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METACYCLOPS LEPTOPUS TOTAENSIS, NEW SUBSPECIES (CRUSTACEA: COPEPODA) FROM LAGO DE TOTA, COLOMBIA

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Abstract.—*Metacyclops leptopus totaensis,* a new subspecies of cyclopoid copepod from the plankton of Lago de Tota, a high-altitude Andean lake in Colombia, differs from other members of the *leptopus*-complex in the ornamentation of the leg 1 coupler, and in the proportions of the appendages of the free article of leg 5.

Two planktonic species of copepods (Crustacea) inhabit Lago de Tota, Colombia. Lago de Tota is among the northernmost known habitats of the calanoid *Boeckella gracilis* (Daday), which is distributed through the Andes southwards to Tierra del Fuego, and in the Argentine Pampas; Gaviria (1989) supplied several new records from Colombia, and described the morphology of Colombian populations of this species. The other planktonic copepod in Lago de Tota is a previously undescribed subspecies of the *Metacyclops leptopus*-complex (Cyclopoida). Since no member of this group has yet been completely described, we furnish detailed figures to facilitate future evaluation of members of this complex.

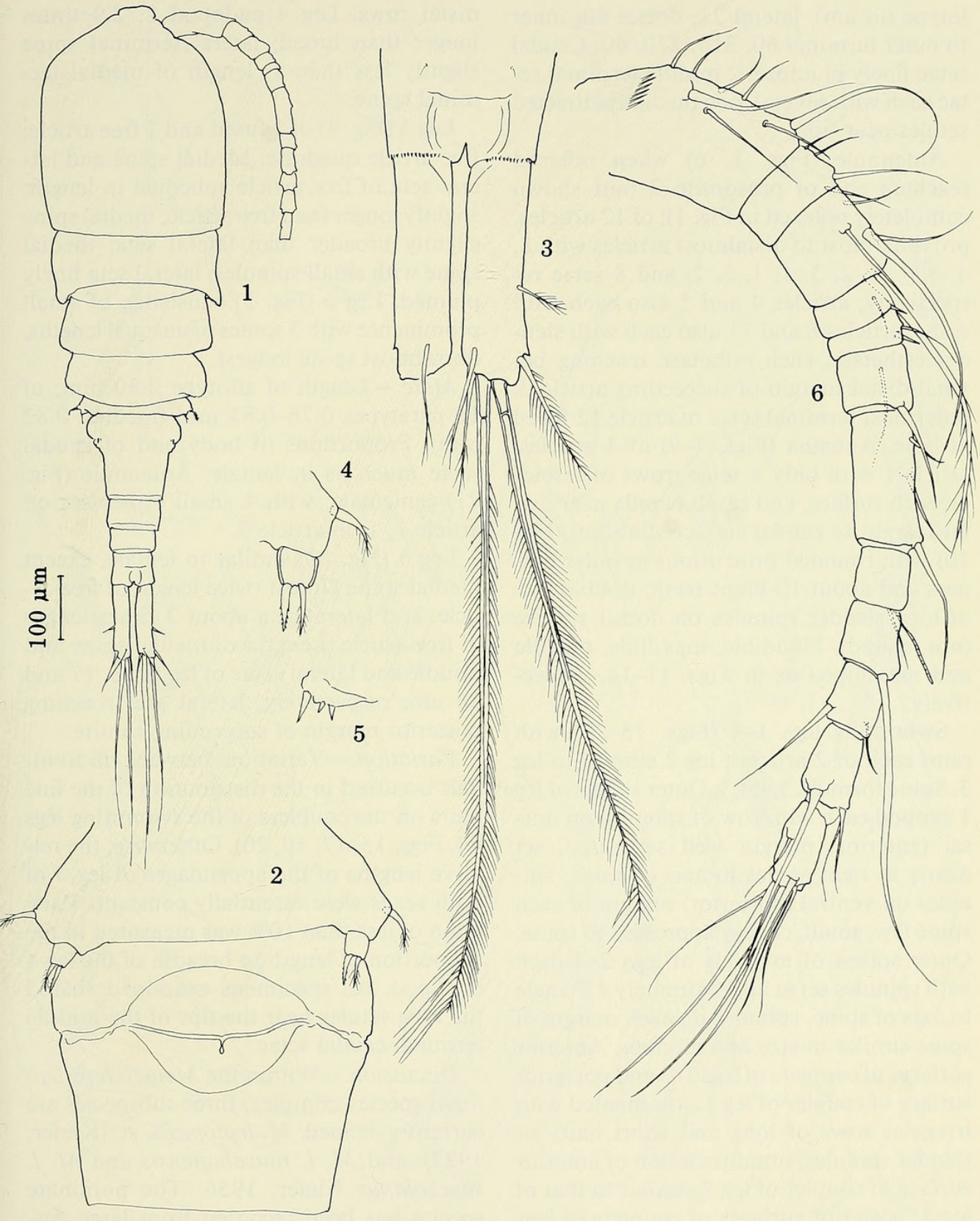
Lago de Tota is situated in the páramo region of the Colombian Andes, at 5°30′S, 72°50′W; its elevation is 3015 m, area about 56 km^2, mean depth 34 m and maximum depth 67 m. Annual ambient temperatures range from 0°–20°C, conductivity 70–90 μS, and pH values 7–9.4. Except for its large size, physical and chemical characteristics of Lago de Tota are typical of waters in the páramo region (Gaviria 1989).

