THE SPECIES OF *METAPROTELLA*

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ABSTRACT

A new species of caprellidean amphipod, *Metaprotella tanzaniensis*, is described based on specimens collected by the expedition of "Grigore Antipa" National Museum of Natural History from the coasts of Tanzania. *Metaprotella tanzaniensis* differs primarily from the remaining species of *Metaprotella* by the 2-articulate pereopods 3 and 4 and the setal formula 1-x-1 of the mandibular palp. On the basis of these characteristics the diagnosis of the genus *Metaprotella* is modified. A key to the species of *Metaprotella* is provided and a discussion on the family Protellidae is included.

Although the tropical areas of the Indo-Pacific are well recognised as having a high species diversity of marine invertebrates, systematic studies on the Caprellidea in these areas are still very scarce (Takeuchi and Guerra-García, in press). To date, only 21 caprellid species have been reported from along the Indian Ocean (McCain and Steinberg, 1970; Larsen, 1997). Since Mayer's 1903 monograph on the world Caprellidea from the Siboga Expedition little work has been done on Indian Ocean Caprellidea other than the recent work of Larsen (1997) where a new species of *Metaprotella* was described based on material collected from Zanzibar Island in the western Indian Ocean, near Tanzania. As McCain and Steinberg (1970) pointed out, the Caprellidea from the Indian Ocean are virtually unstudied and undoubtedly many new records and species will be found along these areas in future. In general, there are few studies dealing with peracarid crustaceans from the equatorial coast of eastern Africa (Petrescu, 1998). Because of this, during December 1973 and January 1974 the "Grigore Antipa" National Museum of Natural History from Bucharest conducted a scientific expedition along the coast of Tanzania. The four members of the expedition were Mihai Băcecu (oceanographer, carcinologist, director of the museum at that time and the scientific leader of the expedition), the late Geza Julius Müller (marine biologist researcher with the Romanian Institute of Marine Research from Constanta), Teodor T. Nalbant (ichthyologist, at that time researcher at "Grigore Antipa" Museum) and Dragos Neculce (mammalogist, at that time researcher at the Institute of Biology from Bucharest). During this study several specimens identified in the genus *Metaprotella* Mayer, 1903 were collected. Although very close to *Metaprotella sandalensis* Mayer, 1898, a detailed examination revealed that these specimens belonged to a new species of *Metaprotella*, described herein as *Metaprotella tanzaniensis* n. sp.

Material and Methods

Marine samples were collected during 1973–74 by Băcescu, Müller and Nalbant by dredging and SCUBA diving (Müller and Nalbant) between corals and algae. Additional material was obtained by algae washing taking during low tide. A map of the study area is included in Petrescu (1998). Material was fixed in a formalin seawater solution and preserved in 70% ethanol. A mature male (holotype) and female (allotype) were illustrated for the taxonomic description with the aid of a camera lucida. Preparations of the mouthparts were made in polyvinyl-lactophenol. The type

material (holotype, allotype and paratypes) are deposited in the "Grigore Antipa" National Museum of Natural History in Bucharest (Romania) (AMP 325).

Results

Genus *Metaprotella* Mayer, 1890

Metaprotella Mayer, 1890, 1898, 1903; McCain, 1968, 1970; Arimoto, 1976; Müller, 1990; Laubitz, 1991; Takeuchi, 1993.

Diagnosis.—Pereonites 6 and 7 fused. Flagellum of antenna 2 with 2 articles; swimming setae absent. Mandibular palp 3-articulate; setal formula for terminal article 1-x-1 or 1-x-y-1 indicating the presence of 1 long seta at either end of row of variable number of short setae (x) and intermediate one (y) (McCain, 1968); molar present. Gills on pereonites 3 and 4. Pereopods 3 and 4 with 1 or 2 articles; pereopod 5, 6-articulate. Abdomen of male with a pair of uniarticulate appendages and pair of lobes; female with a pair of lobes.

Type Species.—*Protella haswelliana* Mayer (1882).

Metaprotella tanzaniensis new species
(Figs. 1–4)

Material Examined.—Holotype: mature male, 7.3 mm in length, from sta. 78. Allotype: mature female, 4.7 mm in length, from sta. 91. Paratypes: 1 female from sta. 57, 1 female from Mbudya Island, 1 female clinging to *Fungia*, 2 males and 1 female from corals, 1 juvenile clinging to *Syringodium*.

