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## New species of *Macrochiron* (Copepoda, Cyclopoida) associated with hydroids in Madagascar

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ABSTRACT

From the region of Nosy Bé, Madagascar, three new species of copepods belonging to the lichomolgid genus *Macrochiron*, associated with plumulariid hydrozoans, are described: *M. lytocarpi* and *M. valgum* from *Lytocarpus philippinus* and *M. rostratum* from *L. philippinus* and *L. spectabilis*. Certain features of the external anatomy of *Macrochiron* are briefly discussed.

### INTRODUCTION

The genus *Macrochiron* Brady, 1872, has been generally regarded as free-living. However, at Ifaluk Atoll in the Caroline Islands, Vervoort (1964) has recorded *M. cheliferum* (Thompson & A. Scott, 1903) apparently living on hydroids. As a result of recent collecting in the vicinity of Nosy Bé, in northwestern Madagascar, three new species of the lichomolgid genus *Macrochiron*, described below, have been found associated with the hydrozoan genus *Lytocarpus* Allman, 1883 (family Plumulariidae).

The hydroids were collected by hand while swimming with a face mask and snorkel tube. In order to avoid the violent stinging sensation received when these featherlike hydroids were disturbed, and to insure that copepods living on them were not dislodged during handling, each colony was cut free at its basal attachment and then floated quickly into a plastic bag which was closed immediately and tied. The copepods were later recovered from the sediment obtained after washing the hydroids in weakly alcoholized sea water.

The material covered in this paper comprises:

*Macrochiron lytocarpi* n. sp., *Macrochiron valgum* n. sp., and *Macrochiron rostratum* n. sp., all from *Lytocarpus philippinus* (Kirchenpauer, 1872), and

*Macrochiron rostratum* n. sp., from *Lytocarpus spectabilis* Allman, 1883.

### ACKNOWLEDGEMENTS

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delphia and in 1963-64 while participating in the activities of the U.S. Program in Biology of the International Indian Ocean Expedition.

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I wish to thank Dr. Anita Brinckmann-Voss of the University of Manitoba for the identifications of the hydroids, and to acknowledge the assistance to the field work given by the staff of the Centre d'Océanographie et des Pêches at Nosy Bé.

**Macrochiron lytocarpi** n. sp. Figs. 1—32.

Type material. — 155 ♀♀, 87 ♂♂, and 6 copepodids washed from a hydroid, *Lytocarpus philippinus* (Kirchenpauer), in a depth of 2 m, at Ambariobe, a small island nearly between Nosy Bé and Nosy Komba, Madagascar. September 19, 1964. Holotype female, allotype, and 90 paratypes (60 ♀♀, 30 ♂♂) deposited in the Zoölogisch Museum, Amsterdam (Z.M.A. Co. 101.017), the same number of paratypes in the United States National Museum, Washington, and the remaining paratypes in the collection of the author.

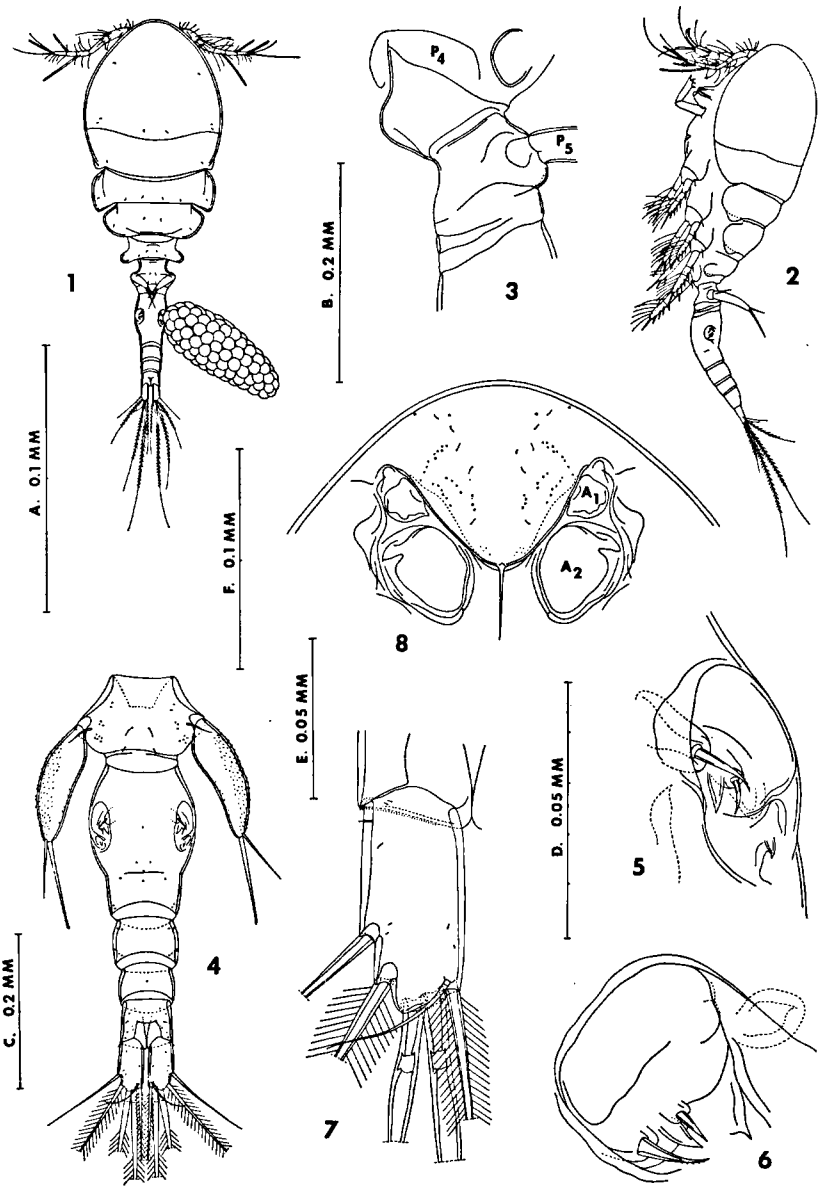
Other specimens. — 15 ♀♀, 28 ♂♂, and 30 copepodids from *Lytocarpus philippinus* in 1 m, Tany Kely, a small island to the south of Nosy Bé, June 23, 1963.

Female. — Body (figs. 1 and 2) rather slender. Length (excluding setae on caudal rami) 1.28 mm (1.18—1.38 mm) and greatest width 0.51 mm (0.46—0.54 mm), based on 10 specimens. Ratio of length to width of prosome 1.7 : 1. Segment bearing leg 1 separated from head dorsally and laterally by a furrow. Epimeral areas of metasomal segments differing in size and form as shown in figures. Posteroventral region of segment of leg 4 produced (fig. 3).

Segment of leg 5 (fig. 4) 91 × 161 μ. Between this segment and genital segment a very short ventral intersegmental sclerite (shown in fig. 3). Genital segment (fig. 4) elongated, 200 μ in length, in dorsal view its anterior two-thirds gently rounded (greatest width 135 μ), its posterior third slightly constricted with nearly parallel margins (width here about 94 μ). Ventral surface of genital segment with very fine transverse striae. Areas of attachment of egg sacs dorsolateral, each area (figs. 5 and 6) bearing 2 setae (7 and 13 μ in length) with a spinous process (8 μ) between them and a small spinous process posteriorly. Three postgenital segments 68 × 78, 47 × 70, and 55 × 66 μ from anterior to posterior. Anal segment with row of minute spinules along posteroventral border.

Caudal ramus (fig. 7) moderately elongated, 66 × 31 μ in greatest dimensions. Ratio of length to width 2.1 : 1. Outer lateral seta 130 μ long and naked. Pedicellate dorsal seta 39 μ and naked. Outermost terminal seta 213 μ with lateral spinules along its proximal two-thirds; innermost terminal seta 239 μ with similar spinules. Two long median terminal setae 370 μ (outer) and 484 μ (inner) with lateral spinules in their midregions; these 2 setae inserted between dorsal (smooth) and ventral (with row of minute spinules) flaps. Ramus with a minute lateral setule 2 μ long on outer basal margin and with a few small hairs on dorsal and ventral surfaces.

Dorsal surface of prosome and urosome with few minute hairs (sensilla) and refractile points; ventral surface of urosome with very little such ornamentation. Ratio of length of prosome to that of urosome 1.65 : 1.




FIGURES 1—8. *Macrochiron lytocarpi* n. sp., female: 1, body, dorsal (A); 2, body, lateral (A); 3, junction of segments of legs 4 and 5, lateral (B); 4, urosome, dorsal (C); 5, area of attachment of egg sac, dorsal (D); 6, area of attachment of egg sac, lateral (D); 7, caudal ramus, dorsal (E); 8, rostrum, ventral (F).

Egg sac (see fig. 1) elongated, in one female 495 × 187 μ, with numerous eggs each about 50 μ in diameter.

Rostrum (fig. 8) well-developed, its posteriorly directed margin rounded and terminating in a slender, needlelike process (57 μ long) lying between bases of second antennae.

