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Two new species of *Leodamas* Kinberg, 1866 (Annelida, Orbiniidae) from China seas*

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Abstract Two species of *Leodamas* (Annelida, Orbiniidae) from China seas are described based on both material of the Marine Biological Museum (Chinese Academy of Sciences, Qingdao), and newly collected specimens. *Leodamas robustus* sp. n. is characterized by having uncini arranged in two short rows, anterior row with 3–5 uncini, increasing in size, with uncini on posterior chaetigers thicker, heavier and more curved than those on precedent chaetigers; posterior row with 2–5 uncini, thin and delicate, nearly the same size on all chaetigers, with 2–3 thin capillaries dorsally to two rows of uncini. *Leodamas weizhouensis* sp. n. is characterized by having delicate pocket-like membrane below and posterior to neuropodia, neuropodia of thoracic chaetigers with five dense rows of uncini. A key to all species of *Leodamas* from China seas is also provided.

Keyword: Beibu Gulf; East China Sea; Polychaeta; South China Sea; taxonomy

1 INTRODUCTION

Orbiniidae are burrowing deposit feeder annelids, inhabiting from intertidal to the deep sea, but apparently being more common in muddy and sandy shallow intertidal zones (Meca et al., 2021). *Leodamas*, previously regarded as a subgenus of *Scoloplos* (Hartman, 1957; Pettibone, 1957; Day, 1973, 1977; Fauchald, 1977; Blake, 1996; Eibye-Jacobsen, 2002) was raised to genus based on the form and arrangement of the thoracic neuropodial uncini by Blake (2000), this proposal has been followed by Blake (2000, 2017, 2020), López et al. (2003), Bleidorn et al. (2009), Dean and Blake (2015), and Zhadan et al. (2015). The species of *Leodamas* (either as genus or as subgenus of *Scoloplos*) were divided into two groups without taxonomic range, according to the start of branchiae and the number of vertical rows of uncini (Blake, 2017). With the recent description of two new species (Sun et al., 2018; Blake, 2020), the genus contains 31 species worldwide (Read and Fauchald, 2021).

Leodamas can be diagnosed by having thoracic neuropodial uncini large, conspicuous, arranged in 1–7 (usually 1–4) rows per chaetiger, few relatively inconspicuous capillaries; and posterior thoracic chaetigers with 0–2 postchaetal lobes and 0–2 subpodial lobes, with never more than four lobes of both types combined (Fauchald, 1977; Blake, 2017, 2020).

Sorting the polychaete material deposited in the Marine Biological Museum, Chinese Academy of Sciences in Qingdao, China (MBMCAS), as well as new samples collected from China seas, we identified

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two morphotypes belonging to *Leodamas*, which we are here describing as new species. Furthermore, we include a key to *Leodamas* species from China seas.

2 MATERIAL AND METHOD

The studied material were collected from coastal areas of China seas. Specimens were preserved in 75% ethanol solution and deposited in the MBMCAS, except some specimens that were deposited at the Yancheng Teachers University (YCTU). Detailed morphological structures were examined under Zeiss Stemi 2000-C stereomicroscope. Parapodia and chaetae were dissected with iris scissors and mounted on slides. Photographs were taken with AxioCam MRc 5 digital camera attached to stereomicroscope and compound microscope. Line drawings were made in Adobe Photoshop CS6 using a graphic tablet. For scanning electron microscope (SEM), the selected parapodia were detached from the specimens, rinsed in absolute ethanol, critical-point dehydrated, coated in gold, observed, and photographed.

The following abbreviations are used through the text (spec: specimen; Sta.: station; ECS: East China Sea; SCS: South China Sea; BG: Beibu Gulf) and in figures (ac: acicula; br: branchia; neL: neuropodial lobe; noL: notopodial lobe; nuO: nuchal organ; per: peristomium; pigB: pigment band; pr: prostomium; subPFla: subpodial flange; plM: pocket-like membrane).

3 RESULT

3.1 Taxonomy

Family Orbiniidae Hartman, 1942
Subfamily Orbiniinae Hartman, 1942
Genus *Leodamas* Kinberg, 1866
Type-species: *Leodamas verax* Kinberg, 1866

3.2 *Leodamas robustus* sp. n.

