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HALICYCLOPS CANEKI N. SP. (COPEPODA, CYCLOPOIDA) FROM CELESTÚN LAGOON (YUCATÁN, MEXICO)

by

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SUMMARY

Halicyclops caneki n. sp. is described from Celestún Lagoon (northwest of the Yucatán Peninsula) and is compared with its congeners *H. herbsti* Rocha and Iliffe, and *H. bowmani* Rocha and Iliffe, known from the Bermuda cave system. *H. magniceps* previously reported from the peninsula is considered as a possible junior synonym of *H. caneki*. The new species was found among several other copepods living between the *aufwuchs* covering submerged mangrove pneumatophores.

Key words : Cyclopoida, *Halicyclops*, taxonomy, new species.

INTRODUCTION

More than 20 different species of *Halicyclops* are currently recognized in the central west Atlantic coastal region, extending from Brazil in the south to Cape Hatteras in the north. The enormous lagoonal and estuarine Brazilian coast is known to accommodate at least ten different species (HERBST, 1955 ; ROCHA, 1983a ; 1983b ; 1984 ; REID, 1985 ; LOTUFO and ROCHA, 1993). Four species are known to inhabit coastal waters of the United States Gulf Coast (ROCHA and HAKENKAMP, 1993), 5 from several localities in Central America and the Caribbean (HERBST, 1987 ; and see REID, 1990), and 3 from anchialine caves in Bermuda (ROCHA and ILIFFE, 1993). An unnamed male specimen was reported by PLEŞA (1981) from Cuba.

The presence in this region of typical European Atlantic and Mediterranean species (e.g. *H. aequoreus* (Fischer, 1860), *H. neglectus* (Kiefer, 1935), *H. septentrionalis* (Kiefer, 1935), and *H. magniceps* (Lilljeborg, 1853)) is questionable (REID, 1990 ; ROCHA and HAKENKAMP, 1993 ; present study).

Celestún Lagoon (Laguna de Celestún), type-locality of the herein described *H. caneki* n. sp., is located at the northwestern edge of the Yucatán Peninsula and

is a 20 km long narrow southwards directed estuary, bordered by a dense red mangrove forest. This highly productive estuary is currently under study by hydrologists and ecologists (VALDÉS *et al*, 1988). The northern part receives important quantities of freshwater through discharges from the underground water table of the yucatecan karst. The relationship between rainfall and underflow nutrient load carried into the estuary has recently been documented by HERRERA-SILVEIRA (1994).

MATERIAL AND METHODS

The sample was taken with a hand net (mesh 80 µm), scraping the *aufwuchs* covering the submerged pneumatophores of mangrove trees (direction of Celestún Village, at the right side of the bridge spanning the estuary; estimated coörd. 20° 49′ 59″ N — 90° 21′ 50″ W; Leg. F. Fiers, 15 March 1993, MEX 93-95). The sample was fixed in 4 % buffered formaldehyde. The animals were transferred to 75 % denaturated ethyl alcohol for long-term storage. Observations and dissections were made in glycerine with coverglasses sealed for permanent slides. Observations and drawings were made at 1250X on a Leitz Dialux 20 light microscope, equipped with a drawing tube.

Eleven females, 2 males and 3 juveniles of *Halicyclops caneki* n. sp. were preserved in 75 % denaturated ethanol (COP 3826, designated paratypes), and dissected specimens (holotype female, paratype female and allotype male) were labeled COP 3823a-b, COP 3824a-b and COP 3826a-b, respectively.

Associated harpacticoid copepod fauna : Darcythompsoniidae : *Leptocaris* spec. 1., *Leptocaris* spec. 2, *Kristensenia pallida* Por ; Tisbidae : *Tisbe* spec. ; Diosaccidae : *Robertsonia* cfr *salsa* Gurney ; *Schizopera* cfr *knabeni* Lang ; Ameiridae : *Nitocra laingensis* Fiers, *Nitocra* spec. ; Canthocamptidae : *Mesochra wolski* Jakubisiak ; Argestidae : *Actinocletodes woutersi* Fiers ; Cletodidae : *Enhydrosoma lacunae* Jakubisiak ; Laophontidae : *Folioquinpes chathamensis* (Sars).

The type-specimens of *H. caneki* as well as the associated harpacticoid fauna were deposited in the collections of the Recent Invertebrate Section of the Royal Belgian Institute of Natural Sciences, Brussels.

DESCRIPTION

***Halicyclops caneki* n. sp.**

Synonymy

? *Halicyclops magniceps* (Lilljeborg, 1853) : Wilson, 1936 : pp. 82.

Etymology

The species is named after the legendary mythical Mayan hero Jacinto Canek (EMILIO ABREU GÓMEZ, 1983. Canek. Dante, Mérida, 108 pp.).

