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A NEW, NEOTROPICAL SPECIES OF *ACANTHOCYCLOPS* (COPEPODA: CYCLOPOIDA: CYCLOPIDAE)

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Keywords: *Acanthocyclops*, Copepoda, Cyclopoida, taxonomy, Honduras, Mexico, neotropics

ABSTRACT

Acanthocyclops smithae, a new species of cyclopoid copepod and a member of the *A. vernalis-robustus* group, is described from Honduras and southeastern Mexico. The few previous records of species of *Acanthocyclops* in tropical latitudes apparently refer to isolated populations of a few widespread temperate species. *Acanthocyclops smithae* is the only known exclusively tropical member of the genus.

INTRODUCTION

Collections in northern Honduras and in Quintana Roo, Mexico yielded specimens of a previously unknown cyclopoid copepod belonging to the genus *Acanthocyclops*. The new species is described herein.

Species of the genus *Acanthocyclops* are primarily temperate in distribution. A review of records from tropical latitudes is provided.

MATERIALS AND METHODS

The specimens were fixed and stored in 70% ethanol, and transferred to glycerine and/or lactic acid for morphological examination. Dissected specimens were mounted in CMC-10 with a little chlorazol black E added. Drawings were made at magnifications of 600X or (with an oil immersion lens) 1000X, using a Wild M30 microscope fitted with a drawing tube. The material was deposited in the collections of the United States National Museum of Natural