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Figs.1–2

Diagnosis: *Leodamas* with prostomium conical, blunt. Branchiae from chaetiger 19. Thorax with 19 chaetigers, thoracic neuropodial postchaetal lobe greatly reduced. Thoracic neuropodia with two rows of uncini; anterior row with 3–5 uncini, increasing in size along thorax, uncini on posterior chaetigers thicker, heavier, more curved than those on precedent chaetigers; posterior row with 2–5 thin, delicate uncini, of similar size along all chaetigers, with 1–3 thin capillaries dorsally to two rows of uncini.

Material examined: **Holotype**: MBM304676: ECS, Sta. DH 9–2, 26°30′N, 121°00′E, 52-m depth, 24 Dec. 2015, fine silt. **Paratype**: MBM202032: 1 spec, BG, Sta. 6242, 18°30′N, 108°00′E, 78-m depth, mud, 21 Oct. 1960. MBM202033: 1 spec, BG, Sta. 6254, 18°30′N, 107°30′E, 72-m depth, silty sandy mud, 22 Aug. 1960. **Additional material**: MBM023214: 1 spec, SCS, Sta. 6105, 21°00′N, 112°00′E, 49-m depth, silty sandy mud, 2 Jul. 1960. MBM202035: 1 spec, BG, Sta. 6235, 20°45′N, 108°00′E, 42-m depth, sandy mud, 11 Nov. 1960. MBM202036: 1 spec, BG, Sta. 6253, 19°00′N, 107°30′E, 67-m depth, sandy mud, 22 Apr. 1960. MBM023280: 1 spec, SCS, Sta. 6089, 21°15′N, 112°30′E, 41-m depth, muddy sand, 7 Apr. 1960. MBM023247: 1 spec, SCS, Sta. 6205, 17°45′N, 109°00′E, 74-m depth, muddy sand, 11 Apr. 1959. MBM023042: 1 spec, SCS, Sta. 6045, 21°45′N, 114°30′E, 61-m depth, soft mud, 10 Jan. 1960. YCTU000001: 1 spec, ECS, Sta. DH9–1, 26°30′N, 121°00′E, 52-m depth, fine silt, 24 Dec. 2015. YCTU000002: 1 spec, ECS, Sta. DH11–5, 25°30′N, 120°45′E, 87-m depth, fine silt, 23 Dec. 2015. YCTU000003: 3 specs, ECS, Sta. DH11–3, 25°45′N, 120°30′E, 64-m depth, fine silt, 13 Dec. 2015.

Description: All specimens incomplete, posterior end missing; holotype 1.5 mm of maximum width. Thoracic region cylindrical, with 19 chaetigers. Prostomium conical, slightly longer than wide, blunt, lacking eyespots; peristomium with a single, short, achaetous ring; nuchal organs transverse slits on anterior peristomial border (Fig.1a). Branchiae from chaetiger 19, simple, ligulate, continuing along body through posterior chaetigers (Fig.1d).

Parapodia biramous. Thoracic notopodia with cirriform postchaetal lobe, short on chaetiger 1, then increasing to reach full size by chaetigers 5–6; abdominal notopodial postchaetal lobe similar, but much elongated, twice longer than those of thoracic chaetigers (Fig.1d). Interramal cirrus absent. Thoracic neuropodial postchaetal lobe greatly reduced (Fig.1b–c). Abdominal neuropodia digitate (Fig.1d).

