

Two species of *Hyalinoecia* Malmgren, 1867 (Polychaeta: Onuphidae) from the South China Sea, with the first record of *Hyalinoecia papillata* from China

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Received 14 August 2017; accepted 30 November 2017

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Abstract

A taxonomic study of *Hyalinoecia* species based on the materials deposited in the Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS) yielded two species: *Hyalinoecia tubicola* (Müller, 1776) and *H. papillata* Imajima, 1999. Both species were collected from the sandy bottoms in the northern South China Sea. *Hyalinoecia tubicola* is widely distributed from the coast of Guangdong Province southwards to the Xisha Islands. *Hyalinoecia papillata* is reported for the first time in the South China Sea. It differs from *H. tubicola* in having a prolonged, tongue-like prechaetal lobe with papillae along the lateral margins in the first parapodium (vs. auricular prechaetal lobe with smooth margins). The morphological description and illustration of both species are given.

Key words: Annelida, Eunicida, taxonomy, biodiversity, new record

Citation: Wu Xuwen, Xu Kuidong. 2018. Two species of *Hyalinoecia* Malmgren, 1867 (Polychaeta: Onuphidae) from the South China Sea, with the first record of *Hyalinoecia papillata* from China. *Acta Oceanologica Sinica*, 37(10): 140–144, doi: 10.1007/s13131-018-1315-0

1 Introduction

Within the family Onuphidae, the genus *Hyalinoecia* Malmgren, 1867 is characterized by its translucent and quill-like tube which is composited by onuphid acid and mucoprotein (Moermans, 1974). Other diagnostic characters include the well-developed frontal lips, absence of peristomial cirri, flat pectinate chaetae, and subacicular hooks located in median position of the chaetal fascicles (Paxton, 1986). Species of *Hyalinoecia* are distributed worldwide from the shallow water down to the bathyal region, especially in the slope depths (Hartman, 1965; Southward, 1977; Carrasco, 1983; Orensanz, 1990; Lechapt, 1997; Imajima, 1999). Up to date, 20 species of *Hyalinoecia* have been described (Read and Fauchald, 2018).

Members of *Hyalinoecia* are very common and usually abundant in the South China Sea, where, however, the knowledge of their diversity and distribution is poorly known. Only one species namely *Hyalinoecia tubicola* (Müller, 1776) has been recorded so far (Yang and Sun, 1988; Glasby et al., 2016). Wu and Chen (1985) first recorded the species in the sea area of the Xisha Islands and later Meng et al. (1994) reported it in the waters surrounding the Hainan Island. However, both of them did not give a description as well as the distribution range. The consequence is that all *Hyalinoecia* specimens collected in China seas were identified as *H. tubicola*. Our examination of the historic material of *Hyalinoecia* revealed the presence of a second species, *H.*

papillata Imajima, 1999. The morphological description and illustrations of both species as well as their geographical distribution are given.

2 Materials and methods

All polychaete specimens examined were collected during the “National Comprehensive Oceanography Survey” (NOCS) from 1957 to 1960. The specimens are now preserved in 70% ethanol solution and deposited in the Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS) in the Institute of Oceanology (IOCAS) at Qingdao, China. Microscopic observation was made using a Zeiss Stemi SV 11 Apo stereomicroscope and a Zeiss Axiostar plus compound microscope. Digital photographs were taken using an AxioCam MRc5 digital camera mounted on the stereomicroscope and then patched through extended Depth of Field with images of different focal planes. Line drawings were made using a XSZ-H camera lucida mounted on the compound microscope. Character choice and terminology mainly follow Paxton (1986, 1998) and Imajima (1999). The following abbreviations are used: coll., collector; MBM, Marine Biological Museum; Mx, maxillae; R/V, research vessel; SCS, South China Sea; spec., specimen; Sta., station.

3 Taxonomy

Family Onuphidae Kinberg, 1865

Foundation item: The National Natural Science Foundation of China under contract No. 31601842; the Strategic Priority Research Program of the Chinese Academy of Sciences under contract No. XDA11030201; the Scientific and Technological Innovation Project financially supported by the Pilot National Laboratory for Marine Science and Technology (Qingdao) under contract No. 2016ASKJ14.

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Subfamily Hyalinoeciinae Paxton, 1986

Genus *Hyalinoecia* Malmgren, 1867*Hyalinoecia tubicola* (Müller, 1776)

(Figs 1–3)

Nereis tubicola Müller, 1776: 18.

