

**Two new interstitial species of *Remaneicaris* JAKOBI 1972 from the Ribeirão do Ouro River, Minas Gerais, Brazil, with a redefinition of the genus
(Crustacea, Copepoda, Harpacticoida, Parastenocarididae)**

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Abstract

Members of the copepod genus *Remaneicaris* JAKOBI 1972 are reported for the first time from the state of Minas Gerais, southeastern Brazil. Two new species were discovered in interstitial near-shore waters of the small river Ribeirão do Ouro (tributary of the Paraopeba River of the São Francisco hydrographic basin). *Remaneicaris analuizae* n. sp. and *R. euniceae* n. sp. are described in detail, and their phylogenetic relationships within the genus are discussed; holotypes ♂♂ in coll. INPA, Petrópolis (Manaus, Brazil). The species differ from each other by the shape of endopod of leg 2, shape of leg 3 exopod, armature of leg 5, ornamentation of the telson, and by the number of integumental windows and sensilla. The monophyletic status of the genus is discussed and an updated list of species provided. The geographical occurrence of the genus in South America is briefly reviewed.

Key words: Copepoda, Parastenocarididae, *Remaneicaris*, hyporheos, Neotropis, phylogeny.

Introduction

Harpacticoid copepods belonging to the family Parastenocarididae CHAPPUIS 1933 are typical meiofaunal components of freshwater subterranean waters. They represent, together with members of the Canthocamptidae BRADY 1880, the most successful group of benthic fresh-water harpacticoids in terms of both diversity and abundance. For example REID (1993) recorded 43 species of Harpacticoida from a “campo úmido” (hillside flush marsh) in Brasília, Brazil, 18 of them Parasteno-

carididae (16 new to science). Further, NOODT (1963, 1965, 1972) found as many as 16 new species of Harpacticoida in South and Central American interstitial habitats.

Despite their presumable importance, very little is known about the actual diversity of Parastenocarididae in Neotropical countries, nor about their role in freshwater ecosystems. This may be the consequence of the traditional devotion of most South American limno-

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logists to the study of lakes and reservoirs, neglecting non-planktonic habitats.

Currently, the Brazilian parastenocaridid fauna encompasses of 31 known species (REID 1998). In this study we describe two new species of the genus *Remaneicaris* collected from the hyporheic zone of one stream, Ribeirão do Ouro, belonging to the São Francisco River basin, in Florestal, Minas Gerais, Brazil. This represents the first record of *Remaneicaris* for the state of Minas Gerais. We favour the revalidation of the genus *Remaneicaris*, arguing for its monophyly. A list of current valid species of the genus is provided, based on literature descriptions.

Material and methods

The samples were taken next to the river bank using the Karaman-Chappuis method (CHAPPUIS 1942) using a 100 μm mesh, stained with rose bengal, and fixed with formalin at a final concentration of about 4 %.

Animals were dissected in lactic acid and mounted on slides in glycerine. Drawings were made with an Olympus microscope, using a drawing tube, at 400 \times and 1000 \times magnification.

Abbreviations used are: ap = apomorphy, A1 = antennule, A2 = antenna, Ae = aesthetasc, Md = mandible, Mx1 = Maxillulae, Mx2 = Maxillae, Mxp = maxilliped, enp = endopod, exp = exopod, pl = plesiomorphy, P1-P5 = legs 1 to 5.

The type material is deposited in the invertebrate collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil.

Descriptive part

Family Parastenocarididae

Genus *Remaneicaris* JAKOBI 1972

Differential diagnosis: Parastenocarididae with 9-segmented antennule in σ (pl) and 7-segmented antennule in ♀ (pl). σ antennule haplocer (pl). Maxilla with 2 endites, proximal endite with 2 seta (pl). P1 endopod nor sexually dimorphic (pl). P2 and P4 middle and distal exopodal segments with long spinule located medially on outer margin (ap). P4 distal exopodal segment with distal outer seta shifted to subdistal position (ap). P3 male with endopodal segment bearing one seta (pl), apophysis rounded without setae (ap?). P4 male enp leaf-shaped and hirsute (ap?). P5 without sexual dimorphism (pl), displaced to ventro-lateral position (ap?) and lacking intercoxal sclerite (ap?). Furca with all three anterolateral setae located on distal third.

Remaneicaris analuizae n. sp.

Holotype: dissected σ on 5 slides (INPA 1384).

Paratypes (1 σ , 3 ♀): allotype: 1 dissected ♀ on 5 slides (INPA 1385); 1 σ (INPA 1388) and 2 ♀ (INPA 1386, 1387) mounted on 1 separated slide each.

Derivatio nominis: The species is named after the senior author's daughter, Ana Luiza CESAR CORGOSINHO.

Locus typicus: Ribeirão do Ouro, Sítio do Corgosinho, Florestal, state of Minas Gerais, Brazil. Coordinates: 19°10'30" S, 44°54'20" W.

σ . **Habitus** (Fig. 1 A–B). Length 375 μm (measured from tip of rostrum to distal rim of anal operculum). Rostrum not fused to cephalothorax, with a wide base and two sensilla on tip. Cephalothorax and second urosomite with 1 dorsal integumental window each. Urosomites 4–5 with pair of lateral integumental windows. For sensilla on tergites see Fig. 1 A–B. Telson with

1 row of 10 spinules, dorsally on proximal third, 2 pairs of spinules ventrally on proximal half, and 2 rows of 5 spinules each distally. Anal operculum ornamented with transverse row of 8 spinules. Anal field flanked by row of 3 spinules on right side and 5 spinules on left side. Furca (Fig. 2 A–C) about 4 times as long as wide, with 7 setae. All setae located in distal third, 3 dorsal spinules located in proximal part of distal half of furca, distoventral margin with 2 spinules. A1 (Fig. 3 A) 9-segmented, prehensile and with a peculiar hyaline tip on distal segment; armament beginning with proximal segment: 0/5/4/1/5+Ae/1/4/1/9+Ae. A2 (Fig. 3 D) with allobasis; 1-segmented exp with 1 seta, and 1-segmented enp bearing a ventral hyaline frill and 7 setae; the innermost setae lost on holotype but present on paratype (represented by a dotted line). Md, Mx1, and Mxp armature as *Parastenocaris hispanica* MARTÍNEZ ARBIZU 1997; excepting proximal endite on Mx2 with carries 2 setae on the new species (Fig. 3 F). P1 (Fig. 4 A) coxa unarmed, with two rows of spinules at posterior side; basis with outer seta and 1 pore on anterior outer margin, 2 spinules on outer margin, and 3 distally; exp 3-segmented, segment 1 with outer spine, segment 2 unarmed, segment 3 with 2 outer spines, 2 geniculate setae and posterior pore; enp 2-segmented, segment 1 with 1 row of 6 long spinules along inner and 2 rows of 3 shorter spinules on outer margin, segment 2 with hyaline frill and 2 setae distally, 1 of them geniculate. P2 (Fig. 4 B) coxa unarmed, with 1 row of small spinules posteriorly; basis without outer seta and ornamented with 1 row of spinules on outer margin, 3 spinules distally and 1 pore on anterior outer margin; exp 3-segmented, segment 1 with outer spine, segment 2 without setae, but a row of spinules distally and with one long spinule located medially at the outer side; segment 3 with 3 setae, a distal hyaline frill at inner corner and one spinule located medially at the outer side and one subdistally; enp 1-



Fig. 1. *Remaneicaris analuizae*, new species. A, habitus, dorsal view, ♂; B, habitus, lateral view, ♂; C, habitus, lateral view, ♀. — Scale bar: 50 μ m.