Thoracic notopodia with fascicles of crenulated capillaries (Fig.1a). Abdominal notopodia with fascicles of capillaries (Fig.1d), 1–2 furcate chaetae (Fig.1e) and 1–2 projecting aciculae (Fig.1d). Thoracic neurochaetae with two short rows of uncini and 1–3 companion capillaries (Fig.2a–c); anterior row increasing in size along thorax, with 3–5 uncini,

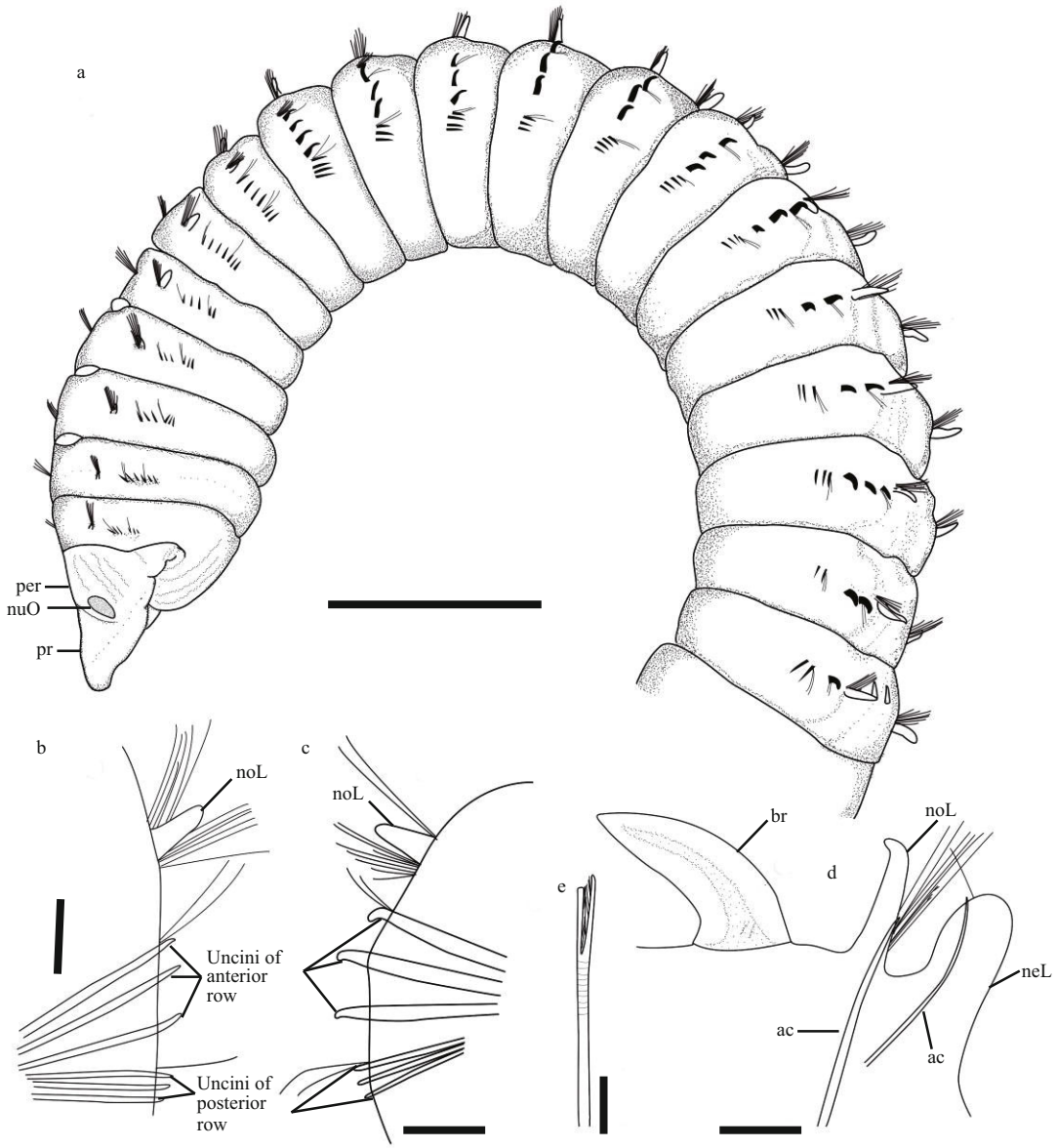

Fig.1 *Leodamas robustus* sp. n., the holotype

a. anterior region, left lateral view. Parapodia: b. 5th, posterior view; c. 15th, posterior view; d. abdominal, posterior view; e. furcate chaeta. Scale bars: a: 1 mm; b: 100 μm; c–d: 200 μm; e: 25 μm.

uncini on posterior chaetigers thicker, heavier, and more curved than those on anterior chaetigers (Fig.1a–c), with blunt tipand 2–4 prominent transverse ribs on convex side (Fig.2a, b, d); posterior rows all similar size, with 2–5 thin, delicate uncini (Fig.1a–c), with straight-shaft and weakly developed subapical groove, remaining shaft with weakly developed transverse ribs (Fig.2a, c). Abdominal neuropodia with 4–8 thin crenulated capillaries and single imbedded acicula, thinner than dorsal ones (Fig.1d). Flail chaetae not seen.

