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, from Louisiana

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THE GENUS *METACYCLOPS* (COPEPODA: CYCLOPOIDA)  
PRESENT IN NORTH AMERICA: *M. CUSHAE*,  
NEW SPECIES, FROM LOUISIANA

Janet W. Reid

ABSTRACT

The cyclopoid copepod *Metacyclops cushae*, new species, was collected from temporarily water-filled depressions in greater New Orleans, Louisiana. The species possesses a combination of characters unique in the genus: the antennule of 11 articles, legs 1-4 spine formula 3,4,3,3, leg 4 endopodite article 2 with only 1 terminal spine, legs 1-4 couplers lacking ornament, and medialmost terminal caudal seta shorter than lateralmost terminal caudal seta. This is the first confirmed published report of the genus *Metacyclops* from the North American continent.

The genus *Metacyclops* Kiefer, 1927, sensu Lindberg, 1961, includes 51 named species and subspecies. Forty-seven currently recognized taxa were listed in a world key by Herbst (1988). Recently described species and a subspecies not included in Herbst's key are *M. postojnae* Brancelj, 1987, from Yugoslavia, *M. janstocki* Herbst, 1990, from Antigua, and *M. leptopus totaensis* Reid, Molina, and Fukushima, 1990, from Colombia. *Microcyclops pseudo-anceps* Green, 1962, from Nigeria is clearly a *Metacyclops*, as was suggested but not formally transferred by Dussart and Defaye (1985). A new, as yet undescribed Australian species was mentioned by Timms and Morton (1988).

The genus is tropical and temperate in distribution. Europe is known to harbor 10 species and subspecies, Asia eight, Africa 14, New Zealand and Australia together four, South America 14, Central America (Nicaragua) two, and the Antilles eight; several species have been recorded from more than one continent. In view of this broad distribution, it is surprising that no member of the genus is currently recognized as inhabiting North America.

There are two more or less equivocal published records, and one unpublished record from this continent. The earliest record is by Herrick (1895), who supplied a description and two figures of a species from Minnesota that he ascribed to *Cyclops* (now *Metacyclops*) *gracilis* Lilljeborg, 1853, known from Eurasia and Africa. The figure of leg 5 of a female (Herrick, 1895: plate XIX, fig. 11) clearly represents a *Metacyclops*. However, Herrick's species cannot have been *M. gracilis*, since the latter has

the antennule composed of 11 articles rather than the 12 reported by Herrick for the Minnesota form. Other salient features of Herrick's description include the long cylindrical distal (free) article of leg 5, about three times longer than broad as measured from Herrick's figure; and the medialmost terminal caudal seta longer than the lateralmost terminal caudal seta. These characters and the number of articles in the antennule distinguish the Minnesota species from the previously undescribed species reported in this article from Louisiana (see description below). Herrick's description is insufficiently detailed to permit either identification with a known species, or naming as a species new to science. Since his collection no longer exists, the Minnesota species must remain in limbo until additional material is collected. A second report of *M. gracilis*, from Chesapeake Bay near the mouth of the Patapsco River at a salinity of 10.4‰, was made, without description, by Wilson (1932). Wilson's record was later questioned by H. C. Yeatman (personal communication to Burrell and Zwerner, 1972), who suggested that Wilson might have been referring to a species of *Mesocyclops*. The specimens examined by Wilson were apparently not deposited, as was most of Wilson's collection, in the U.S. National Museum (now the National Museum of Natural History), and his record cannot be confirmed. In an unpublished thesis, Davis (1979) reported *M. gracilis* from a cave in Texas; the determination was made by H. C. Yeatman. Drawings of Davis' specimens sent to me by Yeatman (personal communication to J. Reid, 1991) show several slight differences from *M. gracilis*, and the Texas

population may be a previously undescribed species.

The dearth of recent published records of *Metacyclops* in North America probably results from inadequate collecting in suitable nonplanktonic habitats. An equally important factor is likely to be the exclusion of the genus from regional keys. Later authors apparently followed Marsh (1910), who included Herrick's record of *Cyclops gracilis* in his treatment of *C.* (now *Microcyclops*) *varicans* G. O. Sars, 1863. It is very possible that some later North American records of *M. varicans* refer to species of *Metacyclops*. In *M. varicans*, the subterminal medial spine of the free article of leg 5 is continuous with the article rather than distinct as in species of *Metacyclops*, but this difference is not always easily seen.