Description

Female : Length ranging from 597 to 628 µm (holotype : 623 µm) with a typical *Halicyclops* appearance (Fig. 1a, c). Largest width near posterior margin of cephalothorax (± 240 µm ; in holotype 242 µm) and prosome/body length ratio of 1/1.65. Posterolateral edges of cephalothorax and pedigerous somites not produced. Genital double somite with nearly parallel lateral margins (in Fig. 2a : urosome somewhat flattened during mounting), without marked lateral extensions in anterior half ; slightly longer than broad ; length/width ratio : 1/0.85.

Posterior hyaline fringes of prosomal and fifth pedigerous somites not incised, of urosomal somites finely incised, except for posteroventral fringe of genital double somite being deeply incised (Fig. 2a), and dorsomedian part of pre-anal somite being slightly crescentic produced and showing somewhat larger crenulations than lateral and ventral region (Fig. 1d).

Anal somite with spinules along the posterolateral and posteroventral margins, above articulation with caudal rami. Anal operculum nearly straight and anal sinus wide, furnished with row of hairs on both sides (Fig. 1d).

Integument of all somites with dense pattern of minute pores. Cephalothorax with a lock-shaped dorsal pore depression in the anterior half, and an ovate one near the posterolateral edge. Pedigerous somites 2, 3, 4 and first abdominal somite with a lateral rounded to ovate pore depression (Fig. 1a, c ; Fig. 2a). Large active glandulae in front of genital field, below pore depressions of first abdominal somite, in the anterior half of abdominal somites 2-4 having pore orifices opening below hyaline fringe of preceding somite, and in the caudal rami showing pore orifice opening close to the posteroventral margin (Fig. 2a : glandulae dotted in illustration).

Caudal ramus (Fig. 1d) slightly longer than wide (L/W ratio : 1/1.13 in holotype, 1/1.12 to 1/1.15 in paratypes), with distinctly produced distal dorsal edge, bearing dorsal seta. Integument of ramus smooth, except for some minute spinules near the implantation of distal lateral and dorsal seta, and along ventral distal margin. Lengths of armament (µm) : lateral seta, 19 ; distal lateral seta, 34 (twice as long as ramus) ; outer median one 190 ; inner median one, 315 ; dorsal one, 67 (three times as long as caudal ramus). Inner distal seta absent. Lateral and dorsal setae plumose ; outer median setae spinulose in proximal half along outer side of the stem, but plumose in distal half ; inner median seta with smooth proximal half, spinulose in second third, and plumose in distal third, with fine setules along outer side of stem, more rigid setules along medial side.

Antennule (Fig. 2b) six-segmented with proportional lengths (L/W) of segments : 0.90-0.75-0.50-1.88-0.90-2.60. First segment with two parallel rows of spinules. Segments (Roman numerals) with number of setae (Arabic numerals),

spines and esthetascs in parentheses : I(8) — II(12) — III(5+sp) — IV(5) — V(3+esth) — VI(10+esth). Esthetasc on segment V, implanted near articulation with segment IV, and reaching nearly halfway segment VI.

Antenna (Fig. 3a) typically three-segmented. Basipodite with short exopodal seta and two inner setae. First endopodal segment with a single set ; second endopodal segment, 2.90 times as long as wide, having 8 lateral setae and seven apical setae. Caudal surface of basipodite with two short proximal rows of slender spinules and some minute spinules nearly halfway the inner margin. Frontal surface of basipodite without ornamentation. Caudal surface of second endopodal segment with two transversal rows of minute spinules one in the posterior third and one in the median third.

Mandible (Fig. 3c) with normal armament of three setae ; surface smooth except for a row of minute spinules in the outer half and for two spinules near the biting edge.

Labrum (Fig. 3e) rather wide, with a mediodistal row of blunt teeth and a laterodistal serrate hyaline fringe, on both sides.

Arthrite of maxillule (Fig. 3h) armed with four slightly curved medial claws ; dorsal margin with an outer spine and plumose seta, and a median group of three setae and a blunt spine. Coxa with two smooth setae and one armed one medially and one plumed seta on the outer margin ; palp, shorter than wide, set with three plumed setae.

Praecoxa of maxilla (Fig. 3i) with two long plumed endal setae ; coxa with a single serrate endal spine in the proximal half, and a long distal endite bearing a long and blunt proximal armament and a distal armed spine. Claw of basis and additional spine ornamented with spinules over the entire distance ; basis with an additional slender seta. One segmented palp bearing three robust spines (apical ones armed) and two slender and smooth setae.

Maxilliped (Fig. 3g) slender, two-segmented. Coxa and basis each bearing three spines ; the latter with two slender subdistal setae.