Hyalinoecia tubicola. Imajima and Hartman, 1964: 243; Wu and Chen, 1985: 79; Yang and Sun, 1988: 177, Figs 77E–J; Lechapt, 1997: 311; Imajima, 1997: 180; Imajima, 1999: 31–35, Figs 16a–h, 19a–s; Imajima, 2003: 206–207.

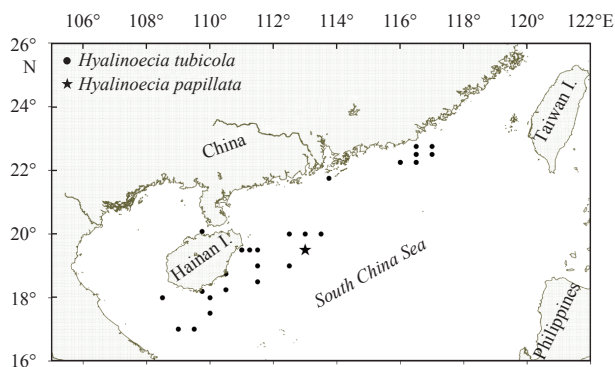


Fig. 1. Distribution of *Hyalinoecia tubicola* (Müller, 1776) and *H. papillata* Imajima, 1999 in the South China Sea based on the examined material.

Material examined. MBM009371 (17 spec.), SCS, R/V 101, Sta. 6159, 18°45'N, 110°30'E, 32 m, medium sand, coll. Shen Shoupeng, 8 March 1960. MBM009366 (1 spec.), SCS, R/V Hanggong, Sta. 6080, 20°05'N, 109°45'E, 210 m, medium sand, coll. Shen Shoupeng, 10 February 1960. MBM009365 (4 spec.), SCS, R/V 101, Sta. 6207, 17°00'N, 109°00'E, 108 m, sandy mud, coll. Liu Jixing, 15 May 1960. MBM009363 (6 spec.), SCS, R/V 101, Sta. 6189, 17°00'N, 109°30'E, 164 m, soft mud, coll. Liu Jixing, 11 March 1960. MBM009369 (10 spec.), SCS, R/V 171, Sta. 6140, 19°30'N, 111°00'E, 33 m, fine sand, coll. Wang Yongliang, 27 January 1959. MBM009385 (1 spec.), SCS, R/V Hanggong, Sta. 6092, 20°00'N, 112°30'E, 101 m, mud and sand, coll. Tang Zhichan, 6 April 1960. MBM009364 (1 spec.), SCS, R/V 307, Sta. 6225, 18°00'N, 108°30'E, 75 m, soft mud, coll. Xu Fengshan, 15 April 1959. MBM009367 (31 spec.), SCS, R/V 171, Sta. 6140, 19°30'N, 111°00'E, 29 m, fine sand, coll. Ma Xiutong, 25 April 1959. MBM009384 (1 spec.), SCS, R/V 220, Sta. 6014, 22°45'N, 116°30'E, 37 m, medium sand, coll. Qu Jingzuo, 23 April 1960. MBM009401 (3 spec.), SCS, R/V 101, Sta. 6175, 19°30'N, 111°00'E, 106 m, coarse sand and mud, coll. Shen Shoupeng, 13 May 1960. MBM009403 (2 spec.), SCS, R/V 307, Sta. 6161, 18°15'N, 110°30'E, 125 m, sandy mud, coll. Liu Jixing, 27 January 1959. MBM009404 (1 spec.), SCS, R/V 220, Sta. 6021, 22°15'N, 116°00'E, 51.3 m, gray mud and sand, coll. Qu Jingzuo, 19 July 1959. MBM009405 (2 spec.), SCS, R/V 307, Sta. 6176, 17°30'N, 110°00'E, 140 m, sandy mud, coll. Fan Zhengang, 7 April 1959. MBM009406 (1 spec.), SCS, R/V 171, Sta. 6144, 18°30'N, 110°00'E, 148 m, soft sand, coll. Ma Xiutong, 22 April 1959. MBM009396 (1 spec.), SCS, R/V 101, Sta. 6181, 18°12'N, 109°45'E, 68 m, sandy mud, coll. Liu Jixing, 12 May 1960. MBM009397 (1 spec.), SCS, R/V 131, Sta. 6122, 19°00'N, 111°30'E, 160 m, fine sand and mud, coll. Tang Zhichan, 16 July 1959. MBM009398 (1 spec.), SCS, R/V 220, Sta. 6123, 18°30'N, 111°30'E, 102 m, coll. Zhang Weiquan, 22 March 1959. MBM009399 (2 spec.), SCS, R/V Hanggong I, Sta. 6094, 19°00'N,

