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Article in *Zootaxa* · August 2005

DOI: 10.5281/zenodo.169725

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A revision of *Metapontius* (Siphonostomatoidea: Artotrogidae) with the description of a new species associated with an octocoral from Eniwetok Atoll, Marshall Islands (USA)

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Abstract

The Artotrogidae is among the most primitive of siphonostomatoid families. Their preferred hosts, as well as precise nature of their symbiotic relationship with the host, remain uncertain despite more than a hundred years of occasional descriptions of new species and genera. *Metapontius* is one such case. The genus, erected in 1923 by Hansen to accommodate a single species, has remained monospecific and no other record of this species has been provided. Samples collected by Dr. Arthur Humes in 1969 at Eniwetok Atoll, and left aside for future studies, remained untouched for more than 30 years and among them a new species belonging to *Metapontius* was found. The main differences between the two species are the number of antennule segments, the shape of the cephalosome, the length of the siphon and the setation of legs 1 and 4. In addition, several other characters of the genus such as the antennal exopod and setation of maxillule and legs 2 and 3 are described for the first time.

Key words: Artotrogidae, Copepoda, Siphonostomatoidea, Octocoral

Introduction

The Artotrogidae is one of the most primitive families of Siphonostomatoidea and with few exceptions, such as the absence of the mandibular palp and fusion of the distal segments of the antennule, the remaining characters support this position. Typically, species belonging to this family have been recorded in very low numbers, mainly from washings or dredgings of other invertebrate groups. The genus *Metapontius* Hansen, 1923 provides such an

example: Hansen (1923) described the single species of the genus based on one female and one male only.

The low number of specimens partly reflects the difficulties in establishing the hosts of these organisms. Boxshall (1986), based on the existence of extensive caeca of some artotrogids, suggested they feed intermittently and spend much of their lives away from their hosts. So far, among the few groups already identified as hosts for the family, it is possible to cite: sponges (Stock 1965), cnidarians (Johnsson 2001; Snelgrove & Lewis 1989), bryozoans (Kim 1996), ascidians (Kim 1996; 1998) and seaweeds (Kim 1996) while the new species was found associated with the octocoral *Pachyclavularia violacea* (Quoy & Gaimard, 1833).

Although based on a single specimen, the description of a new species of *Metapontius* is extremely relevant since it enables a modern description of the genus to be written, which includes characteristics previously omitted. The original description of *M. latispinis* (Hansen, 1923), the only species in the genus *Metapontius*, was deficient due to the lack of information and drawings to the point that the genus was questionable. This study also provides another clue to possible hosts of *Metapontius* and expands the distribution of the genus to include the Pacific Ocean.

Materials and methods

Samples collected by Dr. Arthur Humes in 1969 at Eniwetok Atoll, and left aside for future studies, remained untouched for more than 30 years and among them a new species of *Metapontius* was found.

The copepod was cleared in lactic acid and body proportions were measured. The specimen was stained in Black Chlorazol E, dissected and mounted permanently on a slide with CMC-9 mounting media. All drawings were made with the aid of a camera lucida. The lengths of the antennule segments were measured along the posterior non-setiferous margins. Roman numerals represent spines and Arabic numerals indicate setae in the armature formula of legs 1–4.

ARTOTROGIDAE Brady, 1880

Within the Artotrogidae there are presently 21 genera (Boxshall & Halsey 2004), which can be grouped according to characters related to the fourth leg. Among the variable states, it is possible to observe the reduction of the leg to a protopod bearing 1 or 2 setae, as seen in *Pseudotrogus* (Johnsson & Rocha 2002). Other conditions found are: the total absence of the endopod, as observed in *Pteropontius*, *Cryptopontius*, *Dyspontius*, *Pulicitrogus* and *Ascidipontius*; or the absence of the whole leg, as in *Artotrogus*, *Glyptotrogus*, *Tardotrogus* and *Sewellopontius*. An uncommon, intermediary state is the endopodal ramus bearing

