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Polychaete Worms of the Genus *Perinereis* (Annelida, Nereididae) from Taiwan, with Description of 17 New Species

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A taxonomic review on the genus *Perinereis* (Annelida, Polychaeta, Nereididae) from Taiwan has been conducted by examining over 1000 specimens of the worms in the author's private collection and in the depository of the National Museum of Natural Science. A total of 24 species for this genus has been recognized in the present study. Of these 24 species, 17 are new to science, and they are: *Perinereis daxiensis* sp. nov., *P. fugangensis* sp. nov., *P. kaomeiensis* sp. nov., *P. kebalanae* sp. nov., *P. houbihuensis* sp. nov., *P. hsinchuensis* sp. nov., *P. liuqiuensis* sp. nov., *P. longdongwanensis* sp. nov., *P. ludaoensis* sp. nov., *P. pangcahae* sp. nov., *P. pseudocultrifera* sp. nov., *P. qiguensis* sp. nov., *P. taitungensis* sp. nov., *P. tubicola* sp. nov., *P. wanlitongensis* sp. nov., *P. yehliuensis* sp. nov., and *P. yufuensis* sp. nov. The presence of *P. cultrifera* (Grube, 1840) in Taiwan is confirmed. The remaining six are species previously reported from Taiwan, which are: *Perinereis aibuhitensis* (Grube, 1878), *P. floridana* (Ehlers, 1868), *P. mictodonta* (Marenzeller, 1879), *P. nigropunctata* (Horst, 1889), *P. vancaurica* (Ehlers, 1868), and *P. wilsoni* Glasby & Hsieh, 2006. The generic diagnosis is partially amended to include the presence of neuropodial homogomph spinigers found in the subacicular fascicle of *P. longdongwanensis* sp. nov. A key to *Perinereis* species reported from Taiwan is herein provided.

Key words: Biodiversity, *Perinereis* polychaetes, Nereidinae, Taxonomy, Taiwanese waters

BACKGROUND

The genus *Perinereis* Kinberg, 1865 is characterized by having conical and bar-shaped paragnaths on area VI of the pharynx and is one of highly diversified nereidid with 92 recognized species worldwide (Bakken et al. 2018). Several regional taxonomic revisions of the genus in the West Pacific are available: For instance, Grube (1878; Philippines), Wu (1967; Taiwan), Imajima (1972; Japan), Wu et al. (1981 1985; China), Hutchings et al. (1991; Australia), Sun and Yang (2004: China). Other taxonomic revisions were emphasized on the single species complex (like the nuntia species complex) of the genus (Wilson and Glasby 1993; Glasby and Hsieh 2006). For convenient studying this highly diversified taxon group, Hutchings et al. (1991) proposed a grouping system by breaking down these species into nine categories based on the number of bar-shaped paragnaths on area VI of the pharynx and the degree of expansion of notopodial dorsal ligule on posterior chaetigers, and these categories are: G1A, G1B and G1 with unknown condition of notopodial dorsal ligule, G2A, G2B and G2 with unknown condition of notopodial dorsal ligule, and G3A, G3B and G3 with unknown condition of notopodial dorsal ligule, whereas A and B represent conditions of notopodial dorsal ligule on posterior chaetigers are not greatly expanded and greatly expanded, respectively.

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Wu (1967) reported 10 *Perinereis* species from Taiwan, but four of them are considered junior names of the other species by latter works, which are: *P. novaehollandiae* Kinberg, 1865, *P. cultrifera* (Grube, 1840), *P. linea* (Treadwell, 1936), and *P. brevicirris* (Grube, 1866). Hutchings et al. (1991) synonymized *P. novaehollandiae* with senior name of *P. amblyodonta* (Schmarda, 1861); Park and Kim (2017) considered *P. cultrifera* as a new species of *P. euiini* Park and Kim, 2017; Imajima (1972) synonymized *P. linea* as junior name of *P. vancaurica tetradentata* Imajima, 1972, but Hutchings et al. (1991) later synonymized these two species as junior names of *P. vancaurica* (Ehlers, 1868); Glasby and Hsieh (2006) commented that material of *P. brevicirris* examined in Wu (1967) was actually represented by three different species, *P. mictodonta* (Marenzeller, 1879), *P. shikueii* Glasby and Hsieh, 2006, and *P. wilsoni* Glasby and Hsieh, 2006. The total number of *Perinereis* species reported from Taiwan was increased to only 12 with latter studies of Chen et al. (2002) and Glasby and Hsieh (2006), which are: *Perinereis aibuhitensis* (Grube, 1878), *P. amblyodonta*, *P. euiini*, *P. floridana* (Ehlers, 1868), *P. helleri* (Grube, 1878), *P. mictodonta*, *P. neocaledonica* Pruvot, 1930, *P. nigropunctata* (Horst, 1889), *P. shikueii*, *P. singaporiensis* (Grube, 1878), *P. vancaurica*, and *P. wilsoni*. Villalobos-Guerrero et al. (2021: 3, fig. 1A–C) redefined the terminology for conical paragnaths as "broad-petite bar-shaped" paragnaths and transferred *Neanthes babuzai* Hsueh, 2019, *N. kinmenensis* Hsueh, 2019 and *N. shigungensis* Hsueh, 2019 to *Perinereis* by claiming all three species have bar-shaped paragnaths on area VI of the pharynx. However, this newly proposed classification to call conical appearance paragnaths as "broad-petite" bar-shaped paragnaths is considered premature (C. Glasby, pers. comm.). The author herein regards these new combinations as requiring verification.

Hsueh (2018 2019a b 2020 2021 2022) reported a total of 28 new species, new record genera and new record species of several nereidid genera (*i.e.*, *Composetia* Hartmann-Schröder, 1985, *Eunereis* Malmgren, 1865, *Dendronereis* Peters, 1854, *Neanthes* Kinberg, 1865, *Nereis* Linnaeus, 1758, *Platynereis* Kinberg, 1865, and *Pseudonereis* Kinberg, 1865) from Taiwan. These reports suggest that biodiversity of *Perinereis* Kinberg, 1865, one of most diversified nereidid genera, in this geographic region might also be overlooked. Consequently, the author examines *Perinereis* specimens of his private collection, cumulated from over three decades of field samplings along Taiwan and in the depository of the National Museum of Natural Science, Republic of China, in the present study to increase understanding on biodiversity of this genus occurring in Taiwan. As results, a total of 24 species for the genus has been recognized. Of these 24 species, 17 species are new to science, one occurrence reconfirmed species, and six previously reported species. The present study describes these 17 new species and reports the presence of seven previous recorded species. Of these 17 newly described species, *P. longdongwanensis* sp. nov. possess homogomph spinigers in the subacicular fascicle of neuropodia, which is not included in the generic diagnosis. Therefore, the generic diagnosis is herein partially emended. A key to *Perinereis* species reported from Taiwan is also provided.

MATERIALS AND METHODS

Some 1000+ specimens were examined in the present study. These specimens were collected from hard or soft bottoms of intertidal habitats in Taiwan and vicinity offshore islands during various ecological surveys in the past 30 years (Fig. 1). These collections were made using shovels, chisels, and hammers where it applies. All specimens were relaxed with menthol before fixed with 10% buffered formalin and later transferred to 70% alcohol for storage. They were later examined using stereo (Leica MZ12.5) and compound microscopes (Leica DM2500). Digital images of body parts of these animals were taken with Canon EOS 6D Mark II, 26.2 megapixels and Canon EOS 7D Mark II, 20 megapixels. When it is necessary, photo images were processed with computer software Helicon Focus 7.0.2 and PhotoImpact 8 to enhance photo sharpness. Figures were prepared using CorelDraw 5 Suite X. Terminology of prostomium region and chaetal morphology followed Bakken and Wilson (2005); description of parapodia followed Villalobos-Guerrero and Bakken (2018); description of paragnath patterns and areas VII–VIII in furrow-ridge regions followed Conde-Vela (2018); and description of ridge pattern of areas VI–V–VI followed Villalobos-Guerrero (2019). The tentacular belt was used to describe the anterior apodous segment of the worm (Salazar-Vallejo et al. 2021). Length measurements of dorsal ligule and dorsal cirrus followed Conde-Vela (2018: 257, fig. 6C–F). A symbol "x" is used to express multiples. Abbreviations: IRHB = intertidal rocky hard bottom; SRHB = subtidal rocky hard bottom; ISSB = intertidal soft sediment bottom. All specimens of this study were deposited at the National Museum of Natural Science (NMNS), Taichung, Taiwan, Republic of China. The name of specimen collector was showed only of which the specimen is not collected by the author. Numbers in parentheses represent variations of a given morphological character.

RESULTS

TAXONOMY

Family Nereididae Blainville, 1818
Subfamily Nereidinae Blainville, 1818
Genus *Perinereis* Kinberg, 1865

Type-species: *Perinereis novaehollandiae* Kinberg, 1865 by subsequent designation.

Diagnosis (after Glasby 2015: 226, new feature highlighted in boldface): Frontal antennae present, 1 pair. Palpophore with transverse groove present; palpostyles conical. Prostomium with entire anterior margin. Eyes present, 2 pairs. One apodous anterior segment, greater than length of chaetiger 1. Tentacular cirri with distinct cirrophores. Jaws with smooth or slightly crenulate cutting edge or with dentate cutting edge. Maxillary ring of pharynx with paragnaths, Oral ring paragnaths present. Dorsal notopodial ligule present. Prechaetal notopodial lobe present or absent. Ventral notopodial ligule present. Dorsal cirrus simple,

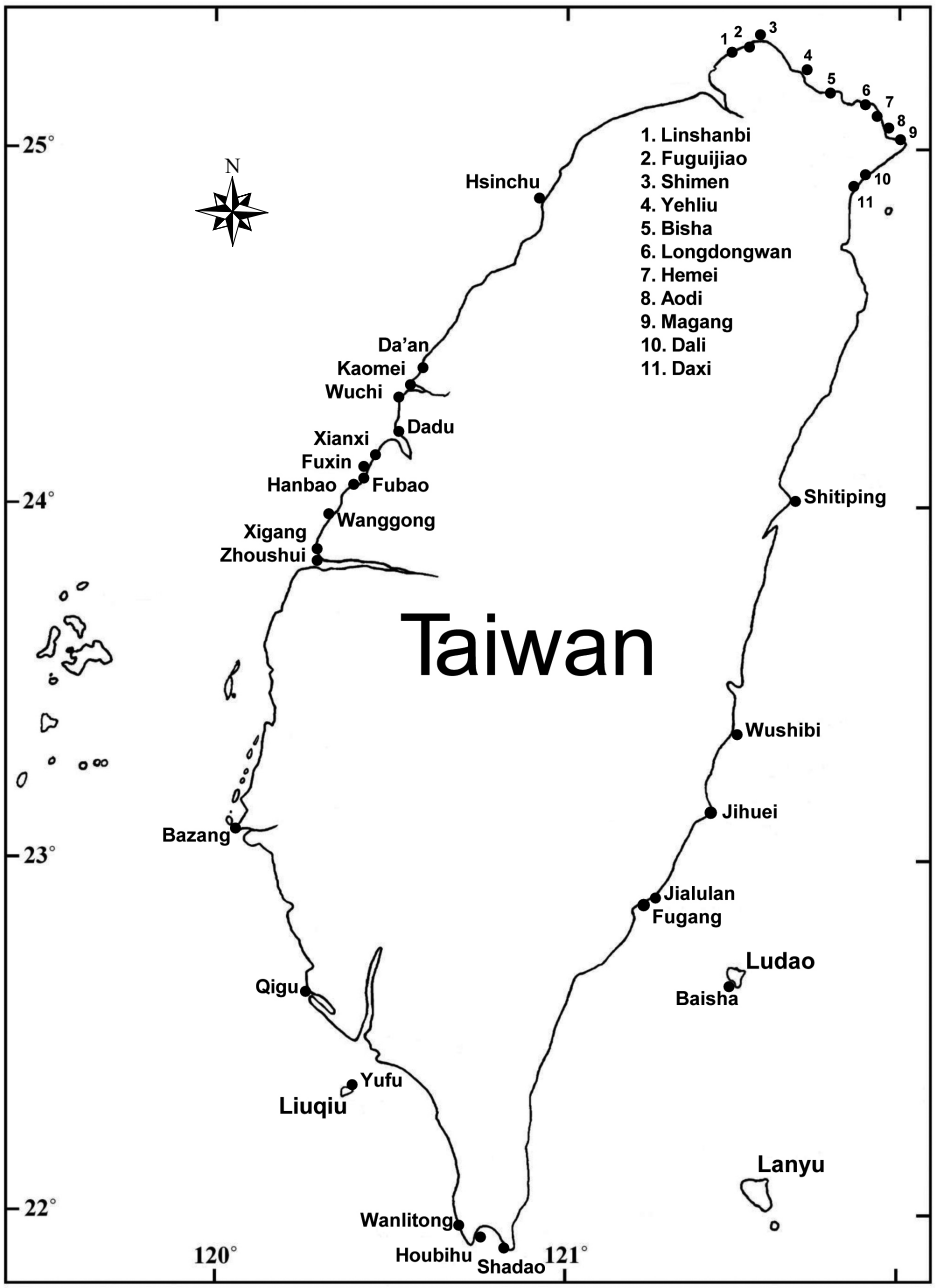

Fig. 1. Collection sites of the present study.

lacking basal cirrophore. Neuropodial prechaetal lobe absent. Neuropodial postchaetal lobe absent or present. Ventral neuropodial ligule of anterior chaetigers present. Ventral cirri single. Notoaciculae absent from segments 1 and 2. Notochaetae are homogomph spinigers. Neurochaetae dorsally are homogomph spinigers, heterogomph falcigers; blades serrated. Neurochaetae ventrally homogomph spinigers (may be absent), **heterogomph spinigers (may be absent)**, heterogomph falcigers; blade lacking distinct tendon on terminal tooth. Anal cirri cirriform or conical.

Perinereis aibuhitensis **(Grube, 1878)**
(Fig. 2)

Nereis (*Perinereis*) *aibuhitensis* Grube 1878: 89–90, p1. 5, fig. 3; Horst 1924: 168–169, p1. 33, figs. 4–6.
Nereis aibuhitensis Monro 1934: 361–362.
Neanthes linea Treadwell 1936: 268–270, fig. 19a–e.
Neanthes orientalis Treadwell 1936: 270–272, fig. 19f–i.
Perinereis aibuhitensis Fauvel 1932: 106, 1953: 209–210, fig. 107a; Russell 1962: 6–7; Wu 1967: 70; Wu et al. 1981: 171–172, figs. 107A–J, 108A–H, 109A–F; Wu et al. 1985: 189–193; Hylleberg et al. 1986: 3–5, fig. 2A–Q; Hutchings et al. 1991: 245–246, fig. 2a–e.

Material examined: Changhua County: 1 specimen, NMNS 8748-1, Xigung (23°52.29'N, 120°17.60'E), habitat type: ISSB, 17 March 2007; 1 specimen, NMNS 8748-2, Fubao (24°02.83'N, 120°22.75'E), habitat type: ISSB, 18 March 2007; 1 specimen, NMNS 8748-3, Fubao Bridge (24°02.68'N, 120°22.91'E), habitat type: ISSB, 18 March 2007; 3 specimens, NMNS 8748-4–6, Fubao Bridge (24°02.69'N, 120°22.90'E), habitat type: ISSB, 1 May 2007; 1 specimen, NMNS 8748-7, Zhuoshui (23°51.50'N, 120°22.75'E), habitat type: ISSB, 20 March 2009; 1 specimen, NMNS 8748-8, Zhuoshui (23°51.50'N, 120°22.75'E), habitat type: ISSB, 7 June 2010; 1 specimen, NMNS 8748-9, Xianxi (24°05.17'N, 120°25.13'E), habitat type: ISSB, 22 April 2017. Chiayi County: 1 specimen, NMNS 8748-10, Bazang (23°19.51'N, 120°07.78'E), habitat type: ISSB, 7 January 2007.

Description: Based on five complete specimens (NMNS 8748-1, 4, 6, 8,10; all atoke) and five incomplete specimens (NMNS 8748-2–3, 5, 7, 9; all atoke); complete specimens for general body morphology, incomplete specimens for anterior body morphology and paragnath pattern only: Body length 75.0–179.0 (n = 5) mm with 152–202 (n = 5) chaetigers, chaetiger 10 width 1.0–5.0 (n = 10) mm, excluding parapodia; beige in alcohol (Fig. 2A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2–6 (n = 10). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.1–1.4x (n = 10) longer than chaetiger 1. Pharynx with dark brown jaws, each with 5–7 (n = 10) teeth; paragnath pattern: I = 3–6 (mostly 4 or 5, one case of 3 and 6; n = 10, same sample size on following areas), in triangle or cluster; II = 12–23 (left), 11–26 ones (right), in 2–3 oblique rows; III = 40–57 (center region with 27–56 cones, in 3–4 transverse rows; mostly 2 lateral regions, each with 0–3 or 0–4 cones; one case of 4 lateral regions, outer lateral regions with 2 cones, inner lateral regions with 6 or 8 cones, in longitudinal lines); IV = 14–25 (left), 15–23 (right), in 2–3 oblique rows; V = 3, in triangle; VI = mostly 2 short bars, one case of 1 additional cone (left), mostly 2 short bars, one case of 3 short bars (right), in transverse row; VII–VIII = 39–58, in 3–4 rows. Ridge pattern of areas VI–V–VI, u-shaped (Fig. 2A, B).

Dorsal cirri digitiform, medially attached to dorsal ligule on anterior to mid-body chaetigers, about 0.4–0.5x as long as dorsal ligule, attached 1/3 to base of dorsal ligule on posterior chaetigers, about 0.2x as long as dorsal ligule (Fig. 2C–E).

Dorsal ligule subconical throughout, about 1.8x longer than median ligule on anterior chaetigers, about 2.0–2.2x longer than median ligule on mid-body to posterior chaetigers; center lobe of dorsal ligule with one irregular-shaped glandular mass on posterior chaetigers (Fig. 2E). Notopodial prechaetal lobe absent.

Median ligule subconical throughout, as long as neuroacicular ligule on anterior and posterior chaetigers, greatly longer than neuroacicular ligule on mid-body chaetigers (Fig. 2C–E).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, about 0.4–0.5x as long as ventral ligule, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.5x as long as ventral ligule on mid-body chaetigers, about 1.5x longer than ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, as long as ventral ligule throughout (Fig. 2C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and long-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: long-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 2F).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 3–8 (n = 5) chaetigers.

Distribution: Australia, China, India, Andaman

Islands, Indonesia (Sulawesi, Sumatra, Java), Philippines (Hutchings et al. 1991), Taiwan (Wu 1967).

Remarks: Morphology of examined specimens in the present study largely agrees with redescription of *P. aibuhitensis* (Grube, 1878) in Hutchings et al. (1991: 245, fig. 2a–c) (Fig. 2A–F). However, some morphological discrepancies can be noted between present specimens and redescription: 1) several present specimens have greater number of paragnaths on areas I (up to 6 versus 4), II (mostly with 16–23 versus 6–14), III (40–57 versus 8–23); and 2) one present specimen has two short bars and one cone on left side of area VI and three short bars on left side of area VI (versus always 2 short bars on each side of area VI) (Hutchings et al. 1991: 245, fig. 2a–c). These discrepancies might be due to the size-related variations. Moreover, present specimens have one glandular mass on center lobe of dorsal ligule on posterior chaetigers (Fig. 2E), which is not mentioned by neither Wu (1967), nor Hutchings et al. (1991: 245); however, this feature had been illustrated in Hylleberg et al. (1986: 4, fig. 2E, J). This species is commonly found in soft bottom habitats of river mouths and coastal flats of western Taiwan.

***Perinereis cultrifera* (Grube, 1840)**

(Fig. 3, Table 2)

Nereis cultrifera Grube 1840: 76, fig. 6.
Perinereis cultrifera Hutchings et al. 1991: 253–254, fig. 8a–c; Park and Kim 2017: 255, figs. 4C, 5F.

Material examined: 19 specimens, NMNS 8748-11–20, Fuguijiao (25°17.75'N, 121°31.99'E), habitat type: IRHB, 19 November 2003; 11 specimens, NMNS 8748-21–22, Fuguijiao (25°17.75'N, 121°31.99'E), habitat type: IRHB, 12 March 2004; 16 specimens, NMNS 8748-23, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 14 March 2004; 13 specimens, NMNS 8748-24–27, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 17 March 2006; 10 specimens, NMNS 8748-28–32, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 14–15 April 2007; 15 specimens, NMNS 8748-33–34, Wanlitong (21°59.73'N, 120°42.26'E), habitat type: IRHB, 14 December 2007; 13 specimens, NMNS 8748-35–39, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 9–10 May 2008; 6 specimens, NMNS 8748-40–42, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 7–9 October 2010;

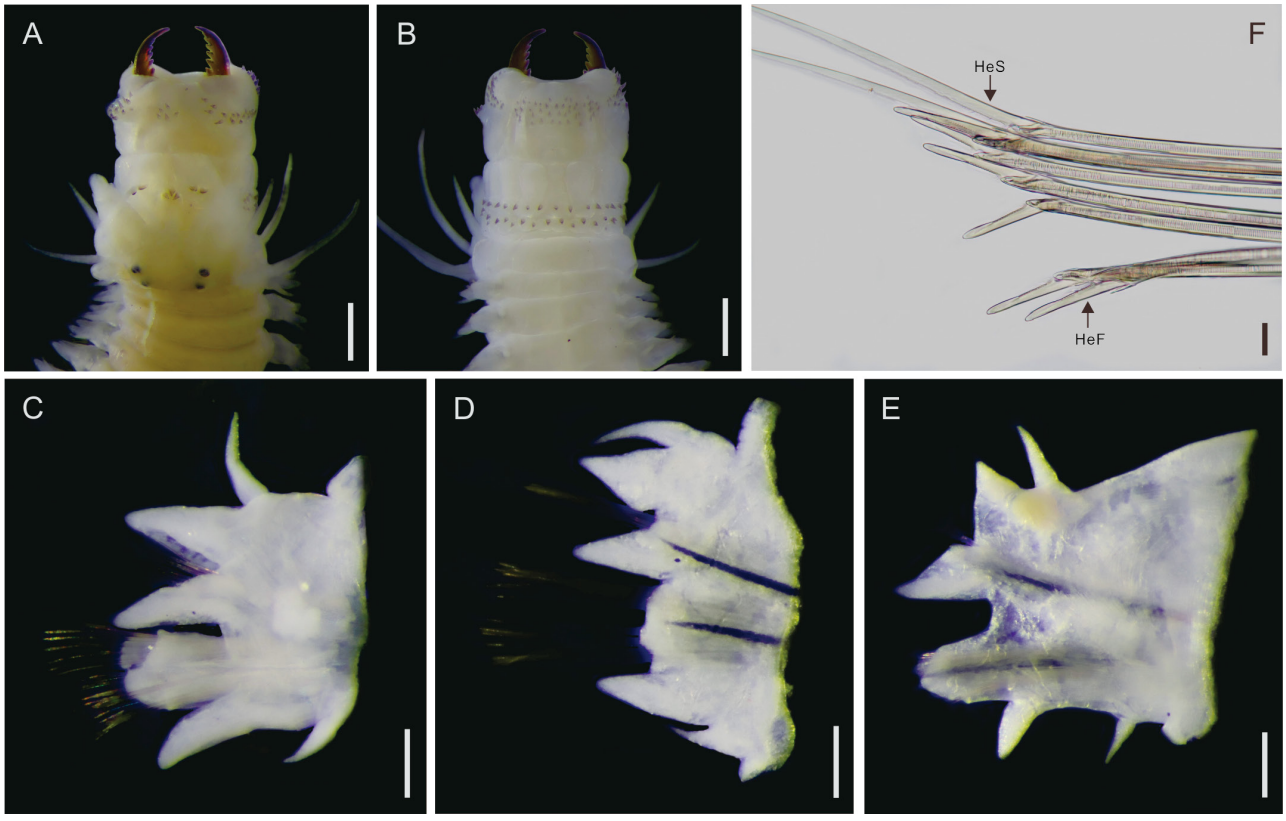

Fig. 2. *Perinereis aibuhitensis* (Grube, 1878); A, B (NMNS 8748-9), C–F (NMNS 8748-6): A, anterior body region, dorsal view; B, anterior body region, ventral view; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 51; E, right parapodium, anterior view, chaetiger 101; F, neuropodial subacicular fascicle chaetae. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F = 0.02 mm.

1 specimen, NMNS 8748-43, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 25 March 2011.

Description: Based on 10 complete specimens (NMNS 8748-11–12, 14–15, 18, 24–25, 27(1); all atoke) and two incomplete specimens (NMNS 8748-13–17; all atoke): Body length 23.0–58.0 (n = 10) mm with 71–96 (n = 10) chaetigers, chaetiger 10 width 1.5–3.7 (n = 12) mm, excluding parapodia; beige in alcohol

Table 1. *Perinereis* species reported from East and Southeast Asia

Taxon	Type locality	Distribution	Habitats	References
P. aibuhitensis (Grube, 1878)	Aibuhit (Babeldaob, Palau)	Andaman Islands; Australia; China; Philippines; Taiwan	A, B	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. amblyodonta (Schmarda, 1861)	New South Wales	Australia; New Zealand; Philippines; Taiwan	B	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. barbara (Monro, 1926)	New South Wales	Australia; India; Singapore	B	Hutchings et al. 1991; Glasby et al. 2016
P. binongkae (Horst, 1924)	Binongka, Indonesia	Known only from the type locality	F	Horst 1924
P. brevicirris (Grube, 1866)	St. Paul Island, Indian Ocean	Indian Ocean; Red Sea; Persian Gulf.	B, C	Grube 1866; Augener 1913
P. caeruleis (Hoagland, 1920)	Limbe Strait, Philippines	Arabian Sea; Australia; Indonesia; New Caledonia; Southern Japan; Taiwan	n.a.	Wu 1967; Wilson and Glasby 1993
P. calmani (Monro, 1926)	Macclesfield Bank, South China Sea	Australia; China	B	Hutchings et al. 1991; Glasby et al. 2016
P. camiguinoides (Augener, 1922)	Juan Fernandez Islands, Chile	Chile; New Zealand; South China Sea	n.a.	Hutchings et al. 1991; Glasby et al. 2016
P. cavifrons (Ehlers, 1920)	Ambon, Indonesia	Indonesia; South China Sea	n.a.	Hutchings et al. 1991; Glasby et al. 2016
P. cultrifera (Grube, 1840)	Gulf of Naples	English Channel; Mediterranean; South China Sea; Taiwan	B	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. dongalae (Horst, 1924)	Sulawesi, Indonesia	Known only from the type locality	F	Horst 1924
P. euiini Park and Kim, 2017	Gusan-myeon, Korea	Eastern Asia (China, Japan, Korea, Taiwan)	B, D	Park and Kim 2017
P. floridana (Ehlers, 1868)	Florida, USA	Caribbean Sea; Gulf of Mexico; Mexico	B	de León-González and Solís-Weiss 1998
P. helleri (Grube, 1878)	Bohol, Philippines	Andaman Islands; Australia; China; Indonesia; Philippines; Taiwan	B, C	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. linea (Treadwell, 1936)	Xiamen, China	Mediterranean; China; Korea; Taiwan	C, E	Treadwell 1936; Arias et al. 2013; Glasby et al. 2016
P. majungaensis Fauvel, 1921	Madagascar	Madagascar; South China Sea	n.a.	Wilson and Glasby 1993; Glasby et al. 2016
P. malayana (Horst, 1889)	Malaysia	Known only from the type locality	n.a.	Horst 1889
P. mictodonta (Marenzeller, 1879)	Japan	Japan; China; Taiwan	A, C, D	Wilson and Glasby 1993; Glasby and Hsieh 2006
P. neocaledonica Pruvot, 1930	New Caledonia	Arabian Sea; Southern Japan; New Caledonia; New Hebrides	n.a.	Fauvel 1932; Wilson and Glasby 1993
P. nigropunctata (Horst, 1889)	Malaysia	Australia; Borneo; Madagascar; Gulf of Thailand; Marshall Islands; Taiwan	B, C	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. nuntia (Lamarck, 1818)	Gulf of Suez	Red Sea; Gulf of Aden; tropical Indo-Pacific	B, C	Wilson and Glasby 1993; Glasby and Hsieh 2006
P. obfuscata (Grube, 1878)	Philippines	Australia; Philippines	B, C	Hutchings et al. 1991
P. perspicillata (Grube, 1878)	Philippines	Philippines; South China Sea	n.a.	Grube 1878; Glasby et al. 2016
P. quatrefagesi (Grube, 1878)	Philippines	Philippines; South China Sea	n.a.	Grube 1878; Glasby et al. 2016
P. rhombodonta Wu, Sun and Yang, 1981	Guangdong, China	Indonesia; Malaysia; Singapore; Southern China; South China Sea; Taiwan; Thailand	C	Wu et al. 1981; Glasby and Hsieh 2006
P. rumphii (Horst, 1919)	Banda Sea, Indonesia	Banda Sea, Indonesia	n.a.	Horst 1919
P. shikueii Glasby and Hsieh, 2006	Taiwan	Japan; Taiwan	C	Glasby and Hsieh 2006; Tosuji et al. 2019
P. singaporiensis (Grube, 1878)	Singapore	Australia; India; Indonesia; New Caledonia; Philippines; Singapore; Taiwan	B	Wu 1967; Hutchings et al. 1991; Glasby et al. 2016
P. striolata (Grube, 1878)	Bohol, Philippines	New Caledonia; Philippines; Persian Gulf	n.a.	Grube 1878; Pruvot 1930
P. suluana (Horst, 1924)	Sulu, Philippines	Australia; Malay Archipelago; New Caledonia; Papua New Guinea; Philippines	D	Horst 1924; Hutchings et al. 1991
P. tenuisetis (Fauvel, 1915)	Port de Syracuse, Sicily	Mediterranean; South China Sea	F	Fauvel 1915; Glasby et al. 2016
P. vancaurica (Ehlers, 1868)	Nicobar Islands, Andaman	Australia; tropical Indian and Pacific Oceans	B, C	Hutchings et al. 1991
P. viridis Glasby and Hsieh, 2006	Singapore	Singapore; Sulawesi, Indonesia	B	Glasby and Hsieh 2006
P. weijhouensis Wu, Sun and Yang, 1981	Guangxi, China	Southern China; South China Sea	B	Wu et al. 1981; Glasby et al. 2016
P. wilsoni Glasby and Hsieh, 2006	Taiwan	China; Japan; South China Sea; South Korea; Taiwan	B	Glasby and Hsieh 2006

A = brackish waters; B = intertidal hard bottom; C = intertidal soft bottom; D = subtidal hard bottom; E = subtidal soft bottom; F = pelagic; n.a. = not available.

(Fig. 3A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3–8 (n = 12). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.2–1.4x (n = 12) longer than chaetiger 1. Pharynx with dark brown jaws, each with 5–7 (n = 12) teeth; paragnath pattern: I = 1–6 (mostly 4–5, one case of 1, 3 and 6) (n = 12, same sample size on following areas), in cluster; II = 14–25 (left), 13–20 (right), in 2–3 oblique rows; III = 13–29 (center region with 12–24 cones, in 3–4 transverse rows; mostly 2 lateral regions, each with 1–4 or 0–3 cones); IV = 18–29 (left), 14–30 (right), in 3–4 oblique rows; V = 1–4 (mostly 3, one case of 1, 2 and 4); VI = 1 (left), 1 (right), short bars; VII–VIII = 22–37, in 2 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 3A, B, Table 2).

Dorsal cirri digitiform, medially attached dorsal ligule throughout, about 0.6x as long as dorsal ligule on anterior to mid-body chaetigers, about 0.4x as long as dorsal ligule on posterior chaetigers (Fig. 3C–E, Table 2).

Dorsal ligule subconical throughout, about 1.4x longer than median ligule on anterior chaetigers, about 1.8–2.0x longer than median ligule on mid-body to posterior chaetigers; central and proximal lobes of dorsal ligule with one glandular mass throughout (Fig. 3C–E, Table 2). Notopodial prechaetal lobe present on anterior to anterior-most of mid-body chaetigers (Fig. 3C, D, Table 2).

Median ligule subconical throughout, about as long as neuroacicular ligule throughout (Fig. 3C–E).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, about as long as ventral ligule throughout, inferior and superior lobes subequal in length on mid-body to posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule on anterior to mid-body chaetigers, about 0.9x as long as ventral ligule on mid-body chaetigers to posterior chaetigers (Fig. 3C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout.

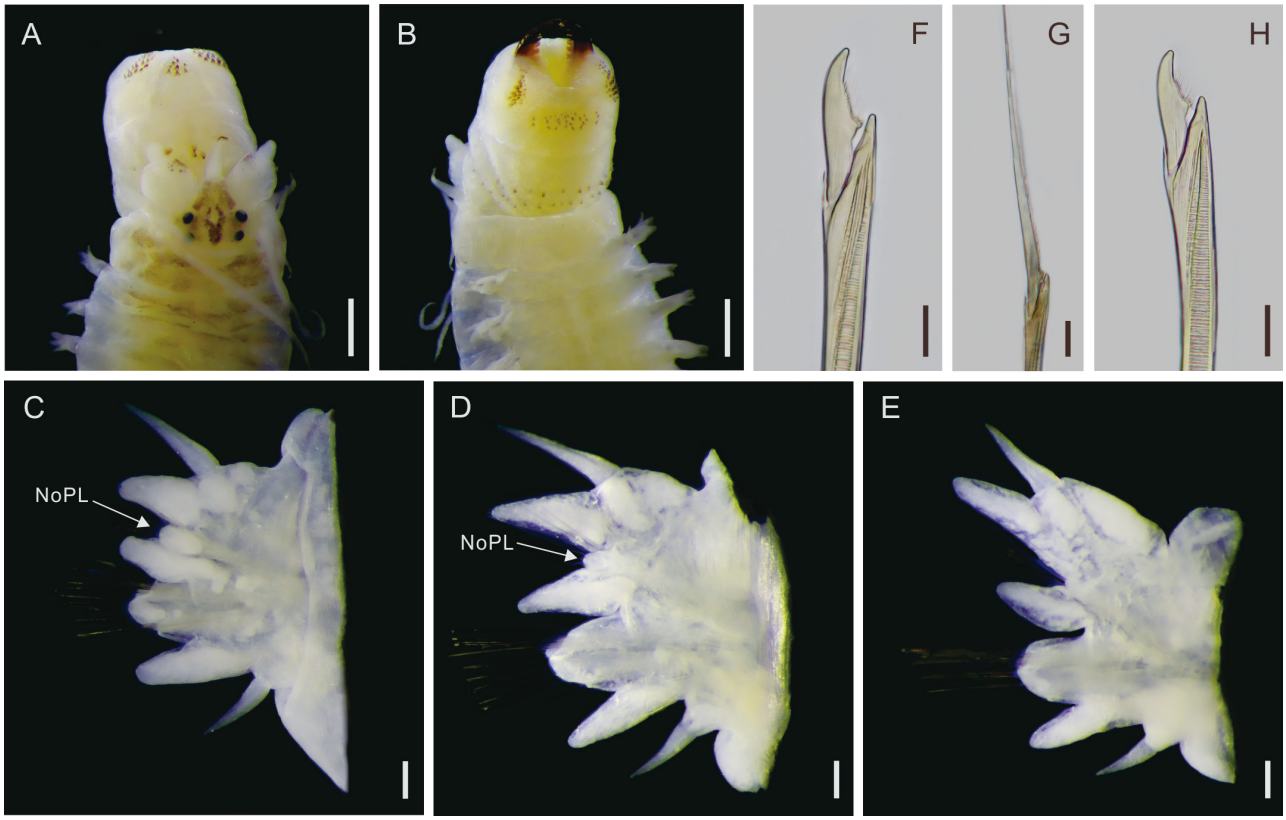

Fig. 3. *Perinereis cultrifera* (Grube, 1840); A, B (NSNM 8748-34(1)), C–H (NMNS 8748-28): A, anterior body region, dorsal view; B, anterior body region, ventral view; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 34; E, right parapodium, anterior view, chaetiger 70; F, neuropodial subacicular fascicle heterogomph falciger, chaetiger 10; G, neuropodial subacicular fascicle heterogomph spiniger, chaetiger 34; H, neuropodial subacicular fascicle heterogomph falciger, chaetiger 70. Abbreviation: NoPL = notopodial prechaetal lobe. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F–H = 0.02 mm.

Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 3F–G, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 2–4 (n = 6) chaetigers (Table 2).

Distribution: Mediterranean Sea, English Channel (Hutchings et al. 1991); Taiwan.

Remarks: Park and Kim (2017) reported that *P. cultrifera* reported by Izuka (1912) and Wu (1967) from Taiwan are all actually *P. euiini* Park and Kim, 2017. This practice makes the presence record of *P. cultrifera* in Taiwan no longer valid. However, material of the present study suggests that *P. cultrifera* does exist in Taiwan. Paragnath pattern and morphology of parapodia and chaetae of present specimens (Fig. 3B, C–G, Table 2) agree mostly with syntypes of *P. cultrifera* examined by Hutchings et al. (1991: 253, fig. 8a–c) and Park and Kim (2017: 255–256, 258, figs. 3A, 4A–C, 5A1, 2, 5F, table 4), including several key characters (*i.e.*, the presence of lateral teeth on area III, central and proximal lobes of dorsal ligule with one glandular mass on all chaetigers, the presence of prechaetal lobe on anterior chaetigers, and not greatly expanded dorsal ligule on posterior chaetigers). Figure 4 in Park and Kim (2017: 255) showed that *P. cultrifera* has λ-shaped ridge pattern of areas VI–V–VI, which is the same as the present specimens (Fig. 3A). Nevertheless, minor morphological discrepancies between the present specimens and above-mentioned descriptions have been noted in the present study. For example, number of paragnaths on areas I and III in the present specimens have a range of 1–9 with mostly 4–5 and 13–29, respectively, whereas that of is 1–2 and 5–11 or 10–12,

Table 2. Key characters of *Perinereis* species described in the present study of group 1A

Taxon\Categories	LTC	TJ	I	IIL, IIR	III/LT	IVL, IVR	V	VIL, VIR	VII–VIII	RP VI–V–VI
P. cultrifera (Grube, 1840)	3–8	5–7, 5–7	1–9 (mostly 4–5)	14–25, 14–30	13–29/Present	18–29, 14–30	1–4 (mostly 3)	1, 1	22–37	λ-shaped
P. floridana (Ehlers, 1868)	2–3	5–8, 5–8	1–3 (mostly 1)	9–13, 9–12	9–15/Absent	15–23, 15–23	1 (rarely 0)	1, 1 (rarely 0 or with cones)	27–38	λ-shaped
P. houbihuensis sp. nov.	2	5, 5	2	11, 12	19/Absent	16, 12	1	1, 1	33	χ-shaped
P. longdongwanensis sp. nov.	3–4	8. 8	13	29, 29	24/Absent	33, 31	4–16	1 (1+2–6 cone), 1 (1+3–8 cone)	140–194	λ-shaped
P. pangcahae sp. nov.	2–4	4–5, 4–5	2–5	12–15, 11–14	22–27/Present	22–30, 19–33	3	1, 1 (1+0–1 cone)	27–33	ɔc-shaped
P. pseudocutrifera sp. nov.	2–3	5–8, 5–8	1–3	9–10, 8–11	8–14/Present	15–18, 12–21	0	1, 1	30–35	λ-shaped
P. taitungensis sp. nov.	3–4	3–4, 3–5	2	6, 8–11	13–19/Present	19–25, 24–26	3	0–1, 1	28–30	ɔc-shaped

Taxon\Categories	DC/DL AC	DC/DL MC	DC/DL PC	DL/ML PC	NoPL	GM in DL PC	SP/SB AC	SP/SB MC	SP/SB PC	AnC
P. cultrifera (Grube, 1840)	0.6	0.6	0.4	2.2	Present/AC–MC	2	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	2–4
P. floridana (Ehlers, 1868)	0.8	0.8	0.4	2.2	Absent	0	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	4–5
P. houbihuensis sp. nov.	0.5	0.5	0.5	2.5	Present throughout	2	HoS, HeF/ HeF	HoS, HeF/ HeF	HoS, HeF / HeS, HeF	3
P. longdongwanensis sp. nov.	0.5	0.5	0.7	1.8	Present/AC	0	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	HoS, HeF/ HoS, HeF	4
P. pangcahae sp. nov.	0.8	0.6	0.3	1.8	Absent	1	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	3–7
P. pseudocutrifera sp. nov.	0.8	0.8	0.4	2.3	Present throughout	0	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	2–6
P. taitungensis sp. nov.	0.8	0.4	0.4	1.8	Present/MC	2	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	3

Abbreviations: AC = anterior chaetigers; AnC = last chaetiger reached by anal cirri; DC = dorsal cirri; DL = dorsal ligule; GM = glandular mass; LT = lateral teeth; LTC = chaetigers reached by longest tentacular cirri; MC = mid-body chaetigers; NoPL = notopodial prechaetal lobe; PC = posterior chaetigers; RP = ridge pattern of areas VI–V–VI; SB = subacicular fascicle; SP = supra-acicular fascicle; TJ = teeth of jaws.

respectively (Table 2, Hutchings et al. 1991: 253; Park and Kim 2017: 258, table 4). Collection and habitat information of present specimens indicate this species is widespread on rocky coasts in Taiwan.

Perinereis cultrifera is originally described from the Mediterranean Sea and later reported from most temperate oceans (Grube 1840; Hutchings et al. 1991). However, taxonomic confusions from work of Fauvel (1932) leads to the suggestion by Hutchings et al. (1991) that additional distribution records of the species from other geographic regions, such as Marshall Islands, New Caledonia, India, South Africa and Madagascar, Japan, require verification. Park and Kim (2017: 256, fig. 6) suggested that all *P. cultrifera* reported from East China, Korea, Japan, and Taiwan are actually *P. euiini*. In the present study, the author follows the distribution range reported in Hutchings et al. (1991) and adds a verified additional location of the species from Taiwan.

***Perinereis daxiensis* sp. nov.**

(Fig. 4, Table 3)

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Material examined: Holotype, NMNS 8748-44, Daxi (24°56.59'N, 121°54.23'E), habitat type: IRHB, 25 April 2000.

Etymology: The name is derived from the name of nearby village, Daxi, where the worm was collected.

Description: Holotype, atoke, complete, body length 110.0 mm with 128 chaetigers, chaetiger 10 width 3.6 mm, excluding parapodia; beige in alcohol (Fig. 4A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 5. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.4x longer than chaetiger 1. Pharynx with dark brown jaws, each with 5 teeth; paragnath pattern: I = 2, in

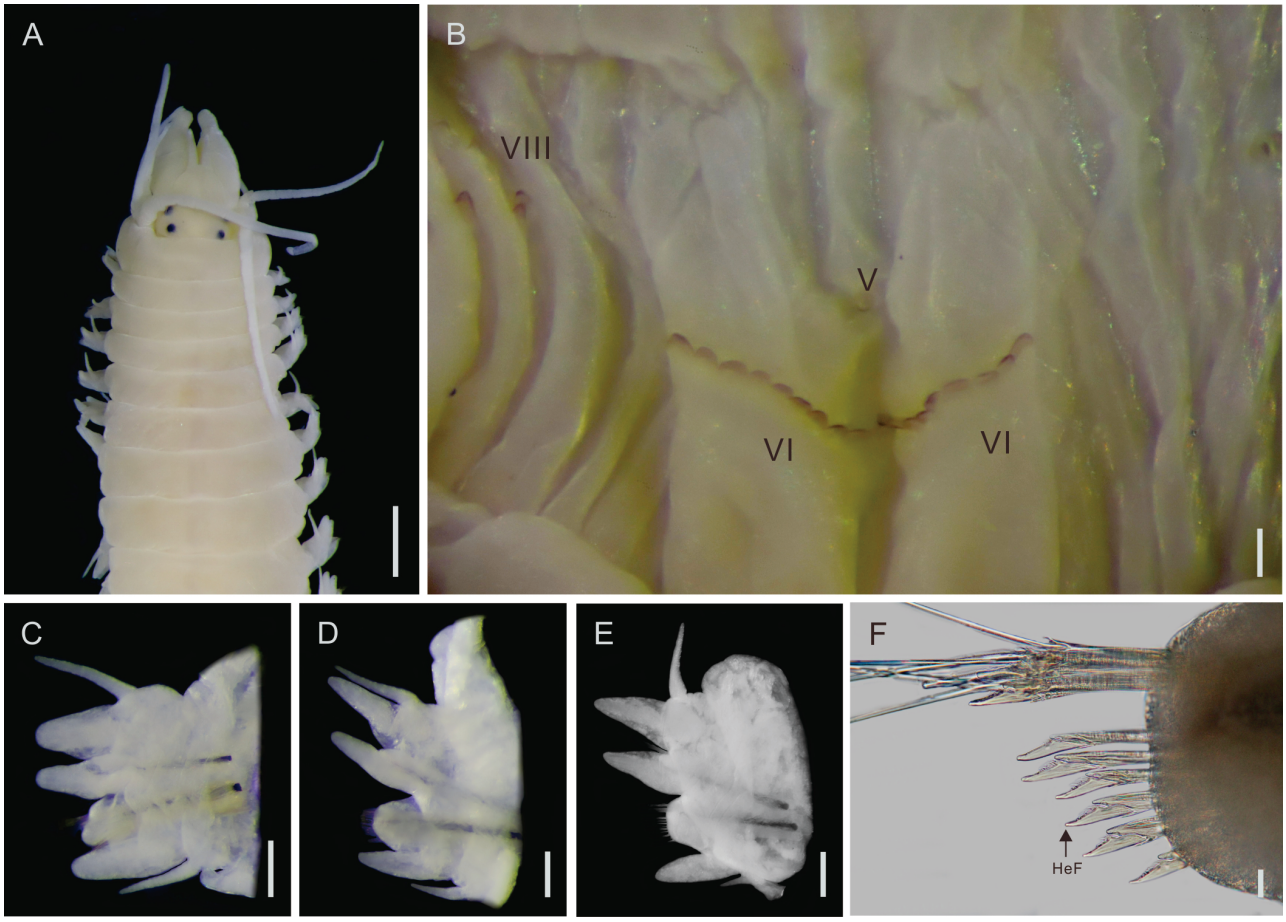

Fig. 4. *Perinereis daxiensis* sp. nov.; holotype (NSNM 8748-44): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 50; E, right parapodium, anterior view, chaetiger 90; F, neurochaetae of chaetiger 90. Abbreviations: HeF = heterogomph falciger. Scale bars: A = 1.0 mm; B = 0.1 mm; C–E = 0.2 mm; F = 0.02 mm.

longitudinal line; II = 9 (left), 10 (right), in cluster; III = 16 (center region with 14 cones, in oval-shaped patch; 2 lateral regions, each with 1 cone); IV = 22 (left), 23 (right), in 3 oblique rows, without bars; V = 1; VI = 9 (left), 10 (right), even length short bars in transverse row; VII–VIII = 23, in 2–3 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 4B, Table 3).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule, about 0.7x as long as dorsal ligule on anterior chaetigers, attached 1/4–1/5 to base of dorsal ligule on mid-body to posterior chaetigers, about 0.8x as long as dorsal ligule on mid-body chaetigers, about 0.6x as long as dorsal ligule on posterior chaetigers (Fig. 4C–E, Table 3).

Dorsal ligule subconical throughout, about 2.0x longer than median ligule on anterior chaetigers, about 1.2–1.4x longer than median ligule on mid-body to posterior chaetigers; center lobe of dorsal ligule with one round glandular mass on posterior chaetigers (Fig. 4E, Table 3). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, longer than

Table 3. Key characters of *Perinereis* species described in the present study of group 3A

Taxon\Categories	LTC	TJ	I	IIL, IIR	III/LT	IVL, IVR	V	VIL, VIR	VII–VIII	RP VI–V–VI
P. daxiensis sp. nov.	5	5, 5	2	9, 10	16/Present	22, 23	1	9, 10	23	λ-shaped
P. hsinchuensis sp. nov.	2	6, 6	3	16, 17	21/Present	26, 30	3	3, 3	37	ɔc-shaped
P. kaomeiensis sp. nov.	8	4, 4	9	17, 18	54/Absent	22, 25	5	5, 4	52	ɔc-shaped
P. liuqiuensis sp. nov.	5	3, 3	3	9, 12	17/Present	17, 22	3	9, 9	29	ɔc-shaped
P. ludaoensis sp. nov.	3	5. 5	6	11, 11	17/Present	23, 24	0	11, 9	18	λ-shaped
P. mictodonta (Marenzeller, 1879)	3–13	3–6, 3–6	1–6 (mostly 2–5)	14–26, 12–25	15–32/Present	23–42, 23–42	1–4 (mostly 3)	3–9, 3–9 (rarely 3)	20–39	χ-shaped
P. qiguensis sp. nov.	6	5, 5	5	21, 23	30/Present	22, 23	3	7, 6	36	λ-shaped
P. tubicola sp. nov.	3	5, 5	1	2, 1	0/Absent	2, 3	3	9, 8	12	u-shaped
P. wilsoni Glasby and Hsieh, 2006	4–11	5–6, 5–6	1–3	6–15, 6–15	14–25/Present	13–34, 19–34	1–3	4–7, 4–7	14–36	χ-shaped
P. yehliuensis sp. nov.	5	2?, 5	3	5?, 21	27/Present	33, 31	5	6, 8	23	ɔc-shaped
P. yufuensis sp. nov.	3	4, 4	2	9, 7	10/Present	18, 16	3	7, 6	28	ɔc-shaped

Taxon\Categories	DC/DL AC	DC/DL MC	DC/DL PC	DL/ML PC	NoPL	GM in DL PC	SP/SB AC	SP/SB MC	SP/SB PC	AnC
P. daxiensis sp. nov.	0.7	0.8	0.6	1.5	Absent	0	HoS, HeF/ HeF	HoS, HeF/ HeF	HoS, HeF/ HeF	8
P. hsinchuensis sp. nov.	0.7	0.8	0.5	1.8	Absent	1	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeF	n.a.
P. kaomeiensis sp. nov.	0.8	0.6	0.5	2.1	Present/PrN	0	HoS, HeF/ HeS, HeF	NCh	HoS, HeF/ HeS, HeF	9
P. liuqiuensis sp. nov.	0.5	0.5	0.3	1.6	Absent	1	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	11
P. ludaoensis sp. nov.	0.5	0.3	0.3	1.7	Absent	0	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	n.a.
P. mictodonta (Marenzeller, 1879)	0.8	0.8	0.5	1.3	Absent	2	HoS, HeF/ HeF, HeS	HoS, HeF/ HeF, HeS	HoS, HeF/ HeS, HeF	4–8
P. qiguensis sp. nov.	0.6	0.7	0.5	2.3	Present throughout	1	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	6
P. tubicola sp. nov.	1.0	0.6	0.8	1.8	Absent	0	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	n.a.
P. wilsoni Glasby and Hsieh, 2006	0.9	0.7	0.5	2.0	Absent	2	HoS, HeF/ HeF, HeS	HoS, HeF/ HeF, HeS	HoS, HeF/ HeS, HeF	5–9
P. yehliuensis sp. nov.	0.7	0.7	0.5	1.7	Absent	0	HoS, HeF/ HeS, HeF	NCh	HoS, HeF/ HeS, HeF, NCh	n.a.
P. yufuensis sp. nov.	0.5	0.3	0.3	1.7	Absent	1	HoS, HeF/ HeF	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	3

Abbreviations: AC = anterior chaetigers; AnC = last chaetiger reached by anal cirri; DC = dorsal cirri; DL = dorsal ligule; GM = glandular mass; LT = lateral teeth; LTC = chaetigers reached by longest tentacular cirri; MC = mid-body chaetigers; NC = natatory chaetigers; NCh = natatory chaetae; NoPL = notopodial prechaetal lobe; PC = posterior chaetigers; PoN = post- natatory chaetigers; PrN = pre-natatory chaetigers; RP = ridge pattern of areas VI–V–VI; SB = subacicular fascicle; SP = supra-acicular fascicle; TJ = lateral teeth of jaws.

neuroacicular ligule throughout (Fig. 4C–E).

Neuroacicular ligule with subequal inferior and superior lobes, about 0.4–0.5x as long as ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule on anterior chaetigers, about 0.5x as long as ventral ligule on mid-body chaetigers to posterior chaetigers (Fig. 4C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations present throughout (Fig. 4F, Table 3), heterogomph spinigers absent (Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 8 chaetigers.

Type locality: Daxi, Yilan County, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis daxiensis* sp. nov. has an arc of 9–10 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers, which can be categorized to the group 3A proposed by Hutchings et al. (1991: 271) (Fig. 4B, Table 3). Likewise, members of the 3A group are also belonging to the *Perinereis nuntia* species group (Hutchings et al. 1991: 273; see the species group diagnosis in Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species of the *Perinereis nuntia* group recognized by Villalobos-Guerrero (2019: 490), only *P. weijhouensis* Wu, Sun and Yang, 1981 is similar to *P. daxiensis* sp. nov. Both species have: 1) dorsal ligule not elongated and of similar size in all parapodia, notopodial prechaetal and neuropodial postchaetal lobes not developed; 2) area II with paragnaths, area III with lateral paragnaths, area V with less than 5 paragnaths, area VI with single arc of paragnaths, areas VII–VIII with less than 199 paragnaths; and 3) neuropodial heterogomph spinigers absent on chaetigers of all body regions (Fig. 4B–F, Table 3; Wu et al. 1981: 181–182, fig. 114A–B, G). However, *P. daxiensis* sp. nov. differs from *P. weijhouensis* by having: 1) greater number of paragnaths on areas II, IV, and VI (9–10, 22–23, and 9–10 versus 4–6, 12–18, and 4–8, respectively) and fewer number of paragnaths on areas VII–VIII (23 versus 39); 2) area VI paragnaths in semicircular-shaped and tightly aligned without gaps (versus rectangular and loosely aligned with gaps between paragnaths); 3) dorsal cirri shorter than dorsal ligule on posterior chaetigers (versus longer than dorsal ligule); and 4) one round glandular mass in the center lobe of dorsal ligule on posterior chaetigers (versus absent) (Fig. 4B–F, Table 3; Wu et al. 1981: 181–182, fig. 114A–B, G). The differences between *P. daxiensis* sp. nov. and the other new species of the 3A group described in the present study are discussed below.

Perinereis floridana (Ehlers, 1868)

(Fig. 5, Table 2)

Nereis floridana Ehlers 1868: 503–506.

Perinereis floridana Monro 1933: 256; Salazar-Vallejo and Jiménez-Cueto 1996–1997: 367, figs. 8, 32, 33; de León-González and Solís-Weiss 1998: 684, figs. 6A–E, 7A–E; Chen et al. 2002: 17–29; Fauchald et al. 2009: 771; de León-González and Goethel 2013: 7.

Material examined: 4 specimens, NSNM 8748-44–48, Wuchi Harbor (24°17.61'N, 120°31.18'E), habitat type: SRHB, 7 July 2015; 4 specimens, NSNM 8748-49–52, Wuchi (24°17.61'N, 120°31.18'E), habitat type: SRHB, 5 October 2015.

Description: Based on 4 complete specimens (NSNM 8748-45, 47, 49–50; all atoke) and 4 incomplete specimens (NSNM 8748-46, 48, 51–52; all atoke): Body length 35.0–93.0 (n = 4) mm with 71–96 (n = 4) chaetigers, chaetiger 10 width 2.0–4.0 (n = 8) mm, excluding parapodia; beige in alcohol (Fig. 5A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2–3 (n = 7). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.1–1.4x (n = 7) longer than chaetiger 1. Pharynx with dark brown jaws, each with 5–8 (n = 8) teeth; paragnath pattern: I = 1–3 (mostly 1, one case of 2 (in longitudinal line) and 3 (in triangle), n = 8, same sample size on following areas); II = 9–13 (left), 9–12 (right), in 2–3 oblique rows; III = 9–15 (mostly without lateral teeth, two cases of 1 lateral teeth on one side), in oval-shaped patch; IV = 15–23 (left), 15–23 (right), in 3–4 oblique rows, without bars; V = 0–1 (mostly 1, one case of 0); VI = 0–1 short bar (mostly 1, one case of 0) + 0–4 cones (mostly 0 cones, one case of 4 cones) (left), 1 short bar (right); VII–VIII = 27–38, in 2 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 5A–D, Table 2).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule, about 0.8x as long as dorsal ligule on anterior to mid-body chaetigers, attached 2/3 to base of dorsal ligule on posterior chaetigers, about 0.4x as long as dorsal ligule (Fig. 5E–G, Table 2).

Dorsal ligule subconical throughout, about 1.7–2.0x longer than median ligule on anterior to mid-body chaetigers, about 2.2x longer than median ligule on posterior chaetigers (Fig. 5E–G). Notopodial prechaetal

lobe Absent (Table 2).

Median ligule subconical throughout, about as long as neuroacicular ligule on anterior chaetigers, about 1.7–1.8x longer than neuroacicular ligule on mid-body to posterior chaetigers (Fig. 5E–G).

Neuroacicular ligule with prominent inferior lobe on anterior to mid-body chaetigers, about 0.6x as long as ventral ligule, inferior and superior lobes subequal in length on posterior chaetigers, about 0.5x as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule on anterior chaetigers, about 0.8x as long as ventral ligule on mid-body chaetigers to posterior chaetigers (Fig. 5E–G).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 5H, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 4–5 (n = 6) chaetigers (Table 2).

Distribution: Gulf of Mexico, Caribbean Sea, Quintana Roo (Mexico) (de León-González and Solís-Weiss 1998), Red Sea (Gravier 1901); South China Sea (Glasby et al. 2016), western and northern Taiwan.

Remarks: Morphology of examined specimens in the present study agrees mostly with description of *P. floridana* (Ehlers, 1868) in de León-González and Solís-Weiss (1998: 684, figs. 6A–E) (Fig. 5A–H, Table 2). Although the type of ridge pattern of areas VI–V–VI was not available in the text, de León-González and Solís-Weiss (1998) did draw a pharynx everted epitoke form of the species which is clearly with λ-shaped ridge pattern of areas VI–V–VI (de León-González and Solís-Weiss 1998: 686, fig. 7A). The present specimens also have the same type ridge pattern of areas VI–V–VI (Fig. 5A, C, Table 2). However, there are some morphology discrepancies between the present specimens and the above-mentioned description. For example, one of present specimens has cones and bars on area VI of the pharynx, and this variation was not observed by de León-González and Solís-Weiss (1998: 684) (Fig. 5C). Moreover, dorsal ligule on posterior chaetigers of the present specimens has greater dorsal ligule to median ligule ratio (2.2 versus 1.6) on posterior chaetigers than that of described in de León-González and Solís-Weiss (1998: 684–685, fig. 6D) (Fig. 5C, Table 2). The presence of cone on area VI of *P. floridana* collected from the Red Sea was also observed by Gravier (1901: 186, text-fig. 188). Moreover, Gravier (1901: 186, text-figs. 188–189) noted that specimens of *P. floridana* from the Red Sea has 1 to 3 paragnaths on area V, in comparing to that of 0 to 1 and 1 in specimens of the present study and de León-González and Solís-Weiss (1998: 684), respectively. All examined specimens of

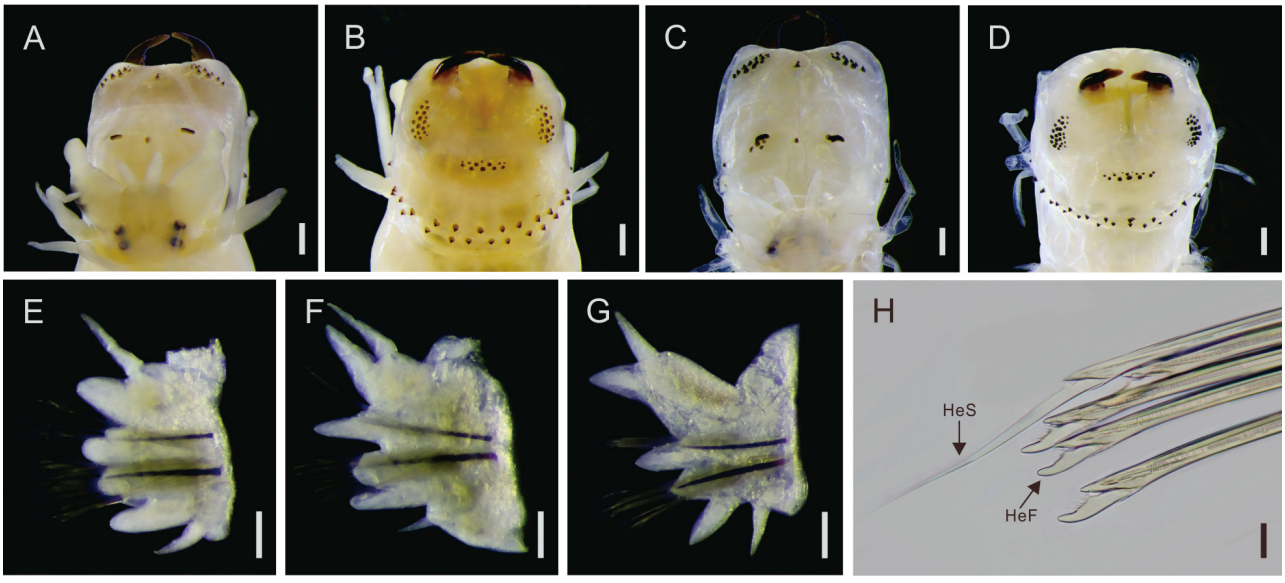

Fig. 5. *Perinereis floridana* (Ehlers, 1868); A, B, E–H (NSNM 8748-46), C, D (NSNM 8748-49): A, anterior body region, dorsal view; B, anterior body region, ventral view; C, anterior body region, dorsal view; D, anterior body region, ventral view; E, right parapodium, anterior view, chaetiger 10; F, right parapodium, anterior view, chaetiger 34; G, right parapodium, anterior view, chaetiger 70; H, neuropodial subacicular fascicle chaetae, chaetiger 10. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A–D = 0.5 mm; E–G = 0.2 mm; H = 0.02 mm.

P. floridana in the present study have been collected from subtidal fouling community on cement surfaces of piers in Wuchi Harbor (central-west Taiwan) and Bisha Harbor (northern Taiwan).

Perinereis floridana is somewhat similar to *P. helleri* (Grube, 1878), but it can be distinguished from the latter species by having: 1) the longest tentacular cirri reaching chaetigers 2–3 (versus chaetiger 16); 2) no lateral teeth on area III (versus presence of lateral teeth); and 3) greater ratio of dorsal ligule to median ligule on posterior chaetigers (2.2x versus 1.4x) (Fig. 5A, C, G, Table 2; Hutchings et al. 1991: 255, fig. 9b). *Perinereis floridana* is also somewhat similar to *P. obfuscata* (Grube, 1878), but the former species differs from the latter species by having: 1) the longest tentacular cirri reaching chaetigers 2–3 (versus chaetiger 1); 2) no lateral teeth on area III (versus presence of lateral teeth); and 3) greater ratio of dorsal ligule to median ligule on posterior chaetigers (2.2x versus 1.9x) (Fig. 5A, C, G, Table 2; Hutchings et al. 1991: 258, fig. 11b).

***Perinereis fugangensis* sp. nov.**

(Figs. 6, 7)

urn:lsid:zoobank.org:act:F112629E-329A-48C5-BB68-4F3C19DFE2C3

Material examined: Holotype, NSNM 8748-53, Fugang (22°47.63'N, 121°11.89'E), habitat type: IRHB, 15 October 2004.

Etymology: The name is derived from the name of nearby village, Fugang, where the worm was collected.

Description: Holotype, atoke, complete, body length 236.0 mm with 521 chaetigers, chaetiger 10 width 2.6 mm, excluding parapodia; body beige in alcohol (Fig. 6A). Prostomium wider than long, lateral antennae antero-lateral, longer than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 1. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 1. Pharynx with dark brown jaws, each without teeth; paragnath pattern: I = 0; II = 0; III = many minute cones in wide band; IV = many minute cones in wide band, without bars; V = 10 scattered small cones + many minute cones in wide band; VI = 20 (left), 21 (right), even length short bars in transverse row + many minute cones in wide band posteriorly; VII–VIII = numerous minute cones in wide band. Ridge pattern of areas VI–V–VI, u-shaped (Fig. 6B–E).

Dorsal cirri digitiform, medially attached to dorsal ligule, about 0.4–0.6x as long as dorsal ligule on anterior chaetigers, attached 2/3 to base of dorsal ligule, about 0.3x as long as dorsal ligule on posterior-half of anterior to mid-body chaetigers, subdistally attached to dorsal ligule on posterior chaetigers, distally attached to dorsal ligule, about 0.1x as long as dorsal ligule on posterior-most chaetigers (Fig. 7A–E).

Dorsal ligule subconical throughout, distal lobe of dorsal ligule greatly reduced in size on posterior-half of anterior to posterior chaetigers; expansion of dorsal ligule commenced at chaetiger 395, gradually increased thereafter, about 3.7x longer than median ligule at chaetiger 507 and thereafter (Fig. 7A–E). Notopodial prechaetal lobe present on posterior-half of anterior chaetigers to end of posterior chaetigers (Fig. 7B–E).

Median ligule conical throughout, about 2.0x longer than neuroacicular ligule (Fig. 7A–E).

Neuroacicular ligule with subequal inferior and superior lobes, about as long as ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule on anterior chaetigers, about 0.5x as long as ventral ligule on mid-body chaetigers, about 0.3x as long as ventral ligule on posterior chaetigers (Fig. 7A–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations present throughout, heterogomph spinigers present on posterior-half of anterior to posterior chaetigers (Fig. 7F).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 1 chaetiger.

Type locality: Fugang, Taitung City, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis fugangensis* sp. nov. has 20–21 bar-shaped paragnaths on area VI of the pharynx and greatly expanded notopodial dorsal ligule on posterior chaetigers, which can be categorized in group 3B proposed by Hutchings et al. (1991: 271) (Figs. 6B, 7E). This group of *Perinereis* has been represented by a single species, *P. maindroni* Fauvel, 1943 (type locality: Pondicherry (now known as Puducherry), India). *Perinereis fugangensis* sp. nov. can be easily distinguished from *P. maindroni* by paragnath patterns and notopodial morphology. *Perinereis fugangensis* sp. nov. has no paragnaths on area II (versus few cones in crescentic rows), many minute cones in a wide band on area IV (versus few in arcs), 10 scattered small cones and many minute cones in a wide band on area V (versus no paragnaths), 20 to 21 short bars and many minute cones in a wide band posteriorly on area VI (versus 5 to 6 short bars), and numerous minute cones on areas VII–VIII (versus 3 rows of cones) (Fig. 6B–E;

Fauvel 1943: 201). The expansion of dorsal ligule in *P. fugangensis* sp. nov. begins on posterior chaetigers, but that of *P. maindroni* starts on mid-body chaetigers (Fig. 7E; Fauvel 1943: 201, fig. 1h–i). Moreover, the expansion region of dorsal ligule on posterior chaetigers in *P. fugangensis* sp. nov. is the proximal lobe of dorsal ligule, whereas that of region of *P. maindroni* is the distal lobe of dorsal ligule (Fig. 7E; Fauvel 1943: 201,

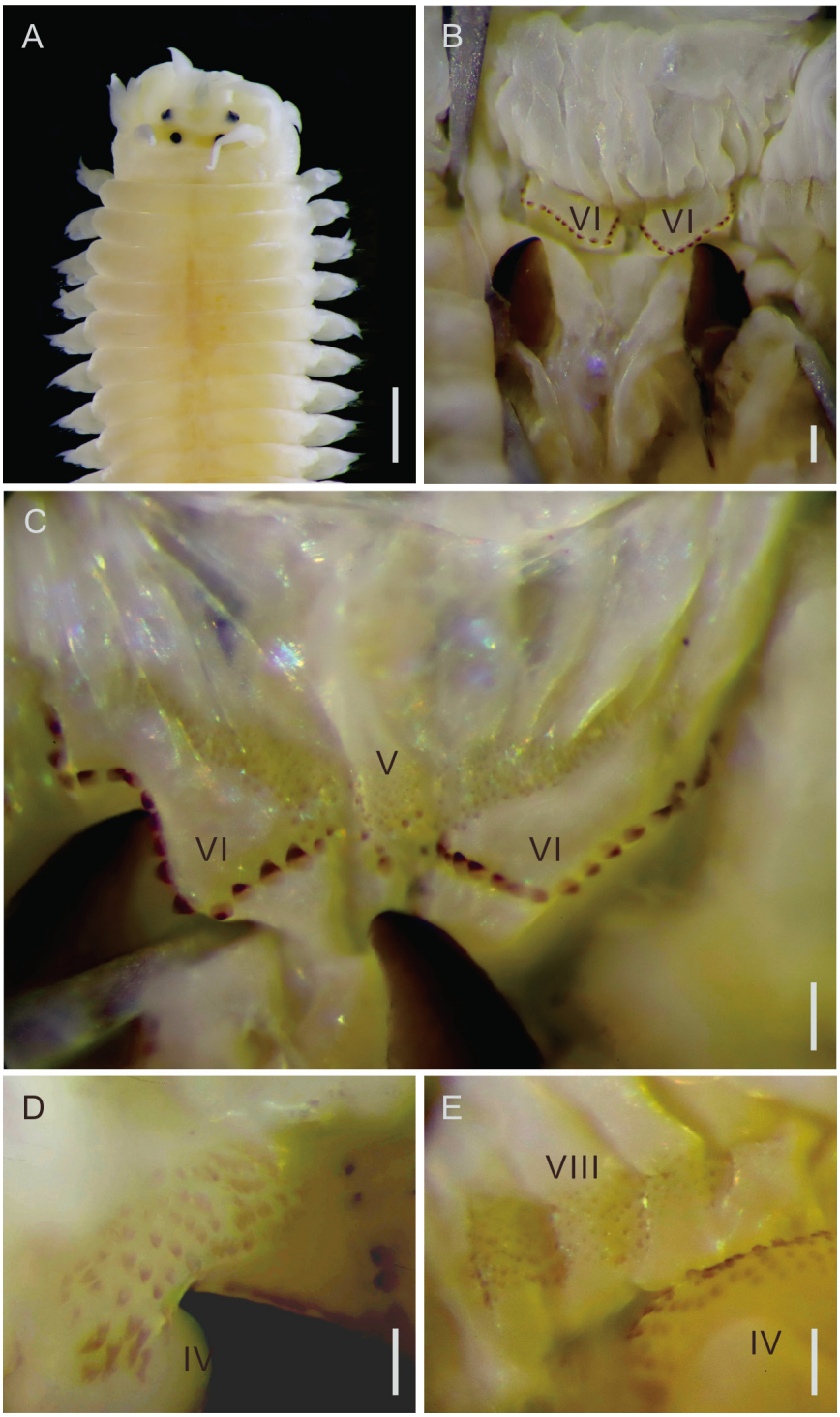

Fig. 6. *Perinereis fugangensis* sp. nov.; holotype (NSNM 8748-53): A, anterior body region, dorsal view; B, areas V and VI of the pharynx; C, close-up of areas V and VI of the pharynx; D, close-up of area IV of the pharynx; E, close-up of area of the pharynx. Scale bars: A = 1.0 mm; B, C = 0.2 mm; D, E = 0.1 mm.

fig. 1h–i).