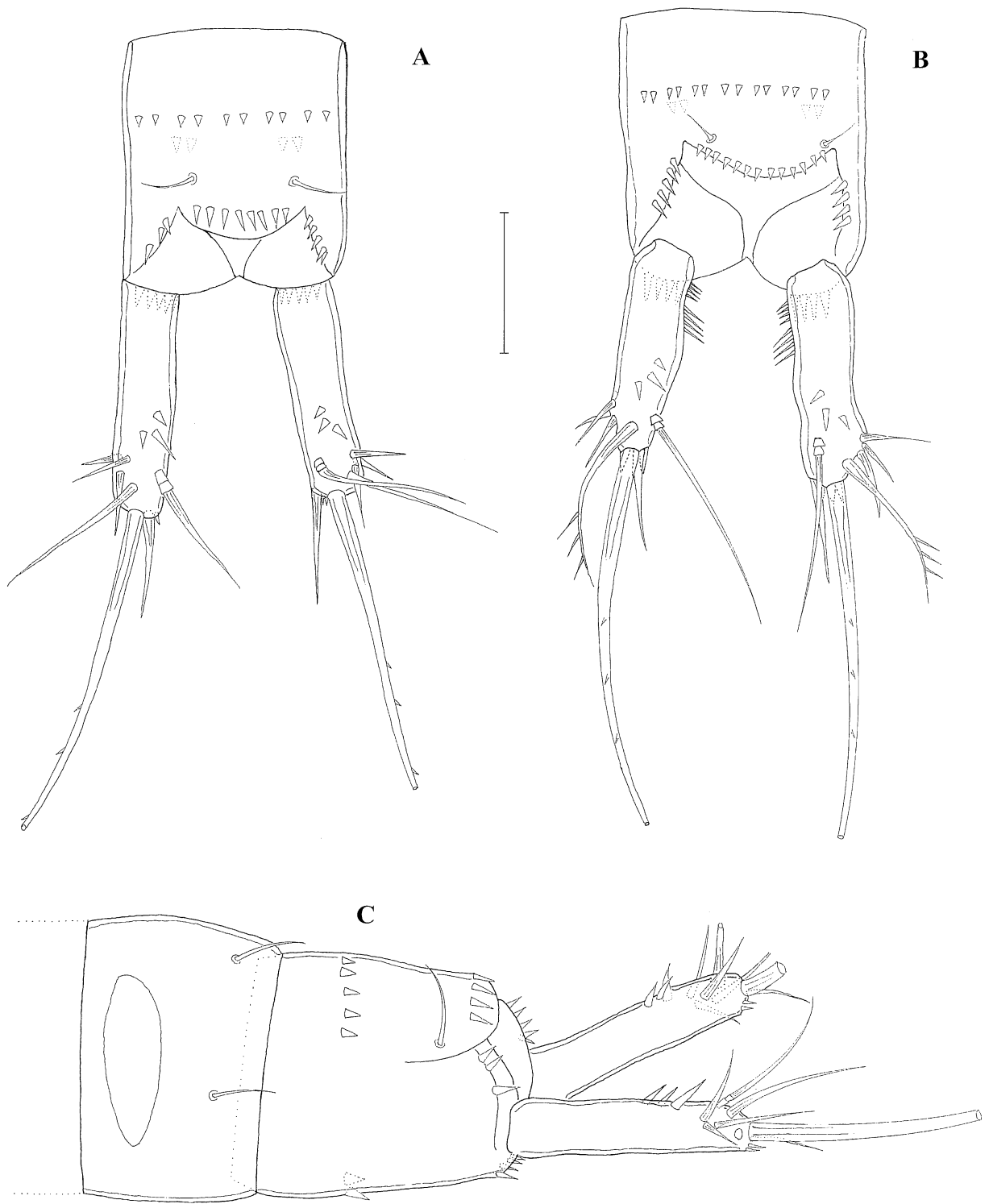


Fig. 2. *Remaneicaris analuizae*, new species. A, anal somite, dorsal view, ♂; B, anal somite, dorsal view, ♀; C, fourth urosomite and anal somite, lateral view, ♂. — Scale bar: 20 μ m.

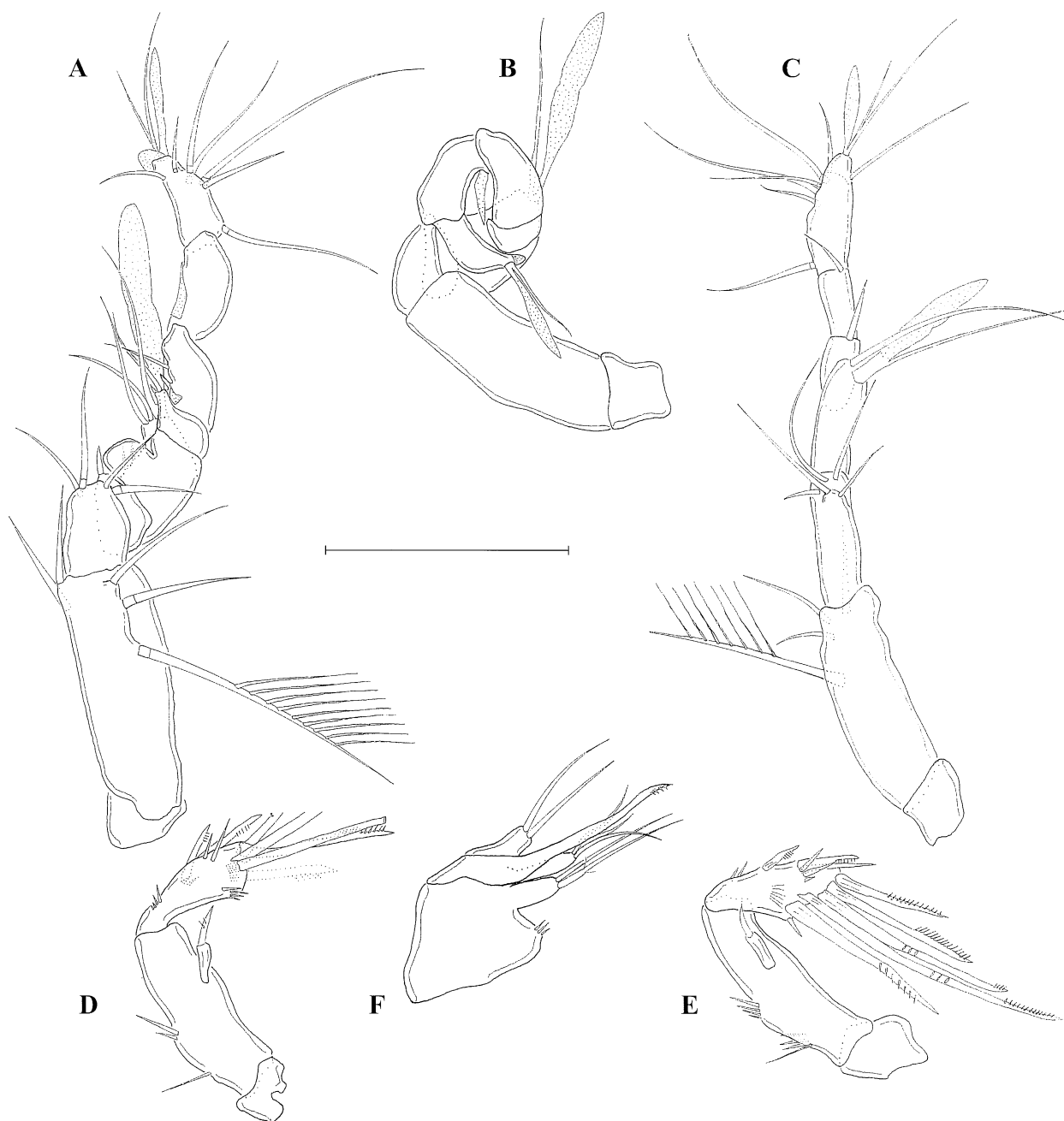


Fig. 3. *Remaneicaris analuizae*, new species. A, ♂ antennule; B, dorsal view of ♂ antennule in grasping position; C, ♀ antennule; D, ♂ antenna; E, ♀ antenna; F, Mx2 (Paratype). — Scale bar: A, B, C, D and E = 30 μm, F = 20 μm.

