

Three new species of *Hemicyclops* (Copepoda: Poecilostomatoida: Clausidiidae) from northwestern Madagascar

by Arthur G. HUMES

Abstract. — Three new species of the copepod genus *Hemicyclops* (Clausidiidae) from Nosy Bé, northwestern Madagascar, are described, from burrows of unknown origin, probably those of crustaceans, one from the scleractinian *Favia* sp., and one from a gastropod shell occupied by a hermit crab. *Hemicyclops acanthophorus*, new species, may be recognized by a pair of posterolateral spiniform processes on the genital double-somite of the female, and by the triangular form of the free segment of leg 5. *Hemicyclops apiculus*, new species, is characterized by its elongate genital double-somite with anterior rounded lateral expansions, its subquadrate caudal ramus, and the small sharply pointed lateral projections on the first segment of leg 5. *Hemicyclops vicinalis*, new species, may be distinguished by the absence of setules on the inner side of the caudal ramus and on the outer margin of the second segment of the antenna proximal to the seta.

Keywords. — Copepoda, Poecilostomatoida, Clausidiidae, *Hemicyclops*, Madagascar.

Trois nouvelles espèces d'*Hemicyclops* (Copepoda : Poecilostomatoida : Clausidiidae) du nord-ouest de Madagascar

Résumé. — Trois espèces nouvelles du genre *Hemicyclops* (Copepoda : Clausidiidae) de Nosy Bé, au nord-ouest de Madagascar, sont décrites, l'une provenant de terriers d'origine inconnue, probablement de crustacés, une autre provenant du sclérectiniaire *Favia* sp., et la troisième d'une coquille de gastéropode occupée par un bernard-l'hermite. *Hemicyclops acanthophorus* n. sp. peut être identifiée par une paire de prolongements spini-formes postérolatéraux sur le somite génital de la femelle et la forme triangulaire du segment libre de la cinquième patte. *Hemicyclops apiculus* n. sp. se caractérise par un somite génital allongé avec des expansions latérales antérieures arrondies, des rames caudales subcarrées et la présence de petites projections pointues latérales sur le premier segment de la cinquième patte. *Hemicyclops vicinalis* n. sp. peut être identifiée par l'absence de sétules sur le bord interne de la rame caudale et au bord externe du deuxième segment de l'antenne.

Mots-clés. — Copépodes, Poecilostomatoida, Clausidiidae, *Hemicyclops*, Madagascar.

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INTRODUCTION

Since the revision of *Hemicyclops* by VERVOORT & RAMIREZ (1966), in which 23 valid species were recognized, several congeners have been described, extending the range of this clausidiid genus to Hong Kong (BOXSHALL & HUMES, 1987), Korea (HO & KIM, 1990, 1991; KIM & HO, 1992), Panama (HUMES, 1984), Curaçao (STOCK, 1992), Japan (ITOH & NISHIDA, 1993), and Brazil (KIHARA & DA ROCHA, 1994).

In addition to the species recognized in the work of VERVOORT & RAMIREZ (1966), the following species have been described: *Hemicyclops perinsignis* Humes, 1973, from the sponge *Agelas* sp. in Madagascar; *H. columnaris* Humes, 1984, from the scleractinian coral *Porites lobata*

Dana on the Pacific coast of Panama; *H. murtoni* Boxshall & Humes, 1987, from burrows of the echiuran *Ochetostoma erythrogrammon* Leuckhart & Rüppell at Hong Kong; *H. ctenidis* Ho & Kim, 1990, from the polychaete *Neanthes japonica* (Izuka) in Korea; *H. gomsoensis* Ho & Kim, 1991, from burrows occupied by the crab *Macrophthalmus japonicus* de Haan in Korea; *H. saxatilis* Ho & Kim, 1991, from burrows occupied by the crab *Heteropanope (Pilumnopeus) makinana* (Rathbun) in Korea; *H. geminatus* Stock, 1992, from the hermit crabs *Calcinus tibicen* (Herbst), *Paguristes grayi* Benedict, and *Dardanus venosus* (H. Milne Edwards) at Curaçao; *H. caissarum* Kihara & da Rocha, 1993, from burrows of the callianassid *Callichirus major* (Say) in Brazil; *H. japonicus* Itoh & Nishida, 1993, from dredged material in Tokyo Bay, Japan; and *H. sebastiani* Kihara & da Rocha, 1993, from the thalassinid *Callichirus guassutinga* (Rodriguez) in Brazil.

In this paper, three new species of *Hemicyclops*, all from northwestern Madagascar, are described. The number of valid species in the genus now stands at 36.

MATERIAL AND METHODS

The copepods from intertidal burrows were collected at low tide by means of a small bilge pump. In other cases, the host invertebrates were washed in a dilute solution of ethanol in sea water (approximately 5%) and the copepods recovered from the sediment obtained after passing the wash water through a fine net.

Lactic acid was used to clear the copepods for measurements and dissection. The length of the body does not include the setae on the caudal rami. The segments of the antennule were measured along their posterior nonsetiferous margins. In the formula for legs 1-4, Roman numerals indicate spines, Arabic numerals represent setae.

POECILOSTOMATOIDA Thorell, 1859

Family CLAUDIIDAE Embleton, 1901

HEMICYCLOPS Boeck, 1872

Hemicyclops acanthophorus n. sp.

(Figs 1-4)

TYPE MATERIAL. — 13 ♀♀, 5 ♂♂ from large burrows in intertidal sand, Befotaka, Nosy Bé, northwestern Madagascar, 29 April 1964. Holotype ♀ (MNHN - Cp 1052), allotype ♂ (MNHN - Cp 1053), and 12 paratypes (9 ♀♀, 3 ♂♂) (MNHN - Cp 1054) deposited in the Muséum national d'Histoire naturelle, Paris. Remaining paratypes (dissected) and copepodids (3 ♀♀, 1 ♂) in the collection of the author.

ETYMOLOGY. — The name of the species is formed from the Greek words *akantha*, a thorn or spine, and *phorein*, to bear or carry, alluding to the pair of small spiniform processes on the genital double-somite of the female.

DESCRIPTION OF FEMALE

Body (Fig. 1a) relatively slender. Length 1.35 mm (1.25-1.45 mm) and greatest width 0.56 mm (0.50-0.61 mm), based on 10 specimens. Greatest dorsoventral thickness 0.37 mm. Epimera of somites bearing legs 1-4 flaring outward and pointed. Somite bearing leg 1 fused

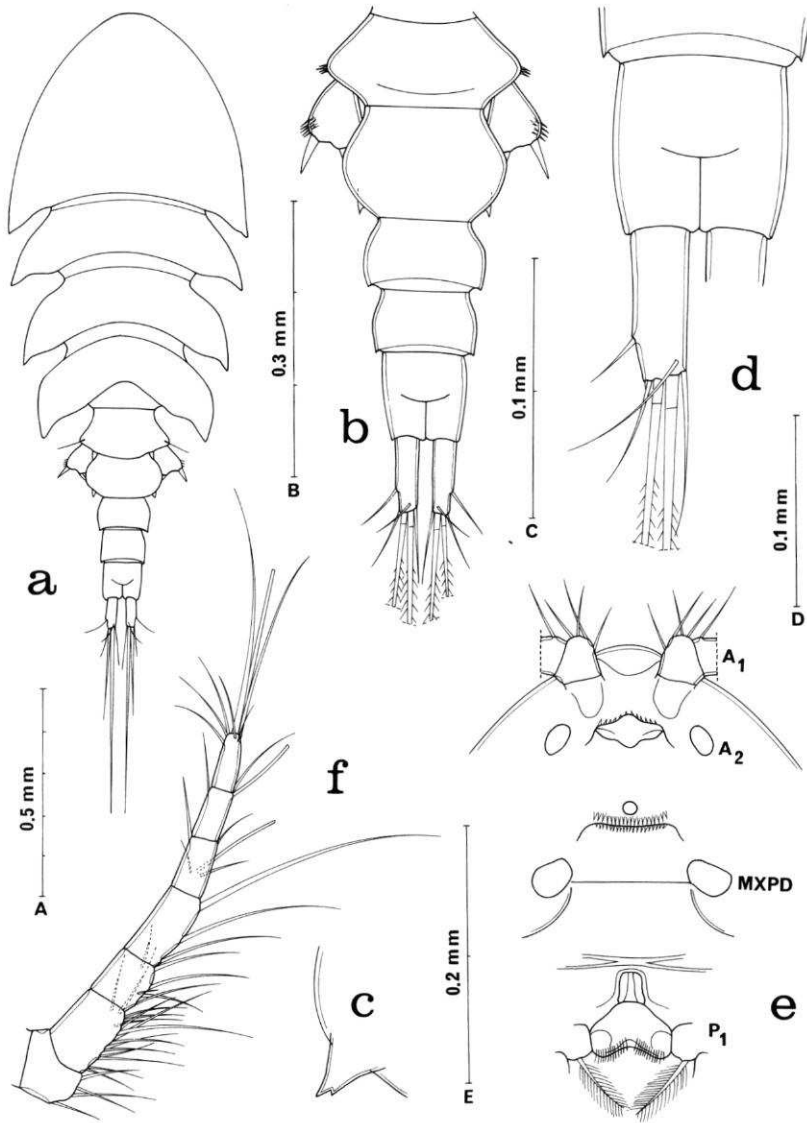


FIG. 1. — *Hemicyclops acanthophorus*, n. sp., female. a, dorsal (scale A); b, urosome, dorsal (B); c, spiniform process on genital double-somite, lateral (C); d, anal somite and caudal ramus, dorsal (D); e, median part of cephalosome, showing rostrum, labrum, postoral area, and area between maxillipeds and first pair of legs, ventral (E); f, antennule, posteroventral (E). A₁ = antennule, A₂ = antenna, MXP = maxilliped, P₁ = leg 1.