Legs 1 (Fig. 4a), P2, P3 (Fig. 4b) and P4 (Fig. 4c) with three-segmented rami. Leg 1 coxopodite furnished with rows of spinules near the outer distal edge on frontal and caudal surface and a spinule row near the proximal outer margin on the caudal surface ; basis ornamented with a comb of spinules along median distal margin and near the implantation of medial spine ; medial margin of basis with fragile hairs. Protopodites of legs 2-4 equally ornamented : with, on coxopodites, minute spinules along the distal half of outer margins and along the outer third of distal margin ; and with, on basipodites, a median spinule row and a hairy medial margin. Medial coxal seta of leg 1 reaching beyond second endopodal segment, of leg 2 and 3 not quite to distal end of first endopodal segment, and of leg 4 only just beyond basis. Outer seta of bases short, not reaching to distal ends of first exopodal segments. Medial spine on basis of leg 1 as long as first two endopodal segments, and serrate.

All outer spines of exopodites and all terminal endopodal spines serrate. Exopodite spine formula 3,4,4,3, and setal formula 5,5,5,5. Inner seta of first

exopodal segment of leg 1 short, only reaching towards distal margin of segment 2. Outer distalmost seta of third exopodal segment of leg 1 ornamented with few setules. All other setae on exopodal and endopodal rami densely plumed, except for proximal inner serrate seta on third endopodal segments of leg 2 and 3, and both inner serrate setae on third endopodal segment of leg 4. Distalmost spine of leg 1 endopodite, slightly longer than segment (± 1/1.3), and outer spine much shorter than segment (± 1/0.66). Distalmost endopodal spines on leg 2 and 3, 1.5, and of leg 4, 1.45 times as long the segment. Outer spines on third endopodal segments of leg 2-4, respectively 0.65 (proximal ones) and 0.89 (sub-distal ones) times longer than segments. Length/width ratio of third endopodal segment of leg 4 : 1/1.55.

P2 and P3 identical in all aspects, former not illustrated.

Coupler of leg 1 (Fig. 2d), sub-quadrate with pair of crescentic extensions, each ornamented with long slender spinules, surface smooth. Couplers of leg 2 and 3 sub-quadrate, without spinules on paired rounded extensions, and smooth surface. Leg 4 coupler sub-rectangular with convex median margin, and minutely produced paired extensions ; entirely smooth.

Leg 5 (Fig. 2c) nearly 1.5 times longer than wide (holotype : 1/1.42, paratypes : 1/1.41-1/1.53) with a slightly concave medial margin. Typically armamented with a medial spine, a distal plumose seta, and two outer spines ; with medial spine 1.15 times longer than segment, distal seta 1.30 times longer than segment, and outer lateral spines as long as the segment. Leg 5 surface smooth, except for spinules along the medial and outer margins, and at implantation of armament.

Leg 6 (Fig. 1a, c) with two blunt elements (ventralmost twice as long as median one) and a plumed, 30 µm long, seta. Genital field (Fig. 2a and a') with a deep semi-circular genital pore leading to an ovate seminal receptacle ; lateral arms bent in medial third, and distinctly more strongly sclerotized in medial half than in outer half.

Male. — Length of allotype : 377 µm, of paratypes 369 and 375 µm, like female general aspect, except for sexual dimorphism in urosomites (Fig. 5c), and as follows : posteroventral margins of urosomites with regularly and finely incised hyaline fringe ; density of pores on each somite probably identical with female, but not observed (Fig. 5a, b).

Antennule typically geniculate ; 12-segmented with full complement of esthetascs on first segment ; general shape as 13-segmented antennule in *H. clarkei* see Herbst, 1982 (Fig. 25), except for two fused ultimate segment ; segments (Roman numerals) with armament of setae (Arabic numerals), spines and esthetascs in parentheses : I(8+2 esth) — II(4) — III(4) — IV(3) — V(3) — VI(1+sp) — VII(5) — VIII(3) — IX(2) — X(2) — XI(2) — XII(10+2 esth).

Ultimate segment of antenna (Fig. 3b) somewhat shorter than in female (L/W ratio : 1/2.75) ; less ornamented on surface ; and 4 lateral setae out of 8 clustered together in proximal third.

Leg 5 more elongated than in female (L/W ratio : 1/1.80), with 2 outer spines, a distal plumose seta, a medial distal spine and a medial proximal plumose seta, having the following segment length/armament length ratio : 1/1.20 (proximal outer

spine), 1/0.85 (distal outer spine), 1/0.66 (distal seta), and 1/0.64 (medial spine and seta). Ornamentation as in female leg 5.

Leg 6 (Fig. 5c) with large paired sub-quadrangular plates, each bearing an outer and median plumed seta, and a medial large spine.