Samples of zooplankton were fixed in formalin and transferred to a solution of 70% ethanol for long-term storage. Specimens were slowly evaporated to glycerin and examined in this medium, or in commercial polyvinyl lactophenol with chlorazol black E added. Drawings were made with the aid of a camera lucida at magnifications of 400× or 600×; details were confirmed under oil immersion at 1000×.

Cyclopidae Sars, 1913
Metacyclops Kiefer, 1927,
sensu Lindberg, 1961
Metacyclops leptopus totaensis,
new subspecies
Figs. 1–22

Material.—Holotype ♀, USNM 242365; allotype ♂, USNM 242367; paratypes: 3 ♀ and 1 ♂, dissected on slides, and 20 ♀ and 10 ♂, undissected, USNM 242366; all from Lago de Tota, col. 1985 by JAMA. All undissected specimens alcohol-preserved. Additional paratype material in personal collection of JAMA.

Female.—Length of holotype, excluding caudal setae 1.03 mm; lengths of 10 paratypes 0.90–1.08 mm (median 1.02 mm). Egg-bearing females with 1 or 2 eggs each side. Body widest at prosomite 1 in dorsal view (Fig. 1). Outer margins of posterior 2 prosomites slightly crenulate. Genital segment (Fig. 2) expanded anteriorly, length slightly less than breadth; seminal receptacle ovoid, lateral canals almost horizontal. Caudal rami (Fig. 3) 4 times longer than broad; lateral seta inserted slightly distal to midlength. Lengths of caudal setae of ho-



Figs. 1–6. *Metacyclops leptopus totaensis,* female: 1, Habitus, dorsal; 2, Urosomite 1 and genital segment, ventral; 3, Caudal rami, dorsal; 4, Leg 5; 5, Leg 6; 6, Antennule. Scale applies to Fig. 1 only; remaining figures not to same scale.

lotype (in μm): lateral 21, dorsal 60, inner to outer terminal 60, 315, 270, 60. Caudal setae finely plumose, 2 middle terminal setae each with several long medially-directed setules near tip.

Antennule (Figs. 1, 6) when reflexed reaching end of prosomite 2 (not shown completely reflexed in Fig. 1); of 12 articles, proximalmost to distalmost articles with 8, 4, 5, 1, 1, 2, 3, 1, 1, 2, 2, and 8 setae respectively; articles 4 and 5 also each with spine; articles 8 and 11 also each with slender esthetasc, each esthetasc reaching beyond distal margin of succeeding article; 2 outermost terminal setae of article 12 fused at base. Antenna (Figs. 7–9) of 4 articles; article 1 with only 2 setae, rows of setules on each surface, and small papilla near distal margin of caudal surface. Labrum (Fig. 10) with rounded protrusions at outer corners and about 10 blunt teeth; double row of long slender spinules on dorsal surface (not figured). Mandible, maxillule, maxilla and maxilliped as in Figs. 11–14, respectively.