This paper describes the species of *Metacyclops* found in Louisiana. The specimens were collected by Dr. Gerald G. Marten as part of a long-term investigation of local species of cyclopoid copepods as potential agents for biocontrol of mosquito larvae (Marten, 1989). Samples were fixed and stored in 70% ethanol. For microscopic examination, specimens were transferred to a solution of 70% ethanol-10% glycerin, allowed to evaporate to nearly pure glycerin, and examined in this medium. The permanent mount was made in commercial polyvinyl lactophenol medium with chlorazol black E added. Specimens were drawn at magnifications of 400 $\times$ , 600 $\times$ , and 1,000 $\times$ , the latter with an oil immersion lens, using a camera lucida mounted on a Wild M20 microscope. Specimens were deposited in the collections of the Division of Crustacea, Department of Invertebrate Zoology, National Museum of Natural History (USNM).

Cyclopidae Burmeister, 1834  
*Metacyclops* Kiefer, 1927,  
 sensu Lindberg, 1961  
*Metacyclops cushae*, new species  
 Figs. 1–4

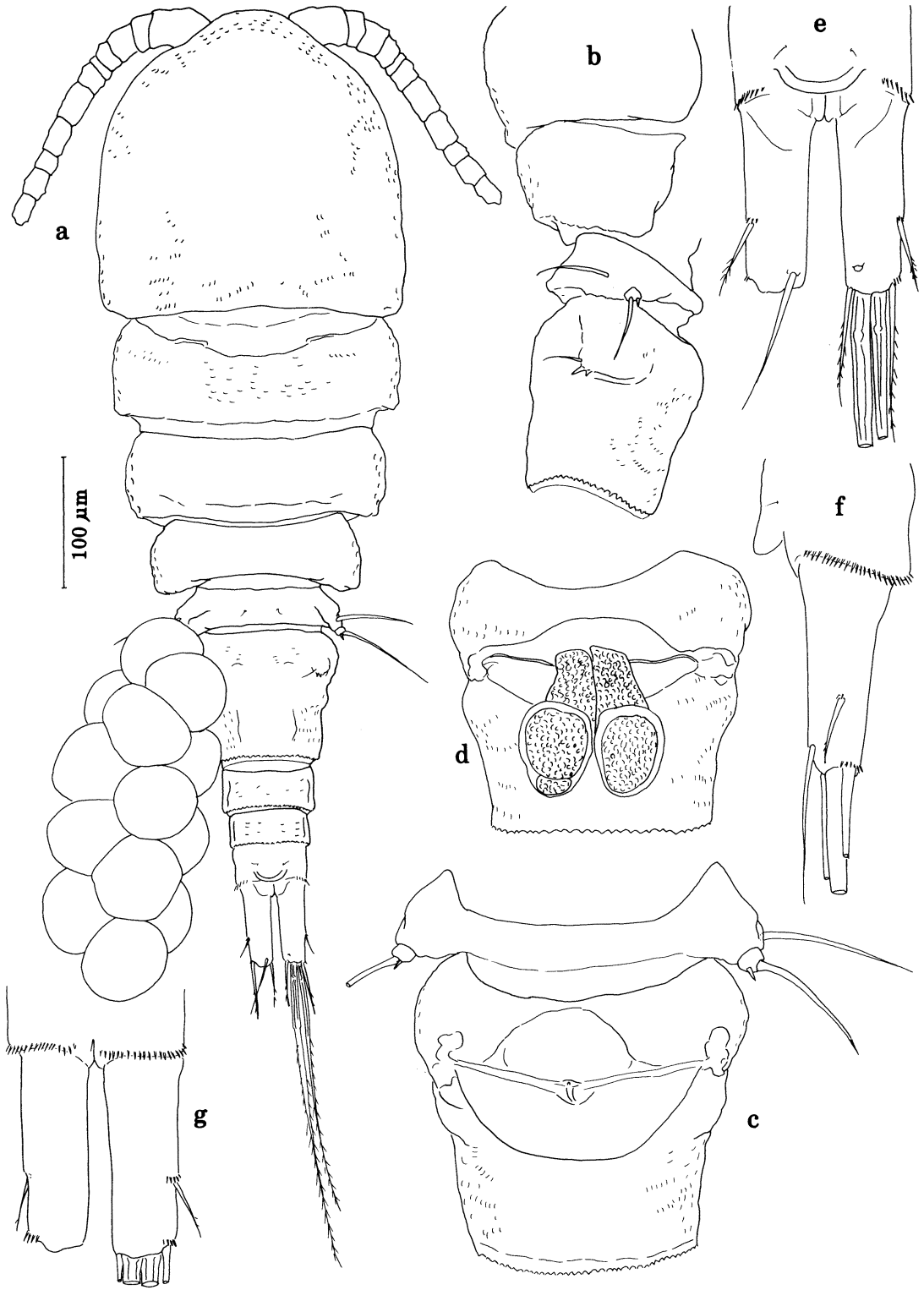
*Material Examined.*—Holotype ♀, USNM 250953; allotype ♂, USNM 250954, Sample 67, isolated temporary pool in swale in grassy area in front yard of house, Route 6, Box 147D, eastern New Orleans Parish, Louisiana, 6 June 1988. Paratypes: 1 ♀, dissected on slide; 7 ♀♀, 1 copepodid, Sample 67, USNM 250955; 3 ♀♀, Sample 68, temporarily water-filled swale in grassy area in front yard of house, Route 6, Box 275, eastern New Orleans Parish, Louisiana, 8 June 1988, USNM 250956; 5 ♀♀, 1 ♂, 2 copepodids, Sample 71A, temporarily water-filled shallow ditch in Joe Brown Park, New Orleans Parish, Louisiana, 1988, USNM 250957. Collected by G. G. Marten. All undissected specimens preserved in ethanol.