segmented with 1 seta, 2 terminal spinules, and 3 spinules along outer margin. P3 (Fig. 4 C) coxa unarmed; basis with outer seta and a foliaceous hyaline structure proximal to enp on inner margin; enp represented by 1 short spine; exp 1-segmented, elongate, bearing 2 minute spinules on proximal inner margin and 2 rows of spinules along outer margin; subterminally with 1 short curved seta (“thumb”) which is bifid at tip; apophysis short and rounded, slightly trilobed. P4 (Fig. 4 D) coxa unarmed, with two small spinules posteriorly; basis with outer seta and one pore on anterior margin; exp 3-segmented, segment 1 with outer spine, segment 2 without setae,

with arrow of small spinules along inner subdistal margin, a row of longer spinules at outer distal margin and a long spinule located medially at outer margin, segment 3 with 1 apical, 1 subterminal outer seta, a distal hyaline frill and one spinule located medially at outer margin and one subdistally; enp 1-segmented, leaf-shaped, covered with numerous long spinules. P5 (Fig. 4 E) small bilobed plate with 3 setae on inner lobe and 1 seta on outer lobe. Intercoxal sclerite absent. P6 not discernible.

♀. Sexually dimorphic in A1, P1, P2, P3 and P4, genital field, and telson. — Habitus (Fig. 1 C). Length 380 μm (from rostrum to operculum). Anal operculum

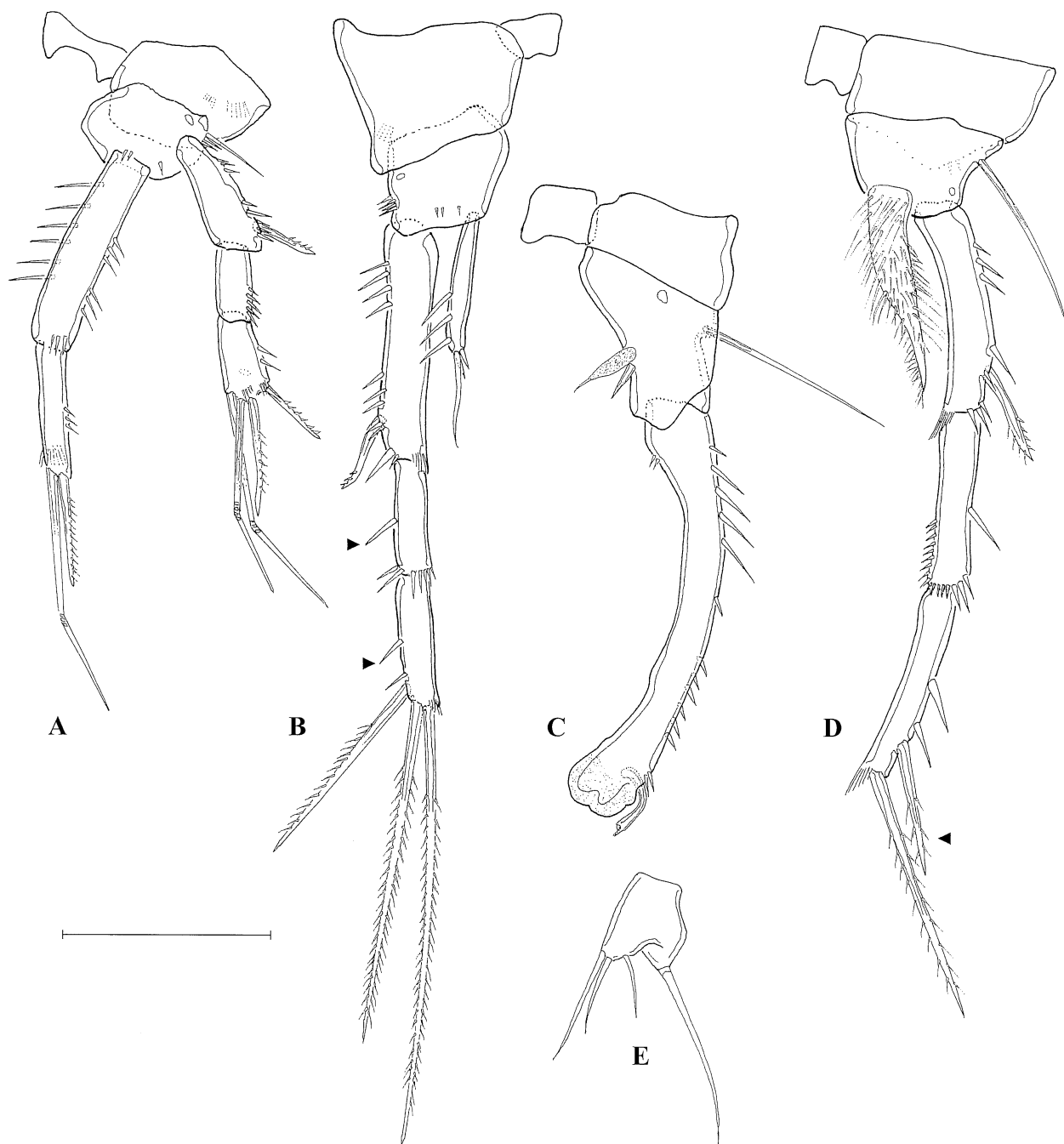


Fig. 4. *Remaneicaris analuizae*, new species, ♂. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, fifth thoracic somite with leg 5. — Scale bar: 20 μ m.

(Fig. 2 B) convex, ornamented with 13 spinules and flanked with 4 spinules on right side and 5 on left side. Telson with 1 row of 14 spinules dorsally in proximal third, 2 rows of 2 spinules ventrally, and 2 rows of 4 spinules distally. Furca (Fig. 2 B), ventrodistal margin with 3 spinules, and with 2 additional rows of 4 short and 4 long spinules on inner margin. A1 (Fig. 3 C) 7-segmented, not prehensile; number of setae beginning at proximal segment: 0/4/5/2+Ae/1/1/9+Ae. A2 (Fig. 3 E) with allobasis; 1-segmented exp with 1 seta, and 1-seg-

mented enp bearing 7 setae and a hyaline frill. P1 enp 1 (Fig. 5 A) as in male, except for the presence of two rows of three small spinules distally on basis; spinules along inner margin of first enp segment somewhat closer to each other. P2 (Fig. 5 B) as in male, pore on the basis and on the second exp segment not discernible; spinules on outer enp margin somewhat longer. P3 (Fig. 5 D) coxa unarmed and with 1 row of outer distal spinules; basis with 1 outer seta, and ornamented with 1 row of spinules; exp 2-segmented, segment 1 with outer spine,