Type Locality.—Western Indian Ocean, Tanzania.

Etymology.—The species bears the name of the type locality, Tanzania.

Diagnosis.—Pereonites 6 and 7 fused. Suture between the head and pereonite 1 well marked. Flagellum of antenna 2 with 2 articles; swimming setae absent. Mandibular palp 3-articulate; setal formula for terminal article 1-x-1, being x = 10–11; molar present. Pereopods 3 and 4 with 2 articles. Abdomen of male with a pair of uniarticulate appendages setose apically.

Description.—Mature Male (Holotype).—Body length 7.3 mm (Fig. 1A). Suture between head and pereonite 1 present; pereonite 4 the longest; pereonites 3 and 5 subequal. Head with elongate triangular projection. Eye large and distinctive. Pereonite 2 with a pair of anterior projections and one posterodorsally; pereonite 3 with a pair of mid-dorsal projections. Gills on pereonites 3 and 4, slender, length about 4 times the width; first pair 1.2 times as long as the second pair.

Mouthparts.—Upper lip (Fig. 2A) symmetrically bilobed; each lobe carrying a distal row of dense setulae. Mandibles with palp; mandibular molar process strong; left mandible (Fig. 2B) with incisor divided into 4 teeth and 3 submarginal pectinate setae; right mandible (Fig. 2C) with incisor divided into 5 teeth followed by lacinia mobilis divided into 3 teeth and 2 pectinate setae; palp with 3 articles; article 1 lacking setae; article 2 with 5 setae; article 3 with setal formula 1-10-1 on left mandible and 1-11-1 on right one. Inner lobes of the lower lip (Fig. 2D) well demarcated, marging smooth. Maxilla 1 (Fig. 2E) outer lobe carrying 7 bifurcate spines; distal article of palp with 4 teeth on apical end

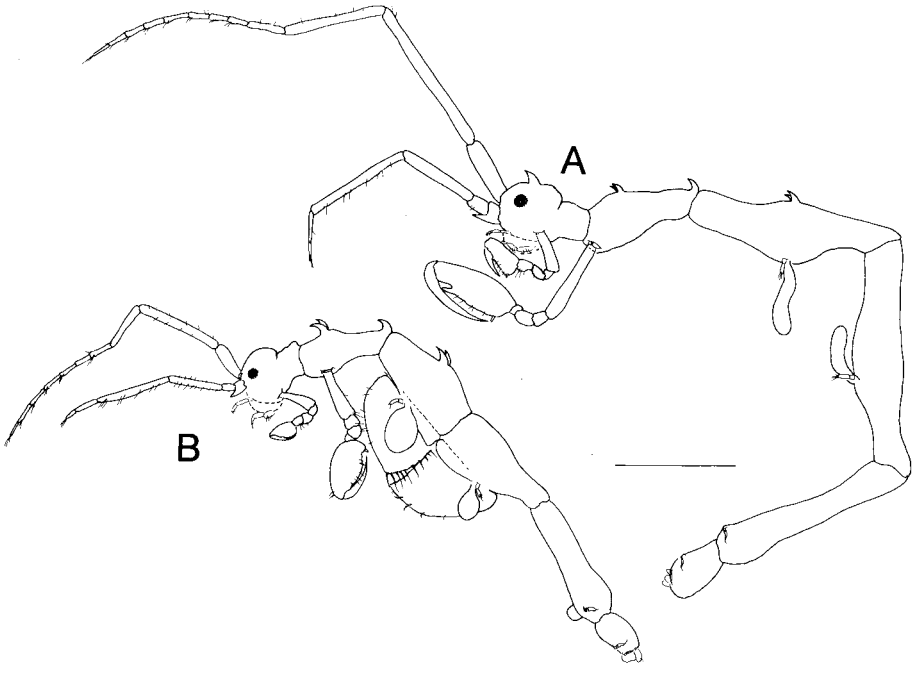

Figure 1. *Metaprotella tanzaniensis*, n. sp. Lateral view. A, holotype male; B, allotype female. Scale bar: 1 mm.

and 5 setae medially. Maxilla 2 (Fig. 2F) outer lobe carrying 8 setae; inner lobe, a little shorter than outer lobe, with 5 setae distally. Maxilliped (Fig. 2G) inner plate rectangular apically truncate, with 3 simple setae distally and 1 tooth on mediodistal margin; outer plate larger than inner, inner margin setulose, bearing 1 seta apically; article 3 of the palp distally expanded.

