form of a large tooth (from octocoral, *Sinularia humesi*) ..... *L. dentipes* Thompson and A. Scott, 1903
Inner expansion large, not well delimited, and giving a triangular appearance to the segment (from octocoral, *Anthelia gracilis*) ..... *L. triquetrus* Humes and Ho, above
47. Free segment of leg 5 195 $\mu \times 26\ \mu$, with spines on outer surface arranged in two rows proximally and in one row distally (from octocorals, *Sinularia polydactyla*, *S. pedunculata*, and *S. whiteleggei*) ..... *L. adelphus* Humes and Ho, 1968c
Free segment of leg 5 82 $\mu \times 34\ \mu$, with spines on outer surface not arranged in rows (from octocorals, *Sinularia polydactyla* and *S. whiteleggei*) ..... *L. squamiger* Humes and Frost, 1964
48. Body length 3 mm; caudal ramus 7.8 : 1 (from sea anemone, *Stoichactis giganteum*) ..... *L. magnificus* Humes, 1964
Body length less than 1.5 mm; caudal ramus 2 : 1 or less, in some even wider than long 49
49. Seta on first segment of endopod of leg 4 naked; mandible with a spiniform or toothlike process on convex margin 50
Seta on first segment of endopod of leg 4 feathered; mandible without a spiniform or toothlike process 51
50. Free segment of leg 5 short, 33 $\mu \times 15\ \mu$, with an inner expansion but unornamented (from octocoral, *Cladiella laciniosa*) ..... *L. decorus* Humes and Frost, 1964
Free segment of leg 5 elongated, 101 $\mu \times 15\ \mu$, with an inner expansion and outer surface with spinules (from octocorals, *Cladiella krempfi*, *C. laciniosa*, and *C. pachyclados*) ..... *L. foxi* Gurney, 1927
51. Inner surface of segment 2 of second antenna with small spines;

caudal ramus wider than long, 24 $\mu \times 30$ μ (from nudibranch, *Platydoris scaber*) ..... *L. audens* Humes, 1959
Inner surface of segment 2 of second antenna smooth; caudal ramus longer than wide, 55 $\mu \times 31$ μ (from sea anemone, *Stoichactis giganteum*) ..... *L. gemmatus* Humes, 1964

Males

(The males of *L. cristatus* Humes and Ho, 1968c, and *L. singularipes* Humes and Ho, 1968c, are unknown, and hence are not included in the key.)

1. Last segment of exopod with formula II,I,5 2
   Last segment of exopod with formula III,I,5 40
2. Second antenna with 1 claw 3
   Second antenna with 2 claws 20
3. A large sometimes toothlike process on convex margin of mandible 4
   Convex margin of mandible without such a process or at most with 2–4 small digitiform processes 6
4. A setiferous sphere on segment 2 of second maxilla ..... *L. actinophorus* Humes and Frost, 1964
   Without such a sphere 5
5. Last segment of endopod of leg 1 = I,I,4; free segment of leg 5 18 $\mu \times 6$ μ; caudal ramus 1.55 : 1 ..... *L. rhadinus* Humes and Ho, 1967a
   Last segment of endopod of leg 1 = I,5, as in female; free segment of leg 5 15 $\mu \times 9$ μ; caudal ramus 3.2 : 1 ..... *L. campulus* Humes and Ho, 1968a
6. Convex margin of mandible with 2–4 small digitiform processes 7
   Convex margin of mandible without such processes 10
7. A prominent posteroventral lobe on second postgenital segment ..... *L. lobophorus* Humes and Ho, 1968a
   Without such a lobe 8
8. Segments 3 and 4 of second antenna fused; segment 2 of maxilliped with two rows of prominent spinules ..... *L. arcuatipes* Humes and Ho, 1968a
   Segments 3 and 4 of second antenna not fused; segment 2 of maxilliped with only one row of prominent spinules 9
9. Caudal ramus 2 : 1 ..... *L. prolixipes* Humes and Ho, 1968a
   Caudal ramus 4.3 : 1 ..... *L. digitatus* Humes and Ho, 1968a
10. Formula for endopod of leg 4 = 0–1; 1,I 11
    Formula for endopod of leg 4 = 0–1; II 12
11. Seta on first segment of endopod of leg 4 naked; inner margin of segment 2 of second antenna with a notched lamella; concave edge of claw of maxilliped smooth ..... *L. incisus* Humes and Ho, 1968c

Seta of first segment of endopod of leg 4 feathered; inner margin of segment 2 of second antenna with a striated membrane; concave edge of claw of maxilliped with hyaline knobs ..... *L. insolens* Humes and Ho, 1968c