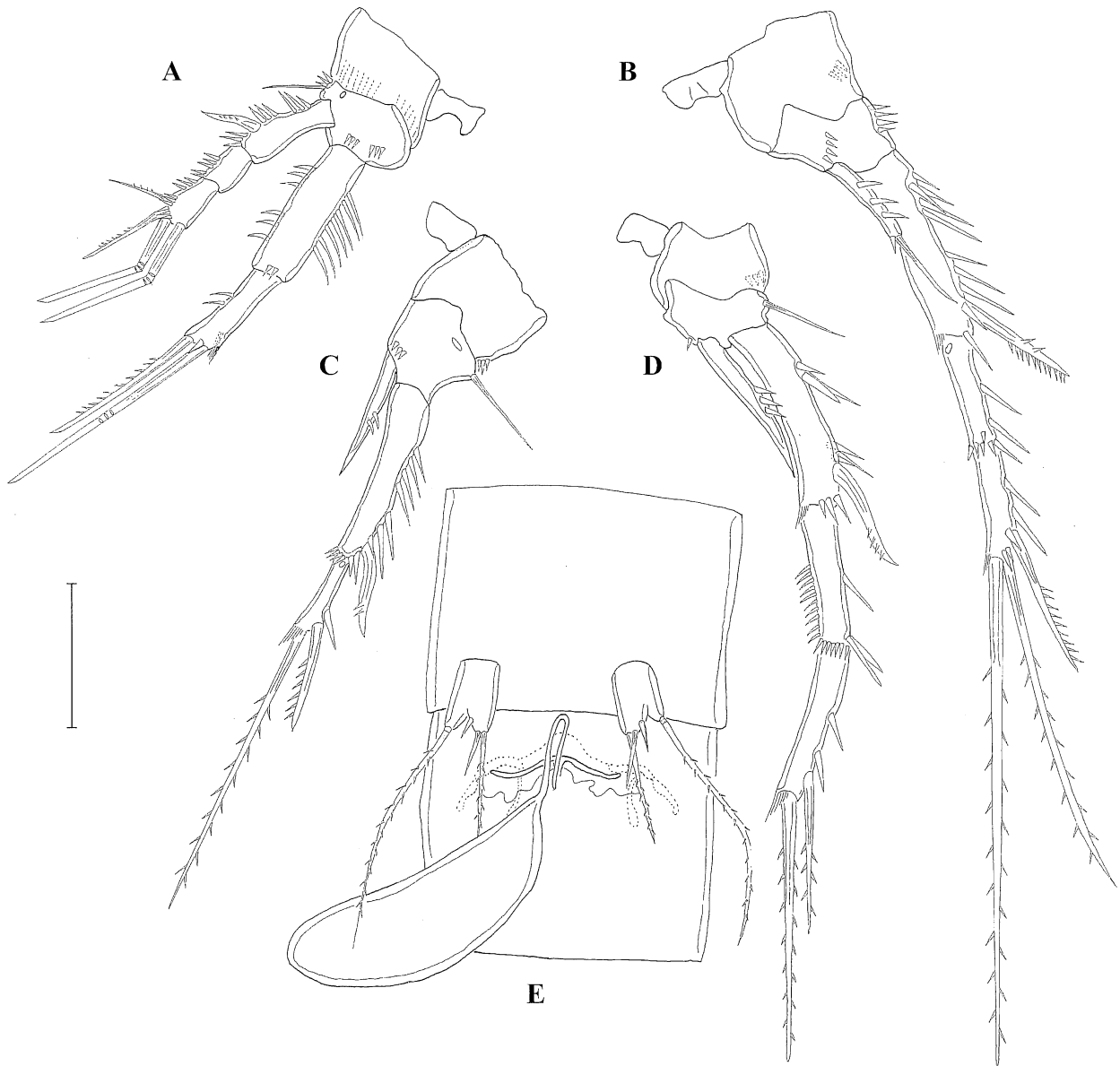


Fig. 5. *Remaneicaris analuizae*, new species, ♀. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, fifth thoracic somite with leg 5 and first urosomite with genital operculum and attached spermatophore. — Scale bar: 20 μ m

segment 2 with 1 spine, 1 seta and a proximal pore; enp 1-segmented and spiniform, with 2 spinules on outer margin. P4 (Fig. 5 C) as in male, except enp spine-like with 1 row of 3 spinules on outer margin. P5 (Fig. 5 E) as in male. Genital field as illustrated in Fig. 5 E. Copulatory pores not discernible, but according to spermatophore position a single medially located copulatory pore is probably present. Gonopore a transverse slit.

Variability: ♂. Paratype 1: Telson with row of 12 spinules; anal operculum ornamented with only 6 spinules and flanked with 4 spinules on each side. ♀. Paratype 2: Telson with row of only 12 spinules dorsally; furca with 5 spinules distally.

***Remaneicaris euniceae* n. sp.**

Holotype: ♂, dissected and mounted on 5 slides (INPA 1389).

Paratype: 1 ♂ mounted on 1 slide (INPA 1390).

Derivatio nominis: The species is named after the senior author's mother, Eunice Helena COSTA CORGOSINHO.

Locus typicus: Ribeirão do Ouro, Sítio do Corgosinho; Florestal, state of Minas Gerais, Brazil. Coordinates: 19°10'30" S, 44°54'20" W.

♂. (Fig 6 A–B). Length 315 μ m (from rostrum to operculum). Rostrum with large base and 2 sensilla on

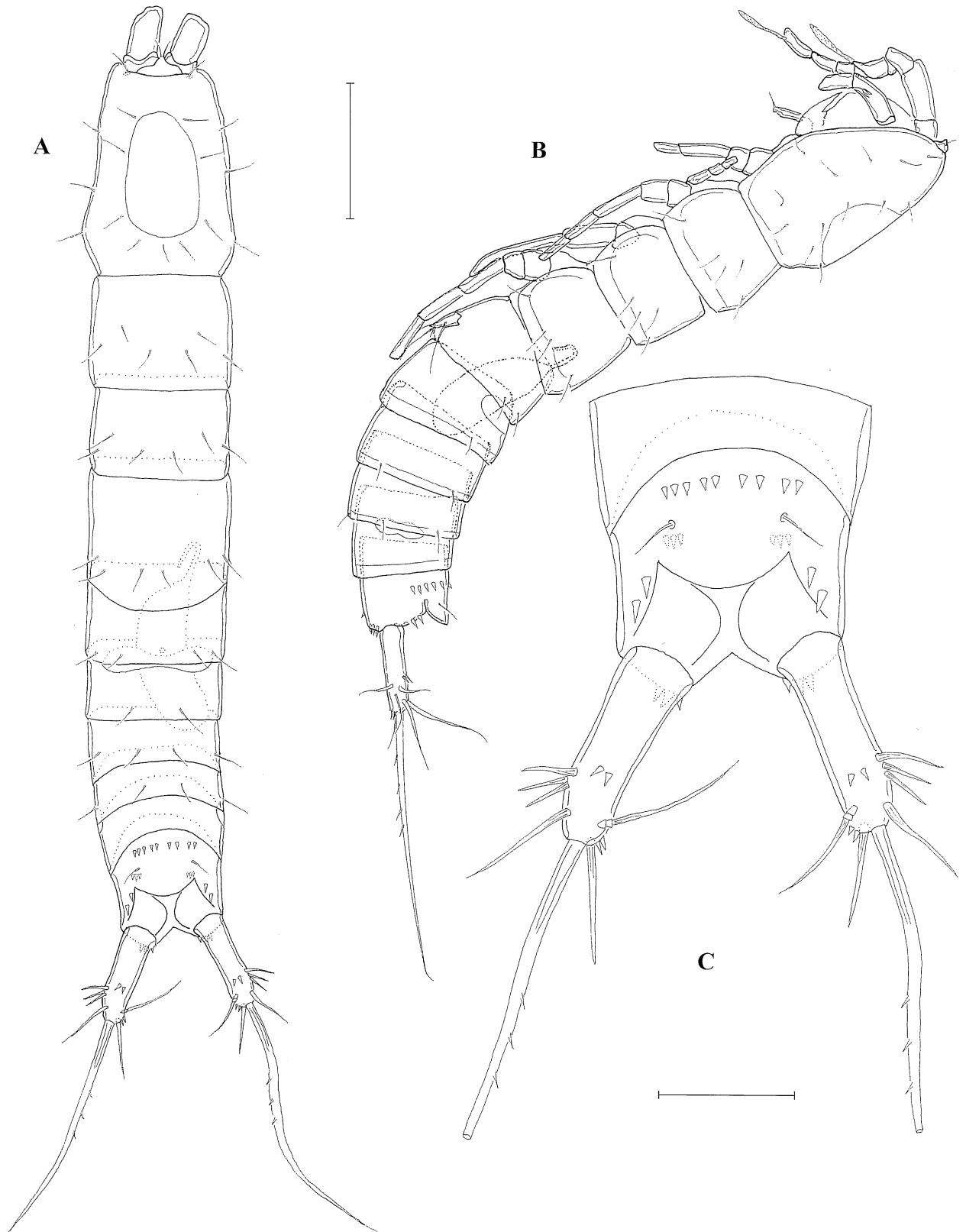


Fig. 6. *Remaneicaris euniceae*, new species, ♂. A, habitus, dorsal view; B, habitus, lateral view; C, anal somite and fourth urosomal somite, dorsal view. — Scale bars: A = 50 μm , B = 20 μm .