112°30'E, 270 m, fine sand, coll. Sun Fuzeng, 19 April 1959. MBM009389 (63 spec.), SCS, R/V Hanggong, Sta. 6067, 20°00'N, 113°30'E, 129 m, muddy sand, coll. Tang Zhichan, 9 April 1960. MBM009390 (7 spec.), SCS, R/V 220, Sta. 6011, 22°45'N, 117°00'E, 40.5 m, yellow medium sand, coll. Wu, 5 June 1960. MBM009391 (5 spec.), SCS, R/V 220, Sta. 6016, 22°15'N, 116°30'E, 41 m, coll. Zhang Weiquan, 23 March 1959. MBM009392 (2 spec.), SCS, R/V 220, Sta. 6058, 21°45'N, 113°45'E, 34.4 m, mud and sand, coll. Wu, 10 June 1960. MBM009393 (5 spec.), SCS, R/V S, Sta. 6015, 22°30'N, 116°30'E, 43 m, coll. Zhang Weiquan, 4 April 1959. MBM009394 (15 spec.), SCS, R/V Hanggong, Sta. 6079, 20°00'N, 113°00'E, 125 m, mud and sand, coll. Tang Zhichan, 6 April 1960. MBM009395 (12 spec.), SCS, R/V S, Sta. 6016, 22°15'N, 116°30'E, 44.3 m, coll. Zhang Weiquan, 4 April 1959. MBM009407 (1 spec.), SCS, R/V 171, Sta. 6133, 19°30'N, 111°15'E, 90 m, sandy mud, coll. Wang Yongliang, 28 June 1959. MBM009408 (1 spec.), SCS, R/V 101, Sta. 6121, 19°30'N, 111°30'E, 118 m, sandy mud, coll. Wang Yongliang, 6 April 1960. MBM009409 (3 spec.), SCS, R/V 307, Sta. 6181, 18°12'N, 109°45'E, 68 m, sandy mud, coll. Liu Jixing, 29 June 1959. MBM009410 (1 spec.), SCS, R/V 228, Sta. 6021, 22°15'N, 116°00'E, 49.5 m, fine sand, coll. Wang Yongliang, 10 June 1960. MBM009765 (5 spec.), SCS, R/V 307, Sta. 6174, 18°00'N, 110°00'E, 102 m, sandy mud, coll. Liu Jixing, 28 June 1959. MBM009370 (105 spec.), SCS, R/V 220, Sta. 6012, 22°30'N, 117°00'E, 44 m, coarse sand, coll. Chen Mu and Lv Siming, 23 April 1960. MBM009411 (1 spec.), SCS, R/V 220, Sta. 6015, 22°30'N, 116°30'E, 41 m, coll. Zhang Weiquan, 23 March 1959. MBM009412 (1 spec.), SCS, R/V 101, Sta. 6181, 18°12'N, 109°45'E, 64 m, sandy mud, coll. Liu Jixing, 10 March 1960.

Description. Tube very hard, cylindrical, translucent and quill-like (Fig. 2d). Body slightly flattened dorsoventrally (Figs 2a, b).

Prostomium small, with a pair of subulate frontal lips (Figs 2a, g). Ceratophores of antennae and palps with 2–5 rings (Figs 2a, b, g). Eyes light-colored or indistinct, located at lateral to bases of lateral antennae (Fig. 2g). Peristomium distinctly shorter than following chaetigers, without peristomial cirri (Fig. 2g). Maxillary formula: I=1+1, II=11+13, III=12+0, IV=10+12, and V=1+1. MxIII long and located behind left MxII. Mandibles as long as maxillae, well calcified on the anterior end.

Branchia simple, present from chaetigers 22 and 23 to near posterior end (third chaetiger from anus in MBM009371); branchial filaments strap-like, distinctly longer than dorsal cirri (Fig. 3f).

First parapodia distinctly stouter, oriented forward (Figs 2a, b); prechaetal lobes auricular; poschaetal lobes subulate, subequal prechaetal lobes in length (Fig. 3a). Prechaetal lobes of following chaetigers auricular or rounded, shorter than poschaetal lobes, decreasing to small lobes posteriorly (Figs 3b–e); poschaetal lobes subulate to digitate, present in the first 25 chaetigers (Figs 3a–f). Dorsal cirri subulate in anterior chaetigers (Figs 3a–e), gradually becoming shorter and narrower posteriorly (Fig. 3f). Ventral cirri subulate in first 3 chaetigers (Figs 3a, b), transitional in chaetigers 4 and 5 with inflated bases and sometimes free tips (Figs 3c, d), modified to glandular cushions in following chaetigers (Figs 3e, f).

