

Mediomastus chinensis sp. nov., a new species of Capitellidae (Annelida: Polychaeta) from the southeast coast of China

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Received 19 September 2017; accepted 20 January 2018

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Abstract

Mediomastus is a common genus around the world, and Chinese specimens used to be identified as *M. californiensis* Hartman. In this study, 118 *Mediomastus* specimens collected from four localities along the southeast coast of China were examined. They belonged to an unknown species. We treat them as a new species, described herein. The new species is characterized as follows: (1) chaetigers 1–9 biannulate with chaetal fascicles at midsegment, thereafter multiannulate with chaetal fascicles posterior to midsegment; (2) parapodial ridges on posterior abdomen; (3) possession of bilimbate capillary chaetae on chaetigers 1–4; (4) thoracic hooks with long, straight shaft, hood length about 3–5 times width; (5) abdominal hooks shorter, with developed shoulder and distinct constriction, markedly different from those in thorax; (6) unique staining pattern with methyl green. The present study indicated that *Mediomastus* species inhabiting Chinese waters might be misidentified as *M. californiensis*, and that *Mediomastus chinensis* sp. nov. is widely distributed along the southeast coast of China.

Key words: *Mediomastus*, Capitellidae, polychaeta, new species, taxonomy, China

Citation: Lin Junhui, Wang Jianjun, Zheng Fengwu. 2018. *Mediomastus chinensis* sp. nov., a new species of Capitellidae (Annelida: Polychaeta) from the southeast coast of China. Acta Oceanologica Sinica, 37(10): 126–129, doi: 10.1007/s13131-018-1316-z

1 Introduction

Mediomastus species are widely distributed around the world. Hartman (1944) first established the genus *Mediomastus* for *M. californiensis* Hartman. Since then, 16 species (Table 1) have been reported from various parts of the world. These species share similar morphological characters: thorax with 11 segments, including one achaetous segment; segments 2–5 only with capillary chaetae in both rami; thereafter, with hooded hooks (Hartman, 1944; Day, 1967; Fauchald, 1977; Warren et al., 1994; Green, 2002). Capitellid morphology is simple and relatively few distinct morphological characters can be used for classification, which might cause confusion in the identification of some species (García-Garza and De León-González, 2011; García-Garza et al., 2012). It is also the case for the separation of *Mediomastus* species. *Mediomastus* exhibited high diversity in Japanese waters and four distinct *Mediomastus* species were recorded, *M. californiensis* in the Sagami Bay (Imajima, 2006), *M. opertaculeus* near Hokkaido (Tomioka et al., 2013), *M. duobalteus* and *M. hanedaensis* in the Tokyo Bay (Tomioka et al., 2014). By contrast, Chinese specimens were generally identified as *M. californiensis*, although specimens were collected from various parts of Chinese waters (Wang et al., 2006; Du et al., 2011; Chen et al., 2012; Ji et al., 2015). However, the original description showed that *M. californiensis* was mainly distributed to the east and west coasts of North America. Reports of *M. californiensis* in other parts of the world were unconfirmed. In this study, we examined the *Mediomastus* specimens from the southeast coast of China. Morphological observations and staining pattern with methyl green indicated that the specimens were not *M. californiensis* but rather a new species, *M. chinensis* sp. nov.

2 Materials and methods

The *Mediomastus* specimens, from subtidal soft sediments at four localities along the southeast coast of China, were collected during marine environmental surveys conducted between 2015 and 2017. Water depths ranged from 6 m to 30 m. All specimens were fixed with 7% diluted formalin in seawater. Type materials of the new species and the additional specimens examined are deposited in the Third Institute of Oceanography, State Oceanic Administration, Xiamen, China. The methyl green staining pattern (MGSP) was used to observe some morphological structures presenting specific patterns of coloration for the species, following the protocol of Warren et al. (1994). Morphological terminology also follows that of Warren et al. (1994).

3 Systematics

Class Polychaeta Grube, 1850

Order Capitellida Fauchald, 1977

Family Capitellidae Grube, 1862

Genus *Mediomastus* Hartman, 1944

Mediomastus chinensis sp. nov.

Type material. Holotype: TIO-BTS-Poly-1101, 1 specimen, Jiexi Bay, Lufeng City, Guangdong Province, 22°49.08'N, 115°36.96'E, 8 m depth, mud, incomplete; Paratypes: TIO-BTS-Poly-1102, 3 specimens, same collection site as holotype, 22°44.22'N, 115°46.32'E, 14 m, mud, all incomplete. All specimens collected in April 2017.