First antenna (fig. 9) 7-segmented, lengths of segments (measured along their posterior non-setiferous margins) 44 (55 μ along anterior margin), 78, 26, 59, 45, 33, and 47 μ respectively. Formula for armature: 4, 13 (5 + 8), 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. Terminal seta 200 μ long. All setae naked. Ventral sclerite on third segment suggesting an intercalary segment.

Second antenna (fig. 10) 3-segmented, last segment 137 μ long. First segment with a short naked seta. Second with a strong spinelike naked seta and minute inner surficial bosses. Third segment proximally with 3 setae (one naked, one unilaterally with spinules, and the third with a spinulose fringe) and an oblique row of bosses; distally with 6 setae (4 of them naked and 2 with fine unilateral barbules, one of these 2 being jointed and slightly unguiform) and a prominent claw 114 μ along its axis. Claw bisegmented with proximal part showing a line of partial further division; teeth along concave surface in a single row.

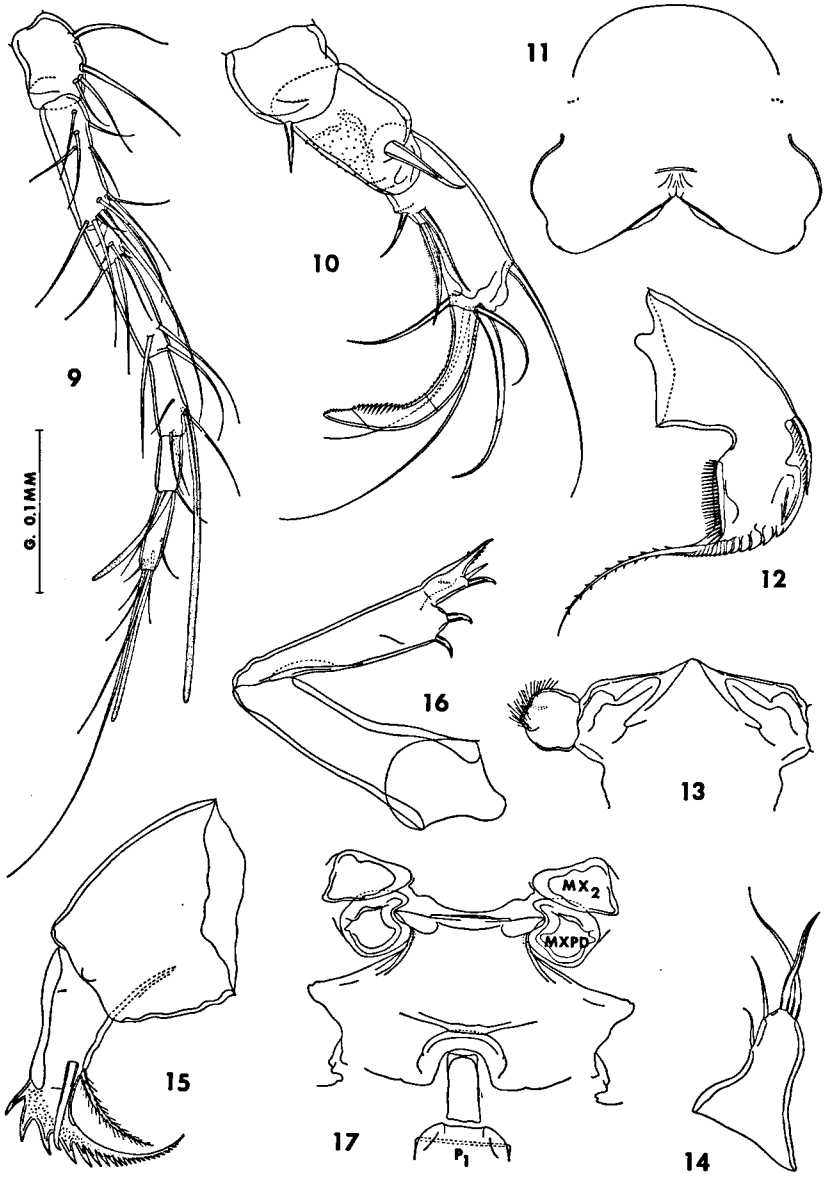
Labrum (fig. 11) with 2 ventral lobes widely divergent.

Mandible (fig. 12) with blade having near its concave edge a row of slender spinules, on its posterior surface a spinous sclerotization, and on its convex edge a pectinate scalelike sclerotization followed by a row of graduated teeth. Lash with spinules along each side. Paragnath (fig. 13) a small lobe with hairs. First maxilla (fig. 14) with 4 setae. Second maxilla (fig. 15) 2-segmented, first segment unornamented; second produced to form a serrated lash and bearing proximally a minute spinule and distally 2 setae, one setose, the other spiniform, hyaline, with a rather blunt tip. Maxilliped (fig. 16) 3-segmented, though separation of last 2 segments not very distinct. Second segment elongated and straight, with 2 recurved spines. Third segment small with 4 elements — a small subterminal setule, a recurved spine, a hyaline seta, and a pectinate spine (without definite articulation).

Area between maxillipeds and first pair of legs (fig. 17) only slightly protuberant (see fig. 2); sclerotized line connecting bases of maxillipeds.

Legs 1—4 (figs. 18, 19, 20, and 21) with trimerous rami except for endopod of leg 4 which consists of a single segment. Armature as follows (Roman numerals indicating 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; III,I,5 |
| | | end 2 |




FIGURES 9—17. *Macrochiron lytocarpi* n. sp., female (continued): 9, first antenna, ventral (G); 10, second antenna, inner (G); 11, labrum, ventral (F); 12, mandible, posterior (E); 13, paragnath and median area, ventral (E); 14, first maxilla, posterior (E); 15, second maxilla, posterior (E); 16, maxilliped, postero-inner (F); 17, area between maxillipeds and first pair of legs, ventral (B).

Inner seta on coxa of legs 1—3 long and plumose, but in leg 4 somewhat shorter (42 $\mu$) and naked. In legs 1—3 inner margin of basis with row of hairs, but this margin smooth in leg 4. In leg 1 margin of basis median to endopod not projected, but in legs 2—4 forming a process. Endopods of legs 1—3 with outer and terminal processes obtuse, but inner processes acute. Three spines on last segment of endopod of leg 2 measuring 37, 34, and 59 $\mu$ in length from outer to inner; those on leg 3, 47, 44, and 73 $\mu$. Leg 4 with exopod slightly twisted; endopod 74 $\mu$ in length (about as long as first exopod segment), 17.5 $\mu$ wide proximal to outer marginal notch, 15.5 $\mu$ wide distal to notch, with 2 terminal setae 33 $\mu$ (outer) and 91 $\mu$ (inner), both with extremely minute barbules, and with a few delicate hairs along outer margin distal to notch. Endopod with very indistinct line of division.

Leg 5 (fig. 22) held erect in specimens in alcohol (see fig. 2). Free segment elongated, 159 $\times$ 44 $\mu$ in greatest dimensions, tapered distally, with numerous minute spinules on outer half of dorsal surface, outer terminal seta 72 $\mu$ long and naked, inner terminal seta 107 $\mu$ with few spinules near its blunt tip (fig. 23). Seta on body near free segment 30 $\mu$ and naked.

Leg 6 probably represented by 2 setae near attachment of each egg sac (see figs. 5 and 6).

Color in life in transmitted light varying from slightly opaque to translucid, almost glassy, eye red, egg sacs gray.

M a l e. — Body (figs. 24 and 25) resembling in general that of female. Length (without setae on caudal rami) 1.08 mm (1.00—1.14 mm) and greatest width 0.37 mm (0.34—0.40 mm), based on 10 specimens. Ratio of length to width of prosome 1.65 : 1.

Segment of leg 5 (fig. 26) 60 $\times$ 99 $\mu$. Between this segment and genital segment no ventral intersegmental sclerite. Genital segment longer than wide, 229 $\times$ 180 $\mu$, its lateral margins in dorsal view slightly convex. Four post-genital segments 52 $\times$ 68, 49 $\times$ 62, 31 $\times$ 57, and 43 $\times$ 56 $\mu$ from anterior to posterior.