Antenna 1 (Fig. 3A) nearly 2/3 the length of the body; article 2 of the peduncle the longest; flagellum 9-articulate.

Antenna 2 (Fig. 3B) slightly shorter than the peduncle of antenna 1; swimming setae absent; peduncular article 1 with acute distal projection; flagellum 2-articulate, although the proximal article almost tabicated into two smaller ones.

Gnathopod 1 (Fig. 3C) basis as long as ischium to carpus combined; carpus setose; propodus triangular with a proximal grasping spine, palm margin serrate; dactylus denticulate on the inner margin.

Gnathopod 2 (Fig. 3D) inserted on the anterior half of pereonite 2; basis slender, almost as long as pereonite 2; propodus elongate, length about 2.5 times of width, with a grasping spine on a small proximal projection, and another large and slender projection followed by smaller distal ones; dactylus slender, almost as long as propodus, bearing small medial teeth medially on the inner margin.

Pereopods 3–4 with 2 articles; distal article about 5 times as long as the proximal one, length about 4 times the width; distal article of pereopod 3 (Fig. 4A) carrying 1 medial seta and 5 setae distally; pereopod 4 (Fig. 4B) with 2 medial setae and 3 distal setae.

Pereopods 5–7 (from paratypes, missing in holotype and allotype) increasing in length respectively but similar in feature; pereopod 5 (Fig. 4C) located posteriorly on pereonite

