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***Allocyclops (Allocyclops) austronipponicus*, a New Species of Cyclopoid Copepod (Crustacea: Cyclopoida: Cyclopidae) from Okinawa Island, Japan**

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A new species of cyclopoid copepod, *Allocyclops (Allocyclops) austronipponicus*, is described from a freshwater habitat in Okinawa Island, Japan. This is the first record of the genus *Allocyclops* from Asia. The new species is distinguished from its congeners by having the following combination of character states: (1) antennal seta representing exopod present; (2) maxillule with two-segmented palp; (3) legs 1–4 each with inner coxal seta; (4) distal endopodal segment of leg 4 with three inner and one outer setae and two apical spines; and (5) seta present on remnant of proximal segment of leg 5, this seta short in comparison to length of somite.

Key Words: Cyclopoida, *Allocyclops*, Okinawa Island, Japan, new species, taxonomy.

Introduction

Allocyclops is a genus in the family Cyclopidae. Although 13 species of *Allocyclops* are known from freshwater habitats in Europe, Africa, the USA, Cuba, Brazil, and Australia (Kiefer 1932, 1933, 1937, 1955; Chappuis 1951; Fryer 1956; Petkovski 1971; Lamoot *et al.* 1981; Pleša 1981; Rocha and Björnberg 1988; Reid and Spooner 1998; Karanovic 2001, 2003), there is no record from Asia. They are divided into three subgenera (Karanovic 2001, 2003): *A. (Allocyclops)* Kiefer, 1932, *A. (Psammocyclops)* Kiefer, 1955, and *A. (Stolonicyclops)* Reid and Spooner, 1998. We have found a previously unknown species from the Yona River on Okinawa Island, southern Japan, and describe this species here as *Allocyclops (Allocyclops) austronipponicus*. The new species is the ninth member of the subgenus *Allocyclops*.

Methods

Specimens were collected by scooping with a fine-mesh hand-net, and then fixed in 5% formalin at the site. Appendages were dissected and embedded in gum-chloral medium on glass slides. The specimens were examined using a phase contrast and Nomarski differential interference contrast microscope and illustrated with the aid of a camera lucida. The body length from the rostrum to the posterior

margin of the caudal rami (excluding apical setae) was measured to the nearest 0.01 mm. The type material is deposited in the National Science Museum, Tokyo (NSMT).

Taxonomy

Genus *Allocyclops* Kiefer, 1932

Allocyclops (Allocyclops) austronipponicus sp. nov.

(Figs 1–4)

Type series. Holotype: female, body length 0.60 mm, dissected and mounted on slide, NSMT-Cr 15639. Paratypes: 3 females (length 0.63 mm, 0.59 mm, 0.60 mm), dissected and mounted on 1 slide each (NSMT-Cr 15640–15642); 10 undissected females in 70% ethanol (NSMT-Cr 15643). All the types were collected on 11 Mar. 2003 by T. Ishida at Yona River (26°45'34"N, 128°13'9"E), Kunigami Village, Okinawa Prefecture, Japan.

Etymology. The specific name "*austronipponicus*", an adjective, is derived from *austro* (Latin; southern) and *nipponicus* (Latinized Japanese; of Japan) referring to the type locality of the new species (southern Japan).

Description. *Holotype, female.* Habitus (Fig. 1A, B) compact, dorsoventrally flattened. Body surface without ornamentation (Figs 1A, B, 2A, B). Body widest at cephalothorax in dorsal view (Fig. 1A). Rostrum (Fig. 1B) large, rounded anteriorly and ventrally deflected, but not extending beyond segment 1 of antennule. Nauplius eye absent. Posterolateral margins of pedigers 3–5 produced in dorsal view, smooth. Posterior borders of cephalosome, pedigers 2–5, genital double-somite, and abdominal somites 1 and 2 smooth. Length of genital double-somite (Fig. 2A, B) 97% of width. Copulatory pore small, triangular; copulatory duct short. Seminal receptacle broad (unclear due to imperfect mounting). Anal somite with row of spinules along ventral posterior margin. Anal opeculum convex, not extending beyond posterior margin of anal somite.

Caudal ramus (Fig. 2A, B) 2.1 times as long as maximum width, with six setae; seta (I) absent; small seta (II) on dorsolateral surface; length of dorsal seta (VII) 54% that of ramus; length of posterolateral seta (III) 65% that of terminal accessory seta (VI).

