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Two new species of *Mediomastus* (Annelida, Capitellidae) from Tokyo Bay, Japan

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Abstract

Two undescribed species of polychaetes in *Mediomastus* (Annelida: Capitellidae) were collected from intertidal to shallow habitats in Tokyo Bay, Japan. These are *M. duobalteus* sp. n. and *M. hanedaensis* sp. n. *Mediomastus duobalteus* sp. n. is distinguishable from all congeners by the following characters: 1) segments 3, 4, 8–11 stainable with methyl green, 2) thoracic capillary chaetae unilimbate, 3) abdominal capillary chaetae absent, 4) paddle-like chaetae in the thorax absent, and 5) abdominal hooded hooks not flared. *Mediomastus hanedaensis* sp. n. is similar to *M. warrenae* Green, 2002, but differs from the latter in the shapes of the thoracic capillary chaetae and the abdominal hooded hooks, and the staining pattern with methyl green. In addition, a key to all *Mediomastus* species is provided.

Keywords

Taxonomy, morphology, polychaete, Pacific

Introduction

Capitellids in the genus *Mediomastus* Hartman, 1944 are benthic polychaete worms that occur in marine and brackish water. *Mediomastus* is distinguishable from other genera in Capitellidae by the following characters: 1) peristomium (segment 1) without chaetae, 2) thorax with 10–12 segments, 3) segments 2–5 with capillary chaetae in both
rami, and 4) remaining thoracic and abdominal segments with hooded hooks (Hartman 1944, Warren et al. 1994, Green 2002). The genus was originally established for *M. californiensis* Hartman, 1944 (Hartman 1944) and now contains 14 species (Tomioka et al. 2013). In Japan, species in the genus have been reported from eight localities (Fig. 1, references therein), but only two of these records were identified to species: *M. californiensis* from Sagami Bay (Imajima 2006) and *M. opertaculeus* from Hokkaido (Abashiri, Monbetsu, Rishiri Island, and Oshoro) (Tomioka et al. 2013, 2014).

**Figure 1.** Map showing the distribution of *Mediomastus* records in Japan. Open circles, previous studies; closed circle, this study. Sources: Rishiri Island (Kato et al. 2003, Tomioka et al. 2014); Sarufutsu (Imajima 1992); Monbetsu (Tomioka et al. 2014); Abashiri (Tomioka et al. 2013); Oshoro (Tomioka et al. 2014); Tokyo Bay (Nishi and Tanaka 2007, Nishi et al. 2009); Sagami Bay (Imajima 2006); Ariake Bay (Suyama et al. 2003, Niki et al. 2006).
Nishi and Tanaka (2007) reported the occurrence of representatives of *Mediomastus* in Tokyo Bay but did not identify their material to species. Our capitellid specimens from Tokyo Bay were collected during an environmental assessment for the Haneda Airport re-expansion project (Nishi et al. 2009). They turned out to comprise two undescribed species, which we describe and illustrate in this paper. In addition, we provide a key to all species in *Mediomastus*.

**Materials and methods**

Worms were collected from sandy mud sediment off Haneda, at the mouth of the Tamagawa River, Tokyo Bay, Japan. All specimens were fixed in 10% formalin in seawater and were later transferred to 70% ethanol after rising in deionized water. Morphological observation and methyl-green staining were performed as described by Tomioka et al. (2013). All specimens have been deposited in the Natural History Museum and Institute, Chiba, Japan. Morphological terminology follows that of Warren et al. (1994).

**Systematics**

*Mediomastus duobalteus* sp. n.

http://zoobank.org/BD73215A-6470-4BE1-A439-A3F6ED585513

Figs 2–6

**Material examined.** Holotype: CBM−ZW 1088, Haneda, Tokyo Bay, St. L3e-2-1 (35.52783203°N, 139.7884979°E, sandy mud bottom, incomplete, collected May 2012. Paratypes (six specimens): CBM-ZW 1089, Haneda, Tokyo Bay, St. L4e-1-1, 35.52949905°N, 139.7836609°E, incomplete; mounted on SEM stub, collected spring 2007; CBM-ZW 1090, Haneda, Tokyo Bay, St. L2b-2, 35.52531815°N, 139.7931824°E, sandy-mud bottom, 5 m depth, incomplete, some parts of body mounted on slides, remaining parts preserved in 70% ethanol, collected May 2012; CBM-ZW 1091, Haneda, Tokyo Bay, St. 07s-L4e-1-2, 35.52949905°N, 139.7836609°E, sandy mud bottom, incomplete, collected spring 2007; CBM-ZW 1092, St. 07s-L4e-1-3, 35.52949905°N, 139.7836609°E, sandy mud bottom, incomplete, collected spring 2007; CBM-ZW 1093, St. 07s-L4e-1-4, 35.52949905°N, 139.7836609°E, incomplete, collected spring 2007; CBM-ZW 1094, Haneda, Tokyo Bay, St. L4e-1-2, sandy mud bottom, incomplete, collected May 2012.