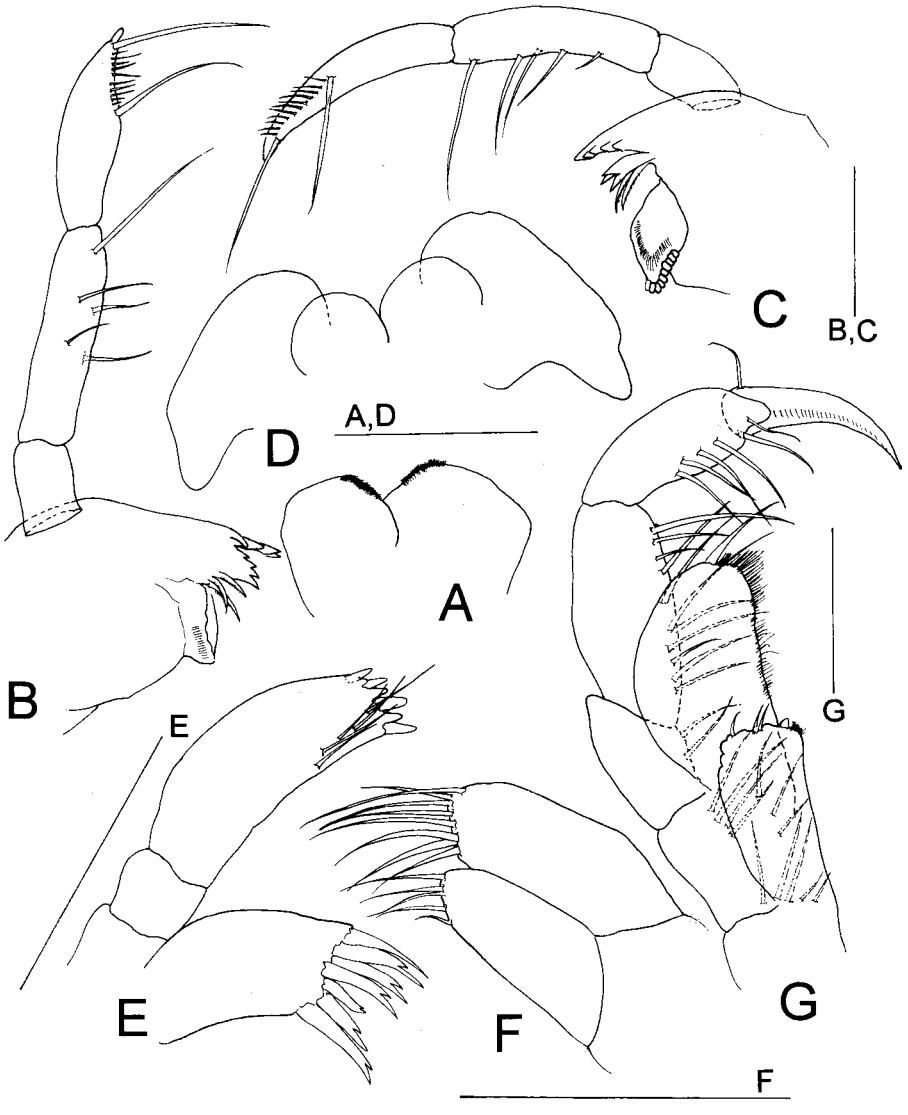

Figure 2. *Metaprotella tanzaniensis*, n. sp. Holotype male. A, upper lip; B, left mandible; C, right mandible; D, lower lip; E, maxilla 1; F, maxilla 2; G, maxilliped. Scale bars: 0.1 mm

5, propodus with a pair of proximal grasping spines and 3 accessory spines along the palm.

Penes small, situated medially (Fig. 4D).

Abdomen with a pair of 1-articulate appendages carrying small setae on end, a pair of lobes and a dorsal lobe (Fig. 4D).

MATURE FEMALE (ALLOTYPE).—Body length 4.7 mm (Fig. 1B). Pereonite 5 the longest; pereonites 3 and 4 subequal. Head without dorsal projection. Gills oval, length about 1.5 times the width. Flagellum of antenna 1 with 7 articles. Palm of gnathopod 2 straight, without projections (Fig. 3E). Oostegites on pereonite 3 with inner margin setose; oostegites