Antennule (Fig. 1C) 11-segmented, shorter than cephalothorax (excluding apical setae), with slender aesthetascs on segments 8 and 11; setal formula 6, 2, 4, 2, 3, 3, 3, 2+ae, 2, 2, 7+ae; medial seta on article 5 minute, spiniform. Antenna (Fig. 1D) four-segmented; segment 1 with exopodal seta; setal formula 1, 1, 9, 5.

Labrum (Fig. 1E) with strong teeth on distal margin but without any surface ornamentation. Mandible (Fig. 1F) with six teeth and plumose seta at dorsal corner; palp represented by three setae, two of them long and plumose, third short and naked. Maxillule (Fig. 1G, H) comprising elongated praecoxa and two-segmented palp; praecoxa with four strong apical spines, inner margin with three spines and three setae. Maxilla (Fig. 1I) five-segmented, comprising praecoxa, coxa, basis, and two-segmented endopod; proximal and distal endites of praecoxa with two and no setae, respectively; on coxa, proximal endite with seta (broken), distal endite elongate, with two setae; basis expanded into robust, smooth claw, with spine-like seta;

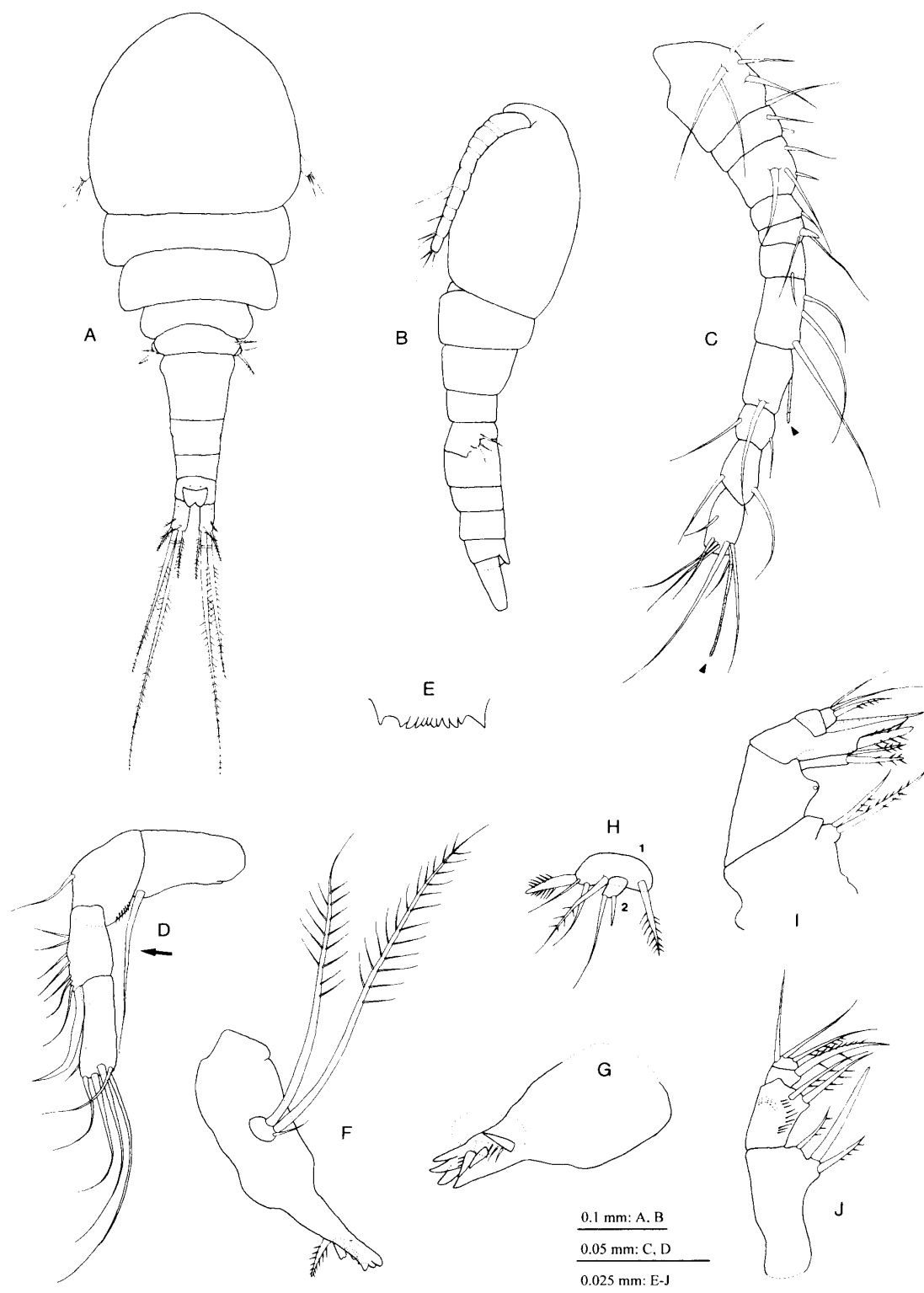


Fig. 1. *Allocyclops (Allocyclops) austronipponicus* sp. nov., female, holotype (NSMT-Cr 15639). A, Habitus, dorsal; B, habitus, left lateral; C, antennule (aesthetascs indicated by arrowheads); D, antenna (exopodal seta indicated by arrow); E, labrum; F, mandible; G, maxillule (with palp removed); H, palp of maxillule (1 and 2, segments 1 and 2 of palp); I, maxilla; J, maxilliped.

