

Leocrates bitungensis (Hesionidae, Annelida): a new polychaete species from North Sulawesi, Indonesia

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Abstract. *Leocrates bitungensis*, new species, is described based on a single specimen collected from an intertidal reef at Lembah Strait, Bitung City, North Sulawesi Province. It represents the first discovery of a new hesionid species in Indonesian waters in over 50 years. This species is distinguished from all other *Leocrates* species in having: (1) small anterior eyes (about 1/15 of the prostomial width) that are larger than the posterior ones, (2) notoacicular lobes that are blunt at their distal end, (3) scarce neurochaetae (about 20 per bundle), (4) lateral antennae with indistinct ceratophores, (5) no pharyngeal lateral vesicles, (6) noticeable lateral cushions situated at the base of parapodia, (7) projected neuroacicular lobes with a blunt tip that is wider than long, and (8) body colour (in alcohol) that is shiny pale yellow with a more intense colouration on the dorsum. A distributional map and a key to all hesionid species occurring in Indonesian waters are also provided.

Key words. Annelida, marine biodiversity, taxonomy

INTRODUCTION

Hesionidae Grube, 1850 is a polychaete family with about 200 species (Pamungkas et al., 2019). Members of this family are considered to be rare in nature, as only singletons or a few individuals are usually obtained at any one time during sampling (e.g., Al-Hakim & Glasby, 2004; Salazar-Vallejo, 2020; Chuar et al., 2021).

The number of hesionid species that have been identified from Indonesia is disproportionately small, with only 12 species in six genera. These species include *Hesione* cf. *horsti* Salazar-Vallejo, 2018, *Hesione eugeniae* Kinberg, 1866, *Hesione intertexta* Grube, 1878, *Hesione splendida* Lamarck, 1818, *Leocrates chinensis* Kinberg, 1866, *Leocrates indicus* Horst, 1921 (this species has been transferred to *Dalhousia* and reinstated as *Dalhousia indica* by Salazar-Vallejo (2020) although the World Register of Marine Species (WoRMS; accessed 28 June 2024) still lists the accepted species name as *L. indicus*), *Leocratides ehlersi* (Horst, 1921), *Leocratides filamentosus* Ehlers, 1908, *Oxydromus angustifrons* (Grube, 1878), *Paralamprophaea diplognatha* (Monro, 1926), *Paraleocrates djangkarensis* (Augener & Pettibone in Pettibone, 1970), and *Paraleocrates wesenberglundae* (Pettibone, 1970). Most of these species

were collected during the Dutch Siboga Expedition at the turn of the 20th century by European scientists, and none of the materials were deposited in Indonesian institutions (Table 1). Three hesionid species, in addition, were collected during the Indonesian Anambas Expedition (2001), but the worms, i.e., *Gyptis* sp., *Ophiadromus* sp. (the accepted genus name is now *Oxydromus* sp. according to WoRMS; accessed 28 June 2024) and *Psamathe* sp., could only be identified to the genus level due to their poor condition (Al-Hakim & Glasby, 2004).

Of those 12 Indonesian hesionid species, only four species were described from Indonesia between the 1860s and the 1970s, i.e., *H. eugeniae*, *L. ehlersi*, *L. indicus*, and *P. djangkarensis*. Thereafter, for over half a century, no new hesionid species have been discovered in Indonesia. Recently, a new hesionid species was collected from North Sulawesi, Indonesia and is described herein.

MATERIAL AND METHODS

The single specimen was collected during a low tide from the intertidal area of Lembah Strait, Bitung City, North Sulawesi Province, Indonesia, on 14 December 2017. A chisel and a hammer were used to crack reef rubble, and polychaete worms that appeared from the rubble were picked up using tweezers and placed into a jar containing 70% alcohol. The specimen was identified under both Leica Z6 APO and Olympus BX53 stereo and compound microscopes, respectively. Photomicrographs were taken using Leica DMC 5400 and Olympus DP22 cameras mounted on their respective microscopes. Due to postal restrictions (the Indonesian post cannot send biological specimens immersed in any liquid abroad), no comparative *Leocrates* material was examined.