two segments, found only in *Arctopontius* and *Metapontius*. All remaining genera of the family have P4 unmodified, with both rami present, and 3-segmented. Therefore *Arctopontius* and *Metapontius*, among all other Artotrogidae genera, are probably very closely related. However, it is possible to distinguish these two genera based on the following characteristics. In *Arctopontius*, the pedigerous somite 4 is projected backwards as in the previous segment, reaching the mid-region of the genital double-somite. In *Metapontius*, pedigerous somite 4 is slightly rounded posteriorly, hardly reaching the lateral margin of the following pedigerous somite. Both genera also differ in the proportions of both lobes of the maxillule. In *Arctopontius*, the inner lobe is twice as long as the outer lobe while in *Metapontius*, the outer lobe is almost as long as the inner one.

***Metapontius* Hansen, 1923**

Cephalothorax of the female greatly expanded; in the male, considerably narrower. Pedigerous somite 4 with sternite short and not produced backwards. Urosome 5-segmented with caudal rami rather large. Antennule, 8- to 14-segmented in female and 17-segmented in male. Antenna, endopod segments II and III fused, exopod 1-segmented. Mandibular palp absent. Maxillule with inner lobe slightly longer than outer lobe, each one bearing 2 distal setae. P4, exopod 3-segmented, endopod 2-segmented. P5 consisting of short, smooth seta near insertion of small, free segment, armed with two distal smooth setae.

Remarks

The original description provided by Hansen (1923) listed two character-states, which can now be attributed to the species itself and not the genus: 1) the 14-segmented antennule on the female and 2) the prosome with posterolateral corners nearly rectangular and not produced.

Several studies have indicated that the number of antennule segments varies within the genera of the Artotrogidae (Kim 1998, 1996; Johnsson *et al.* 2002; Johnsson & Rocha 2002) and thus the number of antennule segments is no longer used as a generic character.

The original diagnosis of the genus *Metapontius* states “prosome with the postero-lateral corners nearly rectangular and not produced”. This character-state is now considered a specific variation as it is only found on pedigerous somite 4 of the new species. Consequently, the genus diagnosis is emended to restrict the condition to this particular body somite.

***Metapontius walteri* sp. nov.**

Figures 1–3

Material examined.—Holotype: female, associated with the octocoral, *Pachyclavularia*

violacea, from 2 m depth, on the western side of reef, at northern end of David, Eniwetok Atoll, Marshall Islands, USA, 29 June 1969, coll. Dr. A.G. Humes. Holotype deposited in the National Museum of Natural History (Smithsonian Institution) reg. no. USNM 1074640.

