

Chaetopterid Polychaetes from Taiwan and Okinawa Island (Japan), with Descriptions of Two New Species

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Eijiroh Nishi and Hwey-Lian Hsieh (2009) Chaetopterid polychaetes from Taiwan and Okinawa Island (Japan), with descriptions of two new species. *Zoological Studies* 48(3): 370-379. Chaetopterid polychaetes (Annelida: Spionida) were studied in shallow-water sandy and muddy areas of Taiwan and Okinawa I., Japan. We found 4 species of the family, *Mesochaetopterus japonicus* Fujiwara, 1934, *M. formosana* sp. nov., *Phyllochaetopterus verrilli* Treadwell, 1943, and *P. awasensis* sp. nov. The former 3 species were found in Taiwan, and the latter 2 species at Okinawa. *Mesochaetopterus formosana* sp. nov. is characterized by having 2 middle-region (region B) chaetigers. These middle-region chaetigers are very long resulting in the middle region being 1.5-2 times longer than the anterior region (region A). Region A has 6-8 A4 modified cutting chaetae that have both small and large teeth on the head. *Phyllochaetopterus awasensis* sp. nov. is characterized by having 13 or 14 region A chaetigers, approximately 20 region B chaetigers, A4 chaetae with small teeth on the edge of the heads, and a tough brown chitinous tube. These are the first records of *Mesochaetopterus japonicus* and *P. verrilli* in Taiwanese waters. We compared the species reported here with other Pacific chaetopterids. <http://zoolstud.sinica.edu.tw/Journals/48.3/370.pdf>

Key words: Chaetopteridae, *Mesochaetopterus*, *Phyllochaetopterus*, Taiwan, Okinawa.

The Chaetopteridae is a polychaete family with about 65 currently accepted species, placed in 4 genera: *Chaetopterus* Cuvier 1830, *Mesochaetopterus* Potts 1914, *Phyllochaetopterus* Grube 1863, and *Spiochaetopterus* Sars 1853. All are tubicolous and commonly occur on muddy or sandy mud bottoms from intertidal to shallow shelf waters. Recently, new taxa were described (Nishi and Rouse 2007, Martin et al. 2008). The following 6 species of *Phyllochaetopterus* and 5 species of *Mesochaetopterus* are presently known from the Pacific: *P. brevitentaculata* Hartmann-Schröder 1965 (Cook I.), *P. claparedii* McIntosh 1885 (Japan), *P. verrilli* Treadwell 1943 (Okinawa I., Hawaii Is., and Cook I.), *P. ellioti* Crossland 1903 (Solomon Is. and Cook I.), *P. socialis* Claparède 1870 (Solomon Is.), and *P. herdmani* (Hornell in Willey

1905) (Solomon Is. and Japan) (Okuda 1935, Gibbs 1971 1972, Nishi and Arai 1996); and *M. minutus* Potts 1914, *M. japonicus* Fujiwara 1934, *M. selangolus* Rullier 1976, and *M. sagittarius* (Claparède 1870) (Okuda 1935, Gibbs 1971 1972, Bailey-Brock 1987, Nishi and Arai 1996, Bhaud et al. 2006). Prior to this paper, only 1 chaetopterid species, *Chaetopterus variopedatus* (Renier 1804), was recorded from Taiwan (Hsueh 2001). We studied chaetopterids from Okinawa, Japan and Taiwan and found 4 species. Two species are new to science, and 2 are first reported in Taiwanese waters. This paper describes the new species of *Phyllochaetopterus* and *Mesochaetopterus* from the tidal flats of Neotropical East Asia. These species are the 22nd species of *Phyllochaetopterus* and 13th of *Mesochaetopterus* to be described.

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MATERIALS AND METHODS

Chaetopterid worms were collected from the intertidal zone, a shallow water with coral debris, and mudflats: at Shianshan, Hsinchu City, northwestern Taiwan, West Pacific, 22.494–24.769°N, 120.908–120.915°E; on Hsiao-Liu-Chiu, Pingtung County, offshore island, southwestern Taiwan, West Pacific, 22.334–22.345°N, 120.359–120.388°E, and at Dadu River estuary, Changhua County, western central Taiwan, West Pacific, 24.202°N, 120.483°E. Specimens were also collected at Awase tidal flat, Okinawa City, on the Pacific side of Okinawa I. (Fig. 1). All worms were fixed in 10% formaldehyde in seawater before transfer to 70% ethanol. Scanning electron microscopic (SEM) observations were made on chaetae after dissection from a paratype to show the ultrastructure of the A4 specialized chaetae. Permanent slide mounts for uncini and chetae were also made. Terminology for each body region and chaetae follows Bhaud et al. (1994) and Crossland (1904). Type specimens are deposited at Academia Sinica, Taipei, Taiwan (ASIZW), South Australian Museum, Adelaide, Australia (SAMA), BP Bishop Museum, Honolulu, Hawaii, USA (BPB),

Natural History Museum and Institute, Chiba, Japan (CBM), Coastal Branch of Natural History Museum and Institute, Chiba, Katsuura, Chiba, Japan (CMNH), The Natural History Museum, London, UK (NHM), National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM), Senckenberg Museum, Frankfurt, Germany (SMF), Zoological Museum, University of Copenhagen, Copenhagen, Denmark (ZMUC), and Zoologisches Museum der Humboldt Universität, Berlin, Germany (ZMB).

RESULTS

SYSTEMATICS

Family Chaetopteridae Audouin and Milne Edwards, 1833

Genus *Mesochaetopterus* Potts 1914

Mesochaetopterus formosana sp. nov.