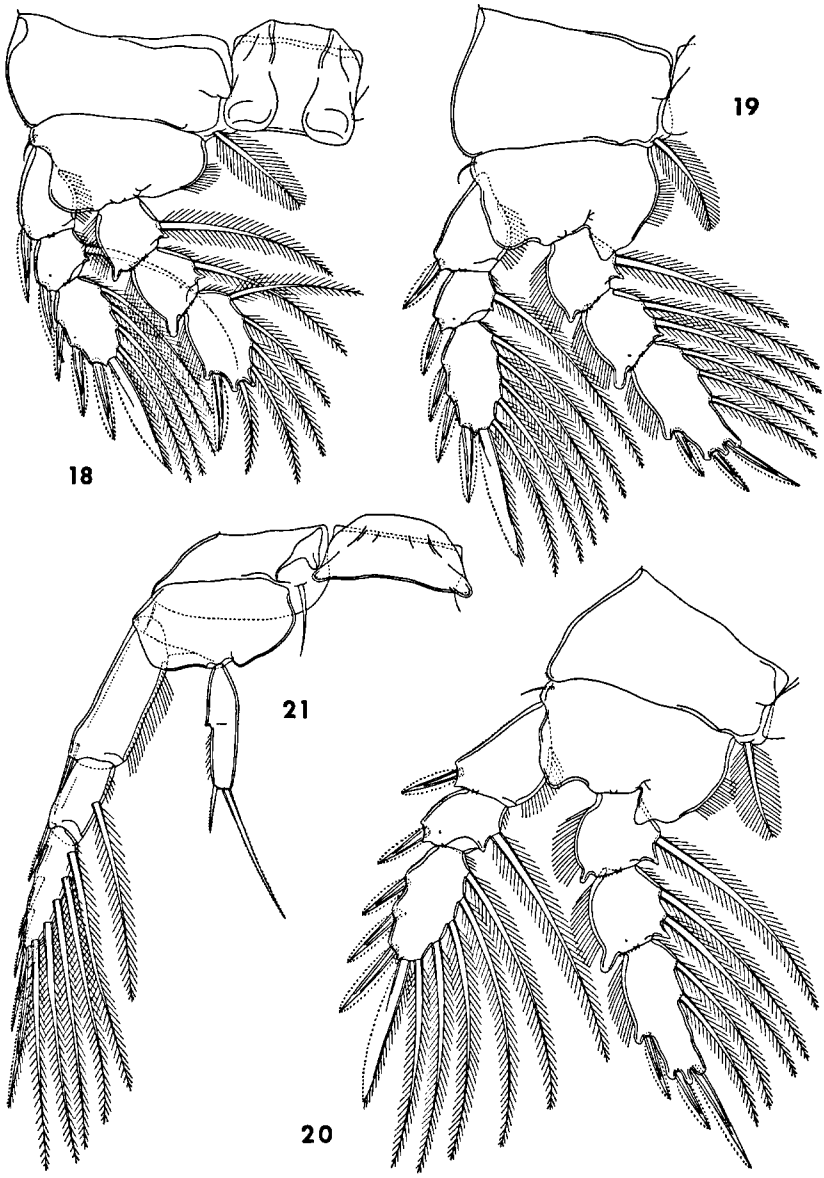
Caudal ramus like that of female but smaller, 53 $\times$ 26 $\mu$.

Surfaces of prosome and urosome with fine hairs and minute refractile points as shown in figs. 24 and 26. Ratio of length of prosome to that of urosome 1.25 : 1.

Rostrum like that of female.

First antenna (fig. 27) resembling that of female but with 3 aesthetes added. Lengths of segments (measured along their posterior non-setiferous margins) 35 (45 $\mu$ along anterior margin), 51, 22, 50, 44, 32, and 47 $\mu$ respectively. Formula for armature: 4, 13 + 2 aesthetes, 6, 3 + 1 aesthete, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae naked.

Second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla like those in female. Maxilliped (fig. 28) slender and elongated (cf. fig. 25), 4-segmented, assuming that proximal half of claw represents a fourth segment. Second segment with 2 naked setae and a row of spinules on inner surface. Claw 153 $\mu$ along its axis (including large terminal lamella), partially




FIGURES 18—21. *Macrochiron lytocarpi* n. sp., female (continued): 18, leg 1, anterior (G); 19, leg 2, anterior (G); 20, leg 3, anterior (G); 21, leg 4, anterior (G).

divided about midway, and bearing 2 unequal setae proximally, larger one with small spinules along one edge.

Legs 1—4 segmented as in female and having similar armature and ornamentation, except for leg 1 where last segment of endopod (fig. 29) shows sexual dimorphism, its formula being I,I,4 (outer spinulose spine 37 $\mu$, inner spine 42 $\mu$ and naked except for scalelike knobs along edges). Slight sexual dimorphism seen also in spines on last segment of endopod of leg 2 (29, 26, and 37 $\mu$ in length from outer to inner) and of leg 3 (42, 29, and 49 $\mu$).

Leg 5 (fig. 30) much smaller than in female, its free segment slender, 44 $\times$ 13 $\mu$, with its 2 terminal naked setae 35 $\mu$ (outer) and 46 $\mu$ (inner) and with its surface unornamented except for a few minute refractile points.

Leg 6 (fig. 31) a posteroventral flap on genital segment, bearing 2 naked setae 23 and 40 $\mu$ in length.

Spermatophore (fig. 32), extruded under slight pressure from body of male, about 208 $\times$ 83 $\mu$, not including neck.

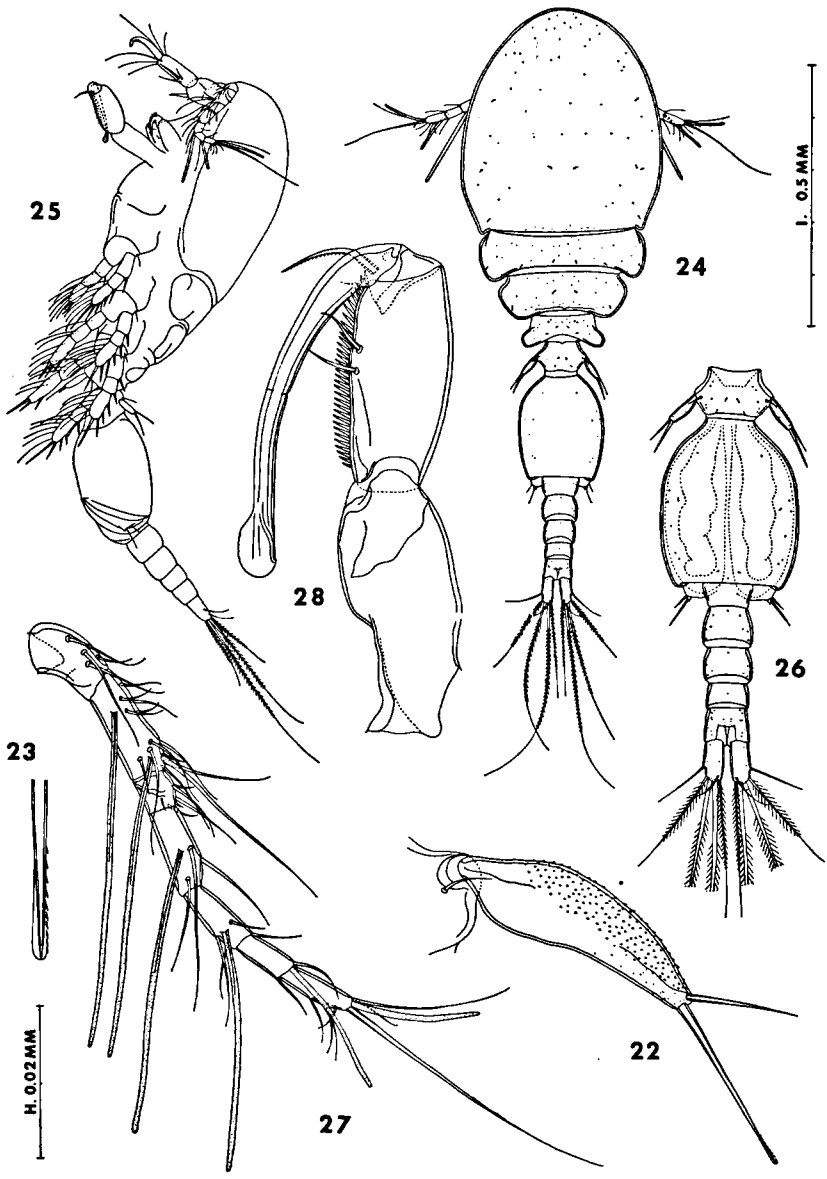
Color in life in transmitted light resembling that of female.

(The specific name *lytocarpi* is based on the generic name of the host.)

Relationship to other species in the genus. Following Stock's (1957) restricted generic definition of *Macrochiron* Brady, 1872, the genus may be recognized by its lichomolgid appearance; the 3-segmented second antenna with a strong, often bisegmented terminal claw; the second maxilla bearing near the base of the apical lash an ornamented seta and a smooth, often hyaline, rather blunt seta; the maxilliped in the female 3-segmented, its last segment small and sometimes indistinctly separated from the preceding segment; legs 1—3 with 3-segmented rami; leg 4 with a 3-segmented exopod and a small 1- or 2-segmented endopod (the line of division often not well-developed) with 2 terminal setae; leg 5 with a long free segment bearing 2 terminal setae.

Many species formerly attributed to *Macrochiron* actually belong to other genera, as Stock (1957) has pointed out. In addition to those listed by Stock, *Macrochiron* (*Paramacrochiron*) *ornatum* Krishnaswamy, 1952, does not belong to *Macrochiron*, since it has a 4-segmented second antenna. Instead it probably represents, along with *Macrochiron malayense* Sewell, 1949, and *Pseudanthessius parvus* A. Scott, 1909, a new genus near *Paramacrochiron* Sewell, 1949. (The advisability of erecting a new genus for *M. malayense* and *P. parvus* has already been indicated by Stock, 1957). *Macrochiron* (*Macrochiron*) *rigidum* Ummerkutty, 1962, is to be referred to *Lichomolgus* Thorell, 1860, since it has a 4-segmented second antenna and its 2-segmented endopod of leg 4 has the formula 0—1; II.