First parapodia elongated, with about 4 robust bidentate hooded hooks with teeth slightly worn (Figs 3a, b). Parapodium 2 consisting of a pectinate chaeta, 4 limbate chaeta (Figs 3o, p) and 2 thinner bidentate hooks with better defined teeth (Figs 3i, j). Limbate chaetae present from chaetiger 2 (Figs 3o, p), tapering with distinct wings on one side or both sides (Figs 3l–p). Pectinate chaetae present from chaetiger 2, flat and straight with about 13 teeth (Fig. 3k). Aciculae tapering with sharp tips (Fig. 3r). Subacicular hooks bidentate (Fig. 3q), present from chaetiger 23 to posterior end, paired in most chaetigers.



Fig. 2. *Hyalinoecia tubicola* (Müller, 1776) (a, b, e, g, MBM009370) and *H. papillata* Imajima, 1999 (c, d, f, h, MBM009368). a and b. Anterior fragments in dorsal and ventral views, c and d. anterior fragments in dorsal and ventral views, e. anterior part of a tube, f. three intact tubes, g. close-up of head in dorsal and ventral views (1. frontal lips, 2. median antenna, 3. lateral antenna, 4. palp, 5. upper lip, 6. lower lip, 7. mandible, and 8. first parapodium), and h. maxillae in dorsal view and mandible in ventral view. Scale bars: 1 mm (a, b, g), 2 mm (c–e), 10 mm (f) and 0.5 mm (h).

Distribution. Northern South China Sea (29–270 m, not beyond 22.5°N); Tsukumo Bay to Tanegashima Island, Japan (10–550 m); Indian Ocean; New Zealand; California; West Atlantic; East Atlantic from Greenland to South Africa; Mediterranean.

Remarks. The examined specimens agree well with the description of *Hyalinoecia tubicola* given by Imajima (1999). The main difference is that eyes are indistinct in our specimens and even invisible in some cases, while in Japanese specimens they are large and dark. In our specimens unidentate hooks occasionally occurred in the first two chaetigers, as observed by Hartmann-Schröder (1971), while this structure is absent in the Japanese specimens. We think the presence of unidentate hooks probably resulted from the abrasion of tips of bidentate hooks (Figs 3g, h) and thus should not be considered as a diagnostic character.

Hyalinoecia tubicola is a common and abundant species from the coast of Guangdong Province southwards to the Xisha Islands. The species represents a typical warm water species in China where the distribution is restricted to the North South China Sea. It should be noted that we do not put the distribution of *H. tubicola* in sea area of the Xisha Islands on the map (Fig. 1) because no voucher specimen is available for confirming the presence.

Hyalinoecia papillata Imajima, 1999

(Figs 1, 2 and 4)

Hyalinoecia papillata Imajima, 1999: 28–31, Figs 16a–h; 17a–n.

Material examined. MBM009368 (10 spec.). SCS, R/V *Hanggong*, Sta. 6080, 19°30'N, 113°00'E, medium sand, 210 m, coll. Shen Shoupeng, 10 February 1960. MBM009388 (6 spec.), SCS, R/V *Hanggong*, Sta. 6080, 19°30'N, 113°00'E, sand, 210 m, coll. Tang Zhichan, 8 April 1960.

Description. Preserved animal pale, epithelium slightly iridescent. Body slightly flattened dorsoventrally with the same body width from first chaetiger to near posterior end (Figs 2c, d). Tube very hard, cylindrical, translucent and quill-like (Fig. 2f). Specimen MBM009368 complete, with 146 chaetigers, about 65 mm long, 3 mm maximum wide; body cavity filled with ova after chaetiger 41 (Figs 2c, d).