(Figs. 2, 3)

Material examined: Holotype. ASIZW 715, Gaban, Hsiao-Liu-Chiu, Pingtung County, offshore island, southwestern Taiwan, West Pacific, less

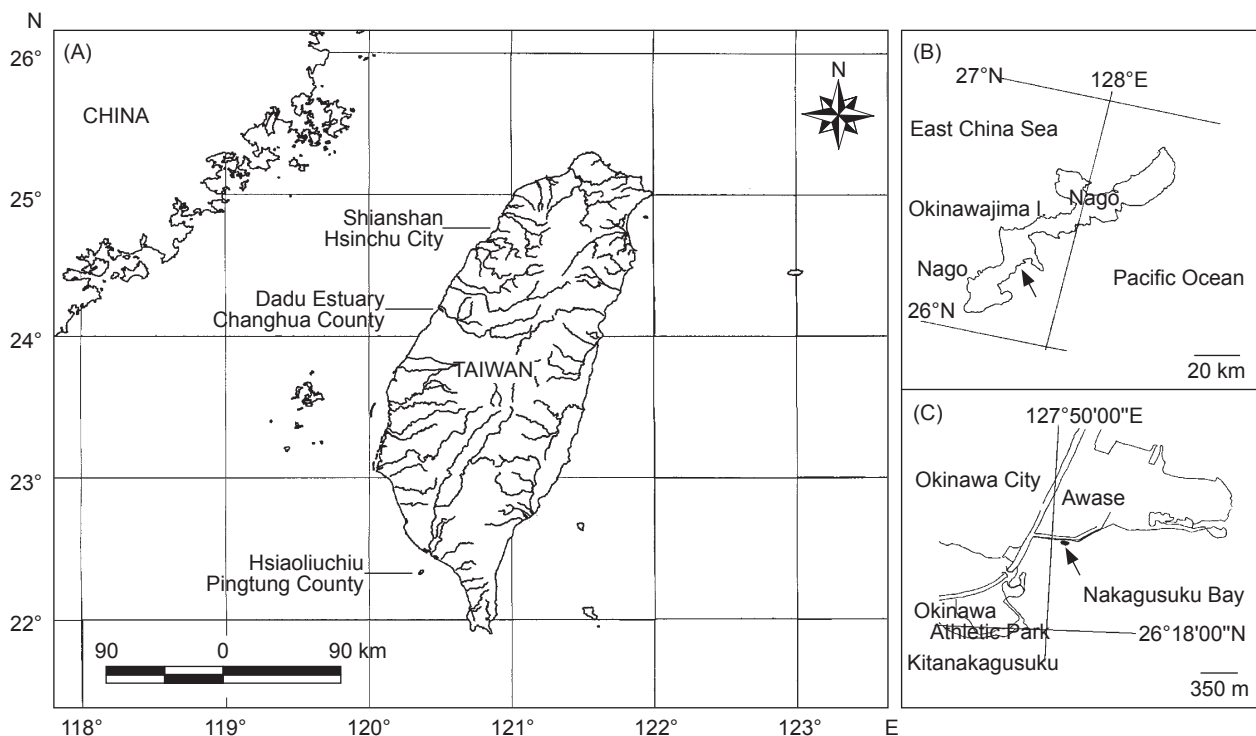


Fig. 1. Map of collection sites in Okinawa and Taiwan. Hsiao-Liu-Chiu in Pingtung County, Taiwan is the type locality of *Mesochaetopterus formosana* sp. nov., and the Awase tidal flat, Okinawa, Japan is the type locality of *Phyllochaetopterus awasensis* sp. nov.

than 1 m deep, by shovel, coll. H.L. Hsieh, 2 July 1989.

Ten paratypes, same collection data as for holotype. NHM-2008.3467; USNM 1116466, complete; ZMUC-POL -1983, incomplete, lacking posterior parts; SMF 17371, complete; ZMV "Vermes" 11363, complete; ASIZW 716.

Nine paratypes from Hsiao-Liu-Chiu, Pingtung County, offshore island, southwestern Taiwan, West Pacific, less than 1 m deep, in Long-Xia-Dong, coll. H.L. Hsieh, 9 July 1992. ASIZW 717; CMNH-ZW 1694; CBM-ZW 1008; SAMA E 3689; BPBM-R 3047.

Additional material examined: *Mesochaetopterus japonicus* Fujiwara 1934 Kagoshima Bay, Kyushu, Japan. *Mesochaetopterus minutus* Potts 1914 Katsuura, Boso Peninsula, Chiba, Japan. *Mesochaetopterus taylori* Potts 1914 Royal British Colombia Museum specimens.

Description: Holotype complete and with tube (some paratypes lacking posterior parts). Holotype, 24 mm long and 0.3-0.5 mm wide; paratypes, 20-30 mm long (Figs. 2A, B). Complete fixed worms up to 30 mm in length, up to 0.6 mm in width, with up to 36 chaetigers (10A+2B+16-24C; $n = 10$, holotype 10A+2B+18C).