Of the known congeners, *P. fugangensis* sp. nov., in fact, is rather similar to *P. neocaledonica* Pruvot, 1930 (type locality: New Caledonia), a member of the group 3A, in terms of paragnath patterns and parapodial morphology of posterior chaetigers (Hutchings et al. 1991). Both species have no paragnaths on areas I and II, many minute cones in a wide band on areas III and IV, many minute cones in a wide band posteriorly on areas V and VI, and numerous minutes cones in a wide band on areas VII–VIII (Pruvot 1930: 53, pl. III, fig. 77–79). Moreover, both species have greatly expanded dorsal ligule on posterior chaetigers (Fig. 7E; Pruvot 1930: 51, fig. IVb). However, Hutchings et al. (1991: 273) and Wilson and Glasby (1993: 262) suggested *P. neocaledonica* is a junior synonym of *P. caeruleis* (Hoagland, 1920), which has no greatly expanded dorsal ligule on posterior chaetigers and has been categorized in group 3A. Due to the above-mentioned authors had examined only non-type material of *P. caeruleis*. The

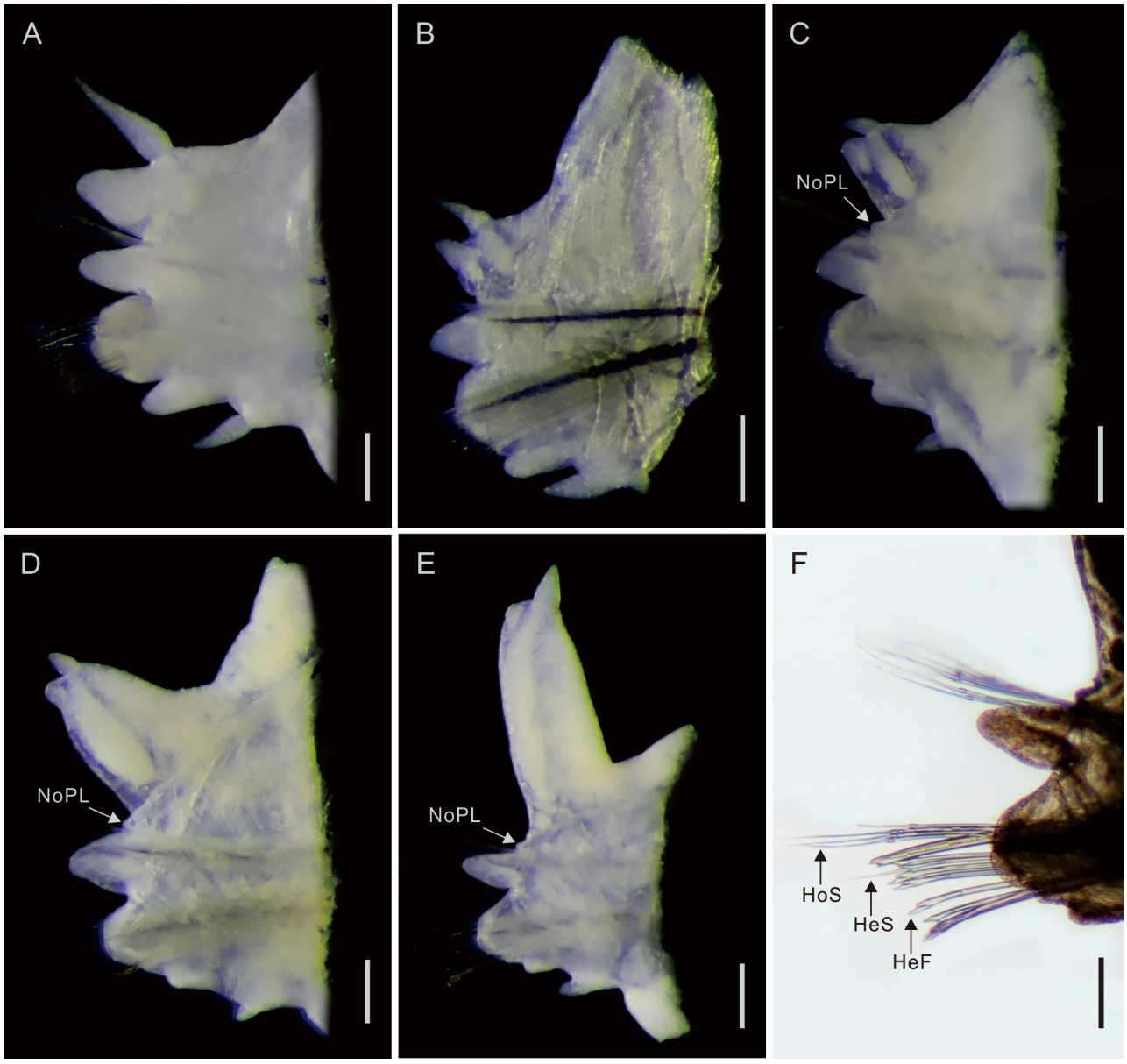

Fig. 7. *Perinereis fugangensis* sp. nov.; holotype (NSNM 8748-53): A, right parapodium, anterior view, chaetiger 10; B, right parapodium, anterior view, chaetiger 50; C, right parapodium, anterior view, chaetiger 159; D, right parapodium, anterior view, chaetiger 423; E, right parapodium, anterior view, chaetiger 507; F, chaetae of chaetiger 507. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; HoS = homogomph spiniger; NoPL = notopodial prechaetal lobe. Scale bars: A–E = 0.2 mm; F = 0.05 mm.

author herein treats *P. neocaledonica* as a valid species. In fact, Pruvot (1930: 54) commented that the type specimen of *P. caeruleis* is incomplete posteriorly and cannot be ascertain of its parapodial morphology on posterior chaetigers. On the contrary, *P. neocaledonica* is known to have greatly elongated dorsal ligule on posterior chaetigers (Pruvot 1930: 51–52, fig. IVb). With this evidence, *P. neocaledonica* should belong in group 3B. Despite morphological similarities between the two species, *P. fugangensis* sp. nov. can be distinguished from *P. neocaledonica* by having: 1) 10 small and many minute cones scattered on area V (versus one large and many minute cones); 2) short bars on area VI (versus cones); 3) smaller length ratio of expanded dorsal ligule to median ligule on posterior chaetigers (about 3.7 versus about 5.2 (based on the measurement from the drawing of fig. IVb in Pruvot 1930)); and 4) one elongated rectangle glandular mass in each of the center and proximal lobes of dorsal ligule on posterior chaetigers (versus one elongated rectangle glandular mass) (Figs. 6B, C, E, 7E; Pruvot 1930: 51–54, fig. IVb, pl. III, figs. 77–79).

It is worth mentioning that there are some morphological discrepancies between *P. neocaledonica* reported by Wu (1967) and the type by Pruvot (1930) in several aspects. Wu (1967: 74, fig. 12d) showed that the length ratio of dorsal ligule to median ligule on posterior chaetiger is only about 3.2, whereas that of ratio in the type is about 5.2 (Pruvot 1930: 51, fig. IVb). Moreover, Wu (1967: 73) stated that *P. neocaledonica* has neuropodial heterogomph spinigers present only on posterior chaetigers, but Pruvot (1930: 52) acknowledged the presence of neuropodial heterogomph spinigers at the beginning of middle third of the body segments to posterior chaetigers.

Perinereis houbihuensis sp. nov.

(Fig. 8, Table 2)
urn:lsid:zoobank.org:act:98CAF5A1-D840-4902-9628-30579ED51AAB

Material examined: Holotype, NSNM 8748-54, Houbihu Harbor (21°56.32'N, 120°44.73'E), habitat type: SRHB, 19 November 2010.

Etymology: The name is derived from the name of Houbihu Harbor, where the worm was collected.

Description: Holotype, atoke, complete, body length 74.5 mm with 72 chaetigers, chaetiger 10 width 2.5 mm, excluding parapodia; beige in alcohol (Fig. 8A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt longer than chaetiger 1. Pharynx with dark brown jaws, each with 5 teeth; paragnath pattern: I = 2 uneven size cones, in longitudinal line, larger cone with square base, located posteriorly; II = 11 (left), 12 (right), in 3 oblique rows; III = 19, in oval-shaped patch, without lateral teeth; IV = 16 (left), 12 (right), in 3 oblique rows, without bars; V = 1; VI = 1 (left), 1 (right), short bars; VII–VIII = 33, in 2 rows. Ridge pattern of areas VI–V–VI, χ-shaped (Fig. 8A, B, Table 2).

Dorsal cirri digitiform with base bulged, attached 1/3 to base of dorsal ligule, about 0.5x as long as dorsal ligule on anterior chaetigers, medially attached to dorsal ligule, about 0.5x as long as dorsal ligule on mid-body to posterior chaetigers (Fig. 8C–E, Table 2).

Dorsal ligule conical on anterior chaetigers, about 1.8x longer than median ligule, subconical on mid-body to posterior chaetigers, about 2.3–2.5x longer than median ligule; center and proximal lobes of dorsal ligule each with one irregular-shaped glandular mass on posterior chaetigers (Fig. 8E, G, I, Table 2). Notopodial prechaetal lobe present throughout (Fig. 8C–F, I, Table 2).

Median ligule with truncated tip on anterior chaetigers, as long as neuroacicular ligule, subconical on mid-body chaetigers, about 2.0x longer than neuroacicular ligule on mid-body chaetigers, about 2.0x long than neuroacicular ligule on posterior chaetigers (Fig. 8C–E).

Neuroacicular ligule with subequal inferior and superior lobes throughout, about as long as ventral ligule on anterior to mid-body chaetigers, about 0.8x as long as ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule conical on anterior chaetigers, subconical on mid-body to posterior chaetigers. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about as long as ventral ligule throughout (Fig. 8C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout; some abnormal posterior chaetigers with only one simple chaeta and losing both heterogomph falcigers and heterogomph spinigers (Fig. 8I). Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations present throughout, heterogomph spinigers present only on posterior chaetigers (Fig. 8F–H, J, K, Table 2); some abnormal posterior chaetigers losing both heterogomph falcigers and heterogomph spinigers (Fig. 8I).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 3 chaetigers (Table 2).

Type locality: Houbihu Harbor, Pingtung County, Taiwan.

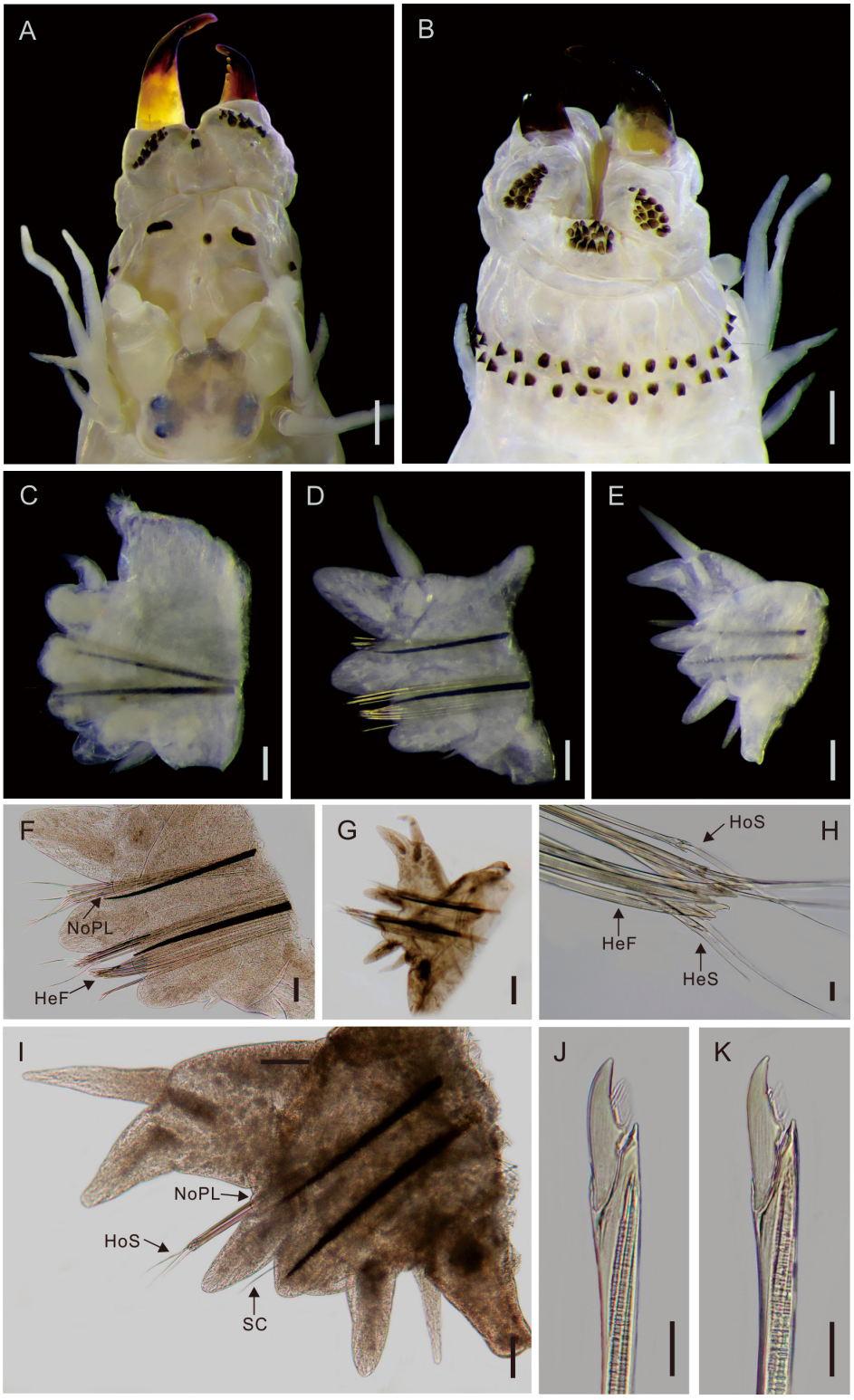

Fig. 8. *Perinereis houbihuensis* sp. nov.; holotype (NSNM 8748-54): A, anterior body region, dorsal view; B, anterior body region, ventral view; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 35; E, right parapodium, anterior view, chaetiger 59; F, close-up of chaetiger 35, anterior view; G, close-up of chaetiger 56, anterior view; H, neuropodial chaetae of chaetiger 56; I, close-up of chaetiger 59, anterior view; J, K, neuropodial heterogomph falciger, chaetiger 10. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; HoS = homogomph spiniger; NoPL = notopodial prechaetal lobe; SC, simple chaeta. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F, I = 0.1 mm; G = 0.2 mm, J, K = 0.02 mm.

Distribution: Known only from type locality.

Remarks: *Perinereis houbihuensis* sp. nov. has one bar-shaped paragnath on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers, which would include it in group 1A proposed by Hutchings et al. (1991: 271) (Fig. 8A, E). Seven species in this group were reported from East and Southeast Asia, which are: *Perinereis calmani* (Monro, 1926), *P. cultrifera* (Grube, 1840), *P. dongalae* (Horst, 1924), *P. euiini* Park and Kim, 2017, *P. floridana* (Ehlers, 1868), *P. helleri* (Grube, 1878), and *P. tenuisetis* (Fauvel, 1915) (Wu 1967; Imajima 1972; Wu et al. 1981 1985; Sun and Yang 2004; Glasby et al. 2016; Park and Kim 2017). Of these seven species, only *P. floridana* has the similar paragnath patterns as *P. houbihuensis* sp. nov. on areas I, III, V and VI (2, 1, 19 without lateral teeth, and 1 versus 2, 1, 16 without lateral teeth and 1, respectively) (de León-González and Solís-Weiss 1998: 684). However, *P. houbihuensis* sp. nov. can be distinguished from *P. floridana* by having: 1) χ-shaped ridge pattern on areas V–VI–V (versus λ-shaped ridge pattern); 2) notopodial prechaetal lobe present on chaetigers of all body regions (versus absent); 3) the center and proximal lobes of dorsal ligule each with one irregular-shaped glandular mass on posterior chaetigers (versus absent); and 4) neuropodial heterogomph spinigers present only on posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 8B, C, E, H, Table 2; de León-González and Solís-Weiss 1998: 684–685, fig. 6B–E).

Hutchings et al. (1991: 255) suggested that the length ratio of dorsal cirri to dorsal ligule is not an reliable character for species identification in the 1A group of the genus and has not been used herein for comparing differences between congers. The differences between *P. houbihuensis* sp. nov. and four other new species of the 1A group described in the present study are discussed below.

Perinereis hsinchuensis sp. nov.

(Fig. 9, Table 3)

urn:lsid:zoobank.org:act:E71CE585-7333-457B-91F1-A5A306582487

Material examined: Holotype, NSNM 8748-55, Hsinchu Harbor (24°51.00'N, 120°55.48'E), habitat type: SRHB, 1 September 2019.

Etymology: The name is derived from the Hsinchu Harbor, where the worm was collected.

Description: Holotype, atoke, without posterior end, remaining body length 23.5 mm with 59 chaetigers, chaetiger 10 width 1.2 mm, excluding parapodia; beige in alcohol (Fig. 9A–C). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.4x longer than chaetiger 1. Pharynx with dark brown jaws, each with 6 teeth; paragnath pattern: I = 3 large cones, in longitudinal line; II = 16 (left), 17 (right), in 2–3 oblique rows; III = 21 (center region with 17 cones, in oval-shaped patch; 2 lateral regions, each with 1 or 3 cones); IV = 26 (left), 30 (right), in 4–5 oblique rows, without bars; V = 3, in triangle; VI = 3 (left), 3 (right), uneven-length smooth bars in transverse row; VII–VIII = 37, in 2 rows. Ridge pattern of areas VI–V–VI, χ-shaped (Fig. 9B and C, Table 3).

Dorsal cirri digitiform, medially attached to base of dorsal ligule, about 0.7x as long as dorsal ligule on anterior chaetigers, attached 1/3 to base of dorsal ligule on mid-body chaetigers, about 0.8x as long as dorsal ligule, attached 2/3 to base of dorsal ligule on posterior chaetigers, about 0.5x as long as dorsal ligule (Fig. 9D–F, Table 3).

Dorsal ligule subconical throughout, about 2.4x longer than median ligule on anterior chaetigers, about 1.9–2.0x longer than median ligule on mid-body to posterior chaetigers; center lobe of dorsal ligule with one round glandular mass on posterior chaetigers (Fig. 9D–F, Table 3). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, about as long as neuroacicular ligule on anterior to mid-body chaetigers, about 1.8x longer than neuroacicular ligule on posterior chaetigers (Fig. 9D–F).

Neuroacicular ligule with subequal inferior and superior lobes, as long as ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, as long as ventral ligule on anterior to mid-body chaetigers, about 1.2x longer than ventral ligule on posterior chaetigers (Fig. 9D–F).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-sized blade heterogomph falcigers with serrations present throughout (Fig. 9G, H, Table 3). Subacicular fascicle of neuropodia: medium-size blade heterogomph falcigers with serrations present throughout, heterogomph spinigers present only on anterior to mid-body chaetigers (Fig. 9G, H, Table 3).

Type locality: Hsinchu Harbor, Hsinchu City, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis hsinchuensis* sp. nov. has an arc of three bar-shaped paragnaths on each side of area VI of the pharynx and not greatly expanded notopodial

dorsal ligule on posterior chaetigers, which include it in group 3A, as well as the *Perinereis nuntia* species group (Fig. 9B, F; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species in this species group recognized by Villalobos-Guerrero (2019), only *P. viridis* Glasby and Hsieh, 2006 is similar to *P. hsinchuensis* sp. nov., because both species have uneven bar-shaped paragnaths and number of paragnaths ranging in 2–4 on area VI, and presence of lateral paragnaths on area III (Fig. 9B, C, Table 3; Glasby and Hsieh 2006: 562, 569–570, fig. 9A–B, table 2; Villalobos-Guerrero 2019: 489). However, *P. hsinchuensis* sp. nov. differs from *P. viridis* in terms of having: 1) cones only on area IV (versus cones and bars), 2) three paragnaths on area V (versus one); 3)

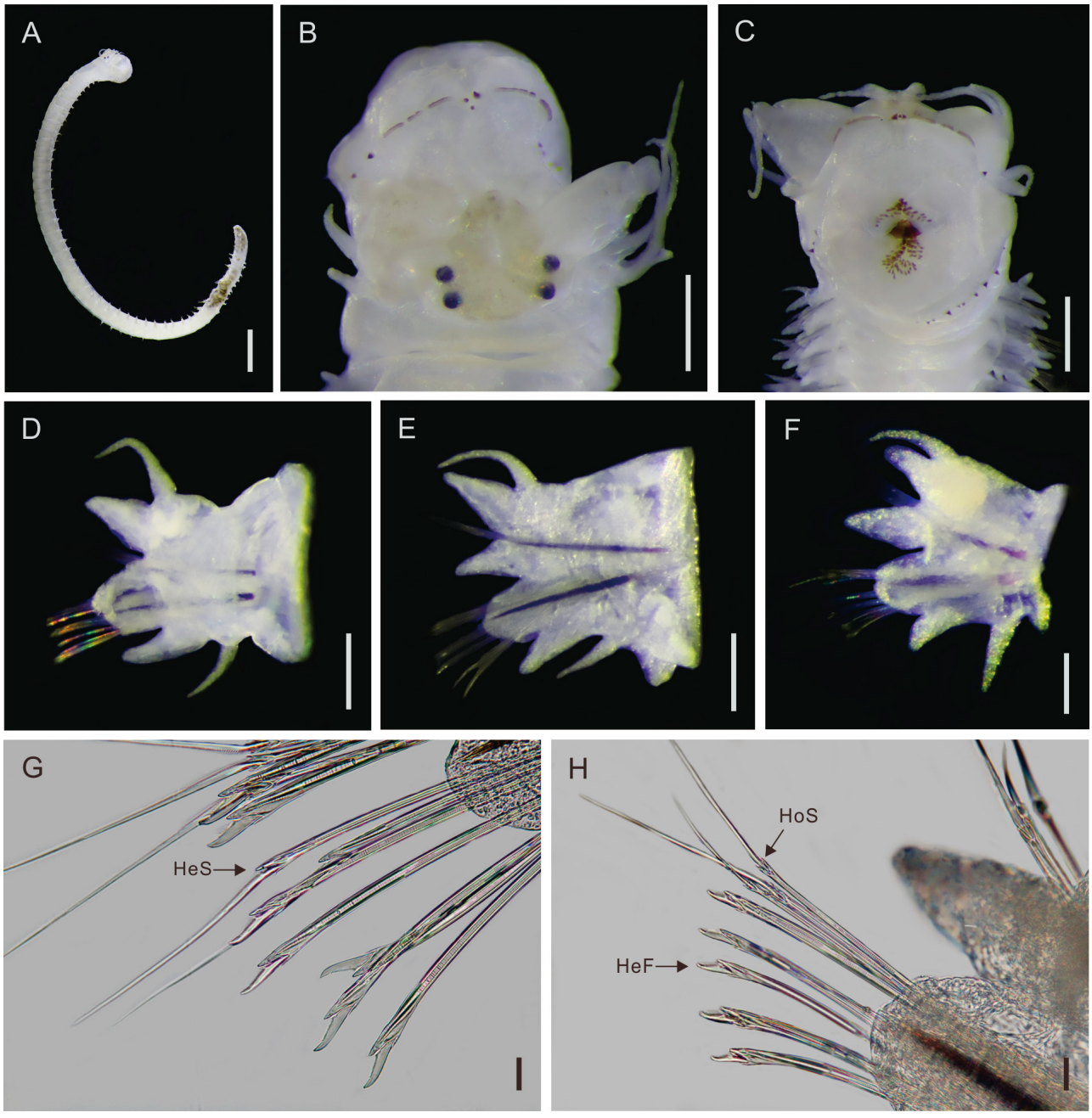

Fig. 9. *Perinereis hsinchuensis* sp. nov.; holotype (NSNM 8748-55): A, whole animal, lateral view; B, anterior body region, dorsal view; C, anterior body region, frontal view; D, right parapodium, anterior view, chaetiger 10; E, right parapodium, anterior view, chaetiger 24; F, right parapodium, anterior view, chaetiger 49; G, chaetae of chaetiger 24; H, chaetae of chaetiger 49. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; HoS = homogomph spiniger. Scale bars: A = 2.0 mm; B, C = 0.5 mm; D, E = 0.2 mm; F = 0.1 mm; G, H = 0.02 mm.

ɔc-shaped ridge pattern of area areas VI–V–VI (versus χ-shaped ridge pattern); 4) dorsal cirri about 0.5x as long as dorsal ligule on posterior chaetigers (versus as long as dorsal ligule); 5) one round glandular mass in the center lobe of dorsal ligule on posterior chaetigers (versus one irregular-shaped glandular mass in each of the center and proximal lobes of dorsal ligule); and 6) neuropodia without heterogomph spinigers on posterior chaetigers (versus present throughout all body regions) (Fig. 9B, C, F, H, Table 3; Glasby and Hsieh 2006: 562, 569–570, fig. 9A–D, table 2; Villalobos-Guerrero 2019: 489). The differences between *P. hsinchuensis* sp. nov. and eight other new species of the 3A group described in the present study are discussed below.

Perinereis kaomeiensis sp. nov.

(Fig. 10, Table 3)
urn:lsid:zoobank.org:act:FBF66483-C273-4161-972B-16B6C2233621

Material examined: Holotype, NMNS 3031-2, Kaomei (24°18.50'N, 120°32.42'E), habitat type: ISSB, coll. S-M Chao, 2 November 1997.

Etymology: The name is derived from the name of nearby village, Kaomei, where the worm was collected.

Description: Holotype, epitoke, complete, body length 98.0 mm with 180 chaetigers, chaetiger 10 width 5.0 mm, excluding parapodia; light brown in alcohol (Fig. 10A, B). Prostomium wider than long, lateral antennae antero-lateral, longer than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 8. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.5x longer than chaetiger 1. Pharynx with dark brown jaws, each with 4 teeth; paragnath pattern: I = 9, in cluster; II = 17 (left), 18 (right), in 2 oblique rows; III = 54, in 5–6 transverse rows; IV = 22 (left), 25 (right), in 4–6 oblique rows, without bars; V = 5, in cluster; VI = 5 (left), 4 (right), even length short bars in transverse row; VII–VIII = 52, in 2–3 rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 10A–C, Table 3).

Pre-natatory region: Dorsal cirri robust with filament distally on chaetiger 1 to 7, basally or medially attached to dorsal ligule, about 1.3x longer than dorsal ligule, digitiform on chaetiger 8 to 20, medially attached to dorsal ligule, about 0.8x as long as dorsal ligule. Dorsal ligule subconical. Notopodial prechaetal lobe present. Median ligule subconical. Neuroacicular ligule with predominant inferior lobe. Neuropodial postchaetal lobe absent. Ventral ligule subconical. Ventral cirri robust with filament distally on chaetiger 1 to 7, becoming digitiform from chaetiger 8 to 20, mid-ventrally attached to ventral edge of parapodia, about 0.8x as long as ventral ligule. Notochaetae homogomph spinigers. Supra-acicular fascicle of neuropodia: homogomph spinigers and long blade heterogomph falcigers with narrow serrations. Subacicular fascicle of neuropodia: homogomph spinigers and long blade heterogomph falcigers with narrow serrations (Fig. 10D, J, Table 3).

Natatory region: Dorsal cirri digitiform, medially attached to dorsal ligule, about 0.6x as long as dorsal ligule; dorsal cirrus with small lobe presence from chaetiger 21, becoming large auricular lobe from chaetiger 24 to mid-body chaetigers, reduced progressively in size thereafter, absent on posterior half of posterior chaetigers. Dorsal ligule subconical. Notopodial prechaetal lobe absent. Median ligule subconical throughout, slightly longer than neuroacicular ligule, with small lobe close to base of dorsal surface on all natatory chaetigers, with irregular-shaped lobe at base of ventral surface on posterior-half of natatory chaetigers. Neuroacicular ligule with predominant inferior lobe, about as long as ventral ligule. Large neuropodial postchaetal lamella present on posterior-half of natatory chaetigers. Ventral ligule subconical, with small lobe close to base of dorsal surface throughout natatory chaetigers. Ventral cirri attached to base of parapodia, about 1.6x longer than ventral ligule with irregular-shaped dorsal and ventral lobes on anterior-half of natatory chaetigers, gradually reduced in size thereafter. Notochaetae homogomph spinigers absent, replaced by sesquigomph natatory chaetae. Supra-acicular fascicle of neuropodia: homogomph spinigers and heterogomph falcigers absent, replaced by sesquigomph natatory chaetae. Subacicular fascicle of neuropodia: homogomph spinigers and heterogomph falcigers absent, replaced by single sesquigomph natatory chaeta (Fig. 10E, F, H, I, K, Table 3).

Post-natatory region: Dorsal cirri digitiform, medially attached to dorsal ligule, about 0.5x as long as dorsal ligule. Dorsal ligule subconical, not greatly expanded, about 2.1x longer than median ligule. Notopodial prechaetal lobe absent. Median ligule subconical, with small lobe close to base of dorsal surface on all chaetigers. Neuroacicular ligule with predominant inferior lobe, about as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical. Ventral cirri digitiform, with small irregular-shaped lobe on dorsal surface, shorter than ventral ligule. Notochaetae homogomph spinigers absent. Supra-acicular fascicle of neuropodia: homogomph spinigers and heterogomph falcigers absent. Subacicular fascicle of neuropodia: single heterogomph falciger and single homogomph spiniger present (Fig. 10G, L, M, Table 3).

Pygidium with anus crenulated, opened dorsally,

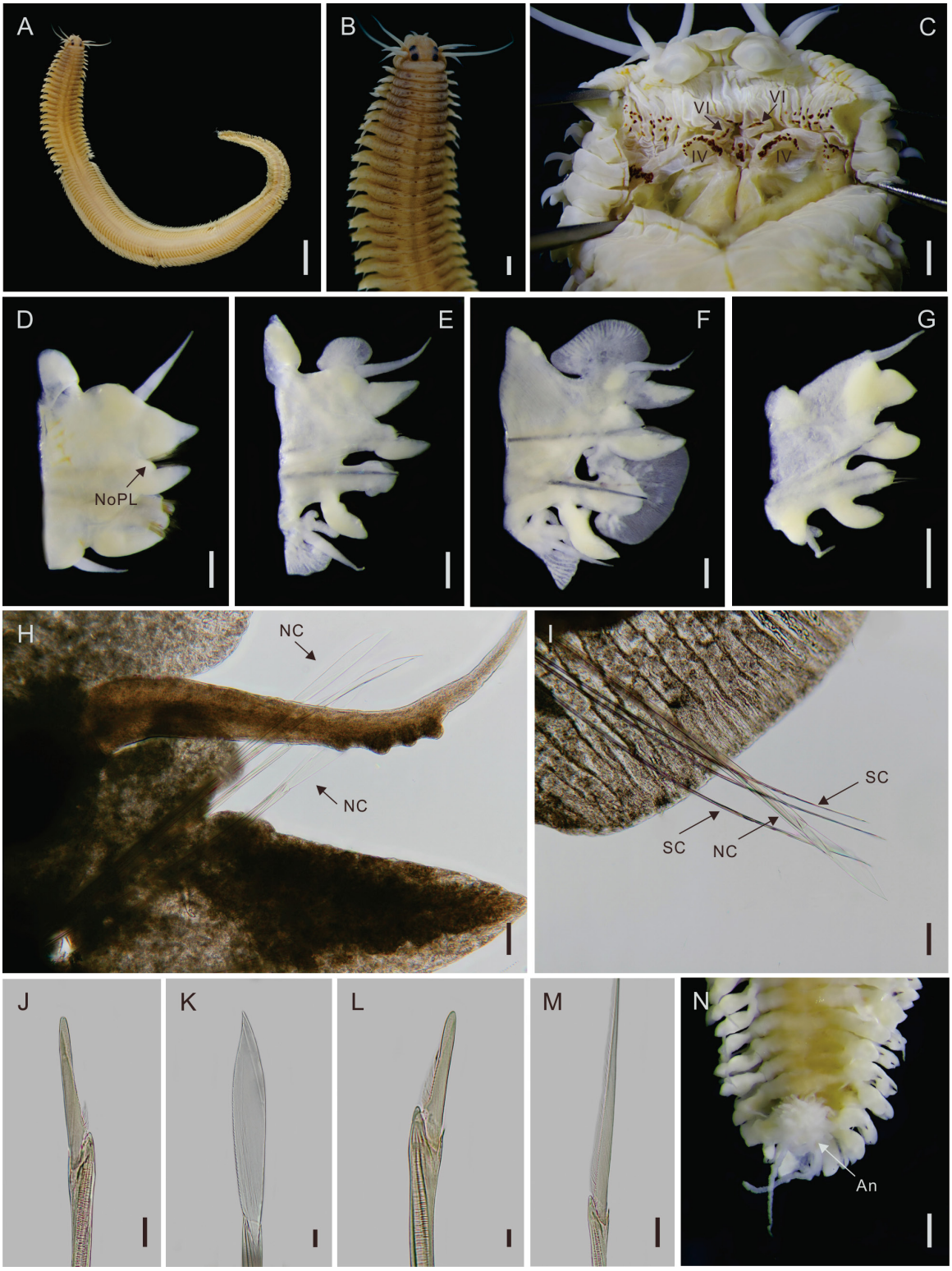

Fig. 10. *Perinereis kaomeiensis* sp. nov.; holotype (NSNM 3031-2): A, whole animal, lateral view; B, anterior body region, dorsal view; C, paragnath patterns of the pharynx; D, left parapodium, anterior view, chaetiger 10; E, left parapodium, anterior view, chaetiger 24; F, left parapodium, anterior view, chaetiger 71; G, right parapodium, anterior view, chaetiger 145; H, close-up of notopodium, chaetiger 71; I, close-up of neuropodium, chaetiger 71; J, neuropodial heterogomph falciger, chaetiger 15; K, natatory chaeta, chaetiger 71; L, neuropodial heterogomph falciger, chaetiger 173; M, neuropodial heterogomph spiniger, chaetiger 15; N, posterior end of the body. Abbreviations: An = Anus; NC = natatory chaeta; NoPL = notopodial prechaetal lobe; SC, simple chaeta. Scale bars: A = 5.0 mm; B = 1.0 mm; C–G, N = 0.5 mm; H–M = 0.02 mm.

surrounded by papillae; anal cirri cirriform, as long as last 9 chaetigers (Fig. 10N).