Swimming legs 1–4 (Figs. 15–20) with rami each of 2 articles; leg 2 similar to leg 3. Spine formula 3,4,4,3. Outer spines of leg 1 exopod each with row of spinules on dorsal (anterior) margin well separated, set nearly at right angles to axis of spine; spinules on ventral (posterior) margin of each spine few, small, closely appressed to spine. Outer spines of exopods of legs 2–4 each with spinules set at approximately 45° angle to axis of spine, spinules on each margin of spine similar in size and number. Anterior surfaces of couplers of legs 1–3 and posterior surface of coupler of leg 1 ornamented with irregular rows of long and short hairs or slender spinules; ornamentation of anterior surface of coupler of leg 2 similar to that of leg 3; posterior surfaces of couplers of legs 2 and 3 without ornament. Anterior surface and distal margin of leg 4 coupler without ornament; posterior surface with 3 rows of irregularly spaced slender spinules, spinules of proximal row shorter than spinules of distal rows. Leg 4 endopod 2, 2.9 times longer than broad; lateral terminal spine slightly less than ½ length of medial terminal spine.

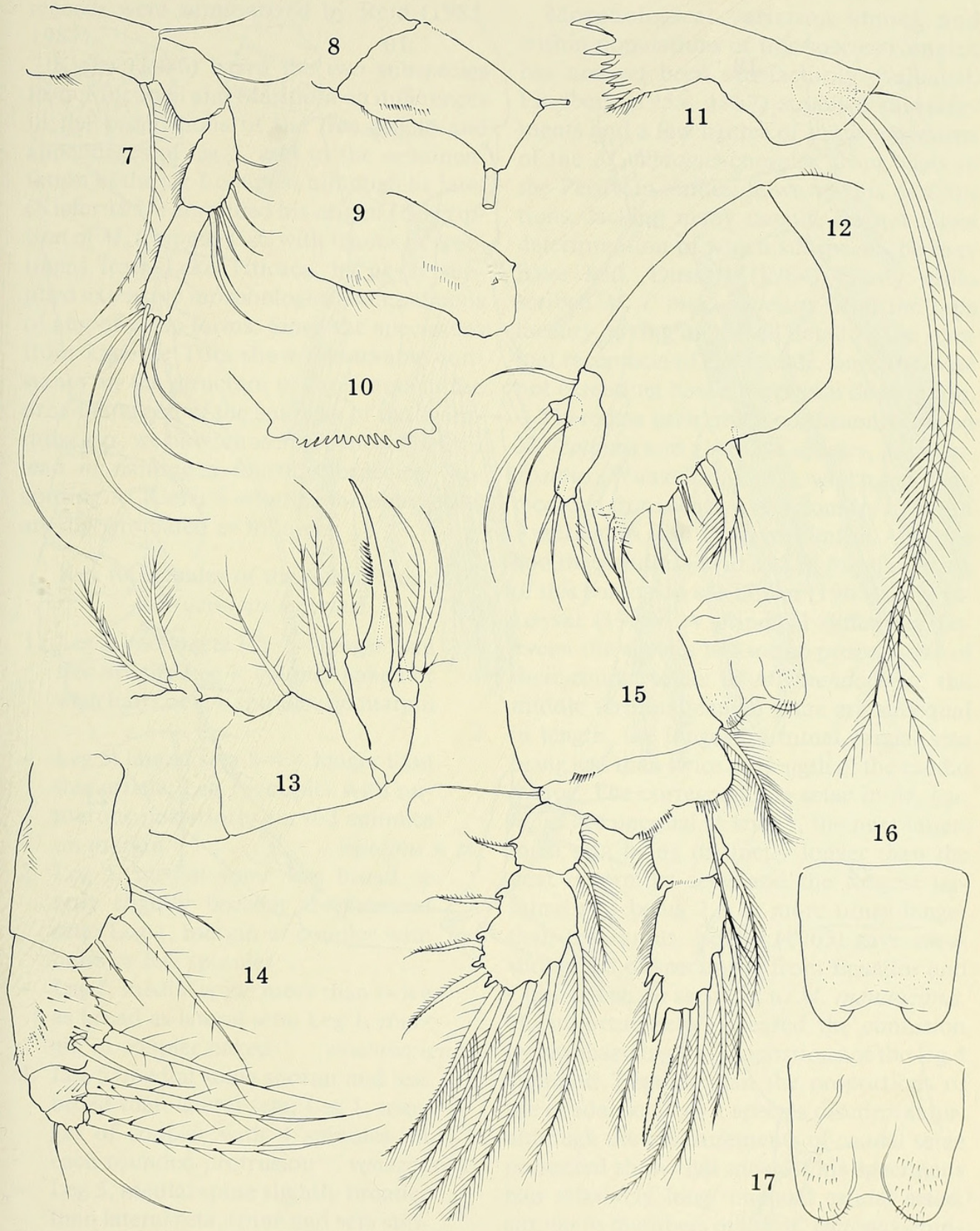
Leg 5 (Fig. 4) of 1 fused and 1 free article; free article quadrate. Medial spine and lateral seta of free article subequal in length, slightly longer than free article; medial spine slightly broader than lateral seta; medial spine with small spinules, lateral seta finely plumed. Leg 6 (Fig. 5) consisting of small prominence with 3 spines of unequal lengths, dorsalmost spine longest.