Hemicyclops acanthophorus, n. sp., femelle. a, vue dorsale (échelle A); b, urosome, vue dorsale (B); c, processus spiniforme sur le double somite génital, vue latérale (C); d, somite anal et rames caudales, vue dorsale (D); e, partie médiane du céphalosome, montrant le rostre, le labre, la région postorale et la zone située entre les maxillipèdes et la première paire de pattes, vue ventrale (E); f, antennule, vue postéro-ventrale (E). A₁ = antennule, A₂ = antenne, MXP = maxillipède, P₁ = première paire de pattes.

with cephalosome. Ratio of length to width of prosome 1.66:1. Ratio of length of prosome to that of urosome 1.80: 1.

Somite bearing leg 5 (Fig. 1b) $101 \times 218 \mu\text{m}$. Genital double-somite $112 \times 177 \mu\text{m}$, wider than long, in dorsal view with gently rounded lateral margins and bearing pair of small post-erolateral, unequally bifid, spiniform processes about $15 \mu\text{m}$ long (Fig. 1c), perhaps part of modified leg 6. Genital areas located laterally but no evidence of setae. Three postgenital somites 78×127 , 75×103 , and $88 \times 86 \mu\text{m}$.

Caudal ramus (Fig. 1d) unornamented, elongate, $75 \times 26 \mu\text{m}$, ratio 3: 1. Outer lateral seta $30 \mu\text{m}$, dorsal seta $52 \mu\text{m}$, outermost terminal seta $40 \mu\text{m}$, innermost terminal seta $65 \mu\text{m}$, all smooth. Two long median terminal setae $180 \mu\text{m}$ (outer) and $450 \mu\text{m}$ (inner), both with delicate short lateral setules.

Body surface without visible sensilla.

Egg sac not seen.

Rostrum (Fig. 1e) broadly rounded posteroventrally. Antennule (Fig. 1f) $308 \mu\text{m}$ long. Lengths of 7 segments: 13 ($44 \mu\text{m}$ along anterior margin), 39, 36, 60, 39, 39, and $39 \mu\text{m}$, respectively. Formula for armature: 4, 15, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae smooth. Distal seta on segment 4 long, $250 \mu\text{m}$.

Antenna (Fig. 2a) 4-segmented, with armature 1, 1, 4, and 7. First segment with long distal seta having lateral setules. Second segment with shorter smooth seta. Third segment with 3 slender setae, one of them with setules, and 1 swollen almost clawlike seta with recurved tip. Fourth segment with 6 smooth setae and 1 seta with setules.

Labrum (Fig. 1e) with marginal row of spines and pair of rows of small submarginal spines. Postoral area with 2 rows of spines (Fig. 2b).

Mandible (Fig. 2c) terminally with 2 stout elements and 2 setae. Paragnath (Fig. 2b) elongate lobe, $48 \mu\text{m}$, with few minute setules. Maxillule (Fig. 2d) bearing 8 setae. Maxilla (Fig. 2e) with first segment bearing 2 long setae with setules and 1 very small setule; second segment with 3 setae and large bifurcate element. Maxilliped (Fig. 2f) 4-segmented, with 2 setae on first segment, 2 setae on second segment, and 6 setae on fourth segment, one of them slightly bent and having lateral setules.

Ventral area between maxillipeds and first pair of legs as in Fig. 1e.

Legs 1-4 (Figs 2g, h, 3a, b) segmented and armed as follows:

P ₁	coxa 0-1	basis 1-1	exp I-0; enp 0-1;	I-1; 0-1;	I,I,6 1,5
P ₂	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	II,II,5 I,II,3
P ₃	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	II,I,5 I,II,3
P ₄	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	I,II,5 I,II,2

Intercoxal plate of leg 1 with slender setules on ventral margin; intercoxal plates of legs 2-4 with marginal spines.

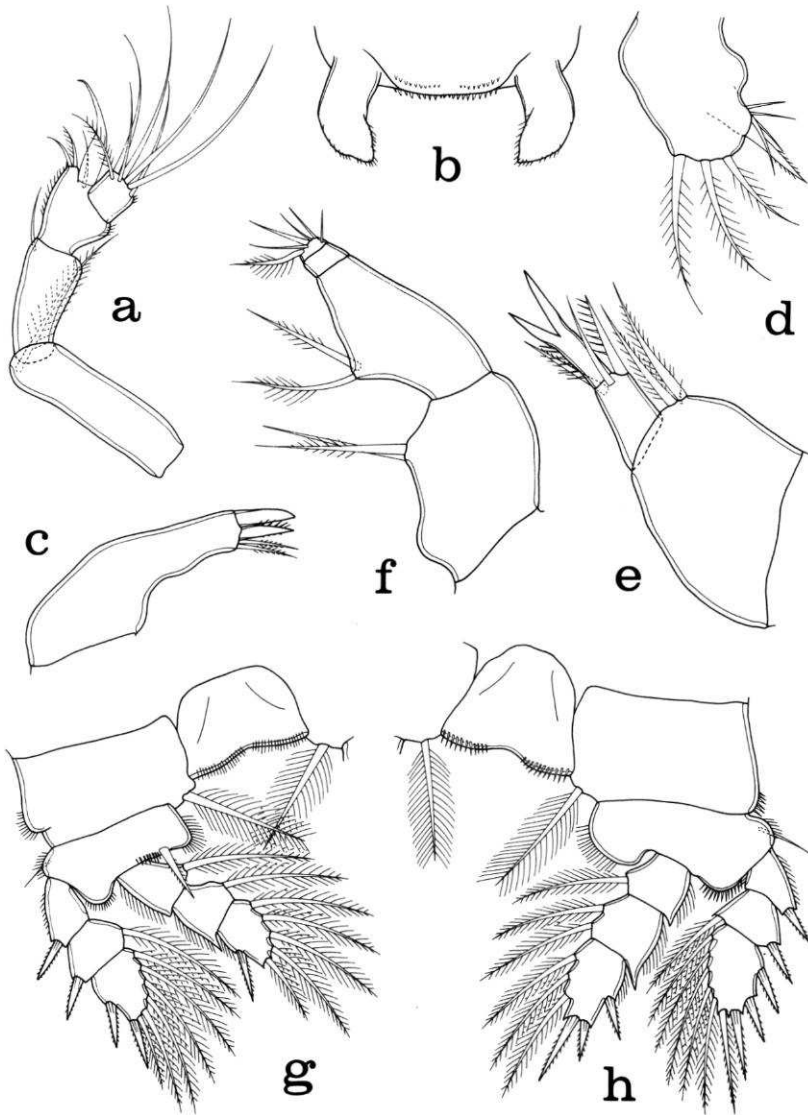


FIG. 2. — *Hemicyclops acanthophorus*, n. sp., female. a, antenna, posterior (scale D); b, postoral area and paragnaths, posterior (D); c, mandible, posterior (C); d, maxillule, posterior (C); e, maxilla, posterior (C); f, maxilliped, posterior (C); g, leg 1 and intercoxal plate, anterior (E); h, leg 2 and intercoxal plate, anterior (E).

Hemicyclops acanthophorus, n. sp., femelle. a, antenne, face postérieure (échelle D); b, région postorale et paragnathes, vue postérieure (D); c, mandibule, vue postérieure (C); d, maxillule, vue postérieure (C); e, maxille, vue postérieure (C); f, maxillipède, vue postérieure (C); g, P_1 et plaque intercoxale, face antérieure (E); h, P_2 et plaque intercoxale, face antérieure (E).

Leg 1 with inner spine on basis 50 μm . Other details of ornamentation as illustrated.

Leg 5 (Fig. 3c) with free segment triangular, 57 μm along inner side, 68 μm along outer side and 65 μm wide, armed with 3 spines and 1 small seta, these elements from outer to inner 47, 50, 22, and 42 μm . Segment ornamented near insertion of outermost seta with group of spinules. Dorsal seta 70 μm , with few spinules near its insertion.