In *Macrochiron* three species were included by Stock (1957) : *M. fucicolum* Brady, 1872, *M. cheliferum* (Thompson & A. Scott, 1903), and *M. mutatum* Stock, 1957 (= *fucicolum* G. O. Sars, 1917, non Brady). *Macrochiron sargassi* G. O. Sars, 1916 (redescribed by Yeatman, 1962) also belongs almost certainly to the genus, in spite of the fact that Sars showed a small terminal fourth segment on the second antenna (see Yeatman, 1962: 256).




FIGURES 22—23. *Macrochiron lytocarpi* n. sp., female (continued): 22, leg 5, dorsal (G); 23, tip of inner seta on free segment of leg 5, dorsal (H).

FIGURES 24—28. *Macrochiron lytocarpi* n. sp., male : 24, body, dorsal (I); 25, body, lateral (I); 26, urosome, dorsal (C); 27, first antenna, ventral (G); 28, maxilliped, antero-outer (F).

*M. lytocarpi* differs from both *M. fucicolum* and *M. cheliferum* in the formula for the last segment of the exopod of leg 4 (III,I,5 in *M. lytocarpi*, II,I,5 in *M. fucicolum* and *M. cheliferum*). It may be distinguished from *M. sargassi* by the nature of the terminal armature of the second antenna (a single large claw in *M. lytocarpi*, two unequal claws in *M. sargassi*). It differs from *M. mutatum* in having the large teeth on the claw of the second antenna more distally located than in that species, the outer and terminal processes on the endopod segments of legs 1—3 blunt rather than acute, the second segment of the maxilliped in the female elongated and slender with the two spines far distal rather than relatively short and stout with the two spines in a central position, and the free segment of leg 5 in the female elongated but somewhat widened and spinulose rather than elongated, narrow, and smooth.

**Macrochiron valgum** n. sp. Figs. 33—60.

Type material. — 31 ♀♀, 48 ♂♂, and 42 copepodids washed from *Lytocarpus philippinus* (Kirchenpauer), in a depth of 1 m, Pte. Lokobe, Nosy Bé, Madagascar. November 3, 1960. Holotype female, allotype, and 28 paratypes (10 ♀♀, 18 ♂♂) deposited in the Zoölogisch Museum, Amsterdam (Z.M.A. Co. 101.018); 27 paratypes (10 ♀♀, 17 ♂♂) in the United States National Museum, Washington; and the remaining paratypes in the collection of the author.

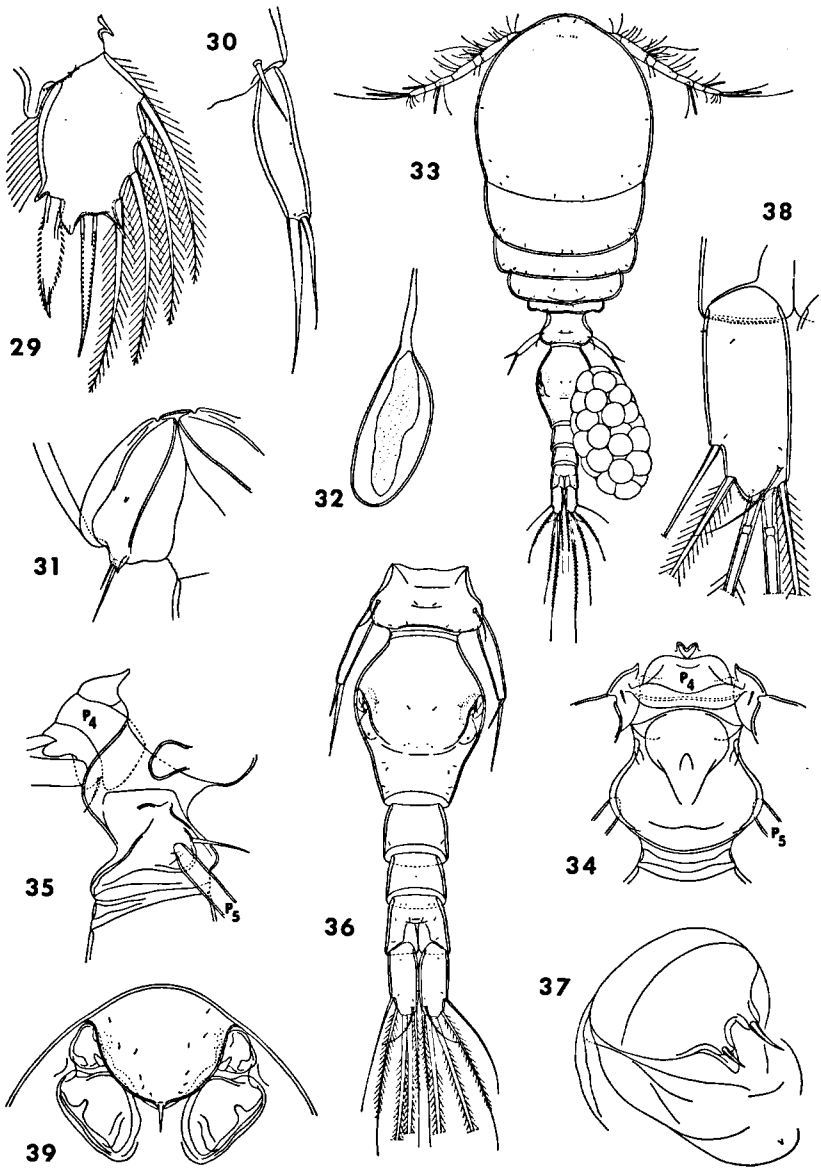
Female. — Body (fig. 33) moderately slender. Length (not including setae on caudal rami) 0.94 mm (0.89—1.01 mm) and greatest width 0.34 mm (0.32—0.36 mm), based on 10 specimens. Ratio of length to width of prosome 1.68 : 1. Segment of leg 1 separated from head by a furrow. Metasomal segments relatively broader than in *M. lytocarpi* and their epimeral areas less prominent. Posteroventral region of segment of leg 4 produced (figs. 34 and 35).

Segment of leg 5 (fig. 36) 57 × 96 μ. Between this segment and genital segment a very short ventral intersegmental sclerite. Genital segment longer than wide, 151 × 117 μ, moderately expanded in its anterior two-thirds and tapered posteriorly. Areas of attachment of egg sacs dorsolateral, each area (fig. 37) bearing 2 naked setae 5 and 7 μ in length, an adjacent spinous process, and more posteriorly a minute spinous process. Three postgenital segments 49 × 56, 39 × 52, and 48 × 54 μ from anterior to posterior. Last segment with row of minute spinules along posteroventral margin.

Caudal ramus (fig. 38) 65 × 26 μ in greatest dimensions, with ratio of length to width 2.5 : 1. Outer lateral seta 83 μ, dorsal seta 33 μ, outermost terminal seta 120 μ, innermost terminal seta 130 μ, and 2 long median terminal setae 200 μ (outer) and 275 μ (inner), the ornamentation of these setae as in preceding species. Minute setule on outer basal margin of ramus only 1 μ long.

Surfaces of prosome and urosome ornamented with hairs and refractile points as in figs. 33 and 36. Ratio of length of prosome to that of urosome 1.49 : 1.

Egg sac (see fig. 33) moderately elongated, in one female 275 × 140 μ, with fewer eggs than in *M. lytocarpi*, each egg about 47 μ in diameter.




FIGURES 29—32. *Macrochiron lytocarpi* n. sp., male (continued): 29, last segment of endopod of leg 1, anterior (E); 30, leg 5, dorsal (E); 31, leg 6, ventral (G); 32, spermatophore, extruded from body of male, dorsal (C).

FIGURES 33—39. *Macrochiron valgum* n. sp., female: 33, body, dorsal (I); 34, segments of legs 4 and 5, ventral (G); 35, junction of segments of legs 4 and 5, lateral (G); 36, urosome, dorsal (B); 37, area of attachment of egg sac, lateral (D); 38, caudal ramus, dorsal (E); 39, rostrum, ventral (B).

Rostrum (fig. 39) broadly rounded, its posterior margin terminating in a needlelike process 24 μ long (relatively shorter than in preceding species).

First antenna (fig. 40) with segmentation and armature as in *M. lytocarpi*. Lengths of segments (measured along their posterior non-setiferous margins) 39 (48 μ along anterior margin), 68, 21, 61, 44, 21, and 29 μ respectively. Terminal seta 110 μ long.

Second antenna (fig. 41) more slender than in preceding species but with generally similar armature and ornamentation. Third segment 122 μ long. Claw bisegmented, 130 μ along its axis, with row of teeth graduating proximally into sharp serrations.

Labrum (fig. 42) with lobes less divergent than in preceding species.

Mandible (fig. 43) similar to that in *M. lytocarpi* but with lateral spinules on lash less prominent. Paragnath and first maxilla as in *M. lytocarpi*. Second maxilla (fig. 44) similar to that in preceding species but teeth on lash more evenly spinelike. Maxilliped (fig. 45) with elongated second segment distinctly bowed; armature as in *M. lytocarpi* though all elements except hyaline seta more spinulose. Separation of last 2 segments not well-developed.

Area between maxillipeds and first pair of legs (fig. 46) only slightly protuberant and resembling that in *M. lytocarpi*.