DISCUSSION AND COMPARISON

Of the 22 species known in the central west Atlantic region, *H. caneki* resembles most *H. herbsti* and *H. bowmani* recently described from the Bermuda limestone cave system (ROCHA and ILIFFE, 1993). *H. caneki* shares with *H. herbsti* the coarsely incised hyaline fringe along the posterior ventral margin of the genital double somite (but lacking the coarse fringe on the second abdominal somite); the only slightly produced pseudo-operculum on the preanal somite; the reduced armature of the caudal rami, lacking the medial terminal seta; and the full armament of the second endopodal segment of the antenna bearing 8 lateral setae instead of the usual 5. *H. caneki* however, is easily distinguishable from its congener by the distinctive pattern of pore depressions on the cephalothorax and thoracic somites which are entirely absent in *H. herbsti*. Other differences between both species are : the longer outer apical seta on the caudal rami (up to twice as long as the rami in *H. caneki*, only 1.2 times longer in *H. herbsti*) ; the relatively shorter terminal segment of the antenna (2.90 times as long as wide in *H. caneki*, 3.25 times in *H. herbsti*) ; and the longer outer terminal spine on the third endopodal segment of leg 4 (1.42 times the segment length in *H. caneki* and only 1.29 in *H. herbsti*). Although *H. herbsti* was only partially described based on a single female specimen, the differences listed here clearly distinguish it from the here described *H. caneki*.

The pattern of ovate lateral pore depressions on several somites and especially the lock-shaped median depression on the cephalothorax in *H. caneki* shows a striking resemblance to the pattern known in *H. bowmani*. However, *H. bowmani* differs in many aspects from the present species, viz. the coarsely serrate pseudo-operculum ; the more slender female leg 5 exopodal segment bearing a very long terminal plumose seta ; and the presence of a dimorphic serrate seta on the median leg 4 endopodite.

The single male specimen reported by PLEŞA (1981) from Cuba is at once distinguished from *H. caneki* by the slender shape and short outer spines of the male leg 5 exopodite, and by the short caudal rami bearing a small but distinct medial terminal seta.

Few *Halicyclops* species seem to possess 8 setae along the lateral margin of the second endopodal segment of the antenna, although this feature has not always been described in detail. Besides the above mentioned *H. herbsti*, thus far this armature complement has been observed in *H. maculatus* Rocha and Hakenkamp, 1993 from Maryland (U.S.A.). *H. caneki* is at once distinguished from *H. maculatus* by its shorter caudal rami ; the less pronounced pseudo-operculum ; the smooth prosomal hyaline fringes ; and not at least by the absence of sexual dimorphic setal ornamentation in legs 1-4.