Additional materials examined. One hundred and fourteen specimens collected from the following four localities along the southeast coast of China: (1) 56 specimens, subtidal water off Xiaguan Town, Wenzhou City, Zhejiang Province: Sta. CNHD03, 4 specimens, 27°11.23'N, 120°32.37'E, 13 m, mud, 15 November

Table 1. All *Mediomastus* species reported since 1944 and their habitats

No.	Latin name	Substrate	Type locality
1	<i>Mediomastus californiensis</i> Hartman, 1944	sandy mud	California, USA
2	<i>Mediomastus ambiseta</i> (Hartman, 1947)	mud/muddy sand	California, USA
3	<i>Mediomastus setosus</i> Hartmann-Schröder, 1959	tube made of sand	El Salvador
4	<i>Mediomastus capensis</i> Day, 1961	sand	South Africa
5	<i>Mediomastus deductus</i> (Pillai, 1961)	oyster beds	Sri Lanka
6	<i>Mediomastus branchiferus</i> Hartmann-Schröder, 1962	holdfast of macroalgae	Peru
7	<i>Mediomastus acutus</i> Hartman, 1969	silty sand/fine sand	California, USA
8	<i>Mediomastus fragilis</i> Rasmussen, 1973	mud/muddy sand	Isefjord, Denmark
9	<i>Mediomastus cirripes</i> Ben-Eliahu, 1976	reef	Israel
10	<i>Mediomastus australiensis</i> Warren et al., 1994	mud	East Australia
11	<i>Mediomastus calliopensis</i> Warren et al., 1994	mud	Australia
12	<i>Mediomastus thomassini</i> Warren et al., 1994	sand bank off reef	Madagascar
13	<i>Mediomastus warrenae</i> Green, 2002	mud/muddy sand/sand	Thailand
14	<i>Mediomastus opertaculeus</i> Tomioka et al., 2013	rock	northern Japan
15	<i>Mediomastus duobalteus</i> Tomioka et al., 2014	sandy mud	Japan
16	<i>Mediomastus hanedaensis</i> Tomioka et al., 2014	sandy mud	Japan

2016; Sta. CNHD14, 6 specimens, 27°14.35'N, 120°40.04'E, 17 m, mud, 16 November 2016; Sta. CNHD16, 4 specimens, 27°4.62'N, 120°34.04'E, 19 m, mud, 16 November 2016; Sta. CNHD18, 10 specimens, 27°6.56'N, 120°25.18'E, 10 m, mud, 17 November 2016; Sta. CNHD19, 7 specimens, 27°21.44'N, 120°36.80'E, 11 m, mud, 16 November 2016; Sta. CNHD26, 11 specimens, 27°12.90'N, 120°22.99'E, 18 m, mud, 17 November 2016; Sta. CNHD35, 11 specimens, 27°11.54'N, 120°33.89'E, 13 m, mud, 15 November 2016; Sta. CNHD42, 3 specimens, 27°55.63'N, 120°32.07'E, 26 m, mud, 17 November 2016. (2) 11 specimens, waters around Xiamen Island, Xiamen City, Fujian Province: Sta. XM3, 5 specimens, 24°31.40'N, 118°4.30'E, 10 m, mud, 13 August 2015; Sta. XM6, 5 specimens, 24°25.32'N, 118°0.48'E, 11 m, mud, 12 August 2015; Sta. XM9, 1 specimen, 24°26.45'N, 118°11.25'E, 24 m, muddy sand, 12 August 2015. (3) 32 specimens, Jieshi Bay and adjacent water, Lufeng City, Guangdong Province: Sta. 07, 1 specimen, 22°33.84'N, 115°56.34'E, 24 m, mud, 18 April 2017; Sta. 08, 3 specimens, 22°43.86'N, 115°51.42'E, 20 m, mud, 17 April 2017; Sta. 16, 3 specimens, 22°45.36'N, 115°47.16'E, 14 m, mud, 17 April 2017; Sta. 17, 4 specimens, 22°49.08'N, 115°42.6'E, 8 m, mud, 19 April 2017; Sta. 18, 3 specimens, 22°44.58'N, 115°39.78'E, 11 m, mud, 19 April 2017; Sta. 21, 4 specimens, 22°49.08'N, 115°36.96'E, 8 m, mud, 19 April 2017; Sta. 24, 5 specimens, 22°38.19'N, 116°12.71'E, 30 m, mud, 17 April 2017; Sta. 32, 3 specimens, 22°40.68'N, 115°46.8'E, 9 m, mud, 19 April 2017; Sta. 40, 2 specimens, 22°44.22'N, 115°46.32'E, 14 m, mud, 17 April 2017; Sta. 48, 4 specimens, 22°53.2'N, 116°17.06'E, 20 m, mud, 18 April 2017. (4) 15 specimens, Daya Bay, Shenzhen City, Guangdong Province: Sta. D3, 1 specimen, 22°35.55'N, 114°33.0'E, 9 m, mud, 16 April 2016; Sta. D5, 7 specimens, 22°37.5'N, 114°35.4'E, 10 m, mud, 16 April 2016; Sta. D6, 3 specimens, 22°34.7'N, 114°33.5'E, 12 m, sandy mud, 16 April 2016; Sta. D13, 4 specimens, 22°34.93'N, 114°36.84'E, 14 m, mud, 16 April 2016.