**Description.** Holotype, anterior fragment with 73 segments; 18.0 mm in length; 0.51 mm in maximum width. Body color white in ethanol. Epithelium smooth. Nephridiopores lacking. Branchiae absent. All segments cylindrical. Sex uncertain.

Prostomium (Fig. 2A) conical, with short palpode; eversible proboscis with numerous minute papillae. Peristomium twice as long as chaetiger 1, without eyespots, achaetigerous.
Capillary chaetae unilimbate, with narrow wing (Figs 3A, 4A), present on chaetigers 1–4; noto- and neurochaetae each 8–12 in number per fascicle (Fig. 3A). Chaetigers 5–10 with hooded hooks, but without paddle-like chaetae. Notopodial hooded

Figure 2. Mediomastus duobalteus sp. n., holotype, CBM-ZW 1088. A Anterior end of body, left lateral view B abdominal segments, left lateral view.

Figure 3. Mediomastus duobalteus sp. n., paratype, CBM-ZW 1089, SEM images. A Capillary chaetae on segment 3 B notopodial hooded hooks on segment 6 C neuropodial hooded hooks on segment 6 D notopodial hooded hooks on segment 13.
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hooks (Figs 3B, 4B) with short, stout fang and 3 fine teeth (Fig. 4B); hood with opening (Fig. 3B); shaft without constriction (Fig. 4B); shoulder indistinct (Fig. 4B); 6–10 hooks per fascicle. Neuropodial hooded hooks (Figs 3C, 4C) with short, stout fang and 3 fine teeth (Fig. 4C); hood with small opening (Fig. 3C); shaft without constriction (Fig. 4C); shoulder indistinct (Fig. 4C); 5–10 hooks per fascicle (Fig. 4C).

Abdominal segments twice as long as wide (Fig. 2B); with hooded hooks only. Hooded hooks (Figs 3D, 4D) with stout, pointed fang and 3 coarse teeth (Fig. 4D); hood with opening (Fig. 3D); shaft without constriction (Fig. 4D); shoulder indistinct; 2–6 hooks per fascicle.

Transition from thorax to abdomen marked by change in shape of hooded hooks; hooded hooks in thorax have small fang with fine, small teeth (Fig. 4B, C), while those in abdomen have stout, pointed fang; coarse and large teeth (Fig. 4D).

**Methyl-green staining.** Among seven specimens observed, methyl-green staining resulted in three patterns (Fig. 5). All patterns showed two bands of numerous, dense, minute spots: one band on segments 2 and 3, or 3 and 4; the other extending from segments 8 or 10 to segment 11. Figure 6 shows a stained worm having the pattern diagrammed in Fig. 5C.

**Etymology.** The specific name is a noun in the nominative singular, from the Latin numeral *duo* (“two”) and the Latin noun *balteus* (“belt”), referring to the species’ diagnostic staining pattern, in which the staining pattern is two belt-like bands.

**Remarks.** Among 14 congensers, *M. duobalteus* most closely resembles *M. warrenae*, but differs from the latter in the staining pattern with methyl green (segments 5
and 6 lack spots in *M. duobalteus* but are darkly stained post-chaetally in *M. warrenae*), the shape of the thoracic capillary chaetae (unilimbate in *M. duobalteus* vs. bilimbate in *M. warrenae*), and the shape of the abdominal hooded hooks (constriction absent in *M. duobalteus* but present in *M. warrenae*).
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Mediomastus hanedaensis sp. n.
http://zoobank.org/CE8D8CDA-3450-4E4D-86C6-AC40DD6EA18B
Figs 7–11

Material examined. Holotype: CBM-ZW 1095, Haneda, Tokyo Bay, St. 07s-L4e-1-c, 35.52949905°N, 139.7836609°E, incomplete. Paratypes (two specimens): CBM-ZW 1096, same collection site as holotype, incomplete, mounted on SEM stub; CBM-ZW 1097, same collection site as holotype, incomplete, cut into 5 portions, all mounted on two slides. All specimens collected spring 2007.

Description. Holotype incomplete, with 27 segments, sex uncertain; 16.2 mm in length; 1.33 mm in maximum width. Body color whitish yellow in ethanol. Epidermis smooth. Nephridiopores lacking. Branchiae absent. All segments cylindrical.

Prostomium (Fig. 7A) conical, with short palpode; eversible proboscis with numerous minute papillae. Peristomium 1.2 times as wide as long, slightly longer than chaetiger 1, without eyespot, achaetigerous.