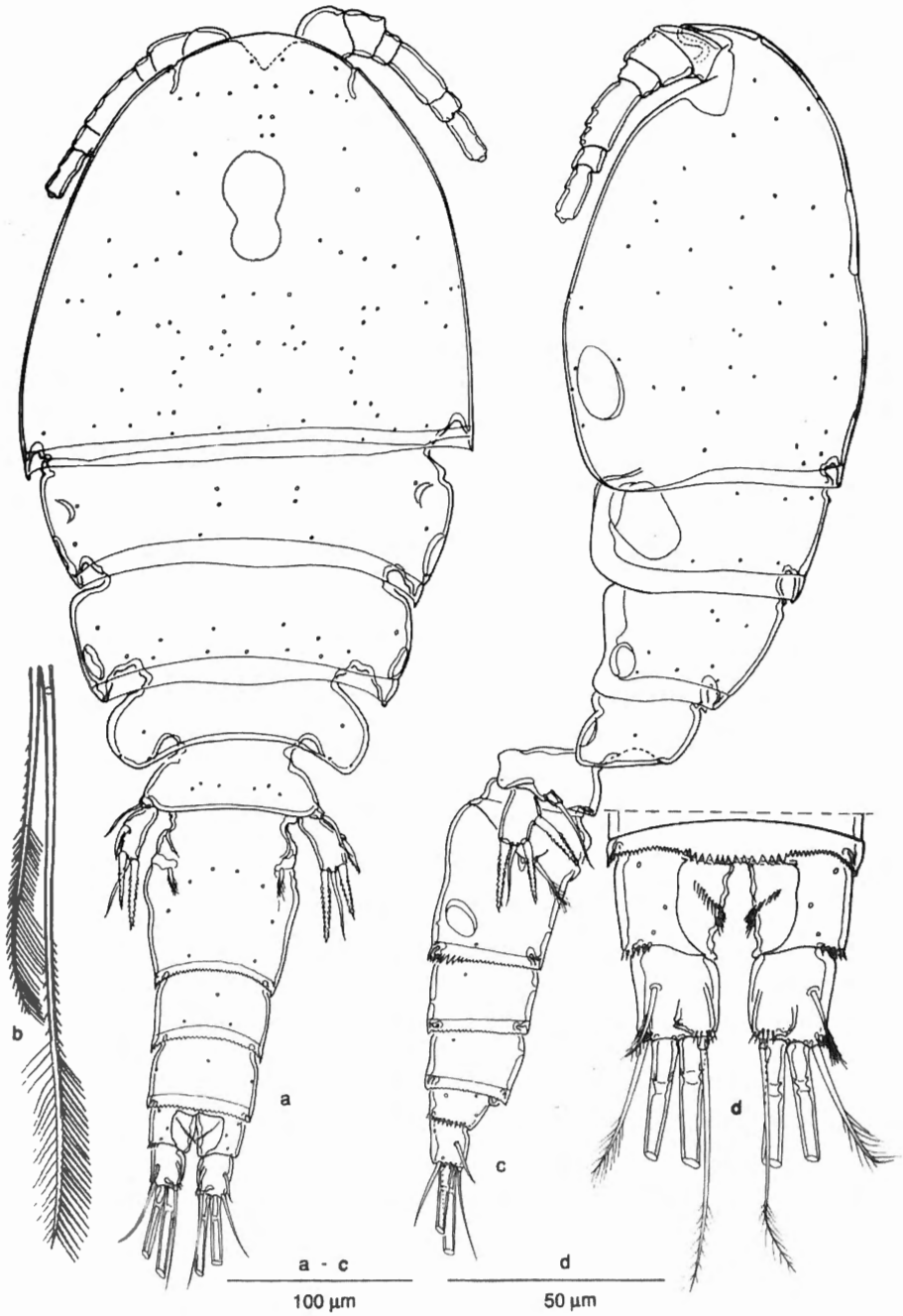

Fig. 1. — *Halicyclops caneki* n. sp., female — a, habitus, dorsal — b, principal terminal setae of left caudal ramus — c, habitus, lateral — d, anal somite and posterior region of pre-anal somite, dorsal (a-d of COP 3824).