Leg 6 not identified.

Living specimens in transmitted light opaque gray, eye red.

DESCRIPTION OF MALE

Prosoma slightly broader (Fig. 3d) than in female. Length 1.05 mm (1.00-1.08 mm) and greatest width 0.44 mm (0.43-0.46 mm), based on 5 specimens. Greatest dorsoventral thickness 0.28 mm. Internal sclerotizations visible along sides of prosoma as in Fig. 3e. Somite bearing leg 4 having somewhat different form (Fig. 3d) than in female. Ratio of length to width of prosoma 1.61:1. Ratio of length of prosoma to that of urosome 1.40:1.

Segment bearing leg 5 (Fig. 4a) 70 \times 153 μm . Genital somite 146 \times 180 μm , shape similar to that of female, but lacking pair of spiniform processes. Four postgenital somites 65 \times 112, 60 \times 91, 40 \times 81, and 42 \times 74 μm .

Caudal ramus like that of female but smaller, 61 \times 25 μm .

Body surface unornamented.

Rostrum similar to that of female. Antennule like that of female, but extra seta added on segments 3 and 4. Antenna like that of female.

Labrum, mandible, paragnath, maxillule, and maxilla resembling those of female. Maxilliped (Fig. 4b, c) with long seta on first segment. Second segment expanded, with 2 inner setae and 2 rows of spines, those in one row stout, those in other row slender. Claw 148 μm long with slight protuberance on concave margin, and bearing 2 small proximal setae.

Postoral area as in female.

Leg 1 (Fig. 4d) lacking inner spine on basis (as in many congeners), but otherwise as in female. Legs 2-4 like those of female.

Leg 5 (Fig. 4e) with free segment elongate, 91 \times 47 μm , ornamented with spinules along both sides; armature as in female.

Leg 6 (Fig. 4f) consisting of posteroventral flap on genital somite bearing 1 seta 26 μm .

Spermatophore not seen.

Color as in female.

REMARKS

Hemicyclops acanthophorus may be distinguished from all other species in the genus by the presence of a pair of small thornlike posterolateral spiniform processes on the genital double-somite of the female. The triangular shape of the free segment of leg 5 in the female is also characteristic.

Although the occupants of the burrows in which the copepods were found is not known, it is likely that they were crustaceans. Several species of *Hemicyclops* are known from burrows of crustaceans at Nosy Bé, Madagascar: *H. axiophilus* Humes, 1965, and *H. amplicaudatus*

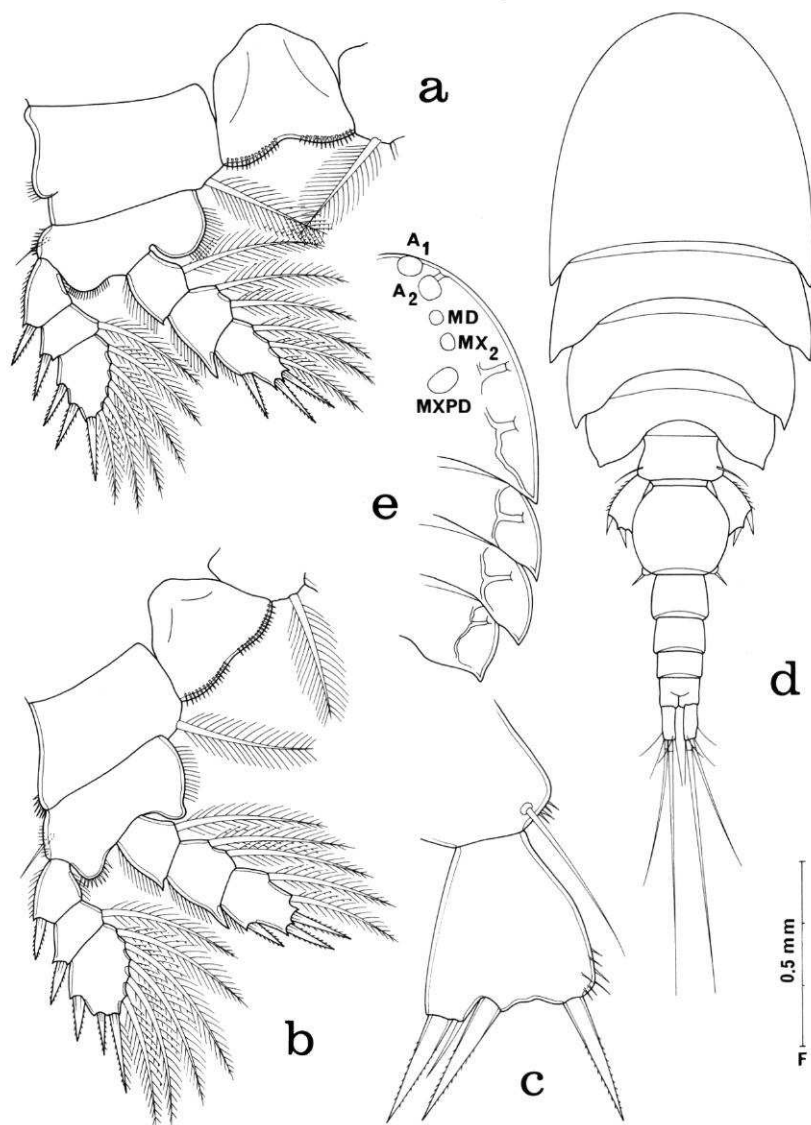


FIG. 3. — *Hemicyclops acanthophorus*, n. sp., female. a, leg 3 and intercoxal plate, anterior (scale E); b, leg 4 and intercoxal plate, anterior (E); c, leg 5, dorsal (C). Male. d, dorsal (F); e, side of prosome showing internal sclerotizations, dorsal (F). A₁ = antennule, A₂ = antenna, MD = mandible, MX₂ = maxilla, MXPDP = maxilliped.

Hemicyclops acanthophorus, n. sp., femelle. a, P3 et plaque intercoxale, face antérieure (échelle E); b, P4 et plaque intercoxale, face antérieure (E); c, P5, vue dorsale (C). Mâle. d, vue dorsale (F); e, bord du prosome montrant des sclérotisations internes, vue dorsale (F). A₁ = antennule, A₂ = antenne, MD = mandibule, MX₂ = maxille; MXPDP = maxillipède.

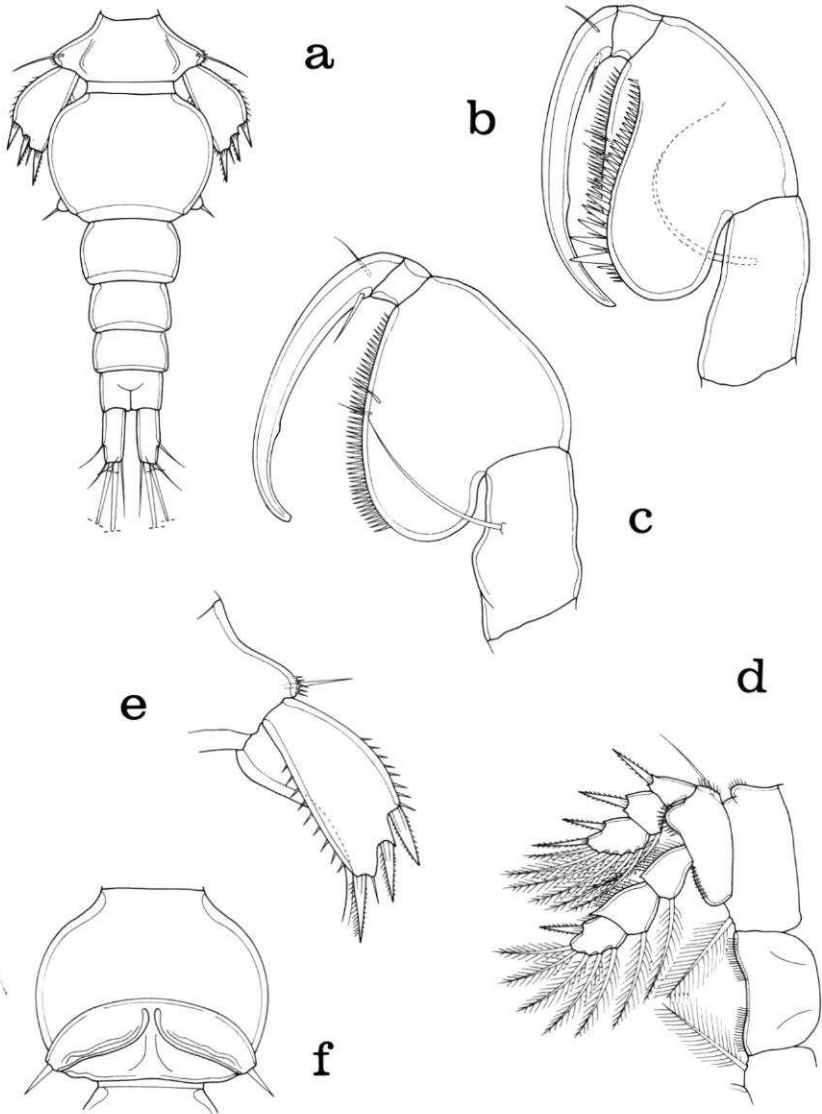


FIG. 4. — *Hemicyclops acanthophorus*, n. sp., male. a, urosome, dorsal (scale B); b, maxilliped, posterior (D); c, maxilliped, anterior (D); d, leg 1 and intercoxal plate, anterior (E); e, leg 5, ventral (D); f, genital somite, ventral (E).

