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# A new genus of Pseudomesochrinae Willen, 1996 (Copepoda, Harpacticoida, Pseudotachidiidae) from the Guinea Basin*

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## Abstract

A new species of the new genus *Keraia* gen. nov. from the Guinea Basin is described in the present paper. The new taxon belongs to the Pseudomesochrinae Willen, 1996, which until now has contained only the genus *Pseudomesochra* T. Scott, 1902. Both genera are prevalent in the deep sea. Whereas *Pseudomesochra* reaches quite high individual and species numbers in the investigated samples of the DIVA 1, DIVA 2 and ANDEEP deep-sea expeditions, *Keraia* is found only occasionally and as single specimens. *Keraia* is characterised among others by a modified antenna exopodite and the shape of P1. *Pseudomesochra* on the other hand can still be identified as a monophylum by specialised setation on the P1 endopodite and the lack of the inner setae of the first segment of swimming leg exopodites. Other species of *Keraia* gen. nov. are *K. longiseta* (Vasconcelos, George & Santos 2008) and the type species *K. tamara* (Smirnov, 1946). The available records implicate a widespread occurrence of *Keraia* gen. nov. from the northern to the southern Atlantic, and even reaching both northern and southern polar regions. Up to now all individuals that have been found occur exclusively at deep-sea sites and in very low abundances.

**Key words**: *Keraia*, new species, systematics, deep sea, meiofauna

## Introduction

The international deep-sea campaigns DIVA 1 and 2 and ANDEEP are integrated into the global deep-sea biodiversity program “Census of the Diversity of Abyssal Marine Life” (CeDAMar). CeDAMar aims in the next few decades to produce reliable information on deep-sea diversity and the factors regulating it (for more information please visit www.cedamar.org). Eventually, the stations of the DIVA and ANDEEP expeditions will for the first time provide a sampling transect of a complete latitudinal deep-sea gradient from the tropics to the pole in the Southern Atlantic. The first DIVA expedition into the Angola Basin took place in July 2000. For the first time a comprehensive replicative sampling design was performed for the meiofauna (compare Rose *et al*. 2005).

Within this framework the species diversity of Copepoda Harpacticoida in the deep sea of the Angola Basin (DIVA 1), Cape Basin (DIVA 2), Guinea Basin (DIVA 2) and in the Weddell Sea (ANDEEP II) has been investigated. Among others, one goal of the whole project is to obtain data on the presence and distribution of harpacticoid higher taxa and species. A major harpacticoid family present in the samples are the Pseudotachidiidae Lang, 1936, containing among others the Pseudomesochrinae Willen, 1996.

Until now, the Pseudomesochrinae have only been represented by the single taxon *Pseudomesochra* T. Scott, 1902. Its species occur mainly in deeper waters and are mostly documented to live in or on muddy

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sediment. In the samples of DIVA 1 and 2, ANDEEP, and in other deep-sea samples investigated by our working group they have always been the most important subtaxon of the Pseudotachdiidae Lang, 1936, always constituting about half of all species and individuals. Generally they seem to be an important and significant part of the harpacticoid community in deep-sea sediments. Only 18 species have been described so far, but multiple species have already been encountered in the above-mentioned samples. The two investigated DIVA 1 stations contained almost 60 species (compare also Willen in press), ANDEEP station 138 10 species and DIVA 2 (all locations together) 38 species, with very few species overlapping. This gives an impression of the magnitude of the global species number, which presumably could still be expected. However, besides *Pseudomesochra*, another hitherto unknown but related taxon, *Keraia* gen. nov. regularly occurs in the samples. A new species of the new taxon is described in the present paper. Whereas *Pseudomesochra* appears in great species and individual numbers, the new genus *Keraia* is encountered only occasionally and only as single specimens. One copepodid specimen was found containing another organism, presumably a copepod, as gut content, suggesting a carnivore life-style. By contrast, as far as visible in the light microscope, in the specimens of *Pseudomesochra* only non-distinguishable pellets of detritus were present in the gut.

## Material and methods

The (type) material is stored in the collection of the Senckenberg research institute, Germany. Catalogue No.: *Keraia ricardae* gen. nov., sp. nov.: female holotype: SNG 32244

The treatment of the multicorer samples is described in detail by Rose *et al.* (2005). Specimens were preserved in 5% buffered formalin and subsequently transferred to glycerine. Drawings were made with the aid of a *camera lucida* on a Leica Diaplan microscope equipped with UCA condenser, IC prism and doubler x 1.5. The dissected parts are mounted on several slides. The terminology is adopted from Lang (Lang 1948; Lang 1965) except for the segmental composition of the mandible, maxilliped and the numbering of the furcal setae, in which cases Huys and Boxshall (1991) were followed. Abbreviations used in the text: F.R.: furcal rami; Aes: aesthetasc; exp: exopodite; enp: endopodite; enp1: first segment of endopodite; Md: mandible; Mxl: maxillula; Mx: maxilla; Mxp: maxilliped; P1–P6: swimming legs 1–6; benp: baseoendopodite of P5; Ro: rostrum; Ceph: Cephalothorax.

The term groundpattern is used in the sense of "Grundmuster" (Ax 1984, page 156).