*Type Locality.*—Swale, Sample 67.

*Description of Female.*—Length of holotype, excluding caudal setae 716  $\mu\text{m}$ ; range of lengths of paratypes 592–824  $\mu\text{m}$  (median = 692  $\mu\text{m}$ ). Body widest at prosomite 1 in dorsal view (Fig. 1a). Most somites with short irregular rows of narrow ovoid pits. Posterior lateral margin of prosomite 4 and entire posterior hyaline membranes of genital segment and succeeding 2 urosomites irregularly serrate. Genital segment (Fig. 1a–d), anterior two-thirds expanded laterally, length slightly less than breadth; seminal receptacle with convex anterior and posterior expansions, these less developed in immature females (Fig. 1d); lateral canals almost horizontal. Anal somite (Fig. 1a, e–g) with small spines along nearly all of posterior margin; anal operculum convex, sclerotized, reaching nearly to posterior end of anal somite. Caudal ramus (Fig. 1a, e–g) 3 times longer than broad; lateral seta inserted at distal three-fifths of ramus. Medial surface of ramus naked; few small spines on ramus proximal to bases of lateral seta and lateralmost terminal seta. Lengths of caudal seta of holotype in  $\mu\text{m}$ : lateral 21, dorsal 46, medialmost to lateralmost terminal 39, 232, 188, 44. Terminal and lateral setae with extremely fine setules, these closely appressed to setae in preserved specimens. Oviparous females with 10–21 eggs each side. Spermatophores (Fig. 1d) ovoid.

Antennule (Figs. 1a, 2a) shorter than prosomite 1; of 11 articles; posterior surfaces

Fig. 1. *Metacyclops cushae*, new species, female; a–c, e–g, holotype, USNM 250953; d, paratype from Sample 71A, USNM 250957: a, habitus, dorsal; b, posterior prosome and anterior urosome, right lateral; c, leg 5 and genital segment, ventral; d, genital segment of immature female bearing spermatophores, ventral; e, anal somite and caudal rami, dorsal; f, anal somite and caudal ramus, right lateral; g, anal somite and caudal rami, ventral. Scale refers to Fig. 1a only; Fig. 1a, b drawn at 400 $\times$ ; Fig. 1c–g drawn at 600 $\times$ ; details of Fig. 1c, e–g confirmed at 1,000 $\times$ .



of articles 6 and 7 with shallow transverse grooves; article 5 with spine; sensory hair on article 9 reaching past midlength of article 10; no hyaline membrane visible on terminal articles. Antenna (Fig. 1b), exopodite seta short, slender, not reaching past distal end of article 3; article 1 with 3 groups of small spines. Labrum (Fig. 1c) with 9 teeth between rounded lateral protrusions. Mandible and maxillule (not figured) similar to corresponding structures of *M. leptopus totaensis* Reid, Molina, and Fukushima, 1990. Maxilla (Fig. 1d) short and stout, with few teeth on claw. Maxilliped (Fig. 1e) short and stout, lacking surface ornament, with only 2 setae on article 1.