Region A slender, very long and narrow, usually with 10 chaetigers. Prostomium large and prominent, oval in dorsal view (Figs. 2C, D), with 1 pair of brown eyespots next to palps (Figs. 2A, D). Peristomium extended anteriorly, funnel-shaped (Figs. 2A, C, D, F). Two long, grooved palps arising dorsally just posterior to junction of posterolateral border of peristomium and prostomium (Figs. 2E, F). Palps 3-5 mm long, in some paratypes, palps reaching anterior B2. No antennae posterior to palps. Middorsal ciliated groove beginning posterior of prostomium and continuing posteriorly to region C, deepest and most apparent in region B. Especially conspicuous dorsal cupule or an associated feeding organ on B2 (Figs. 2A, G, H). Ventral surface of region A with a long, slender, cream-colored plastron, without secretory crescents (Figs. 2A, F). Length/width of slender plastron 8.8-9.7. Parapodia short, composed only of notopodia. Notopodia of A1-A3 and A5-A9 or A10 with a single row of 10-30 straw-colored, slightly asymmetrical, lanceolate, oarlike chaetae; dorsalmost chaetae longest and most slender, ventralmost chaetae gradually becoming shorter and wider. A4 chaetiger longer than other region A chaetigers and stouter than those of A3 or A5. A4 with 7 or 8 plate-like, stout, modified chaetae with small and large teeth on the heads

(Figs. 3A-E). Modified chaetae light brown, partly embedded in A4 chaetigers (Figs. 3D, E). Apical teeth of various sizes, small to large, all with dull tips (Figs. 3D, E). Some teeth also present on neck below head (Figs. 3A, B).

Region B glandular dorsally, with 2 slender and elongate chaetigers, chaetigers (Figs. 2A, E, G, H). B1 longer than B2, both longer than individual A and C chaetigers; B1 longer than region A, and B2 same or similar length to region A (holotype, region A and B2 = 3 mm, B1 = 4 mm, paratype 1, region A and B2 = 3 mm, B1 = 4 mm). Parapodia of region B biramous; neuropodia unilobed in B1 and bilobed in B2 (Figs. 2F, H). Luminous gland on B1 and anterior B2 (Figs. 2A, G, H). Notopodia unilobed; B1 with pointed digiform, distally swollen, knob-like lobe; B2 with small pointed lobe (Figs. 2A, H). Associated feeding organ (Kudenov 1976, cupule in Nishi and Arai 1996) on posterior part of B2 (Figs. 2A, H). Neuropodia of B1 with lower ventral lobe only, that of B2 with short, rounded, anteriorly oriented lobe on upper dorsal side and elongated, posteriorly oriented ventral lower lobe (Figs. 2F, H). Ventral lobe with fewer uncini than dorsal lobe. Uncini bluntly D-shaped, with a single row of minute teeth (Figs. 3F, G). Uncini of dorsal and ventral lobes in 3 or more irregular rows. Uncini with 7 or 8 teeth in a single row, approximately 30 μm long (Figs. 3F, G).

Region C with 16-24 chaetigers. All parapodia biramous; notopodia unilobed, digiform, distally swollen and containing 2 or 3 embedded aciculate chaetae; neuropodia subdivided as in region B; only ventral lobe in most-posterior part (Figs. 2I, J, L). Uncini similar to those of region B, with 8 or 9 teeth, approximately 26-28 μm long. Pygidium simple, open, without anal papillae (Fig. 2L).

Tube. Composed of a thin inner lining and an outer layer embedded with sand and shell fragments. Inner layer translucent or beige, soft, and delicate. Tube completely buried in substrate except for opening.

Remarks: Fifteen species of *Mesochaetopterus* have been described. The genus was revised by Nishi (1999) and Martin et al. (2008). According to Nishi's (1999) classification, *M. formosana* sp. nov. belongs to group II by having 2 or 3 modified conical notopodia. Martin et al. (2008) would classify *M. formosana* sp. nov. as a small-sized species. Among these groupings, the new Taiwanese species is most similar to *M. malayensis* Caullery 1944, but the former species has a characteristically slender body