## Taxonomy

Pseudotachidiidae Lang, 1936
*Keraia* gen. nov.
***Keraia ricardae* gen. nov., sp. nov.**
(Figures 1–6)

*Holotype*: *Keraia ricardae* gen. nov., sp. nov.: 1 female specimen collected during the DIVA 2 campaign (M63/2) of RV *Meteor* to the Eastern Atlantic from 24.1.–30.3. 2005 using a multicorer at station 59 in the Guinea Basin (0°0.0'S, 2°25.1'W; depth: 5063 m), sampled on 15.03.2005.

*Other examined material*: *Keraia* sp.: 1 female specimen collected during the DIVA 1 campaign of the RV *Meteor* M48/1 to the Angola Basin from 06.7.–08.8. 2000 using a multicorer at station 346 (16°17.00'S, 005°27.00'E; depth: 5388 m), sampled on 27.7.2000; 1 female specimen collected during the DIVA 1 campaign of the RV *Meteor* M48/1 to the Angola Basin from 06.7.–08.8. 2000 using a multicorer at station 346 (16° 17.005'S, 005° 26.989' E, depth 5432 m), sampled on 27.7.2000; 3 copepodid specimens from the DIVA 2 expedition (RV *Meteor* cruise M63/2):

Cape Basin: 28° 6.7' S, 7° 20.8' E, 5035 m depth

Guinea Basin II: 0° 50.1' N, 5° 35.0' W, 5138 m depth

Guinea Basin I: 0° 0.1' S, 2° 25.1' W, 5197 m depth

*Etymology.* The genus name is Greek and means "antenna", referring to the modified antenna, which characterises the genus. The species is named after the mother of the junior author, Ricarda Dittmar.

*Genus diagnosis*. Pseudomesochrinae. Rostrum with 4 sensilla, antennule 5-segmented, with outer projections on first segment, antenna with 2-segmented exp, exp1 enlarged, exp2 with large, modified terminal seta, one of which developed as a "rat-tail" seta, P1 with elongate exp1, outer spines of exp1 and exp2 seta-like, terminal and outer spines of P1 exp3 developed as long "rat-tail" setae; setation of P1 enp2 consists of slender outer seta, longer middle "rat-tail" seta and 1 shorter inner seta; P2–P4 endopods 2-segmented, inner terminal setae on enp2 shortened, P2–P4 exopods 3-segmented, P5 of characteristic shape: benp narrow and elongate, expodal part only slightly prominent.

*Setal formula (after Lang 1948):*

| | *Exp* | *Enp* |
|---|---|---|
| P2–P4 | 1-1-2, 2, 3 | 1-2, 2, 1 |

*Type species: Keraia tamara* (Smirnov, 1946). Other species: *Keraia longiseta* (Vasconcelos, George & Santos 2008).

*Description of female (holotype).* Body length 890 µm, furcal rami length 150 µm.

Rostrum (figure 1A). Demarcated from cephalothorax, slightly broader than long, rounded, with one pair of sensilla apically and one subapically.

Body (figures 1A; 2A, B) with distinct separation between prosome and urosome. Cephalothorax longer than broad, cylindrical, cephalic shield with sensilla. Posterior margin of each body somite (excluding penultimate somite) with sensilla, frill of prosomal somites with reticular texture, frill of urosomal somites smooth with serrated margin. Urosomal somites with dorsolateral spinule rows, genital double-somite (free somites 5 and 6) ventrally separated by cuticular ridge, dorsally not completely fused, genital field as in figure 2B; P6 with 1 elongate slender outer seta and 2 minute inner setae. Anal somite completely divided with two dorsal sensilla, anal operculum absent, pseudoperculum present (figure 1A). Furcal rami (figures 1A; 2A, B) approximately 5 times longer than broad, furcal seta I absent, II very small, III inserting near apical margin, displaced slightly proximad, outer edge developed as a large pore, IV and V well developed, distal parts shaped as "rat-tail" setae, VI inserting on apical margin, juxtaposed to IV and V, VII subterminally on dorsal surface.

Antennule (figure 3C) with 5 segments. Armature: damaged; segment I with 1 large and 1 small process on outer distal edge.

Antenna (figure 3A). Allobasis medially with a long abexopodal pinnate seta; exp 2-segmented, exp1 longer and broader than exp2, with 2 marginal setae, exp2 bent off perpendicularly to exp1, with 1 outer pinnate seta and 2 elongated and enlarged claws terminally, enp with subapical spinule row, subapical armature consisting of 3 setae; apically with 7 setae: 1 slender naked spine, 4 geniculate setae of "rat-tail" shape, the outermost of which is fused basally with a long slender seta, and one additional small naked seta on outer edge.

Mandible (figure 4B, C, D). Gnathobase slender with 4 larger and several smaller, finer, pointed and rounded teeth, fringed with spinule row, inner edge with 1 large, tapering pinnate seta, basis with 4 setae; enp longer than exp, with 3 lateral and 6 terminal setae; exp shorter, with 4 lateral and 2 terminal setae.