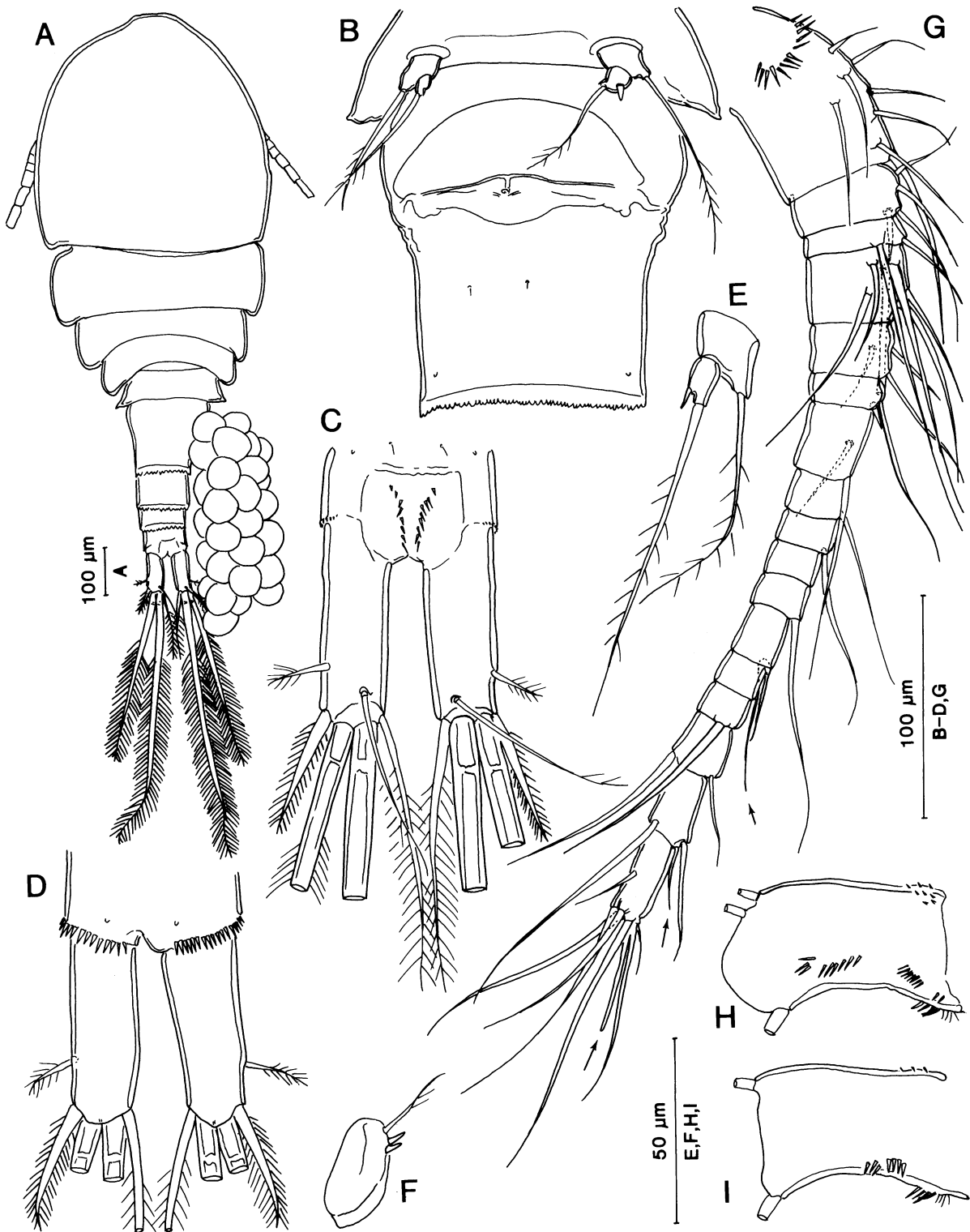


Fig. 1. *Acanthocyclus smithae* n. sp., female. A-D, F-I, holotype (USNM 288017), E, paratype (USNM 267447): A, habitus, dorsal; B, pediger 5 and genital double somite, ventral; C, anal somite and caudal rami, dorsal; D, anal somite and caudal rami, ventral; E, leg 5; F, leg 6; G, antennule (arrows indicate aesthetascs); H, antenna basipodite, caudal side; I, antenna basipodite, frontal side. Scales = 100 µm.

History (USNM), and the Zoölogisch Museum, Universiteit van Amsterdam (ZMA).

SYSTEMATIC DESCRIPTION

Cyclopidae Burmeister, 1834

Cyclopinae Dana, 1853, emend. Kiefer, 1927

Acanthocyclops Kiefer, 1927

Acanthocyclops smithae new species

Figs. 1A-I, 2A-K, 3A-D

Acanthocyclops smithae Suárez-Morales & Reid, 1998: 258, 261, tab. 1.

Acanthocyclops sp. *vernalis* (Fischer, 1853) group; Marten et al., 1994: 39.

Acanthocyclops sp. A; Suárez-Morales et al., 1996: 84, 95, 121, 253, fig. 98.

Acanthocyclops sp.; Suárez-Morales & Reid, 1998: 261.

?*Acanthocyclops vernalis* (Fischer, 1853) sensu Smith & Fernando, 1978: 2015-2017, 2019, 2023, figs. 14, 15, tabs. 1, 2; Smith & Fernando, 1980: 11, 18, fig. 8H-K, tab. 2; Fernando & Smith, 1982: 192; Collado et al., 1984: 115, tab. 3; Dussart & Defaye, 1985: 74 (partim); Reid, 1990: 179 (partim).

MATERIAL EXAMINED

Holotype, dissected ♀, mounted on slide (USNM 288017) from sample H21-2, fishpond adjacent to sample 21-1. Ethanol-preserved paratypes: 2 ♀♀ (USNM 267447), from sample H21-2; 1 ♀, sample H21-1, rice project (USNM 267446); 3 ♀♀, sample H21-3, rice project pond with *Lemna* (USNM 267448); 4 ♀♀, sample H21-3 (ZMA Co. 204350); 1 ♀, sample A3-20 (USNM 267449). All from Honduras: El Progre-so: near Puente (Bridge) Comandante, leg. G. G. Marten and associates, 1 December 1990.