Swimming legs 1–4 (Figs. 2f, 3) with both rami of 2 articles. Spine and seta formulae of distal articles of exopodites 3,4,3,3 and 5,5,5,5, respectively. Setae of distal article of endopodite of leg 1 slightly shorter or longer than spine; setae of distal articles of endopodites of legs 2–4 reaching well past spines (Fig. 3). Basipodite of leg 1 with lobed medial expansion bearing group of hairs, and spine reaching midlength of distal article of endopodite; terminal spine of endopodite long, stout. Leg 3 similar to leg 2 except distal article of exopodite of leg 3 with 3 rather than 4 spines. Leg 4, basipodite with medial expansion deeply sculptured; medial surface of endopodite 1 notched; endopodite 2 about 1.5 times longer than broad, length of single terminal spine four-fifths length of terminal article. Couplers of all swimming legs lacking ornament.

Leg 5 (Fig. 1a–c) consisting of 1 fused and 1 free article; free article broader than long. Spiniform setae of fused and free articles subequal in length; medial terminal spine of free article slightly shorter than article. Leg 6 (Fig. 1b) bearing 1 seta and 2 spines.

*Description of Male.*—Length of each specimen 572  $\mu\text{m}$ . Habitus (Fig. 4a) much as female. Antennule (Fig. 4a) geniculate, apparently of 16 articles because of complete fusion of former articles 16 and 17; article 1 with 3, article 4 with 1 slender esthetasc, setation similar to that of *M. gracilis* (cf. Gurney, 1933: fig. 1806). Leg 5 (Fig. 4b) similar to that of female except medial spine of free article about twice length of article. Leg 6 (Fig. 4) with 2 spiniform setae, ventral seta slightly shorter and stouter than dorsal

seta, neither seta reaching posterior margin of succeeding somite.

*Etymology.*—Named for Mary Cush, in grateful recognition of her services as technical assistant to Gerald Marten, and in particular for her original and entertaining packing methods.

*Comparisons.*—*Metacyclops cushae* does not match any species in the key of Herbst (1988), because of the combination of these characters: antennule of 11 articles, legs 1–4 spine formula 3,4,3,3, leg 4 endopodite article 2 with only 1 terminal spine, legs 1–4 couplers lacking ornament, and medialmost terminal caudal seta shorter than lateralmost terminal caudal seta. Of the four described species and subspecies that were not included in Herbst's key, *M. postojnae* differs in having the spine formula 3,4,4,3, and the distal article of the endopodite of leg 4 with a medial terminal seta in addition to a terminal spine; *M. pseudo-anceps* has the spine formula 3,4,4,3, two terminal spines on the distal article of the leg 4 endopodite, and lacks a spine on the medial expansion of the basipodite of leg 1; and *M. janstocki* and *M. leptopus totaensis* each have the antennule of 12 articles, spine formula 3,4,4,3, and the leg 4 endopodite with 2 terminal spines, among other differences. The most morphologically similar species seems to be *M. denticulatus* Dussart and Frutos, 1985 (1986), from Argentina. *Metacyclops denticulatus* resembles *M. cushae* in the structure of leg 5, body pitting, anal operculum, serrate urosomal membranes, antennule of 11 articles, proportions of the caudal ramus, and the leg 4 endopodite with 1 terminal spine. A principal difference is the spine formula, which is 3,4,4,3, in *M. denticulatus*; the setal formulae of the two species are identical (based on information supplied by B. H. Dussart, personal communication to J. Reid, 1991; and on examination of a paratype female specimen of *M. denticulatus*, USNM 250982). In addition, in *M. denticulatus*, the leg 1 basipodite medial expansion is less pronounced and less lobate than in *M. cushae*; in the former species the setae of the distal article of the endopodite of leg 4 are shorter, extending only slightly past the end of the terminal spine; and the leg 4 coupler is ornamented with transverse rows of hairs on its posterior surface.