Maxillule (figure 1B). Arthrite of praecoxa with 7 apical spines and 2 pinnate setae, 1 small and naked seta posteriorly, 2 juxtaposed setae on anterior surface; coxal endite with 6 setae; basis with uni-lobed endite bearing 6 setae; exp and enp cylindrical, with 3 setae each.

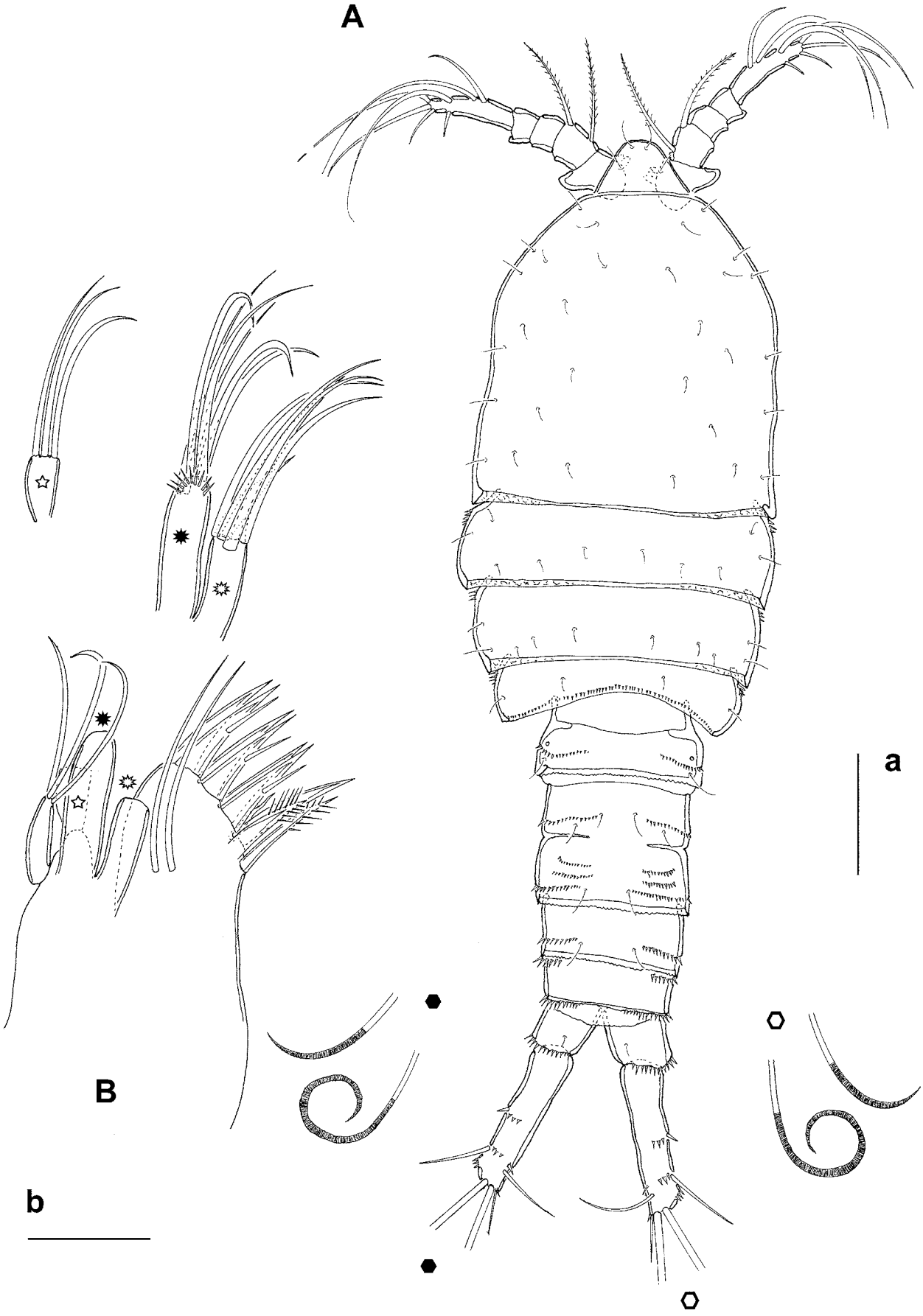


**FIGURE 1.** *Keraia ricardae* gen. nov., sp. nov. A, habitus, dorsal, scale bar = 100 µm; B, Mxl, scale bar = 25 µm.

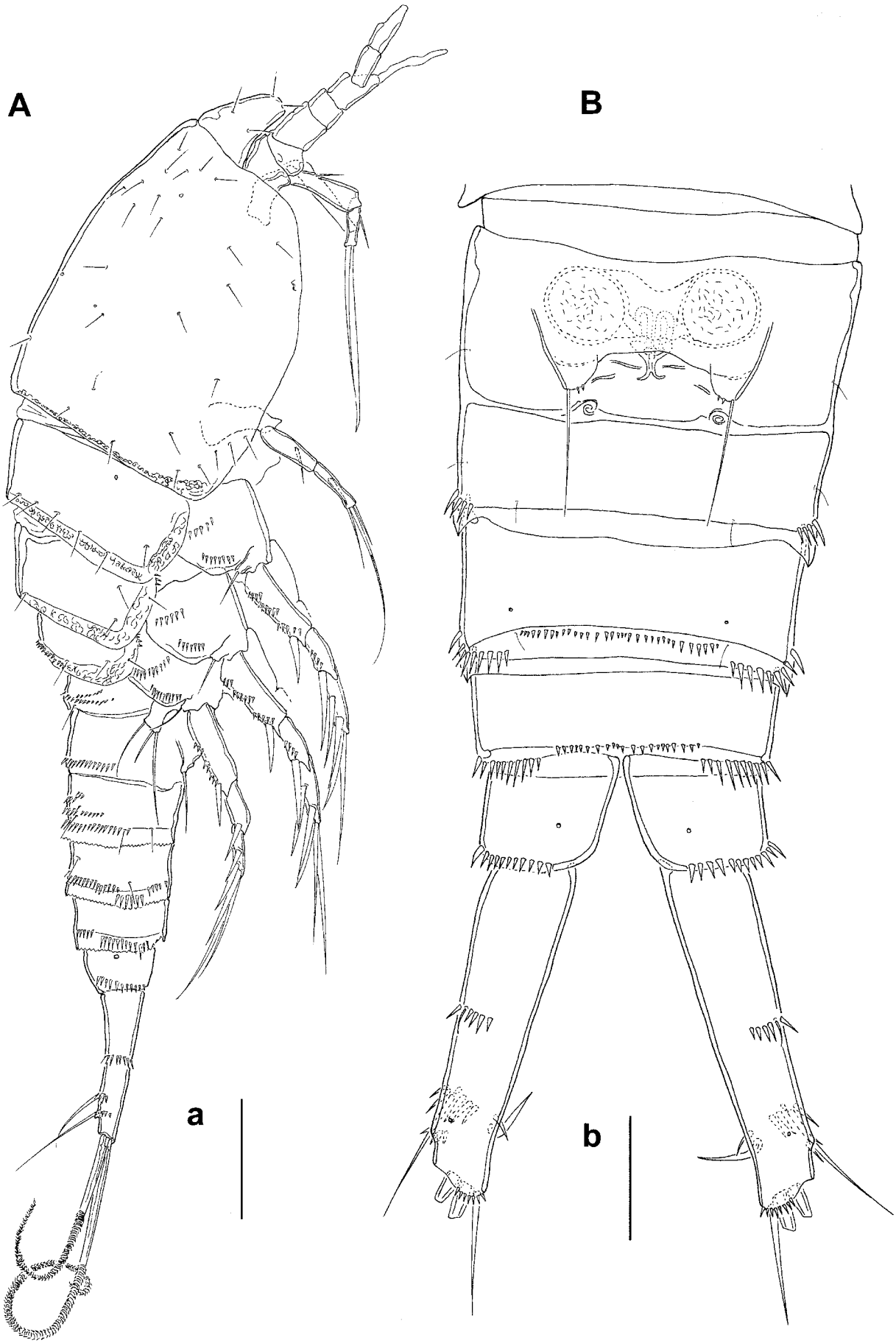


**FIGURE 2.** *Keraia ricardae* gen. nov., sp. nov. A, habitus lateral, scale bar = 100 µm; B, urosome ventral, scale bar = 50 µm.