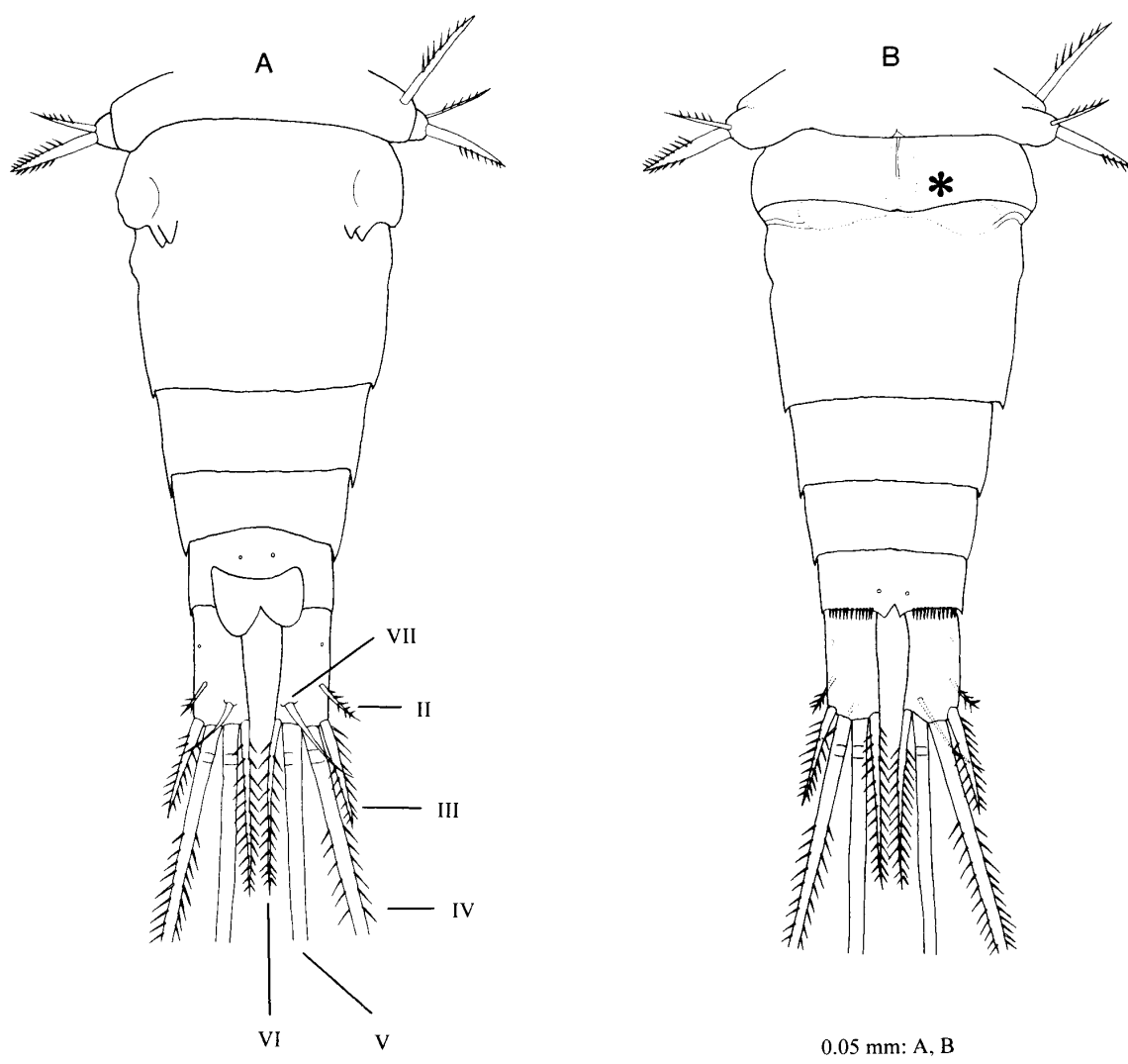


Fig. 2. *Allocyclops (Allocyclops) austronipponicus* sp. nov., female, holotype (NSMT-Cr 15639). A, Urosome, dorsal; B, urosome, ventral. Abbreviations: II, anterolateral seta; III, posterolateral seta; IV, outer terminal seta; V, inner terminal seta; VI, terminal accessory seta; VII, dorsal seta; *, Imperfect mounting.

proximal and distal endopodal segments with one and three setae, respectively. Maxilliped (Fig. 1J) four-segmented, comprising coxa, basis, and two-segmented endopod; proximal and distal endites of coxa with two and one setae, respectively; on basis, medial margin and submargin each with seta, inner and outer surfaces with short setae, proximal and distal endopodal segments with one and three setae, respectively.

Legs 1-4 (Fig. 3A-D) with two-segmented rami, seta and spine formula as shown in Table 1. Intercoxal sclerites without surface ornamentation. Leg 5 (Fig. 3E) inserted laterally and fused to somite; remnant of proximal segment a small protuberance, with plumose seta; distal segment as small protrusion extending little beyond somite fringe, with plumose flexible seta and plumose stiff seta. Leg 6 (Fig. 3F) inserted dorsolaterally and fused to somite, with two short, spinous