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ISSN 2345-7600 (electronic) | ISSN 0217-2445 (print)

Table 1. List of all hesionid species reported to occur in Indonesian waters.

No.	Species	Authority	Type locality	Record(s) in Indonesian waters	Expedition ⁴	Repository ⁵	References
1	<i>Gyptis</i> sp.	–	–	Off Sedanau Island, Natuna, the Riau Islands	Anambas	NTM	Al-Hakim & Glasby (2004)
2	<i>Hesione</i> cf. <i>horsti</i>	Salazar-Vallejo, 2018	East Timor	Sunda Strait	SJADES	LKCNHM	Chuar et al. (2021)
3	<i>Hesione eugeniae</i>	Kinberg, 1866	Bangka Strait, Indonesia	Bangka Strait	Eugenie	NRS	Kinberg (1866)
4	<i>Hesione intertexta</i>	Grube, 1878	Philippines	Off Jedan Island, the Aru Islands, Maluku	Siboga	NBC	Horst (1924)
5	<i>Hesione splendida</i> ¹	Lamarck, 1818	Red Sea, Middle East	Pijot, East Lombok, West Nusa Tenggara	Siboga	NBC	Horst (1924)
6	<i>Leocrates bitungensis</i>	–	Bitung, North Sulawesi, Indonesia	Lohia, Muna, South East Sulawesi	Siboga	NBC	Horst (1924)
7	<i>Leocrates chinensis</i>	Kinberg, 1866	Hong Kong, China	Kwandang Bay, North Gorontalo Seram and Arafura Sea	Siboga	NBC	Horst (1924)
8	<i>Leocrates indicus</i> ²	Horst, 1921	Banda Sea, Indonesia	Samang, the Aru Islands, Maluku	–	–	Ehlers (1918)
9	<i>Leocratides ehlersi</i>	(Horst, 1921)	Saleh Bay, Sumbawa, West Nusa Tenggara, Indonesia	Lembeh Strait, Bitung, North Sulawesi	–	MZB	Present study
10	<i>Leocratides filamentosus</i>	Ehlers, 1908	Tropical Pacific Ocean	Off Ambon Island, Maluku	Siboga	NBC	Horst (1924); Pettibone (1970)
				Off Jedan Island, the Aru Islands, Maluku	Siboga	NBC	Horst (1924); Pettibone (1970)
				Off Sailus Besar Island, South Sulawesi	Siboga	NBC	Horst (1924); Pettibone (1970)
				Off Selayar Island, South Sulawesi	Siboga	NBC	Pettibone (1970)
				Off Sawang, Siau Island, North Sulawesi	Siboga	NBC	Horst (1924); Pettibone (1970)
				Nangamase Bay, Ngada, East Nusa Tenggara	Siboga	NBC	Horst (1924); Pettibone (1970)
				Banda Sea	Siboga	NBC	Horst (1921)
				Saleh Bay, Sumbawa, West Nusa Tenggara, Indonesia	Siboga	NBC	Horst (1921, 1924)
				South of Central Java, Indian Ocean	SJADES	LKCNHM	Chuar et al. (2021)

No.	Species	Authority	Type locality	Record(s) in Indonesian waters	Expedition ⁴	Repository ⁵	References
11	<i>Ophiodromus</i> sp. ³	–		Off Pengadah Island, Natuna, the Riau Islands	Anambas	MZB & NTM	Al-Hakim & Glasby (2004)
12	<i>Oxydromus angustifrons</i>	(Grube, 1878)	Philippines	Banda Island, Central Maluku, Maluku	Siboga	NBC	Horst (1924)
13	<i>Paralamprophaea diplognatha</i>	(Monro, 1926)	China Sea	Kwandang Bay, North Gorontalo, Sulawesi	Siboga	NBC	Horst (1924)
14	<i>Paraleocrates djangkarensis</i>	(Augener & Pettibone in Pettibone, 1970)	Jangkar, Situbondo, East Java, Indonesia	Sunda Strait	SIADES	LKCNHM	Chuar et al. (2021)
15	<i>Paraleocrates wesenberglundae</i> ¹	(Pettibone, 1970)	Gulf of Oman	Off Jangkar, Situbondo, East Java	Siboga	NBC	Pettibone (1970)
16	<i>Psamathe</i> sp.	–	–	Off Salor Island, Natuna, the Riau Islands	Anambas	NTM	Al-Hakim & Glasby (2004)
				Off Pengadah Island, Natuna, the Riau Islands	Anambas	MZB & NTM	Al-Hakim & Glasby (2004)
				Off Sedanau Island, Natuna, the Riau Islands	Anambas	MZB & NTM	Al-Hakim & Glasby (2004)