Hemicyclops acanthophorus, n. sp., mâle. a, urosome, vue dorsale (échelle B); b, maxillipède, vue postérieure (D); c, maxillipède, vue antérieure (D); d, P₁ et plaque intercoxale, vue antérieure (E); e, P₅, vue ventrale (D); f, somite génital, face ventrale (E).

Humes, 1965, from burrows of the thalassinidean macruran *Axius* (*Neaxius*) *acanthus* (Axiidae); *H. acanthosquillae* Humes, 1965, from the body of the stomatopod *Acanthosquilla* sp. (= *A. humesi* Manning) dug from intertidal sand; and *H. visendus* Humes, Cressey, and Gooding, 1958, from the body surface of the thalassinidean macruran *Upogebia* (*Upogebia*) sp. (Callianassidae) in burrows (Humes, 1965).

Hemicyclops apiculus n. sp.
(Figs 5-7)

TYPE MATERIAL. — 3 ♀♀ from washing of one colony of the scleractinian coral *Favia* sp., in 3 m, Pointe-à-la-Fièvre, Nosy Bé, northwestern Madagascar, 26 December 1963. Holotype (MNHN – Cp 1055) and 1 paratype (MNHN – Cp 1056) deposited in the Muséum national d'Histoire naturelle, Paris. Remaining paratype (dissected) in the collection of the author.

OTHER SPECIMEN. — 1 ♀ from the ahermatypic coral *Dendrophyllia* sp., in 7 m, Nosy Tangam, near Nosy Bé, 1 January 1964.

ETYMOLOGY. — The specific name *apiculus*, Latin meaning "pointed", alludes to the small sharp projection on the first segment of leg 5.

DESCRIPTION OF FEMALE

Body (Fig. 5a, b) moderately slender. Length 1.42 mm (1.36-1.50 mm) and greatest width 0.51 mm (0.48-0.54 mm), based on 3 specimens. Greatest dorsoventral thickness 0.33 mm. Somite bearing leg 1 fused with cephalosome. Epimera of somites bearing legs 1-4 pointed posteriorly in somites bearing legs 1 and 2, less pointed in somites bearing legs 3 and 4. Ratio of length to width of prosome 1.58:1. Ratio of length of prosome to that of urosome 1.22:1.

Somite bearing leg 5 (Fig. 5c) $109 \times 268 \mu\text{m}$. Genital double-somite in dorsal view much longer than wide, 273 μm long, 213 μm wide in expanded anterior third, and 122 μm wide in posterior two-thirds with parallel sides. Posterolateral corners of anterior expanded portion bluntly produced. Ratio of length to greatest width 1.28:1. Genital openings situated laterally (Fig. 5b) and lacking setae but showing 2 minute knoblike projections. Three postgenital somites from anterior to posterior 107×130 , 78×122 , and $65 \times 120 \mu\text{m}$.

Caudal ramus (Fig. 6a) subquadrate, $65 \times 60 \mu\text{m}$, only slightly longer than wide. Outer lateral seta 44 μm , dorsal seta 88 μm , both smooth. Outermost terminal seta 96 μm , innermost terminal seta 208 μm , and 2 long median terminal setae 360 μm (outer) and 580 μm (inner), all with lateral setules, those on 2 median setae long and placed well apart. Postero-inner corner of ramus with small spiniform projection 5 μm long.

Body surface without visible ornamentation.

Egg sac not seen.

Rostrum (Fig. 6b) triangular and bluntly pointed posteroventrally. Antennule (Fig. 6c) 385 μm long. Lengths of its 7 segments: 17 (52 μm along anterior margin), 47, 31, 90, 60, 44, and 52 μm , respectively. Formula for armature: 4, 15, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae smooth.

Antenna (Fig. 6d) 4-segmented with formula 1, 1, 3 + 1 spine, and 7. Second segment with setules on both sides, third segment with outer setules, and fourth segment with inner setules. Seta on segment 1 with bilateral setules. Seta on segment 2 with long unilateral setules. One

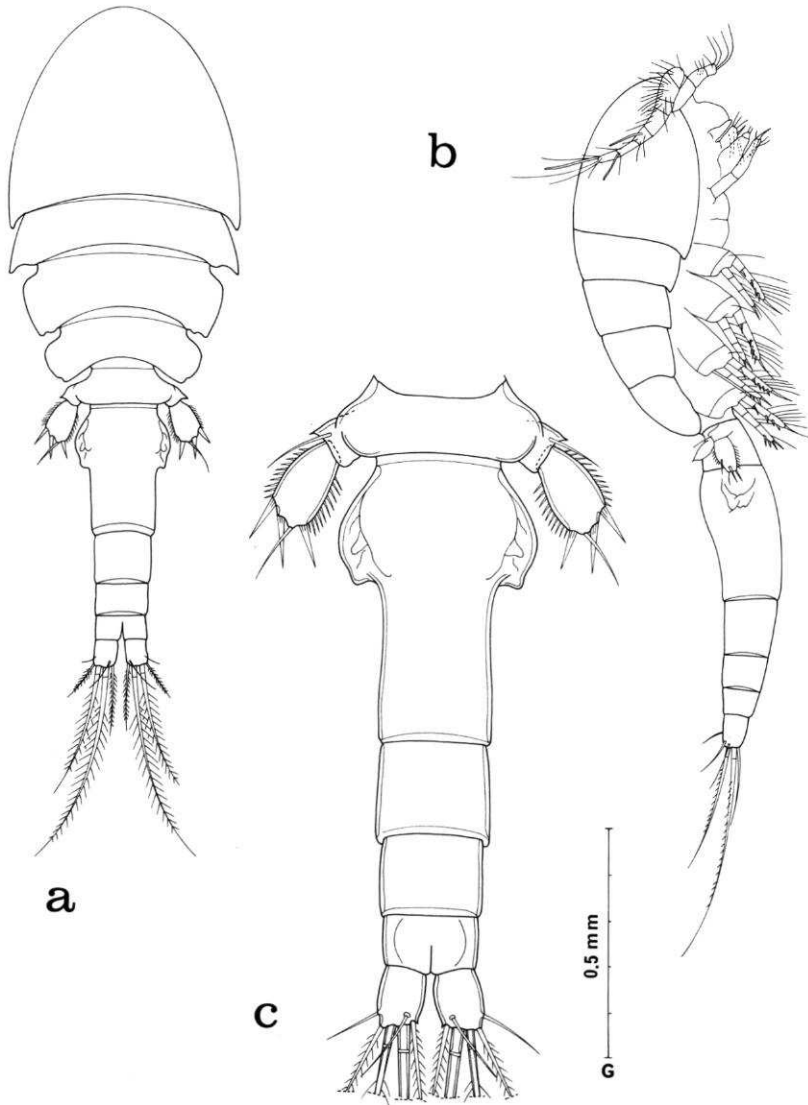


FIG. 5. — *Hemicyclops apiculus*, n. sp., female. a, dorsal (scale G); b, lateral (G); c, urosome, dorsal (B).
Hemicyclops apiculus, n. sp., femelle. a, vue dorsale (échelle G); b, vue latérale (G); c, urosome, vue dorsale (B).

seta on segment 3 with several unilateral spinules, other setae and spine smooth. One seta on segment 4 with long spinules, other 6 setae smooth, 4 longest of these slightly geniculate.

Labrum (Fig. 6b) with row of short spinules anteriorly, followed by row of small blunt spinules; another interrupted row of small setae posteriorly. Postoral area (Fig. 6e) with 6 sub-marginal spines and row of minute marginal spinules; corners of labium with prominent tooth.