Type locality: Kaomei tidal flat, Taichung City, Taiwan.

Distribution: Known only from type locality.

Remarks: With an arc of 4–5 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers, *P. kaomeiensis* sp. nov. can be categorized in group 3A, together with *Perinereis nuntia* species group (Fig. 10C, G, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 species in this species group recognized by Villalobos-Guerrero (2019), only *P. mictodonta* (Marenzeller, 1879) and *P. nuntia* (Lamarck, 1818) have paragnath patterns on areas V and VI that are somewhat similar to *P. kaomeiensis* sp. nov., which have 0–5 cones on area V and 4–10 bars on area VI (Fig. 10C, Table 3; Glasby and Hsieh 2006: 562, table 2; Villalobos-Guerrero 2019: 489). However, *P. kaomeiensis* sp. nov. differs from *P. mictodonta* by having; 1) greater number of paragnaths on area I (9 versus 1–5 (type) or 2–6 (Taiwan); 2) no lateral paragnaths on area III (versus present); 3) even-length bars on area VI (versus uneven-length bars); 4) ɔc-shaped ridge pattern of areas VI–V–VI (versus χ-shaped ridge pattern); 5) notopodial prechaetal lobe present on pre-natatory chaetigers (versus absent in all chaetigers); 6) smaller length ratio of dorsal cirri to dorsal ligule on anterior and posterior chaetigers (about 0.8 and about 0.5 versus 1.07 and 1.04, respectively); 7) no glandular mass in the proximal lobe of dorsal ligule (versus two irregular-shaped glandular masses); 8) only one small lobe at dorsal base of ventral cirri on anterior-half of post-natatory chaetigers (versus auricular lobes continuing to within 10–25 chaetigers before pygidium); and 9) long blade neuropodial heterogomph falcigers (medium-sized blade heterogomph falcigers) (Fig. 10C, D, G, L, Table 3; Glasby and Hsieh 2006: 559–562, fig. 5A–F, table 2; Villalobos-Guerrero 2019: 489).

Perinereis kaomeiensis sp. nov. can be distinguished from *P. nuntia* by having; 1) greater number of paragnaths on areas I and III (9 and 54 versus 1–3 (Red Sea) or 0–5 (all) and 9–17 (Red Sea) or 1–30 (all), respectively); 2) no lateral paragnaths on area III (versus present); 3) only bars on area VI (versus bars and cones); 4) ɔc-shaped ridge pattern of areas VI–V–VI (versus χ-shaped ridge pattern); 5) notopodial prechaetal lobe present on pre-natatory chaetigers (versus absent in all chaetigers) and 6) long blade neuropodial heterogomph falcigers (medium-sized blade heterogomph falcigers) (Fig. 10C, D, L, Table 3; Glasby and Hsieh 2006: 562–565, fig. 6A–E, table 2; Villalobos-Guerrero 2019: 471, 489). The differences between *P. kaomeiensis* sp. nov. and eight other new species of group 3A described in the present study are discussed below.

***Perinereis kebalanae* sp. nov.**

(Fig. 11, Table 4)

urn:lsid:zoobank.org:act:E8412AC0-FAFC-4879-AAF7-A05F4C296129

Material examined: Holotype, NSNM 8748-56, Daxi (24°56.59'N, 121°54.23'E), habitat type: IRHB, 25 April 2000. Paratypes: 1 specimen, NSNM 8748-57, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 17 March 2006; 1 specimen, NSNM 8748-58, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27 March 2014.

Etymology: The name is derived from the Kebalan aboriginal tribe, who has settled to northeastern of Taiwan in 13th century.

Description: Based on holotype (atoke, complete) and paratypes (atoke, complete): body length 39.0 (32.5–52.5) mm with 101 (103–105) chaetigers, chaetiger 10 width 2.0 (2.6–3.0) mm, excluding parapodia; beige in alcohol (Fig. 11A). Prostomium wider than long, lateral antennae antero-lateral, as long as palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.4x (1.2–1.3x) longer than chaetiger 1. Pharynx with dark brown jaws, each with 6 teeth; paragnath pattern: I = 1; II = 19 (19–25) (left), 25 (16–20) (right), in 4 oblique rows; III = 35 (30–35), in 4 transverse rows; IV = 50+4 p-bars near jaw (49–54+3–4 p-bars) (left), 52+4 p-bars near jaw (50+4 p-bars) (right), in 4–6 oblique rows; V = 1; VI = 1 (left), 1 (right), smooth bars; VII–VIII=37 (33–38), in 3 rows. Ridge pattern of areas VI–V–VI, u-shaped (Fig. 11B, Table 4).

Dorsal cirri digitiform throughout, medially attached to dorsal ligule, about 1.2–1.3x longer than dorsal ligule on anterior to mid-body chaetigers, subdistally attached to dorsal ligule on posterior chaetigers, about 0.6x as long as dorsal ligule (Fig. 11C–E).

Dorsal ligule conical on anterior chaetigers, about 2.0x longer than median ligule, subconical on mid-body chaetigers, about 2.3x longer than median ligule, becoming rectangular and greatly elongated on posterior chaetigers, about 3.5x longer than median ligule (Fig. 11C–E). Notopodial prechaetal lobe absent.

Median ligule conical, about 1.7x longer than neuroacicular ligule on anterior chaetigers, subconical on mid-body to posterior chaetigers, about 1.5x longer than neuroacicular ligule on mid-body chaetigers, about as long as neuroacicular ligule on posterior chaetigers

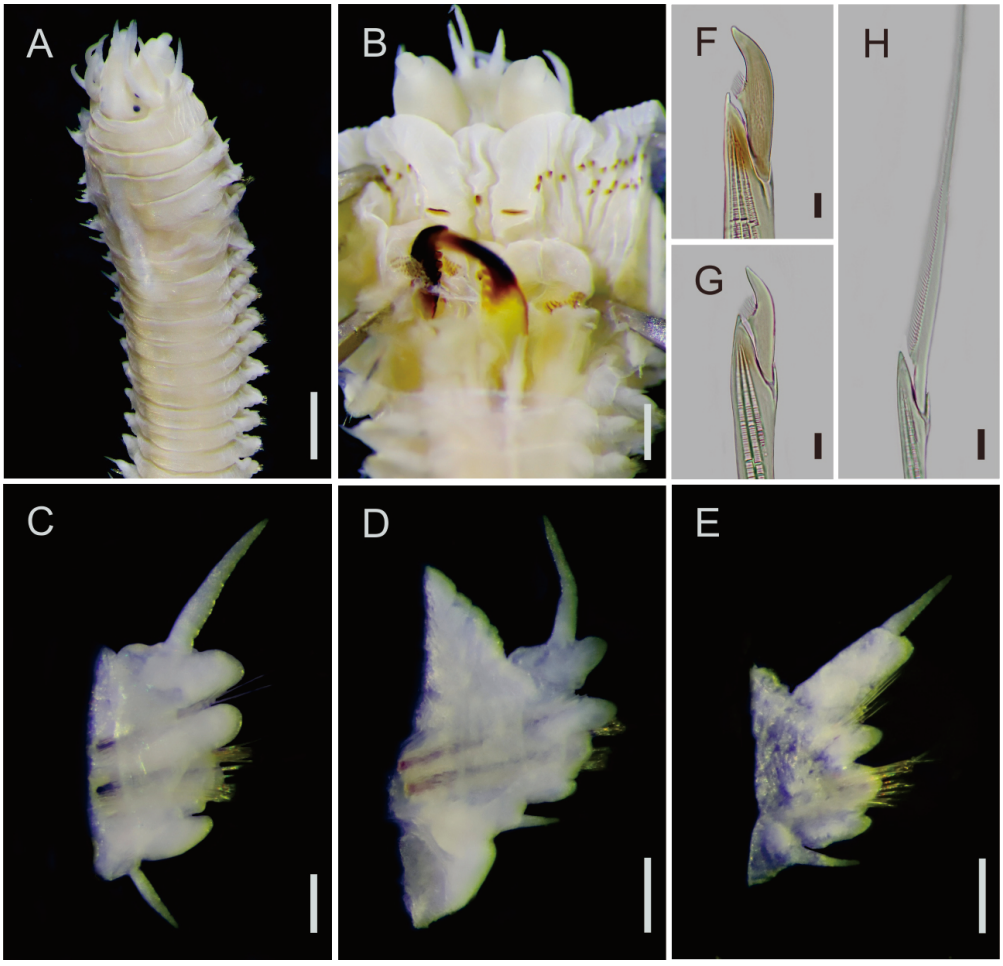

Fig. 11. *Perinereis kebalanae* sp. nov.; holotype (NSNM 8748-56): A, anterior body region, dorsal view; B, paragnath patterns of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 36; E, right parapodium, anterior view, chaetiger 78; F, G, neuropodial heterogomph falciger, chaetiger 76; H, neuropodial heterogomph spiniger, chaetiger 76. Scale bars: A = 1.0 mm; B = 0.5 mm; C–E = 0.2 mm; F–H = 0.02 mm.

Table 4. Key characters of *Perinereis* species described in the present study of group 1B

Taxon\Categories	LTC	TJ	I	IIL, IIR	III/LT	IVL, IVR	V	VIL, VIR	VII–VIII	RP VI–V–VI
P. kebalanae sp. nov.	3	6, 6	1	19–25, 20–25	30–35/Absent	50–54+4 bars, 5?–52+2-4 bars	1	1, 1	33–37	u-shaped
P. nigropunctata (Horst, 1889)	1–7	5–6, 5–7	3–11	6–23, 6–25	20–29/Present	17–31, 19–35	2–5	1, 1	25–39	λ-shaped
P. wanlitongensis sp. nov.	3–4	5–6. 5–6	2	11–12, 13	20/Present	22–24, 24–27	3–4	1, 1	23–33	λ-shaped

Taxon\Categories	DC/DL AC	DC/DL MC	DC/DL PC	DL/ML PC	NoPL	GM in DL PC	SP/SB AC	SP/SB MC	SP/SB PC	AnC
P. kebalanae sp. nov.	1.3	1.2	0.6	3.5	Absent	0	HoS, HeF/ HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	3–7
P. nigropunctata (Horst, 1889)	1.0	0.5	0.4	3.3	Present throughout	1	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	2–4
P. wanlitongensis sp. nov.	0.8	0.8	0.3	4.2	Absent	3	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	HoS, HeF/ HeS, HeF	3–8

Abbreviations: AC = anterior chaetigers; AnC = last chaetiger reached by anal cirri; DC = dorsal cirri; DL = dorsal ligule; GM = glandular mass; LT = lateral teeth; LTC = chaetigers reached by longest tentacular cirri; MC = mid-body chaetigers; NoPL = notopodial prechaetal lobe; PC = posterior chaetigers; RP = ridge pattern of areas VI–V–VI; SB = subacicular fascicle; SP = supra-acicular fascicle; TJ = lateral teeth of jaws.

(Fig. 11C–E).

Neuroacicular ligule with subequal inferior and superior lobes throughout, slightly longer than ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about as long as ventral ligule throughout (Fig. 11C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations present throughout, heterogomph spinigers present on mid-body to posterior chaetigers (Fig. 11F–H, Table 4).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 7 (1–3) (n = 3) chaetigers.

Type locality: Daxi, Yilan County, Taiwan.

Distribution: Know from type locality, Shimen (New Taipei City) and Jihuei (Taitung County), Taiwan.

Remarks: *Perinereis kebalanae* sp. nov. has one bar-shaped paragnath on area VI of the pharynx and greatly expanded notopodial dorsal ligule on posterior chaetigers, which implies it be categorized in group 1B proposed by Hutchings et al. (1991: 271) (Fig. 11B, E, Table 4). Six species in this group were reported from East and Southeast Asia, which are: *Perinereis amblyodonta* (Schmarda, 1861), *P. barbara* (Monro, 1926), *P. malayana* (Horst, 1889), *P. nigropunctata* (Horst, 1889), *P. obfuscata* (Grube, 1878), and *P. suluana* (Horst, 1924) (Wu 1967; Wu et al. 1981 1985; Sun and Yang 2004; Glasby et al. 2016). Of these six species, only *P. amblyodonta* and *P. barbara* are similar to *P. kebalanae* sp. nov., because all have conical and bar-shaped paragnaths on area IV (Fig. 11B, Horst 1889: 168; Fauvel 1915: 7; Hutchings et al. 1991: 248; 250, 257–258, 263). However, *P. kebalanae* sp. nov. can be distinguished from *P. amblyodonta* by having: 1) one conical paragnath on area I (versus 2–5); 2) only bar-shaped paragnaths on area VI (versus bar-shaped and conical paragnaths); 3) dorsal cirri not greatly exceeding dorsal ligule in length, with about 1.2–1.3x longer than dorsal ligule on anterior chaetigers (versus greatly exceeding dorsal ligule in length); 4) greater length ratio of dorsal cirri to dorsal ligule on posterior chaetigers (about 0.6 versus about 0.3 (based on measurement from the drawing of fig. 3f in Hutchings et al. 1991)); 5) smaller length ratio of dorsal ligule to median ligule on posterior chaetigers (about 3.5 versus about 5.0 (based on measurement from the drawing in fig. 3f in Hutchings et al. 1991)); 6) no notopodial prechaetal lobe (versus present on anterior chaetigers); and 7) neuropodial heterogomph spinigers present on mid-body to posterior chaetigers (versus absent on chaetigers of all body regions) (Fig. 11B, C, E, H, Table 4; Hutchings et al. 1991: 247–248, fig. 3a–f).

Perinereis kebalanae sp. nov. is clearly different from *P. barbara* by having: 1) greater number of paragnaths on areas II and III (15–29 and 30–35 versus 6–14 and 3–7, respectively); 2) greater number of cones on area IV (50–54 versus 9–23); 3) fewer number of paragnaths on area V (1 versus 2–7); 4) only bar-shaped paragnaths on area VI (versus bar-shaped and conical paragnaths); 5) fewer number of paragnaths on areas VII–VIII (33–37 versus 45–101); 6) dorsal cirri subdistally attached to dorsal ligule on posterior chaetigers (versus attached 2/3 from the base of dorsal ligule); 7) greater dorsal cirri to dorsal ligule length ratio on anterior, mid-body, and posterior chaetigers (1.3, 1.2 and 0.6 versus 0.6, 0.5, and 0.5, respectively (based on the measurement from fig. 4b, d, e in Hutchings et al. 1991)); 8) dorsal ligule rectangular basally, about 3.5x longer than median ligule on posterior chaetigers (versus very broad basally and curved dorsally, about 2.5x (based on the measurement from fig. 4e in Hutchings et al. 1991) longer than median ligule on posterior chaetigers); 9) no notopodial prechaetal lobe (versus present on anterior to mid-body chaetigers); and 10) neuropodial heterogomph spinigers present on mid-body to posterior chaetigers (versus absent on chaetigers of all body regions) (Fig. 11B–E, H, Table 4; Hutchings et al. 1991: 249–250, fig. 4b, d, e). The differences between *P. kebalanae* sp. nov. and the other new species of group 1B described in the present study are discussed below.

Perinereis liuqiuensis sp. nov.

(Fig. 12, Table 3)

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Material examined: Holotype, NSNM 8748-59, Yufu (22°20.90'N, 120°23.38'E), habitat type: ISSB, 11 May 2000.

Etymology: The name is derived from the name of a small offshore island, Liuqiu, southwestern Taiwan, where the worm was collected.

Description: Holotype, atoke, complete, body length 122.0 mm with 167 chaetigers, chaetiger 10 width 4.2 mm, excluding parapodia; beige in alcohol (Fig. 12A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 5. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 5. Pharynx with dark brown jaws, each with 3 teeth; paragnath pattern: I = 3, in

longitudinal line; II = 9 (left), 12 (right), in cluster; III = 17 (center region with 13 cones, in 3 transverse rows; 2 lateral regions, each with 2 cones in longitudinal line); IV = 17 (left), 22 (right), in 3 oblique rows, without bars; V = 3, in triangle; VI = 9 (left), 9 (right), even length short bars in transverse row; VII–VIII = 29, in 2 rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 12B, Table 3).

Dorsal cirri digitiform, medially attached to dorsal ligule throughout, about 0.5x as long as dorsal ligule on anterior to mid-body chaetigers, about 0.3x as long as dorsal ligule on posterior chaetigers (Fig. 12C–E,

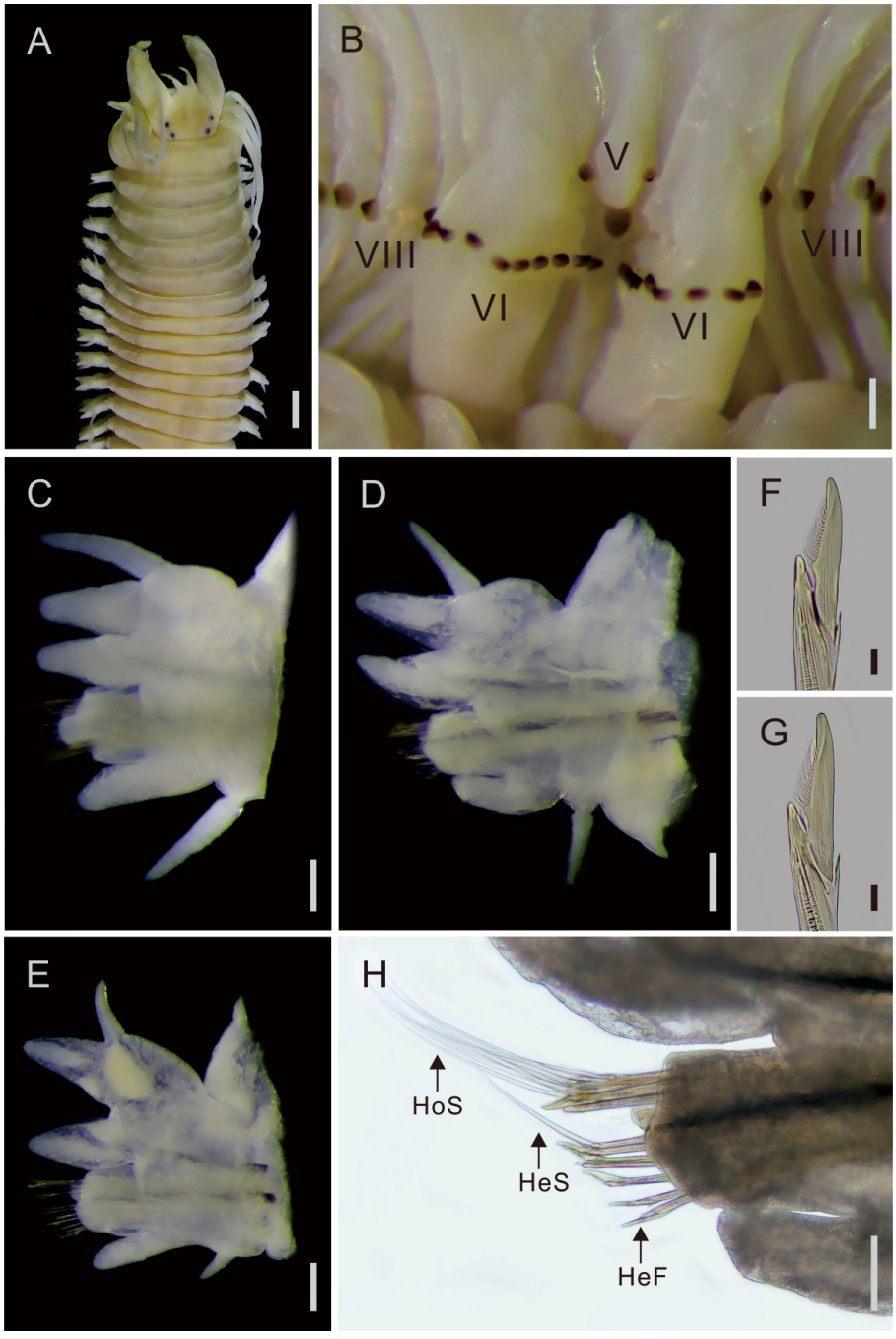

Fig. 12. *Perinereis liuqiuensis* sp. nov.; holotype (NSNM 8748-59): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 57; E, right parapodium, anterior view, chaetiger 115; F–G, neuropodial heterogomph falciger, chaetiger 59; H, chaetae of chaetiger 57. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; HoS = homogomph spiniger. Scale bars: A = 1.0 mm; B–E = 0.2 mm; F–H = 0.01 mm.

Table 3).

Dorsal ligule subconical throughout, about 1.8–1.9x longer than median ligule throughout; center lobe of dorsal ligule with one oval-shaped glandular mass on posterior chaetigers (Fig. 12C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, slightly longer than neuroacicular ligule on anterior chaetigers, about 1.4–1.5x longer than neuroacicular ligule on mid-body to posterior chaetigers (Fig. 12C–E).

Neuroacicular ligule with predominant inferior lobe on anterior to posterior chaetigers, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.7–0.8x as long as ventral ligule on anterior to posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about as long as ventral ligule on anterior chaetigers, about 0.7x as long as ventral ligule on mid-body chaetigers, about 0.5x as long as ventral ligule on posterior chaetigers (Fig. 12C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations present throughout, heterogomph spinigers present only on mid-body to posterior chaetigers (Fig. 12F–H, Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 11 chaetigers.

Type locality: Yufu intertidal soft bottom, Liuqiu Township, Pingtung County, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis liuqiuensis* sp. nov. has an arc of nine bar-shaped paragnaths on each side of area VI of the pharynx and not greatly expanded notopodial dorsal ligule, indicating it clearly belongs to group 3A and the *Perinereis nuntia* species group (Fig. 12B, E, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species in this species group recognized by Villalobos-Guerrero (2019), only *P. shikueii* Glasby and Hsieh, 2006 is similar to *P. liuqiuensis* sp. nov. in terms of having lateral paragnaths on area III, three paragnaths on area V, a range of 4–10 bars (9 in latter species) on area VI, and ɔc-shaped ridge pattern of areas VI–V–VI (Fig. 12B, Table 3; Glasby and Hsieh 2006: 562, 567, table 2; Villalobos-Guerrero 2019: 489). However, *P. liuqiuensis* sp. nov. differ from *P. shikueii* by having: 1) jaws with fewer teeth (3 versus 6–10); 2) less paragnaths on area II (9–12 versus 17–26); 3) less paragnaths on areas VII–VIII (29 versus 36–52); 4) smaller length ratio of dorsal cirri to dorsal ligule on anterior and posterior chaetigers (about 0.5 and 0.3 versus 0.9–1.08 and 0.69–1.63, respectively); 5) one small, irregular-shaped glandular mass in the center lobe of dorsal ligule on posterior chaetigers (versus one large, round, glandular mass in the center lobe of dorsal ligule); 6) the blade of heterogomph falciger with blunt tip and not tapered off distally (versus point-tipped and significantly tapered off distally); and 7) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 12B–H, Table 3; Glasby and Hsieh 2006: 562, 567–568, fig. 8A–F, table 2). The differences between *P. liuqiuensis* sp. nov. and eight other new species of group 3A described in the present study are discussed below.

***Perinereis longdongwanensis* sp. nov.**

(Fig. 13, Table 2)

urn:lsid:zoobank.org:act:8D2E8D69-51EB-4015-8555-FF1EFD4FEEE6

Material examined: Holotype, NSNM 8748-60, Longdongwan (25°07.02'N, 121°54.98'E), habitat type: SRHB, 6 November, 2006. Paratypes: 3 specimens, NSNM 8748-61–63, collection date, habitat and location information same as holotype. Non-type material: 2 specimens, NSNM 8748-64–65, atoke, collection date, habitat and location information same as holotype.

Etymology: The name is derived from the name of the bay, Longdongwan, where worms were collected.

Description: Based on holotype (NSNM 8748-60, atoke, complete) and three paratypes (NSNM 8748-61–63, atoke, incomplete); holotype for general morphology, oral ring paragnath patterns, parapodial morphology and chaetal morphology; one larger paratype (NSNM 8748-63) with pharynx dissected for jaw morphology, oral and maxillary ring paragnath patterns, two paratypes (NSNM 8748-61–62) for oral ring paragnath patterns only: Holotype, atoke, complete, body length 15.5 mm with 46 chaetigers, chaetiger 10 width 0.8 mm, excluding parapodia; paratypes, three specimens incomplete posteriorly, remaining body length 9.0–15.5 mm with 30–44 chaetigers, chaetiger 10 width 0.7–1.1 mm, excluding parapodia; beige in alcohol (Fig. 13A–D). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3 (3, n = 3). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x (1.3x, n = 3) longer than chaetiger 1. Pharynx with brown jaws, each with 8 teeth; paragnath pattern: I = 5, in transverse row; II = 29 (left), 29 (right), in 3 oblique rows; III = 24, in 5

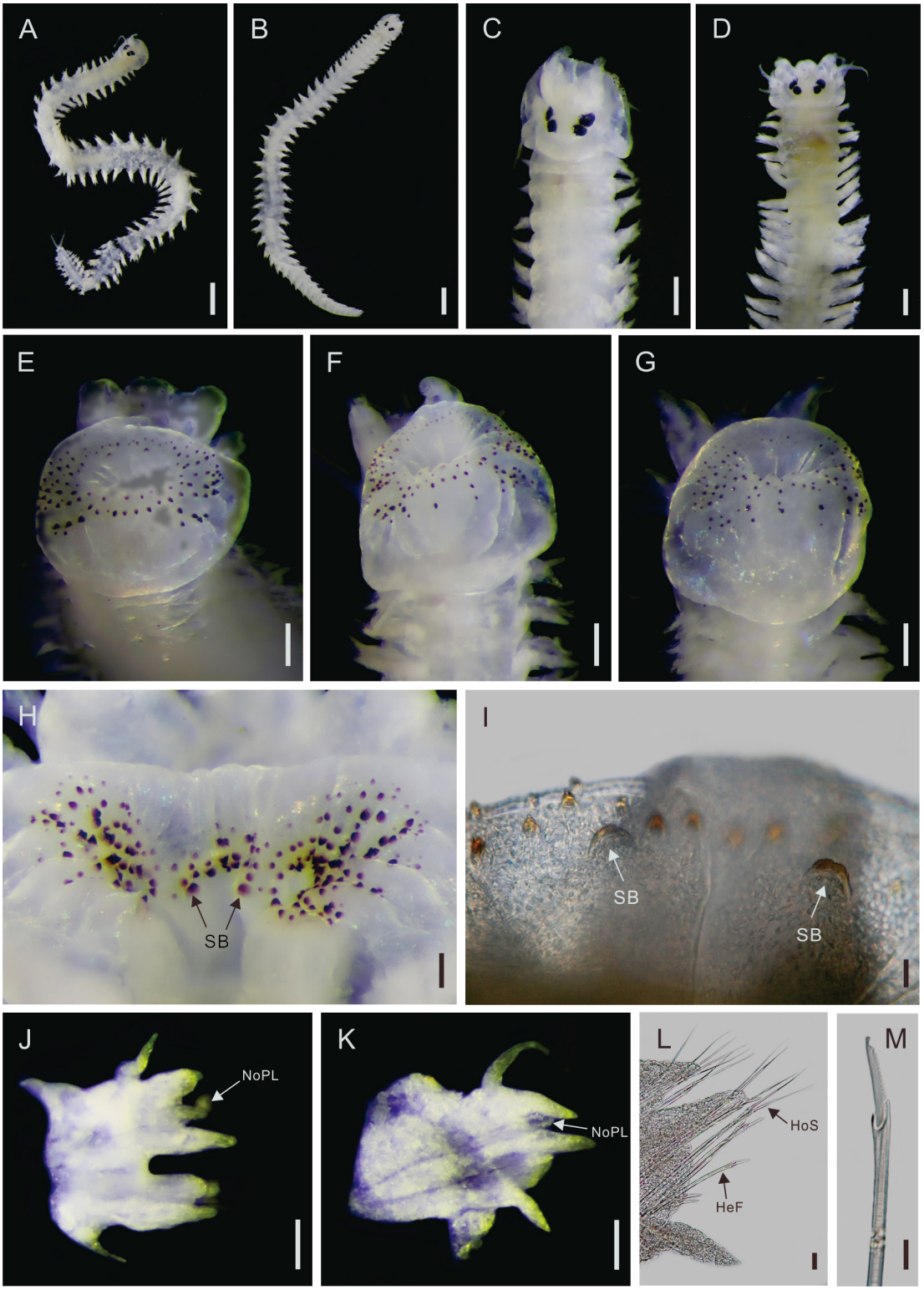

Fig. 13. *Perinereis longdongwanensis* sp. nov.; A, C, E, J, K–M, holotype (NSNM 8748-60); B, F, I, paratype (NSNM 8748-61); D, H, paratype (NSNM 8748-63); G, paratype (NSNM 8748-62) : A, B whole animal, dorsal view; C, D, anterior body region; E–H, paragnath patterns of the pharynx; I, close-up of areas V and VI of the pharynx; J, left parapodium, anterior view, chaetiger 9; K, left parapodium, anterior view, chaetiger 33; L, chaetae of chaetiger 33, anterior view; M, neuropodial heterogomph falciger, chaetiger 38. Abbreviations: HeF = heterogomph falciger; HoS = homogomph spiniger; NoPL = notopodial prechaetal lobe; SB = short bar. Scale bars: A, B = 1.0 mm; C, D = 0.5 mm; E–G = 0.2 mm; H, J, K = 0.1 mm; I, L, M = 0.02 mm.

transverse rows; IV = 33 (left), 31 (right), in 5 oblique rows, without bars; V = 4 (4–16, *n* = 3), in transverse line; VI = 1 short bar + 2 (2–6, *n* = 3) small cones (left), 1 short bar + 3 (3–8, *n* = 3) small cones (right); VII–VIII = 106 (136–194, *n* = 3) small cones in wide bands. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 13E–I, Table 2).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule throughout, about 0.5x as long as dorsal ligule, about 0.7x as long as dorsal ligule (Fig. 13J, K, Table 2).

Dorsal ligule subconical throughout, about 1.4x longer than median ligule, about 1.8x longer than median ligule on posterior chaetigers (Fig. 13J, K). Notopodial prechaetal lobe present throughout (Fig. 13J, K, Table 2).

Median ligule subconical throughout, about 1.2x longer than neuroacicular ligule on anterior to mid-body chaetigers, about 1.8x longer than neuroacicular ligule on posterior chaetigers (Fig. 13J, K).

Neuroacicular ligule with elongate inferior lobe on anterior to anterior-half of posterior chaetigers, inferior and superior lobes subequal in length on posterior chaetigers, about as long as ventral ligule on anterior chaetigers, about 0.7x as long as ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.5x as long as ventral ligule on throughout (Fig. 13J, K).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and long-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: long-bladed heterogomph falcigers with serrations and homogomph spinigers present throughout (Fig. 13K–M, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 4 chaetigers (Table 2).

Type locality: Longdongwan, New Taipei City, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis longdongwanensis* sp. nov. has one bar-shaped paragnath on each side of area VI and not greatly expanded notopodial dorsal ligule on posterior chaetigers, it clearly belongs to group 1A proposed by Hutchings et al. (1991: 271) (Fig. 13H, I). *Perinereis longdongwanensis* sp. nov. can be easily distinguished from the seven species in this group reported from East and South Asia (see the Remarks section in *P. houbihuensis* sp. nov. for the name of these seven species) by having a unique paragnath pattern of the pharynx: areas I, V, VI, and VII–VIII have 13 cones, 4–16 cones, 1 bar plus 2 to 8 cones on each side, and 140–194 cones, respectively (Fig. 13E–I, Table 2; Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de León-González and Solís-Weiss 1998: 684; Park and Kim 2017: 256). Of these seven species, only *P. dongalae* (Horst, 1924) has 7–8 cones on area I and the other six congeners have only a range of 1–3 cones on the same area (Ehlers 1868: 504; Grube 1878: 82; Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de León-González and Solís-Weiss 1998: 686; Park and Kim, 2017: 256). On the same token, only *P. cultrifera* (Grube, 1840) has 2–5 cones on area V and the other six congeners have only a range of 0–3 cones on the same area (Ehlers 1868: 504; Grube 1878: 82; Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de León-González and Solís-Weiss 1998: 686; Park and Kim 2017: 256). None of these seven species has paragnaths on area VII-VIII exceeding 100 cones (Ehlers 1868: 504; Grube 1878: 82; Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de León-González and Solís-Weiss 1998: 686; Park and Kim 2017: 256). Finally, *P. tenuisetis* (Fauvel, 1915) is the only species of these seven congeners with long-bladed falcigers as in *P. longdongwanensis* sp. nov. However, the type of falcigers in the former species is homogomph, whereas that of *P. longdongwanensis* sp. nov. is heterogomph (Fig. 13L, M, Table 2; Fauvel 1915: 8–9, fig. 5e; Horst 1924: pl. 8; Hutchings et al. 1991: 251, 254–255, figs. 5e, 8c, 9c; de León-González and Solís-Weiss 1998: 685, fig. 6E; Park and Kim 2017: 254, fig. 2L). The differences between *P. longdongwanensis* sp. nov. and four other new species of group 1A described in the present study are discussed below.

Perinereis longdongwanensis sp. nov. has homogomph spinigers in subacicular fascicle of neuropodia on chaetigers of all body regions, which is different from the diagnosis of this genus by Bakken and Wilson (2005: 531) and Glasby (2015: 226) who stated only heterogomph spinigers present in subacicular fascicle of neuropodia. The present study herein emends the generic diagnosis of this part.

***Perinereis ludaoensis* sp. nov.**

(Fig. 14, Table 3)

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Material examined: Holotype, NSNM 8748-66, Baisha (23°38.34'N, 121°29.46'E), habitat type: SRHB, 6 September 1996.

Etymology: The name is derived from the name of a small offshore island, Ludao, eastern Taiwan, where the worm was collected.