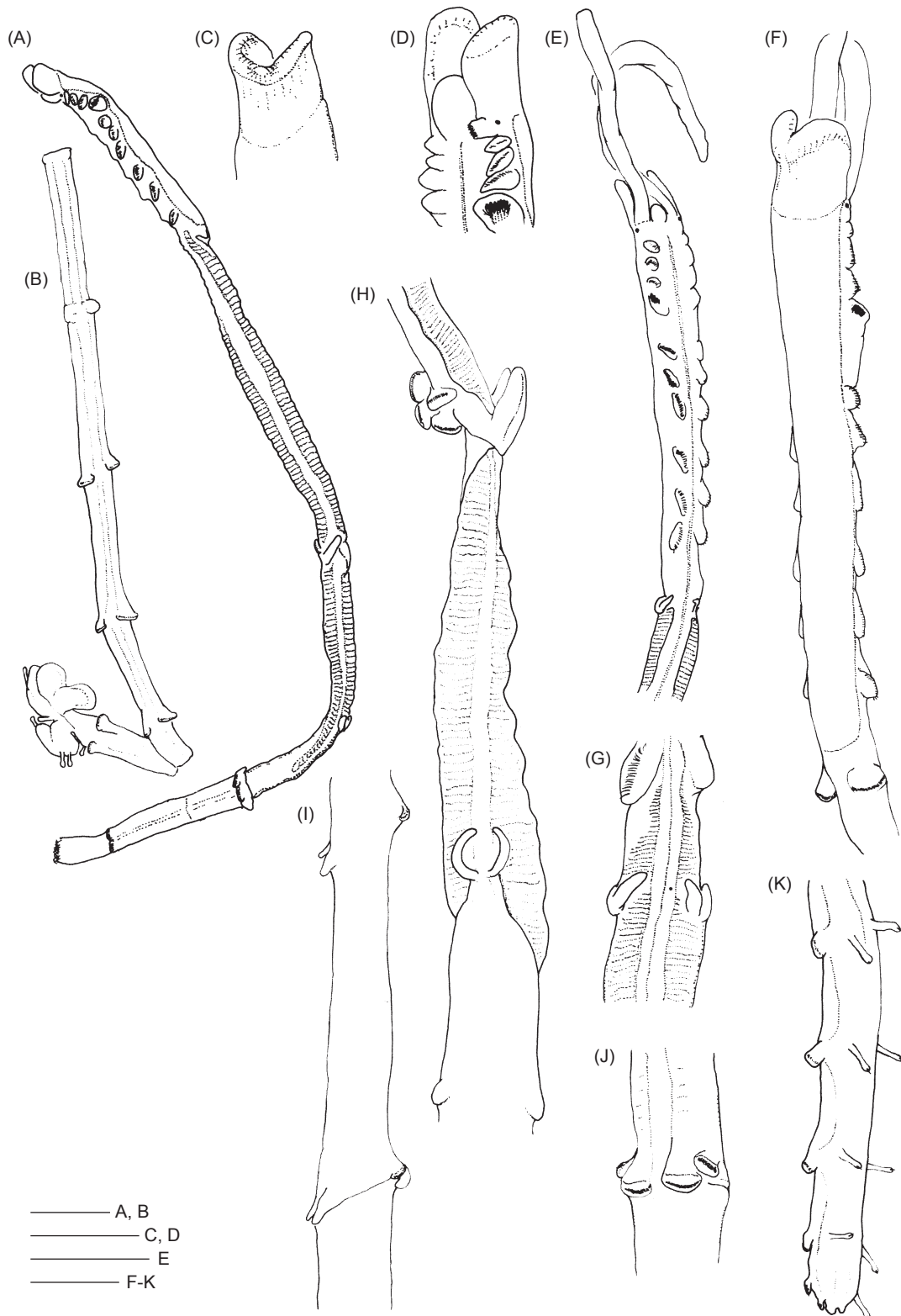


Fig. 2. *Mesochaetopterus formosana* sp. nov. (A-D, I-K) Paratype (NHM. 2008.3467); (E-H) holotype. (A, B) Anterior and posterior regions of a paratype; (C, D) peristomium and head part; (E) dorsal view of A and B1; (F) lateroventral view of regions A and B1; (G) A10 and B1, dorsal view; (H) posterior B1 to B2, showing notopodia, neuropodia, and cupule; (I) lateral view of C2 and C3 of region C; (J) ventral view of C2 and C3; (K) posterior-most chaetigers and pygidium. Scale bars: A, B, E = 1 mm; C, D, F-K = 0.5 mm.

and very long region B chaetigers (6-7 mm long). *Mesochaetopterus malayensis* also has a long, slender plastron, but the length/width of the ventral shield (plastron) is approximately 2.3 in *M. malayensis* (1.2 mm long/0.5 mm wide, estimated from fig. 20 of Caullery 1944), while the length/width is approximately 9 in *M. formosana* sp. nov. (2.2-2.8 mm long/ 0.25-0.3 mm wide: Figs. 2A, F). The region B length/width also differs; in *M. formosana* sp. nov. it is 8.5-13 in B1 and 8.5-11 in B2; while in *M. malayensis*, it is approximately 4.4 in B1 (2.2/0.5 mm in fig. 20A of Caullery 1944) and 2.4 in B2 (1.2/0.5 mm in Fig. 20A of Caullery 1944). Additionally, *M. formosana* sp. nov. usually has 7 or 8 pairs of A4 chaetae in a row (Figs. 3D, E), while *M. malayensis* has 4 chaetae in a row

(Caullery 1944).

Mesochaetopterus japonicus Fujiwara, 1934

Material examined: ASIZW 719, 1 individual, Dadu River estuary, intertidal, Changhua County, western central Taiwan, West Pacific, coll. H.L. Hsieh, 5 Apr. 1994.

Remarks: The characters of the Taiwanese specimens completely fit the description by Nishi (1999), and no differences were found between Taiwanese and Kagoshima (Kyushu, Japan) specimens. This represents the first record of *M. japonicus* in Taiwan, and the 3rd record after Japan and Hong Kong (Morton and Morton 1983).