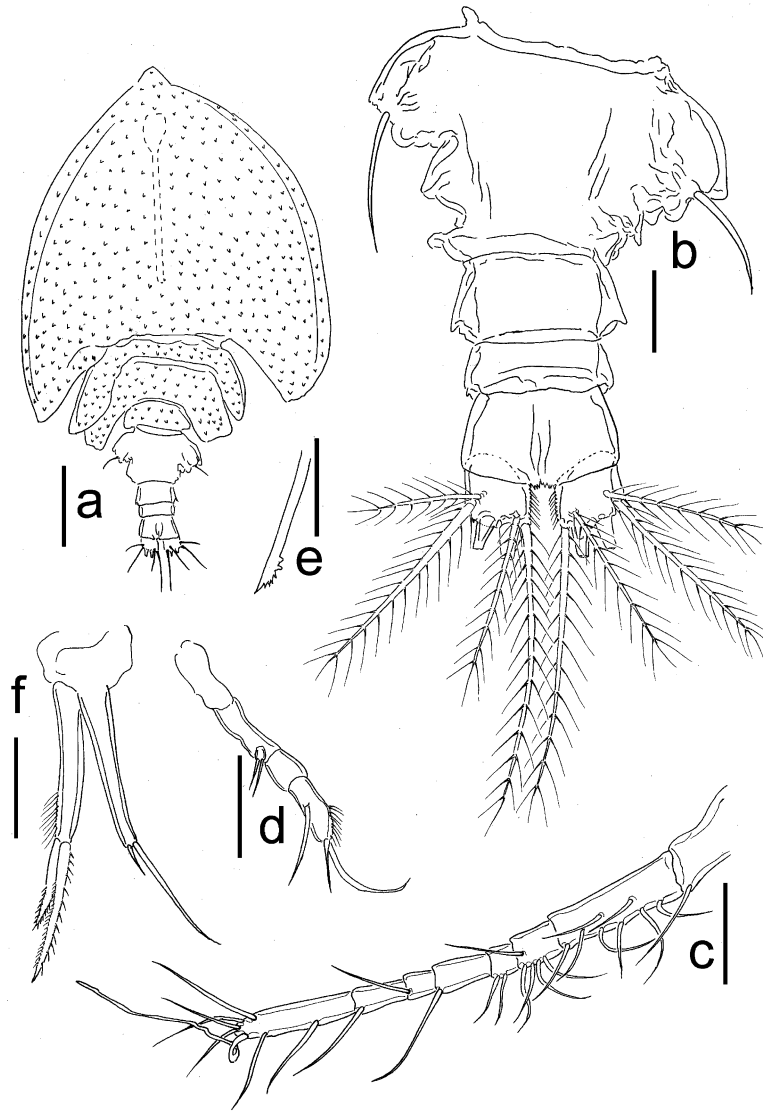


FIGURE 1. *Metapontius walteri* n.sp.. Female Holotype: a) habitus, dorsal view, with oral cone indicated in dashed line; b) urosome, dorsal view; c) antennule; d) antenna; e) mandible; f) maxillule. Scale bars: a–f = 100 μ m.

Description of female. Body length (excluding caudal setae) 1210 μ m, greatest body width 775 μ m, body length 1.6 times width. Body shape cyclopiform (fig. 1a), with sensil-

lae covering prosome, cephalosome not imbricate. Cephalosome and pedigerous somites 2 and 3 with epimera pointed. Pedigerous somite 4 with epimera rounded. Prosome length:width ratio, 1.2:1. Ratio of prosome length to urosome, 3:1.

Urosome 5-segmented. Genital double-somite (fig. 1b) 134 x 237 μm , length:width ratio, 0.6:1, area of genital aperture projected laterally and armed with smooth seta. Three abdominal somites, all wider than long (56 x 113 μm ; 31 x 95 μm ; 61 x 100 μm), length:width ratios, 0.5:1, 0.3:1 and 0.6:1, respectively. Caudal rami 31 x 43 μm , width 1.4 times length, with row of setules on inner margin and armed with 6 setae. Seta I absent, setae IV and V broken. Length of setae II, III, VI, and VII; 68, 137, 174, and 105 μm , respectively; all plumose.

Antennule (fig. 1c) 280 μm long (not including setae) and 8-segmented. Length of segments measured along their posterior margins: 30, 75, 24, 15, 29, 16, 29, and 63 μm , respectively. Segmental homologies and setation as follows. Roman numerals indicate the original segments followed by the number of setae in Arabic (Huys & Boxshall 1991): I-1; II-VIII-8; IX-XIII-5; XIV-2; XV-XVI-1; XVII-XVIII-1; XIX-XX- 1; XXI-XXVIII-6+ae. All setae smooth. Aesthetasc on segment XXI 105 μm long. Antenna (fig. 1d) 150 μm long (including distal seta), with basis 38 μm long. Endopod 2-segmented; first segment 17 μm long, unarmed; second segment 35 μm long with 3 smooth setae, 1 medially placed and 2 distal, none modified as claw. Exopod 1-segmented, armed with 2 distal setae.