Legs 1—4 (figs. 47, 48, 49, and 50) with armature as in preceding species, except for last segment of exopod of leg 4 which is II,I,5. Inner seta on coxa of leg 4 small, 7 μ long, and naked. Three spines on last segment of endopod of leg 2 measuring 20, 24, and 37 μ in length from outer to inner; those on leg 3, 36, 30, and 43 μ. Endopod of leg 4 slender, without a line of division, 48 × 8 μ, with a small notch and indistinct hairs on its outer border and with 2 terminal setae, outer 23 μ long and finely barbed, inner 59 μ and fringed.

Leg 5 (fig. 51) with elongated, slender, unornamented free segment, 73 × 12 μ, bearing terminally 2 setae, outer 39 μ and naked, inner 65 μ and fringed along outer edge. Seta on body near attachment of free segment 33 μ and slightly haired.

Leg 6 probably represented by 2 setae near attachment of each egg sac (see fig. 37).

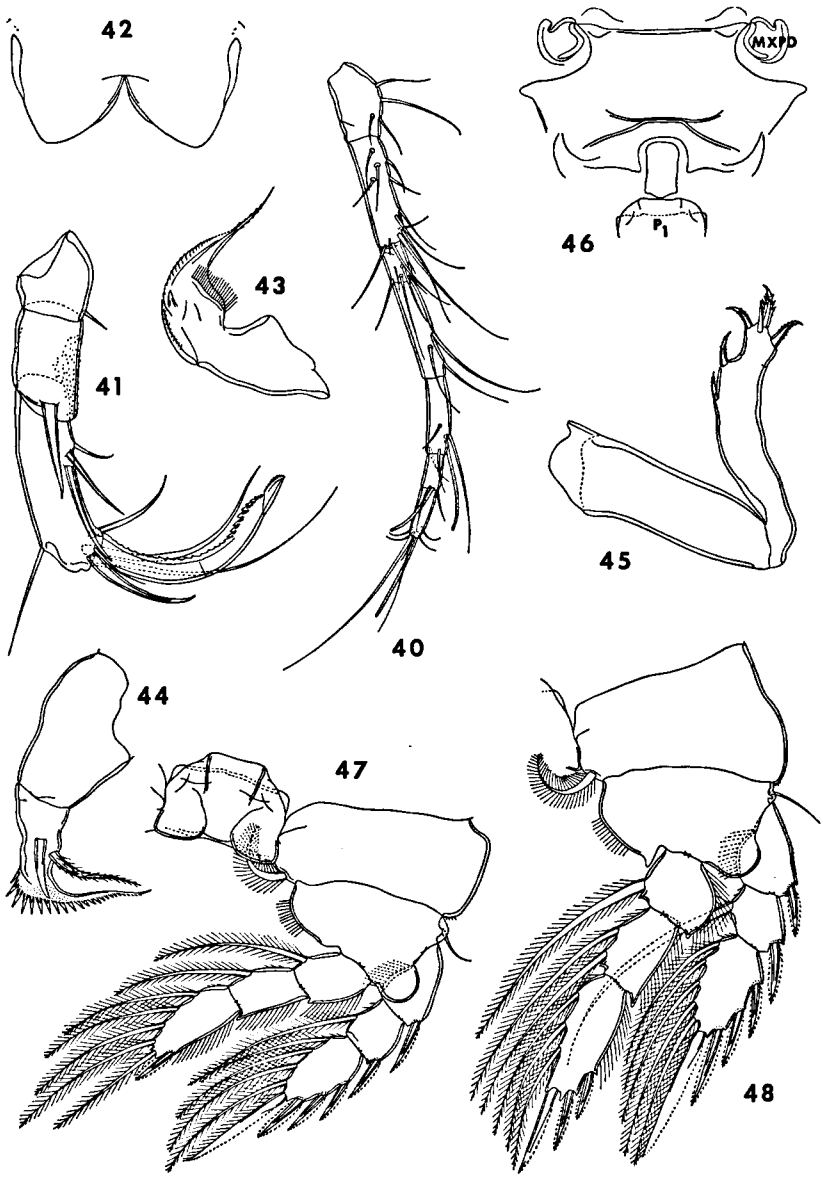
Color in life in transmitted light translucid, eye red, intestine brown, egg sac almost transparent.

M a l e. — Body (fig. 52) resembling in general form that of female. Length (excluding setae on caudal rami) 0.88 mm (0.84—0.95 mm) and greatest width 0.28 mm (0.27—0.29 mm), based on 10 specimens. Ratio of length to width of prosome 1.88 : 1.

Segment of leg 5 (fig. 53) 34 × 75 μ. Between this segment and genital segment no ventral intersegmental sclerite. Genital segment shaped as in previous species, 159 × 133 μ. Four postgenital segments 35 × 53, 34 × 50, 29 × 46, and 36 × 46 μ from anterior to posterior.

Caudal ramus similar to that of female but relatively smaller, 54 × 23 μ.

Surfaces of prosome and urosome with hairs and refractile points as in figs. 52 and 53. Ratio of length of prosome to that of urosome 1.49 : 1.




FIGURES 40—48. *Macrochiron valgum* n. sp., female (continued) : 40, first antenna, ventral (G); 41, second antenna, inner (G); 42, labrum, ventral (E); 43, mandible, posterior (E); 44, second maxilla, posterior (E); 45, maxilliped, antero-outer (E); 46, area between maxillipeds and first pair of legs, ventral (G); 47, leg 1, anterior (F); 48, leg 2, anterior (F).

Rostrum like that of female.

First antenna (fig. 54) segmented and armed as in male of previous species, but aesthetes much shorter. Lengths of segments (measured along their posterior non-setiferous margins) 32 (48 $\mu$ along anterior margin), 61, 22, 63, 48, 28, and 35 $\mu$ respectively.

Second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 55) more slender than in preceding species, with similar armature. Claw 100 $\mu$ along its axis (including large terminal lamella) with only a weak indication of division midway and without a visible fringe along concave margin.

Legs 1—4 segmented as in female, with similar armature and ornamentation, except for leg 1 where last segment of endopod (fig. 56) shows sexual dimorphism, its formula being I,I,4 as in *M. lytocarpi*; outer spine (27 $\mu$) swollen at middle on inner side and bearing a fringe on outer side, inner spine (30 $\mu$) slender and naked. Some sexual dimorphism seen also in spines on last segment of endopod of leg 2 (17, 18, and 33 $\mu$ in length from outer to inner) and of leg 3 (23, 22, and 34 $\mu$). Endopod of leg 4 (fig. 57) resembling that of female, 37.5 $\times$ 7.5 $\mu$, but without distinct notch or hairs on outer margin.

Leg 5 (fig. 58) with free segment much shorter than in female, 31 $\times$ 9 $\mu$, with its 2 terminal setae 28 $\mu$ (outer) and 36 $\mu$ (inner).

Leg 6 (fig. 59) resembling that in previous species, the 2 naked setae 22 and 26 $\mu$ in length.

Spermatophore (fig. 60) elongated, 139 $\times$ 62 $\mu$ (without neck), distally with a small inner knob on its wall and with a few delicate striations.

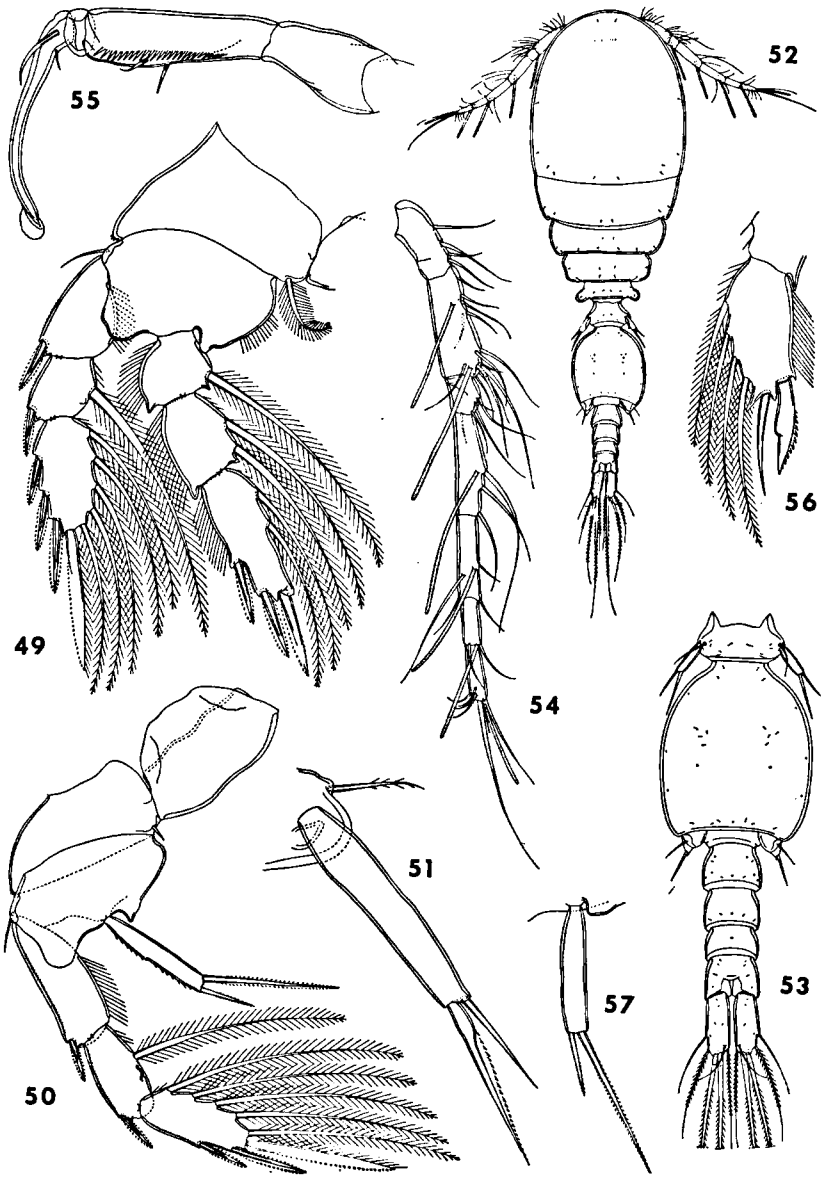
Color in life in transmitted light resembling that of female.