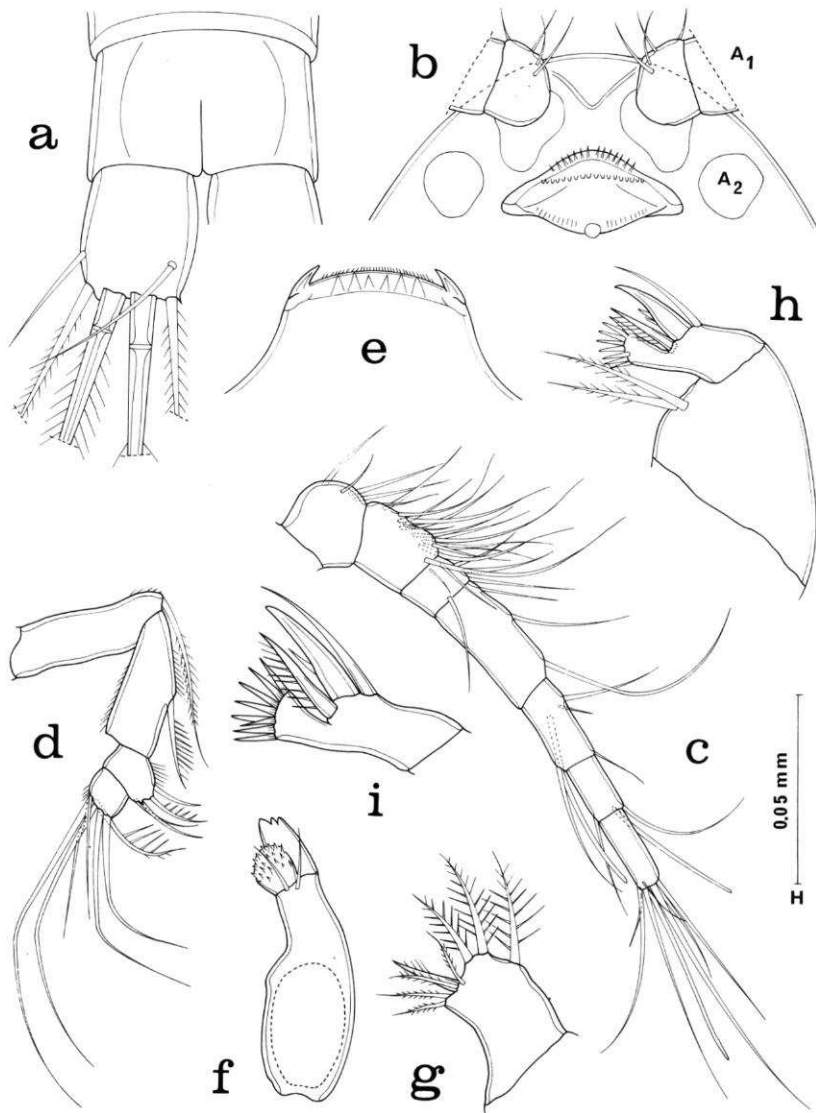


FIG. 6. — *Hemicyclops apiculus*, n. sp., female. a, anal somite and caudal ramus, dorsal (scale D); b, rostrum and labrum, ventral (E); c, antennule, ventral (E); d, antenna, anterior (E); e, postoral area, ventral (H); f, mandible, anterior (D); g, maxillule, anterior (D); h, maxilla, anterior (D); i, second segment of maxilla, posterior (C). A₁ = antennule, A₂ = antenna.

Hemicyclops apiculus, n. sp., femelle. a, somite anal et rames caudales, vue dorsale (échelle D); b, rostre et labre, vue ventrale (E); c, antennule, face ventrale (E); d, antenne, face antérieure (E); e, région postorale, vue ventrale (H); f, mandibule, vue antérieure (D); g, maxillule, vue antérieure (D); h, maxille, vue antérieure (D); i, deuxième segment de la maxille, face postérieure (C). A₁ = antennule, A₂ = antenne.

Mandible (Fig. 6f) terminally with 2 stout elements, one dentate, other spinulose, and 2 setae. Maxillule (Fig. 6g) bearing 8 setae, in groups of 5 + 3. Maxilla (Fig. 6h) with first segment bearing 2 long setae. Second segment (Fig. 6i) bearing 1 smooth seta, clawlike spine bearing 1 inner spinule, and 1 spiniform seta with unilateral setules; segment with prolongation bearing terminal row of 8 smooth spines. Maxilliped (Fig. 7a) with 2 setae on both first and second segments. Small third segment unarmed. Minute fourth segment with 2 unequal clawlike spines 62 μ m and 42 μ m, and 3 slender setae.

Ventral area between maxillipeds and first pair of legs slightly protuberant (Fig. 5b) and appearing as in Fig. 7b.

Legs 1-4 (Fig. 7c-f) with 3-segmented rami armed as follows:

P ₁	coxa 0-1	basis 1-1	exp 1-0; enp 0-1;	1-1; 0-1;	II,6 I,5
P ₂	coxa 0-1	basis 1-0	exp 1-0; enp 0-1;	1-1; 0-2;	III,I,5 I,II,3
P ₃	coxa 0-1	basis 1-0	exp 1-0; enp 0-1;	1-1; 0-2;	III,I,5 II,II,2
P ₄	coxa 0-1	basis 1-0	exp 1-0; enp 0-1;	1-1; 0-2;	II,I,5 II,II,1

Intercoxal plate of leg 1 with slender setules on ventral margin; intercoxal plates of legs 2-4 with marginal spines.

Basis of leg 1 with inner spine 50 μ m. Exopod of leg 1 with 2 distal spines on third segment setiform, with small spinules along outer margin and setules along inner margin; innermost seta on third segment of endopod slender, short, and smooth. Distal spine on third segment of exopod in legs 2-4 setiform.

Leg 5 (Fig. 7g) 2-segmented, with free segment in dorsal view 99 \times 55 μ m, in flat view 94 \times 60 μ m (as in Fig. 7h). Four terminal elements (3 spines and 1 seta) from outer to inner 39, 45, 65, and 58 μ m. Both sides of free segment with prominent setules. First segment, fused with body somite, having pointed outer projection and bearing dorsal seta 60 μ m.

Leg 6 not identified but possibly represented by 2 minute knobs (Fig. 5b).

Color of living specimens in transmitted light slightly yellow, eye red, ovaries lemon yellow. Male unknown.

REMARKS

Among the many species of *Hemicyclops*, seven have an elongate genital double-somite with rounded anterior expansions, as in the new species. *Hemicyclops apiculus*, new species, may be distinguished from the female of all seven of these congeners in the following ways. In *H. kombensis* Humes, 1965, and *H. acanthosquillae* Humes, 1965, the body is more than 2 mm in length. In *H. biflagellatus* Humes, 1965, the body length is more than 2 mm and the somite bearing leg 5 has a pair of setiform processes (setae?). In *H. columnaris* Humes, 1984, the body is smaller (average length 1.13 mm) and the ratio of length to width of the caudal ramus is

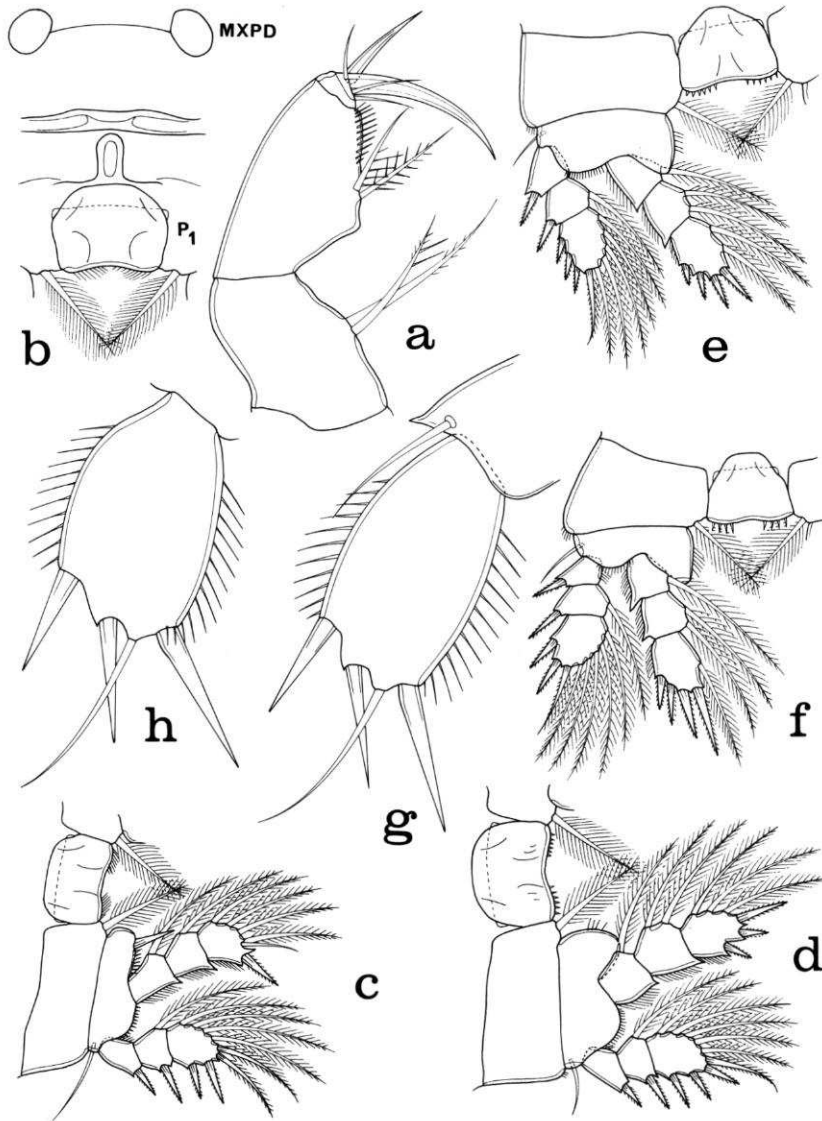


FIG. 7. — *Hemicyclops apiculus*, n. sp., female. a, maxilliped, posterior (scale D); b, area between maxillipeds and first pair of legs, ventral (E); c, leg 1 and intercoxal plate, anterior (B); d, leg 2, and intercoxal plate, anterior (B); e, leg 3 and intercoxal plate, anterior (B); f, leg 4 and intercoxal plate, anterior (B); g, leg 5, dorsal (C); h, second segment of leg 5, flat ventral view (C). MXPD = maxilliped, P₁ = leg 1.