Oral cone (fig. 1a) produced into long, siphon-like distal portion, 406 μm long, 0.3 times body-length. Mandible (fig. 1e) comprised of distally toothed stylet, palp absent. Maxillule (fig. 1f) bilobed, inner lobe 93 μm , armed with 2 stout, pinnate setae. Outer lobe 80 μm long, armed with 2 smooth setae. Maxilla (fig. 2a) with syncoxa 310 μm long, slender claw, 398 μm long, distally curved and showing small seta subdistally. Maxilliped (fig. 2b) 5-segmented, comprising syncoxa 89 μm long, armed with small seta on inner margin, basis 242 μm long with small seta medially on inner margin. Endopod 3-segmented, segments measuring 19, 56, and 77 μm long, respectively. First endopodal segment with 2 setae distally; second segment with 1 seta and third segment bearing curved, 110 μm long, claw, and seta.

Swimming legs 1–3 (P1–P3; figs. 2c–d, 3a) biramous, all with 3-segmented rami. P4 (fig. 3b) with 3-segmented exopod and 2-segmented endopod. Armature formula of legs 1–4 shown in table 1.

TABLE 1: *Metapontius walteri* n.sp. Armature formula of legs 1 to 4.

	COXA	BASIS	ENDOPOD	EXOPOD
P1	0-1	1-0	0-1; 0-2; 0-2-3	0-1; 0-1; II-I-3
P2	0-1	1-0	0-1; 0-2; 1-II-3	I-1; I-1; III-I-5
P3	0-1	1-0	0-1; 0-2; 1-1+I-3	I-1; I-1; III-I-5
P4	0-0	0-0	0-0; 0-1-0	I-1; I-1; III-I-5