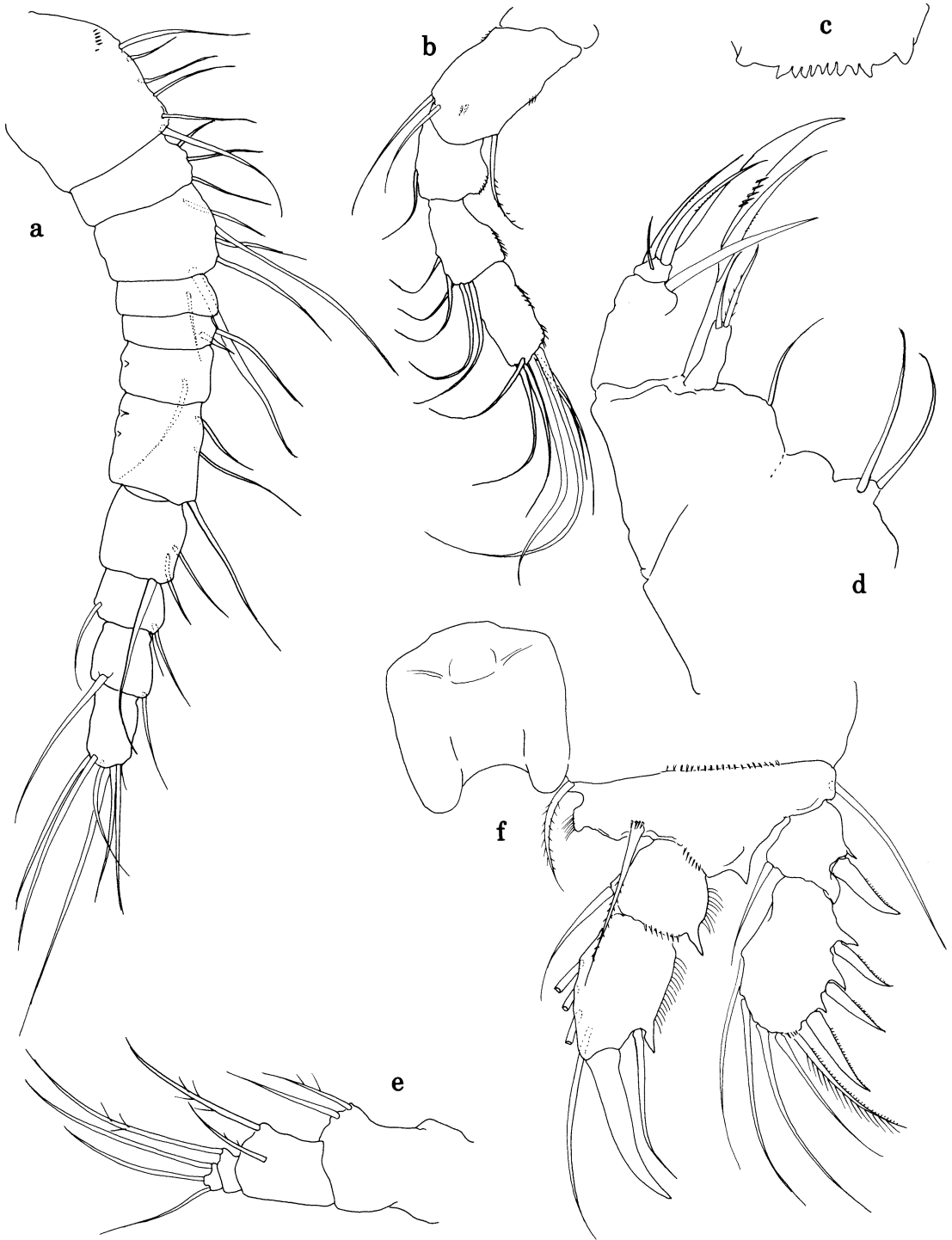


Fig. 2. *Metacyclops cushae*, new species, female; dissected and mounted paratype from Sample 67, USNM 250955: a, antennule; b, antenna; c, labrum; d, maxilla; e, maxilliped; f, left leg 1 and coupler, anterior. Plumage of most setae of leg 1 not indicated. Fig. 2a, b drawn at 600 $\times$ ; Fig. 2c–f drawn at 1,000 $\times$ ; details of Fig. 2a, b confirmed at 1,000 $\times$ .