Additional paratypes: 1 ♀♀ and 1 copepodid, ethanol-preserved (USNM 278048), from slow-moving, shallow (maximum depth 1.5 m), muddy stream beneath Puente Milagros near Chetumal, Quintana Roo, 18° 30' 25"N, 88° 23' 02"W, leg. R. Gasca and E. Suárez-Morales, 25 June 1996.

DESCRIPTION

Female: Length of holotype, excluding caudal setae 1.04 mm; lengths of paratypes from Honduras 0.94-1.13 mm (median 1.06 mm); of adult

paratype (USNM 278048) from Mexico 1.02 mm. Habitus (Fig. 1A) rather slender, posterolateral margins of pedigers 2-4 rounded, lateral corners of pediger 5 acute, slightly curved posteriorly and asymmetrical, ending in small papilla. Genital double somite (Fig. 1A, B) with anterior half swollen, tapering posteriorly. Semi-nal receptacle (Fig. 1B) with broad anterior and narrow posterior expansions. Posterior margins of genital double somite and following two urosomites with finely dentate hyaline membranes. Anal somite (Fig. 1C, D) with two dorsal rows of perianal spinules, and row of spinules along posterior margin, more ventral spinules stout. Anal operculum (Fig. 1C) undeveloped, with nearly straight free margin. Caudal rami (Fig. 1A, C, D) 3.0 times longer than broad, slightly longer than anal somite, without surface ornamentation. Length relationships of caudal setae as in Fig. 1A, especially dorsal seta about 1.1 times longer than caudal ramus; middle terminal setae stout, proximal 3/4 stiff, distal 1/4 slender and whip-like; all setae with fine plumage.

Antennule (Fig. 1G) composed of 17 segments. Number of setae (Arabic numerals), aethetasc (ae, indicated by arrows in figure), and spines (sp) on each segment (Roman numerals) as follows: I(8), II(4), III(2), IV(6), V(3), VI(1 + sp), VII(2), VIII(1), IX(1), X(0), XI(1), XII(1 + ae), XIII(0), XIV(1), XV(2), XVI(2 + ae), XVII(7 + ae). Segment I additionally with row of spinules. Segments XVI and XVII lacking hyaline membrane.

Antenna (Figs. 1H, I, 2A) composed of 5 segments. Coxopodite short, basipodite ornamented with several rows or groups of spinules and bearing three setae, endopodite segments 1-3 with 1, 9, and 7 setae respectively, medial margins with short spinules.

Labrum (Fig. 2B) with 10 blunt marginal teeth between rounded corners, and two groups of long spinules.

Paragnath (Fig. 2C) irregularly lobed, set with row of fine spinules near medial margin and row of three large spinules on small lobe.

Mandible (Fig. 2D) without surface ornament except subterminal transverse row of 4 small spinules near teeth; palp bearing two long plumose setae and one tiny naked seta.