Male.—Length of allotype 0.80 mm; of 10 paratypes 0.76–0.85 mm (median 0.82 mm). Proportions of body and of caudal setae much as in female. Antennule (Fig. 21) geniculate, with 4 small esthetascs on article 1, 1 on article 9.

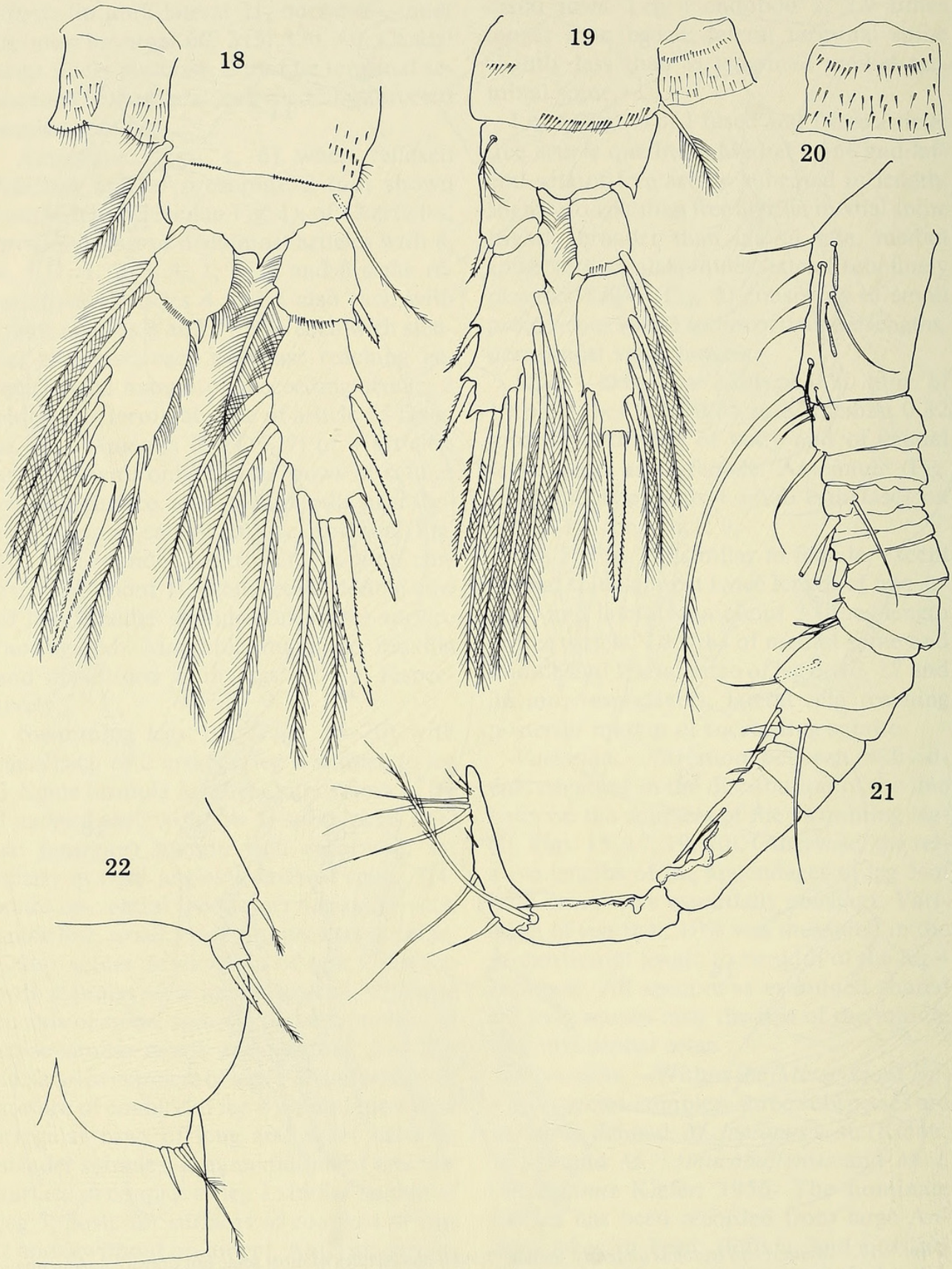
Leg 5 (Fig. 22) similar to female, except medial spine almost twice length of free article, and lateral seta about 3 times length of free article. Lengths of medial spine and middle and lateral setae of leg 6, 16, 17 and 36 μm, respectively; lateral seta reaching posterior margin of succeeding somite.