(The specific name *valgum*, from Latin = bowed outwards or bow-legged, alludes to the bowed form of the distal part of the maxilliped in the female.)

Comparison with other species. — *M. valgum* differs from *M. sargassi*, *M. mutatum*, and *M. lytocarpi*, all three of which have the formula III,I,5 on the last segment of the exopod of leg 4. It may be differentiated from *M. fucicolum* by the dentation of the claw of the second antenna (in *M. valgum* the large teeth being distally located near the division of the claw, while in *M. fucicolum* they are in the midregion, as in Brady's pl. III, fig. 12); furthermore, the endopod of leg 4 in *M. valgum* is 1-segmented, with no line of division, while according to Brady this endopod in *M. fucicolum* is 2-segmented (see Stock, 1957: 380). *M. valgum* differs also from *M. cheliferum* which has in the female a more elliptical dorsal outline of the prosome, a more elongated genital segment which is broadest far anteriorly, and a relatively shorter fifth leg.

### **Macrochiron rostratum** n. sp. Figs. 61—88.

Type material. — 21 ♀♀ and 3 ♂♂ washed from *Lytocarpus philippinus* (Kirchenpauer), in a depth of 2 m, Ambariobe, a small island nearly between Nosy Bé and Nosy Komba, Madagascar. September 19, 1964. Holotype female, allotype, and 11 paratypes




FIGURES 49—51. *Macrochiron valgum* n. sp., female (continued): 49, leg 3, anterior (F); 50, leg 4, anterior (F); 51, leg 5, lateral (E).

FIGURES 52—57. *Macrochiron valgum* n. sp., male: 52, body, dorsal (I); 53, urosome, dorsal (B); 54, first antenna, ventral (G); 55, maxilliped, postero-inner (F); 56, last segment of endopod of leg 1, anterior (E); 57, endopod of leg 4, anterior (E).

(10 ♀♀, 1 ♂) deposited in the Zoölogisch Museum, Amsterdam (Z.M.A. Co. 101.019), 9 paratypic females in the United States National Museum, Washington, and the remaining two paratypes (dissected) in the collection of the author.

Other specimens. — 3 ♀♀ and 2 ♂♂ from *Lytocarpus philippinus* in 1 m, Pte. Lokobe, Nosy Bé, November 3, 1960; 7 ♀♀ and 2 ♂♂ from *Lytocarpus spectabilis* Allman in 1 m, Ambariobe, February 14, 1964.

Female. — Body (fig. 61) resembling in general outline that of *M. lytocarpi* Length (not including setae on caudal rami) 0.88 mm (0.88— 0.90 mm) and greatest width 0.36 mm (0.35—0.36 mm), based on 5 specimens. Ratio of length to width of prosome 1.7 : 1. Segment of leg 1 separated from head by a furrow. Posteroventral region of segment of leg 4 produced (fig. 62).

Segment of leg 5 (fig. 63) 51 × 94 μ. Between this segment and genital segment a short ventral intersegmental sclerite. Genital segment slightly longer than wide, rather abruptly constricted in its posterior third; 110 μ long, 97 μ in greatest width, and 60 μ wide in the middle of its posterior third; with a row of minute hyaline spinuliform processes along posteroventral border of segment. Areas of attachment of egg sacs dorsolateral, each area (fig. 64) bearing 2 short naked setae (6 and 8 μ long) and 2 sclerotized spinous processes. Three postgenital segments 35 × 47, 26 × 43, and 33 × 45 μ from anterior to posterior. First 2 segments bearing row of minute hyaline spinuliform processes on posteroventral border, anal segment with row of minute spinules along posteroventral margin.

Caudal ramus (fig. 65) moderately elongated, 52 × 21 μ in greatest dimensions, with ratio of length to width 2.48 : 1. Outer lateral seta 83 μ, dorsal seta 36 μ, outermost terminal seta 133 μ, innermost terminal seta 169 μ, and 2 long median terminal setae 248 μ (outer) and 341 μ (inner), the ornamentation of these setae as in 2 previous species. Minute setule on outer basal margin of ramus only 1 μ long.

Surfaces of prosome and urosome ornamented with hairs and refractile points as in figs. 61 and 63. Ratio of length of prosome to that of urosome 1.82 : 1.

Egg sac (see fig. 61) moderately elongated, in one female 352 × 150 μ, with numerous eggs, each about 52 μ in diameter.

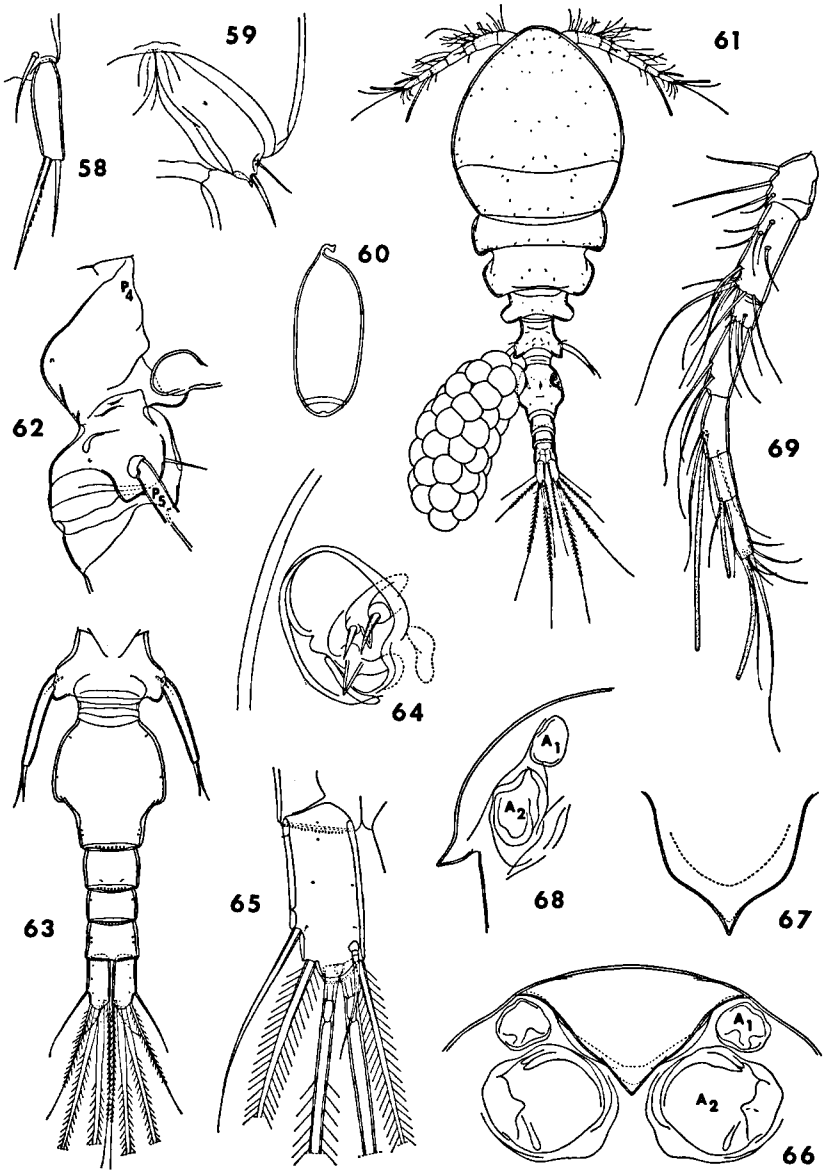
Rostrum (figs. 66, 67, and 68) terminating in a subconical beak turned a little ventrally.

First antenna (fig. 69) with segmentation and armature as in 2 preceding species. Lengths of segments (measured along their posterior non-setiferous margins) 26 (43 μ along anterior margin), 56, 22, 42, 33, 25, and 36 μ respectively. Terminal seta 112 μ long.

Second antenna (fig. 70) resembling in general features that of *M. lytocarpi*, with same segmentation and armature. Third segment 101 μ long. Claw bisegmented, 112 μ along its axis; proximal to few large teeth having 2 rows of denticles which unite in a single row basally.

Labrum (fig. 71) with broad lobes not divergent.