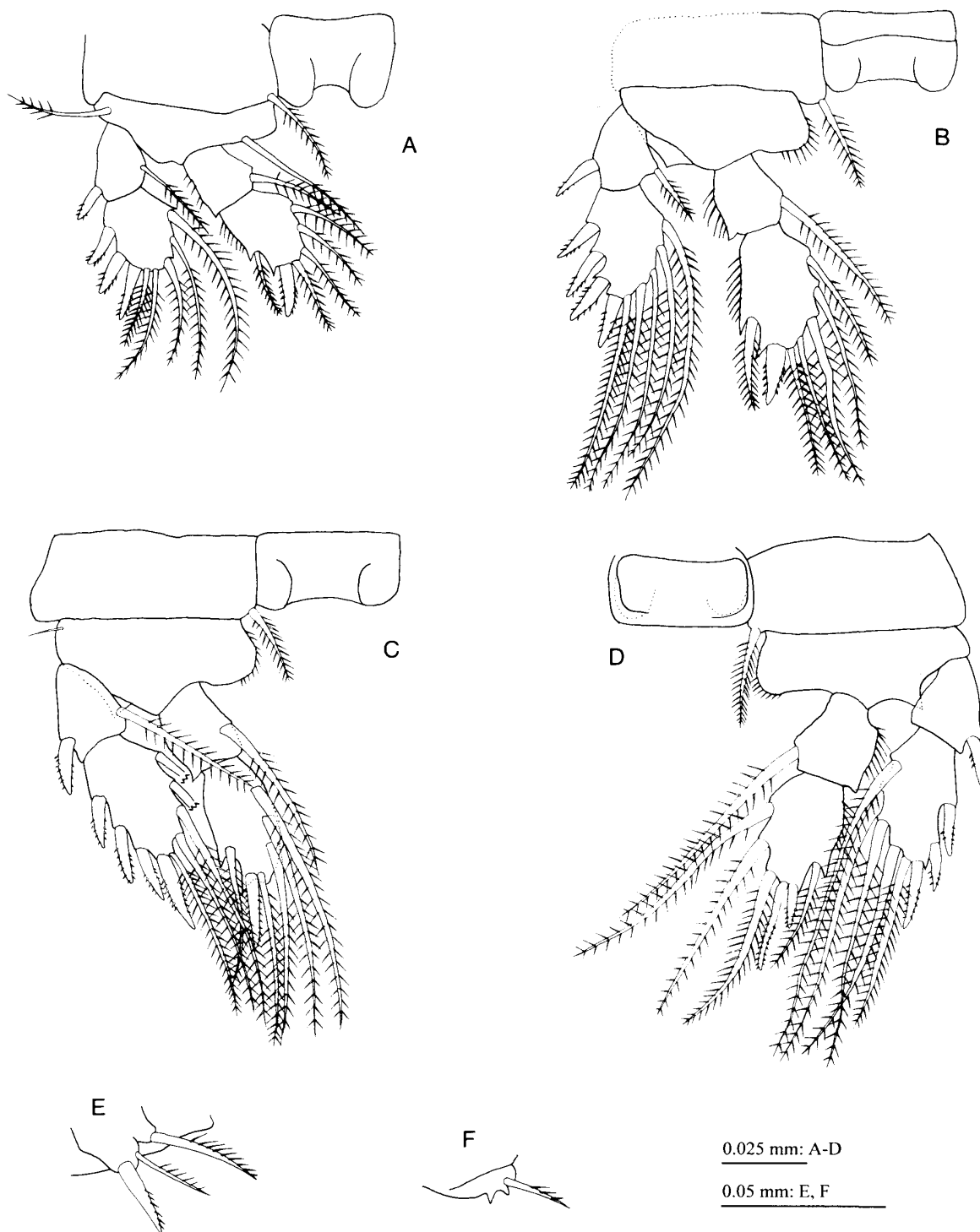


Fig. 3. *Allocyclops (Allocyclops) austronipponicus* sp. nov., female, holotype (NSMT-Cr 15639). A, Left leg 1 and intercoxal sclerite, posterior; B, left leg 2 and intercoxal sclerite, posterior; C, left leg 3 and intercoxal sclerite, posterior; D, left leg 4 and intercoxal sclerite, anterior; E, leg 5; F, leg 6.

Table 1. Armature of legs 1–4 of *Allocyclops (Allocyclops) austronipponicus* sp. nov.

	Coxa	Basis	Exopod segment		Endopod segment	
			1	2	1	2
Leg 1	0-1	1-1	I-1;	III, 2, 3	0-1;	1, I, 4
Leg 2	0-1	1-0	I-1;	III, I, 5	0-1;	1, I, 5
Leg 3	0-1	1-0	I-1;	III, I, 5	0-1;	1, I, 4
Leg 4	0-1	1-0	I-0;	II, I, 5	0-1;	1, II, 3

Roman numerals indicate number of spines, and Arabic numerals indicate number of setae.

processes and plumose seta.

Male. Unknown.

Variability. In three paratype specimens (0.63 mm, 0.59 mm, 0.60 mm, NSMT-Cr 15640–15642), the segment 1 of the antenna has an anterodistal seta (arrowed in Fig. 4), which is absent in the holotype.

Remarks. The present new species belongs to the genus *Allocyclops* sensu Karanovic (2001) because of the following character states: (1) genital double-somite broader than long; (2) 11-segmented antennule; (3) four-segmented maxilliped; (4) legs 1–4 with two-segmented endopods and exopods; (5) leg 5 inserted laterally and fused to the somite; and (6) remnant of proximal segment of leg 5 with a seta.

Karanovic (2001) divided the genus *Allocyclops* into three subgenera using the diagnoses shown in Table 2. *Allocyclops (Psammocyclops) consensus* Karanovic, 2003 was recently described from subterranean waters in Australia. Though *A. (P.) consensus* shares three subgeneric character states with the subgenus *Allocyclops*, two with *Psammocyclops*, and two with *Stolonicyclops*, it was assigned to *Psammocyclops* without any clear justification. In this paper, we agree with Karanovic's