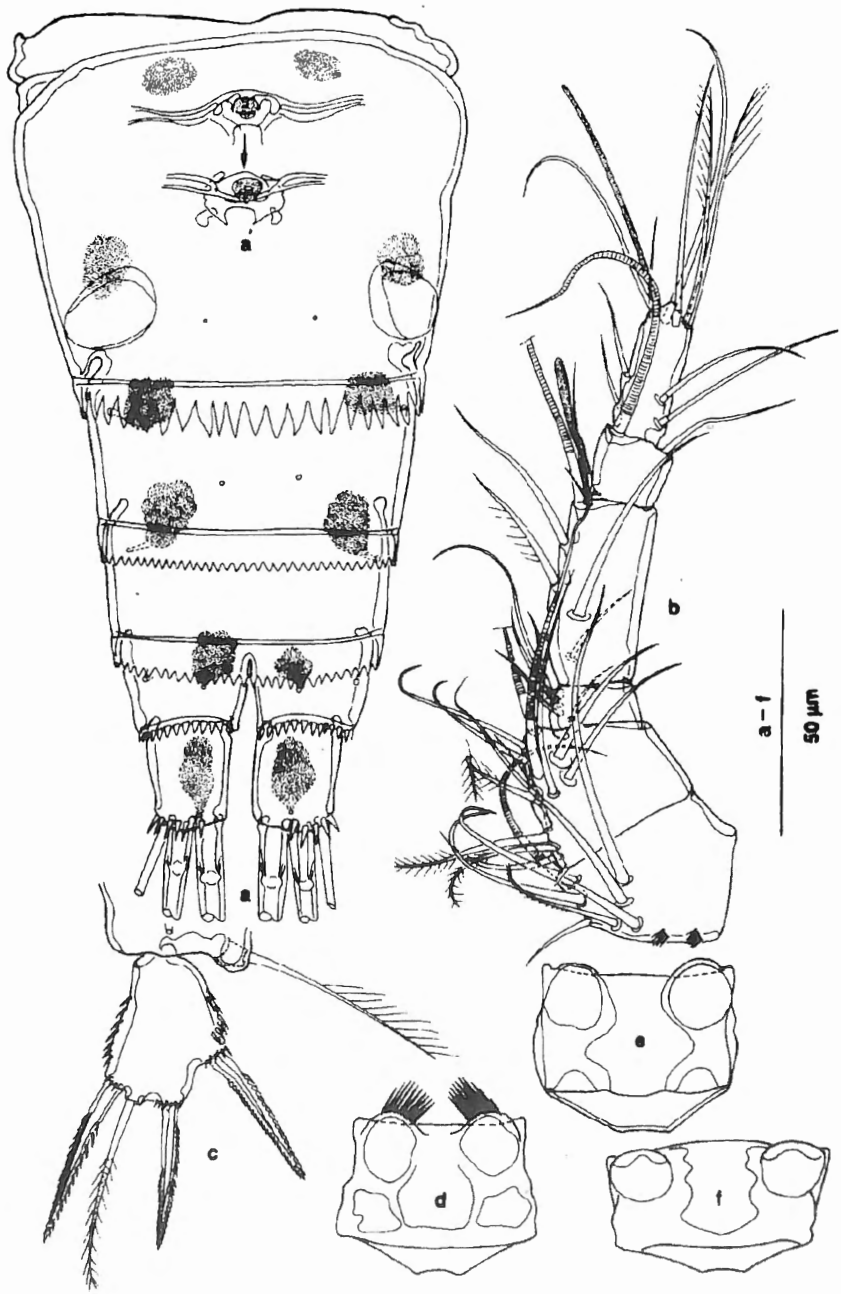

Fig. 2. — *Halicyclops caneki* n. sp., female — a, abdomen, ventral — b, antenna, ventral view — c, P5 — d, P1 coupler — e, P2 coupler — f, P4 coupler (a-c, f of COP 3824 ; d-e, in frontal view, of COP 3823).

Fig. 3. — *Halicyclops caneki* n. sp. — a, antenna, frontal — b, ultimate endopodal segment of male antenna, frontal — c, mandible — d, rostrum, ventral — e, labrum, ventral — f, labrum, dorsal — g, maxilliped — h, maxillule — i, maxilla (a, h of COP 3823 ; b, d, e of COP 3825 ; c, e, g, i of COP 3824).