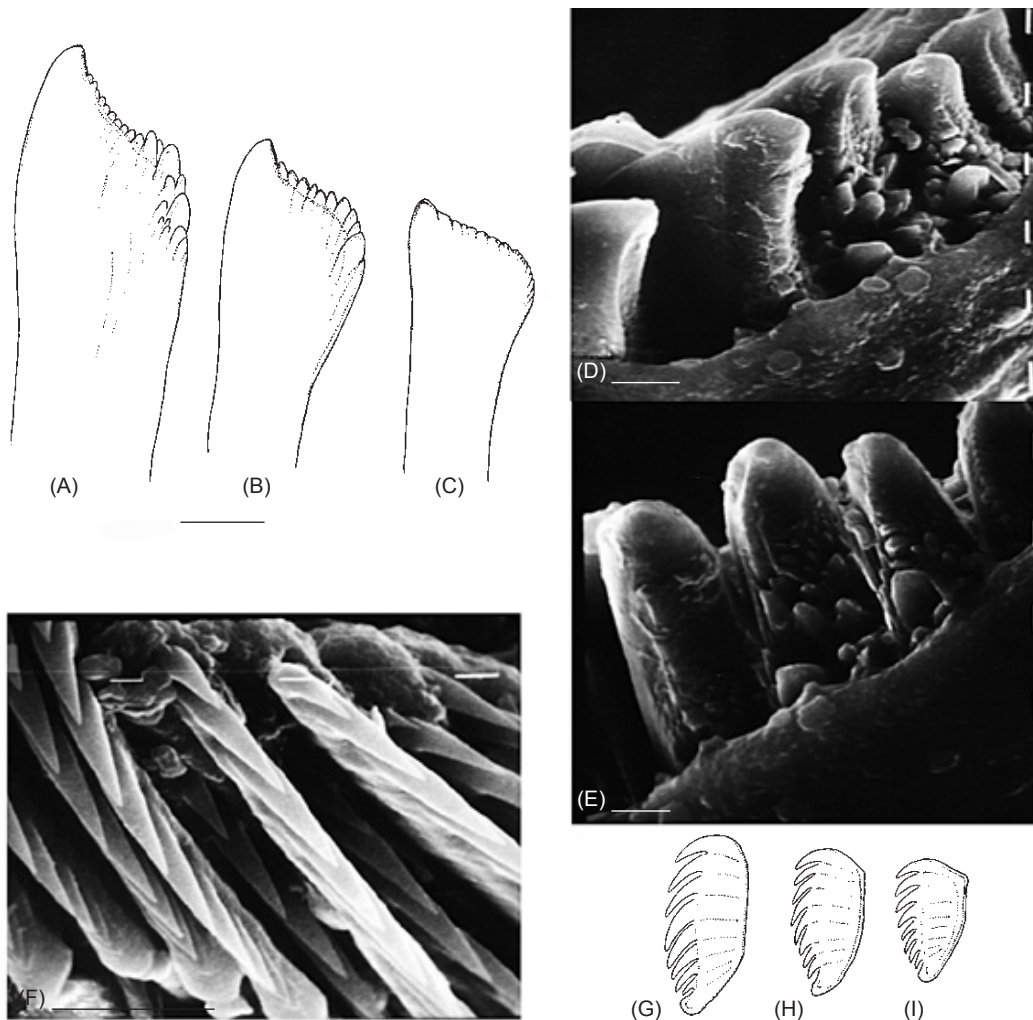


Fig. 3. *Mesochaetopterus formosana* sp. nov. A4 chaetae and uncini. (A-C) A4 chaetae from paratype – CMNH-ZW 1694; (D, E) SEM micrographs of A4 of paratype- CMNH-ZW 1694; (F) B1 uncini of paratype - CMNH-ZW 1694; (G) B1 uncini; (H) C2 uncini (ventral row); (I) C2 uncini (lateral row). Scale bars: A-C = 0.02 mm, D-F = 0.07 mm, G-I = 0.001 mm.

Genus *Phyllochaetopterus* Grube, 1863
***Phyllochaetopterus verrilli* Treadwell, 1943**

Phyllochaetopterus verrilli Treadwell 1943: Bailey-Brock 1987.

Material examined: ASIZW 718. Shianshan, intertidal, Hsinchu City, northwestern Taiwan, West Pacific, coll. H.L. Hsieh, 4 Oct. 1999.

Remarks: The characters of the Taiwanese specimens completely fit the original description by Treadwell from Hawaii. Nishi and Arai (1996) recorded *P. verrilli* from Okinawa I., but the morphology of A4 chaetae differed from those collected on Hawaii, the Central Pacific (Gibbs 1971) and Taiwan (this study). The Okinawa specimens of *Phyllochaetopterus* (Nishi and Arai 1996) also differ in the morphology of the A4 modified chaetae from the ones of Bhaud (1983) and thus may require a revisional study.

***Phyllochaetopterus awasensis* sp. nov.**

(Figs. 4, 5)

Material examined: Holotype CMNH-ZW 01799, complete, with a tube twice the length of the body. Six paratypes (NHM.2008.3466, SAMA-E 3690, SMF 17372, USNM 1116467, ASIZW 720, and CBM-ZW 1009) incomplete, with fragments of tube. Awase tidal flat, muddy sand bottom, intertidal, Okinawa City, Pacific side of Okinawa I., Okinawa, Japan, 25°18'32"N, 127°50'2"E, 25 Feb. 2003, coll. E. Nishi by hand.

Additional material examined: *Phyllochaetopterus* cf. *verrilli* Treadwell 1943 CMNH-ZW-(uncatalogued), Sesoko I., Okinawa I., sandy mudflat, 1-2 m deep, Feb. 1987, coll. E. Nishi. *Phyllochaetopterus claparedii* McIntosh, 1885, CMNH-ZW-(uncatalogued), Tateyama, Boso Peninsula, 5-6 m deep, sandy bottom, coll. E. Nishi, 15 Oct. 1998. *Phyllochaetopterus* sp., Port Jackson, bottle and glass rocks, Sydney Harbour, Australia, 33°58'S, 151°00'E, 4 m deep, coll. G.W. Rouse 4 Apr. 1999.

Diagnosis: Medium-sized *Phyllochaetopterus* 20-35 mm long, anterior region 1.5-2 mm wide, eyes absent, with a pair of long palps. Short cirri present on 1st chaetiger with internal acicular chaetae. Region A with 13 or 14 chaetigers. Two large (cutting) A4 chaetae; 2 per notopodium, with slightly inflated head, plate-like in anteroventral view, with a row of small teeth on both lateral edges. Chaetigers A8 or A9 to last chaetiger of

region A with whitish ventral gland observed in alcohol-preserved specimens. Approximately 20 region B chaetigers. Region C neuropodia bilobed, notopodia with a single small pointed chaetae. Tube tough, chitinous, brown, with sand and shell debris in outer layer of tube.