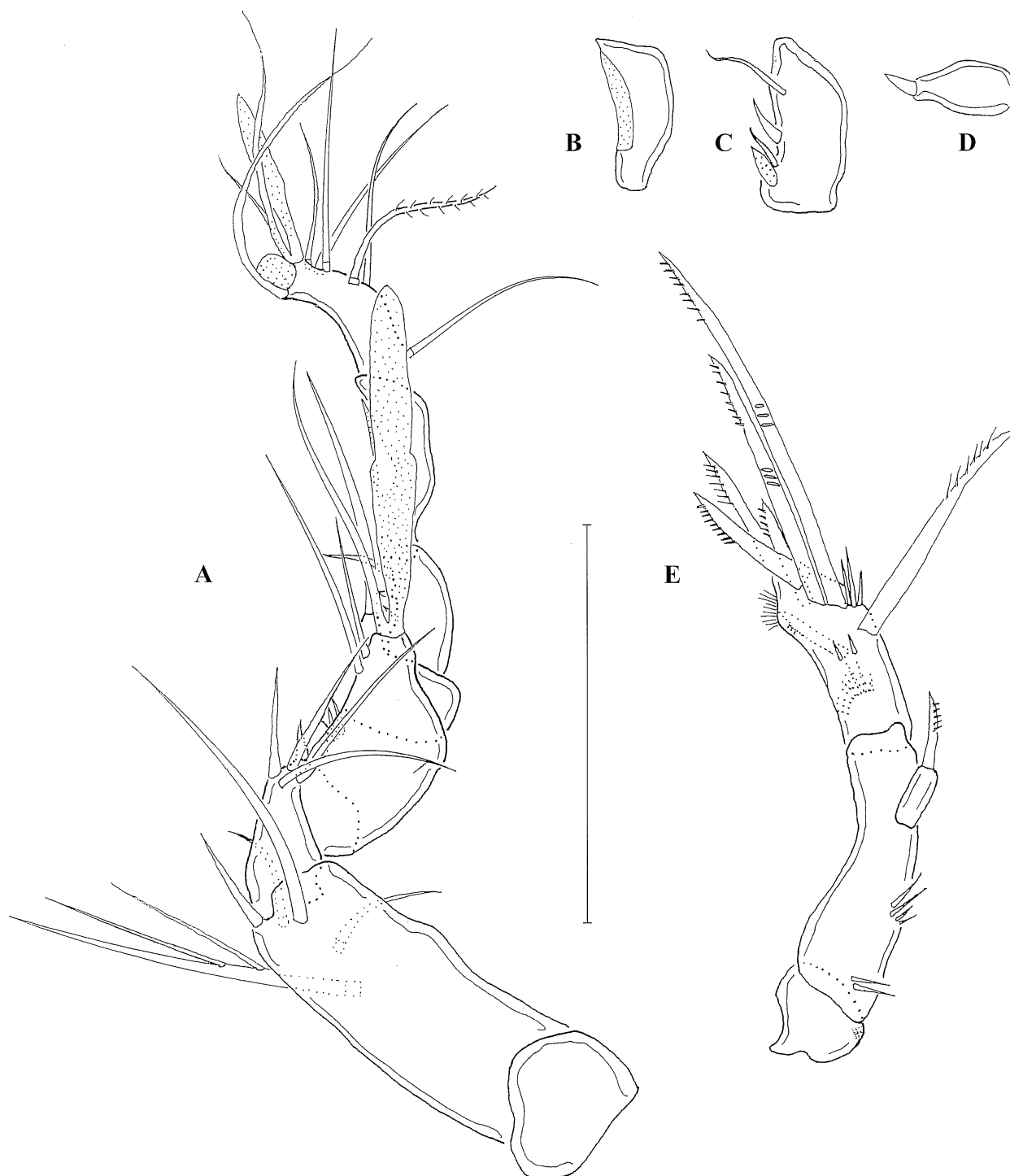


Fig. 7. *Remaneicaris euniceae*, new species, A, G antennule; B, C and D, segments 8, 7 and 4 of G antennule respectively; E, G antenna. — Scale bar: 30 μ m.

tip. Cephalothorax and second urosomite each with 1 dorsal integumental window. Urosomite 5 with lateral integumental window. Urosomite 4 without windows. Arrangement of sensilla on tergites illustrated in Figs. 6 A–B. Telson with row of 9 spinules dorsally, 2 rows of 3 spinules ventrally, and 2 rows of 3 spinules distally in ventral side. Operculum convex without spinules, but

flanked with 2 spinules on each side. Furca with 7 setae, all of them located on distal third, 2 spinules distally, and 2 spinules dorsally on distal third. A1 (Figs. 7 A–D) 9-segmented, prehensile and with a peculiar hyaline tip; armament beginning with proximal segment: 0/5/4/1/5+Ae/1/4/1/9+Ae. A2 (Fig. 7 E) with allobasis; 1-segmented exp with 1 seta, and 1-segmented enp bearing two