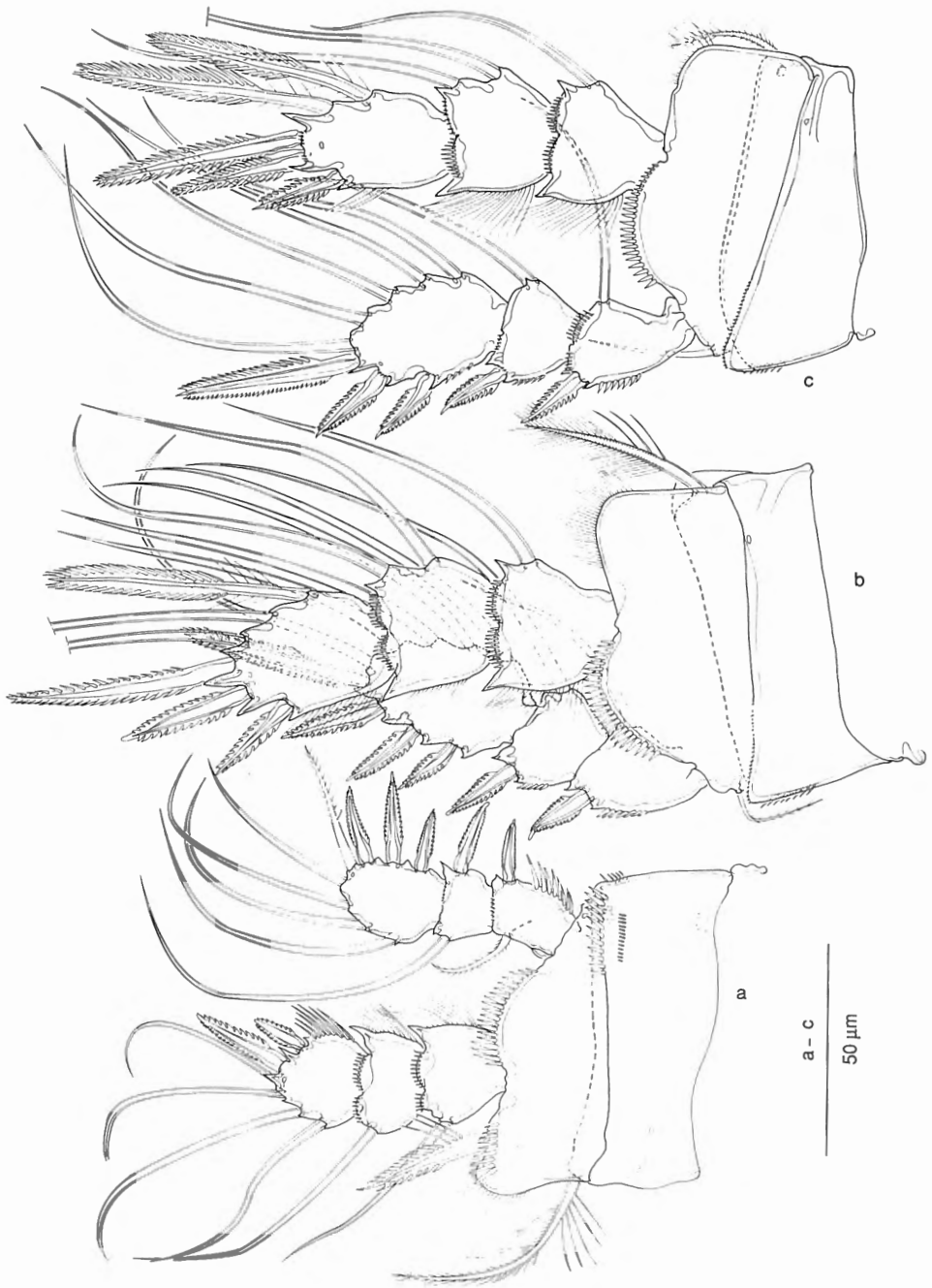

Fig. 4. — *Halicyclops caneki* n. sp., female — a, P1 — b, P3 — c, P4 (a of COP 3823, b,c of COP 3824, all illustrated in frontal view).

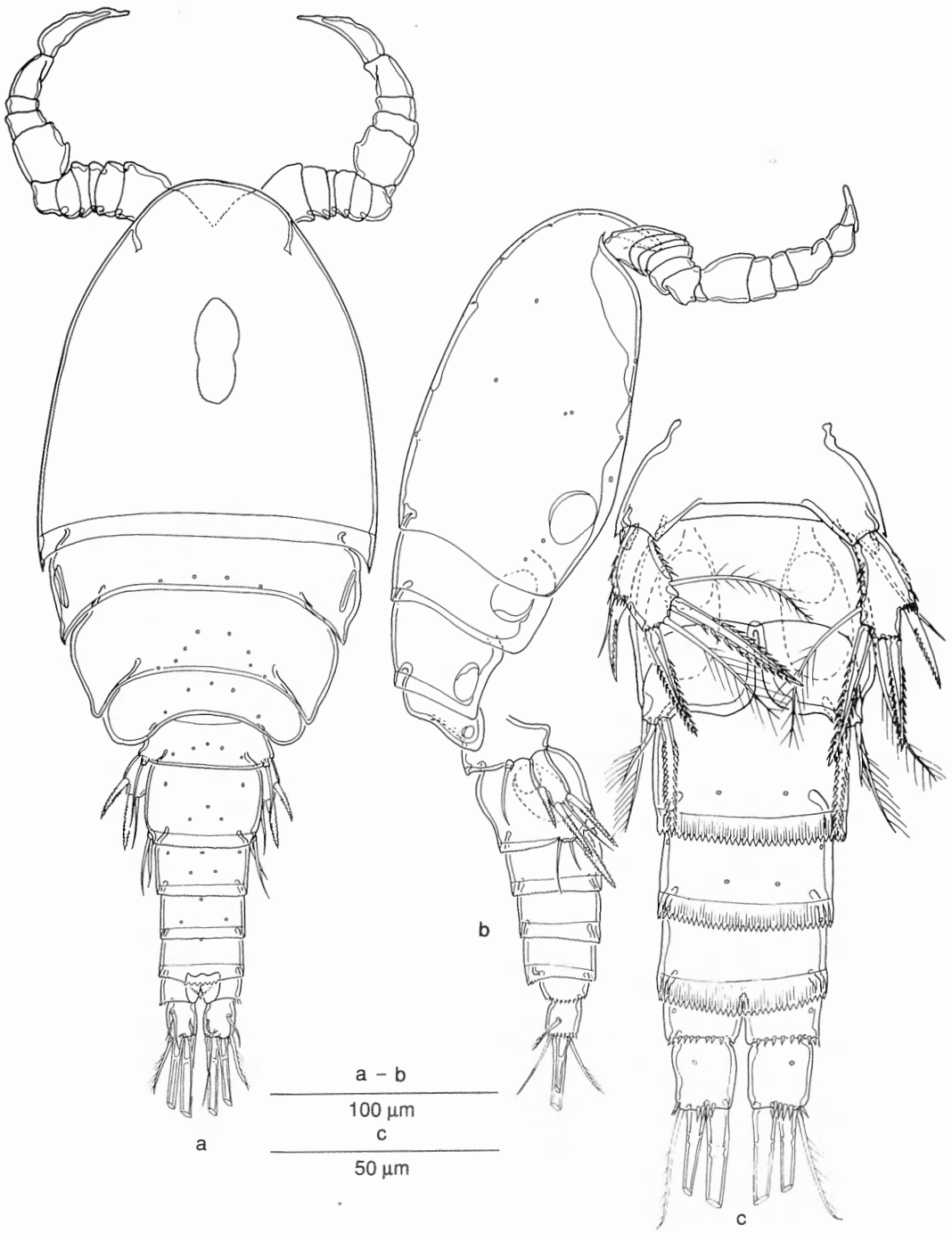

Fig. 5. — *Halicyclops caneki* n. sp., male — a, habitus, dorsal — b, habitus, lateral — c, abdomen and ultimate thoracic somites, ventral (a-c of COP 3825).