Prostomium small, surrounded by peristomium, with a pair of ovoid frontal lips, three antennae and two palps (Fig. 2c). Antennae and palps arranged in a horseshoe pattern; antennae emerging along posterior margin of prostomium; palps isolated in anterolateral region (Fig. 2c). Ceratophores of antennae and palps with 2–5 rings; styles of palps extending to chaetiger 3; lateral antennae to chaetiger 7; median antenna to chaetiger 8. Eyes

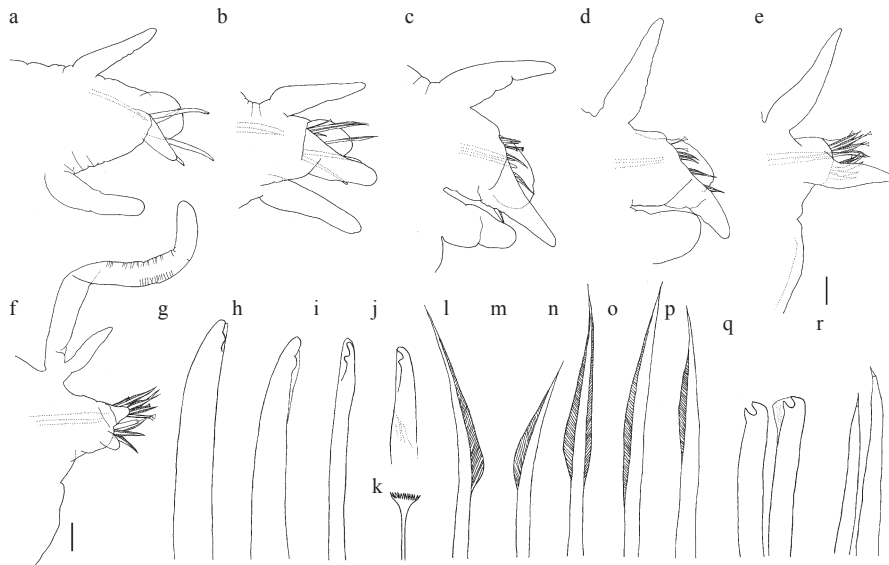


Fig. 3. Parapodia and chaetae of *Hyalinoecia tubicola* (Müller, 1776) (a–r. MBM009370 and a–f. in posterior reviews). a. Parapodium 1; b. parapodium 2; c. parapodium 4; d. parapodium 5; e. parapodium 15; f. parapodium 24; g and h. bidentate hooks from parapodium 1, denticles slightly worn; i and j, bidentate hooks from parapodium 2; k. pectinate chaeta from parapodium 15; l and n. upper limbate chaeta from parapodium 30; m. lower limbate chaeta from parapodium 30; o and p. upper limbate chaetae from parapodium 2; q. subacicular hooks from parapodium 30; and r. aciculae from parapodium 30. Scale bars: 200 μm (a–f) and 50 μm (g–r).

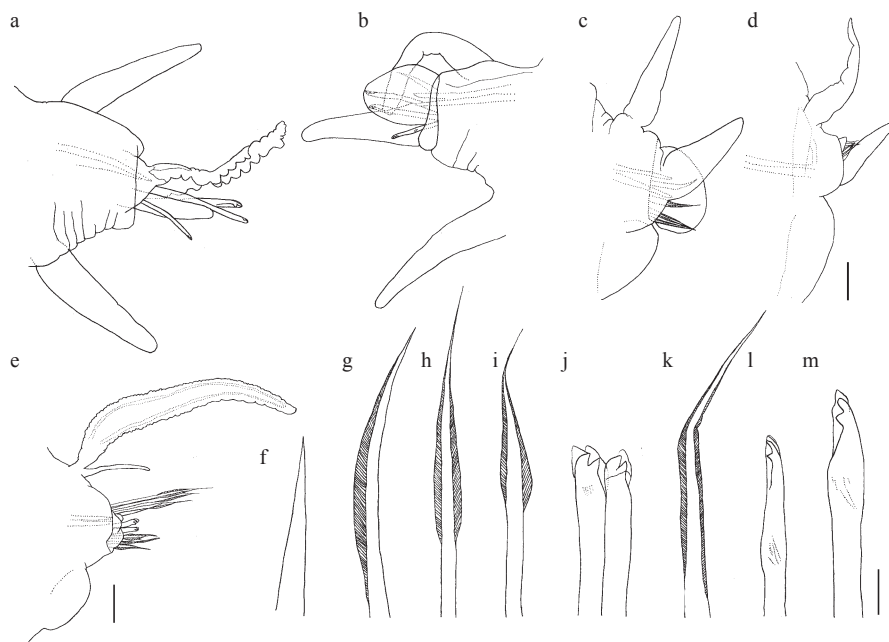


Fig. 4. Parapodia and chaetae of *Hyalinoecia papillata* Imajima, 1999 (a–m. MBM009368). a. Parapodium 1, posterior view; b. parapodium 2, anterior view; c. parapodium 4, posterior view; d. parapodium 11, anterior view; e. parapodium 31, posterior view; f. upper simple chaeta from parapodium 3; g. lower limbate chaeta from parapodium 7; h. upper limbate chaeta from parapodium 31; i. subacicular limbate chaeta from parapodium 31; j. subacicular hooks from parapodium 31; k. lower limbate chaeta from parapodium 6; l. upper bidentate pseudocompound hook from parapodium 2; and m. median bidentate pseudocompound hook from parapodium 2. Scale bars: 200 μm (a–e) and 50 μm (f–m).