Description: Holotype complete, paratypes incomplete, some paratypes lacking posterior part of region B and all of region C. Holotype, 28 mm long excluding palps, palps 5 mm long in holotype. Body 1.4-2.0 mm wide at ventral shield. Body creamy-white except for ventral shield in alcohol-preserved specimens. Region A narrow, 5.0 mm long with 13 chaetigers in holotype, 5.0-8.0 mm long with 13 or 14 chaetigers in paratypes. Prostomium indistinct, peristomium shrunken, horseshoe-shaped (Figs. 4A, B, D). Eyes absent. Cirri of 1st chaetiger ('antennae') prominent and short (Figs. 4B-D). Paired long palps grooved, speckled with brown patches (Fig. 4E), approximately 5 mm long in holotype, 6 mm in paratype, arising from near posterolateral border of prostomium (Fig. 4C). Dorsal groove ciliated, extending from base of palps along body regions A, B, and C (Figs. 4C, G). Ventrums of region A with a long slender plastron (ventral glandular shields) separated into 2 portions based on color (Figs. 4A, B). Peristomium and A1-A7 or A8, light brown; A8 or A9 to last chaetiger of region A, light or white. Chaetigers A1-A3 short and shrunken, parapodia with a single row of 10-20 lanceolate chaetae. A4 elongate, with 2 large (cutting) chaetae in each notopodium, and more than 10 lanceolate chaetae on dorsal side. A5-A13 or A14 slightly longer and wider than anterior 3 chaetigers, with single row of 20-40 lanceolate chaetae. Cutting chaetae of A4 with obliquely plate-like distal end; head slightly inflated, truncate in lateral view; head with 5-7 teeth, asymmetrically distributed, 2 or 3 on left, 3 or 4 on right (Figs. 5A-C); shaft a wide plate in horizontal section, lacking lateral or ventral grooves. Total length of cutting chaetae 600-800 µm; head approximately 25 µm wide, 60-70 µm long (Figs. 4A-C, E). Middle region (region B) possessing 15-20 chaetigers (20 in holotype), each slightly longer than anterior chaetigers; notopodia bilobed, dorsal lobe branched into a Y-shape (Figs. 4F, G). Paddles and cupule lacking. B region neuropodia unilobed with 1 row of minute uncini in B1, bilobed in B2 and following neuropodia: uncini nearly triangular, with approximately 22-25 teeth (Figs. 4D, I).