Hemicyclops apiculus, n. sp., femelle. a, maxillipède, vue postérieure (échelle D); b, zone située entre les maxillipèdes et la première paire de pattes, face ventrale (E); c, P₁ et plaque intercoxale, face antérieure (B); d, P₂ et plaque intercoxale, face antérieure (B); e, P₃ et plaque intercoxale, vue antérieure (B); f, P₄ et plaque intercoxale, face antérieure (B); g, P₅, vue dorsale (C); h, deuxième segment de P₅, vue ventrale (C). MXPD = maxillipède, P₁ = première paire de pattes.

1.7:1. In *H. perinsignis* Humes, 1973, the free segment of leg 5 is short and broad, ratio 1.5:1, and the ratio of the caudal ramus is 1.72:1. In *H. saxatilis* Ho & Kim, 1991, the body length is about 2:1, and the genital double-somite has 2 pointed leaflike extensions laterally. *Hemicyclops australis* Nicholls, 1944, is poorly known, but may be distinguished by the posterolateral projections on the swollen portion of the genital double-somite.

***Hemicyclops vicinalis* n. sp.**

(Figs 8-11)

TYPE MATERIAL. — 2 ♀♀, 1 ♂ from one hermit crab, *Dardanus guttatus* (Olivier), in shell of *Conus* sp., 1.5 m, Ankify, near Nosy Bé, Madagascar, 48°20'15"E, 13°30'30"S, 30 December 1963. Holotype ♀ (MNHN - Cp 1057) and allotype ♂ (dissected) (MNHN - Cp 1058) deposited in the Muséum national d'Histoire naturelle, Paris. One paratype ♀ (dissected) in the collection of the author.

ETYMOLOGY. — The specific name *vicinalis*, Latin meaning "neighboring" or "near", alludes to the close similarity in external anatomy to *H. columnaris* and *H. geminatus* Stock, 1992.

DESCRIPTION OF FEMALE

Body (Fig. 8a, b) with moderately broad prosome. Length 1.16 mm (1.08-1.23 mm) and greatest width 0.44 mm (0.42-0.46 mm), based on 2 specimens. Greatest dorsoventral thickness 0.31 mm. Somite bearing leg 1 not separated dorsally from cephalosome. Epimera of metasomal somites rounded except pointed on somite bearing leg 1. Ratio of length to width of prosome 1.26:1. Ratio of length of prosome to that of urosome 1.11:1.

Somite bearing leg 1 (Fig. 8c) 109 × 218 μm. Genital double-somite elongate, cylindrical, in dorsal view 239 μm long, 185 μm wide at small lateral swellings in anterior third, and 156 μm wide posteriorly. Ratio of length to greatest width 1.77:1. Genital openings, lacking setae or spines, situated laterally at level of lateral swellings. Three postgenital somites from anterior to posterior 88 × 133, 55 × 120, and 52 × 109 μm. Anal somite with posteroventral row of spines on its distal edge (Fig. 8d).

Caudal ramus (Fig. 8d) subquadrate, little wider proximally than distally, length 61 μm, proximal width 50 μm, distal width 44 μm. Ratio (taking width at middle) 1.17:1. Outer lateral seta 47 μm and dorsal seta 95 μm, both smooth. Outermost terminal seta 96 μm, innermost terminal seta 170 μm, both with small lateral setules. Two median terminal setae in holotype: outer 350 μm with lateral setules, inner broken at proximal joint. Inner distal corner of ramus with minute setule 3 μm long.

Body surface lacking visible ornamentation.

Egg sac (Fig. 8e) elongate, 440 × 132 μm, with many eggs, each with diameter of approximately 42 μm.

Rostrum (Fig. 8f) broadly rounded. Antennule (Fig. 9a) 320 μm long, lengths of its 7 segments: 13 (44 μm along anterior margin), 37, 34, 55, 39, 44, and 42 μm, respectively. Armature: 4, 15, 6, 3, 4 + 1 aesthete, 2 + 1 aesthete, and 7 + 1 aesthete. All setae smooth. Antenna (Fig. 8b) 4-segmented, with armature 1, 1, 4, and 7. Seta on second segment relatively short and weak. Otherwise similar to *Hemicyclops acanthophorus*, new species, except for minor setation.

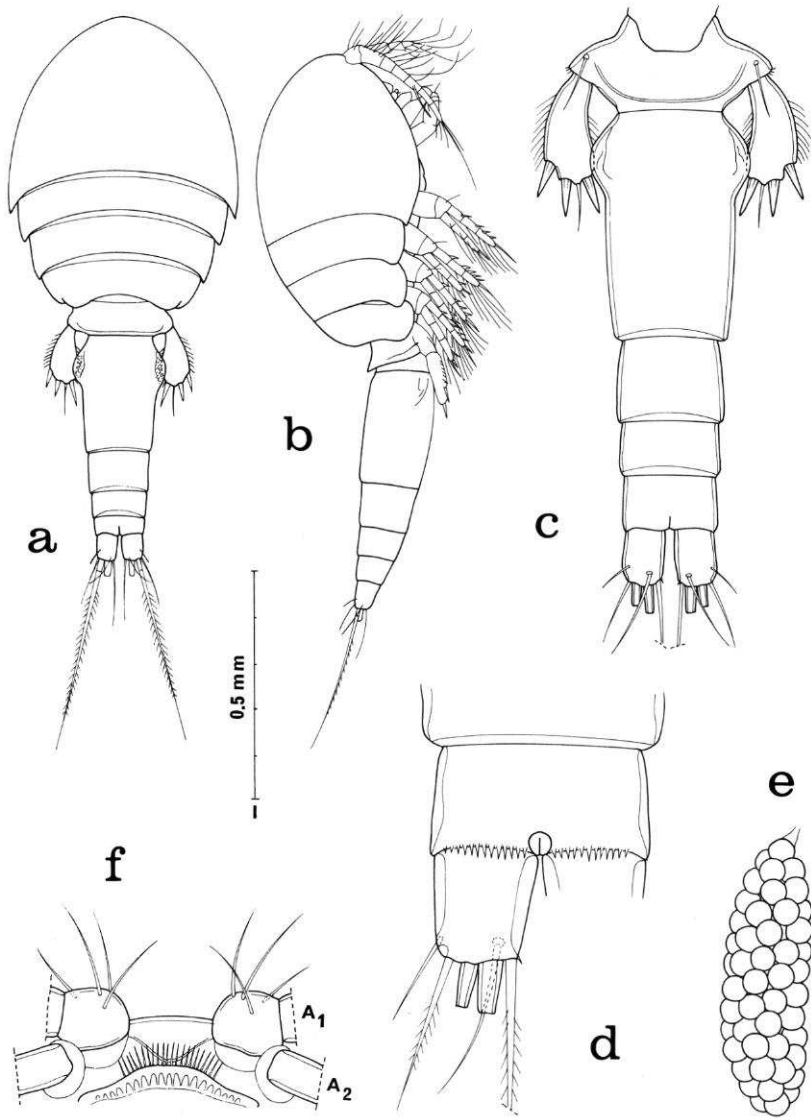


FIG. 8. — *Hemicyclops vicinalis*, n. sp., female. a, dorsal (scale 1); b, lateral (1); c, urosome, dorsal (B); d, anal somite and caudal ramus, dorsal (D); e, egg sac, ventral (A); f, rostrum and edge of labrum, ventral (D). A₁ = antennule, A₂ = antenna.