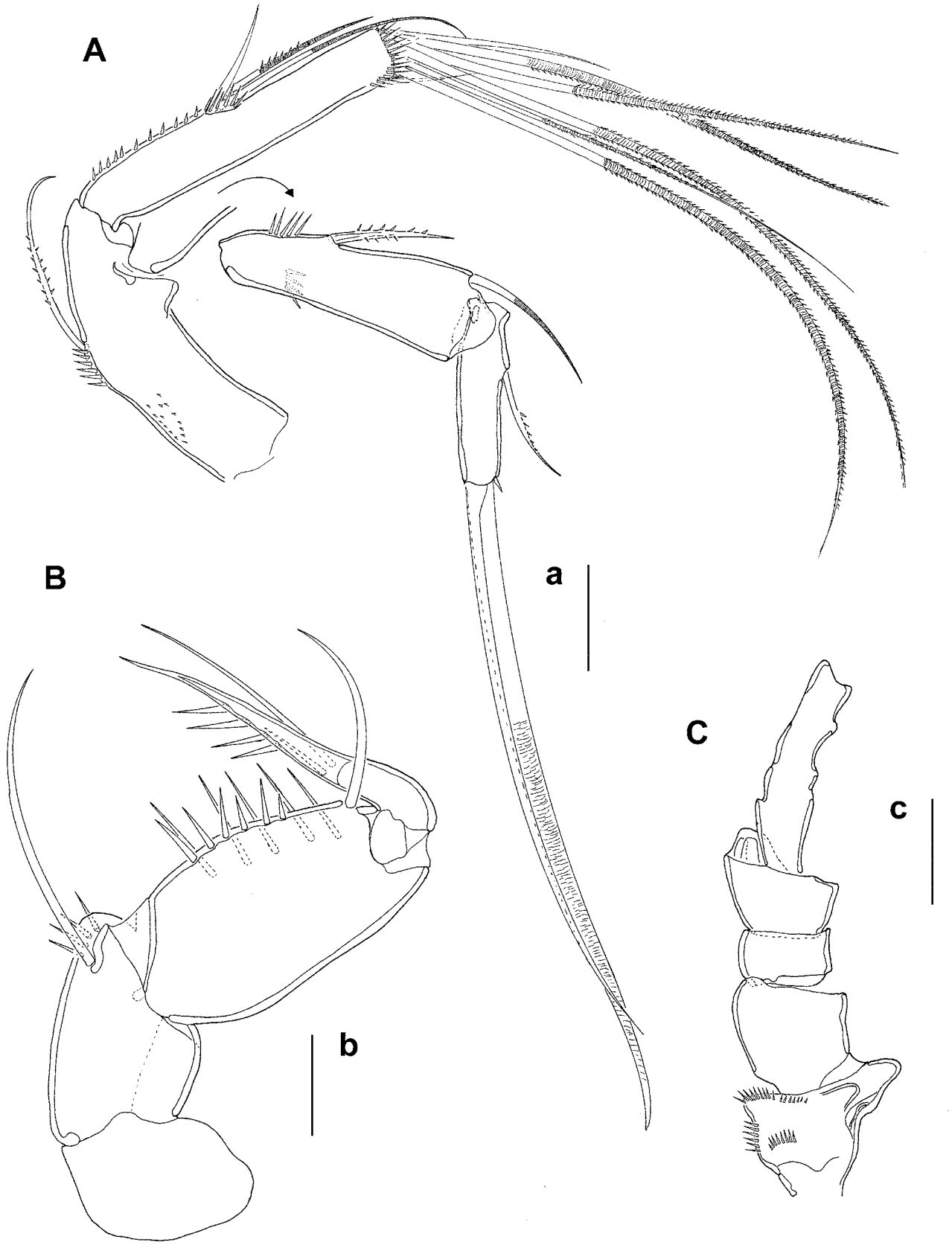


**FIGURE 3.** *Keraia ricardae* gen. nov., sp. nov. A, antenna, scale bar = 25 µm; B, maxilliped, scale bar = 12.5 µm; C, antennule, scale bar = 50 µm.