12. Length 1.74 mm (1.60–1.80 mm); inner coxal seta long and feathered ..... *L. clavatus* Humes and Ho, above
Length not exceeding 1.55 mm; inner coxal seta much reduced and either naked or at most with minute barbules 13
13. Last segment of endopod of leg 1 with formula I,5, as in female 14
Last segment of endopod of leg 1 with formula I,I,4 16
14. Caudal ramus 4.4 : 1, its setae relatively long and naked ..... *L. chamarum* Humes, 1968
Caudal ramus at least 5.13 : 1, its setae otherwise 15
15. Two terminal setae on caudal ramus not broadened, ornamented with hairs; concave margin of claw of maxilliped smooth; free segment of leg 5 minute, 18 $\mu \times 12 \mu$ ..... *L. asaphidis* Humes, 1959
Two terminal setae on caudal ramus naked and slightly broadened; concave margin of claw of maxilliped with hyaline dentation; free segment of leg 5 larger, 35 $\mu \times 10 \mu$ ..... *L. crassus* Humes and Ho, 1968a
16. Second antenna with third and fourth segments fused 17
Second antenna 4 segmented 18
17. Outer of two terminal spines on last segment of endopod of second leg not modified ..... *L. compositus* Humes and Frost, 1964
Outer of two terminal spines on last segment of endopod of second leg modified (truncated and broadened at tip) ..... *L. geminus* Humes and Ho, 1968a
18. Caudal ramus about as long as wide ..... *L. spathophorus* Humes and Ho, 1968c
Caudal ramus distinctly longer than wide 19
19. Length 1.33 mm (1.26–1.40 mm); caudal ramus 138 $\mu \times 36 \mu$, ratio 3.8 : 1 ..... *L. politus* Humes and Ho, 1967b
Length 0.96 mm (0.85–1.08 mm); caudal ramus 52 $\mu \times 34 \mu$, ratio 1.5 : 1 ..... *L. simulans* Humes and Ho, 1967b
20. Convex margin of mandible with a strong toothlike process 21
Convex margin of mandible without such a process 22
21. Caudal ramus 31 $\mu \times 21 \mu$, ratio 1.48 : 1; free segment of leg 5 36 $\mu \times 9 \mu$, ratio 4 : 1 ..... *L. organicus* Humes and Ho, 1967c
Caudal ramus 25 $\mu \times 21 \mu$, ratio 1.19 : 1; free segment of leg 5 28 $\mu \times 8 \mu$, ratio 3.5 : 1 ..... *L. conjunctus* Humes and Ho, 1967c
22. Longer claw on second antenna about as long as or longer than greatest length of fourth segment 23
Longer claw on second antenna shorter than greatest length of fourth segment 27
23. Caudal ramus 2 : 1; terminal spine on third segment of endopod

of leg 1 concave with two rows of strong spinules ..... *L. aculeatus* Humes and Ho, 1968b

Caudal ramus about 1 : 1; terminal spine on third segment of endopod of leg 1 otherwise 24

24. Rostral area pointed, not broadly rounded as in female; two terminal setae on caudal ramus naked; free segment of leg 5 33 $\mu \times 9\ \mu$, ratio 3.66 : 1 ..... *L. varirostratus* Humes and Ho, 1968b

Rostral area rounded; two terminal setae on caudal ramus haired; free segment of leg 5 with ratio of 5–5.77 : 1 25

25. One of two setae on second segment of maxilliped terminating in several pointed spiniform elements; free segment of leg 5 with ratio of 5.77 : 1 ..... *L. fissisetiger* Humes and Ho, 1968b

Both setae on second segment of maxilliped normally attenuated; free segment of leg 5 with ratio close to 5 : 1 (not more than 5.2 : 1) 26

26. Outer spine on last segment of endopod of leg 1 angularly bent; genital segment with lateral margins rounded posteriorly ..... *L. exilipes* Humes and Ho, 1968b

Outer spine on last segment of endopod of leg 1 not strongly bent; genital segment with lateral margins angular posteriorly ..... *L. gentilis* Humes and Ho, 1968b

27. Spine on first segment of exopod of leg 1 unusually long (about twice length of succeeding spines) ..... *L. longispinifer* Humes and Ho, above

Spine on first segment of exopod of leg 1 of usual length 28

28. Setae on caudal ramus naked 29

Setae on caudal ramus haired 30

29. First segment of endopod of leg 4 with slightly barbed spine ..... *L. cuneipes* Humes and Ho, 1968b

First segment of endopod of leg 4 with feathered seta ..... *L. venustus* Humes, 1959