Description. Holotype incomplete, with 70 segments, measuring 39.3 mm long by 1.1 mm wide. Body thread-like. Thoracic segments solid and muscular. Color change from brown on first 10 chaetigers to whitish brown on following chaetigers (Fig. 1). Epithelium smooth. Prostomium short, conical with round-tipped palpode. Eyespots not observed. Eversible proboscis with numerous minute papillae. Peristomium achaetous, twice as wide as long, slightly longer than first chaetiger. Paratypes incomplete, with 37–83 segments measuring 22.0–46.7 mm long and 1.0–1.3 mm wide.

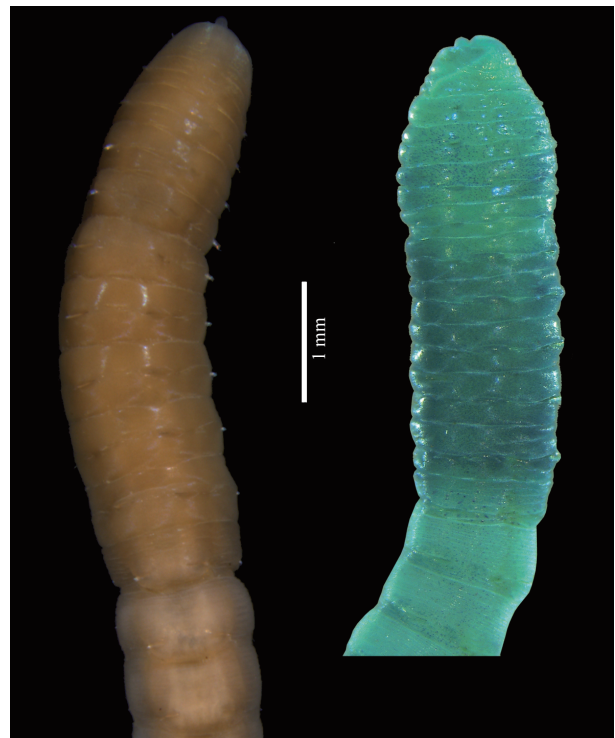


Fig. 1. Change in body color of the thorax and anterior abdomen before (left) and after (right) the methyl green staining.

Thorax with 10 chaetigers, all more or less the same width; segmental length about 0.33–0.5 times width; chaetigers 6–9 longer (Fig. 2a). Thorax slightly flattened ventrally. Notopodia lateral in first chaetiger, moving dorsally to anterior abdomen, and neuropodia ventrolateral. Chaetigers 1–9 biannulate, each with clear inter-segmental grooves; chaetal fascicles inserted at midsegment. Chaetiger 10 transitional, shorter and posteriorly narrower, multiannulate, chaetal fascicles posterior to midsegment (Fig. 2a). Lateral organs present throughout the thorax, located between noto- and neuropodia, closer to notopodia. Chaetigers 1–4 only with narrow, bilimbate capillary chaetae; noto- and neuropodia each 12–25 in number per fascicle. Chaetigers 5–10 with hooded hooks only; 12–21 notopodial hooks per fascicle

while 13–21 neuropodial hooks per fascicle. Shape of thoracic hooks similar between noto- and neuropodia (Figs 2d, e), with long and straight shaft, without constriction, indistinct shoulder.

Short, triangular fang surmounted by several rows of teeth. Hood long, about 3–5 times width, tapering gradually to shaft, longer in notopodia.