Description: holotype, atoke, without posterior end, remaining body length 138.0 mm with 116 chaetigers, chaetiger 10 width 5.2 mm, excluding parapodia; beige in alcohol (Fig. 14A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.4x longer than chaetiger 1. Pharynx with dark brown jaws, each with 5 teeth; paragnath pattern: I = 6, in cluster; II = 11 (left), 11 (right), in 3 oblique rows; III = 17 (center region with 14 cones, in 3–4 rows; 2 lateral regions, each with 1 or 2 cones); IV = 23 (left), 24 (right), in 4 oblique rows,

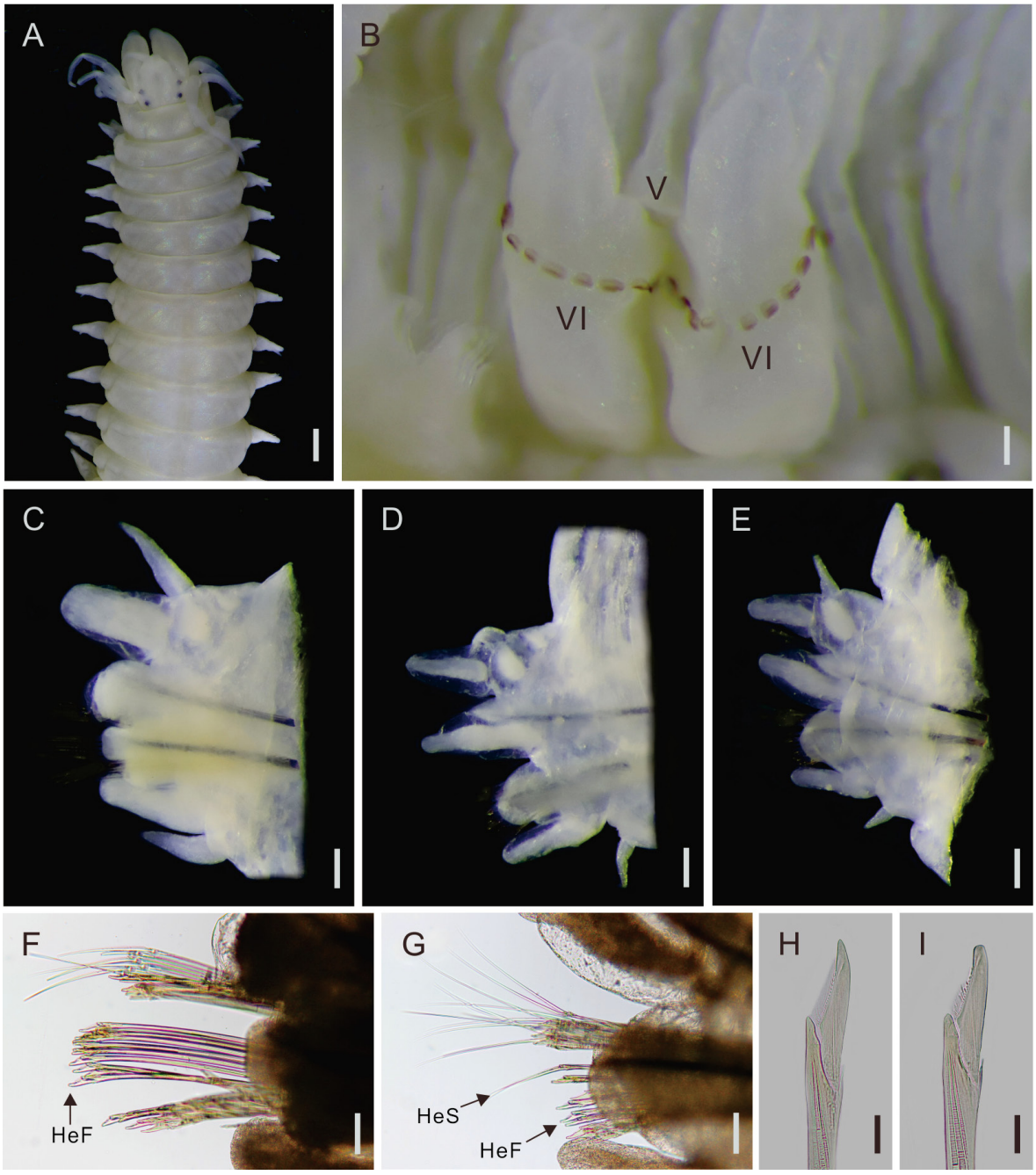

Fig. 14. *Perinereis ludaoensis* sp. nov.; holotype (NSNM 8748-66): A, anterior body region, dorsal view; B, close-up of areas V and VI of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 50; E, right parapodium, anterior view, chaetiger 110; F, chaetae of chaetiger 10, G, chaetae of chaetiger 110; H, I, neuropodial heterogomph falciger, chaetiger 110. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A = 1.0 mm; B–E = 0.5 mm; F, G = 0.1 mm; H, I = 0.02 mm.

without bars; V = 0; VI = 11 (left), 9 (right), even length short bars in transverse row; VII–VIII = 18, in 2 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 14B, Table 3).

Dorsal cirri digitiform, attached 2/5 to base of dorsal ligule throughout, about 0.5x as long as dorsal ligule on anterior chaetigers, about 0.3x as long as dorsal ligule on mid-body to posterior chaetigers (Fig. 14C–E, Table 3).

Dorsal ligule conical on anterior chaetigers, about 3.3x longer than median ligule, subconical on mid-body to posterior chaetigers, about 1.3x longer than median ligule; center lobe of dorsal ligule with one oval-shaped glandular mass on mid-body to posterior chaetigers (Fig. 14C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule conical on anterior-most chaetigers, about as long as neuroacicular ligule, subconical thereafter, about 1.7x longer than neuroacicular ligule (Fig. 14C–E).

Neuroacicular ligule truncate distally, with predominant superior lobe on anterior chaetigers, about 0.7x as long as ventral ligule, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.6x as long as ventral ligule on mid-body to posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia throughout, about 0.8x as long as ventral ligule on anterior chaetigers, about 0.4x as long as ventral ligule on mid-body to posterior chaetigers (Fig. 14C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-sized blade heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations present throughout, heterogomph spinigers present on mid-body to posterior chaetigers (Fig. 14H, I, Table 3).

Type locality: Baisha, Ludao Township, Taitung County, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis ludaoensis* sp. nov. is a species that can be included in group 3A and the *Perinereis nuntia* species group, which has 9–11 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule (Fig. 14B, E, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species in this group recognized by Villalobos-Guerrero (2019), only *P. nuntia* (Savigny, 1818) and *P. vallata* (Grube, 1857) are somewhat similar to *P. ludaoensis* sp. nov. in terms of number of paragnaths on areas V (both with a range of 0–5 versus 0) and VI (with a range of 4–17 and 5–14, respectively versus 9–11) and the presence of lateral paragnaths on area III (Glasby and Hsieh 2006: 562, table 2, Villalobos-Guerrero 2019: 489). However, *P. ludaoensis* sp. nov. can be distinguished from *P. nuntia* by having: 1) greater number of paragnaths on area I (6 versus ranging 1–5 with an average of 1.8 ± 0.8); 2) only bars on area VI (versus bars and cones); 3) fewer number of paragnaths on areas VII–VIII (18 versus ranging 42–129 with an average of 28 ± 6.2); 4) λ-shaped ridge pattern of areas VI–V–VI (versus χ-shaped ridge pattern); 5) smaller dorsal cirri to dorsal ligule ratio in all body regions (about 0.5 and 0.3 in the anterior body and middle to posterior body regions, respectively versus about 1.0 and 0.5 (based on measurements from drawings of fig. 11B–D in Wilson and Glasby 1993), respectively; 6) an oval-shaped glandular mass in the center lobe of dorsal ligule on mid-body to posterior chaetigers (versus absent); 7) neuroacicular ligule with predominant superior lobe on anterior chaetigers (versus subequal of superior and inferior lobes); and 8) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 14B–E, H, I, Table 3; Wilson and Glasby 1993: 266–268, fig. 11B–D; Glasby and Hsieh 2006: 562, table 2; Villalobos-Guerrero 2019: 489).

Perinereis ludaoensis sp. nov. differs from *P. vallata* by having: 1) fewer number of paragnaths on areas VII–VIII (18 versus ranging 42–129 with an average of 69.0 ± 13.6); 2) the distal lobe of dorsal ligule about 1.3x longer than median ligule (versus as long as median ligule); 3) absence of notopodial prechaetal lobe on chaetigers of all body regions (versus present on chaetigers 5–25); 4) tip of neuroacicular superior lobe truncate on anterior chaetigers (versus subconical); 5) an oval-shaped glandular mass present in the center lobe of dorsal ligule on mid-body to posterior chaetigers (versus absent); and 6) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 14B–E, H, I, Table 3; Wilson and Glasby 1993: 269–271, fig. 12D–F; Glasby and Hsieh 2006: 562, table 2; Villalobos-Guerrero 2019: 489). The differences between *P. ludaoensis* sp. nov. and eight other new species of group 3A described in the present study are discussed below.

Perinereis mictodonta (Marenzeller, 1879)

(Fig. 15, Table 3)

Nereis mictodonta Marenzeller 1879: 118–119, pl. 2, fig. 2; Izuka, 1912: 148–151, pl. 16, figs. 1–6.

Perinereis mictodonta Wilson and Glasby 1993: 264; Glasby and Hsieh 2006: 558–561, fig. 5 (for complete synonym).

Material examined: 2 specimens, NMNS 1955-22, Kaomei (24°18.50'N, 120°32.42'E), habitat type: ISSB, 10 November 1992; 3 specimens, NMNS 8748-67, Da'an (24°22.29'N, 120°34.70'E), habitat type: ISSB, 30 January, 1999; 1 specimen, NMNS 8748-68, Kaomei (24°18.50'N, 120°32.42'E), habitat type: ISSB, 24 August, 1999; 2 specimens, NMNS 3328-112, Hanbao (24°00.75'N, 120°21.11'E), habitat type: ISSB, 1 February 2000; 1 specimen, NMNS 8748-69, Wushibi (23°13.70'N, 121°25.08'E), habitat type: IRHB, 16 October 2004; 1 specimen, NMNS 8748-70, Bazang (23°19.51'N, 120°07.78'E), habitat type: ISSB, 7 January, 2007; 7 specimens, NMNS 8748-71–78, Fubao (24°02.83'N, 120°22.75'E), habitat type: ISSB, 29 January, 2007; 1 specimen, NMNS 8748-79, Wanggong (23°58.36'N, 120°19.43'E), habitat type: ISSB, 29 January, 2007; 13 specimens, NMNS 8748-80–83, Fubao, 2 March 2007; 4 specimens, NMNS 8748-84–87, Fuxin (24°03.40'N, 120°24.50'E), habitat type: ISSB, 18 March, 2007; 4 specimens, NMNS 8748-88–91, Dadu (24°12.77'N, 120°28.06'E), habitat type: ISSB, 20 March 2015; 4 specimens, NMNS 8748-92, Hemei (25°04.91'N, 121°54.93'E), habitat type: ISSB, 17 October 2016.

Description: Based on eight complete specimens (NMNS 8748-69, NMNS 8748-71–73, NMNS 8748-79, NMNS 8748-83(1), NMNS 8748-90–91; all atoke) and 14 incomplete specimens (NMNS1559-22, NMNS 8748-67(1) –68, NMNS 3328-112, NMNS 8748-70, NMNS 8748-75–78, NMNS 8748-81–82, NMNS 8748-84–85; all atoke): Body length 41.0–103.0 (n = 8) mm with 82–151 (n = 8) chaetigers, chaetiger 10 width 1.1–4.0 (n = 22) mm, excluding parapodia; beige in alcohol (Fig. 15A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3–13 (n = 20). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.1–1.4x (n = 21) longer than chaetiger 1.

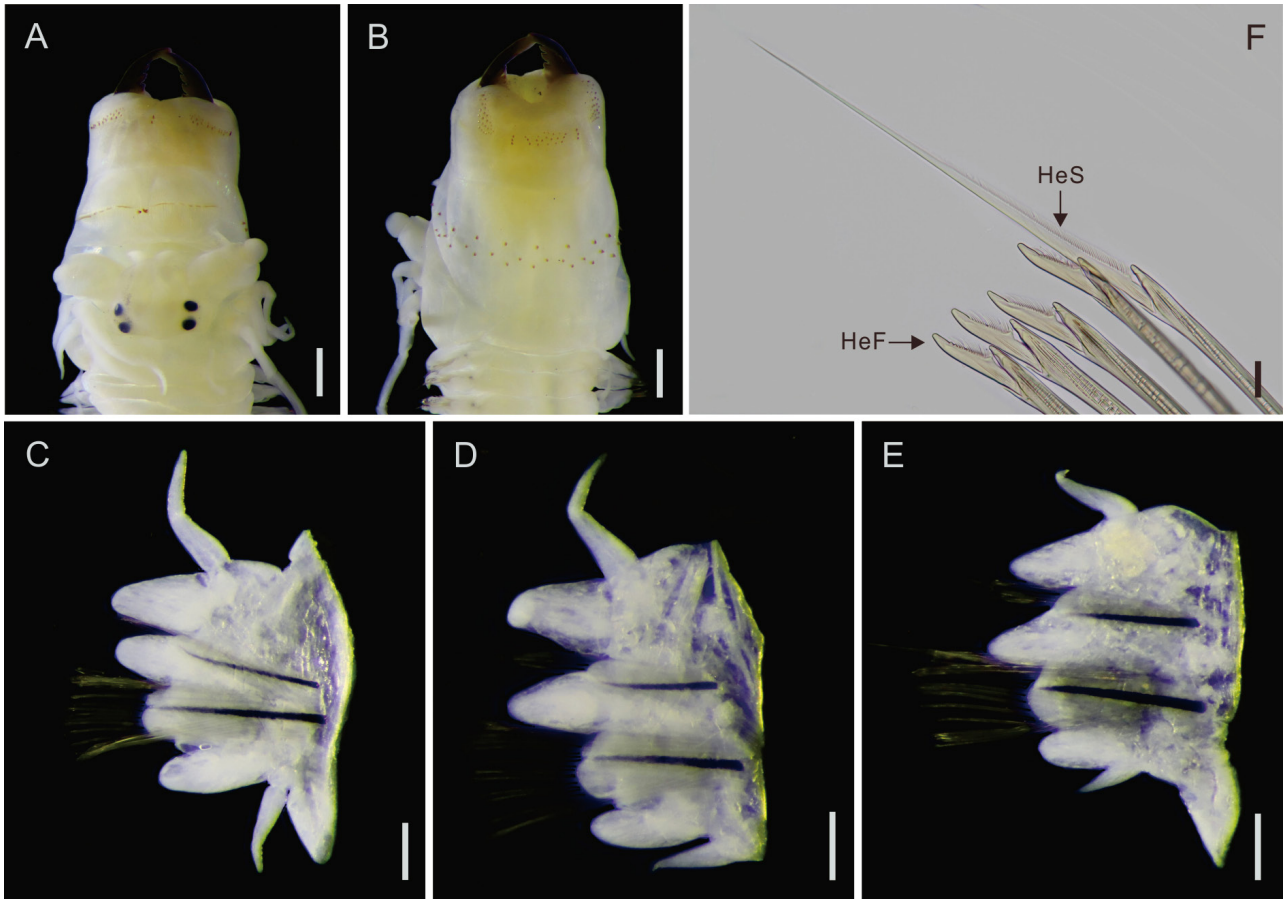

Fig. 15. *Perinereis mictodonta* (Marenzeller, 1879); A, B (NMNS 8748-79); C–F (NMNS 8748-76): A, anterior body region, dorsal view; B, close-up of areas V and VI of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 30; E, right parapodium, anterior view, chaetiger 55; F, neuropodial subacicular fascicle chaetae, chaetiger 10. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F = 0.02 mm.

Pharynx with dark brown jaws, each with 3–6 (n = 22) teeth; paragnath pattern: I = 1–6 (mostly 2–5, in cluster or longitudinal line, one case of 1 and two cases of 6, n = 22, same sample size on following areas); II = 14–26 (left), 12–25 (right), in 2–4 oblique rows; III = 15–32 (center region with 11–24 cones, in 3–4 transverse rows; mostly 2 lateral regions, each with 1–6 cones, three case of 3 lateral regions, outer region with 1–2 cones); IV = 23–42 (left), 23–42 (right), in 3–7 oblique rows, without bars; V = 1–4 (mostly 3, in triangle or transverse row, one case of 1 cone, two cases of 2 cones, four cases of 4 cones); VI = 3–9 uneven-length bars, innermost and outermost longest (left), 3–8 uneven-length bars, innermost and outermost longest (right); VII–VIII = 20–39, in 2 rows, posterior row zigzagged. Ridge pattern of areas VI–V–VI, χ-shaped (Fig. 15A, B, Table 3).

Dorsal cirri digitiform, medially attached dorsal ligule throughout, about 0.8x as long as dorsal ligule on anterior to mid-body chaetigers, about 0.5x as long as dorsal ligule on posterior chaetigers (Fig. 15C–E, Table 3).

Dorsal ligule subconical throughout, about 2.0x longer than median ligule on anterior to mid-body chaetigers, about 1.3x longer than median ligule on posterior chaetigers; center lobe of dorsal ligule with one irregular-shaped glandular mass on posterior chaetigers (Fig. 15C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, greatly longer than neuroacicular ligule throughout (Fig. 15C–E).

Neuroacicular ligule with prominent inferior lobe on anterior to mid-body chaetigers, about as long as ventral ligule, inferior and superior lobes subequal in length on posterior chaetigers, about as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia on anterior to mid-body chaetigers, about 0.9x as long as ventral ligule, distally attached to ventral ligule on posterior chaetigers, about 0.6x as long as ventral ligule (Fig. 15C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-sized blade heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 15F, Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 4–8 (n = 5) chaetigers.

Remarks: The morphology of examined specimens in the present study agrees with description of *P. mictodonta* (Marenzeller, 1879) in Glasby and Hsieh (2006: 599–561, fig. 5A–F) (Fig. 15A–F, Table 3). All examined specimens of *P. mictodonta* in the present study were mostly collected from soft bottom on river mouths and coastal flats of central-west Taiwan, which largely agree with distribution of this species in Taiwan reported by Glasby and Hsieh (2006: 555, fig. 1). Glasby and Hsieh (2006: 555, fig. 1) commented that no polychaete in the *Perinereis nuntia* group were found from river mouths on east coasts of Taiwan. However, the present distribution record of *P. mictodonta* in Taiwan showed one exception. One specimen of *P. mictodonta* was collected from rocky tide pool in coasts of Wushibi, eastern Taiwan. Presumably, windy seasons on east coasts of Taiwan provide suitable temporal living environment in rocky tide pool (*i.e.*, sediment and algae brought in by strong wave actions) for larvae of *P. mictodonta* to settle and grow in that environment. This favorable living environment of biota vanished during summer with weak wave actions and high evaporation.

Perinereis nigropunctata **(Horst, 1889)**

(Fig. 16, Table 4)

Nereis nigro-punctata Horst 1889: 171, pl. 8, figs. 1–3.
Perinereis nigro-punctata Gravier 1901: 188–191, text-figs. 190–193, table 2, pl. 11, fig. 49.
Perinereis marjorii Southern 1921: 595–597, text-figs. 7 8a–c, pl. 23, fig. 10A–G.
Nereis (*Perinereis*) *yorkensis* Augener 1922: 24, fig. 6a–e.
Nereis (*Perinereis*) *nigropunctata* Horst 1924: 171.
Perinereis nigropunctata Monro 1931a: 16; Fauvel 1953: 210, fig. 107b–f; Day 1967: 337, fig. 14.13r–v; Wu 1967: 64–66, fig. 9a–d; Hartmann-Schröder 1979: 116–117, figs. 203–206; Hutchings et al. 1991: 256–257, fig. 10a–e.

Examined material: 1 specimen, NMNS 8748-93, Linshanbi (25°16.99'N, 121°30.59'E), habitat type: IRHB, 1 November 2003; 3 specimens, NMNS 8748-94–96, Wanlitong (21°59.73'N, 120°42.26'E), habitat type: IRHB, 16 December 2007; 2 specimens, NMNS 8748-97–98, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27–28 March, 2014; 3 specimens, NMNS 8748-99–101, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27 September, 2014; 9 specimens, NMNS 8748-102–110, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 28–29 April, 2017; 4 specimens, NMNS 8748-111–114, Shadao (21°54.78'N, 120°50.83'E), habitat type: IRHB, 17 October 2020.

Description: Based on 11 complete specimens (NMNS 8748-93, NMNS 8748-95–96, NMNS 8748-104, NMNS 8748-106–107, NMNS 8748-109, NMNS 8748-111–114; all atoke) and 11 incomplete specimens (NMNS 8748-94, NMNS 8748-97–103, NMNS 8748-105, NMNS 8748-108, NMNS 8748-110; all atoke): Body length 61.0 (10.5–57.0, n = 11) mm with 75 (60–79, n = 11) chaetigers, chaetiger 10 width 2.5 (1.0–2.1,

n = 11) mm, excluding parapodia; beige to dark brown in alcohol (Fig. 16A–D). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2 (1–7, *n* = 20). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x (1.2–1.4x, *n* = 20) longer than chaetiger 1. Pharynx with dark brown jaws, each with 6 teeth; paragnath pattern: I = 5 (3–11, *n* = 20, same sample size on following areas), in triangle; II = 15 (6–23) (left), 16 (6–22) (right), in 2–3 oblique rows; III = 23 (12–30) (center region with 19 (8–25) cones, in 4 (3–4) transverse rows; 2 lateral regions, each with 2 (1–3) cones, in longitudinal line); IV = 20 (8–32) (left), 19 (9–35) (right), in 4 (4–6) oblique rows, without bars; V = 3 (1–5), in triangle (cluster, T-shaped or V-shaped); VI = 1 (1) (left), 1 (mostly 1, one case of 1+ 0–1 cone) (right), shield-shaped bars; VII–VIII = 37 (18–39), in 2–3 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 16A–D, Table 4).

Dorsal cirri digitiform throughout, medially attached to dorsal ligule on anterior to mid-body chaetigers, about as long as dorsal ligule on anterior chaetigers, about 0.5x as long as dorsal ligule, attached 2/3 to base of dorsal ligule on posterior chaetigers, about 0.4x longer than dorsal ligule (Fig. 16E–G, Table 4).

Dorsal ligule subconical with blunt tip on anterior chaetigers, as long as median ligule, subconical on mid-body to posterior chaetigers, about 2.0x longer than median ligule, base of dorsal ligule bulged and elongated, about 3.3x longer than median ligule on posterior chaetigers; center lobe of dorsal ligule with one irregular-shaped glandular mass (Fig. 16E–G). Notopodial prechaetal lobe present throughout (Fig. 16E–G, Table 4).

Median ligule conical on anterior chaetigers, about 1.4x longer than neuroacicular ligule, subconical on mid-body to posterior chaetigers, about 1.3–1.4x longer than neuroacicular ligule (Fig. 16E–G).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, inferior and superior lobes subequal in length on posterior half of mid-body to posterior chaetigers, about as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri basally attached to ventral ligule, about 0.6x as long as ventral ligule on anterior chaetigers, about as long as ventral ligule on posterior chaetigers (Fig. 16E–G).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 16H, I, Table 4).

Pygidium with anus crenulated; anal cirri

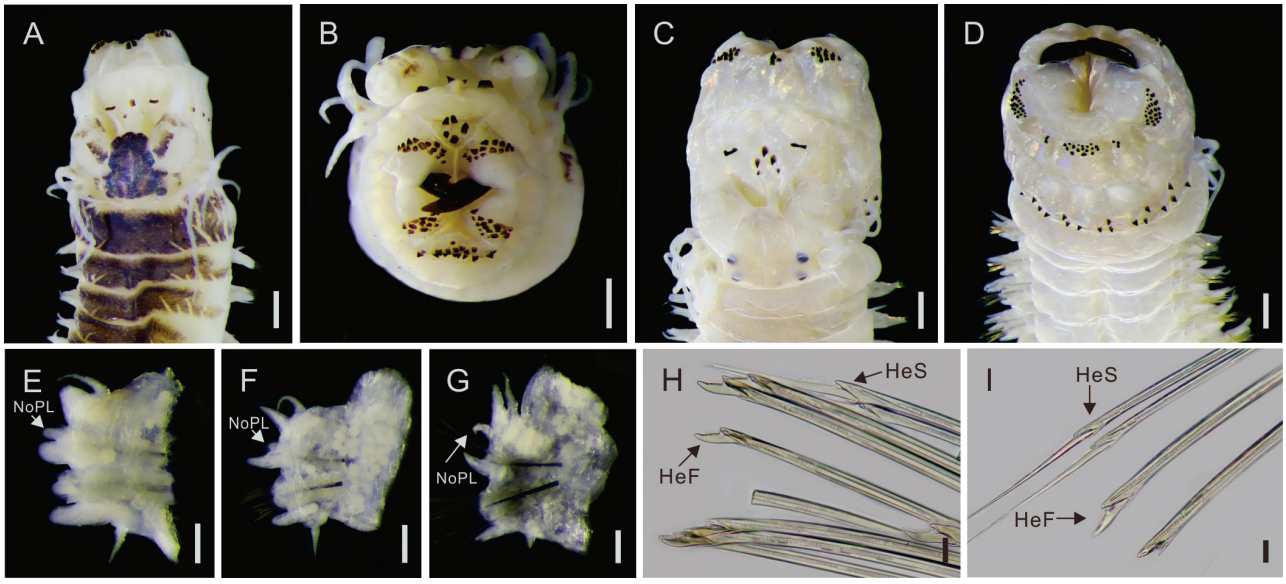

Fig. 16. *Perinereis nigropunctata* (Horst, 1889); A, B, E–I (NSNM 8748-113); C, D (NSNM 8748-110): A, anterior body region, dorsal view; B, anterior body region, frontal view;; C, anterior body region, dorsal view; D, anterior body region, ventral view; E, right parapodium, anterior view, chaetiger 10; F, right parapodium, anterior view, chaetiger 30; G, right parapodium, anterior view, chaetiger 55; H, neuropodial subacicular fascicle chaetae, chaetiger 10; I, neuropodial subacicular fascicle chaetae, chaetiger 54. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; NoPL = notopodial prechaetal lobe. Scale bars: A–D = 0.5 mm; E–G = 0.2 mm; H, I = 0.02 mm.

cirriform, as long as last 4 (2–6) (n = 9) chaetigers (Table 4).

Distribution: North and West Australia, Red Sea, Indian Ocean (India, Madagascar, Marshall Islands), Southeast Asia (Borneo, Malaysia, Singapore), Taiwan (Hutchings et al. 1991).

Remarks: Morphology of present specimens agree with descriptions in Horst (1889), Wu (1967) and Hutchings et al. (1991). Moreover, collection locations of the present material also agree with the distribution of the species reported in Wu (1967) (see Fig. 1). Paragnath pattern on area III of the pharynx in *P. nigropunctata* (Horst, 1889) shows discrepancy between different reports. Horst (1889, collection locations: Malaysia), Wu (1967, collection locations: Taiwan) and Hutchings et al. (1991, collection locations: North and West Australia) noted that this species has lateral groups of cones on area III of the pharynx, whereas other reports (*i.e.*, Gravier (1901), collection locations: Red Sea, Southern (1921), collection locations: India; Augener (1922), collection locations: North Australia, Fauvel (1953), collection locations: India; Day (1967), collection locations: Red Sea; Hartmann-Schroder (1979), collection locations: Malaysia; Hylleberg et al. (1986), collection locations: Malaysia) stated otherwise. The reason for this discrepancy between different geographic locations of the species is unclear.

***Perinereis pangcahae* sp. nov.**

(Fig. 17, Table 2)

urn:lsid:zoobank.org:act:B134E1BE-5E30-4AC0-ACDB-F5BCC4F680C7

Material examined: Holotype, NSNM 8748-115, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 28 April 2017. Paratypes: 3 specimens, NSNM 8748-116–118, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 29 April 2017; 1 specimen, NSNM 8748-119, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27 March 2014. Non-types: 4 specimens, NSNM 8748-120–123, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27–28 March 2014; 3 specimens, NSNM 8748-124–126, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 28–29 April 2017.

Etymology: The name is derived from the Pangcah aboriginal tribe of eastern Taiwan, as a tribute to their glittering cultures.

Description: Based on holotype (NSNM 8748-115, complete specimen; atoke), paratypes (NSNM 8748-116–119, 4 complete specimens; all atoke) and non-types (7 incomplete specimens; all atoke): holotype, atoke, body length 98.5 (73.5–111.5, n = 4) mm with 155 (136–160, n = 4) chaetigers, chaetiger 10 width 2.6 (2.7–4.5, n = 4) mm, excluding parapodia; light to dark brown in alcohol (Fig. 17A–C). Prostomium wider than long, lateral antennae antero-lateral, as long as (or

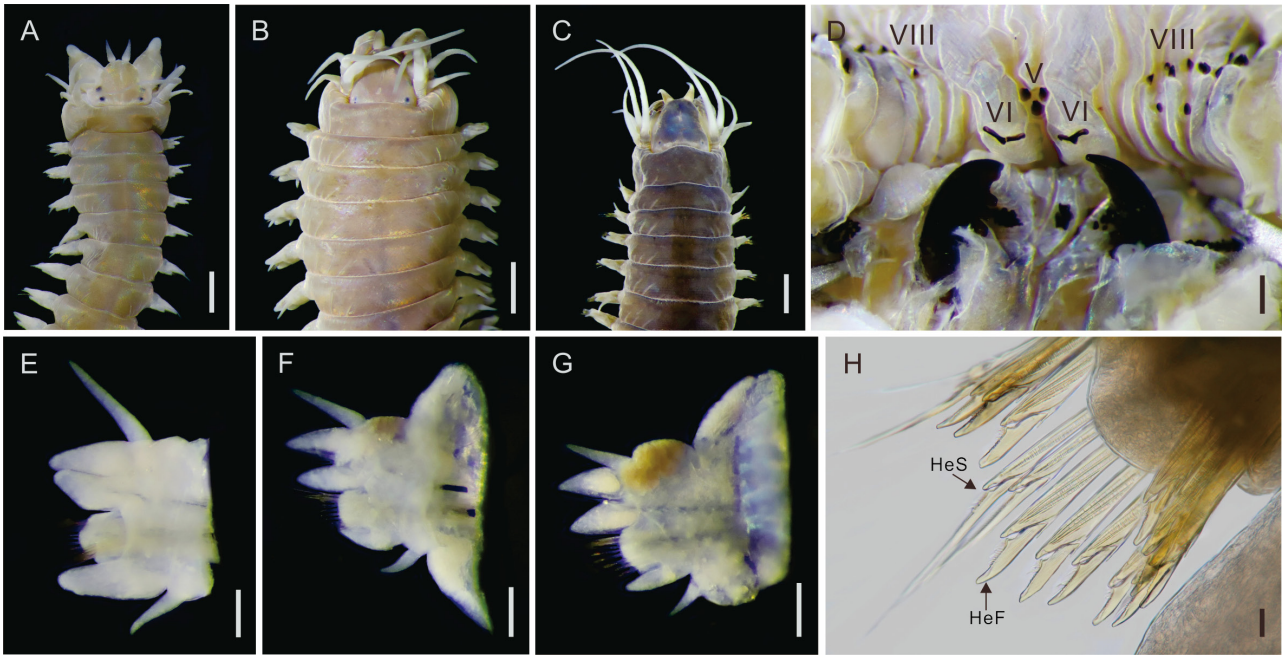

Fig. 17. *Perinereis pangcahae* sp. nov.; A, E–H, holotype (NSNM 8748-115); B, C, paratype (NSNM 8748-124); C, paratype (NSNM 8748-116): A–C, anterior body region, dorsal view; D, close-up of areas V, VI and VIII of the pharynx; E, right parapodium, anterior view, chaetiger 10; F, right parapodium, anterior view, chaetiger 55; G, right parapodium, anterior view, chaetiger 105; H, chaetae of chaetiger 10. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A–C = 1.0 mm; D–G = 0.5 mm; H = 0.02.

shorter) than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3 (2–5, *n* = 10). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.2x (1.1–1.4x) longer than chaetiger 1. Pharynx with dark brown jaws, each with 4 (4–5, *n* = 11) teeth; paragnath pattern: I = 4 (2–5, *n* = 10), in cluster (same sample size on remaining areas); II = 13 (9–15) (left), 11 (8–14) (right), in 3 oblique rows; III = 25 (17–32) (center region with 20 (13–25) cones, in 4 (3–5) transverse rows; 2 lateral regions, each with 2 (2–5) or 3 (2–4) cones in longitudinal line); IV = 30 (20–41) (left), 31 (19–36) (right), in 4 (4–6) oblique rows, without bars; V = 3, in triangle; VI = 1 (1) (left), 1+1 cone (1) (right), chevron-shaped bars; VII–VIII = 29 (21–33), in 2–3 (2–4) rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 17D, Table 2).

Dorsal cirri digitiform throughout, attached 1/3 to base of dorsal ligule on anterior to mid-body chaetigers, about 0.8x as long as dorsal ligule on anterior chaetigers, about 0.6x as long as dorsal ligule on mid-body chaetigers, medially attached to dorsal ligule on posterior chaetigers, about 0.3x as long as dorsal ligule (Fig. 17E–G, Table 2).

Dorsal ligule subconical, about 2.7x longer than median ligule on anterior chaetigers, about 1.9x longer than median ligule on mid-body to posterior chaetigers; proximal lobe with one irregular-shaped glandular mass on mid-body chaetigers, center and proximal lobes with one large irregular-shaped glandular mass on posterior chaetigers (Fig. 17E–G). Notopodial prechaetal lobe absent (Table 2).

Median ligule subconical throughout, about 1.4x longer than neuroacicular ligule on anterior chaetigers, about 1.7–1.8x longer than neuroacicular ligule on mid-body to posterior chaetigers (Fig. 17E–G).

Neuroacicular ligule with predominant inferior lobe, about 0.5x as long as ventral ligule on anterior chaetigers, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.7x as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.6x as long as ventral ligule on anterior chaetigers, about 0.7x as long as ventral ligule on mid-body chaetigers, about 0.6x as long as ventral ligule on posterior chaetigers (Fig. 17E–G).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-sized blade heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 17H, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 7 chaetigers.

Type locality: Jihuei, Taitung County, Taiwan.

Distribution: Known only from the type locality.

Remarks: *Perinereis pangcahae* sp. nov. is included in group 1A by having one bar-shaped paragnath on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers (Hutchings et al. 1991: 271) (Fig. 17D, G, Table 2). Of the seven species in this group reported from East and South Asia (see the Remarks section in *P. houbihuensis* sp. nov. for the name of these seven species), *P. pangcahae* sp. nov. is similar to *P. cultrifera* (Grube, 1840) and *P. helleri* (Grube, 1878), which all have lateral teeth on area III and 3 cones on area V (Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de Leon-Gonzalez and Solis-Weiss 1998: 684; Park and Kim 2017: 256, 258, tables 2, 4). However, *P. pangcahae* sp. nov. differs from *P. cultrifera* by having: 1) greater number of paragnaths on area III (22–27 versus 5–11 or 10–12); 2) chevron-shaped bar on area VI (versus short straight bar); 2) ɔc-shaped ridge pattern of areas VI–V–VI (versus λ-shaped ridge pattern); 3) one large irregular-shaped glandular mass on posterior chaetigers (versus); 4) no notopodial prechaetal lobe on chaetigers of all body regions (versus present on anterior chaetigers); 5) neuroacicular ligule with predominant inferior lobe on anterior chaetigers (versus equal superior and inferior lobes); and 6) shorter serrations on the blade of heterogomph falcigers on neuropodia (Fig. 17D–H, Table 2; Hutchings et al. 1991: 253–254, fig. 8a–c; Park and Kim 2017: 257, figs. 3A, 4C, 5F, table 4).