Variability: 15–19 thoracic chaetigers. Branchiae start from last two thoracic to first abdominal chaetigers.

Etymology: The specific name, *robustus*, meaning thick and strong in Latin, refers to the cylindrical and robust thoracic region.

Distribution: East China Sea, northern South China Sea, and Beibu Gulf, in sediments at 41–87-m depth.

Remark: *Leodamas robustus* sp. n. belongs to the species Group B (Blake, 2017) as it has branchiae first present from last 1–2 thoracic or first abdominal chaetigers and thoracic neuropodial uncini arranged in two rows. However, it clearly differs from all other species in this group in having uncini arranged in two

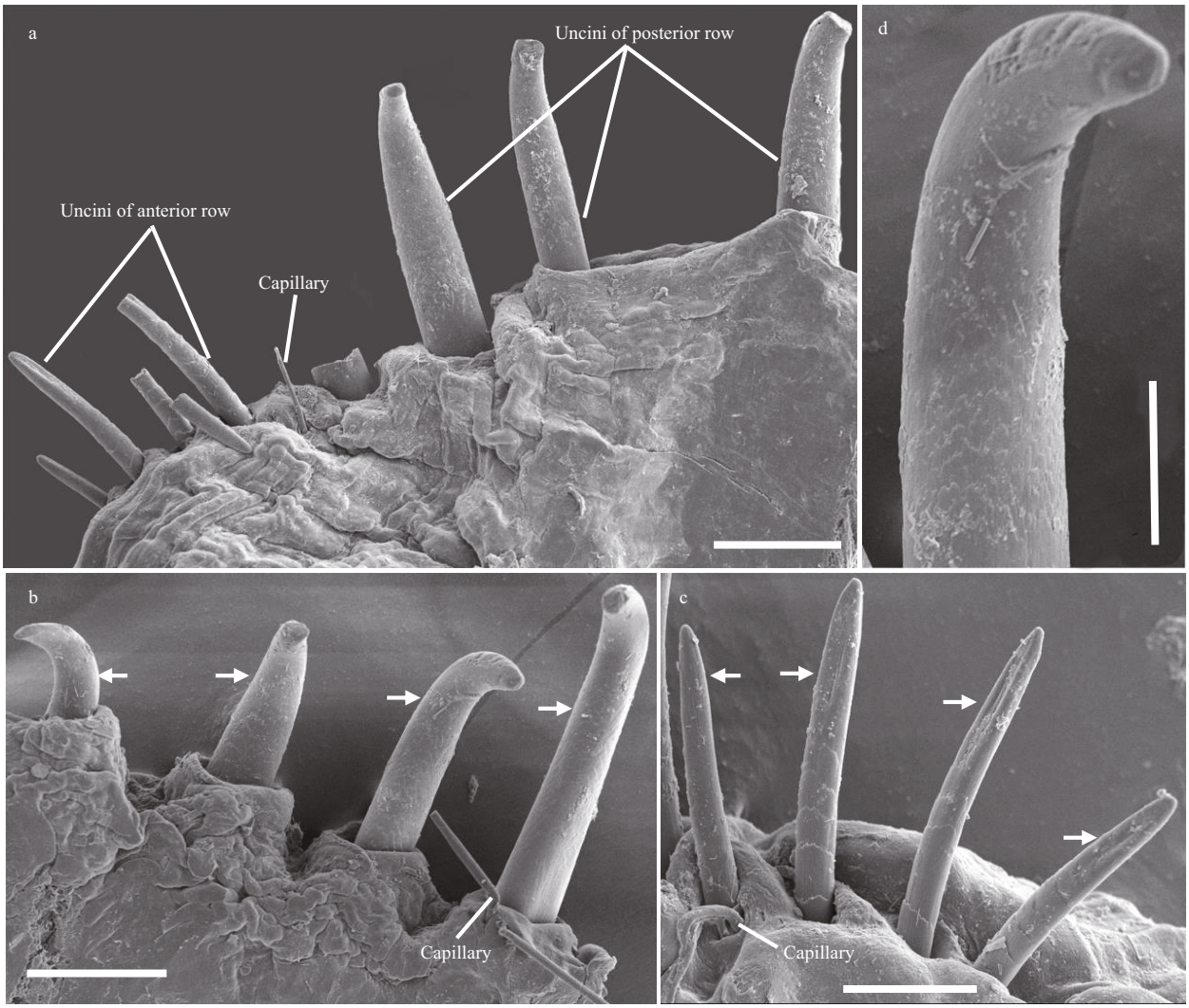

Fig.2 *Leodamas robustus* sp. n. MBM202033; the SEM micrographs

a. posterior thoracic neurochaetae; b, d. uncini of first row, arrows denote uncini; c. second row of uncini. Scale bars: a–b: 50 μm; c: 25 μm; d: 20 μm.

short rows, with 1–3 thin companion capillaries; anterior row of uncini increasing in size, with 3–5 uncini and uncini on posterior chaetigers thicker and more curved than those on precedent thoracic chaetigers; posterior row of similar size along thoracic chaetigers, with 2–5 thin, delicate uncini.