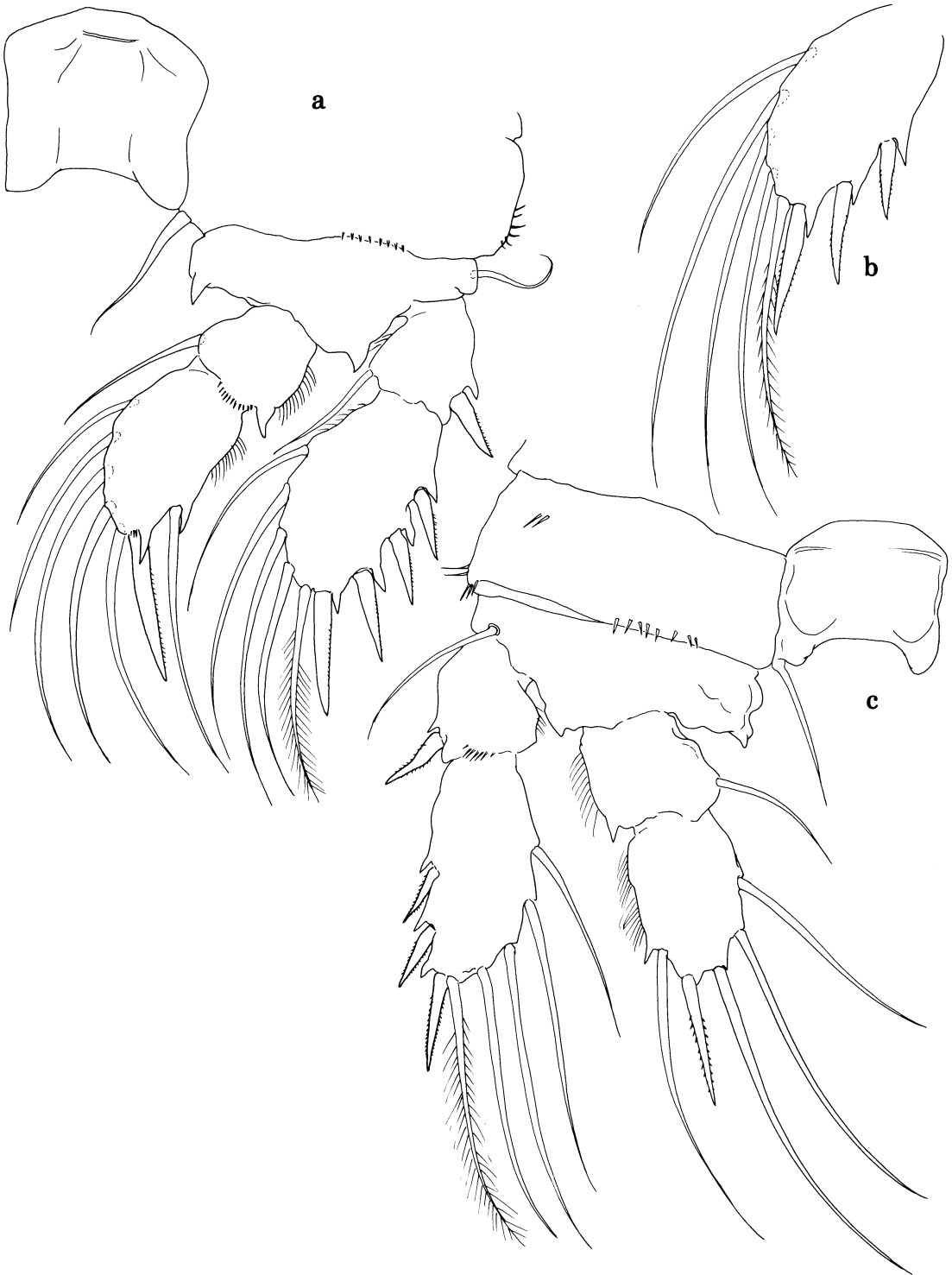


Fig. 3. *Metacyclops cushae*, new species, female; dissected and mounted paratype from Sample 67, USNM 250955: a, left leg 2 and coupler, anterior; b, left leg 3, distal article of exopodite, anterior; c, left leg 4 and coupler, posterior. Plumage of most setae not indicated. Fig. 3a-c drawn at 1,000 $\times$ .