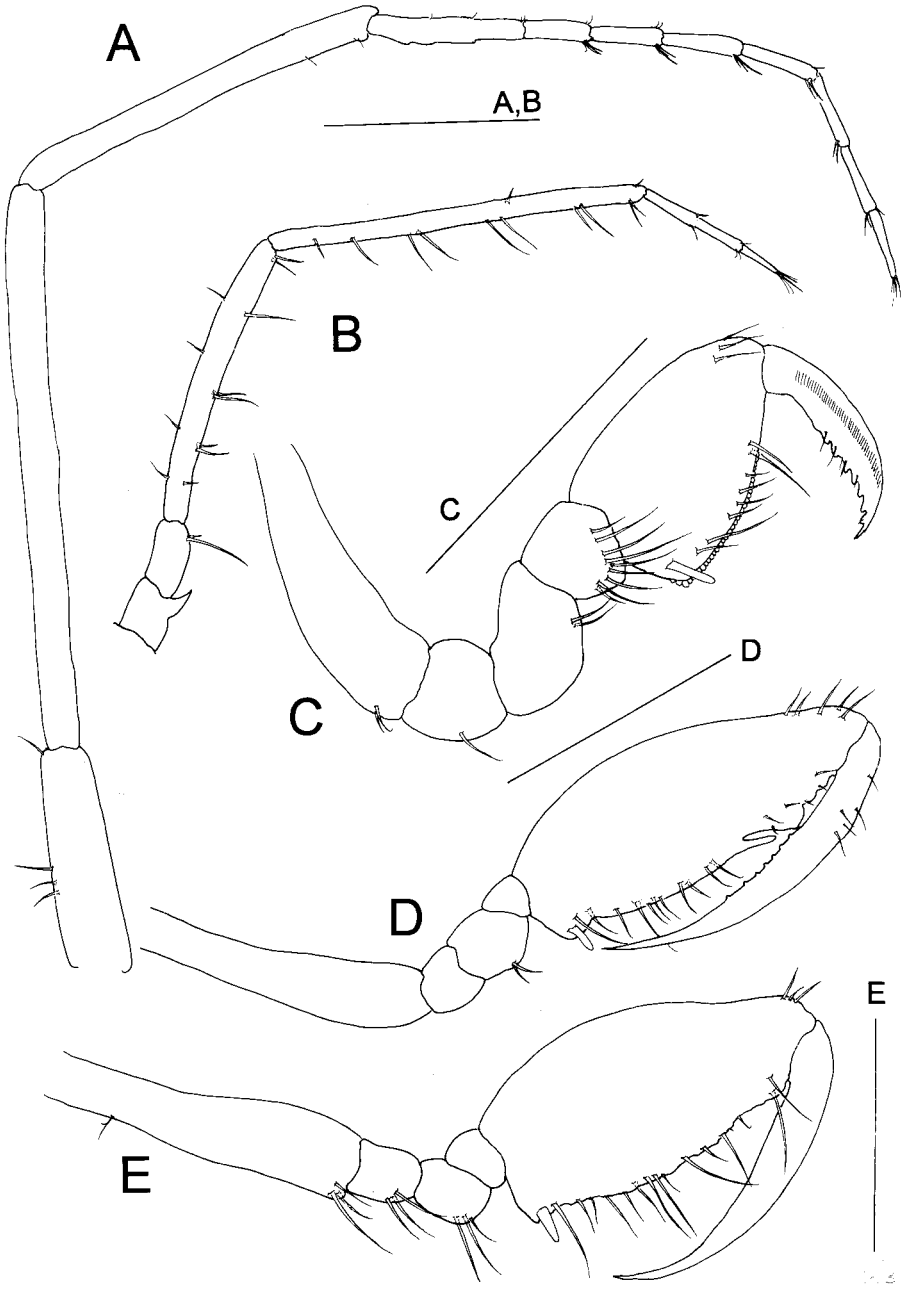

Figure 3. *Metaprotella tanzaniensis*, n. sp. A-D, holotype male. A, antenna 1; B, antenna 2; C, gnathopod 1; D, gnathopod 2. E, allotype female gnathopod 2. Scale bars: 0.5 mm (A,B, D); 0.3 mm (C, E).

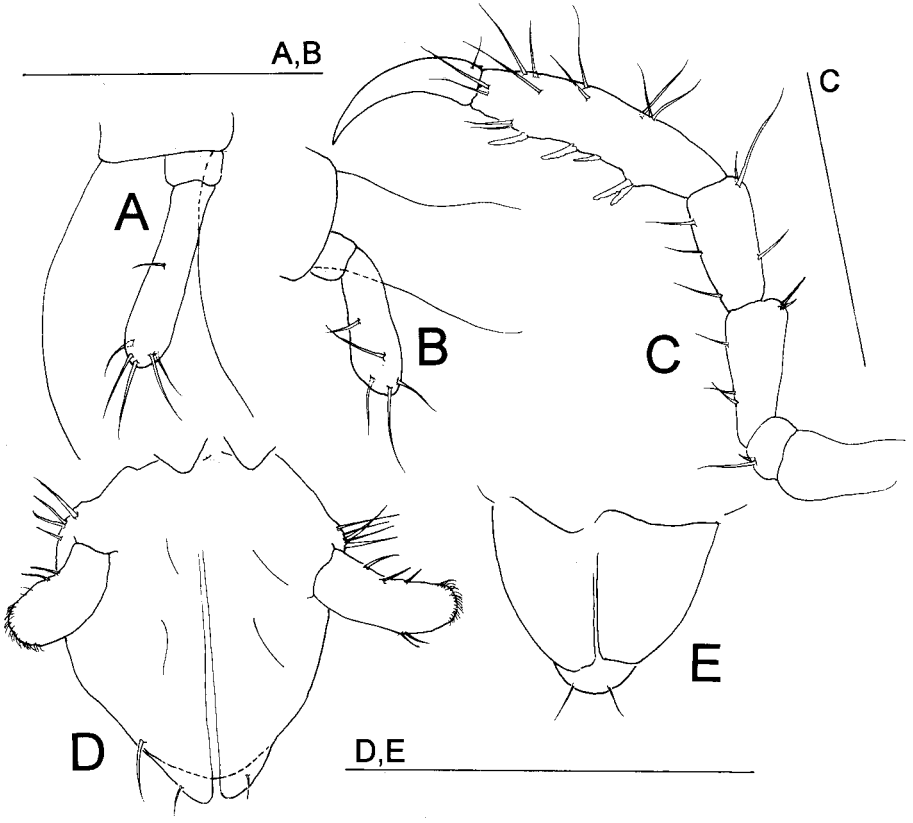

Figure 4. *Metaprotella tanzaniensis*, n. sp. A-D, holotype male. A, pereopod 3; B, pereopod 4; C, pereopod 5; D, abdomen. E, allotype female abdomen. Scale bars: 0.2 mm (A,B, D, E); 0.5 mm (C).

on pereonite 4 smooth except for sparse setae (Fig. 1B). Abdomen with a pair of lateral lobes and a single dorsal lobe (Fig. 4E).