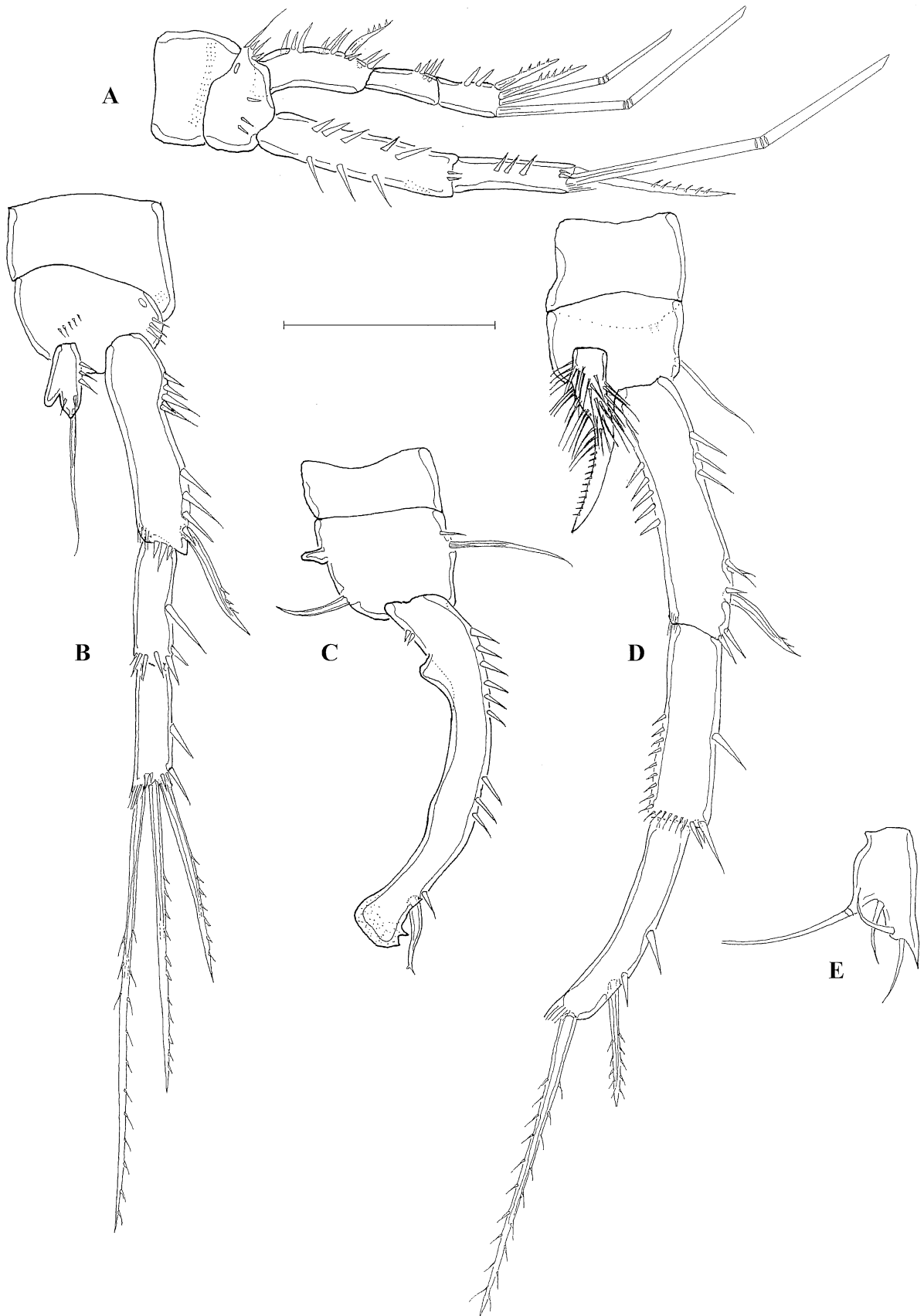


Fig. 8. *Remaneicaris euniceae*, new species, ♂. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, leg 5. — Scale bar: 20 μ m.

hyaline frills and 7 setae; Mouthparts armature as *Remaneicaris analuizae* n. sp.; P1 (Fig. 8 A) with fewer spinules (3 spinules) along inner margin of first enp segment, coxa with a posterior row of spinules, basis with three distal spinules on the anterior side and an outer pore. P2 (Fig. 8 B) enp bilobed with 1 seta and 2 terminal spinules on outer lobe. P3 (Fig. 8 C), basis with inner protuberance and 1 long curved seta representing enp; exp with row of 2 minute spinules proximally on

inner margin and 1 protuberance, thumb sigmoid, tapering distally, bifid at tip; apophysis with 2 small pointed protuberances on outer margin. P4 (Fig. 8 D) similar to *R. analuizae* n. sp.; first exp segment with row of 5 spinules on inner margin; enp leaf-shaped, covered with numerous long spinules proximally and with a strong tip, with a row of small spinules along inner margin side. P5 (Fig. 8 E) bilobed, inner lobe ending in small spinous process and bearing 3 setae, outer lobe with 1 seta.

Discussion

The genus *Remaneicaris* was proposed by JAKOBI (1972) to accommodate the species included in NOODT'S (1963) *remanei*-group, together with some other neotropical species described subsequently. *Remaneicaris* was based on a valid type species, viz. *Parastenocaris remanei* NOODT 1963, and therefore it has to be considered a valid genus according to ICZN. But this and other of JAKOBI'S genera have not been accepted by subsequent workers. This is probably because of JAKOBI'S heterodoxic systematic method, the "Schalenmodell", in which similar complex structures were not considered a priori homologous to each other, but rather the results of convergence or parallelism within evolutionary trends. This methodology has been strongly criticized by SCHMINKE (1976). We do not share most of JAKOBI'S ideas concerning the phylogeny and biogeography of Parastenocarididae. However, *Remaneicaris* represents a valid genus, and therefore must be used to group the species that constitute a monophyletic group around *R. remanei*. It would be a great mistake to describe the present species as "Parastenocaris", while other neotropical species are assigned to genera like *Forficatocaris* JAKOBI 1972, *Potamocaris* DUSSART 1970 and *Murunducaris* REID 1994. The type genus of the family Parastenocarididae has to be used exclusively for the monophyletic group around *Parastenocaris brevipes* KESSLER 1913. Recently GALASSI & DE LAURENTIIS (2004), while proposing the new genus *Simpliocaris* GALASSI & DE LAURENTIIS 2004, to accommodate two parastenocaridids from Italy, redefined the genus *Parastenocaris* sensu stricto. These authors proposed to retain within *Parastenocaris* KESSLER 1913 only those species belonging to the *brevipes*-group as revised by REID (1995). We agree with this argumentation and redefine the genus *Remaneicaris* (see above) to include only species phylogenetically related to *R. remanei*.

Unfortunately a robust hypothesis of the phylogenetic relationships within Parastenocarididae is far from completion. Therefore parastenocaridid species are sometimes assigned in genera using the exclusion principle, rather than synapomorphic characters. In our case, we propose to assign the new species to *Remaneicaris*, using

three characters that we believe to be apomorphic at different evolutionary levels.

The first concerns the position of the outer spine on the third exopodal segment of leg 4. This spine is located terminally on the outer margin in almost all members of Parastenocarididae, while it is located subterminally on the outer margin in all the species that we presently assign to *Remaneicaris* (arrowed in Fig. 4 D). We consider the displacement of this spine a major apomorphy of this genus. The homologous seta is displaced also in the species *Parastenocaris spinosa* WELLS 1964, *P. spinipes* WELLS 1964 from Africa and *P. pusillus* CHAPPUIS 1954 and *P. trisaetosa* CHAPPUIS 1954 from Madagascar. We conclude that this displacement is the result of convergent evolution rather than a synapomorphy linking these species with the Neotropical *Remaneicaris*. The clue for this assumption is given by the type of modification and grasping of the σ antennule. In *Remaneicaris* the G antennule is haplocer representing the symplesiomorphic condition of the family. The same type of antennule is present in the members of the so called "Fontinalicariidae" (SCHMINKE 1993). While grasping, the σ moves the 8th against the 7th segment. The 9th (distal) segment is bent dorsally over the 5th segment. The geniculation mode of σ antennule in *P. spinosa*, *P. spinipes*, *P. pusillus* and *P. trisaetosa* belong to special type where the 8th (penultimate) segment is transformed, displaying a strong process on inner distal margin. While grasping, the 8th segment is moved against the 7th and the 9th segment is moved outwardly and has no function in grasping. According to SCHMINKE (1993 and pers. comm.) this type of antennule is a synapomorphy of the "Parastenocaridinae". *Remaneicaris* do not belong to the crown-group "Parastenocaridinae", and therefore cannot be related to the species from Africa and Madagascar.