Thoracic chaetigers biannulate. Thin, unilimbate, capillary chaetae with narrow wing (Figs 8A, 9A) present on chaetigers 1–4; noto- and neurochaetae each 8–13 in number per fascicle (Fig. 8A). Chaetigers 5–10 with hooded hooks, but without paddle-like chaetae. Notopodial hooded hooks (Figs 8B, 9B) with short, blunt fang and 6 teeth (Fig. 9B); hood with small opening (Fig. 8B); shaft not constricted (Fig. 9B); shoulder indistinct (Fig. 9B); 6–8 hooks per fascicle (Fig. 8B). Neuropodial hooded hooks (Figs 8C, 9C) with short, stout fang and 7 teeth (Fig. 9C); hood with small opening (Fig. 8C); shaft without constriction (Fig. 9C); shoulder indistinct (Fig. 9C); 4–7 hooks per fascicle (Fig. 8C).

Abdominal segments 2.5 times as wide as long (Fig. 7B), with hooded hooks only. Hooded hooks with long fang and 3 teeth (Figs 8D, 9D); fangs in abdominal hooks longer and sharper than those in thoracic hooks; opening of hood wider than that of thoracic hooks; shaft with distinct constriction (Fig. 9D); 2–5 hooks per fascicle (Fig. 8D).

Figure 7. Mediomastus hanedaensis sp. n., holotype, CBM-ZW 1095. A Anterior end of body, left lateral view B abdominal segments, left lateral view.
Transition from thorax to abdomen marked by alteration in shape of segments (longer in abdomen), shape of shaft of hooded hooks (with constriction in abdominal hooks), and length of fang of hooded hooks (longer in abdominal hooks).

**Methyl-green staining.** Among the three specimens observed, methyl-green staining resulted in three patterns (Fig. 10). Numerous minute spots sparsely and uniformly covered segments 5–9, 7–10, or 8–10; segment 10 (Fig. 10A) or 11 (Fig. 10B, C) with denser spots. Figure 11 shows the stained worm diagrammed in Fig. 10A.

**Etymology.** The specific name is an adjective, referring to the type locality.

**Remarks.** *Mediomastus hanedaensis* is similar to *M. warrenae* in the shape of the thoracic hooded hooks, but differs from the latter in the staining pattern with methyl green (segments 8 and 9 uniformly spotted in *M. hanedaensis* vs. post-chaetally spotted in *M. warrenae*) and in the shape of the thoracic capillary chaetae (unilimbate in *M. hanedaensis* vs. bilimbate in *M. warrenae*).
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**Figure 9.** *Mediomastus hanedaensis* sp. n., paratype, CBM-ZW 1097. **A** Capillary chaeta from segment 2 **B** notopodial hooded hook from segment 9 **C** neuropodial hooded hook from segment 7 **D** notopodial hooded hook from segment 18; arrow indicates constriction.

**Figure 10.** Diagram showing methyl-green staining patterns observed in the thorax (consisting of 11 segments) among three specimens of *Mediomastus hanedaensis* sp. n. **A** Paratype, CBM-ZW 1097 **B** paratype, CBM-ZW 1096 **C** holotype, CBM-ZW 1095.
Key to species of genus Mediomastus

Data compiled from Hartman (1944, 1947, 1969), Hartmann-Schröder (1959, 1962), Day (1961), Pillai (1961), Rasmussen (1973), Ben-Eliahu (1976), Warren et al. (1994), Green (2002), Tomioka et al. (2013), and this study.

1  Abdominal capillary chaetae present .................................................................2
   – Abdominal capillary chaetae absent ............................................................4
2  Spine-like hooded hooks present ...Mediomastus ambiseta (Hartman, 1947)
   – Spine-like hooded hooks absent ..............................................................3
3  Thorax with unilimbate capillary chaetae ......................................................
   .................................................................................................................Mediomastus setosus Hartmann-Schröder, 1959
   – Thorax with bilimbate capillary chaetae ......................................................
   ...................................................................................................................Mediomastus branchiferus Hartmann-Schröder, 1962
4  Paddle-like chaetae present ........Mediomastus acutus Hartman, 1969
   – Paddle-like chaetae absent ............................................................................5
5  Thorax does not stain with methyl green .........................................................6
   – Thoracic segments 1–4 stain with methyl green ............................................7
   – Thoracic segments 5–11 stain with methyl green ............................................8
6  Eye spots present ........Mediomastus fragilis Rasmussen, 1973
   – Eye spots absent ........Mediomastus deductus (Pillai, 1961)
7  Thorax with whip-like capillary chaetae ............................................................
   ...................................................................................................................Mediomastus operculatus Tomioka et al., 2013
   – Thorax with unilimbate capillary chaetae ....Mediomastus duobalteus sp. n.
   – Thorax with bilimbate capillary chaetae ...Mediomastus warrenae Green, 2002
8  Thorax with whip-like capillary chaetae ............................................................
   ...................................................................................................................Mediomastus thomassini Warren et al., 1994

Figure 11. Photograph of the thorax of Mediomastus hanedaensis sp. n., holotype, CBM-ZW 1095, showing the methyl-green staining pattern, with the segment numbers and segmental boundaries labeled.
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References

Ben-Eliahu MN (1976) Polychaete cryptofauna from rims of similar intertidal vermetid reefs on the Mediterranean coast of Israel and in Gulf of Elat: Sedentaria. Israel Journal of Zoology 25: 121–155.