Key to the Species of *Metaprotella* (Modified from Larsen, 1997)

1a. Pereopods 3 and 4 with 2 articles ..... *M. tanzaniensis* n. sp.
1b. Pereopods 3 and 4 with 1 2
2a. Propodus of male gnathopod 2 with an acute distal projection ..... *M. makrodactylos*
2b. Propodus of male gnathopod 2 without acute distal projection 3
3a. Male gnathopod 2 ventral margin of propodus with several conspicuous rows of dense setae. Dactylus of male gnathopod 2 decreasing in width midway ..... *M. unguja*
3b. Male gnathopod 2 ventral margin of propodus without conspicuous rows of setae. Dactylus of male gnathopod 2 not decreasing in midway 4
4a. Suture between head and pereonite 1 absent ..... *M. sandalensis*
4b. Suture between head and pereonite 1 present 5
5a. Body dorsally smooth 6
5b. Body with dorsal projections 7
6a. Pereonite 3 with one forward pointing spine laterally ..... *M. problematica*
6b. Pereonite 3 lacking laterally spines ..... *M. hummelincki*
7a. Male gnathopod 2 lacking spines on basis ..... *M. africana*

7b. Male gnathopod 2 with spines on basis 8
8a. Pereopods 3 and 4 about 1/4 the length of the gills. Basis of male gnathopod 2 with dorsomedial spines ..... *M. excentrica*
8b. Pereopods 3 and 4 about 1/2 the length of the gills. Basis of male gnathopod 2 lacking dorsomedial spines ..... *M. haswelliana*

Remarks.—The genus *Metaprotella* is, to date, composed of 9 species: *M. africana* Mayer, 1903; *M. excentrica* Mayer, 1890; *M. haswelliana* (Mayer, 1882); *M. hummelincki* McCain, 1968; *M. makrodactylos* Stebbing, 1910; *M. problematica* Mayer, 1890; *M. sandalensis* Mayer, 1898, *M. tanzaniensis* n. sp. and the recently described *M. unguja* Larsen, 1997. Larsen (1997) provided a key to 6 species. This key is modified here to include the remaining 3 species.

Metaprotella tanzaniensis n. sp. is morphologically close to *M. sandalensis*, differing primarily by the 2-articulate pereopods 3 and 4 and the presence of a well-marked suture between the head and pereonite 1. *Metaprotella sandalensis* has recently been redescribed and illustrated in detail by Müller (1990) and Laubitz (1991). According to the description of *M. sandalensis* given by Laubitz (1991) that was based on specimens from Indonesia and the Philippines, and Müller (1990) using specimens from Bora Bora and Moorea, *M. tanzaniensis* n. sp. is also distinguished from *M. sandalensis* by the following: 1) in *M. sandalensis* the setal formula of the article 3 of the mandibular palp is 1-x-y-1, in *M. tanzaniensis* n. sp. 1-x-1; 2) in *M. sandalensis* the upper lip is completely smooth whereas in *M. tanzaniensis* n. sp. a row of dense setulae are present on each lobe; 3) females in *M. sandalensis* have a dorsal projection on the head while these projections are lacking in *M. tanzaniensis* n. sp.; 4) antenna 1 clearly longer in *M. sandalensis,* about 5/6 the body length while in *M. tanzanensis* is about 2/3 the body length; 5) the gills in females are elongate in *M. sandalensis* and oval in *M. tanzaniensis* n. sp.