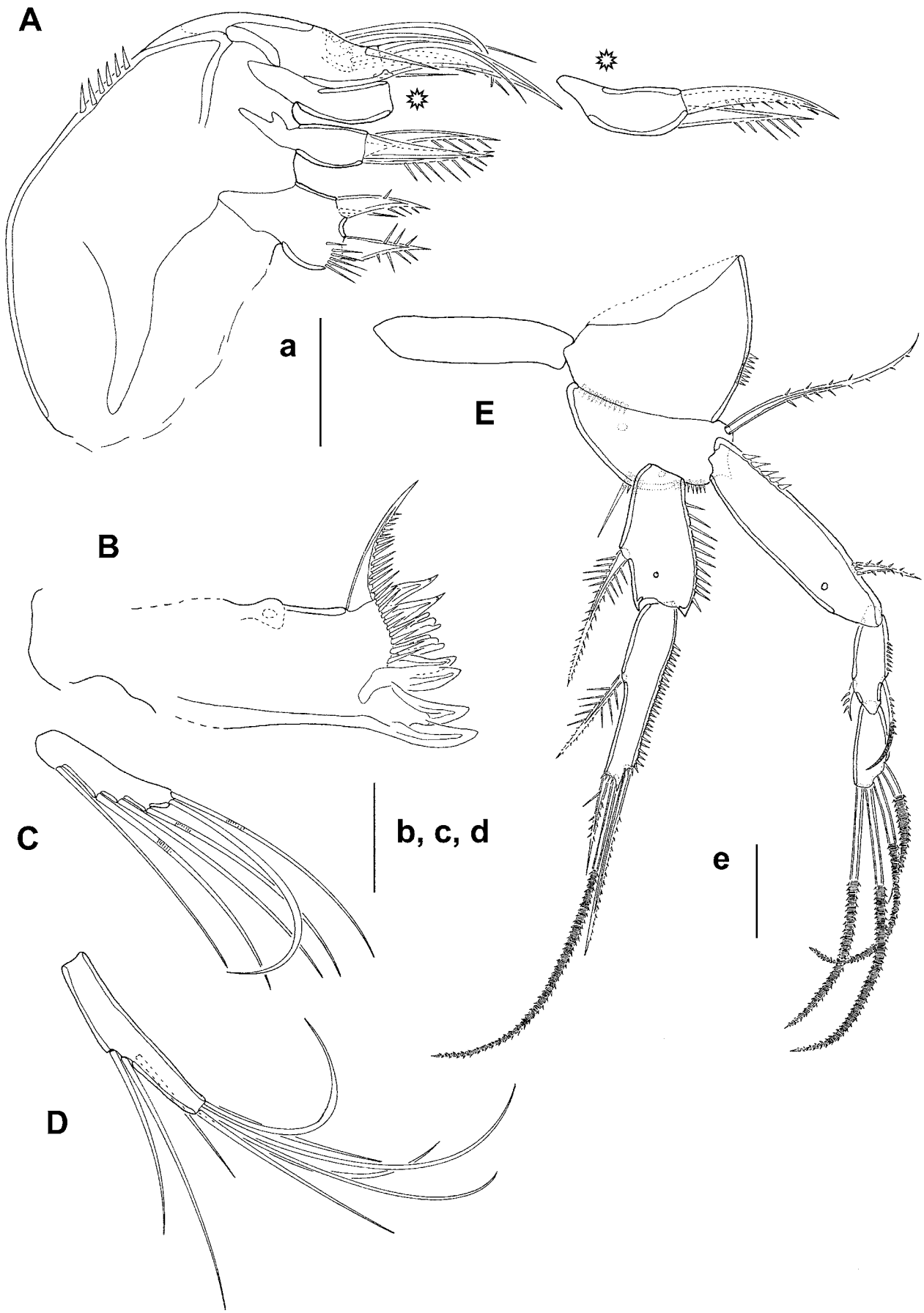


**FIGURE 4.** *Keraia ricardae* gen. nov., sp. nov. A, Mx, scale bar = 25 µm; B, mandible gnathobase, scale bar = 25 µm; C, mandible exopodite, scale bar = 25 µm; D, mandible endopodite, scale bar = 25 µm; E, P1, scale bar = 25 µm.