Variation.—Variation between individuals occurred in the distribution of the fine hairs on the couplers of the swimming legs (cf. Figs. 15, 17, 19, 20). Otherwise, the relative lengths of the appendages of leg 5 of both sexes were essentially constant. Variation of less than 10% was measured in the proportion of length to breadth of the leg 4 endopod. All specimens examined shared the long setules near the tips of the middle terminal caudal setae.

Discussion.—Within the *Metacyclops leptopus* species-complex, three subspecies are currently defined: *M. leptopus* s. st. (Kiefer, 1927), and *M. l. mucabajiensis* and *M. l. venezolanus* Kiefer, 1956. The nominate species has been recorded from large Andean lakes in Peru, Bolivia, and possibly Venezuela; *M. l. mucubajiensis* is known only from Laguna Mucubaji in the Venezuelan Andes; and *M. l. venezolanus* only from Mariposa Reservoir, Caracas; these



Figs. 7–17. *Metacyclops leptopus totaensis,* female: 7, Antenna (setules of most setae not drawn); 8, Antenna article 1, frontal surface, enlarged; 9, Antenna article 1, caudal surface, enlarged; 10, Labrum, ventral surface; 11, Mandible; 12, Maxillule; 13, Maxilla; 14, Maxilliped; 15, Leg 1, anterior; 16, Leg 1 coupler, posterior, enlarged; 17, Leg 1 coupler of another specimen, anterior, enlarged. Figures not to same scale.



Figs. 18–22. *Metacyclops leptopus totaensis.* Figs. 18–20, female: 18, Leg 3, anterior; 19, Leg 4, posterior; 20, Leg 4 coupler of another specimen, posterior, enlarged. Figs. 21–22, male: 21, Antennule; 22, Legs 5 and 6. Figures not to same scale.

records were summarized by Reid (1985, 1987).