Leodamas robustus sp. n. resembles *L. agrestis* (Nonato and Luna, 1970) in having two different uncini rows, but differs in having these two rows along all thoracic chaetigers (instead of one on anterior thoracic chaetigers, and an additional one anterior row of 2–3 large heavy spines on chaetigers 7–15 in *L. agrestis*).

3.3 *Leodamas weizhouensis* sp. n.

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(Figs.3–4)

Diagnosis: *Leodamas* with prostomium conical, pointed. Branchiae from chaetigers 11–13. Thorax with 20 chaetigers, thoracic neuropodial postchaetal lobe greatly reduced, with delicate pocket-like membrane below, posterior to neuropodia. Thoracic neuropodia with five rows of uncini, last uncini row shorter, only half as long as anterior rows, decreasing to 1–2 rows in posterior thoracic chaetigers; uncini distally curved, with 3–4 transverse rows of ribs along shaft, long crenulated capillaries in single posterior row.

Material examined: **Holotype**: MBM196722, 16 Apr. 1978, Beigang Village, Weizhou Island, Guangxi Zhuang Autonomous Region, 21°04′N, 109°08′E, intertidal. **Paratype**: MBM193712: 5 specs, 1 Apr. 1978, ibid. **Additional material**: MBM193720, 3 specs, 13 Apr. 1978; MBM193721: 7 specs, 28 Apr. 1978; MBM193722: 1 spec, 16 Apr. 1978, ibid.