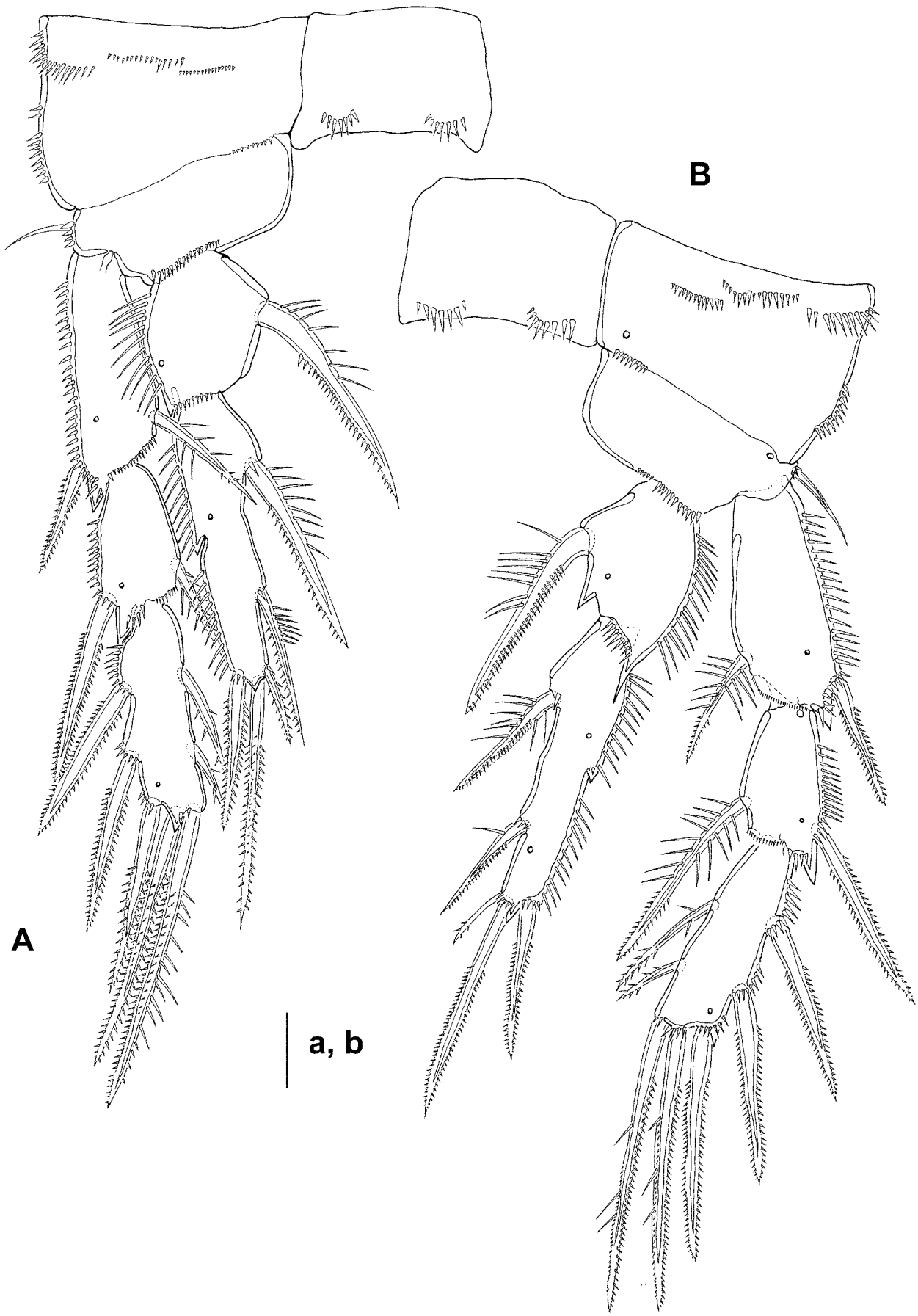


**FIGURE 5.** *Keraia ricardae* gen. nov., sp. nov. A, P3; B, P2; scale bars = 25 µm.

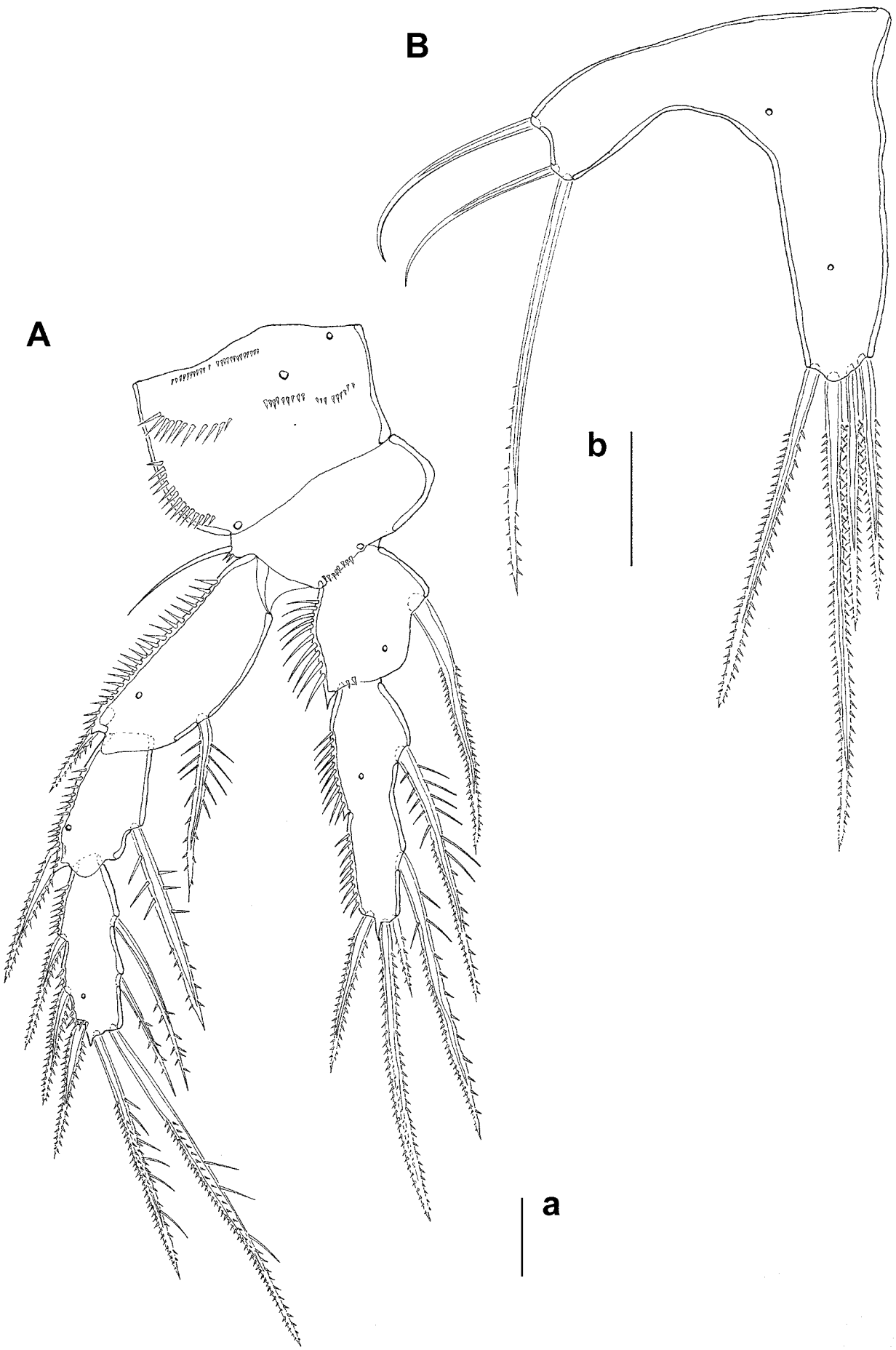


**FIGURE 6.** *Keraia ricardae* gen. nov., sp. nov. A, P4, scale bar = 25 µm; B, P5, scale bar = 25 µm.

Maxilla (figure 4A). Syncoxa with 3 endites; proximal endite bilobed, proximal lobe with 1 large pinnate spine and apical row of spinules, distal lobe with 1 pinnate spine and 1 small seta, middle and distal endites each with 3 large pinnate setae, on distal endite one of which of claw-like shape; basal endite with 1 pinnate claw fused to basis, accompanied by 1 slender naked seta on posterior and 2 setae on anterior side; enp 1-segmented, bearing 2 + 2 setae.

Maxilliped (figure 3B). Syncoxa short and broad, shorter than basis, with spinule row and 1 slender naked seta on distal margin; basis compact, bearing 1 naked seta near distal edge as well as several strong spinules on inner margin; enp with claw, accompanied by 2 naked setae and armed with a few large spinules.

P1 (figure 4E). Basis with small inner and elongate pinnate outer seta; terminal margin, base of spines without spinule rows. Exp 3-segmented, outer and terminal margins of exp1 and exp2 with spinules; exp1 elongated, much longer than exp2 and exp3, exp1 with 1 outer pinnate spine, exp2 with small inner seta and outer spine modified as a "rat-tail" seta; exp3 with 2 terminal and 2 outer "rat-tail" setae, the latter of which is slightly displaced distally; enp two-segmented with spinules along outer and distal margins, enp1 shorter than enp2, with 1 inner pinnate seta; enp2 with 1 inner pinnate seta and terminally with long and slender pinnate outer seta, longer middle "rat-tail" seta and shorter inner terminal pinnate seta.