Maxillule (Fig. 2E, F) with three large termi-

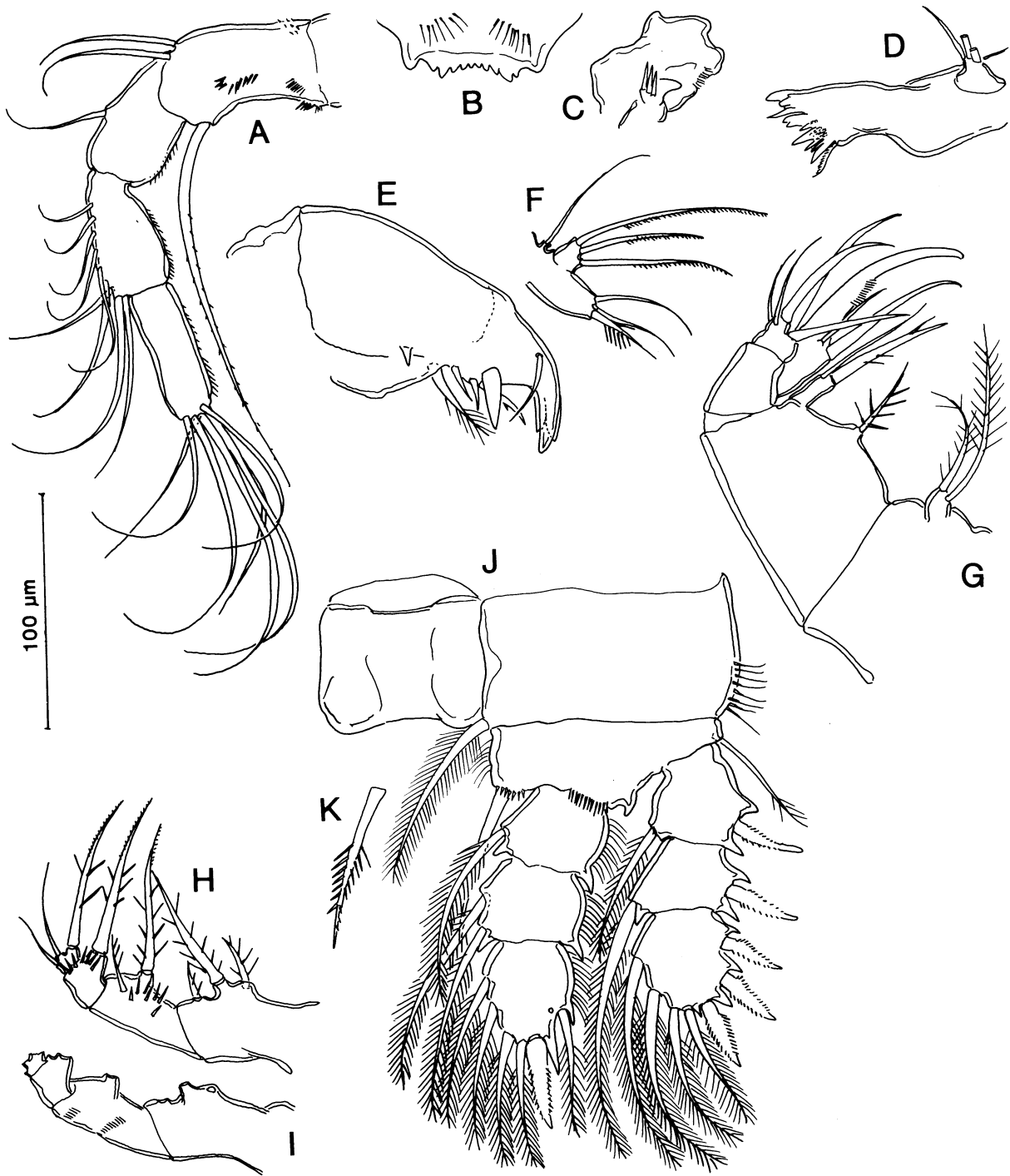


Fig. 2. *Acanthocyclops smithae* n. sp., female, holotype (USNM 288017): A, antenna, caudal side; B, labrum; C, paragnath; D, mandible; E, maxillule; F, maxillular palp; G, maxilla; H, maxilliped; I, maxilliped; J, leg 1 and coupler, frontal; K, spine of leg 1 basipodite medial expansion. Scale = 100 μ m.

nal teeth; palp lacking spinules on surface.

Maxilla (Fig. 2G), claw with row of fine teeth along middle of inner margin.

Maxilliped (Fig. 2H, I), proximal to distal segments bearing three, two, one, and three setae; segments 2 and 3 with several rows of spinules.