¹The record of this species in Indonesian waters might be a misidentification considering the long distance between the type locality and the place where the species was found in Indonesia.²This species has been transferred to *Dalhouisia* and reinstated as *D. indica* by Salazar-Vallejo (2020), yet the accepted species name on the World Register of Marine Species (WoRMS) remains *L. indicus*³The accepted name of this species is *Oxydromus* sp.⁴SIADES is an acronym for South Java Deep-Sea Expedition⁵MZB, Museum Zoologicum Bogoriense (Indonesia); NBC, Naturalis Biodiversity Center (Netherlands); LKCNHM, Lee Kong Chian Natural History Museum, National University of Singapore (Singapore); NRS, Naturhistoriska Riskmuseet Stockholm (Sweden); NTM, Northern Territory Museum (Australia)

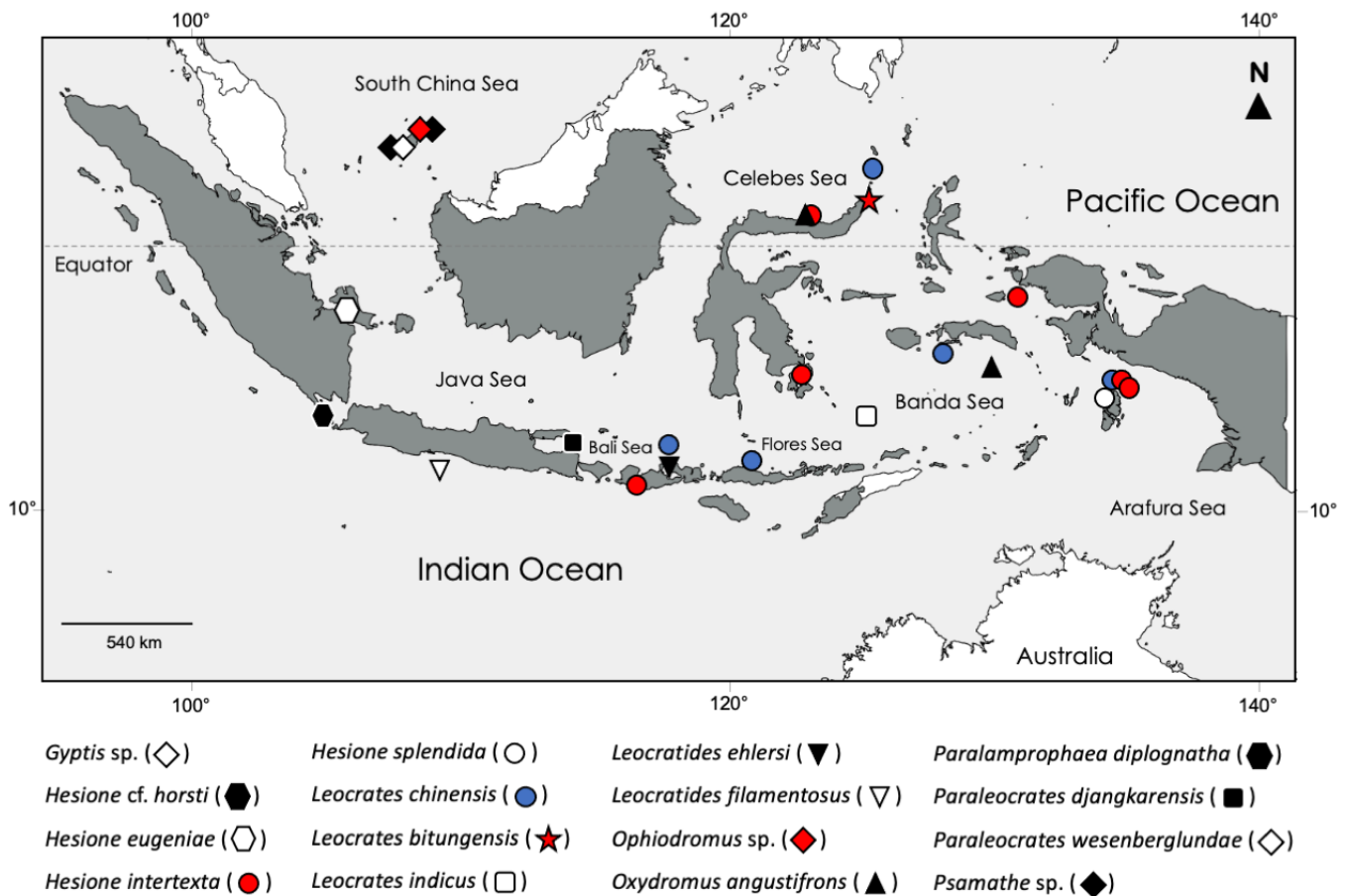


Fig. 1. Distributional map of all hesionid species occurring in Indonesia.

The specimen of the present study was identified as a new species using the identification key of Salazar-Vallejo (2020) and has been deposited at the Museum Zoologicum Bogoriense (MZB) in Cibinong, Bogor, West Java (MZB. Pol. 00240). This represents the first *Leocrates* specimen in the museum's collection. Additionally, a distributional map of hesionids in the country (Fig. 1) was created using SimpleMappr (www.simplemappr.net).

SYSTEMATICS

Family Hesionidae Grube, 1850

Genus *Leocrates* Kinberg, 1866

Leocrates bitungensis, new species (Figs. 2–4)

Material examined. Holotype: 1 (MZB. Pol. 00240), Lembah Strait, Bitung City, North Sulawesi Province, 1°27'09.4"N, 125°14'22.7"E, coll. Joko Pamungkas, 14 December 2017.