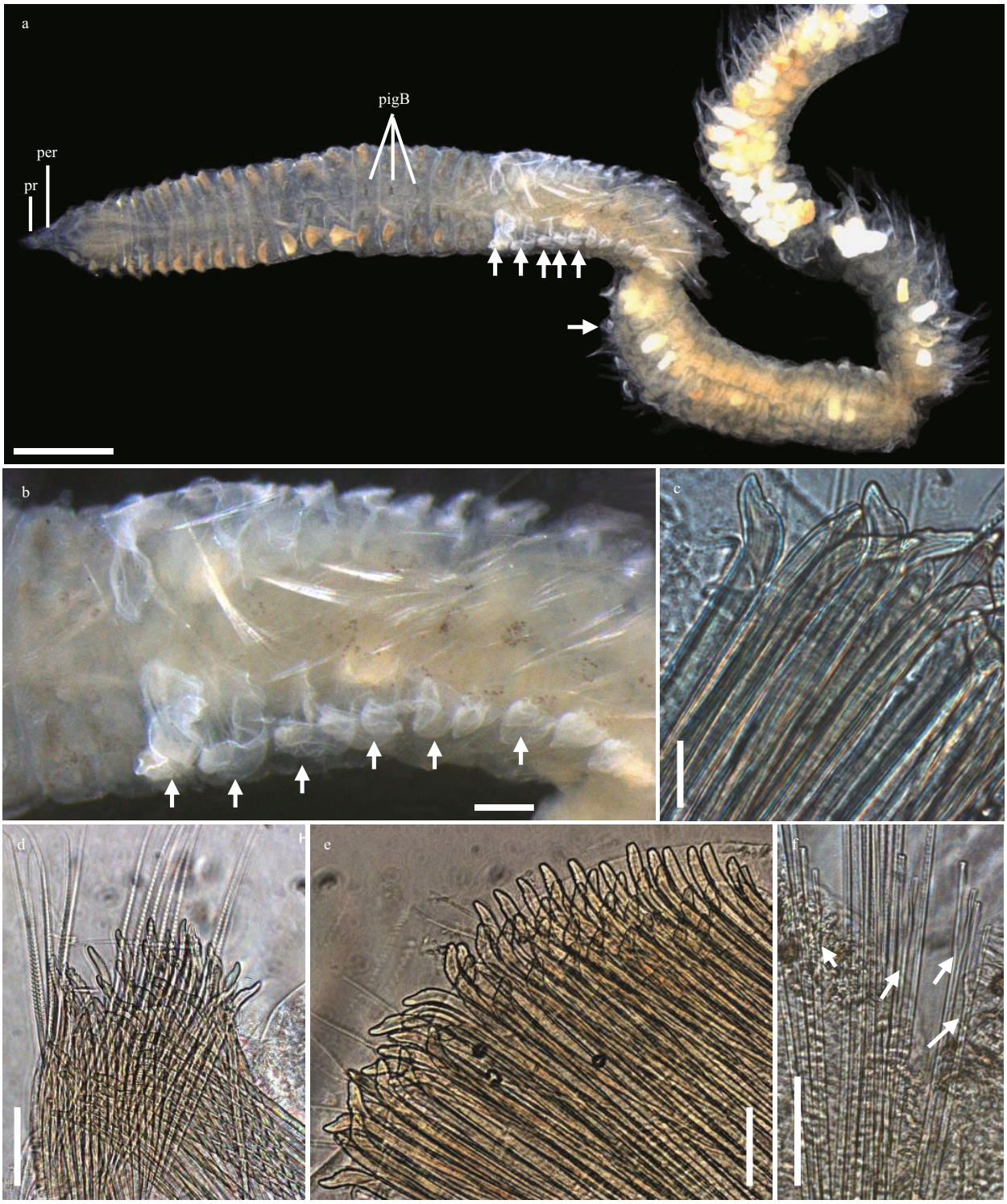

Fig.3 *Leodamas weizhouensis* sp. n., the holotype

a. anterior end, dorsal view, arrows indicate pocket-like membrane; b. anterior chaetigers of abdominal region, arrows point to pocket-like membranes; c. thoracic neuropodial uncini; d. anterior thoracic neuropodium showing arrangement of uncini and capillaries; e. neuropodium of chaetiger 13; f. furcate chaetae, arrows indicate furcate chaetae. Scale bars: a: 1 mm; b: 200 μm; c: 10 μm; d–f, 50 μm.

Description: All specimens incomplete, posterior end missing; holotype 1.3 mm of maximum width (Fig.3a). Color in alcohol: light brown, with dark brown pigment spots on branchiae, abdominal parapodia and subpodial flange (Fig.4c–e), with transverse brown pigment band in middle of each chaetigers (Fig.3a–b).