Swimming legs (Figs. 2J, K, 3) with three-segmented rami. Couplers of legs 1-3 without ornament; coupler of leg 4 with 1 transverse row and two irregular groups of spinules on caudal surface. Leg 1 with spine on medial expansion of basipodite, spine reaching to or slightly past distal end of endopodite 2. Spine formula fundamentally 3,4,4,4; terminal segments of leg 2 endopodite and of legs 3 and 4 exopodites and endopodites with several setae modified, variously spiniform and/or with short stiff setules. Leg 3 as leg 2 except slightly shorter setae and differences in modified setae. Leg 4 endopodite 3, 2.6 times longer than broad, bearing three broad spines, one narrower blunt spiniform seta, and one unmodified, finely plumose seta; all appendages shorter than segment. Number and distribution of modified setae in the Mexican and three Honduran adult paratypes exactly as in holotype. In several specimens from Honduras, the basic pattern of modified setae differs slightly (spines and setae not mentioned are exactly as in the holotype). Two females have all setae of the leg 2 endopodite and leg 3 exopodite unmodified. One has only the distalmost medial seta of leg 4 exopodite modified, and both medial setae of the leg 4 endopodite unmodified. One has the distalmost medial seta of leg 2 endopodite and the next distalmost seta of leg 3 exopodite modified. Three have the next distalmost medial seta of leg 3 endopodite modified. One has both medial setae of the leg 4 endopodite spiniform. Setae that may be modified are indicated by arrows in Fig. 3, with double arrows indicating the most common pattern of modification.

Leg 5 (Figs. 1B, E) composed of two segments, each with long plumose seta; distal segment also with small medial subterminal spine in most specimens. Holotype with distal segment of left leg enlarged, bearing stout accessory spine lateral to terminal seta. All other specimens with leg 5 as in Fig. 1E.

Leg 6 (Fig. 1F) consisting of ovoid plate bearing two spines and one plumose seta on dorsal

margin.

Paired egg sacs (Fig. 1A) long, broken in most specimens examined. Holotype with one complete sac bearing 34 eggs.

Color in life unknown.

Male: Unknown.

Type-locality: Fishpond at rice project, near Puente Comandante, town of El Progreso, Honduras, approximately 15°20'N, 87°45'W.

Etymology: The specific name recognizes Kristin E. Smith, for her valuable work with C. Herbert Fernando on the free-living Copepoda of Cuba.

Remarks: Several species of *Acanthocyclops* have been described since the brief review by Reid et al. (1991), and some of these were not included in the world key of Einsle (1996). All the recently described species are easily distinguished from *A. smithae*. Three of the recently described species (*A. balcanicus* Naidenov & Pandourski, 1992, *A. iskrecensis* Pandourski, 1992, and *A. radevi* Pandourski, 1993, all from Bulgaria) are members of the *kieferi-reductus*-group, with 11-segmented antennules and 2-segmented legs 1 and 2 endopodites. *Acanthocyclops pennaki* Reid, 1992, from Colorado, U.S.A., has 3-segmented swimming legs, but the antennule is composed of 12 segments. *Acanthocyclops parasensitivus* Reid, 1998, from the eastern U.S.A. shares with *A. smithae* an antennule of 17 segments and swimming legs all with rami of 3 segments, but differs in lacking a seta on each of legs 1-4 exopodite 1, in possessing a somewhat produced anal operculum and a transverse row of spinules on each caudal ramus, as well as in other respects. *Acanthocyclops tokchokensis* Kim & Chang, 1991, from Korea, has a 17-segmented antennule and 3-segmented rami of the swimming legs, but differs from *A. smithae* in having the caudal ramus haired on its medial surface, spine formula 2,3,3,3, no modified setae on legs 2-4, the antennule slightly longer than the cephalothorax, and other characters.

Acanthocyclops smithae is clearly a member of the *vernalis-robustus* complex. Of the non-American members of this complex, *A. smithae* falls in the couplet in the key of Einsle (1996) which distinguishes *A. cephalenus* Pesce, 1980