The only *Halicyclops* reported from Yucatán is *H. magniceps* (Lilljeborg, 1853) identified by WILSON (1936) on specimens found in samples from saline pools near Progreso (northern Yucatán). However, it is highly probable that Wilson misidentified his specimens (REID, 1990 ; ROCHA and HAKENKAMP, 1993) and it seems not inconceivable that the here described *Halicyclops caneki* is conspecific with Wilson's *H. magniceps* as Celestún and Progreso are two coastal localities in the same area with a comparable mangrove ecosystem.

The pools along the road Mérida-Progreso are still in excistence today, but changed drastically in the last decade because of badly engineered road constructions, affecting the natural water flow of the several basins. Sampling along the shores of these basins in the hope to find *Halicyclops* and to compare them with the Celestún Lagoon specimens, revealed no copepods at all (pers. observation).

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REFERENCES

HERBST, H.-V. (1955) — Cyclopoida Gnathostoma (Crustacea Copepoda) von der brasilianischen Atlantikküste. *Kieler Meeresforsch.*, **11(2)** : 214-229.

HERBST, H.-V. (1982) — Drei neue marine Cyclopoida Gnathostoma (Crustacea : Copepoda) aus dem nordamerikanischen Küstenbereich. *Gewässer und Abwässer*, **68/69** : 107-124.

HERBST, H.-V. (1987) — Zwei neue Cyclopoiden (Crustacea, Copepoda) von der Insel Barbados. Amsterdam Expeditions to the West Indian Islands, rep. 52. *Bijdr. Dierk.*, **57(1)** : 59-70.

HERRERA-SILVEIRA, J.A. (1994) — Nutrients from underground water discharges in a coastal lagoon (Celestun, Yucatan, Mexico). *Verh. Internat. Verein. Limnol.*, **25** : 1398-1401.

LOTUFO, G.R. and C.E.F. ROCHA, DA (1993) — Intertidal interstitial *Halicyclops* from the Brazilian coast (Copepoda : Cyclopoida). *Hydrobiologia*, **264** : 175-184.

PLEŞA, C. (1981) — Cyclopoides (Crustacea, Copepoda) de Cuba. *Résult. Expéd. biospéol. Cubano-Roum. Cuba*, **3** : 17-34.

REID, J.W. (1985) — Chave de indificaçao e lista de referëncias bibliograficas para as espécias continentais sulamericanas de vida livre da ordem Cyclopoida (Crustacea, Copepoda). *Biol. Zool. Univ. Sao Paulo*, **9** : 17-143.

REID, J.W. (1990) — Continental and coastal free-living Copepoda (Crustacea) of Mexico, Central America and the Caribbean Region. In : *Diversidad Biologica en la Reserva de la biosfera de Sian Ka'an, Quitana Roo, México*. NAVARRO L. and ROBINSON J.G. (eds.), Centro de Investigaciones de Quitana Roo (CIQRO) and Program of studies in tropical Conservation, University of Florida ; Chetumal (Quintana Roo) : 175-213.

ROCHA, C.E.F., DA (1983a) — *Halicyclops glaber*, a new cyclopoid copepod from the Pomonga River, Brazil, with comments on *Halicyclops korodiensis* Onabamiro, 1952. *J. Crust. Biol.*, **3(4)** : 636-643.

ROCHA, C.E.F., DA (1983b) — A new species of *Halicyclops* (Copepoda : Cyclopoida) from the Amazon Basin, Brazil. *Acta amazon.*, **13(5-6)** : 937-943.

ROCHA, C.E.F., DA (1984) — Four new species of *Halicyclops* Norman, 1903 (Copepoda, Cyclopoida) from Brazil. *Hydrobiologia*, **119(2)** : 107-117.

ROCHA, C.E.F., DA and C.C. HAKENKAMP (1993) — New species of *Halicyclops* (Copepoda Cyclopidae) from the United States of America. *Hydrobiologia*, **259** : 145-156.

ROCHA, C.E.F., DA and T. ILIFFE (1993) — New cyclopoids (Copepoda) from anchialine caves in Bermuda. *Sarsia*, **78** : 43-56.

VALDÉS, D.S., J. TREJO, E. REAL (1988) — Estudio hidrológico de la Laguna Celestún, Yucatán, México, durante 1985 (Hydrological study of the Celestún Lagoon, Yucatán, México, during 1985. *Ciencias Marinas*, **14(2)** : 45-68.

WILSON, C.B. (1936) — Copepods of the cenotes and caves of the Yucatan Peninsula, with notes on cladocerans. *Carnegie Inst. Washington Publ.*, **457** : 77-88.