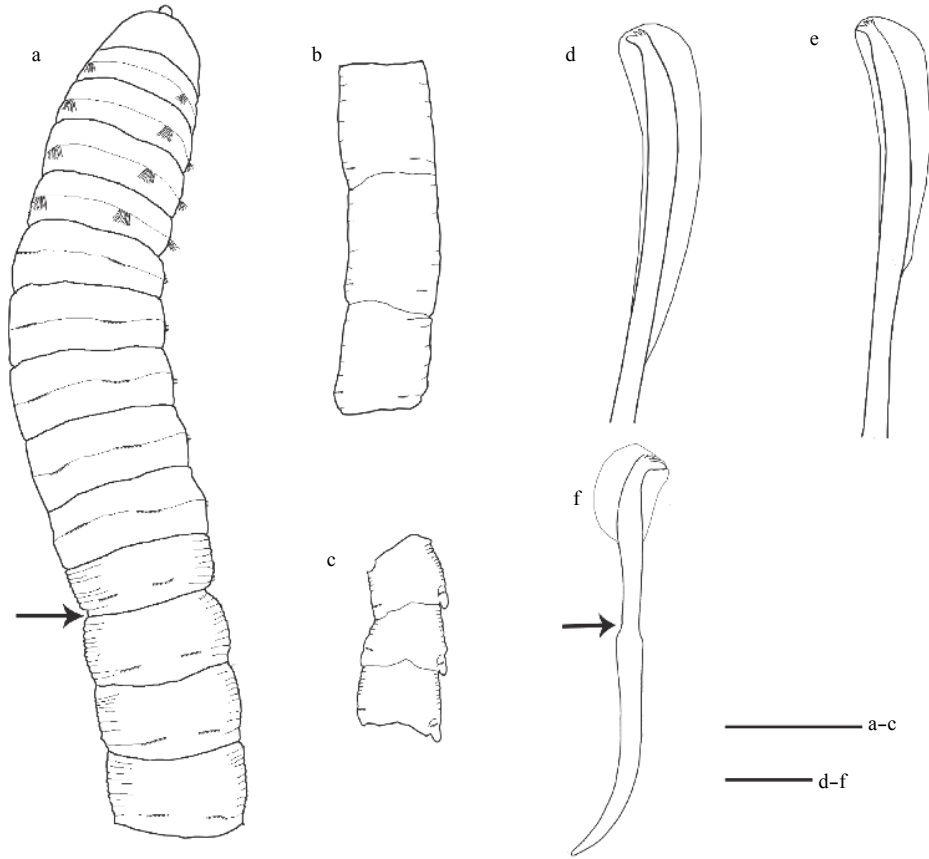


Fig. 2. *Mediomastus chinensis* sp. nov.. a. Anterior 13 chaetigers, dorsal view, arrow indicating the border between the thorax and abdomen; b. chaetigers 29–31, dorsal view; c. chaetigers 59–61, lateral view; d. notopodial hook from chaetiger 9; e. neuropodial hook from chaetiger 9; and f. notopodial hook from chaetiger 50, arrow indicating constriction. Scale bars: 1 mm (a–c) and 20 μ m (d–f).

Transition between thorax and abdomen marked by constriction and increase in segment length. All abdominal segments multiannulate, only with hooded hooks throughout. Anterior abdominal segments slightly longer but narrower than thoracic segments. Length of segments 0.7 times width in anterior abdomen (Fig. 2a), increasing to 1.5 times width in mid-abdomen (Fig. 2b), then decreasing to 0.8 times width in posterior abdomen (Fig. 2c). Posterior abdominal segments with parapodial ridges (evident from chaetiger 60). Chaetal fascicles positioned near posterior end of segments. Anterior abdomen with 18–22 hooks per fascicle, reducing to 5–8 hooks per fascicle in far posterior. Structure of abdominal hooks similar throughout abdomen, with shorter shaft, developed shoulder, distinct constriction (Fig. 2f), markedly different from those in thorax. Three rows of subapical teeth above main fang in lateral view. Hood shorter than in thoracic

hook, length about 1.5 times width. Pygidium unknown, due to absence of posterior body. Branchiae not observed.

Methyl green staining pattern. Light green staining from peristomium to prechaetal part of chaetiger 5 with minute spots, denser on chaetigers 2–3; dark green staining uniformly extending from postchaetal half of chaetiger 5 to anterior of chaetiger 10; posterior of chaetiger 10 stained light green, with sparsely coarse spots (Figs 1 and 3). Anterior abdominal segments stained light green, with sparsely minute spots.