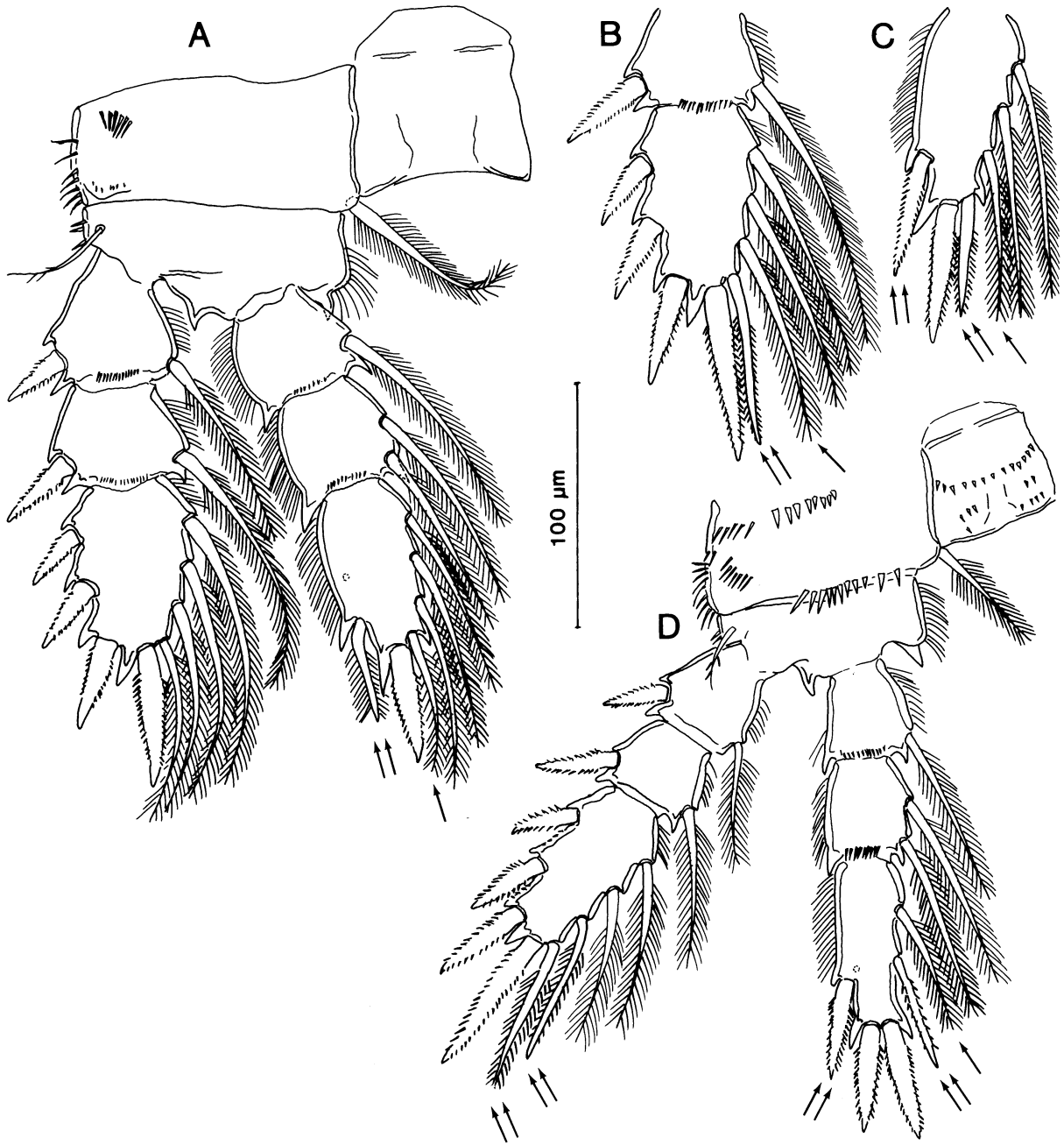


Fig. 3. *Acanthocyclops smithae* n. sp., female, holotype (USNM 288017): A, leg 2 and coupler, caudal; B, leg 3 exopodite 2 and 3; C, leg 3 endopodite 3; D, leg 4 and coupler, caudal. Scale = 100 μ m.

from *A. gordani* Petkovski, 1971. Among other differences from *A. smithae*, both these species have spine formula 2,3,3,3, no modified setae on the swimming legs, and a short leg 4 endopodite 3 (1.60 and about 2 times longer than broad, respectively), with slender terminal spines. *Acanthocyclops tokchokensis*, also a member of the *vernalis-robustus* complex, differs as previously discussed.