Thoracic region with 20 chaetigers, first 3–4

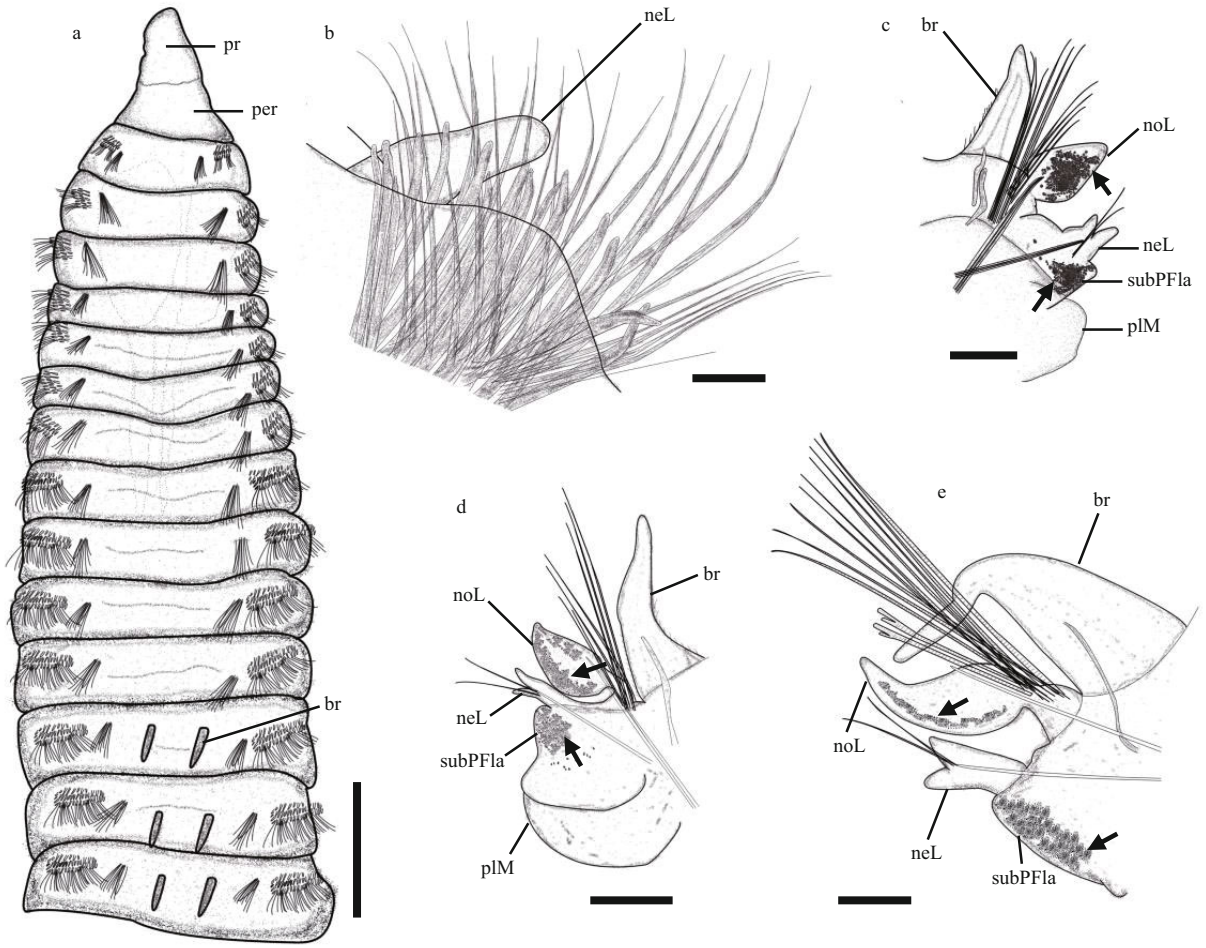

Fig.4 *Leodamas weizhouensis* sp. n., the holotype

a. anterior thoracic chaetigers, dorsal view; b. neuropodium of chaetiger 19. Parapodia: c. chaetiger 20, arrows denote pigment spots; d. middle abdominal region; e. posterior abdominal region. Scale bars: a: 0.5 mm; b: 50 μm; c–d: 200 μm; e: 100 μm.

swollen, thereafter depressed. Prostomium conical, blunt, as long as wide, lacking eyespots; peristomium single short achaetous ring, nuchal organs not observed. Branchiae from chaetiger 12, with ciliated margins, continuing along body throughout posterior chaetigers, smaller in thoracic chaetigers (Fig.4a), and then becoming ligulate, with terminal tips nipple-like, longer than notopodial lobes (Fig.4c–e).