Hemicyclops vicinalis, n. sp., femelle. a, vue dorsale (échelle 1); b, vue latérale (1); c, urosome, vue dorsale (B); d, somite anal et rames caudales, vue dorsale (D); e, sac ovigère, vue ventrale (A); f, rostre et bord du labre, vue ventrale (D). A₁ = antennule, A₂ = antenne.

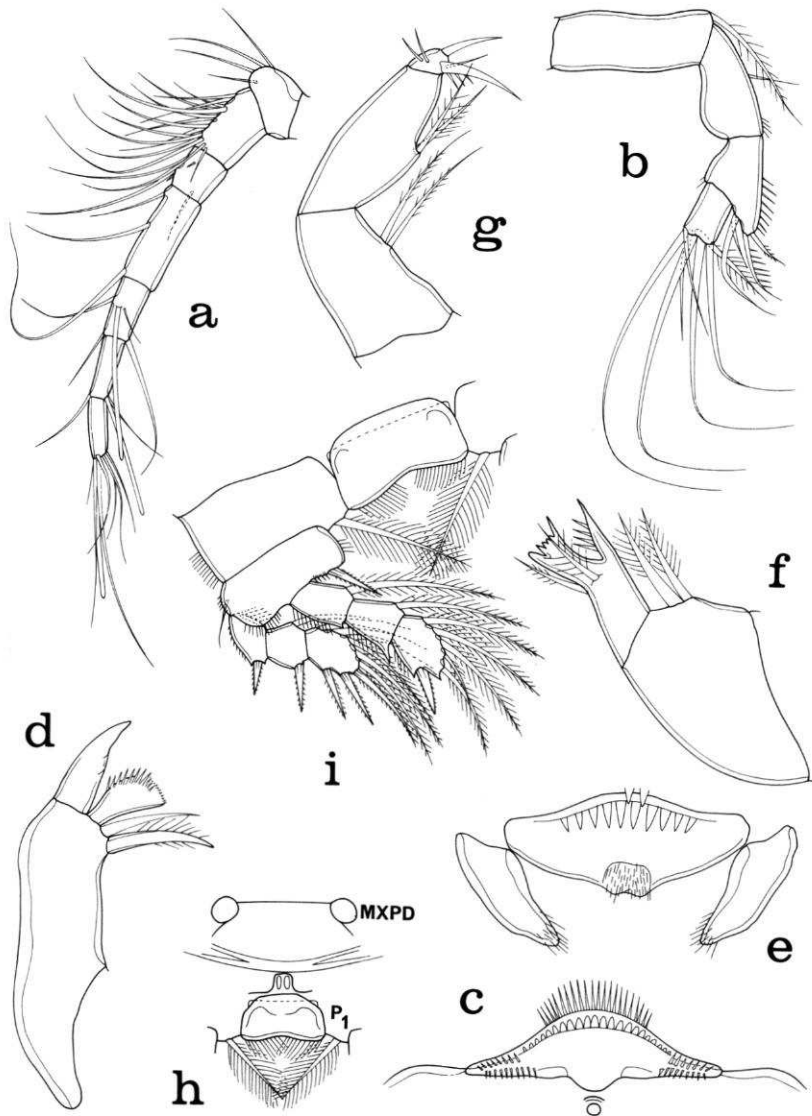


FIG. 9. — *Hemicyclops vicinalis*, n. sp., female. a, antennule, dorsal (scale E); b, antenna, anterior (D); c, labrum, ventral (C); d, mandible, posteroventral (C); e, postoral area and paragnaths, ventral (C); f, maxilla, posterior (D); g, maxilliped, posterior (D); h, area between maxillipeds and first pair of legs, ventral (B); i, leg 1 and intercoxal plate, anterior (E). MXPD = maxilliped, P₁ = leg 1.

Hemicyclops vicinalis, n. sp., femelle. a, antennule, face dorsale (échelle E); b, antenne, face antérieure (D); c, labre, face ventrale (C); d, mandibule, vue postéro-ventrale (C); e, région post-orale et paragnathes, vue ventrale (C); f, maxille, face postérieure (D); g, maxillipède, vue postérieure (D); h, zone située entre les maxillipèdes et la première paire de pattes, vue ventrale (B); i, P₁ et plaque intercoxale, face antérieure (E). MXPD = maxillipède, P₁ = première paire de pattes.

Labrum (Fig. 9c) with anterior row of long setae and subanterior row of blunt hyaline spines, and having 2 rows of setules at each side. Postoral area (Fig. 9e) with row of hyaline spines and median finely setulose area. Mandible (Fig. 9d) with stout elongate nonsetulose element, spatulate element with marginal setules, and 2 slender setae, one spiniform with lateral setules. Paragnath (Fig. 9e) attenuated lobe with distal hairlike setules. Maxillule as in Fig. 11c of male. Maxilla (Fig. 9f) and maxilliped (Fig. 9g) as illustrated

Ventral area between maxillipeds and first pair of legs protruding slightly (Fig. 8b). Two small sclerites in front of intercoxal plate of leg 1 (Fig. 9h).

Legs 1-4 (Figs 9i, 10a-c) with segmentation and armature as follows:

P ₁	coxa 0-1	basis 1-1	exp I-0; enp 0-1;	I-1; 0-1;	II,6 I,5
P ₂	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	III,I,5 I,II,3
P ₃	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	III,I,5 I,II,3
P ₄	coxa 0-1	basis 1-0	exp I-0; enp 0-1;	I-1; 0-2;	II,II,5 I,II,2

Intercoxal plate of leg 1 with slender setules along ventral edge; intercoxal plates of legs 2-4 with marginal spines.

In leg 1 inner spine on basis 49 μm long. In all 4 legs distal spine on third segment of exopod setiform, and outer margin of coxa and basis with setules. Other setules and spinules resembling those in other species, for example, *Hemicyclops columnaris* Humes, 1984.

Leg 5 (Fig. 10d) 2-segmented. First segment with dorsal seta 50 μm long. Second segment elongate, narrow proximally, widened distally, 117 \times 50 μm (greatest width). Ratio 2.34:1. Terminally with 3 spines and 1 seta, from outer to inner 44, 36, 62, and 52 μm . Innermost spine with setules along inner margin. Seta reaching only to middle of genital double-somite. Both outer and inner margins of second segment with strong setules.

Leg 6 not identified.

Living specimens in transmitted light nearly translucent, eye red, egg sacs dull orange brown.

DESCRIPTION OF MALE

Body (Figs 10e, 11a) resembling in general form that of female. Length (of allotype) 1.25 mm and width 0.45 mm. Greatest dorsoventral thickness 0.26 mm. Ratio of length to width of prosome 1.57:1. Ratio of length of prosome to that of urosome 1.24:1.

Somite bearing leg 5 (Fig. 11b) 91 \times 198 μm . Genital somite subquadrate, 146 \times 156 μm , slightly wider than long. Four postgenital somites from anterior to posterior 112 \times 133, 88 \times 122, 60 \times 114, and 48 \times 104 μm . Anal somite with posteroventral spinules as in female.

Caudal ramus like that of female.

Body surface lacking visible ornamentation.