The taxonomy of the North American members of the *vernalis-robustus* complex is incompletely worked out, in spite of several recent efforts. Einsle (1992) provided illustrations of *A. carolinianus* (Yeatman, 1944) and figures of other, unnamed members of the complex from North America. In Wisconsin, Dodson (1994) distinguished six morphological forms: two taxa referable to the putatively cosmopolitan *A. vernalis* (Fischer, 1853) and *A. robustus* (G. O. Sars, 1863); a "warm-water form" referred to *A. robustus* sensu lato; *A. brevispinosus* (Herrick, 1884); and two additional, unnamed morphs. Dahms & Fernando (1997) redescribed *A. brevispinosus* and confirmed the observations by Dodson (1994) regarding its peculiar species characters. These characters, including the perianal patches (rather than the row found in most other species) of spinules, the spiniform outer terminal caudal seta, and the four large spatulate spines of leg 4 exopodite 3, easily serve to distinguish *A. brevispinosus* from *A. smithae*. *Acanthocyclops smithae* bears resemblances to some of the other named and unnamed North American taxa, particularly to the *Acanthocyclops* sp. described by Einsle (1992) from Arizona in regard to the nature of the modified setae on leg 4. However, *A. smithae* differs from this and all other previously described taxa of the *vernalis-robustus* group with respect to the short caudal ramus with its stout middle terminal setae, and the extremely short, stout terminal spines of leg 4 endopodite 3.

Acanthocyclops smithae is exactly congruent with the "*Acanthocyclops vernalis*" reported from Cuba by Smith & Fernando (1978, 1980), as far as can be determined from their illustrations. Unfortunately, the Cuban specimens are unavailable (C. H. Fernando, pers. comm. to J. W. Reid, September 1997). Because of the importance of microcharacters in distinguishing taxa of *Acanthocyclops*, especially the *vernalis-robustus* complex, we

are unable to make a final decision as to the identity of the Cuban animals at this time.

Acanthocyclops smithae is the only known exclusively tropical member of its genus. Species of *Acanthocyclops* occur mainly in temperate and subarctic Eurasia and North America, and southern South America, the Falkland Islands, Australia, and the Antarctic (Einsle, 1996). There are a few records of the widespread *A. vernalis* sensu lato and *A. robustus* sensu lato from tropical localities. *Acanthocyclops vernalis* has been recorded from North Africa, Thailand, Australia, and Andean Bolivia and Peru, and *A. robustus* has been reported from North Africa and from Andean Ecuador, Bolivia and Peru (reviewed by Dussart & Defaye, 1985 and Reid, 1985). Of course, in view of advances in understanding the *vernalis-robustus* complex, all but the most recent records of either species may well represent other, still unrecognized taxa.

In Mexico, most records of *Acanthocyclops* species are from the northern and central states, where the copepod fauna is predominantly temperate North American (Suárez-Morales & Reid, 1998). *Acanthocyclops vernalis* has been recorded from Coahuila (Zamudio-Valdéz, 1991), Michoacán (Osorio-Tafall, 1944), and Nuevo León, Tamaulipas, San Luis Potosí, and Guerrero (Comita, 1951). *Acanthocyclops robustus* has been reported from the Distrito Federal and State of México (Lindberg, 1955), Nuevo León (López-Ceniceros, 1995), Puebla and San Luis Potosí (Osorio-Tafall, 1943; Lindberg, 1955), and Aguascalientes (Dodson & Silva-Briano, 1996). The North American *A. exilis* (Coker, 1934) was found in Aguascalientes by Dodson & Silva-Briano (1996).

Acanthocyclops smithae has been collected from a range of shallow epigeal habitats including a small fishpond, a ricefield, and a stream. These are typical situations for a member of the *vernalis-robustus* group.

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