Region C with 58 chaetigers in holotype (15,

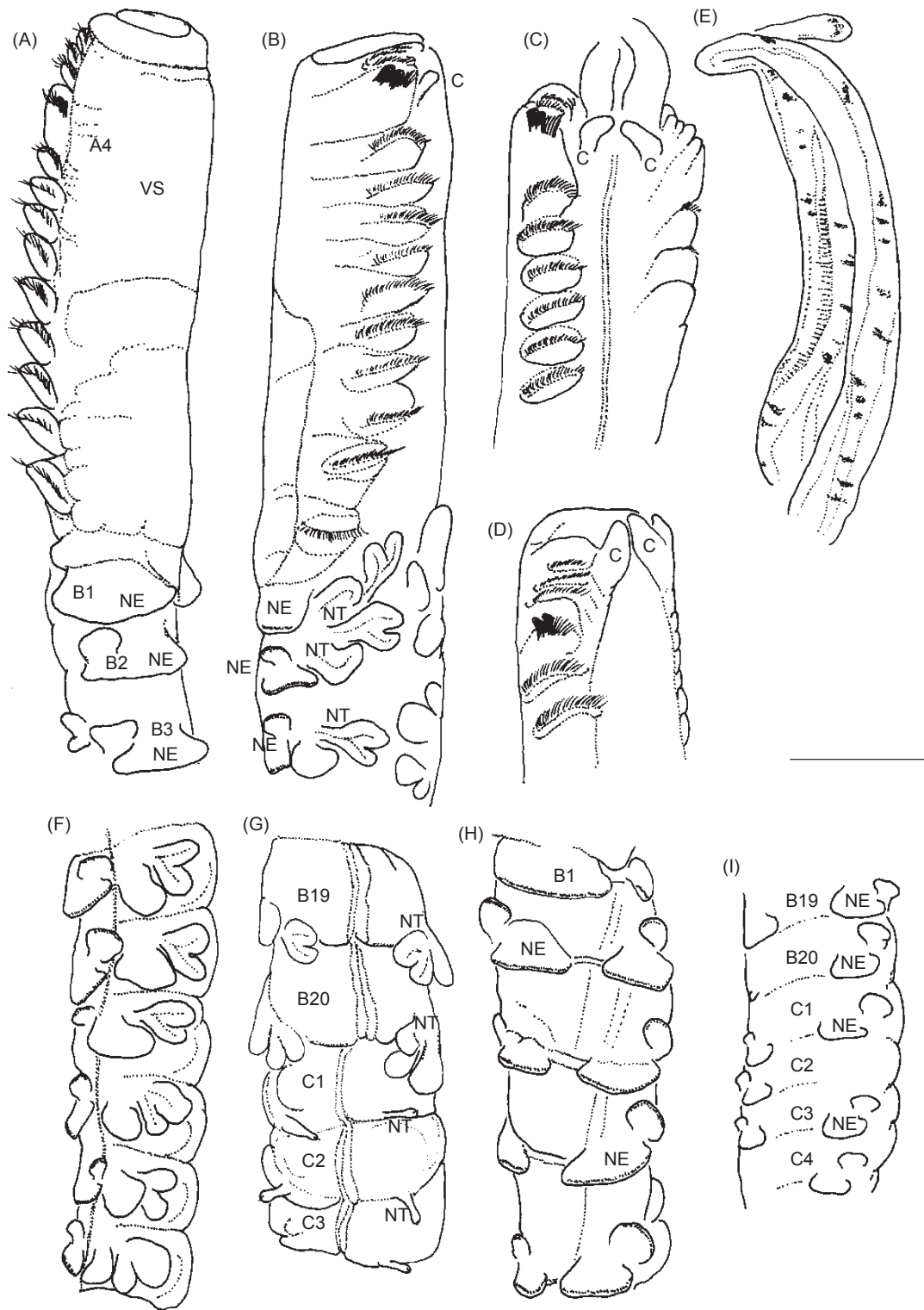


Fig. 4. *Phyllychaetopterus awasensis* sp. nov. (A, F) Paratype NHM-2008.3466; (B, C) holotype; (D, H) SMF 17372; (E) USNM 1116467; (G, I) CBM-ZW 1009. (A) Ventral view of region A and anterior region B. (B) Lateral view of region A to B3. (C) Anterior region A showing palps and 2nd cirri. (D) Dorsolateral view of anterior part of region B. (E) Palp showing brown spots. (F) Lateral view of B8-B13. (G) Dorsal view of B19, B20, C1, and C2, showing junction of regions B and C. (H) Ventral view of B1-B5, showing unilobed B1 neuropodia and bilobed part following neuropodia. (I) Ventral view of B19, and B20-C3, showing bilobed neuropodia. Scale bars = 1 mm.

22, and 22 chaetigers in 3 incomplete paratypes). Anterior region C chaetigers elongate, extended and longer than posterior chaetigers. Notopodia unilobed, with knob-like tip, each with a single chaeta (Figs. 4G, 5H). Neuropodia bilobed as in region B (Fig. 4I). Uncini similar in morphology and size (Fig. 5J).

Tube tough, 2.5-3.0 mm in diameter, slender, nearly straight. Tube wall thin, chitinous, partly lightamber to lightbrown, outer layer with sand grains and shell fragments. Septa and partitions lacking.

Etymology: The specific epithet *awasensis* was derived from the name of the type locality, Awase tidal flat, Okinawa City, Okinawa, Japan.

Remarks: Among the 22 previously described species of *Phyllochaetopterus*, 8 species have 1

or 2 pairs of A4 cutting chaetae, while the others have 3-8 pairs of cutting chaetae in a row (Kudenov 1975, Baud 1977, Nishi and Rouse 2007). These taxa can also be further distinguished by the number of region B chaetigers into 4 groups (A-D in Nishi and Rouse 2007). According to the Nishi and Rouse classification, *P. awasensis* sp. nov. belongs in group B by having 1 or 2 pairs of cutting chaetae in A4 notopodia, and 3 or more region B chaetigers. Group B now contains 7 described species; *P. prolifica* Potts 1914, *anglica* Potts 1914, *gardineri* Crossland 1904, *socialis* Claparède 1870, *platensis* Hartman 1953 (described as *P. socialis platensis*), *pictus* Crossland 1903, and *ramosus* Willey 1905. *Phyllochaetopterus prolifica* is a small species and its A4 cutting chaetae have inflated heads with some teeth on the edge (Potts