Perinereis pangcahae sp. nov. can be distinguished from *P. helleri* by having: 1) greater number of paragnaths on areas III and IV (22–27 and 19–33 versus 11–20 and 10–19, respectively); 2) chevron-shaped bar on area VI (versus long straight bar); 3) ɔc-shaped ridge pattern of areas VI–V–VI (versus u-shaped ridge pattern); 4) dorsal cirri attached 1/3 to base of dorsal ligule on anterior chaetigers (versus medially attached to dorsal ligule); 5) the center and proximal lobes of dorsal ligule with one large irregular-shaped glandular mass on posterior chaetigers (versus absent); and 6) neuroacicular ligule with predominant inferior lobe on anterior chaetigers (versus equal superior and inferior lobes) (Fig. 17D–H, Table 2; Hutchings et al. 1991: 255, fig. 9a–c; Park and Kim 2017: 255–256, 258, figs. 3B, 2, 4E, 5C2, table 4). The differences between *P. pangcahae* sp. nov. and four other new species of the 1A group described in the present study are discussed below.

***Perinereis pseudocultrifera* sp. nov.**

(Fig. 18, Table 2)

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Material examined: Holotype, NSNM 8748-127, Wuchi Harbor (23°13.70'N, 121°25.08'E), habitat type: SRHB, 7 July 2015. Paratype: 1 specimen, NMNS 8748-128, Bisha Harbor (25°08.75'N, 121°47.17'E), habitat type: SRHB, 20 July 2016. Non-types: 1 specimen, NMNS 8748-129, Wuchi Harbor (23°13.70'N, 121°25.08'E), habitat type: SRHB, 7 July 2015; 1 specimen, NMNS 8748-130, Wuchi Harbor (23°13.70'N, 121°25.08'E), habitat type: SRHB, 5 October 2015; 1 specimen, NMNS 8748-131, Bisha Harbor (25°08.75'N, 121°47.17'E), habitat type: SRHB, 20 July 2016.

Etymology: The name is derived from the fusion of the Greek "*pseudês*" (false, deceptive) and the Latin "*cultrifera*", referring to that the species shows a series of affinities to *Perinereis cultrifera*.

Description: Based on holotype (NSNM 8748-127, complete; atoke), paratypes (NMNS 8748-128, complete; atoke) and non-types (NMNS 8748-129–131, incomplete specimens; all atoke): Body length 48.0 (24.5) mm with 86 (68) chaetigers, chaetiger 10 width 1.9 (1.0–2.3, n = 4) mm, excluding parapodia; beige in alcohol (Fig. 18A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3 (2–4, n = 4). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x (1.1–1.3x, n = 4) longer than chaetiger 1. Pharynx with dark brown jaws, each with 6–7 (5–8, n = 4) teeth; paragnath pattern: I = 2 (1–3, n = 4) (same sample size on remaining areas), in cluster; II = 9 (9–11) (left), 9 (8–11) (right), in 2 (2–3) oblique rows; III = 8 (11–14) (center region with 6 (7–11) cones, in 2 (3) in oval-shaped patch; 2 lateral regions, each with 1 (0–4) cones; IV = 16 (15–21) (left), 17 (12–25) (right), in 3 (3–4) oblique rows, without bars; V = 0; VI = 1 (left), 1 (right), short bars; VII–VIII = 31 (30–35) cones, in 2 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 18A, B, Table 2).

Dorsal cirri digitiform, medially attached to dorsal ligule, about 0.7–0.8x as long as dorsal ligule on anterior to mid-body chaetigers, attached 2/3 to base of dorsal ligule on posterior chaetigers, about 0.4x as long as dorsal ligule on posterior chaetigers (Fig. 18C–E, Table 2).

Dorsal ligule subconical throughout, about 2.9x longer than median ligule on anterior chaetigers, about 1.7x longer than median ligule on mid-body chaetigers, about 2.3x longer than median ligule on posterior chaetigers; center and proximal lobes with one large irregular-shaped glandular mass on mid-body to posterior chaetigers (Fig. 18C–E, Table 2). Notopodial prechaetal lobe present throughout (Fig. 18C–E, Table 2).

Median ligule conical, about as long as neuroacicular ligule on anterior chaetigers, subconical on mid-body to posterior chaetigers, about 1.4x longer than neuroacicular ligule on mid-body chaetigers, about 1.6x as long as neuroacicular ligule on posterior chaetigers (Fig. 18C–E).

Neuroacicular ligule with predominant inferior lobe, about 0.5x as long as ventral ligule on anterior chaetigers, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.6–0.7x as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.8x as long as ventral ligule on anterior to mid-body chaetigers, about 0.9x as long as ventral ligule on posterior chaetigers (Fig. 18C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 18F–I, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 2 chaetigers.

Type locality: Wuchi Harbor, Taichung City, Taiwan.

Distribution: Known only from type locality and Bisha Harbor, New Taipei City, Taiwan.

Remarks: *Perinereis pseudocultrifera* sp. nov. can be included in group 1A of the genus based on the presence of one bar-shaped paragnath on area VI of the pharynx and not greatly expanded dorsal ligule on posterior chaetigers (Hutchings et al. 1991: 271) (Fig. 18A, E, Table 2). Of the seven species in this group reported from East and South Asia (see the Remarks section in *P. houbihuensis* sp. nov. for the name of these seven species), only *P. cultrifera* (Grube, 1840) is similar to *P. pseudocultrifera* sp. nov. in terms of having similar paragnath patterns on areas I, II, III, IV, VI and VII–VIII, similar dorsal notopodial morphology, and neuropodial heterogomph spinigers present on chaetigers of all body regions (Fig. 18A–C, F, G, Table 2; Hutchings et al. 1991: 250, 253, 255; Park and Kim 2017: 255–258, tables 2, 4). However, *P. pseudocultrifera* sp. nov. can be distinguished from *P. cultrifera* by having: 1) no paragnaths on area V (versus 2–5); 2) notopodial prechaetal lobe present on chaetigers of all body regions (versus present only on

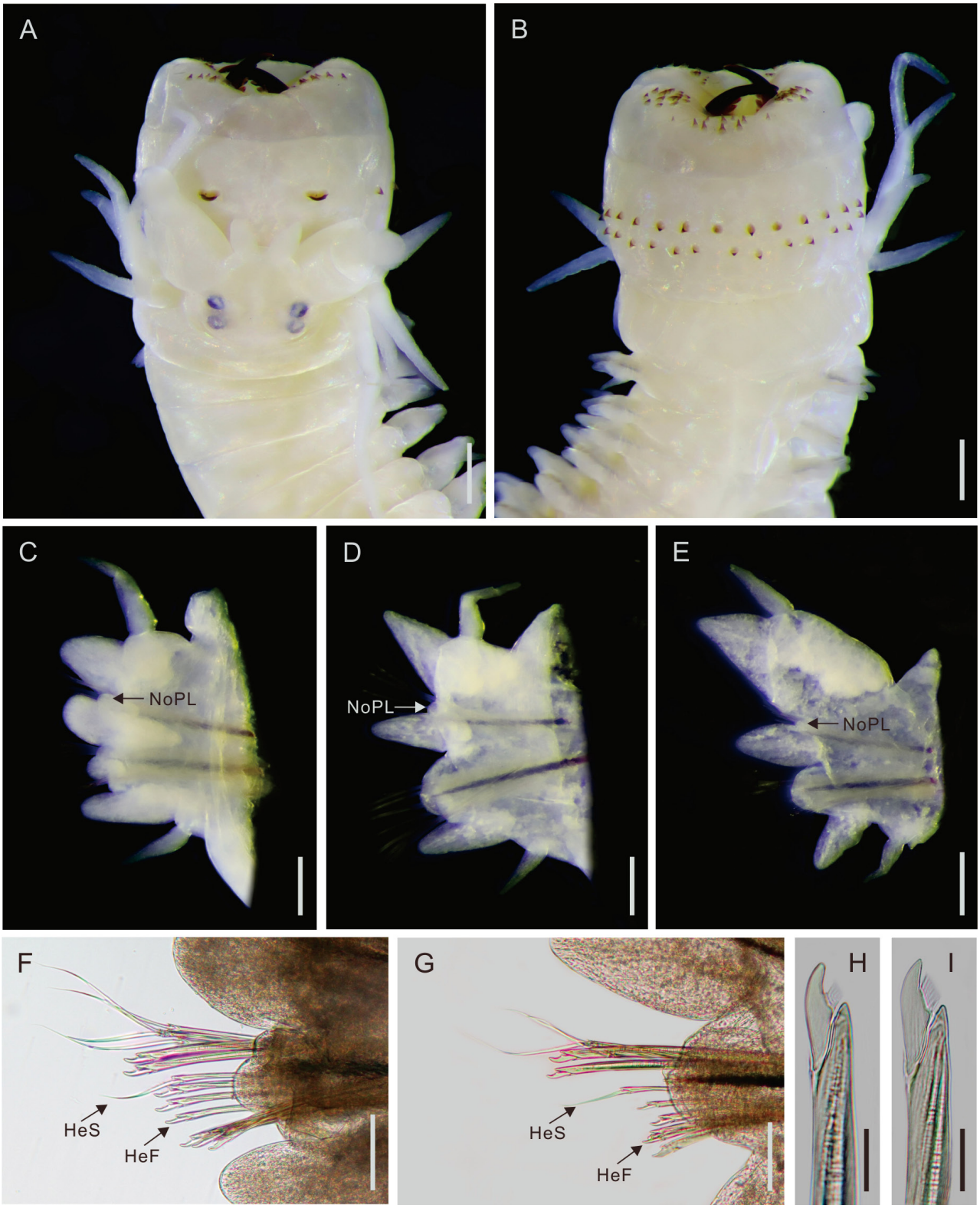

Fig. 18. *Perinereis pseudocultrifera* sp. nov.; holotype (NSNM 8748-127): A, anterior body region, dorsal view; B, anterior body region, dorsal view; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 46; E, right parapodium, anterior view, chaetiger 76; F, chaetae of chaetiger 10; G, chaetae of chaetiger 76; H, I, neuropodial heterogomph falciger, chaetiger 76. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; NoPL = notopodial prechaetal lobe. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F, G = 0.05 mm; H, I = 0.02 mm.

anterior chaetigers); 3) conical median ligule on anterior chaetigers (versus subconical); 4) neuroacicular ligule with predominant inferior lobe on anterior chaetigers (versus subequal inferior and superior lobes); and 5) short-bladed neuropodial heterogomph falcigers (versus medium-sized blade) (Fig. 18A–I, Table 2; Hutchings et al. 1991: 253, fig. 8a–c; Park and Kim 2017: 258, table 4). The differences between *P. pseudocultrifera* sp. nov. and four other new species of group 1A described in the present study are discussed below.

Interestingly, *P. pseudocultrifera* sp. nov. and *P. floridana* (Ehlers, 1868) are the only two *Perinereis* species found in subtidal fouling community on cement pier surface of Wuchi Harbor, Taichung City, west-central Taiwan. Morphologically, *P. pseudocultrifera* sp. nov. is somewhat similar to *P. floridana* but can be readily distinguished from the latter species by having: 1) lateral teeth on area III (versus absent); 2) no conical paragnaths on area V (versus 1 conical paragnath); and 3) notopodial prechaetal lobe present on chaetigers of all body regions (versus absent) (Figs. 5A–G, 18A–E, Table 2; de León-González and Solís-Weiss 1998: 684, figs. 6A–E, 7A–E; de León-González and Goethel 2013: 7).

Perinereis qiguensis sp. nov.

(Fig. 19, Table 3)
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Material examined: Holotype, NSNM 8748-132, Qigu (23°04.70'N, 120°02.46'E), habitat type: ISSB, 20 January 1993.

Etymology: The name is derived from the Qigu lagoon, where the worm was collected.

Description: Holotype: atoke, complete, body length 39.0 mm with 96 chaetigers, chaetiger 10 width 1.5 mm, excluding parapodia; beige in alcohol (Fig. 19A). Prostomium wider than long, lateral antennae antero-lateral, longer palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 6. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 1. Pharynx with dark brown jaws, each with 5 teeth; paragnath pattern: I = 5, in nearly transverse row; II = 21 (left), 23 (right), in 2–3 oblique rows; III = 30 (center region with 16 cones, in 4 transverse rows; 2 lateral regions, each with 3 cones, in longitudinal line); IV = 22 (left), 23 (right), in 3–4 oblique rows, without bars; V = 3, in transverse row; VI = 7 (2 long bars at both end; 5 short bars in between long bars) (left), 6 (2 long bars, 1 outermost, 1 next to outermost; 4 short bars with 3 in between long bars, 1 outermost) (right), in shallow u-shaped line; VII–VIII = 36, in 2–3 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 19B, Table 3).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule on anterior to mid-body chaetigers, about 0.6–0.7x as long as dorsal ligule, medially attached to dorsal ligule on posterior chaetigers, about 0.5x as long as dorsal ligule on posterior chaetigers (Fig. 19C–E, Table 3).

Dorsal ligule subconical, not greatly elongated throughout, about 2.0–2.2x longer median ligule on anterior to posterior chaetigers, center lobe of dorsal ligule with one oval-shaped glandular mass on posterior chaetigers (Fig. 19C–E). Notopodial prechaetal lobe present throughout (Fig. 19C–E, Table 3).

Median ligule conical throughout, about 1.2x longer than neuroacicular ligule on anterior chaetigers, about 1.5–1.6x longer than neuroacicular ligule on mid-body to posterior chaetigers (Fig. 19C–E).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about 0.7x as long as ventral ligule on anterior to mid-body chaetigers, about as long as ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri basally attached to ventral edge, about 0.8–0.9x as long as ventral ligule on anterior to mid-body chaetigers, about as long as ventral ligule on posterior chaetigers (Fig. 19C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed and medium-sized blade heterogomph falcigers with serrations present throughout, heterogomph spinigers present only on mid-body to posterior chaetigers (Fig. 19F–J, Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 6 chaetigers.

Type locality: Qigu Lagoon, Tainan City, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis qiguensis* sp. nov. belongs to group 3A, as well as the *Perinereis nuntia* species group, by having an arc of 6–7 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers (Fig. 19B, E, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species in this species group recognized by Villalobos-Guerrero (2019), only *P. mictodonta* (Marenzeller, 1879) and *P. wilsoni* Glasby and Hsieh, 2006 are somewhat similar to *P. qiguensis* sp. nov., because all have uneven bar-shaped paragnaths and five to six

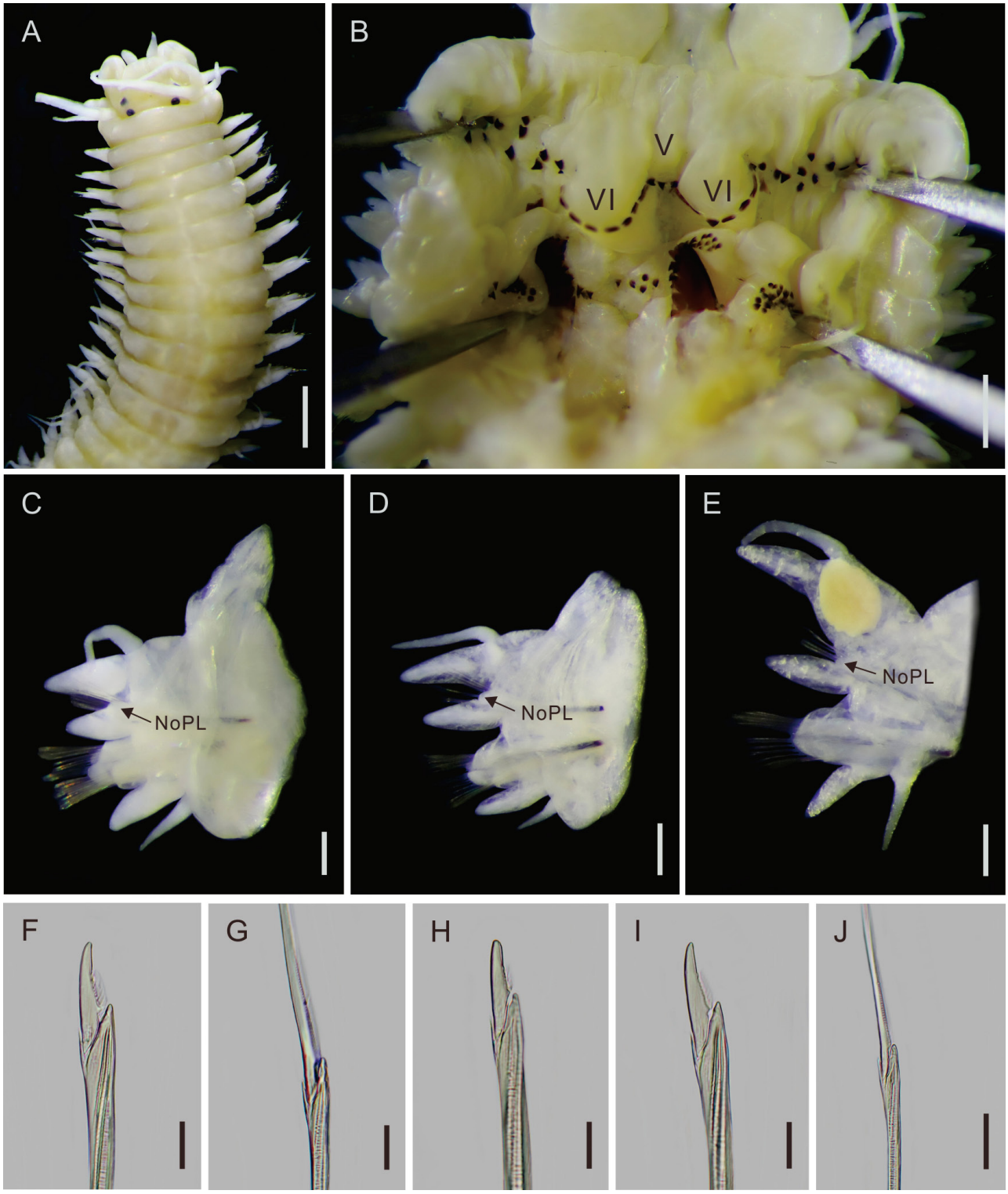

Fig. 19. *Perinereis qiguensis* sp. nov.; holotype (NSNM 8748-132): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 35; E, right parapodium, anterior view, chaetiger 72; F, neuropodial heterogomph falciger, chaetiger 35; G, neuropodial heterogomph spiniger, chaetiger 35; H, I, neuropodial heterogomph falciger, chaetiger 72; J, neuropodial heterogomph spiniger, chaetiger 72. Abbreviation: NoPL = notopodial prechaetal lobe. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F, G = 0.05 mm; H, I = 0.02 mm.

paragnaths on area VI, as well as lateral paragnaths on area III (Figs. 15B, 19B; Glasby and Hsieh 2006: 562, table 2; Villalobos-Guerrero 2019: 489). However, *P. qiguensis* sp. nov. can be distinguished from *P. mictodonta* by having: 1) λ-shaped ridge pattern of areas VI–V–VI (versus χ-shaped pattern); 2) smaller length ratio of dorsal cirri to dorsal ligule on anterior and posterior chaetigers (about 0.6 and about 0.5 versus 1.07 and 1.04, respectively); 3) one large, oval-shaped glandular mass in the center lobe of dorsal ligule on posterior chaetigers (versus one irregular-shaped glandular mass in each of the center and proximal lobes); 4) notopodial prechaetal lobe present on chaetigers of all body regions (versus absent); and 5) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on all chaetigers) (Fig. 15B–F, 19B–I, Table 3; Glasby and Hsieh 2006: 560–561, fig. 5C–D; Villalobos-Guerrero 2019: 489).

Perinereis qiguensis sp. nov. differs from *P. wilsoni* by having: 1) more paragnaths on area I (5 versus 1–3); 2) λ-shaped ridge pattern of areas VI–V–VI (versus χ-shaped ridge pattern); 3) smaller length ratio of dorsal cirri to dorsal ligule on anterior and posterior chaetigers (about 0.6 and about 0.5 versus 1.43 and 2.35, respectively); 4) one large, oval-shaped glandular mass in the center lobe of dorsal ligule on posterior chaetigers (versus one irregular-shaped glandular mass in each of the center and proximal lobes); and 5) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on all chaetigers) (Fig. 19B–I, Table 3; Glasby and Hsieh 2006: 560–561, 572, figs. 5C–D, 10C–D, table 2; Villalobos-Guerrero 2019: 489). The differences between *P. qiguensis* sp. nov. and eight other new species of group 3A described in the present study are discussed below.

Perinereis taitungensis sp. nov.

(Fig. 20, Table 2)

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Material examined: Holotype, NSNM 8748-133, Jialulan (22°48.36'N, 121°11.92'E), habitat type: IRHB, 19 August 2012. Paratype: 1 specimen, NSNM 8748-134, Jihuei (23°06.87'N, 121°24.21'E), habitat type: IRHB, 27 March 2014.

Etymology: The name is derived from the name of the county, Taitung, eastern Taiwan, where with the worm was collected.

Description: Based on holotype (NSNM 8748-133, complete; atoke) and paratype (NSNM 8748-134, incomplete; atoke): body length 84.0 mm with 139 chaetigers, chaetiger 10 width 3.3 mm, excluding parapodia; beige with brown spots on dorsal body edge and base of dorsal ligule on mid-body to posterior chaetigers in alcohol (Fig. 20A, D, E). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 2. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.4x longer than chaetiger 1. Pharynx with dark brown jaws, each with 3 teeth; paragnath pattern: I = 2 (2), in longitudinal line; II = 6 (6) (left), 11 (8) (right), in 2–3 (2) oblique rows; III = 19 (13) (center region with 14 (9) cones, in 4 transverse rows; 2 lateral regions, each with 2 (2) or 3 (2) cones, in longitudinal line); IV = 25 (19) (left), 26 (24) (right), in 4 oblique rows; V = 3 (3 large cone + 1 small cone), in triangle (small cone posteriorly to 3 large cones); VI = 1 (0) (left), 1 (1) (right), shield-shaped bars; VII–VIII = 28 (30), in 3 rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 20B, C, Table 2).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule in anterior chaetigers, about 0.8x as long as dorsal ligule, attached 2/3 to base of dorsal ligule in mid-body to posterior chaetigers, about 0.4x as long as dorsal ligule (Fig. 20F–H, Table 2).

Dorsal ligule subconical throughout, as long as median ligule on anterior to mid-body chaetigers, about 1.9x longer than median ligule on posterior chaetigers; center and proximal lobes of dorsal ligule each with orange brownish, triangle-shaped, glandular mass on mid-body to posterior chaetigers (Fig. 20F–H). Notopodial prechaetal lobe present only on mid-body chaetigers (Fig. 20F–H, Table 2).

Median ligule subconical throughout, slightly longer than neuroacicular ligule throughout (Fig. 20F–H).

Neuroacicular ligule with predominant inferior lobe on anterior to mid-body chaetigers, subequal inferior and superior lobes on posterior chaetigers, slightly shorter than ventral ligule on anterior to mid-body chaetigers, as long as ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule throughout (Fig. 20F–H).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations present throughout, heterogomph spinigers present on mid-body to posterior chaetigers (Fig. 20I–L, Table 2).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 3 chaetigers.

Type locality: Jialulan, Taitung County, Taiwan.

Distribution: Known only from type locality and Jihuei, Taitung County, Taiwan.

Remarks: *Perinereis taitungensis* sp. nov. has one bar-shaped paragnath on area VI and not greatly expanded notopodial dorsal ligule on posterior chaetigers, suggesting it can be categorized in group 1A (Hutchings et al. 1991: 271) (Fig. 20B, H, Table 2). Of the seven species in this group reported from East and Southeast Asia (see the Remarks section in *P. houbihuensis* sp. nov. for the name of these seven species), only *P. cultrifera* (Grube, 1840), *P. euiini* Park and Kim, 2017, and *P. helleri* (Grube, 1878) is similar to *P. taitungensis* sp. nov., which all have 3

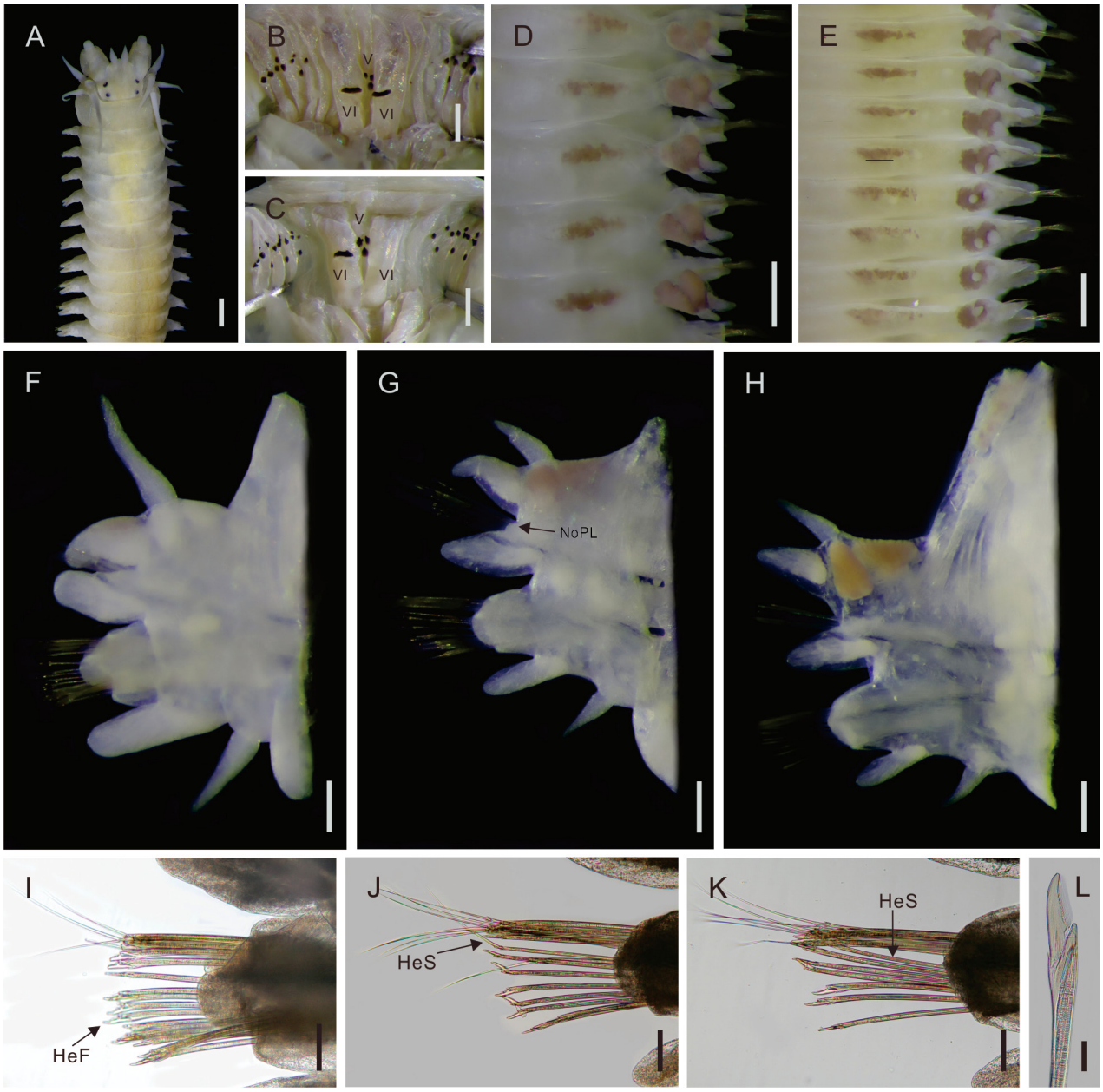

Fig. 20. *Perinereis taitungensis* sp. nov.; A, B, D–L, holotype (NSNM 8748-133); C, paratype (NSNM 8748-134): A, anterior body region, dorsal view; B, C, close-up of areas V, VI and VIII of the pharynx; D, close-up of mid-body segments; E, close-up of posterior body segments; F, right parapodium, anterior view, chaetiger 10; G, right parapodium, anterior view, chaetiger 50; H, right parapodium, anterior view, chaetiger 95; I, close-up of neuropodial chaetae, chaetiger 10; J, close-up of neuropodial chaetae, chaetiger 50; K, close-up of neuropodial chaetae, chaetiger 95; L, neuropodial heterogomph falciger, chaetiger 95. Abbreviation: NoPL = notopodial prechaetal lobe. Scale bars: A, B = 0.5 mm; C–E = 0.2 mm; F, G = 0.05 mm; H, I, = 0.02 mm.

cones on area V (Fauvel 1915: 7; Horst 1924: 174; Hutchings et al. 1991: 250, 253, 255; de León-González and Solís-Weiss 1998: 684; Park and Kim 2017: 256, 258, tables 2, 4). However, *P. taitungensis* sp. nov. can be distinguished from *P. cultrifera* by having: 1) ɔc-shaped ridge pattern of V–VI–V (versus λ-shaped ridge pattern); 2) notopodial prechaetal lobe present only on mid-body chaetigers (versus present on anterior to mid-body chaetigers); 3) smaller length ratio of dorsal ligule to median ligule on posterior chaetigers (1.8 versus 2.2); and 4) the center and proximal lobes of dorsal ligule each with orange brownish, triangle-shaped, glandular masses on posterior chaetigers (versus beige, oblong glandular masses); 5) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on chaetigers of all body regions) (Figs. 3E, 20H–K, Table 2; Hutchings et al. 1991: 253–254, fig. 8a–c; Park and Kim 2017: 256, fig. 5F).

Perinereis taitungensis sp. nov. can be readily distinguished from *P. euiini* by the presence of lateral teeth on area III (versus absent) (Park and Kim 2017: 256, fig. 4A). The other key characters for differentiating *P. taitungensis* sp. nov. from *P. euiini* include: 1) presence of one orange brownish, triangle-shaped, glandular masses in each of the center and proximal lobes of dorsal ligule on mid-body to posterior chaetigers (versus absent); 2) not greatly expanded dorsal ligule on posterior chaetigers (versus greatly expanded); and 3) presence of neuropodial heterogomph spinigers on chaetigers of mid to posterior body regions (versus present on chaetigers of all body regions) (Fig. 20H–K, Table 2; Park and Kim 2017: 257, figs. 2C–I, 3A, 5A).

Perinereis taitungensis sp. nov. differs from *P. helleri* by having: 1) more paragnaths on area IV (19–26 versus 10–19); 2) the center and proximal lobes of dorsal ligule each with one orange brownish, triangle-shaped, masses on mid-body to posterior chaetigers (versus absent); 3) notopodial prechaetal lobe present on mid-body chaetigers (versus absent); and 4) neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 20H–K, Table 2; Hutchings et al. 1991: 255, fig. 9a, b; Park and Kim 2017: 255–256, figs. 3B, 4E, 5C).

***Perinereis tubicola* sp. nov.**

(Fig. 21, Table 3)
urn:lsid:zoobank.org:act:AB171A57-CAB5-4A5D-BF86-024ECF43793D

Material examined: Holotype, NSNM 8748-135, Wanlitong (21°59.73'N, 120°42.26'E), habitat type: IRHB, coll. K.S. Lee, January 1991.

Etymology: The name is derived from the encrypted living condition of the worm in its own secreted tube.

Description: Holotype, atoke, without posterior end, remaining body length 198.0 mm with 162 chaetigers, chaetiger 10 width 5.3 mm, excluding parapodia; beige in alcohol (Fig. 21A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 3. Two pairs of eyes, in trapezoidal arrangement, without dark pigment in alcohol. Tentacular belt longer than chaetiger 1. Pharynx with dark brown jaws, each with 4 teeth; paragnath pattern: I = 1 small cone; II = 2 (left), 1 (right), small cones; III = 0; IV = 2 (left), 3 (right), small cones, without bars; V = 3 small cones; VI = 9 (left), 8 (right), uneven-length short bars in transverse row; VII–VIII = 12 small cones, in 1 row. Ridge pattern of areas VI–V–VI, u-shaped (Fig. 21B, Table 3).

Dorsal cirri digitiform, medially attached to dorsal ligule throughout, about as long as dorsal ligule on anterior chaetigers, about 0.6–0.8x as long as dorsal ligule on mid-body to posterior chaetigers (Fig. 21C–E, Table 3).

Dorsal ligule subconical throughout, about 1.4–1.5x longer than dorsal ligule on anterior to mid-body chaetigers, about 2.5x longer than dorsal ligule on posterior chaetigers (Fig. 21C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, as long as neuroacicular ligule on anterior chaetigers, about 2.7x longer than neuroacicular ligule on mid-body chaetigers, about 1.6x long than neuroacicular ligule on posterior chaetigers (Fig. 21C–E).

Neuroacicular ligule with predominant inferior lobe on anterior to mid-body chaetigers, inferior and superior lobes subequal in length on posterior chaetigers, about as long as ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.8x as long as ventral ligule on anterior chaetigers, about 0.4–0.5x as long as ventral ligule on posterior chaetigers (Fig. 21C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations present throughout (Fig. 21F, G, Table 3), heterogomph spinigers present on mid-body to posterior

chaetigers (Fig. 21H, Table 3).

Type locality: Wanlitong, Pingtung County, Taiwan.

Distribution: Known only from type locality.

Remarks: *Perinereis tubicola* sp. nov. has an arc of 8–9 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers; it belongs to group 3A and the *Perinereis nuntia* species group (Fig. 21B, E, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species of the *Perinereis nuntia* group recognized by Villalobos-Guerrero (2019), *Perinereis tubicola* sp. nov. easily distinguished from the known congeners of this species group by having no paragnath on area III and the fewest number of paragnaths on areas I, II, IV, and VII–VIII (Table 3; Glasby and Hsieh 2006: 562, table 2; Villalobos-Guerrero 2019: 489). The differences between *P. tubicola* sp. nov. and eight other new species of the 3A group described in the present study are discussed below.

***Perinereis vancaurica* (Ehlers, 1868)**

(Fig. 22A–R)

Nereis vancaurica Ehlers 1868: XX; Ehlers 1904: 25 (replacement name for *N. languida* Grube, 1867).
Nereis languida — Grube 1867: 15, pl. 2, fig. l.
Nereis (*Perinereis*) *vancaurica* — Grube 1878: 83–84.
Nereis (*Perinereis*) *nancaurica* Augener 1922: 23.
Perinereis horsti Gravier 1901: 182, figs. 182–184, pl. l, fig. 47.
Perinereis nancaurica Monro 1931a: 14; Monro 1931b: 38–41, fig. 2a–f.
Perinereis vancaurica Fauvel 1932: 103; Kott 1951: 88, l11; Fauvel 1932: 103; Fauvel 1953: 205–206, fig. 105f–g; Russell 1962: 7; Day 1967: 334, fig. 14.12k–o; Wu 1967: 70–71; Wu et al. 1981: 176–177, fig. 111A–J; Wu et al. 1985: 195–197, fig. 111A–J; Hartmann-Schroder 1979: 117, figs. 207–210; Hutchings et al. 1991: 265–266, fig. 17a–h.
Perinereis vancaurica indica Bhatt and Bal 1966: 25.
Perinereis linea Wu 1967: 68–69, fig. 10a–d, non Treadwell 1936.
Perinereis vancaurica tetradentata Imajima 1972: 86–88, fig. 23a–i.