P2–P4 (figures 5A, B; 6A). Exopodites three-segmented, endopodites two-segmented with inner terminal seta on enp2 shortened. Coxae of almost rectangular shape, with spinule rows on surface, terminal and outer margins. Basis of P2–P4 each with slender outer seta, and spinule rows on distal margin and at base of outer setae.

Setal formulae (after Lang 1948):

| | *Exp* | *Enp* |
|---|---|---|
| P2 | 1-1-2, 2, 3 | 1-2, 2, 1 |
| P3 | 1-1-2, 2, 3 | 1-2, 2, 1 |
| P4 | 1-1-2, 2, 3 | 1-2, 2, 1 |

P5 (figure 6B). Pair of legs not fused medially, rami fused to single plate, baseoendopodal part with a slender, long seta located at proximal outer edge, endopodal lobe narrow and elongated, with 4 terminal pinnate setae, exopodal part represented by a small projection bearing 1 shorter outer and 1 longer terminal seta.

Male unknown.

**Systematic discussion**

The Pseudomesochrinae have already been characterised as a monophylum by Willen (1996). To include *Keraia* gen. nov., the list of apomorphies stated there has to be slightly amended. The taxon, henceforth including the type genus *Pseudomesochra* and *Keraia* gen. nov., can be identified by the following apomorphies in the groundpattern: 1. furcal setae IV and V modified as "rat-tail" setae; 2. P1 exp3 with only 4 setae/spines (1 outer seta missing); 3. both rami of female P5 fused in a characteristic manner, expodal part with only 2 setae, the outer of which is always shorter than the inner, endopodal part with no more than 4 setae. *Keraia* shows the following autapomorphies within the Pseudomesochrinae: 1. antennal exp modified in a characteristic manner: first segment (exp1 of the original three-segmented exopod in the Pseudomesochrinae groundpattern) elongated and enlarged, second segment (compound segment of original exp2 and exp3) also elongated, with 2 terminal setae modified into 2 large, powerful and elongate spines; 2. P1 exp1 elongated, reaching beyond enp1, exp2 with outer spine modified into a "rat-tail" seta, outer spines and terminal setae of P1 exp3 also modified into flexible and longer "rat-tail" setae; 3. P2–P4 endopods two-segmented, with inner terminal setae of enp2 minute; 4. P5 benp elongate and narrow. *Pseudomesochra* on the

other hand can still be discerned as a monophylum by the following characters: 1. P1 enp3 with characteristic setation, which is derived from the groundpattern of the Pseudotachidiidae still representing one of the superordinate Podogennonta (compare Willen 2004). In the latter, the setation of P1 enp3 consists of an outer claw-like, a middle geniculate, and an inner slender seta. In the Pseudomesochrinae the 2 distal segments of P1 enp are fused, and in *Pseudomesochra* the middle terminal seta is developed as a claw-like seta. By contrast, in *Keraia* this seta is formed as a "rat-tail" seta, rather matching the plesiomorphic geniculate state; 2. the exopods of P2–P4 lack an inner seta on the first segment in *Pseudomesochra*, which is in contrast present in *Keraia*. A further potential autapomorphy for *Pseudomesochra* might be the modification of the inner terminal setae of P2–P4 endo- and exopods as "rat-tail" setae, at least in its assumed groundpattern (not implemented in all species). In the available specimens of *Keraia* these setae show a "normal" shape in the exopods.

Two former species of *Pseudomesochra* can also be assigned to the new genus: *K. longiseta* (Vasconcelos et al. 2008) from the continental slope of Brazil and *K. tamara* (Smirnov, 1946), which would be the type species of *Keraia* gen. nov. Even considering the rudimentary description of *K. tamara* by Smirnov (1946), the species belongs without doubt to *Keraia*. Both *K. tamara* and *K. longiseta* (compare Vasconcelos et al. 2008) share the shape and setation of P1, A2, swimming legs and female P5 (not illustrated in Vasconcelos et al. 2008) being autoapomorphic for the new taxon. The A2 exp of *K. tamara* being three-segmented in the description of Smirnov is interpreted here as an artefact. The species differ from each other in the length of the rostrum (shortest in *K. ricardae* sp. nov., longer in *K. longiseta*, longest in *K. tamara*), relative length of cephalothorax (short in *K. ricardae* sp. nov., longer in *K. longiseta*, not depicted in *K. tamara*), relative length of furcal rami (longer in *K. ricardae* sp. nov., shorter in *K. longiseta*, longer in *K. tamara* than in *K. ricardae* sp. nov.), 2 terminal setae on A2 exp elongate in *K. ricardae* sp. nov. and *K. tamara* whereas one of the setae is shortened in *K. longiseta*, inner seta of female P5 benp shifted to terminal margin in *K. ricardae* sp. nov. whereas this seta is located on the inner margin in *K. tamara*.

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