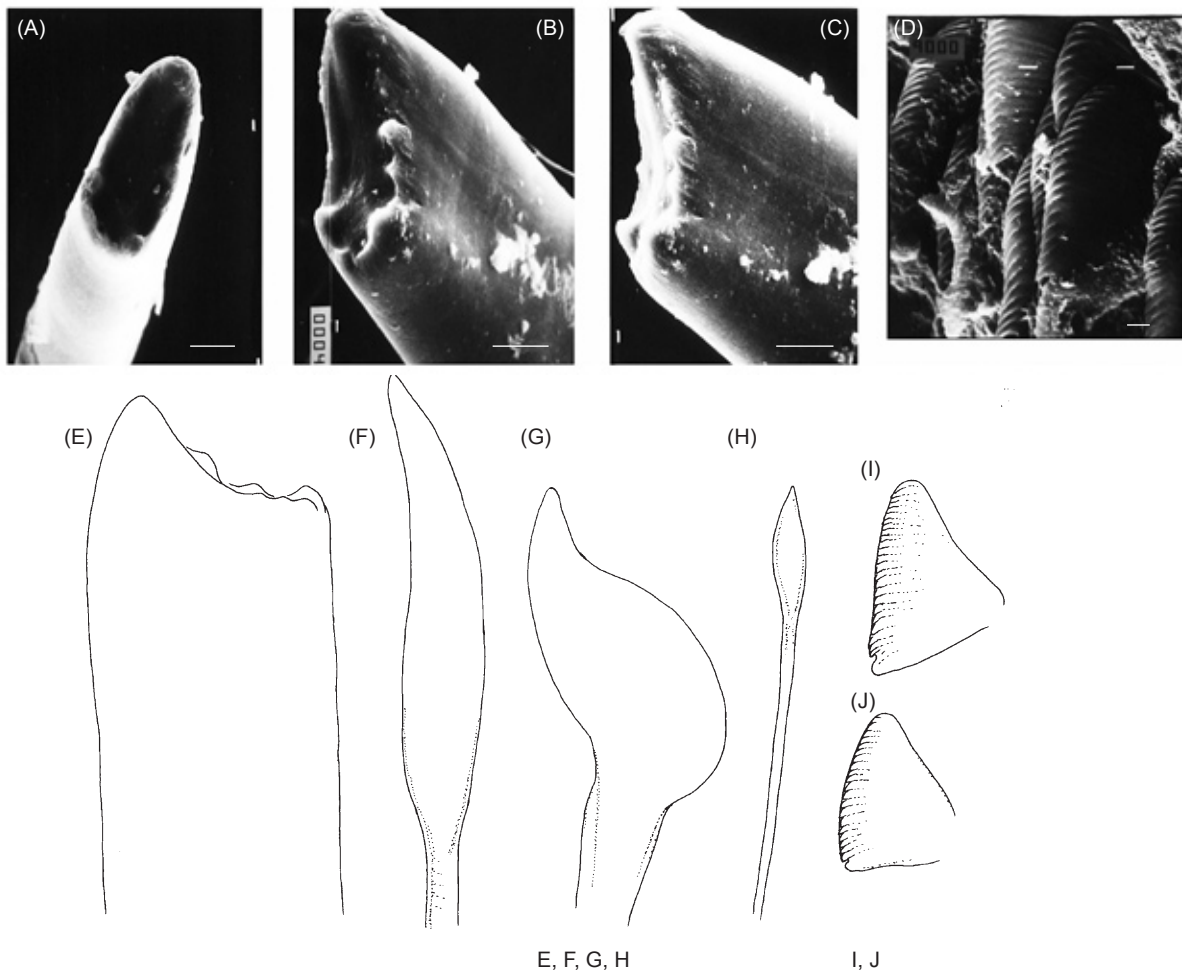


Fig. 5. *Phyllochaetopterus awasensis* sp. nov. (A-D) Scanning electron micrographs; (E-J) pictures drawn from light micrographs. (A) Anterior view of A4 modified chaetae; (B, C) anterolateral view of head of A4 modified chaetae; (D) B2 uncini (dorsal lobe); (E) A4 modified chaetae; (F-H) chaetae of region A notopodium; (I) notochaeta of region C, uncini of B2 (dorsal lobe); (J) uncini of C2. Scale bars: A-D = 70 µm, E-H = 0.05 mm, I, J = 0.025 mm.

1914), while *P. awasensis* has a larger body than *P. prolifica* and plate-like A4 chaetae with teeth on the heads (Figs. 5A-C). The A4 chaetae of *P. anglica* have inflated heads as in *P. prolifica* and thus *P. awasensis* is distinguished from *P. anglica* by its A4 chaetae morphology. *Phyllochaetopterus socialis* and *P. platensis* usually have 1 pair of large A4 chaetae (Hartman 1953, Abbiati et al. 1994), while *P. awasensis* usually has 2 pairs of A4 chaetae. *Phyllochaetopterus pictus* has a low number of region B notopodia (3-9) per fascicle and a U-shaped tube, while *P. awasensis* sp. nov. has 20 or more chaetigers in region B and a brown nearly straight tube. *Phyllochaetopterus awasensis* sp. nov. is most similar to *P. ramosus* Willey 1905, however, *P. awasensis* sp. nov. usually has 13 or 14 chaetigers in region A, and *P. ramosus* has 15 chaetigers. The former species has a tough brown tube vertically buried in the sediment, while the latter has a characteristically branched, creeping tube (Willey 1905).

DISCUSSION

In the genus *Mesochaetopterus*, 13 species are recognized. Those 13 species are separated into 3 groups by the structure of region B notopodia as follows: group I, 3 species with small and triangular notopodia; group II, 5 species with 2 or 3 modified conical notopodia; and group III, 3 species with extended and pointed notopodia (Nishi 1999). Martin et al. (2008) separated *Mesochaetopterus* species into 2 groups based on body size, with 5 small-sized species of *minutus* Potts, *capensis* (McIntosh), *laevis* Hartmann-Schröder, *crypticus* Ben-Eliahu, and *xejubus* Petersen and Fonta; and 7 large-sized species of *taylori* (Potts), *alipes* Monro, *rickettsii* Berkeley and Berkeley, *japonicus* Fujiwara, *selangolus* (Rullier), *mexicanus* Kudenov, and *rogeri* Martin et al. 2008. The small-sized species are up to or seldom reach 35 mm long (Nishi 1999), and the largest uncinal plates are shorter than 70 μm (Bhaud 2005), while large-sized species reach approximately 90 to over 600 mm in length, and the uncinal plates are over 100 μm long (table 3 of Martin et al. 2008). Adding to those general body size characters, the number of parapodia of region B and the distribution of accessory feeding organs are good characters for separating taxa. From the point of view of the geographic distributions of conspecific species, *M. formosana* sp. nov. shares the same area of distribution as *minutus*, *japonicus*, and *selangolus*.

However, the long region B chaetigers clearly distinguish *M. formosana* sp. nov.

Phyllochaetopterus species have hard structures, such as chaetae and uncini, and soft body structures, such as a number of region B chaetigers, and the tube structure is also considered important for their classification (Nishi 1999, Nishi and Rouse 2007). The 22 previously described species in *Phyllochaetopterus* have been classified into 4 groups (Nishi and Rouse 2007) based on the number of A4 cutting chaetae pairs and the number of region B chaetigers: A, with 1 or 2 pairs of A4 cutting chaetae, and 2 region B chaetigers; B, with 1 or 2 pairs of A4 cutting chaetae, and 3 or more region B chaetigers; C, with a row of more than 6 A4 cutting chaetae, and 2 region B chaetigers; and D, with more than 6 A4 cutting chaetae, and 3 or more region B chaetigers. *Phyllochaetopterus bhaudi* Jirkov 2001 has 1-6 A4 chaetae on each notopodium and has 2 region B chaetigers. The Arctic deep sea species (*P. bhaudi* Jirkov) belongs to A or C, and has characteristic rasp-shaped uncini in region C (Jirkov 2001). *Phyllochaetopterus awasensis* sp. nov. belongs in group B, and the new species has characteristically plate-like A4 chaetae with teeth on the heads and a higher number (20 or more) of region B chaetigers.

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