The second character involves the presence of a long cuticular spinule located medially on outer margin of middle and distal exopodal segment on legs 2 and 4. This peculiar spinule (arrowed on Fig. 4 B) is present on all species assigned here to *Remaneicaris*, but is not present in other Parastenocarididae. We speculate that

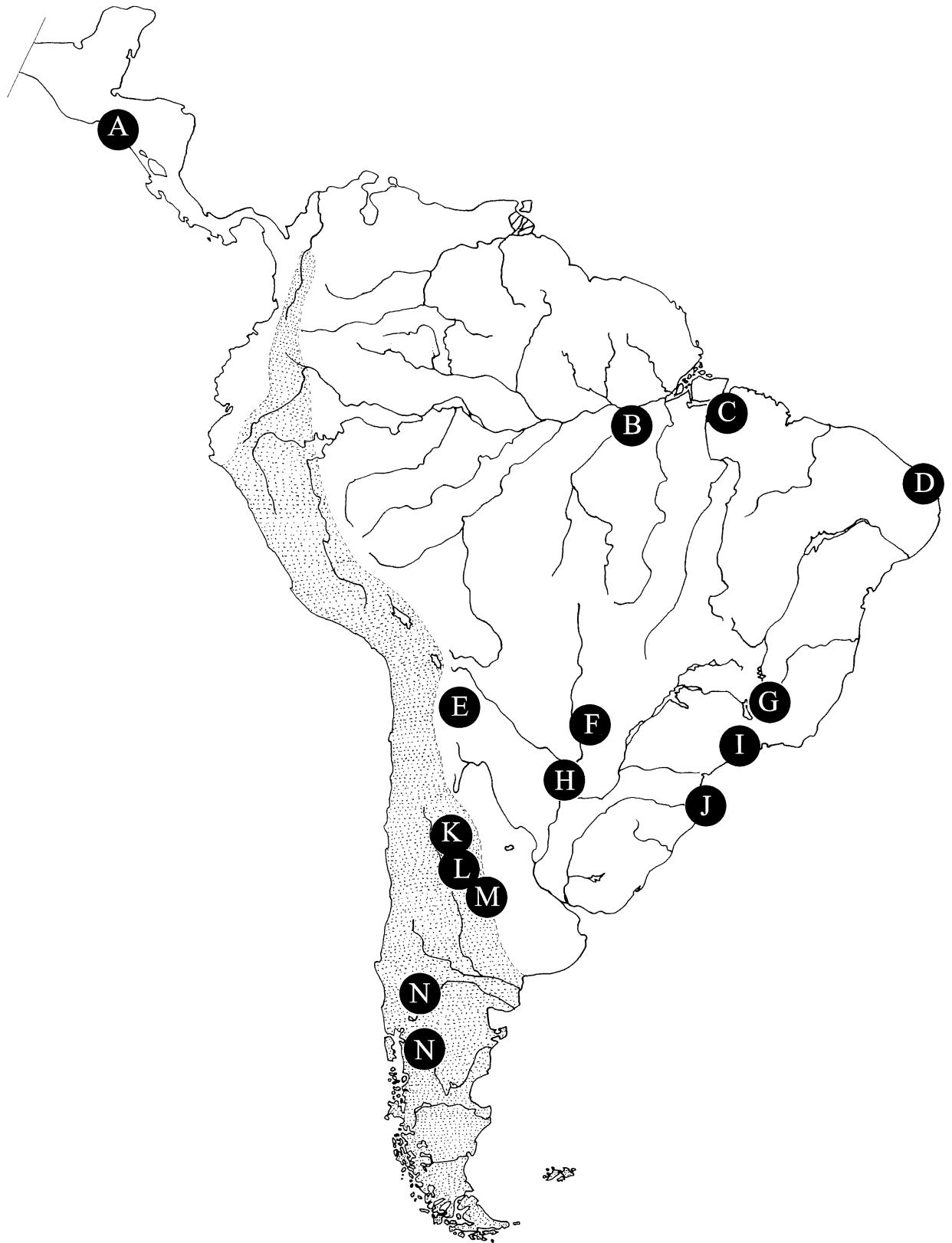


Fig 9. Map of South and Central America showing the locations where species assigned herein to *Remaneicaris* have been reported (see Table 1 for legends). Dotted area: Austral Subregion; clear area: Holarctic Subregion (subregions according to MORRONE 1996).

this spinule is shifted from the outer distal spinule row present in that segments in other Parastenocarididae.

The third character concerns the position of the integumental windows of the fourth and fifth urosomites. These thin cuticular areas are present in various freshwater and brackish-water crustaceans, and have an osmoregulatory function (HOSFELD & SCHMINKE 1997). REID (1994) reviewed the presence of these organs in Parastenocarididae. The presence of integumental windows seems to be a character present in the ground-pattern of Parastenocarididae according to the following pattern: 1 dorsal window on the cephalothorax and 1 dorsal window each on urosomites 2–5 in the ♂ and 2–4 in the ♀ (due to the genital double-somite in the ♀). Variations in this pattern occur and have to be considered derived situations. Male *Murunducaris juneae* REID 1994, for instance, have lost the windows while these organs are still present in ♀ of this genus (REID 1994). Some African parastenocaridids, viz. *P. caffer* CHAPPUIS 1936, *P. madagascarensis* CHAPPUIS 1952, *P. forficulata* CHAPPUIS 1952 and *P. arenosus* FRYER 1956, *P. aethiopica* COTTARELLI & BRUNO 1995 (CHAPPUIS 1936, 1952, FRYER 1956, COTTARELLI & BRUNO 1995) display lateral or ventrolateral windows on the fourth and fifth urosomites. Besides these African species, the only parastenocaridids known to display lateral windows belong to the genus *Remaneicaris*. The shifting of these windows to the lateral position is not a character present in the ground-pattern of the genus, but it evolved within *Remaneicaris*. For example, *Remaneicaris ignotus* (DUSSART 1983) displays 1 dorsal window each on urosomites 2–5, while in *R. palaciosi* (NOODT 1962) and *R. meyerabichi* (NOODT 1962) these urosomal windows extend from the dorsal to the lateral margins (DUSSART 1983, NOODT 1962). All other *Remaneicaris* species, as far as described in detail, seem to have 1 dorsal window on the cephalothorax and second urosomite, and 1 lateral window on the fifth urosomite, as is the case in *R. euniceae* n. sp. (Figs. 6 A–B). The condition present in *R. analuizae* n. sp. is remarkable, because of the presence of a lateral window on the fourth urosomite (Fig. 1 A–C). It seems that there are several apomorphic characters involved in these transformations that will help in future to discern monophyletic subunits within *Remaneicaris*. We can mention the elongation of the dorsal urosomal windows to the lateral position, the splitting of the dorsal windows on urosomites 4 and 5 into lateral windows, the loss of the windows on the fourth urosomite, and the loss of the windows on the third urosomite.

Besides the two characters mentioned above, the inclusion of the new species in *Remaneicaris* is based on the overall similarity of the morphology of legs 2, 3 and 4 in the male and the position of leg 5. Unfortunately we do not know if the condition of these characters represents apomorphies of *Remaneicaris* or of a larger subgroup within the Parastenocarididae, as discussed below.

Table 1: Known parastenocaridid species here ascribed to *Remaneicaris* and their occurrence in South and Central America (Fig. 9).

Species	Loc.
<i>R. palaciosi</i> (NOODT 1962)	A
<i>R. meyerabichi</i> (NOODT 1962)	A
<i>R. clandestina</i> (NOODT 1963)	B
<i>R. drepanephora</i> (KIEFER 1967)	B
<i>R. icoaraci</i> (NOODT 1963)	C
<i>R. paraensis</i> (NOODT 1963)	C
<i>R. hexacantha</i> (KIEFER 1936) comb. nov.	D
<i>R. jujuyensi</i> (NOODT 1965)	E
<i>R. paraguayensis</i> (NOODT 1963)	F
<i>R. remanei</i> (NOODT 1963)	F
<i>R. analuizae</i> CORGOSINHO & MARTÍNEZ ARBIZU n. sp.	G
<i>R. euniceae</i> CORGOSINHO & MARTÍNEZ ARBIZU n. sp.	G
<i>R. ignotus</i> (DUSSART 1983)	H
<i>R. divae</i> (NOODT 1972)	I
<i>R. tageae</i> (NOODT 1972)	I
<i>R. hurdi</i> (JAKOBI & SILVA 1962)	J
<i>R. argentina</i> (NOODT 1965)	K
<i>R. ciliata</i> (NOODT 1965)	K
<i>R. cordobaensis</i> (NOODT 1965)	K
<i>R. rhizophora</i> (NOODT 1965)	K
<i>R. sierrae</i> (NOODT 1965)	K
<i>R. membranacea</i> (NOODT 1965)	L
<i>R. sanctiludovici</i> (NOODT 1965)	L
<i>R. hecate</i> (NOODT 1965)	M
<i>R. oncophora</i> (NOODT 1965)	M
<i>R. persephone</i> (NOODT 1965)	M
<i>R. pluto</i> (NOODT 1965)	M
<i>R. psammae</i> (ROUCH 1962)	N

Leg 3 in the ♂ consists of the coxa, the basis, and a 1-segmented exopod in the species described herein. The exopod is almost straight and the apophysis is short, rounded, and bears no setae (Figs. 4 C, 8 C). This specific condition of the apophysis is shared by most members of *Remaneicaris*, and is surely apomorphic in comparison with the condition present in several other parastenocaridids, in which the apophysis (which is homologous with a second exopodal segment) is rectangular and bears one or two setae (ROUCH 1990, GLATZEL 1991, MARTÍNEZ ARBIZU 1997).