Day JH (1961) The polychaete fauna of South Africa. Part 6. Sedentary species dredged off Cape coasts with a few records from shores. Journal of the Linnean Society, Zoology 44: 436–560.

Green KD (2002) Capitellidae (Polychaeta) from the Andaman Sea. Phuket Marine Biological Center Special Publication 24: 249–343.

Hartman O (1944) Polychaetous annelids from California including the descriptions of two new genera and nine new species. Allan Hancock Pacific Expeditions 10: 239–310.

Hartman O (1947) Polychaetous annelids. Part VII. Capitellidae. Allan Hancock Pacific Expedition 10: 391–480.

Hartman O (1969) Atlas of Sedentariate Polychaetous Annelids from California. Allan Hancock Foundation, University of Southern California, Los Angeles, 812 pp.

Hartmann-Schröder G (1959) Zur Ökologie der Polychaeten des Mangrove-Estero-Gebietes von El Salvador. Beiträge zur Neotropischen Fauna 1: 69–183. doi: 10.1080/0165025909380612

Hartmann-Schröder G (1962) Zweiter Beitrag zur Polychaetenfauna von Peru. Kieler Meeresforschungen 18: 109–147.
Imajima M (1992) Polychaetous annelids around Sarufutsu, northern Hokkaido. Memoirs of the National Science Museum 25: 126–133.

Imajima M (2006) Polychaetous annelids from Sagami Bay and the Sagami Sea, Central Japan. Memoirs of the National Science Museum 40: 317–408.

Kato T, Ito T, Shimomura M (2003) Intertidal polychaetes of Rishiri Island. Rishiri Studies 22: 41–47. [in Japanese with English abstract]

Niki K, Suyama N, Suda Y, Murai T (2006) Relationship between distribution of *Heteromastus*, *Mediomastus*, and *Notomastus* of Capitellidae of polychaete and bottom condition in the northern part of Ariake Sound. Journal of National Fisheries University 54: 7–13. [in Japanese with English abstract]

Nishi E, Tanaka K (2007) Polychaetous annelids in tidal flats and estuaries near Kanagawa Prefecture. Natural History Report of Kanagawa 28: 101–107. [in Japanese]

Nishi E, Masumoto T, Taru M, Nakayama S, Kazama-Wakabayashi M, Monju M, Suyama N, Aida M, Sato M, Tanaka K, Kupriyanova E (2009) Polychaete fauna and diversity around Haneda, Tokyo Bay, a result of environmental assessment of Haneda Airport re-expansion project. Proceedings of the 21st Ocean Engineering Symposium, JFOES-JASNAOE, OES-21-191: 1–8. [in Japanese with English abstract]

Pillai TG (1961) Annelida Polychaeta of Tambalagam Lake, Ceylon. Ceylon Journal of Science (Biological Science) 4: 1–40.

Rasmussen E (1973) Systematics and ecology of the Isefjord marine fauna (Denmark). Ophelia 11: 1–495. doi: 10.1080/00785326.1973.10430115

Suyama N, Koshiishi Y, Suda Y, Murai T (2003) Distribution and composition of the macrobenthos in relation to the bottom sediments in the northern part of Ariake Sound. Journal of National Fisheries University 51: 105–114. [in Japanese with English abstract]

Tomioka S, Hiruta SF, Kajihara H (2013) Description of *Mediomastus opertaculeus* sp. nov. (Annelida: Capitellidae) from Hokkaido, northern Japan. Species Diversity 18: 105–110. doi: 10.12782/sd.18.1.105

Tomioka S, Yamasaki H, Ikoma M, Kajihara H (2014) New record of *Mediomastus opertaculeus* Tomioka, Hiruta & Kajihara, 2013 (Annelida: Polychaeta) from Rishiri Island. Rishiri Studies 33: 17–22. [in Japanese with English abstract]

Warren LM, Hutchings PA, Doyle S (1994) A revision of the genus *Mediomastus* Hartman, 1944 (Polychaeta: Capitellidae). Records of the Australian Museum 46: 227–256. doi: 10.3853/j.0067-1975.46.1994.6