Kiefer (1956) based the two subspecies from Mucubaji and Mariposa on differences in the proportions of the free article and appendages of leg 5, and in the ornamentation of the leg 1 coupler; although he later (Kiefer 1957) amplified his original description of *M. leptopus* s. st. with figures of specimens from Lake Titicaca, he never supplied extensive morphological comparisons of any of these forms. Since the specimens from Lago de Tota show remarkable constancy in the structure of leg 5 and in the ornamentation of the couplers of the swimming legs, we have chosen to follow Kiefer's lead in naming a fourth subspecies. According to Kiefer's criteria, the subspecies are discriminated as follows:

Key to Females of the Subspecies of *Metacyclops leptopus*

1. Leg 5, lateral seta 1.5–2× longer than free article; Leg 1, coupler naked or with hairs or few spinules on margin 2
– Leg 5, lateral seta 3–4× longer than free article; Leg 1, coupler with numerous posteriorly curved spinules on margin ..... *leptopus* s. st.
2. Leg 5, medial spine less broad or only slightly broader than lateral seta; Leg 1, margin of coupler with hairs or few spinules 3
– Leg 5, medial spine more than twice as broad as lateral seta; Leg 1, margin of coupler naked ... *mucubajiensis*
3. Leg 5, medial spine shorter and less broad than lateral seta; Leg 1, margin of coupler with 4 spinules on each rounded protrusion . *venezolanus*
– Leg 5, medial spine slightly broader than lateral seta, spine and seta subequal in length; Leg 1, anterior surface of coupler with fine hairs on and near margin and rows of smaller hairs proximally; posterior surface with tiny spinules ..... *totaensis*

Morphological variation among and within populations of this species-complex has not yet been satisfactorily evaluated. Lindberg (1955, 1957) supplied measurements and a few figures of some specimens of the *M. leptopus*-complex from lakes in the Peruvian Andes; however, his descriptions, lacking many details, do not allow determination of which subspecies he may have had. Dussart (1984) briefly redescribed *M. l. mucubajiensis* from the type locality, giving increased detail of the seminal receptacle of the female, but otherwise not extending Kiefer's original description.

There has been much confusion between *M. leptopus* and a similar species, *M. mendocinus* (Wierzejski, 1892), which has been recorded from nearly every country in South America, as well as from Central America and the Antilles (Reid 1985); for discussion of this confusion see Löffler (1963) and Petkovski (1988). A principal difference between the species lies in the proportions of their caudal setae: in *M. mendocinus,* the middle terminal caudal setae are subequal in length, the longest terminal caudal seta being less than twice the length of the caudal ramus. The corresponding setae in *M. leptopus* are unequal in length, the next innermost seta being distinctly longer than the next outermost seta, and the longest terminal seta being 2.6 or more times longer than the ramus. Löffler (1963) gave measurements of specimens from Ecuador and Chile which he ascribed to *M. mendocinus.* He unfortunately increased the confusion by emphasizing the proportions of the leg 4 endopod 3 rather than the proportions of the caudal setae as a species discriminator, although the measurements of caudal setae presented show that most of his specimens had relatively long, unequal caudal setae, similar to members of the *M. leptopus*-complex. Löffler furnished no figures, nor did he label his measurements as to the populations from which they were derived. As Dussart (1984) noted, Löffler's (1963) suggestion that *leptopus* is the pelagic form of

mendocinus is insupportable, since both species are pelagic. Dussart (1984), however, suggested that *M. leptopus venezolanus* should be considered a form of *M. mendocinus,* without explaining his reasoning. Petkovski (1988) followed this synonymy. In spite of probable confusion in the records, the two species appear to be ecologically distinct: *M. mendocinus,* an eurytopic species, often attains dense populations in saline or highly eutrophic waters (Ringuelet 1958; Sendacz & Kubo 1982), while members of the *M. leptopus*-complex seem to inhabit relatively pristine, mostly high-altitude lakes. The conclusion of both Löffler (1963) and Dussart (1984), that it is necessary to re-evaluate both species and their forms, starting from examination of type material and encompassing representative populations from the entire range of each, is inescapable.

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