Material examined: 2 specimens, NSNM 8748-

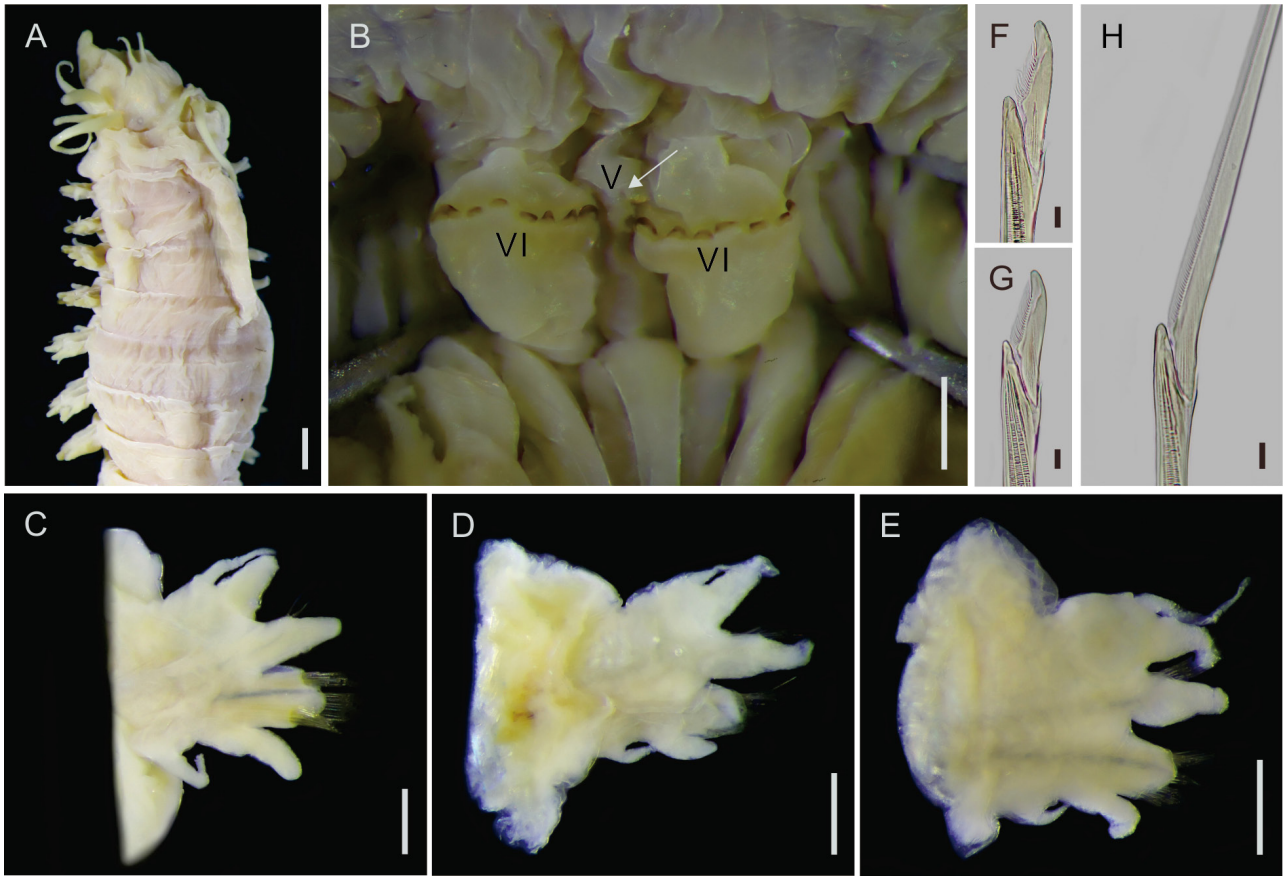

Fig. 21. *Perinereis tubicola* sp. nov.; holotype (NSNM 8748-135): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx, white arrow points cones of area V; C, left parapodium, anterior view, chaetiger 10; D, left parapodium, anterior view, chaetiger 57; E, left parapodium, anterior view, chaetiger 111; F, neuropodial heterogomph falciger, chaetiger 14; G, neuropodial heterogomph falciger, chaetiger 116; H, neuropodial heterogomph spiniger, chaetiger 116. Scale bars: A = 1.0 mm; B–E = 0.5 mm; F–H = 0.02 mm.

136, Fuguijiao (25°17.75'N, 121°31.99'E), habitat type: IRHB, 12 March 2004; 3 specimens, NSNM 8748-137–139, Linshanbi (25°16.99'N, 121°30.59'E), habitat type: IRHB, 14 Mach 2004; 8 specimens, NSNM 8748-140–147, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 3–4 November 2007; 31 specimens, NSNM 8748-148–178, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 9–11 May 2008; 2 specimens, NSNM 8748-179–180, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 22 November 2010.

Description: Based on 12 complete specimens (NSNM 8748-137–139, NSNM 8748-148, NSNM 8748-152, NSNM 8748-156–157, NSNM 8748-163, NSNM 8748-175, NSNM 8748-177–179; all atoke) and

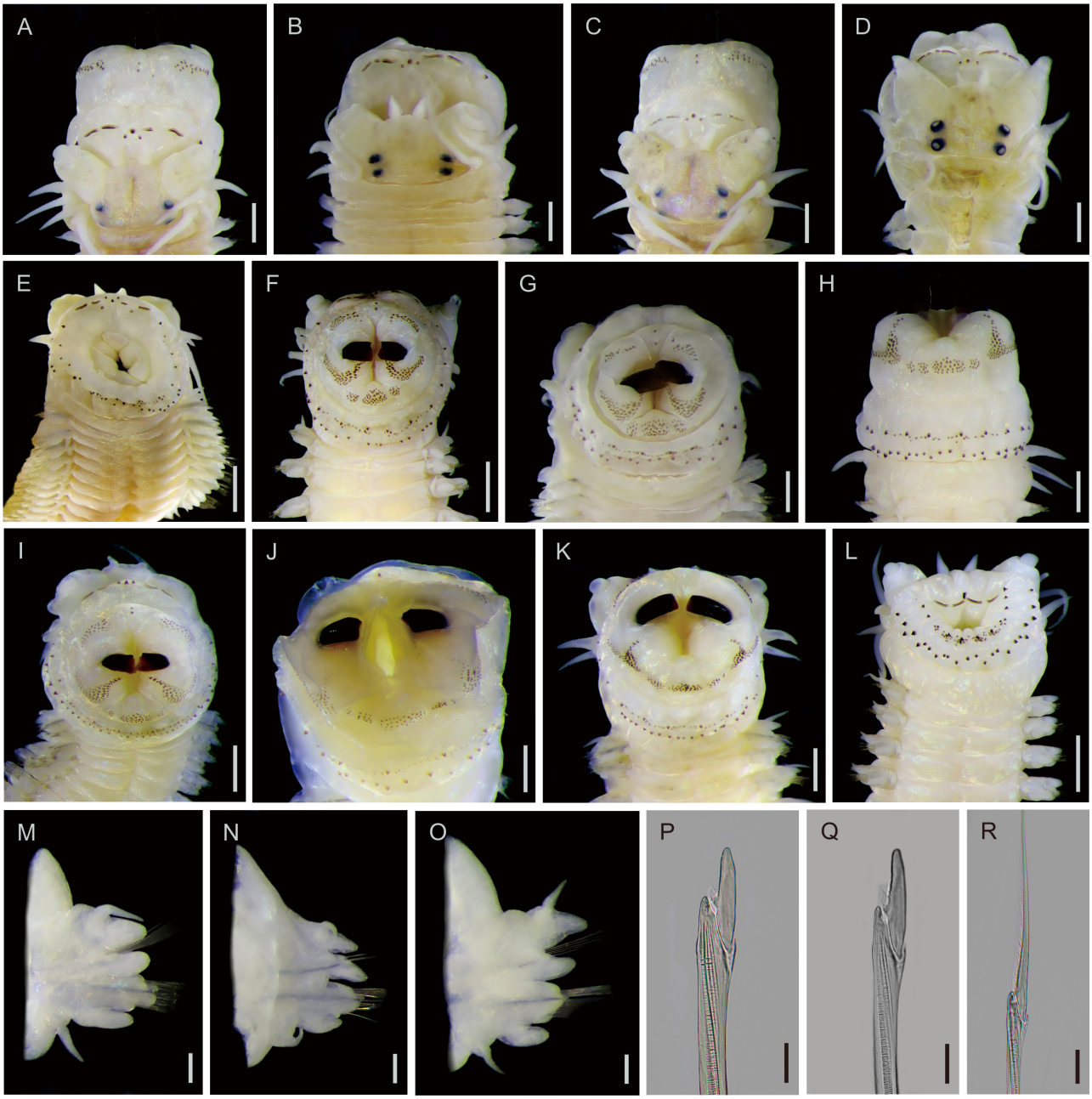

Fig. 22. *Perinereis vancaurica* (Ehlers, 1868); A, J (NMNS 8748-141); B, G (NMNS 8748-136); C, H (NMNS NSNM 8748-157); D (NSNM 8748-180); E (NSNM 8748-138); F (NSNM 8748-151); I (NSNM 8748-152); K (NSNM 8748-140); L (NSNM 8748-144); M-R (NSNM 8748-156): A–D, anterior body region, dorsal view; E–L, anterior body region, dorsal view; M, C, left parapodium, anterior view, chaetiger 10; N, left parapodium, anterior view, chaetiger 50; O, left parapodium, anterior view, chaetiger 90; P, Q, neuropodial heterogomph falciger, chaetiger 90; R, neuropodial heterogomph spiniger, chaetiger 90. Scale bars: A–D, F–H, J, K = 0.5 mm; E, I, L = 1.0 mm; M–O = 0.2 mm; P–R = 0.02 mm.

33 incomplete specimens (NSNM 8748-136, NSNM 8748-140–147, NSNM 8748-149–151, NSNM 8748-153–155, NSNM 8748-158–162, NSNM 8748-164–174, NSNM 8748-176, NSNM 8748-180; all atoke): Body length 40.5–100.0 (n = 12) mm with 109–195 (n = 12) chaetigers, chaetiger 10 width 1.2–3.5 (n = 45) mm, excluding parapodia; beige in alcohol (Fig. 22A–L). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 1–5 (mostly 2, one case of 1 or 5, 3 cases of 3 and five cases of 4, n = 45). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.1–1.4x (n = 45) longer than chaetiger 1. Pharynx with dark brown jaws, each without teeth; paragnath pattern: I = 0–6 (mostly 2, few cases of 3 and 4, one case of 0 and 6, n = 45, same sample size on following areas); II = 20–40 (left), 14–42 (right), in 2–4 oblique rows; III = 48–104 (center region with 27–66 cones, in oval cluster; mostly 2 lateral regions, each with 6–23 cones, in longitudinal lines with less 10 cones, in oval cluster with more than 10 cones, nine cases of 3 lateral groups, outer-most lateral group with 1–3 cones, two cases of 4 lateral groups, outer-most lateral groups each with 3–12 cones) (Fig. 22E–K); IV = 60–108 (left), 59–110 (right), in chevron-shaped; V = 3 (mostly 3, rare cases of 1 or 2), in shallow triangle (longitudinal line, transverse row or triangle); VI = 2 (mostly 2 even length bars, two cases of 2 uneven-length bars, one case of 2 long+1 short bars, one case of 2 long+2 short bars, two cases of 2 bars+1 cone) (left), 2 (mostly 2 even length bars; two cases of 2 uneven-length bars; two cases of even length 2 bars+1 cone) (right) (Fig. 22A–D); VII–VIII = 53–121, in 2 rows; anterior row 8–15 large cones interspaced with 15–79 small and medium cones in 1–3 lines (Fig. 22E–K), six cases of small and medium cones clustered around large cones in mid-ventral oral region, posterior row with 16–37 large cones in zigzag arrangement (Fig. 22L). Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 22A–D).

Dorsal cirri digitiform throughout, attached 1/3 to base of dorsal ligule on anterior chaetigers, about 0.3x as long as dorsal ligule, medially attached to dorsal ligule on mid-body to posterior chaetigers, about 0.5–0.6x as long as dorsal ligule (Fig. 22M–O).

Dorsal ligule conical with blunt tip on anterior chaetigers, about 1.7x longer than median ligule, subconical on mid-body to posterior chaetigers, about 2.0–2.1x longer than median ligule (Fig. 22M–O). Notopodial prechaetal lobe absent.

Median ligule conical, round on anterior chaetigers, about as long as neuroacicular ligule, subconical on mid-body to posterior chaetigers, about as long as neuroacicular ligule (Fig. 22M–O).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, inferior and superior lobes subequal in length on posterior half of mid-body to posterior chaetigers, about as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia, about 0.7x as long as ventral ligule throughout (Fig. 22M–O).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 22P–R).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 2–6 (n = 13) chaetigers.

Distribution: Australia, East Asia, French Guiana (Atlantic Ocean), Gulf of Mexico, Indo-West Pacific Oceans, Red Sea (Fauvel 1932 1953; Hutchings et al. 1991; Fauchald et al. 2009).

Remarks: Different descriptions of *P. vancaurica* (Ehlers, 1868) in different reports causes considerable confusion for properly identifying this species. Grube (1867: 15, pl. 2, fig. 1a b) provided a brief description and an antero-dorsal view drawing of extruded pharynx of *Nereis languida* (Grube, 1867) (type locality: Vancauri (= Nancowry Island), Nicobar Islands, Indian Ocean). Ehlers (1868: XX) noted Grube's name was a junior homonym of *N. languida* Kinberg, 1865 and replaced the junior homonym by *N. vancaurica* (Ehlers, 1868) without giving any description. He later gave a brief description on paragnath pattern of the species: area I with one cone, areas II and IV with double or triple cones in curved rows, area III with cones in transverse double rows, area V with three small cones in triangle, area VI with two large transverse linear ones, areas VII–VIII with cones in one transverse double rows (Ehlers 1904: 25). Based on these two earlier descriptions, specimens with this type of paragnath patterns from many geographic regions in the Indo-West Pacific Oceans were referred to *P. vancaurica* regardless significant differences between these reports in paragnath patterns on areas III and VII–VIII of the pharynx. For instance, area III of type specimen has no lateral groups of cones (Ehlers 1904: 25), but specimens of *P. vancaurica* collected from Singapore (Fauvel 1953: 206, fig. 105g), Japan (Imajima 1972: 86, fig. 23b), Southeast China (Wu et al. 1981: 176, fig. 111B), and Taiwan (Wu 1967: 71) have lateral groups of cones on the same area. However, Hutchings et al. (1991: 265–266, fig. 17c) redescribed *P. vancaurica* collected from Australia with no lateral groups of cones

on area III. Moreover, some reports described the species with small cones interspaced with large cones on anterior row of area VII–VIII (Fauvel 1953: 206, fig. 105g; Wu et al. 1981: 176, fig. 111B; Wu 1967: 71) but other reports indicated otherwise. For instance, Hutchings et al. (1991: 265–266, fig. 17c) described *P. vancaurica* collected from Australia with a large patch of small cones interspaced with large cones in mid-ventral region on the anterior row of area VII–VIII. Both *P. linea* (Treadwell, 1936) in Wu (1967) and *P. vancaurica tetradentata* Imajima 1972, which have been synonymized with *P. vancaurica* by Hutchings et al. (1991), have no small cones interspaced with large cones on anterior row of area VII–VIII (Wu 1967: 71, fig. 10b; Imajima 1972: 86, fig. 23b).

The morphology of the present specimens agrees with the original description of *P. vancaurica* only on paragnath pattern of areas V and VI of the pharynx and morphology of parapodia (Fig. 22A–D, M–O; Grube 1867: 15, pl. 2, fig. 1a, b; Ehlers 1904: 25). The present specimens are more similar to specimens of this species collected from Singapore, Southeast China, and Taiwan than those from Australia and Indian Ocean in terms of paragnath patterns on areas III and VII–VIII of the pharynx (Fig. 22E–K; Grube 1867: 15, pl. 2, fig. 1a, b; Fauvel 1953: 206, fig. 105g; Wu 1967: 71; Wu et al. 1981: 176, fig. 111B; Hutchings et al. 1991: 266, fig. 17c). These significant differences in paragnath patterns between *P. vancaurica* from Southeast Asia and from Australia suggests that further examination using molecular analysis for the possible presence of cryptic species might be needed. The present study reports for the first time that Taiwanese specimens of *P. vancaurica* have a peculiar paragnath pattern on anterior row of areas VII–VIII. Six specimens of the present study have small and medium cones form several clusters around large cones in mid-ventral oral region on the anterior row of areas VII–VIII (Fig. 22L). However, these six specimens cannot be distinguished from other specimens of the same species examined in the present study besides the above-mentioned character. Lastly, a few specimens have one long bar and 2 short to medium length bars on each side of area VI (Fig. 22B, D). This abnormal paragnath pattern of area VI in these few individuals might be explained by breaking off of one long bar into two shorter bars on this pharyngeal area.

Perinereis wanlitongensis **sp. nov.**

(Fig. 23, Table 4)

urn:lsid:zoobank.org:act:3E5DAE6F-23F9-4A36-A028-5C6E77AEE040

Material examined: Holotype, NSNM 8748-181, Wanlitong (21°59.73'N, 120°42.26'E), habitat type: IRHB, 15 May 2009. Paratypes: 1 specimen, NSNM 8748-182, collection date and location information same as holotype; 1 specimen, NSNM 8748-183, collection location information same as holotype, 15 Mach 2008.

Etymology: The name is derived from the name of nearby village, Wanlitong, where worms were collected.

Description: Based on holotype (NSNM 8748-181, complete; atoke) and paratypes (NSNM 8748-182–183, complete; all atoke): body length 64.0 (35.0–112.0, n = 2) mm with 115 (112–161, n = 2) chaetigers, chaetiger 10 width 1.5 (2.1) mm, excluding parapodia; beige in alcohol (Fig. 23A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 4 (3, n = 1). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 1. Pharynx with brown jaws, each with 5–6 (5, n = 2) teeth; paragnath pattern: I = 2 (2, n = 1, same sample size on following areas) uneven size cones, in longitudinal line, posterior cone larger; II = 12 (11) (left), 13 (13) (right), in cluster; III = 20 (20) (center region with 16 (16) cones, in cluster; 2 lateral regions, each with 2 (2) cones, in longitudinal line); IV = 24 (22) (left), 27 (24) (right), in 3–4 oblique rows, without bars; V = 4 (3) uneven size cone, anterior 3 cones in triangle, largest cone anteriorly, smallest cone posteriorly; VI = 1 (1) (left), 1 (1) (right), smooth bars; VII–VIII = 30 (33), in 2–3 rows. Ridge pattern of areas VI–V–VI, λ-shaped (Fig. 23B, Table 4).

Dorsal cirri digitiform, medially attached to dorsal ligule on anterior to mid-body chaetigers, about 0.8x as long as dorsal ligule, attached 4/5 to base of dorsal ligule on posterior chaetigers, about 0.3x as long as dorsal ligule on posterior chaetigers (Fig. 23C, D, Table 4).

Dorsal ligule subconical throughout, about 1.9x longer than median ligule on anterior to mid-body chaetigers; base of dorsal ligule greatly elongated and broader on posterior chaetigers, about 4.2x longer than median ligule; distal, center and proximal lobes each with one irregular-shaped glandular mass on mid-body to posterior chaetigers (Fig. 23C, D). Notopodial prechaetal lobe absent (Table 4).

Median ligule subconical throughout, about 1.3x longer than neuroacicular ligule on anterior chaetigers, about 1.8x longer than neuroacicular ligule on posterior chaetigers (Fig. 23C, D).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, inferior and superior lobes subequal in length on posterior chaetigers, about 0.6x as long as ventral ligule on anterior to mid-body chaetigers, about as long as ventral ligule on posterior chaetigers. Neuropodial postchaetal lobe absent. Ventral

ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.6x as long as ventral ligule on anterior chaetigers, about 0.7x as long as ventral ligule on mid-body chaetigers, about as long as ventral ligule on posterior chaetigers (Fig. 23C, D).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and short-bladed heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: short-bladed heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 23E, F, Table 4).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 3–8 chaetigers.

Type locality: Wanlitong, Pingtung County, Taiwan.

Distribution: Known only from type locality.

Remarks: With one paragnath on area VI of the pharynx and greatly expanded dorsal ligule on posterior chaetigers, *P. wanlitongensis* sp. nov. is included in group 1B proposed by Hutchings et al. (1991: 271) (Fig. 23B, D, Table 4). Of the six species in this group reported from East and Southeast Asia (see the Remarks section in *P. kebalanae* sp. nov. for the name of these six species), only *P. malayana* and *P. nigropunctata* are similar to *P. wanlitongensis* sp. nov. by having lateral paragnaths on area III, no bar-shaped paragnaths on area IV, and mostly 3 cones on area V (Fig. 23B, Table 4; Horst 1889: 168, 172; Fauvel 1915: 7; Hutchings et al. 1991: 248, 250, 257–258, 263). However, *P. wanlitongensis* sp. nov. can be distinguished from *P. malayana* by having: 1) more paragnaths on area III (20

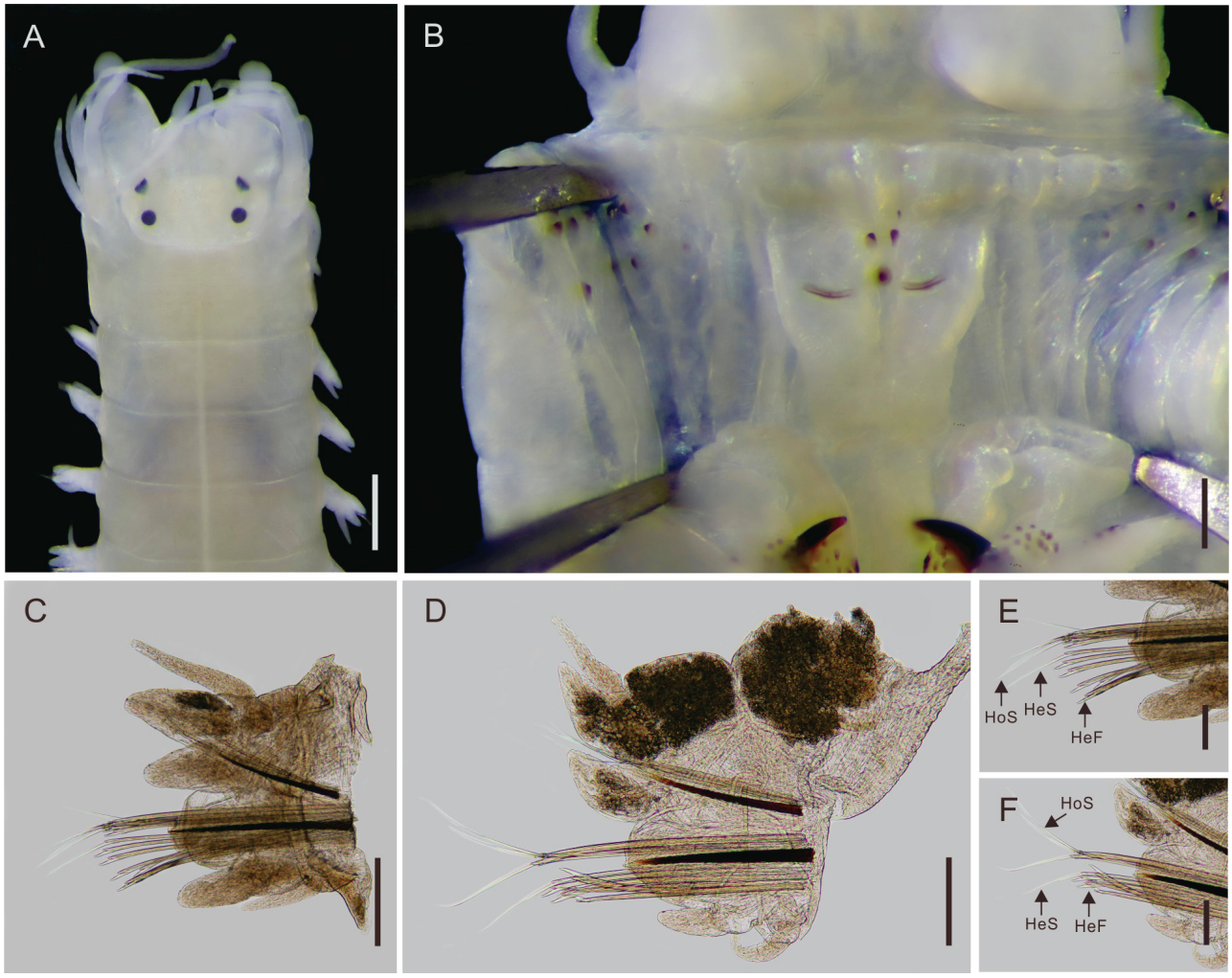

Fig. 23. *Perinereis wanlitongensis* sp. nov.; holotype (NSNM 8748-182): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, right parapodium, anterior view, chaetiger 10; D, right parapodium, anterior view, chaetiger 85; E, neuropodial chaetae, chaetiger 10; F, neuropodial chaetae, chaetiger 85. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger; HoS = homogomph spiniger. Scale bars: A = 0.5 mm; B–D = 0.2 mm; F–H = 0.1 mm.

versus 14); 2) greater dorsal cirri to dorsal ligule length ratio on anterior and posterior chaetigers (about 0.8 and 0.3 versus 0.3 and 0.2 (based on measurements from pl. 8, fig. 4 in Horst 1889), respectively); 3) the distal, center and proximal lobes of dorsal ligule each with one irregular-shaped glandular masses on mid-body to posterior chaetigers (versus absent); and 4) anal opening not surrounded by papillae (versus surrounded by papillae) (Fig. 23B–D, Table 4; Horst 1889: 168–170, pl. 8, figs. 4, 6).

Perinereis wanlitongensis sp. nov. differs from *P. nigropunctata* by having: 1) no prechaetal lobe on chaetigers of all body regions (versus present on chaetigers of all body regions); 2) greater length ratio of dorsal ligule to median ligule on posterior chaetigers (4.3 versus 3.3); and 3) one irregular-shaped glandular mass in each of the distal, center and proximal lobes of dorsal ligule on posterior chaetigers (versus 1 in the center lobe) (Fig. 23C, D, Table 4).

Perinereis kebalanae sp. nov. and *P. wanlitongensis* sp. nov. are the two only new species described in the present study which can be categorized in group 1B (Table 4). *Perinereis kebalanae* sp. nov. can be distinguished from *P. wanlitongensis* sp. nov. by having: 1) more paragnaths on areas II, III and IV (19–25, 30–35 and 50–54 versus 11–13, 20 and 22–27, respectively); 2) no lateral teeth on area III (versus present); 3) bar-shaped paragnaths on area IV (versus absent); 4) fewer number of paragnaths on area V (1 versus 3–4); 5) u-shaped ridge pattern of areas VI–V–VI (versus λ-shaped ridge pattern), no glandular masses in the lobes of dorsal ligule (versus 3 glandular masses); 6) smaller length ratio of dorsal ligule to median ligule on posterior chaetigers (3.5 versus 4.2); and 7) heterogomph spinigers on anterior chaetigers (versus absent on anterior chaetigers) (Table 4).

Perinereis wilsoni Glasby and Hsieh, 2006

(Fig. 24, Table 3)

Perinereis wilsoni Glasby and Hsieh 2006: 570–573, fig. 10 (for complete synonym).

Material examined: 2 specimens, NSNM 8748-184–185, Aodi (25°02.97'N, 121°55.78'E), habitat type: IRHB, 23 March 1993; 1 specimen, NSNM 8748-186, Magang (25°00.81'N, 122°00.13'E), habitat type: IRHB, 6 March 2001; 2 specimens, NSNM 8748-187–188, Linshanbi (25°16.99'N, 121°30.59'E), habitat type: IRHB, 20 November 2003; 1 specimen, NSNM 8748-189, Dali (24°57.62'N, 121°55.27'E), habitat type: IRHB, 23 November 2003; 2 specimens, NSNM 8748-190–191, Longdongwan (25°07.02'N, 121°54.98'E), habitat type: SRHB, 7 March 2004; 4 specimens, NSNM 8748-192–195, Shimen (25°17.85'N, 121°34.14'E), habitat type: IRHB, 14–16 March 2004; 1 specimen, NSNM 8748-196, Hsinchu (24°51.00'N, 120°55.48'E), habitat type: SRHB, 18 July 2016.

Description: Based on 5 complete specimens (NSNM 8748-186–187, NSNM 8748-190–191, NSNM 8748-193, all atoke) and 8 incomplete specimens (NSNM 8748-184–185, NSNM 8748-188, NSNM 8748-189, NSNM 8748-192, NSNM 8748-194–196, all atoke): Body length 29.0–66.5 (n = 5) mm with 73–110 (n = 5) chaetigers, chaetiger10 width 2.0–5.1 (n = 13) mm, excluding parapodia; beige in alcohol (Fig. 24A, B). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 4–11 (n = 12). Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.1–1.6x (n = 13) longer than chaetiger 1. Pharynx with dark brown jaws, each with 5–6 (n = 13) teeth; paragnath pattern: I = 1–3 cones, mostly 2 (n = 13, same sample size on following areas), in longitudinal line; II = 6–15 cones (left), 6–15 cones (right), in 2–3 oblique rows; III = 14–25 cones (center region with 10–23 cones, in 3–4 transverse rows; 2 lateral regions, each with 1–2 or 1–3 cones; IV = 13–34 cones (left), 19–34 cones (right), in 3–4 oblique rows, without bars; V = 1–3 (mostly 1 or 2, one case of 3); VI = 4–7 uneven-length bars, inner and outer-most longest (one case of one additional cone) (left), 4–7 uneven-length bars, inner and outer-most longest (right), in transverse row; VII–VIII = 14–36, in 2–3 rows. Ridge pattern of areas VI–V–VI, χ-shaped (Fig. 24A, B, Table 3).

Dorsal cirri digitiform, attached 1/3 to base of dorsal ligule on anterior chaetigers, about 0.9x as long as dorsal ligule, medially attached dorsal ligule on mid-body to posterior chaetigers, about 0.5–0.7x as long as dorsal ligule on mid-body to posterior chaetigers (Fig. 24C–E, Table 3).

Dorsal ligule subconical throughout, about 2.0x longer than median ligule throughout; proximal lobe of dorsal ligule with two irregular-shaped glandular masses on posterior chaetigers (Fig. 24C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, about 1.2x longer than neuroacicular ligule on anterior chaetigers, about as long as neuroacicular ligule on mid-body to posterior chaetigers (Fig. 24C–E).

Neuroacicular ligule with prominent inferior lobe on anterior chaetigers, about 0.5x as long as ventral ligule, inferior and superior lobes subequal in length on mid-body to posterior chaetigers, about as long as ventral ligule. Neuropodial postchaetal lobe absent. Ventral cirri digitiform, mid-ventrally attached to ventral edge of parapodia throughout, about 0.6–0.7x as

long as ventral ligule (Fig. 24C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-sized blade heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-sized blade heterogomph falcigers with serrations and heterogomph spinigers present throughout (Fig. 24F, Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 5–9 (n = 5) chaetigers (Table 3).

Distribution: Japan, Korea Strait (South Korea), South China Sea and Yellow Sea (China), Taiwan (Glasby and Hsieh 2006).

Remarks: Morphology of examined specimens in the present study agrees with original description of *P. wilsoni* Glasby and Hsieh, 2006 (Fig. 24A–F, Table 3; Glasby and Hsieh 2006: 572, fig. 10A–F). All examined specimens of *P. wilsoni* in the present study were mostly collected from reef habitats on coasts of northern Taiwan, which agrees with the northerly distribution of this species in Taiwan reported by Glasby and Hsieh (2006: 555, fig. 1).

Perinereis yehliuensis **sp. nov.**

(Fig. 25, Table 3)

urn:lsid:zoobank.org:act:D9D90DCA-1FEB-434D-A573-F3C49EAED0DB

Material examined: Holotype, NSNM 8748-197, Yehliu (25°12.46'N, 120°41.56'E), habitat type: IRHB, coll. H.-T. Hung, 13 April 1999.

Etymology: The name is derived from the name of nearby village, Yehliu, where the worm was collected.