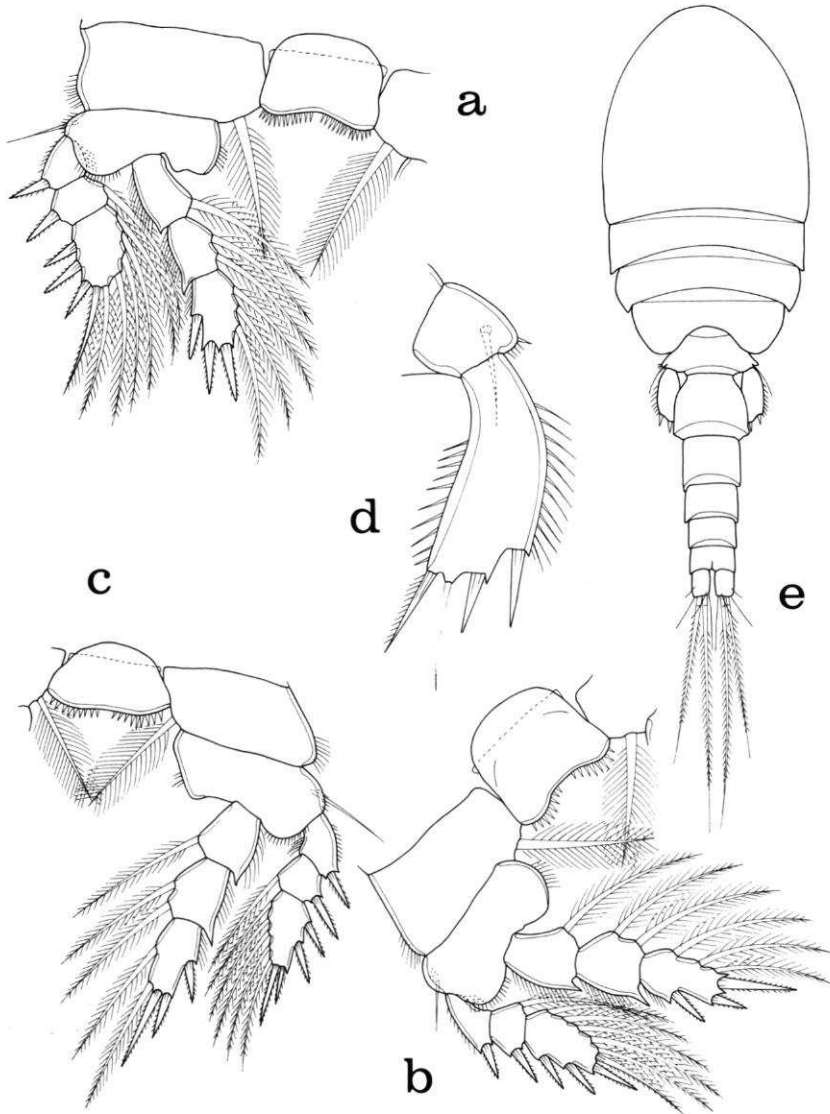


FIG. 10. — *Hemicyclops vicinalis*, n. sp., female. a, leg 2 and intercoxal plate, anterior (scale E); b, leg 3 and intercoxal plate, anterior (E); c, leg 4 and intercoxal plate, anterior (E); d, leg 5, ventral (D). Male. e, dorsal (I).
Hemicyclops vicinalis, n. sp., femelle. a, P_2 et plaque intercoxale, face antérieure (échelle E); b, P_3 et plaque intercoxale, face antérieure (E); c, P_4 et plaque intercoxale, face antérieure (E); d, P_5 , vue ventrale (D). Mâle. e, vue dorsale (I).

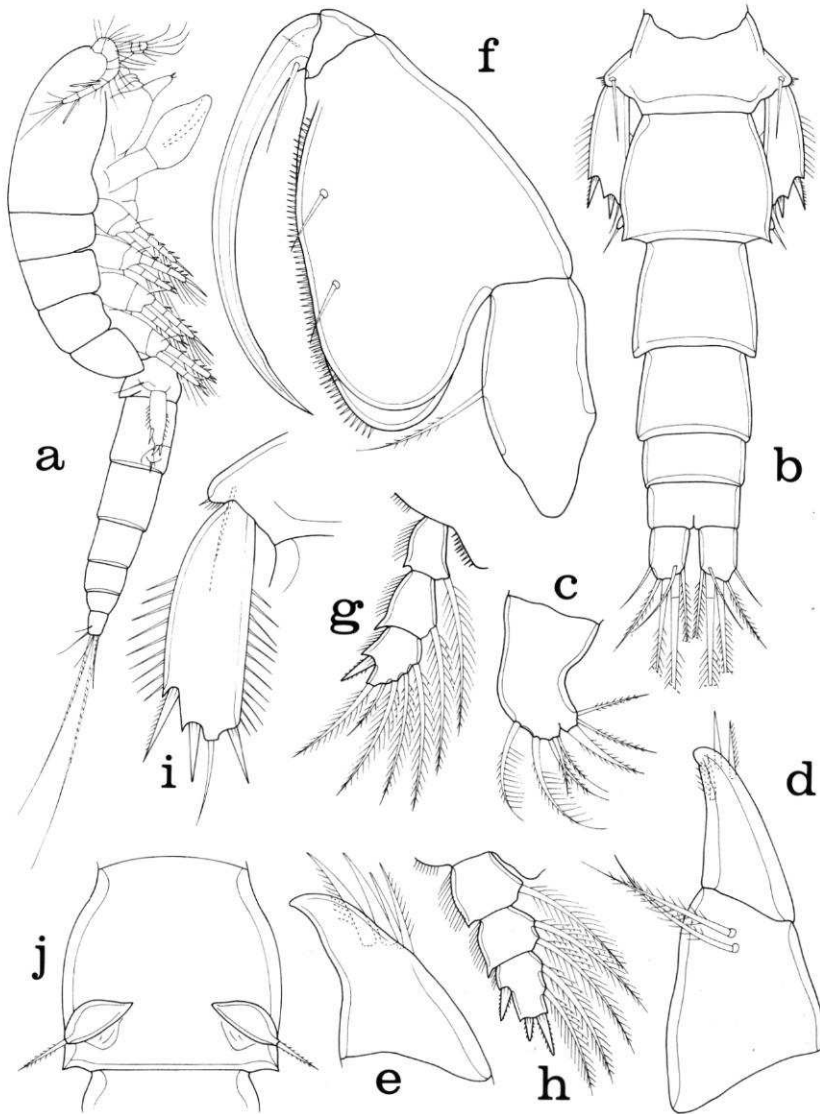


FIG. 11. — *Hemicyclops vicinalis*, n. sp., mâle. a, latérale (échelle 1); b, urosome, vue dorsale (B); c, maxillule, vue antéro-interne (D); d, maxilla, antérieure (D); e, deuxième segment de maxilla, antérieure (C); f, maxillipède, antérieure (D); g, endopode de leg 1, antérieur (E); h, endopode de leg 2, antérieur (E); i, leg 5, ventrale (D); j, genital somite showing sixth pair of legs (E).

Hemicyclops vicinalis, n. sp., mâle. a, vue latérale (échelle 1); b, urosome, vue dorsale (B); c, maxillule, vue antéro-interne (D); d, maxille, face antérieure (D); e, deuxième segment de la maxille, face antérieure (C); f, maxillipède, vue antérieure (D); g, endopodite de P_1 , face antérieure (E); h, endopodite de P_2 , face antérieure (E); i, P_5 , vue ventrale (D); j, somite génital montrant la sixième paire de pattes (E).

Rostrum as in female. Antennule similar to female but 1 seta added on segment 3 and another seta on segment 4. Antenna like that of female. Labrum, postoral area, mandible, paragnath, and maxillule (Fig. 11c) resembling those of female. Maxilla (Fig. 11d) with 2 setae on segment 1; segment 2 stoutly pointed and bearing 4 setae (Fig. 11e). Maxilliped (Fig. 11f) similar to that of *H. columnaris*.

Legs 1-4 with segmentation and armature as in female, but basis of leg 1 lacking inner spine seen in female (Fig. 1g). Segments of endopod of leg 2 (Fig. 11h) somewhat shorter than in female.

Leg 5 (Fig. 11i) with second segment $127 \times 49 \mu\text{m}$. Ratio 2.59:1. Less tapered than in female but otherwise similar.

Leg 6 (Fig. 11j) consisting of posteroventral flap on genital segment bearing 1 finely barbed spinelike seta $36 \mu\text{m}$.

Spermatophore not seen.

Color as in female.

REMARKS

Three species of *Hemicyclops*, *H. columnaris* from Pacific Panama, *H. geminatus* from Curaçao, and *H. vicinalis* from Madagascar, are at first glance remarkably similar. All have, in the female, an elongate columnar genital double-somite with small rounded anterior lateral expansions and a short caudal ramus with a length to width ratio less than 2:1. However, there are subtle differences that separate them and in particular distinguish the new species. In *H. vicinalis*, the inner margin of the caudal ramus is smooth (in *H. columnaris* and *H. geminatus* this margin bears setules); the length to width ratio of the caudal ramus in the female is 1.17:1 (1.7:1 in *H. columnaris*, 1.27-1.52:1 in *H. geminatus*); the outer side of segment 2 of the antenna proximal to the seta lacks setules (these setules present in *H. columnaris* and *H. geminatus*); the second segment of leg 5 is $117 \times 50 \mu\text{m}$ ($125 \times 57 \mu\text{m}$ in *H. columnaris*, $85 \times 40 \mu\text{m}$ in *H. geminatus*); and the inner of the two stout elements on the mandible is tapered proximally and is expanded and rounded distally (in *H. columnaris* this element is not tapered proximally and is rounded distally, in *H. geminatus* it is not tapered proximally and has a truncate tip). In *H. columnaris* the outermost terminal seta on the caudal ramus has a small thornlike process on its outer edge, not found in the two congeners mentioned. In *H. geminatus* the seta on the second segment of leg 5 in the female is much longer than in *H. vicinalis*, "reaching to 75-90% of length of genital segment" (Stock, 1992).

In all three species discussed, there are ventrodiscal spinules on the anal somite (these not mentioned in the original description of *H. columnaris*).

Notes on *Hemicyclops perinsignis* Humes, 1973

This species, described from specimens associated with the sponge *Agelas*, has now been found associated with the alcyonacean coral *Tubipora musica* L. as follows: 5 ♀♀, 1 ♂ from 1 colony, Pointe Lokobe, Nosy Bé, Madagascar, 5 June 1967; 2 ♀♀, 1 ♂ from 1 colony, same locality, 12 June 1967.

Acknowledgements

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