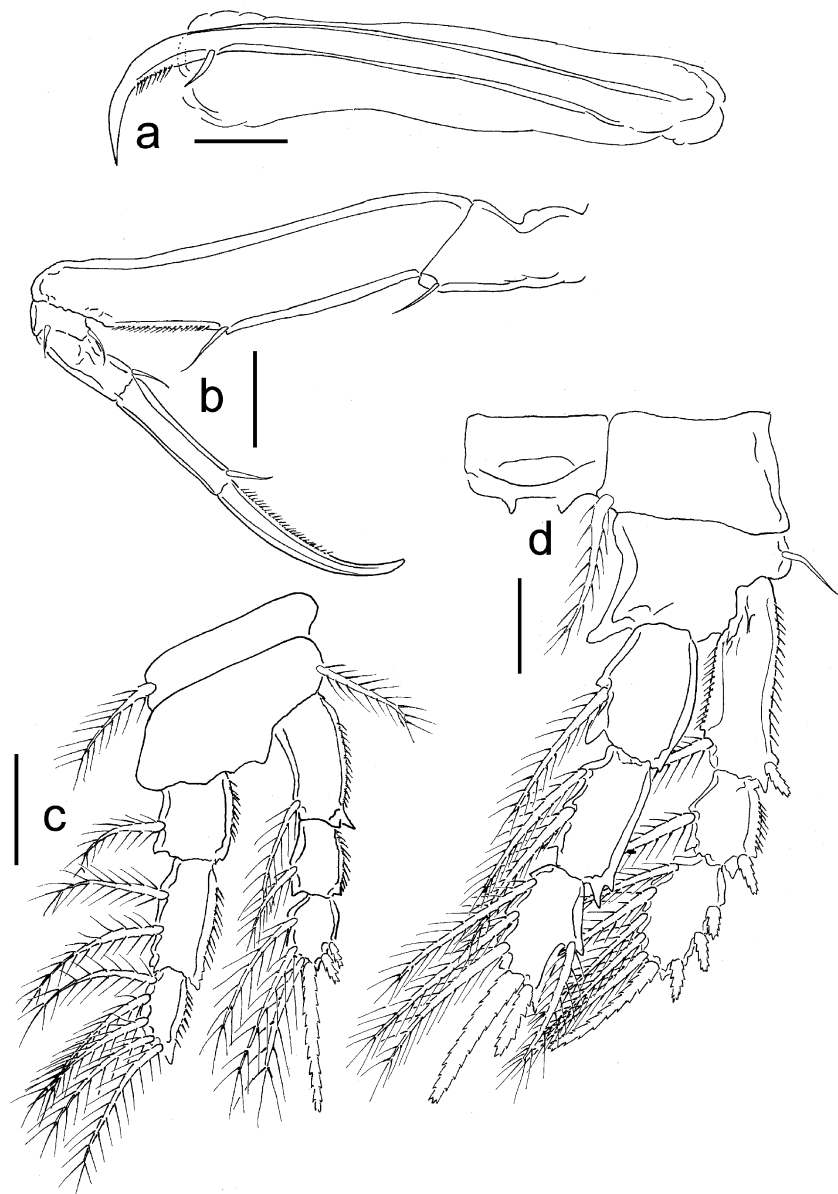


FIGURE 2. *Metapontius walteri* n.sp. Female Holotype: a) maxilla; b) maxilliped; c) leg 1; d) leg 2. Scale bars: a–d = 100 μ m.

Fifth leg (fig. 3b) consisting of short, smooth seta near insertion of small, free segment, armed with 2 distal, smooth setae.

Remarks. All other siphonostomatoids collected at the same location were described by Humes (Humes 1971a & b; 1972a & b; 1973a & b; 1981).

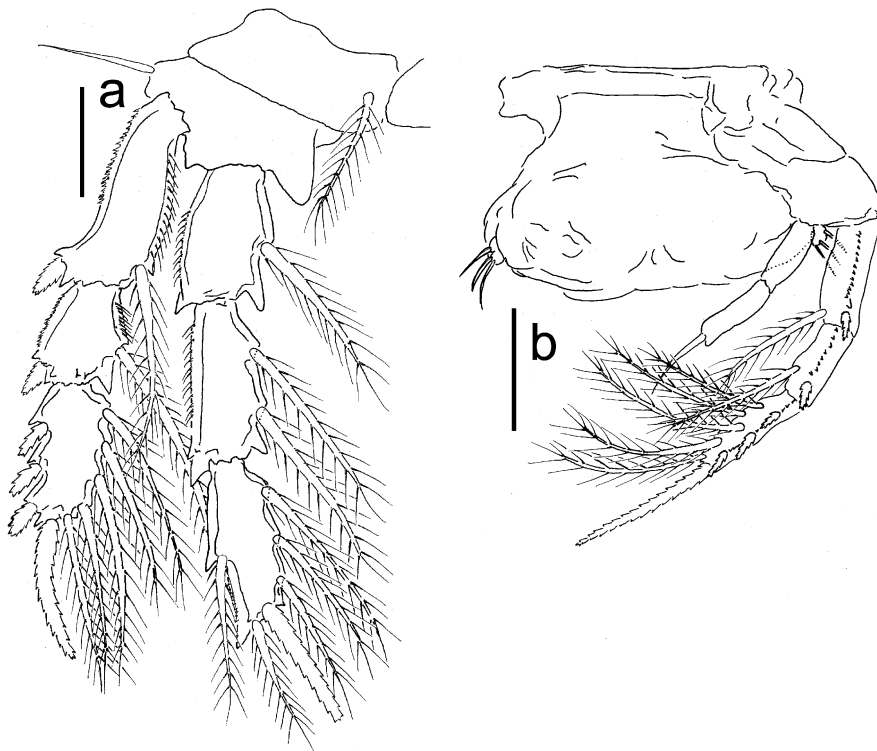


FIGURE 3. *Metapontius walteri* n.sp. Female Holotype: a) leg 3; b) legs 4 and 5. Scale bars: a–b = 100 μ m.