Description: Holotype, epitoke, without posterior end, remaining body length 45.0 mm with 78 chaetigers, chaetiger 10 width 2.0 mm, excluding parapodia; beige in alcohol (Fig. 25A, B). Prostomium wider than long, lateral antennae antero-lateral, longer than palps, palpophores globose, palpostyles spheroid. Four pairs of

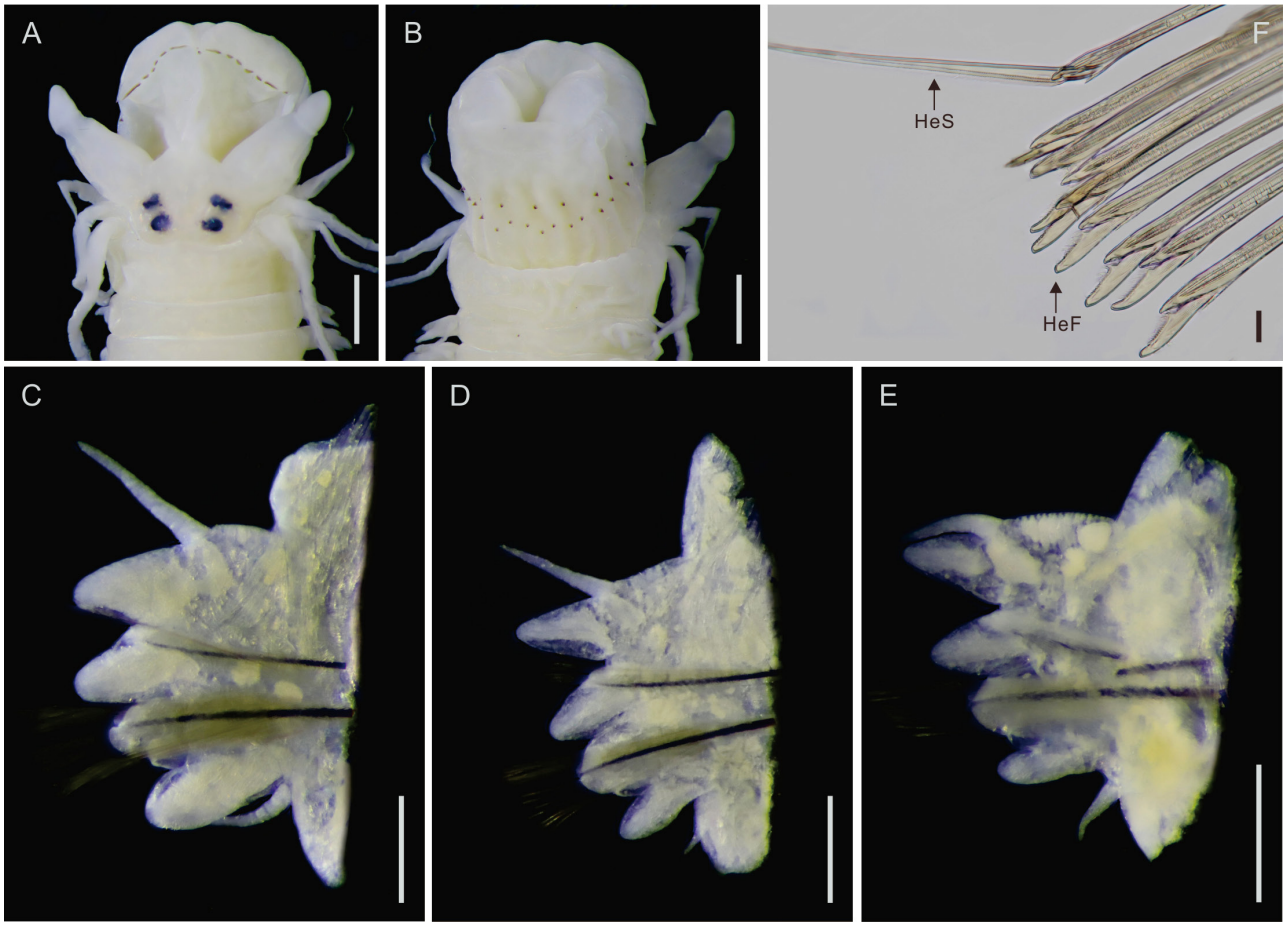

Fig. 24. *Perinereis wilsoni* Glasby and Hsieh, 2006; A, B (NSNM 8748-184); C–F (NSNM 8748-193): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, left parapodium, anterior view, chaetiger 9; D, left parapodium, anterior view, chaetiger 40; E, left parapodium, anterior view, chaetiger 80; F, neuropodial chaetae, chaetiger 9. Abbreviations: HeF = heterogomph falciger; HeS = heterogomph spiniger. Scale bars: A, B = 1.0 mm; C–E = 0.2 mm; F = 0.02 mm.

tentacular cirri, longest one reaching chaetiger 5. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 1. Pharynx with dark brown jaws, each with 2 (damaged?) or 5 teeth; paragnath pattern: I = 3, in triangle; II = 5 (damaged?), 21, in 3 oblique rows; III = 27 (center region with 21 cones, in 4 transverse rows; 2 lateral regions, each with 3 cones, in longitudinal line); IV = 31 (left), 34 (right), in 4 oblique rows; without bars; V = 5, in loosely cluster; VI = 6 (2 long bars (innermost and 2nd outermost), 4 short bars (median and outermost) (left), 8 (2 long bars (innermost and 2nd outermost), 6 short bars (median and outermost) (right), in shallow u-shaped line; VII–VIII = 23, in 2–3 rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 25C, Table 3).

Pre-natatory region: Dorsal cirri robust with filament distally on chaetigers 1 to 7, basally attached to dorsal ligule, about 1.2x longer than dorsal ligule, digitiform on chaetiger 8 to 16, medially attached to dorsal ligule, about 0.8x as long as dorsal ligule (Fig. 25D–F). Dorsal ligule subconical, about as long as median ligule. Notopodial prechaetal lobe absent.

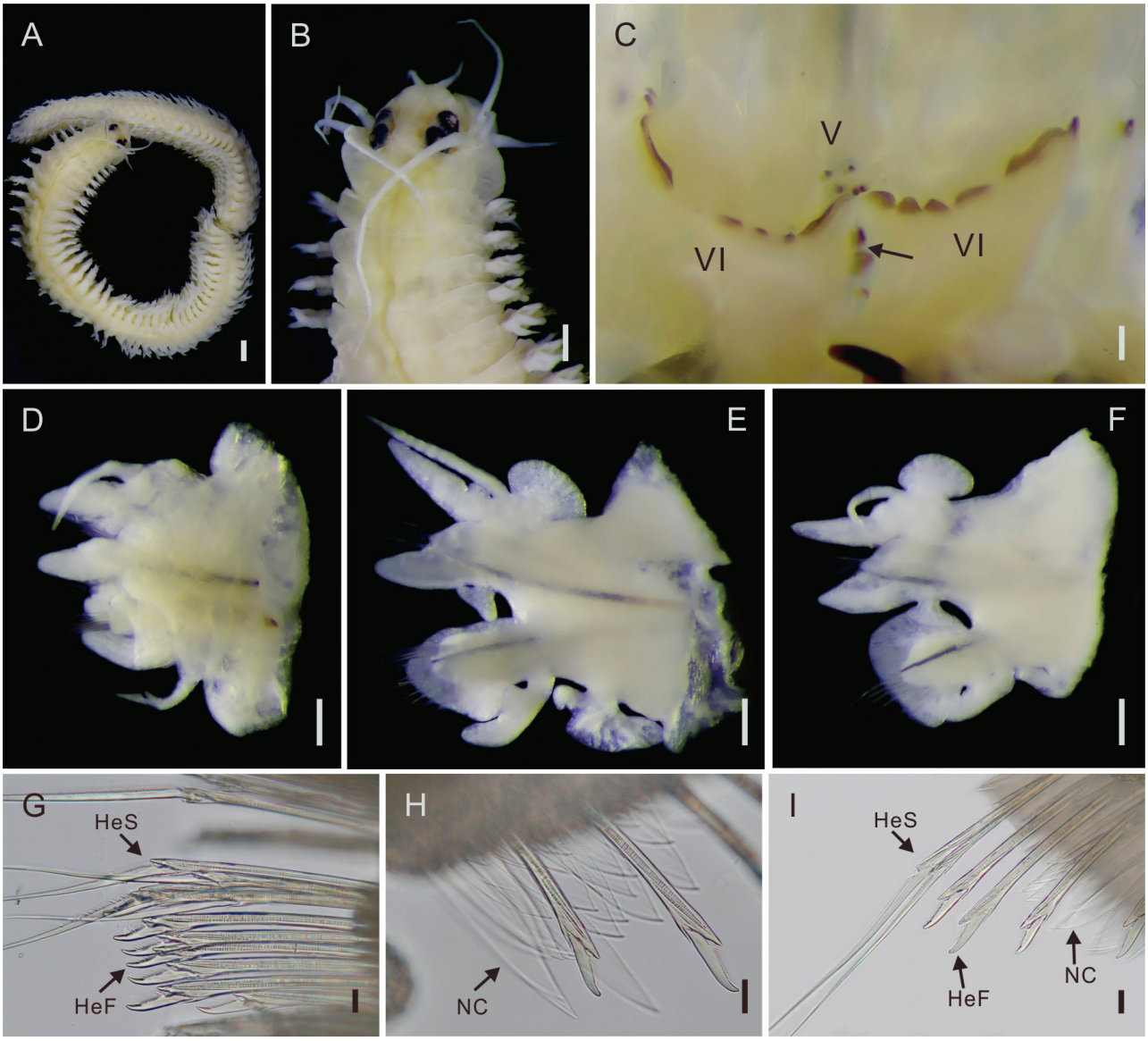

Fig. 25. *Perinereis yehliuensis* sp. nov.; holotype (NSNM 8748-197): A, whole animal; B, anterior body region, dorsal view; C, close-up of areas V and VI of the pharynx, black arrow points fall off bars of right area VI; D, right parapodium, anterior view, chaetiger 10; E, right parapodium, anterior view, chaetiger 35; F, right parapodium, anterior view, chaetiger 57; G, neuropodial chaetae, chaetiger 10; H, natatory chaetae and neuropodial heterogomph chaetae, chaetiger 30; I, natatory chaetae, neuropodial heterogomph falcigers and heterogomph spinigers, chaetiger 57. Abbreviation: NoPL = notopodial prechaetal lobe. Scale bars: A = 1.0 mm; B = 0.5 mm; C = 0.1 mm; D–F = 0.2 mm; G–I = 0.02 mm.

Median ligule subconical. Neuroacicular ligule with predominant inferior lobe. Neuropodial postchaetal lobe absent. Ventral ligule subconical. Ventral cirri robust on chaetigers 1 to 7, becoming digitiform along chaetigers 8 to 16, mid-ventrally attached to ventral edge of parapodia, as long as ventral ligule (Fig. 25D). Notochaetae homogomph spinigers. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-size blade heterogomph falcigers with serrations. Subacicular fascicle of neuropodia: homogomph spinigers and medium-size blade heterogomph falcigers with narrow serrations (Fig. 25G, Table 3).

Natatory region: Dorsal cirri digitiform, medially attached to dorsal ligule, about 0.5–0.6x as long as dorsal ligule. Dorsal cirrus lobe present from chaetiger 17, becoming kidney-shaped lamellae from on mid-body chaetigers, reduced progressively in size thereafter (Fig. 25E, F). Dorsal ligule subconical, about 1.4x longer than median ligule. Notopodial prechaetal lobe absent. Median ligule subconical, as long as neuroacicular ligule. Neuroacicular ligule with predominant inferior lobe, inferior and superior lobes subequal in length on posterior half of mid-body to posterior chaetigers, as long as ventral ligule. Neuropodial postchaetal lobe present. Ventral ligule subconical. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.5–0.7x as long as ventral ligule with irregular-shaped dorsal and ventral lobes on anterior-half of natatory chaetigers, gradually reduced in size thereafter (Fig. 25E, F). Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present. Supra-acicular fascicle of neuropodia: homogomph spinigers present, heterogomph falcigers absent. Subacicular fascicle of neuropodia: medium-size blade heterogomph falcigers with narrow serrations present, natatory chaetae present, homogomph spinigers present only on posterior chaetigers (Fig. 25H, I, Table 3).

Type locality: Yehliu Township, New Taipei City, Taiwan.

Distribution: Known only from the type locality.

Remarks: With the presence of an arc of 6–8 bar-shaped paragnaths on area VI of the pharynx and not greatly expanded notopodial dorsal ligule on posterior chaetigers, *P. yehliuensis* sp. nov. belongs to group 3A and the *Perinereis nuntia* group (Fig. 25C, F, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species of the *Perinereis nuntia* group recognized by Villalobos-Guerrero (2019), *P. yehliuensis* sp. nov. is similar to *P. shikueii* Glasby and Hsieh, 2006 in terms of having similar number of paragnaths on areas I to III and VI, lateral teeth on area III, and ɔc-shaped ridge pattern of areas VI–V–VI (Table 3; Glasby and Hsieh 2006: 562, 568, fig. 8A–D, table 2; Villalobos-Guerrero 2019: 489). However, *P. yehliuensis* sp. nov. can be distinguished from *P. shikueii* by having: 1) more paragnaths on area V (5, in loosely cluster versus mostly 3, in shallow triangle); 2) uneven-length bars on area VI (versus even-length bars); 3) fewer number of paragnaths on areas VII–VIII (23 versus 34–52); 4) smaller length ratio of dorsal cirri to dorsal ligule on both anterior and posterior chaetigers (0.7 and 0.5 versus 0.90–1.08 and 0.69–1.63); and 5) no glandular masses in the center lobe of dorsal ligule on posterior chaetigers (versus present) (Fig. 25C, D, F, Table 3; Glasby and Hsieh 2006: 562, 568, fig. 8A–D, table 2). The differences between *P. yehliuensis* sp. nov. and eight other new species of the 3A group described in the present study are discussed below.

Perinereis yufuensis sp. nov.

(Fig. 26, Table 3)

urn:lsid:zoobank.org:act:8D97DDFE-4BD9-4039-ADA9-B139E8574478

Material examined: Holotype, NSNM 8748-198, Yufu (22°20.90'N, 120°23.38'E), habitat type: ISSB, Liuqiu, 11 May 2000.

Etymology: The name is derived from the name of nearby village, Yufu, where the worm was collected.

Description: Holotype, atoke, complete, body length 72.5 mm with 142 chaetigers, chaetiger 10 width 1.9 mm, excluding parapodia; beige in alcohol (Fig. 26A). Prostomium wider than long, lateral antennae antero-lateral, shorter than palps, palpophores globose, palpostyles spheroid. Four pairs of tentacular cirri, longest one reaching chaetiger 5. Two pairs of eyes, in trapezoidal arrangement. Tentacular belt about 1.3x longer than chaetiger 1. Pharynx with dark brown jaws, each with 4 teeth; paragnath pattern: I = 2, in longitudinal line; II = 9 (left), 7 (right), in cluster; III = 10 (center region with 8 cones, in 3 transverse rows; 2 lateral regions, each with 1 cone); IV = 18 (left), 16 (right), in 3–4 oblique rows, without bars; V = 3, in slightly arced transverse row; VI = 7 (1 dark colored shield-shaped bar (innermost), 5 light to dark colored uneven-length short bars, 1 long bar (outermost) (left), 6 (2 light to dark colored shield-shaped bars (innermost and outermost), 4 light colored short bars) (right), in u-shaped line; VII–VIII = 28, in 3 rows. Ridge pattern of areas VI–V–VI, ɔc-shaped (Fig. 26B, Table 3).

Dorsal cirri digitiform, medially attached to dorsal ligule throughout, about 0.5x as long as dorsal ligule on anterior chaetigers, about 0.3x as long as dorsal ligule on mid-body to posterior chaetigers (Fig. 26C–E, Table 3).

Dorsal ligule subconical throughout, about 1.9x

longer than median ligule on anterior chaetigers, about 1.5x longer than median chaetigers on mid-body to posterior chaetigers; proximal lobe of dorsal ligule with one large, oval-shaped glandular mass on posterior chaetigers (Fig. 26C–E). Notopodial prechaetal lobe absent (Table 3).

Median ligule subconical throughout, about 1.2x longer than neuroacicular ligule, about 1.6x and 1.3x longer than neuroacicular ligule on mid-body and posterior chaetigers, respectively (Fig. 26C–E).

Neuroacicular ligule with predominant inferior lobe on anterior chaetigers, inferior and superior lobes

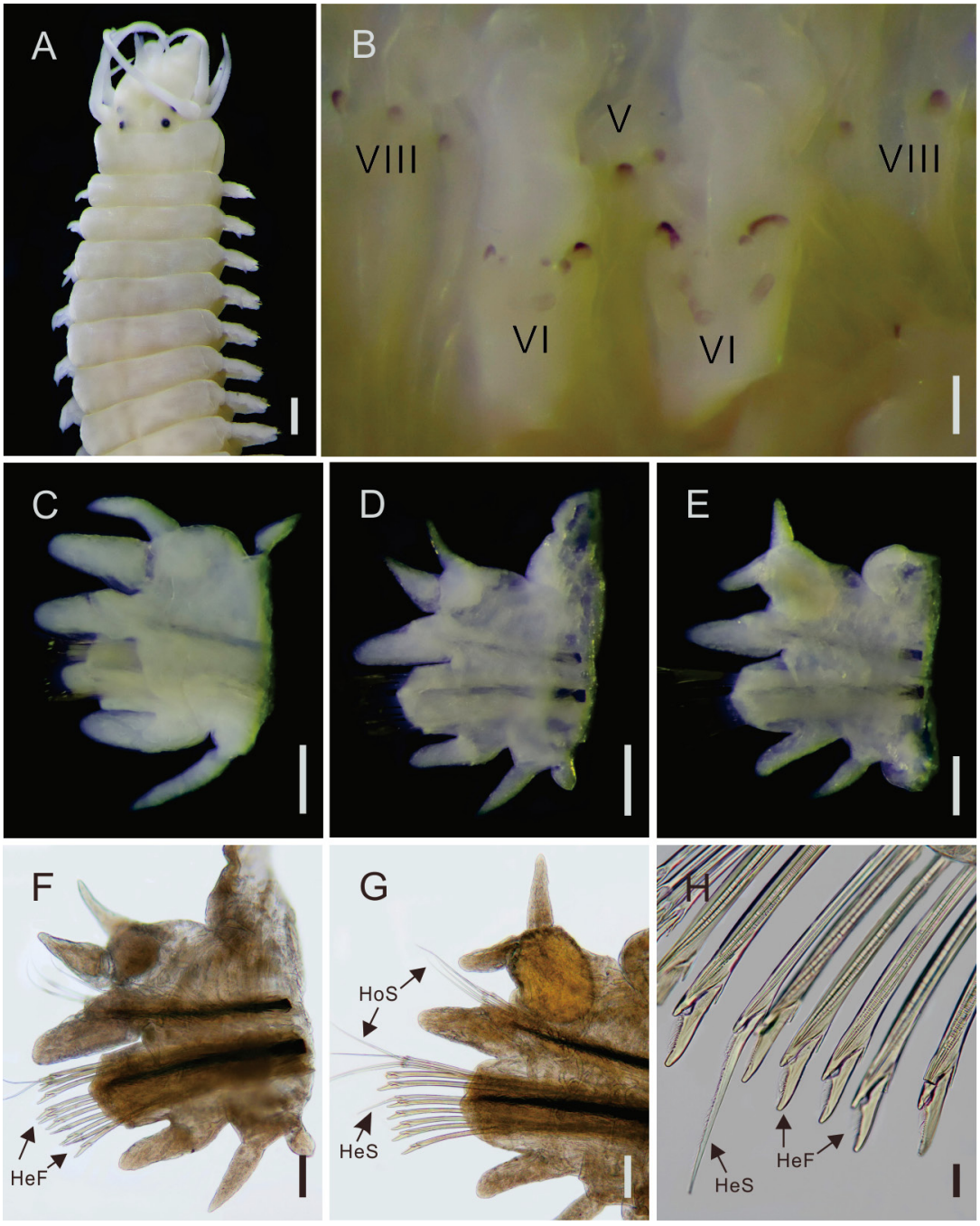

Fig. 26. *Perinereis yufuensis* sp. nov.; holotype (NSNM 8748-198): A, anterior body region, dorsal view; B, close-up of areas V, VI and VIII of the pharynx; C, right parapodium, anterior view, chaetiger 9; D, right parapodium, anterior view, chaetiger 51; E, right parapodium, anterior view, chaetiger 100; F, chaetal pattern of chaetiger 51; G, chaetal pattern of chaetiger 100; H, close-up of neuropodial chaetae, chaetiger 100. Scale bars: A = 0.5 mm; B = 0.1 mm; C–E = 0.2 mm; F, G = 0.1 mm; H = 0.02 mm.

subequal in length on mid-body to posterior chaetigers, about 0.6x as long as ventral ligule throughout. Neuropodial postchaetal lobe absent. Ventral ligule subconical throughout. Ventral cirri mid-ventrally attached to ventral edge of parapodia, about 0.9x as long as ventral ligule on anterior chaetigers, about 0.6x as long as ventral ligule on mid-body chaetigers, about 0.8x as long as ventral ligule on posterior chaetigers (Fig. 26C–E).

Notochaetae present from chaetiger 3 to posterior chaetigers, homogomph spinigers present throughout. Supra-acicular fascicle of neuropodia: homogomph spinigers and medium-size blade heterogomph falcigers with serrations present throughout. Subacicular fascicle of neuropodia: medium-size blade heterogomph falcigers with serrations present throughout, heterogomph spinigers present only on posterior chaetigers (Fig. 26F–H, Table 3).

Pygidium with anus crenulated; anal cirri cirriform, as long as last 3 chaetigers.

Type locality: Yufu, Liuqiu Township, Pingtung County, Taiwan.

Distribution: Known only from the type locality.

Remarks: *Perinereis yufuensis* sp. nov. belongs to group 3A and the *Perinereis nuntia* species group by having an arc of 6–7 bar-shaped paragnaths on area VI of the pharynx and not elongated notopodial dorsal ligule on posterior chaetigers (Fig. 26B, E, Table 3; Hutchings et al. 1991: 271; Wilson and Glasby 1993: 259; Glasby and Hsieh 2006: 558; Villalobos-Guerrero 2019: 468). Of the 20 known species of the *Perinereis nuntia* group recognized by Villalobos-Guerrero (2019), *P. yufuensis* sp. nov. is similar to *P. shikueii* Glasby and Hsieh, 2006 in terms of having similar number of paragnaths on areas I to V and VI, lateral teeth on area III, and ɔc-shaped ridge pattern of areas VI–V–VI (Fig. 26B, Table 3; Glasby and Hsieh 2006: 562, 568, fig. 8A–D, table 2; Villalobos-Guerrero 2019: 489). However, *P. yufuensis* sp. nov. can be distinguished from *P. shikueii* by having: 1) less paragnaths on areas II, III, IV and VII–VIII (7–9, 10, 16–18, 28 versus 17–19, 18–29, 21–35 and 34–52, respectively); 2) uneven-length bars on area VI (versus even-length bars); 3) smaller length ratio of dorsal cirri to dorsal ligule on both anterior and posterior chaetigers (0.5 and 0.3 versus 0.90–1.08 and 0.69–1.63); 4) neuropodial heterogomph spinigers present only on posterior chaetigers (versus present on chaetigers of all body regions) (Fig. 26C–E, Table 3; Glasby and Hsieh 2006: 562, 568, fig. 8A–D, table 2).

Key to *Perinereis* species reported from Taiwan

1. Area VI with 1 bar 2
- Area VI with 2 or more bars 14
2. Dorsal ligule not greatly expanded on posterior chaetigers 3
- Dorsal ligule greatly expanded on posterior chaetigers 10
3. Area III with lateral teeth 4
- Area III without lateral teeth 8
4. Area V with 3 cones 5
- Area V without cones ..... *P. pseudocutrifera* sp. nov.
5. Notopodia with prechaetal lobe 6
- Notopodia without prechaetal lobe 7
6. Notopodia prechaetal lobe present only on anterior chaetigers, neuropodial heterogomph spinigers present on chaetigers of all body regions ..... *P. cultrifera* (Grube, 1840)
- Notopodia prechaetal lobe present only on mid-body chaetigers, neuropodial heterogomph spinigers present only on mid-body to posterior chaetigers ..... *P. taitungensis* sp. nov.
7. Area VI with long straight bar, u-shaped ridge pattern of areas VI–V–VI ..... *P. helleri* (Grube, 1878)
- Area VI with chevron-shaped bar, ɔc-shaped ridge pattern of areas VI–V–VI ..... *P. pangcahae* sp. nov.
8. Area V with one cone 9
- Area V with 4–16 cones ..... *P. longdongwanensis* sp. nov.
9. Areas VI–V–VI with λ-shaped ridge pattern ..... *P. floridana* (Ehlers, 1868)
- Areas VI–V–VI with χ-shaped ridge pattern ..... *P. houbihuensis* sp. nov.
10. Area III with lateral teeth, area IV without bars 11
- Area III without later teeth, area IV with or without bars 12
11. Notopodia prechaetal lobe present; dorsal ligule to median ligule length ratio about 3.3 on posterior chaetigers ..... *P. nigropunctata* (Horst, 1889)
- Notopodia prechaetal lobe absent; dorsal ligule to median ligule length ratio about 4.3 on posterior chaetigers ..... *P. wanlitongensis* sp. nov.
12. Area IV with bars 13
- Area IV without bars ..... *P. euiini* Park and Kim, 2017
13. Area VI with cones; neuropodia without heterogomph spinigers ..... *P. amblyodonta* (Schmarda, 1868)
- Area VI without cones; neuropodial with heterogomph spinigers on mid-body to posterior chaetigers ..... *P. kebalanae* sp. nov.
14. Area VI with 2 bars 15
- Area VI with 3 or more bars 17
15. Area VI with 2 very short bars; neuropodial heterogomph falcigers with long blade ..... *P. aibuhitensis* (Grube, 1878)
- Area VI with 2 long straight bars; neuropodial heterogomph falcigers with medium-sized blade 16
16. Area IV with more than 39 cones; areas VII–VIII with more than 57 cones ..... *P. vancaurica* (Ehlers, 1868)
- Area IV with fewer than 37 cones; areas VII–VIII with fewer than 57 cones ..... *P. singaporiensis* Grube, 1878
17. Dorsal ligule not greatly expanded on posterior chaetigers 18
- Dorsal ligule greatly expanded on posterior chaetigers 29
18. Area III with cones, areas VII–VIII with more than 13 cones 19
- Area III without cones, areas VII–VIII with less than 13 cones ..... *P. tubicola* sp. nov.
19. Area III with lateral teeth 20
- Area III without lateral teeth ..... *P. kaomeiensis* sp. nov.
20. Area VI with 3 bars ..... *P. hsinchuensis* sp. nov.
- Area VI with more than 3 bars 21
21. Areas VI–V–VI with λ-shaped ridge pattern 22
- Areas VI–V–VI with ɔc-shaped or χ-shaped ridge pattern 23
22. Area V with 3 cones, Area III with 30 cones ..... *P. qiguensis* sp. nov.
- Area V without cones, Area III with 17 cones ..... *P. ludaoensis* sp. nov.

23. Areas VI–V–VI with ɔc-shaped 24
- Areas VI–V–VI with χ-shaped ridge pattern 28
24. Area V with 1 cone; neuropodia without heterogomph spinigers on chaetigers of all body regions ..... *P. daxiensis* sp. nov.
- Area V with 3 or more cones; neuropodia with heterogomph spinigers at least on posterior chaetigers 25
25. Neuropodia with heterogomph spinigers on anterior chaetigers 26
- Neuropodia without heterogomph spinigers on anterior chaetigers 27
26. Area VII–VIII with more than 33 cones; dorsal ligule center lobe with one large oval-shaped glandular mass on posterior chaetigers ..... *P. shikueii* Glasby and Hsieh, 2006
- Area VII–VIII with less than 24 cones; dorsal ligule center lobe without glandular mass on posterior chaetigers .... *P. yehliuensis* sp. nov.
27. Area III with 17 cones; neuropodia with heterogomph spinigers on mid-body to posterior chaetigers ..... *P. liuqiuensis* sp. nov.
- Area III with 10 cones; neuropodia with heterogomph spinigers only on posterior chaetigers ..... *P. yufuensis* sp. nov.
28. Dorsal cirri to dorsal ligule length ratio about 1.5 anteriorly, increasing to 2.0–3.0 posteriorly .... *P. wilsoni* Glasby and Hsieh, 2006
- Dorsal cirri to dorsal ligule length ratio about 1.0 throughout (except last few chaetigers) ... *P. mictodonta* (Marenzeller, 1879)
29. Area V with 10 small and many minute cones .... *P. fugangensis* sp. nov.
- Area V with 1 large and many minute cones .... *P. neocaledonica* Pruvot, 1930

DISCUSSION

The present study supports the usage of paragnath patterns (excluding paragnath pattern of area III in some species), ridge patterns of area V–VI–VI, morphology of parapodia, types of heterogomph falcigers, and the composition and distribution of subacicular fascicle neurochaetae of the body regions for properly identifying *Perinereis* species in previous reports (Hutchings et al. 1991; Wilson and Glasby 1993; Bakken and Wilson 2005; Glasby and Hsieh 2006; Conde-Vela 2018; Villalobos-Guerrero 2019; Villalobos-Guerrero et al. 2021). Discrepancy of paragnath pattern on area III of the pharynx in *P. vancaurica* between reports from Indian Ocean and Australia (*i.e.*, Ehlers 1904: 25; Hutchings et al. 1991) and from other geographic regions (*i.e.*, Fauvel 1953: 206, fig. 105g; Wu 1967: 71, Imajima 1972: 86, fig. 23b; Wu et al. 1981: 176, fig. 111B) raises questions on the stability of this character for identifying species. A similar case was also observed by Hutchings et al. (1991: 253), who noted about half of *P. cultrifera* specimens examined in their study have lateral teeth on area III.

The five new *Perinereis* species of group 1A described in the present study can be divided into two groups based on the absence or presence of lateral teeth on area III of the pharynx. *Perinereis taitungensis* sp. nov., *P. pangcahae* sp. nov., and *P. pseudocultrifera* sp. nov. have lateral teeth on area III, whereas *P. houbihuensis* sp. nov. and *P. longdongwanensis* sp. nov. have no lateral teeth. The former group can be further distinguished from the latter group by having 3 or no paragnaths on area V, comparing to that of 1 or 4–16 in the latter group (see Table 2). In the former group, *P. pseudocultrifera* sp. nov. is readily differentiated from *P. pangcahae* sp. nov. and *P. taitungensis* sp. nov. by the absence of paragnaths on area V and glandular masses in the center or proximal lobe of dorsal ligule on posterior chaetigers (versus 3 and 1 or 2, respectively), λ-shaped ridge pattern of areas VI–V–VI (versus ɔc-shaped ridge pattern), and the presence of notopodial prechaetal lobe on chaetigers of all body regions (versus absent and present only on mid-body chaetigers, respectively) (Table 2). *Perinereis taitungensis* sp. nov. differs from *P. pangcahae* sp. nov. by having notopodial prechaetal lobe on mid-body chaetigers (versus absent on chaetigers of all body regions), one triangle-shaped glandular mass in each of the center and proximal lobes of the dorsal ligule on posterior chaetigers (versus 1 large irregular-shaped glandular mass in the center and proximal lobes), and neuropodial heterogomph spinigers absent on anterior chaetigers (versus present on chaetigers of all body regions) (Table 2). In the latter group, *P. houbihuensis* sp. nov. differs from *P. longdongwanensis* sp. nov. by having less paragnaths on all areas of the pharynx, χ-shaped ridge pattern of areas VI–V–VI (versus λ-shaped ridge pattern), greater length ratio of dorsal ligule to median ligule on posterior chaetigers (2.5 versus 1.8), one irregular-shaped glandular mass in the center and proximal lobes of dorsal ligule on posterior chaetigers (versus absent), and neuropodial heterogomph spinigers present only on posterior chaetigers (versus present on chaetigers of all body regions) (Table 2).

Of the nine new *Perinereis* species of group 3A described in the present study, *P. tubicola* sp. nov. can be distinguished from the other eight species by having only few numbers of paragnaths on areas II and IV, no paragnaths on area III (versus at least 10), and u-shaped ridge pattern of areas VI–V–VI (Table 3). The absence of neuropodial heterogomph spinigers on chaetigers of all body regions in *P. daxiensis* sp. nov. is a unique feature that is not seen in the other eight species (Table 3). The remaining seven species can be divided into two groups based on ridge pattern of areas VI–V–VI. *Perinereis ludaoensis* sp. nov. and *P. qiguensis* sp. nov. have λ-shaped ridge pattern, whereas the other four species have ɔc-shaped ridge pattern (Table 3). *Perinereis ludaoensis* sp. nov. differs from *P. qiguensis* sp. nov. by having less paragnaths on areas II, III and VII–VIII (11, 17 and 18 versus 21–23, 30 and 36, respectively), no paragnaths on area V (versus 3),

greater number of paragnaths on area VI (9–11 versus 6–7), no notopodial prechaetal lobe (versus present on anterior chaetigers), and no glandular masses in the center lobe of dorsal ligule on posterior chaetigers (versus one glandular mass) (Table 3). Of the five species with ɔc-shaped ridge pattern of areas VI–V–VI, *P. kaomeiensis* sp. nov. can be easily distinguished from the other four species by having more paragnaths on areas I, III and VII–VIII (9, 54 and 52 versus less than 4, 28 and 38, respectively), no lateral teeth on area III (versus present), and notopodial prechaetal lobe present on pre-natatory chaetigers (versus absent) (Table 3). *Perinereis hsinchuensis* sp. nov. can be distinguished from *P. liuqiuensis* sp. nov., *P. yehliuensis* sp. nov., and *P. yufuensis* sp. nov. by having fewest number of paragnaths on area VI (3 versus exceed 5) and no neuropodial heterogomph spinigers on posterior chaetigers (versus present on posterior chaetigers) (Table 3). *Perinereis yehliuensis* sp. nov. can be differentiated from *P. liuqiuensis* sp. nov. and *P. yufuensis* sp. nov. by having greater number of paragnaths on areas III, IV and V (27, 31–33 and 5 versus less than 18, 22 and 4, respectively), no glandular masses in the center lobe of dorsal ligule on posterior chaetigers (versus one glandular mass), and neuropodial heterogomph spinigers present on anterior chaetigers (versus absent on anterior chaetigers) (Table 3). Finally, *P. liuqiuensis* sp. nov. differs from *P. yufuensis* sp. nov. by having greater number of paragnaths on areas III and VI (17 and 9 versus 10 and 6–7, respectively) and neuropodial heterogomph spinigers present on mid-body to posterior chaetigers (versus present only on posterior chaetigers) (Table 3).

Glasby and Hsieh (2006: 558) added the absence of notopodial prechaetal lobe as an additional character in the diagnosis of the *Perinereis nuntia* species group proposed by Wilson and Glasby (1993: 259). Of the nine new species of this species group described in the present study, seven agree with this diagnosis of which have no notopodial prechaetal lobe (see Table 3). However, *P. kaomeiensis* sp. nov. and *P. qiguensis* sp. nov. have notopodial prechaetal lobe present on anterior or pre-natatory chaetigers (Figs. 10D, 19C–E, Table 3). Similar case was noted by Villalobos-Guerrero (2019: 488) who acknowledged the presence of notopodial prechaetal lobe in *P. maindroni*. However, Villalobos-Guerrero (2019: 468) did not incorporate the above-mentioned character into his emended diagnosis of the species group. The author also makes no attempt herein to emend diagnosis of this body part for this species group.

Counting 12 previously reported species and 18 newly reported species (17 new species and one occurrence reconfirmed species) in the present study, Taiwan is now hosting a total of 30 *Perinereis* species, making the island with the highest regional species richness of the genus in the world, surpassing that of 17 species reported from Australia (Hutchings et al. 1991; Wilson and Glasby 1993; Glasby et al. 2013).

CONCLUSIONS

A review on the biodiversity of the genus *Perinereis* from Taiwan has been conducted in the present study. Results of this study document 24 *Perinereis* species from this geographic area. Of these 24 species, 17 are new to science, and they are: *Perinereis daxiensis* sp. nov., *P. fugangensis* sp. nov., *P. kaomeiensis* sp. nov., *P. kebalanae* sp. nov., *P. houbihuensis* sp. nov., *P. hsinchuensis* sp. nov., *P. liuqiuensis* sp. nov., *P. longdongwanensis* sp. nov., *P. ludaoensis* sp. nov., *P. pangcahae* sp. nov., *P. pseudocultrifera* sp. nov., *P. qiguensis* sp. nov., *P. taitungensis* sp. nov., *P. tubicola* sp. nov., *P. wanlitongensis* sp. nov., *P. yehliuensis* sp. nov., and *P. yufuensis* sp. nov. The record of *P. cultrifera* (Grube, 1840), originally described from the Mediterranean Sea, is confirmed for Taiwan. The remaining six are species previously reported from Taiwan, which are: *Perinereis aibuhitensis* (Grube, 1878), *P. floridana* (Ehlers, 1868), *P. mictodonta* (Marenzeller, 1879), *P. nigropunctata* (Horst, 1889), *P. vancaurica* (Ehlers, 1868), and *P. wilsoni* Glasby & Hsieh, 2006. The cumulated number of *Perinereis* species for Taiwan reaches 30 with the present study, making this island by far with the highest regional species richness of the genus in the world. The generic diagnosis has been partially amended to include the presence of neuropodial homogomph spinigers found in the subacicular fascicle of *P. longdongwanensis* sp. nov.

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