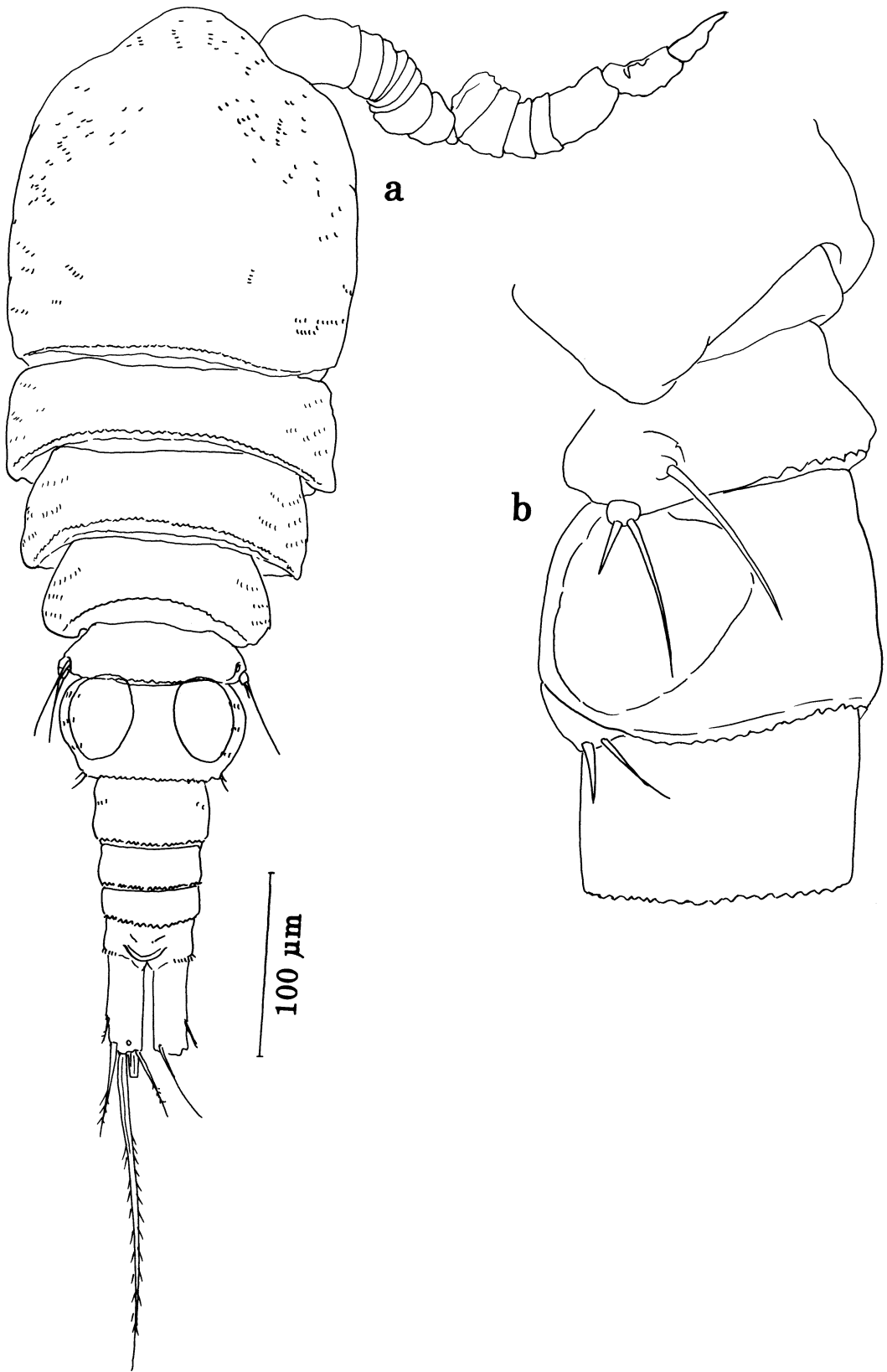


Fig. 4. *Metacyclops cushae*, new species, male allotype, USNM 250954: a, habitus, dorsal; b, posterior prosome and anterior urosome, left lateral. Scale refers to Fig. 4a only; Fig. 4a drawn at 400 $\times$ ; Fig. 4b drawn at 600 $\times$ .



## ACKNOWLEDGEMENTS

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