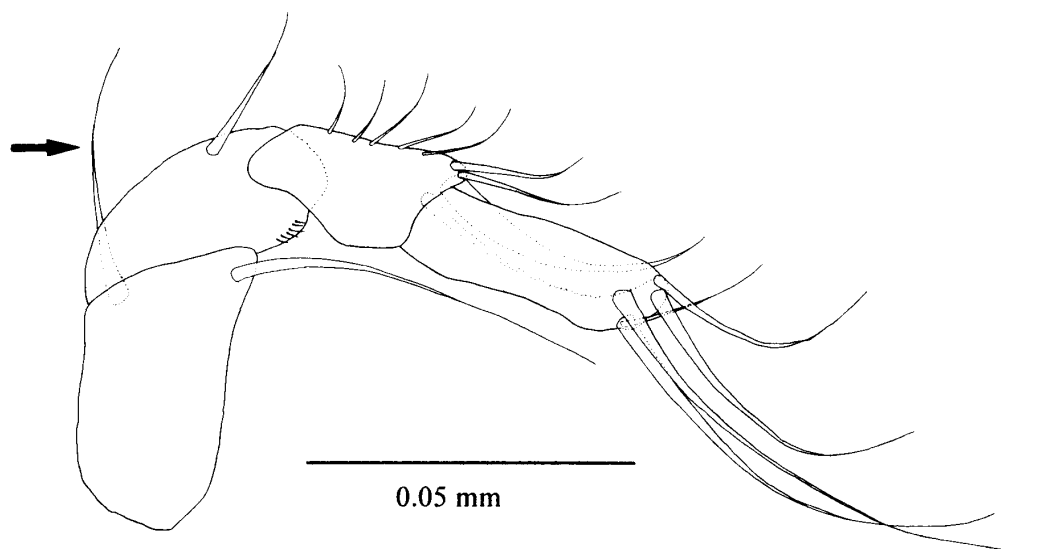


Fig. 4. Antenna of *Allocyclops (Allocyclops) austronipponicus* sp. nov., female, paratype (NSMT-Cr 15641), with anterodistal seta indicated by arrow.

Table 2. Differentiating characters of *Allocyclops (A.) austronipponicus* sp. nov., *Allocyclops (Psammocyclops) consensus*, and the subgenera *Allocyclops*, *Psammocyclops*, and *Stolonicyclops* as defined by Karanovic (2001).

Character/ Species or subgenera	<i>A. (A.) austronipponicus</i>	<i>A. (P.) consensus</i>	<i>Allocyclops</i>	<i>Psammocyclops</i>	<i>Stolonicyclops</i>
Exopodal seta of antenna	present	absent	absent	present	absent
Palp of maxillule	2-segmented	2-segmented	1-segmented	1-segmented	2-segmented
Inner coxal seta of legs 2-4	present	present	present	present	absent
Setal and spine formula of distal endopod segment of leg 4	3 inner and 1 outer setae, 2 apical spines	2 inner and 1 outer setae, 1 apical spine	3 inner and 1 outer setae, 2 apical spines	2 or 3 inner and 1 outer setae, 1 apical spine	3 inner and 1 outer setae, 1 apical spine
Seta on remnant of proximal segment of leg 5	short	short	short	long	long

(2003) subgeneric division and assign our new species to the subgenus *Allocyclops*. As an extension of this study, additional species of the genus *Allocyclops* will be described in the future, and this may eventually clarify the validity of the subgeneric division of *Allocyclops*.

Allocyclops (A.) austronipponicus sp. nov. is similar to *A. (A.) chappuisi* Kiefer, 1932 from a spring near Daloa, Ivory Coast, in having the following character states: (1) inner-distal corner of coxa of legs 1-4 each with a seta; (2) seta present on remnant of proximal segment of leg 5, this seta short in comparison to length of somite; (3) width-to-length ratio of caudal ramus greater than 0.3; (4) innermost apical seta on caudal ramus longer than outermost one; (5) anal operculum convex; (6) posterior margin of anal operculum smooth; and (7) distal endopod segment of leg 4 with three inner setae and two apical spines (cf. Kiefer 1932; Karanovic 2001). However, our new species differs from *A. (A.) chappuisi* in the following characters (the character states of *A. (A.) chappuisi* are shown in parentheses): (1) antenna with an exopodal seta (without); (2) maxillary palp two-segmented (one-segmented).

Distribution and ecology. At present the new species is known only from the type locality. It occurred under decaying leaves deposited near the river bank. The water temperature at the type locality was 14.6°C in March.

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