Etymology. The specific name “*walteri*” honors Dr. Chad Walter of the National Museum of Natural History, Washington, whose efforts in rescuing and preserving Dr. Humes’ samples and notes provided the possibility that his legacy would not be wasted.

Discussion

Copepods belonging to the family Artotrogidae have been reported from all around the world’s oceans, however little is known of their hosts and the host-copepod relationships. The family has been reported in many cases from dredged mixed invertebrates (Johnsson & Rocha 2002) but also more specifically as associated with a variety of hosts including cnidarians, sponges, echinoderms and algae (Boxshall & Halsey 2004). The occurrence of these copepods in low numbers may indicate that they are loosely associated with their hosts and may exploit other invertebrate groups for food or shelter.

The placement of the new species, in the genus *Metapontius*, is based largely on the possession of a 2-segmented endopod on the P4, a condition not commonly observed in

the Artotrogidae. *Metapontius latispinis*, the type species of the historically, monospecific genus, was collected from material dredged north-west of the Faeroe Islands (Denmark) at approximately 860 metres depth and while it is similar to *Metapontius walteri* n. sp. there are also many differences which separate the species.

The cephalosome and pedigerous somites 2 and 3 have projecting epimera while in *M. latispinis* they are rounded. The antennule of *M. latispinis* is 14-segmented while in the new species it is 8-segmented. Hansen (1923) reported the antenna as a 4-segmented structure provided with a very strong lateral seta and 2 terminal spines. The new species has antennal endopod segments II and III fused and setation that agrees with the type description. The antennal exopod, which was not described for *M. latispinis*, shows a single segment armed with 2 distal setae in the new species. Another structure, not reported in the original description of *M. latispinis*, is the maxillule, which in *M. walteri* has both lobes approximately equally size, each with 2 setae distally. Further differences include: the siphon, which is produced into a long tube in *M. walteri* but is absent in *M. latispinis*, and the slender maxilla. Hansen (1923) only illustrated and described the setation of legs 1 and 4 and both show many differences from the new species. In *M. walteri* the endopods of legs 1 and 4 have the following setation; 0-1, 0-2, 1-2-3 and 0-0, 0-1-0 respectively, while in *M. latispinis* it is 0-1, 0-1, 1-2-3 and 0-1, 0-1-2. This indicates the endopod of leg 1 of the new species is complete, while in *M. latispinis* a seta is missing on the inner margin of the second segment. The P4 endopod of both species show a reduction in the number of segments and setae, however, in *M. walteri* there is only a single seta, distally on the endopod and in *M. latispinis* there are 3 more setae (Hansen 1923). The P4 exopod is identical in both species; however, in P1 the inner seta of the first exopodal segment is absent in *M. latispinis* while in *M. walteri* it is present. In the new species, the outer spines of the first and second exopodal segments of P1 are also absent. Although modifications on the outer margin of these segments are very unusual, there were no scars to indicate that spines had broken off during capture or sorting. Finally, the third exopodal segment of P1 of *M. walteri* was missing 2 inner setae. Legs 2 and 3 of new species show the maximum possible setation for Artotrogidae. Legs 2 and 3 were not mentioned by Hansen (1923).

All differences reported in the present discussion confirm the genus *Metapontius*, which for more than eighty years has been monospecific, now has a second species. In addition, further characteristics related to legs 2 and 3, the maxillule and the antennal exopod, which had been omitted on the original generic description, are now reported.

Acknowledgments

We wish to thank Chad Walter (National Museum of Natural History, Smithsonian Institution, Washington, D.C. USA) for preserving Dr. A. G. Humes' samples and notes, and for permitting us to study this material. We also wish to thank Rafael Lemaitre (National Museum of Natural History, Smithsonian Institution, Washington, D.C. USA) for accept-

ing the senior author as a visitor and providing lab facilities. Finally, we would like to thank the anonymous reviewers whose suggestions helped to improve this paper.

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