Traditionally, *M. sandalensis* has been considered as a highly variable species with regards to the number and arrangement of the acute projections on head and pereonites 2-3, as well as the shape of the gnathopod 2 palm (Mayer, 1903; Müller, 1990). Nevertheless other studies shows that body spination appears to be quite constant (Aoki and Kikuchi, 1990). Apart from the body spination, the remaining differences found between *M. sandalensis* and *M. tanzaniensis* n. sp. are substantially enough to consider *M. tanzaniensis* as a new species. *Metaprotella sandalensis* is very common in shallow waters of the tropical Indo Pacific Ocean (Müller, 1990). Since *M. tanzaniensis* is superficially quite similar to *M. sandalensis*, it is therefore probable that some records of the latter species could apply to *M. tanzaniensis*. Laubitz (1991) also suggested this possibility for the rare species *Paradeutella spinosa* Mayer, 1903, which superficially resembles *Pseudoprotella phasma* (Montagu, 1804), a well known North Atlantic species.

M. tanzaniensis shows no specific substrate preference, having been collected from corals, the seagrasses *Fungia* and *Syringodium* and sediments along the coast of Tanzania.

Discussion

Larsen (1997) pointed out that the Protellidae is a family seriously in need of revision despite the recent attempts to clarify caprellid taxonomy by Laubitz (1993) and Takeuchi (1993). Before the taxonomic revision of Laubitz (1993) the following genera were included within the family Protellidae McCain, 1970: *Abyssicaprella* McCain, 1966; *Deutella*

Mayer, 1890; *Luconacia* Mayer, 1903; *Mayerella* Huntsman, 1915; *Metaprotella* Mayer, 1890; *Monoliropus* Mayer, 1903; *Orthoprotella* Mayer, 1903; *Paradicaprella* Hirayama, 1990 (recently discovered and placed in this familly by Hirayama (1990)); *Paraprotella* Mayer, 1903; *Protella* Dana, 1852; *Protellopsis* Stebbing, 1888; *Pseudolirius* Mayer, 1890; *Pseudoprotella* Mayer, 1890; *Triantella* Mayer, 1903; *Tritella* Mayer, 1890 and *Triliropus* Mayer, 1903. This classification supports the definition given by Hirayama (1990) and the relationships suggested by Takeuchi (1993). Recently, Larsen (1996) transferred the genus *Protellina* Stephensen, 1944 from the Caprellidae to the Protellidae on the basis of the morphology of the monotypic species, *Protellina ingolfi* Stephensen, 1944.

Laubitz (1993) removed the genera *Deutella*, *Luconacia*, *Pseudoprotella*, *Triantella* and *Triliropus* from the family Protellidae placing them in the new family Pariambidae on the basis of several differences between the two groups of genera (Table 1). As Larsen (1997) reported, this division does not agree with the definition of Hirayama (1990) and the relationships suggested by Takeuchi (1993). Indeed, the family definition of Laubitz (1993) seems to be unclear. Larsen (1997) considered it inconsistent since the genera *Abyssicaprella* and *Paradicaprella*, although maintained in the Protellidae, lack a molar flake. Nevertheless, Larsen (1997) did not conduct a complete revision, and chose the definition of Laubitz (1993).

After consulting the literature and examining specimens collected by the author, several more characteristics were found in support of keeping the genera *Deutella*, *Luconacia*, *Pseudoprotella*, *Triantella* and *Triliropus* in the Protellidae.

The molar flake is absent not only in the monospecific genera *Abyssicaprella* and *Paradicaprella* as reported by Larsen (1997) but also in some species of *Metaprotella*, e.g., *Metaprotella tanzaniensis*, as described here. Several specimens from different Tanzanian localities were dissected and examined; a molar flake was absent in all of them. In *Protellopsis* the presence of a molar flake has not been reported in recent species descriptions or figures (see figures and text of Laubitz, 1991). Also, *Tritella laevis* Mayer, 1903 (see Laubitz, 1970) and *Mayerella redunca* (McCain, 1968) appear to lack a molar flake. Frequently, the molar flake is often lost during preparations of the mouthparts (Mori, 1996; Guerra-García, pers. observ.). So, only by dissecting several specimens the presence of a molar flake can be determined. Therefore, this character should not be considered useful to separate the genera, unless many specimens are careful dissected and compared. Takeuchi (1993) pointed out the need for redescriptions of each genus and species and careful examination of mouthparts, gnathopods, pereopods and abdomens in order to find significant morphological characters to support a generic classification. For example, the presence of tiny pleopods in *Dodecasella* was confirmed only by close observation of newly collected material and later reconfirmed by examining the type material (Takeuchi and Takeda, 1992).