30. Endopod of leg 4 with formula 0–1; II, first segment with a feathered seta 31

Endopod of leg 4 with formula 0–I; II, first segment with a very finely barbed or naked spine 38

31. One of two setae on second segment of maxilliped strongly modified, with base swollen and spinose and distal part slender and naked ..... *L. cuspis* Humes, 1964

Neither of two setae on second segment of maxilliped so modified 32

32. Second antenna like that of female, without ornamentation added ..... *L. inaequalis* Humes and Ho, 1966

Second antenna with ornamentation on inner surface of second segment 33

33. This ornamentation consisting of hairs ..... *L. commodus* Humes, 1964

This ornamentation consisting of spinules (in some cases knob-like) 34

34. Caudal ramus longer than wide 35
Caudal ramus with ratio close to 1 : 1, or wider than long 36

35. Caudal ramus 1.3 : 1; inner surface of segment 2 of second antenna with small knobs (spinules ?) ..... *L. sensilis* Humes, 1964
Caudal ramus 2.44 : 1; inner surface of segment 2 of second antenna with strong spinules ..... *L. spinulifer* Humes and Frost, 1964

36. Inner distal spine on segment 2 of second maxilla with spinules on one side; seta on first segment of endopod of leg 4 very lightly feathered ..... *L. hetaericus* Humes and Ho, 1968c
Inner distal spine on segment 2 of second maxilla with spinules on both sides; seta on first segment of endopod of leg 4 well feathered 37

37. Free segment of leg 5 small, 20 $\mu \times 9$ μ, without fine ornamentation ..... *L. securiger* Humes, 1964
Free segment of leg 5 larger, 87 $\mu \times 14$ μ, with small spinules on outer surface ..... *L. patulus* Humes, 1959

38. Longer claw on second antenna about 80 per cent of greatest length of fourth segment; slight sexual dimorphism in third segment of endopod of leg 2 ..... *L. hians* Humes and Ho, above
Longer claw on second antenna about 61 per cent of greatest length of fourth segment; without sexual dimorphism in third segment of endopod of leg 2 39

39. One of two setae on second segment of maxilliped with a blunt finely spinulose tip ..... *L. verseveldti* Humes and Ho, above
Both setae on second segment of maxilliped attenuated and naked ..... *L. telestophilus* Humes and Ho, above

40. Second antenna with 1 claw 41
Second antenna with 2 claws 46

41. Formula for endopod of leg 4 = 0–1; 1,I ..... *L. protentus* Humes and Frost, 1964
Formula for endopod of leg 4 = 0–1; II 42

42. Mandible with extremely short flagellum; last postgenital segment much wider than preceding three ..... *L. dentipes* Thompson and A. Scott, 1903
Mandible with long flagellum; last postgenital segment not noticeably wider than preceding segments 43

43. Segment 2 of second antenna with inner surface unornamented, as in female; seta on first segment of endopod of leg 4 naked ..... *L. triquetrus* Humes and Ho, above
Segment 2 of second antenna with inner surface ornamented with spinules or spines; seta on first segment of endopod of leg 4 feathered 44

44. Segment 2 of second antenna with few scalelike spines on inner

surface ..... *L. glabripes* Humes and Ho, above
Segment 2 of second antenna with many spinules on inner surface 45

45. Last segment of endopod of leg 2 with spiniform process between two terminal spines broadly triangular ..... *L. adelphus* Humes and Ho, 1968c
Last segment of endopod of leg 2 with spiniform process between two terminal spines in the form of a bent thumb ..... *L. squamiger* Humes and Frost, 1964

46. Body length 2.74 mm; caudal ramus 6.7 : 1 ..... *L. magnificus* Humes, 1964
Body length not exceeding 1 mm; caudal ramus less than 2 : 1 47

47. Last segment of endopod of leg 1 with formula I,II,3; segment 2 of second antenna with refractile knobs on inner surface ..... *L. gemmatus* Humes, 1964
Last segment of endopod of leg 1 with formula I,I,4; segment 2 of second antenna without refractile knobs on inner surface 48

48. Seta on first segment of endopod of leg 4 naked; genital segment longer than wide ..... *L. foxi* Gurney, 1927
Seta on first segment of endopod of leg 4 feathered; genital segment not longer than wide 49

49. Segment 2 of second antenna with smooth inner surface, as in female; seta on first segment of endopod of leg 4 weakly feathered ..... *L. decorus* Humes and Frost, 1964
Segment 2 of second antenna with spinules on inner surface; seta on first segment of endopod of leg 4 well feathered ..... *L. audens* Humes, 1959

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