absent. Upper lips rounded, without median section. Peristomium distinctly shorter than following chaetigers, without peristomial cirri. Maxillary formula: I=1+1, II=12+11, III=11+0, IV=8+9, and V=1+1. MxIII long and located behind left MxII (Fig. 2h). Mandibles as long as maxillae, well calcified on the anterior end (Fig. 2h).

Branchiae present from chaetigers 20 and 21 (Fig. 2c) to near posterior end, as single filaments. Branchial filaments strap-like, smooth or wrinkled, distinctly longer than dorsal cirri, almost covering dorsum (Fig. 4e).

First parapodium distinctly stouter, oriented forward and surrounding peristomium (Fig. 2c); prechaetal lobes prolonged,

tongue-like, with about 12 papillae along lateral margins on each side (Fig. 4a); postchaetal lobes subulate, shorter than prechaetal lobes (Fig. 4a). Prechaetal lobes auricular or rounded from chaetiger 2 to chaetiger 10 (Figs 4b, c), reducing posteriorly as small lobes (Fig. 4d). Postchaetal lobes subulate to about chaetiger 30 (Figs 4a–d) and reducing posteriorly as small knobs (Fig. 4e). Dorsal cirri subulate in the first 25 chaetigers (Figs 4a–d), gradually becoming filamentous posteriorly, about 1/4–1/3 as long as branchiae (Fig. 4e). Ventral cirri subulate in first 3 chaetigers (Figs 4a, b), modified to ovate in chaetiger 4 and 5 and glandular cushions in subsequent chaetigers (Figs 2d and 4c–e). Pygidium with two long and slender anal cirri.

First parapodia with about 3 robust bidentate pseudocompound hooks with short hoods (Figs 4l, m). Parapodia 2 consisting of 1–2 limbate chaetae, 3 bidentate simple or pseudocompound hooks. Following parapodia mainly with simple limbate chaetae (Figs 4f–i, k) and pectinate chaetae. Limbate chaetae tapering with distinct wings on one side or both sides (Figs 4g–i, k); some chaetae with indistinct wings (Fig. 4f). Subacicular hooks bidentate, present from chaetiger 21–24 to posterior end, paired in most chaetigers (Fig. 4j).

Distribution. Northern South China Sea (210 m); Tsushima Strait and Tosa Bay, Japan (64–155 m).

Remarks. *Hyalinoecia papillata* was originally described from the Tsushima Strait and Tosa Bay of Japan (Imajima, 1999). This is the first record of the species from the northern South China Sea, where our specimens were obtained only from a single site (Fig. 1). Although the distance between the SCS sampling site and the type locality is more than 2000 km, both populations coincide well in morphology. The small differences include: (1) our specimens have the subulate postchaetal lobes in the first 30 chaetigers (vs. 20 chaetigers in Japanese specimens) and (2) the dorsal cirri decreasing to fine filament about 1/4–1/3 length of branchiae from the chaetiger 25 or 26 (vs. 1/6 length of branchiae from the chaetiger 16). We consider these as population-dependent differences, which may also be affected by different preservation status.

In China, the species have been constantly misidentified as *H. tubicola* due to their similarity in morphology (Yang and Sun, 1988; Meng et al., 1994). The main difference is that *H. tubicola* has a uniquely prolonged, tongue-like prechaetal lobe with papillae along the lateral margins in the first parapodia (Fig. 4a), while in *H. tubicola* the first prechaetal lobe is auricular with smooth margins (Fig. 3a). Their distribution patterns are also different. *Hyalinoecia tubicola* is considered as a cosmopolitan species, and in China it is widespread from the sea areas off Guangdong Province southwards to the Xisha Islands (Fig. 1). *Hyalinoecia papillata* seems to be restricted in the West Pacific Ocean. So far, the species has been reported only from the Tsushima Strait, Tosa Bay and East of Hainan Island. It is expected to collect more specimens of *H. papillata* in the South China Sea as the investigation effort increases.

Acknowledgements

The authors are grateful to all the collectors for their great efforts in sample collection.

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