Laubitz (1993) considered the setal formula or the terminal article of mandibular palp 1-x-y-1 for the genera of Protellidae and 1-x-1 for Pariambidae. Nevertheless, the genus *Pseudoprotella* placed within the Pariambidae presents a formula of 2-x-1. After consulting material collected by the author in Southern Spain, this characteristic has been confirmed for the two species of the genus, *Pseudoprotella phasma* (Montagu, 1804) and *Pseudoprotella inermis* Chevreux, 1927, recently redescribed by Guerra-García and Takeuchi (2000). *Metaprotella tanzaniensis* n.sp. is also placed within the Protellidae, and has a setal formula 1-x-1. The genus *Monoliropus* is also characterised by a formula

Table 1. Differences between the families Protellidae McCain, 1970 and Pariambidae Laubitz, 1993 according to Laubitz (1993).

	Protellidae	Pariambidae
Mandible:	Molar flake present, 1-x-y-1 apical setae, right lacinia mobilis complexly toothed or serrate	Molar flake absent, 1-x-1 or 1 apical setae, right lacinia mobilis serrate or broadly 3-toothed
Maxilla 1:	7 (dentate) spines on outer plate	6 (dentate) spines on outer plate
Genital papillae:	Well developed	Short and blunt

of 1-x-1. Hirayama (1990) reported for *Paradicaprella* a formula of 1-7-1, and in the genus *Paraprotella* the formula varies with the species. The recently described *Paraprotella saltatrix* (Takeuchi and Guerra-García, in press) possesses a formula 2-x-1, as the genus *Pseudoprotella*. The formula in *Paraprotella prima* Mayer, 1903 is considered to be variable (Laubitz, 1991). In addition, the formula 1-x-1 is presented in both *Tritella laevis* Mayer, 1903 and *Tritella pilimana* Mayer, 1890.

Regarding the right lacinia mobilis, it is considered complexly toothed or serrated in the Protellidae (Table 1). However, *Paradicaprella* exhibits a bi-toothed right lacinia mobilis (Hirayama, 1990) and Mori (1996) reported a bilobed right lacinia mobilis for *Orthoprotella spinigera* Mori, 1996. Larsen (1997) reported the presence of a 4-toothed right lacinia mobilis in *Metaprotella unguja* Larsen, 1997. Three teeth are present in *M. tanzaniensis* n.sp (Fig. 2C).

The bifurcate spines on the outer plate of maxilla 1 seems more constant within the groups of genera of each family (7 in Protellidae and 6 in Pariambidae). Nevertheless some of the species of Pariambidae have 5, not 6 spines. In the genus *Deutella*, 6 spines were reported by Laubitz (1970) for *Deutella californica* Mayer, 1890, and 5 spines were observed in both *Deutella schieckei* Cavedini (1981) and *Deutella aspiducha* Gable & Lazo-Wasem (1987). Lastly McCain (1968) described 4–5 spines in *Deutella mayeri* Stebbing, 1895. In *Luconacia incerta* Mayer, 1903, the number of spines varies between 5 and 6 (McCain, 1968) whereas all species in *Pseudoprotella* have 5 spines.

Several conflicts exist regarding the size of the genital papillae in males. Although considered short and blunt in Pariambidae (Laubitz, 1993), genital papillae are well developed in the genera *Deutella* (see Laubitz, 1970; Cavedini, 1981; Gable and Lazo-Wasem, 1987), *Luconacia* (see McCain, 1968) and *Pseudoprotella* (Krapp-Schickel, 1993; Guerra-García and Takeuchi, 2000).

Taking all these examples into consideration, it would be better to maintain all of these genera within the same family, at least, until the reanalysis of all the species is completed. The author emphasises the need of redescriptions for many of the genera and species to complete the morphological knowledge and address the phylogenies within the Caprellidea. As Takeuchi (1993) pointed out, other studies are also necessary: discovery of presently unknown genera and species from the tropics to the southern hemisphere and the deep sea, molecular analysis based on sequencing mitochondrial DNA or ribosomal RNA and ecological and behavioural studies.

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