Mandible (fig. 72) similar to that in 2 preceding species, with distinct spinules on lash. Paragnath (see fig. 71) and first maxilla like those in *M. lytocarpi* and *M. valgum*. Second maxilla (fig. 73) resembling that of *M.*




FIGURES 58—60. *Macrochiron valgum* n. sp., male (continued): 58, leg 5, dorsal (E); 59, leg 6, ventral (F); 60, spermatophore, attached to female, lateral (B).

FIGURES 61—69. *Macrochiron rostratum* n. sp., female: 61, body, dorsal (I); 62, junction of segments of legs 4 and 5, lateral (G); 63, urosome, ventral (B); 64, area of attachment of egg sac, nearly dorsal (D); 65, caudal ramus, dorsal (E); 66, rostrum, ventral (F); 67, outline of rostrum as seen in a dissection, ventral (G); 68, rostrum, lateral (G); 69, first antenna, ventral (G).

*valgum*. Maxilliped (fig. 74) with segments a little stouter than in 2 preceding species, last segment not clearly separated from second. Armature also similar, though ornamentation of elements differing as shown in figure.

Area between maxillipeds and first pair of legs as in *M. valgum*.

Legs 1—4 (figs. 75, 76, 77, and 78) with armature as in *M. valgum*, last segment of exopod of leg 4 being II,I,5. Inner seta on coxa of leg 4 small, 11 $\mu$, and naked. Three spines on last segment of endopod of leg 2 measuring 31, 30, and 40 $\mu$ in length from outer to inner; those on leg 3, 30, 44, and 50 $\mu$. Endopod of leg 4 with indistinct line of division as in *M. lytocarpi*. Length 52 $\mu$, width proximal to notch 14 $\mu$, distal to notch 13 $\mu$. Two terminal setae spiniform and fringed, outer 32 $\mu$, inner 55 $\mu$.

Leg 5 (fig. 79) with very slender and elongated free segment, 96 $\times$ 9 $\mu$ (taking width at middle). Outer terminal seta 35 $\mu$, swollen basally and fringed, inner terminal seta slender, 41 $\mu$, and naked.

Leg 6 probably represented by 2 setae near attachment of each egg sac (see fig. 64).

Color in life in transmitted light similar to that of *M. valgum*.

M a l e. — Body (fig. 80) rather like that of female, but anterior part of prosome more rounded. Length 0.71 mm (0.67—0.76 mm) and greatest width 0.23 mm (0.22—0.23 mm), based on 4 specimens (allotype, one paratype, and 2 specimens from Pte. Lokobe, November 3, 1960). Ratio of length to width of prosome 1.89 : 1.

Segment of leg 5 (fig. 81) 39 $\times$ 55 $\mu$. Between this segment and genital segment no ventral intersegmental sclerite. Genital segment 123 $\times$ 100 $\mu$, of a slightly different form than in either *M. lytocarpi* or *M. valgum*, having its lateral margins in posterior half nearly parallel. Four postgenital segments 28 $\times$ 42, 23 $\times$ 39, 20 $\times$ 36, and 25 $\times$ 36 $\mu$ from anterior to posterior.

Caudal ramus similar to that of female but smaller, 36 $\times$ 17$\mu$.

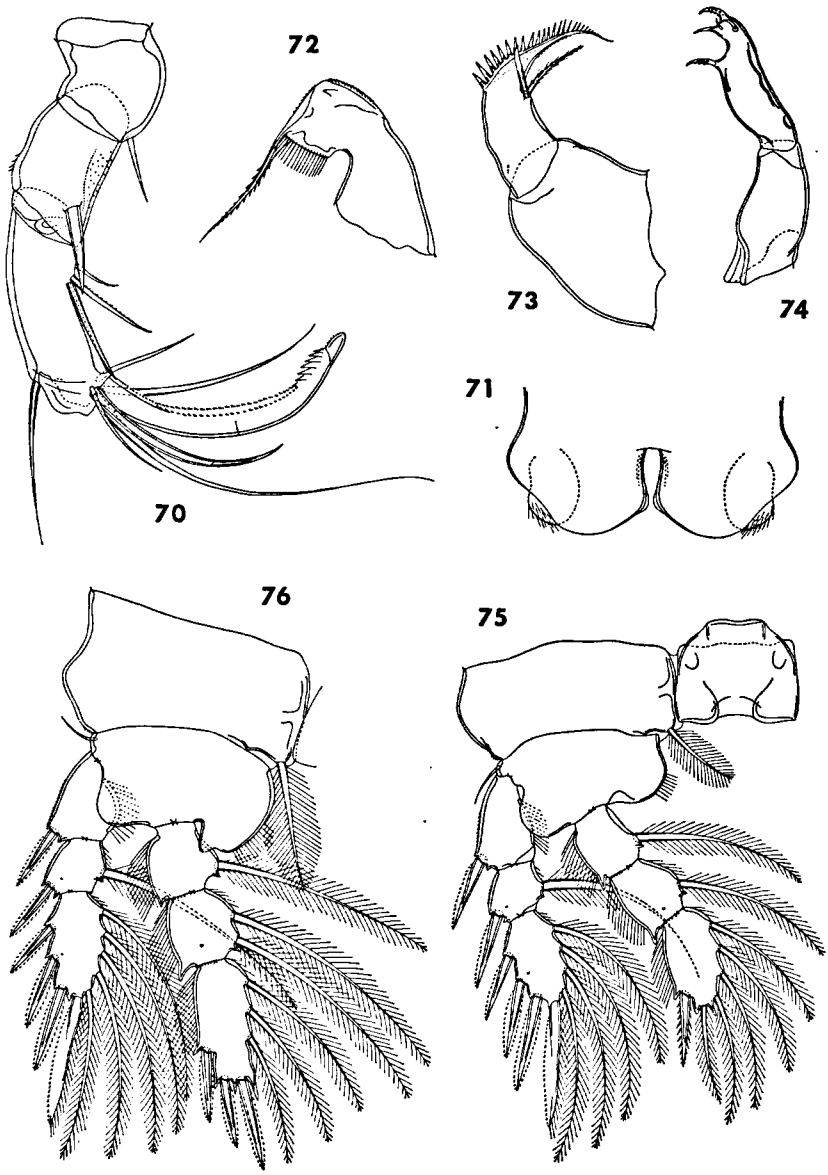
Surfaces of prosome and urosome with hairs and refractile points as in figs. 80 and 81. Ratio of length of prosome to that of urosome 1.57 : 1.

Rostrum like that of female.

First antenna (fig. 82) segmented and armed as in males of 2 preceding species, with very long aesthetes. Lengths of segments (measured along their posterior non-setiferous margins) 22 (36 $\mu$ along anterior margin), 41, 14, 33, 27, and 33 $\mu$ respectively.

Second antenna, labrum, mandible, paragnath, first maxilla, and second maxilla as in female. Maxilliped (fig. 83) slender, with armature similar to that in 2 preceding species. First segment with a distal sclerotized process. Claw 114 $\mu$ along its axis, somewhat swollen in its proximal one-fourth and weakly divided midway.

Legs 1—4 segmented as in female, with similar armature and ornamentation, except for leg 1 where last segment of endopod (fig. 84) shows sexual dimorphism, its formula being I,I,4 as in 2 previous species; both spines fringed, outer 20 $\mu$, inner 29 $\mu$. Slight sexual dimorphism also seen in spines on last segment of endopod of leg 2 (fig. 85), where they are 23, 16, and 26 $\mu$ in length from outer to inner, and of leg 3 where they are 21, 29, and 35 $\mu$.




FIGURES 70—76. *Macrochiron rostratum* n. sp., female (continued): 70, second antenna, inner (F); 71, labrum and paragnaths, ventral (E); 72, mandible, posterior (E); 73, second maxilla, posterior (E); 74, maxilliped, antero-outer (F); 75, leg 1, anterior (F); 76, leg 2, anterior (F).

In leg 4 process on basis medial to endopod more pointed than in female; endopod (fig. 86) 34 × 11 μ, with no line of division, 2 terminal setae 22 μ (outer) and 36 μ (inner).

Leg 5 (fig. 87) with free segment shorter than in female, 34 × 8 μ, with 2 terminal elements 21 μ and 25 μ in length.

Leg 6 (see fig. 81) resembling that in 2 preceding species, with its 2 naked setae 13 and 22 μ.

Spermatophore (fig. 88) elongated, 114 × 44 μ (without neck), with a few delicate striations distally.

Color in life in transmitted light as in female.

(The specific name *rostratum*, from Latin = having a beak, refers to the form of the rostrum.)