The leg 4 endopod in the male is leaf-shaped and covered by many tiny cuticular spinules (Figs. 4 D, 8 D). This condition is apomorphic in comparison with the unmodified endopod present in the female (Fig. 5 B), which consists of 1 segment ornamented with a few strong spinules along the outer margin, and no small and long spinules. Other *Remaneicaris* species seem to share this kind of endopod (NOODT 1962, 1963, 1965, 1972, KIEFER 1967), but published descriptions are not always detailed enough to use this character with confidence.

Leg 5 consists of a bilobed plate in both sexes. These plates are located medio-laterally on the ventral surface of the somite, far from each other and lacking an intercoxal sclerite. This is another apomorphic character

present in both species described herein, in comparison with the medially located leg 5 of, for instance, *P. hispanica*, the plates of which are jointed by a small intercoxal sclerite (MARTÍNEZ ARBIZU 1997). Unfortunately we do not know whether this is an apomorphy of *Remaneicaris*, or of a larger group within the Parastenocarididae.

A striking character of some species of *Remaneicaris* species is the presence of a 1-segmented endopod on the inner margin of leg 3 in the σ . All other male parastenocaridids have lost this endopodal segment, retaining only a seta at this position, or even losing any remnant of the segment. This endopodal segment (armed with one seta) was described repeatedly by NOODT (1963, 1965, 1972), but it is absent in *R. oncophora* (NOODT 1965), and *R. drepanophora* (KIEFER 1967), where only a seta representing the endopod has been retained (NOODT 1965, KIEFER 1967). The presence of an endopod on the male leg 3 could not be verified with our new descriptions. Both species described here have one seta representing the endopod, but no endopodal segment. *Remaneicaris analuizae* n. sp. bears an additional hyaline structure on its inner margin, just above the endopodal seta (Fig. 4 C), while *R. euniceae* n. sp. has a protuberance proximal to the endopodal seta on the inner margin (Fig. 8 C). We do not believe, however, that NOODT may have misinterpreted homologues of these additional ornamentations with a true endopodal segment. The presence of an endopodal segment, if this is verified in the future, should be interpreted as a plesiomorphic character within Parastenocarididae. This would suggest a basal position of the genus within the family, because all members assigned to the so called "Fontinalicaridinae" and "Parastenocaridinae" share the loss of the endopodal segment on male leg 3 (SCHMINKE 1993).

Another peculiar symplesiomorphy of *Remaneicaris* is the presence of two setae on the proximal syncoxal endite of Mx2. Most members of the so called "Parastenocaridinae" and "Fontinalicaridinae" display only one seta at this endite. But two setae at this endite have been described for instance also for "fontinalicaridid" *Murunducaris* by REID (1994) and the "parastenocarids" *P. brevipes*, *P. aethiopica* and *P. impervia* COTTARELLI & BRUNO 1995 (REID 1995, COTTARELLI & BRUNO 1995). Remarkably two seta are also present in *Parastenocaris ahaggarica* BOZIC 1978 from Algeria (BOZIC 1978), a species that resembles *Remaneicaris* in several respects and deserves redescription in order to confirm some unusual setation on Mx1 and leg 5. We prefer to not formally include *P. ahaggarica* into *Remaneicaris* awaiting its redescription.

Remaneicaris analuizae n. sp. differs from all other species of the genus known to date, in possessing a bilobed endopod of leg 2 in the male. The other species, *R. euniceae* n. sp., differs in the possession of an integumental window on the lateral margin of the fourth urosomite.

A hypothesis on the phylogenetic position of these new species within the genus *Remaneicaris* is difficult

to form or evaluate without studying the type material of the known species. Therefore only some comparisons will be provided here.

Both new species have a row of spinules flanking the anal operculum. Similar ornamentation has been reported for *R. paraguayensis* (NOODT 1963) and *R. remanei* (NOODT 1963), both of which having been described from hyporheic groundwaters of Lake Ypacarai in Paraguay (NOODT 1963). But these spinules are much larger and stronger in the Paraguayan species. In addition, the Paraguayan species display a characteristic proximal constriction on the furcal ramus, a row of spinules on the dorsal margin of the fifth urosomite, an endopod on the male leg 3, and an almost triangular leg 5 with a large inner spine, all these characters differing from the conditions present in the Brazilian species. *Remaneicaris paraensis* (NOODT 1963) from the hyporheic of the Amazon River delta near Icoaraci, Pará, Brazil, also displays spinules flanking the operculum (NOODT 1963), and resembles the new species in having a bilobed leg 5. It can be distinguished from the new species in having an endopod on leg 3 in the σ , and a row of long spinules on the proximal inner margin of the basis of leg 4 in the σ . In addition to the species mentioned above, the only species of *Remaneicaris* known to possess spinules flanking the operculum are *R. divae* (NOODT 1972) and *R. tageae* (NOODT 1972) from the hyporheic zone of Cubatão River at the base of the Serra do Mar in the state of São Paulo, Brazil (NOODT 1972). The new species differ from *R. divae* in many respects, particularly the elongated furca, the elongated endopods of legs 2 and 4, and the elongated apophysis of the male leg 3 in *R. divae*. *Remaneicaris tageae* closely resembles both species described here, but can be distinguished by the absence of an additional proximal row of spinules on the dorsal margin of telson, which is present in both species from Minas Gerais.

In this contribution we advocate the use of the genus name *Remaneicaris* for those parastenocaridids belonging to a monophyletic group characterised by the displacement of the outer spine on the third exopod segment of leg 4 to a subterminal position. To our knowledge, 28 species display this character (Table 1). This list differs from the *Remaneicaris* concept of JAKOBI (1972) by the inclusion of *R. hexacantha* (KIEFER 1936) comb. nov. (as already suggested by NOODT 1963) known from the Rio Serido in Rio Grande do Norte, Brazil, and by the exclusion of 3 species (included by JAKOBI in *Remaneicaris*) which do not display this character, viz. *P. dactyloides* KIEFER 1967, *P. itica* NOODT 1962, and *P. staheli* MENZEL 1916. These three species do not belong to *Remaneicaris*, and their phylogenetic relationships will be discussed elsewhere. Almost 50 % of all known South American parastenocaridid species belong to *Remaneicaris*.

The genus *Remaneicaris* is widely distributed in South America (Fig. 9). It has been reported from within the Austral and the Holotropical biogeographic subregions

of the Neotropis (subregions according to MORRONE 1996). From these facts we conclude that

i) the genus was widely distributed in South America long before the elevation of the Andes, which began some 90 million years ago, and

ii) that the sistergroup of *Remaneicaris* should be found within the former Gondwanaland but outside the Neotropis.

Constructing a robust hypothesis of the phylogenetic relationships within *Remaneicaris* will be very useful for understanding the history of South American river

basins. The present contribution is a first step towards that goal.

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