Parapodia biramous. Thoracic notopodia with cirriform postchaetal lobe (Fig.3a). Abdominal notopodia with postchaetal lobe broadly triangular, tapering to narrow tip (Fig.4c–e). Interramal cirrus absent. Thoracic neuropodia with a single papillate postchaetal lobe through anterior chaetigers, then two on last 3–5 thoracic chaetigers (Fig.4b). Abdominal neuropodia elongated, terminally bilobed, inner lobe larger than outer, with fleshy subpodial flange (Fig.4c–e). Abdominal chaetigers with a delicate pocket-like membrane below, posterior to neuropodia (Fig.4d).

Thoracic notopodia with fascicles of crenulated capillaries (Fig.4a). Abdominal notopodia with fascicles of capillaries, 4–5 furcate chaetae, three embedded aciculae, decreasing to one through posterior chaetigers (Fig.4c–e). Thoracic neuropodia with uncini arranged in five rows, decreasing to 1–2 in posterior chaetigers; posterior row with long crenulated capillaries (Figs.3d, 4b). Uncini distally curved, with 3–4 transverse rows of ribs along shaft (Fig.3c, e); abdominal neurochaetae including 4–8 thin crenulated capillaries and 1–3 embedded aciculae (Fig.4c–e).

Variability: Nineteen to twenty thoracic chaetigers, with branchiae first present on chaetiger 11–13 and pocket-like membrane first present from last thoracic or first abdominal chaetigers.

Etymology: The specific name is derived from the type locality, Weizhou Island, with the Latin suffix, *ensis*, indicating living in it.

Distribution: Known only from Weizhou Island (South China Sea), sandy beach.

Remark: *Leodamas weizhouensis* sp. n. is included in *Leodamas* due to the presence of large, conspicuous uncini and capillaries in thoracic neuropodia. It belongs to Group A (Blake, 2017) as it has 19–20 thoracic chaetigers, branchiae from chaetigers 11–13, and thoracic neuropodial uncini arranged in five rows. However, it can be distinguished by having a delicate pocket-like membrane below and posterior to neuropodia. The new species closely resemble *Scoloplos marsupialis* (Southern, 1921) in having a pocket-like membrane, even they belong to different genus, but can be distinguished having four rows of conspicuous uncini and few capillaries behind them, instead of 2–3 rows and numerous capillaries in *S. marsupialis*.

3.4 Key to species of *Leodamas* from China seas

1.a.- Branchiae from anterior thoracic chaetiger (4–7) and thoracic neuropodial uncini typically in three or more rows ·····2

1.b.- Branchiae from posterior thoracic or anterior abdominal setiger, thoracic neuropodial uncini in two rows ····· *L. robustus* sp. n.

2.a.- Thoracic neuropodia postchaetal lobe with broad tori and a digitate to triangular papilla at midlength ····· *L. sinensis* Sun, Sui & Li, 2018

2.b.- Thoracic neuropodia postchaetal lobe reduced or undeveloped, median papilla small or reduced ····3

3.a.- Abdominal chaetigers with delicate pocket-like membrane below and posterior to neuropodia ····· *L. weizhouensis* sp. n.

3.b.- Delicate pocket-shaped membrane absent ····· *L. bathyalis* Blake, 2020

4 CONCLUSION

Four species of *Leodamas* are currently known to occur in China seas, including the two species described in this study and *Leodamas bathyalis* (Blake, 2020) and *Leodamas sinensis* (Sun et al., 2018). *Leodamas robustus* sp. n. belongs to group B and can be easily identified by the morphology and arrangement of uncini. The other three species belong to group A, including *L. weizhouensis* sp. n. that is characterized by having a delicate pocket-like membrane below and posterior to neuropodia.

5 DATA AVAILABILITY STATEMENT

The authors declare that the data supporting the findings of this study are available within the article. The data will be available on request from the corresponding author.

6 ACKNOWLEDGMENT

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