Distribution. *Mediomastus chinensis* sp. nov. was found in several localities along the southeast coast of China, from Zhejiang Province to Guangdong Province. This species inhabits soft sediments of shallow coastal waters. We are not sure whether *Mediomastus chinensis* sp. nov. lives in northern China seas, since no specimens from those areas were examined in this study.

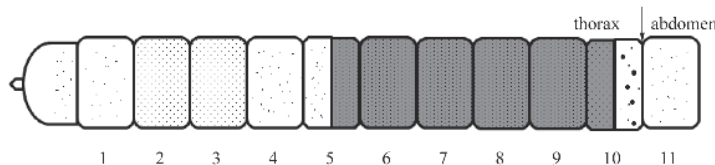


Fig. 3. Diagram showing methyl green staining pattern of *Mediomastus chinensis* sp. nov.

Etymology. The specific name refers to the geographical region in which this species lives.

Remarks. *Mediomastus chinensis* sp. nov. is characterized by its body shape and the structure of its chaetae. Among all described *Mediomastus* species, *M. chinensis* sp. nov. is similar to the other five known species: *M. australiensis*, *M. calliopensis*, *M. capensis*, *M. cirripes*, and *M. fragilis* by the segmental annuli (thoracic chaetigers biannulate and abdominal ones multiannulate); by the position of chaetal fascicles, which are situated at midsegment on chaetigers 1–9 but more posteriorly on the subsequent chaetigers; and by the possession of parapodial ridges on the posterior abdomen. However, *M. chinensis* sp. nov. can be readily distinguished from *M. capensis* and *M. cirripes* by the shape of the capillary chaetae, which were hook-tipped in *M. capensis* and broad-winged in *M. cirripes*, unlike those of the new species. When compared to *M. fragilis* and *M. australiensis*, abdominal hooks of *M. chinensis* sp. nov. have a distinct constriction, which was not observed in the former two species. In *M. calliopensis*, capillary chaetae are unilimbate and hood length of thoracic hooks are shorter than width, whereas *M. chinensis* sp. nov. has bilimbate capillaries and hood of thoracic hooks was 3–5 times as long as wide. Furthermore, staining pattern with methyl green is unique in *M. chinensis* sp. nov., different from other species. The new species also resembles *N. warrenae* reported from the Andaman Sea in chaetal structure and methyl green stain on chaetigers 5–10, but differs from the latter by the location of chaetae on chaetiger 9, the shape of chaetiger 10, and methyl green stain on first 4 chaetigers. The new species can be distinguished from *M. californiensis* reported from various seas around China. The distinct difference between the two species might be that the structure of thoracic and abdominal hooks is similar in *M. californiensis*, and that chaetal fascicles are inserted posterior to midsegment on chaetigers 1–9 and capillary chaetae on chaetigers 1–4 are unilimbate, all of these different from the new species. Thus, the records of *M. californiensis* in Chinese waters need confirmation.

4 Discussion

The genus *Mediomastus* differs from other described capitellid genera in its body shape and the thoracic chaetal formula. According to Hartman's (1944) original description of *Mediomastus*, there are 10 thoracic chaetigers, of which the first four have only capillary chaetae and the following six have hooded hooks. However, juvenile *Heteromastus* also conforms to the above definition, which could cause confusion. For this reason, it is important to collect adult individuals for correct identification. *Mediomastus* mostly resembles *Parheteromastus* in that both have four thoracic chaetigers with capillary chaetae. However, the latter genus has 11 thoracic chaetigers rather than 10. This indicates that the number of thoracic segments is an important diagnostic character that can be used to identify capitellid genera. One of the most useful diagnostic features in the differentiation of species within *Mediomastus* is chaetal characteristics, including the structure of hooks and the size of the hood, which should be carefully examined under oil immersion. Although *Mediomastus* specimens are usually incomplete, they can be identified with anterior fragment that most of diagnostic characters are located on. Dental formula of hooks might be useful for identification, yet

they are difficult to observe. Along with morphological characters, MGSP is also a useful tool to determine whether the specimens belong to the same species.

Acknowledgements

The authors are grateful to Wang Jianjia and Xiang Peng for their assistance in photographing type materials and additional specimens. The authors also thank the members of Benthos Laboratory, Laboratory of Marine Biology and Ecology, Third Institute of Oceanography, State Oceanic Administration, for helping to collect specimens.

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