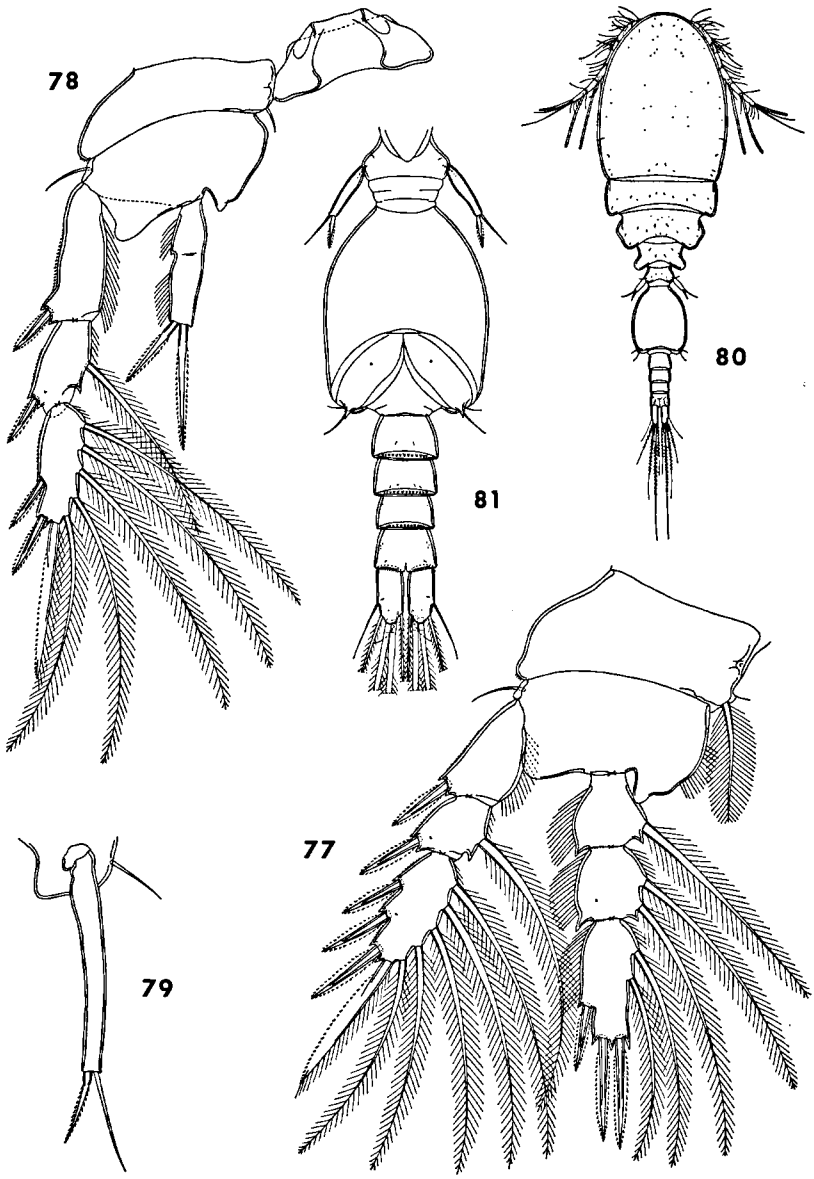
Comparison with other species. — *M. rostratum* may be readily separated from the other six species in the genus by the form of the genital segment in the female (where it is rather abruptly constricted in its posterior third, thus forming conspicuous lateral indentations). It differs further from *M. sargassi*, *M. mutatum*, and *M. lytocarpi* (in which the formula for the last segment of the exopod of leg 4 is III,I,5). It is unlike *M. valgum* in having a subconical beak on the rostrum instead of a needlelike process, and in having the last two segments of the maxilliped in the female much less bowed. *M. rostratum* has a longer fifth leg than in *M. cheliferum* and the last two segments of the maxilliped of the female are less bowed than in that species. It differs from *M. fucicolum* in the dentation of the claw on the second antenna.

## REMARKS ON THE GENUS *MACROCHIRON*

The seven species of *Macrochiron* now known constitute a fairly well-defined group. It is of interest to note that the number of outer spines on the last segment of the exopod of leg 4 may vary interspecifically (either II or III), a condition seen also in the genus *Lichomolgus*.

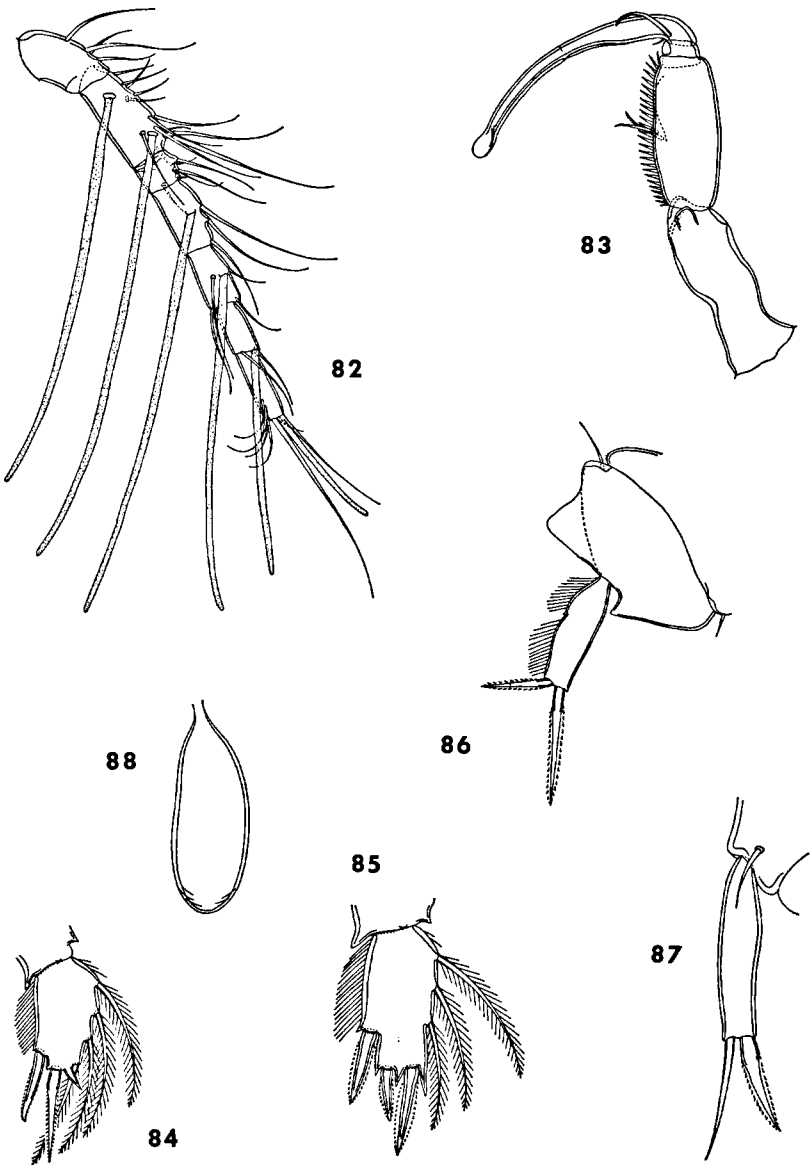
The most conspicuous element in the armature of the last segment of the second antenna is a large denticulated claw. However, in the three species from Madagascar there is also a jointed recurved seta which is slightly unguiform, and may represent either an incipient claw or one which has undergone reduction. Sars (1917: 164) stated that in his *M. fucicolum* (= *M. mutatum*) one seta is „somewhat stronger than the others and may represent the inner claw". The condition of two unequal terminal claws in *M. sargassi* may be regarded as a case where the unguiform seta is more strongly developed and has become distinctly recognizable as a claw. Other features of *M. sargassi* indicate that it is a *Macrochiron*.

The endopod of leg 4 may be a single element, with no line of division, as in *M. valgum*, may show slight indication of segmentation as in *M. lytocarpi* and *M. rostratum*, or may be 2-segmented as reported for *M. fucicolum* (but, as Stock, 1957, has observed, the segmentation line here is sometimes indistinct).




FIGURES 77—79. *Macrochiron rostratum* n. sp., female (continued): 77, leg 3, anterior (F); 78, leg 4, anterior (F); 79, leg 5, lateral (F).

FIGURES 80—81. *Macrochiron rostratum* n. sp., male: 80, body, dorsal (I); 81, urosome, ventral (G).




FIGURES 82—88. *Macrochiron rostratum* n. sp., male (continued): 82, first antenna, ventral (F); 83, maxilliped, postero-inner (F); 84, last segment of endopod of leg 1, anterior (E); 85, last segment of endopod of leg 2, anterior (E); 86, basis and endopod of leg 4, anterior (E); 87, leg 5, dorsal (D); 88, spermatophore, attached to female, lateral (G).

The form of the rostrum is not known for all the species. In *M. lytocarpi* and *M. valgum* there is a posteriorly directed needlelike process. A similar process has been described by Vervoort (1964, fig. 12f) in *M. cheliferum* from Ifaluk Atoll in the Caroline Islands. In *M. rostratum* the rostrum terminates in a subconical beak. For *M. fucicolum* Brady said that it is „short, but distinctly angulated". In *M. sargassi* its form is unknown. For *M. mutatum* (= *M. fucicolum* Sars non Brady) Sars stated that it has a „rostral prominence well defined and pointed at the end". The information available on the nature of the rostrum suggests that it may serve as a useful character for the differentiation of species in the genus.

### Explanation of the figures

All figures were 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.

Abbreviations used: $A_1$ = first antenna, $A_2$ = second antenna, $MX_2$ = second maxilla, MXPD = maxilliped, $P_1$ = leg 1, $P_4$ = leg 4, $P_5$ = leg 5.

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