Description. Specimen complete with dorso-ventrally flattened body consisting of 16 chaetigers measuring 18 mm long by 3 mm wide at widest area, slightly tapering posteriorly from middle part of body. Body colour in alcohol shiny pale yellow with a more intense colouration on dorsum (Fig. 2).

Prostomium wider than long with anterior margin slightly wider than the posterior, width about half of anterior body width (Figs. 2A & 3A). Three antennae present. Lateral antennae with indistinct ceratophores, longer than prostomium (i.e., by nearly 1.4 times) and palps (i.e., by nearly 1.6 times). Median antenna much smaller and shorter, about half of prostomium length, situated between posterior eyes, right at body midline (Figs. 2A & 3A). Between two lateral antennae and symmetrically situated at body midline lies a large conical facial/frontal tubercle (Figs. 2A & 3A). Palps biarticulated with cylindrical palpophores and conical palpostyles; palpophores larger, 2.3 times longer than palpostyles (Figs. 2A & 3A). Two pairs of black round eyes present; anterior eyes twice as large and farther apart than posterior pair (Figs. 2A & 3A). Pharynx fully everted, muscular and slightly expanded distally, with about 30 lobes at anterior margin. Single mid-dorsal and mid-ventral conical jaws present. Dorsal jaw golden and larger; ventral jaw brown and smaller. Lateral vesicles absent (Figs. 2A & B, 3A). A pair of horizontal C-shaped nuchal organ lobes present, situated posterior to prostomium posterior margin, concealed by anterior margin of tentacular belt. Eight pairs of tentacular cirri with distinct cirrophores supported by visible jet-black acicula present, arranged in three rows, each with 3-3-2 pairs of cirri arranged in dorsal to ventral direction (Figs. 2A & 3A).

Both dorsum and ventrum with lateral cushions, situated at base of each parapodium, pale yellow in colour, size gradually

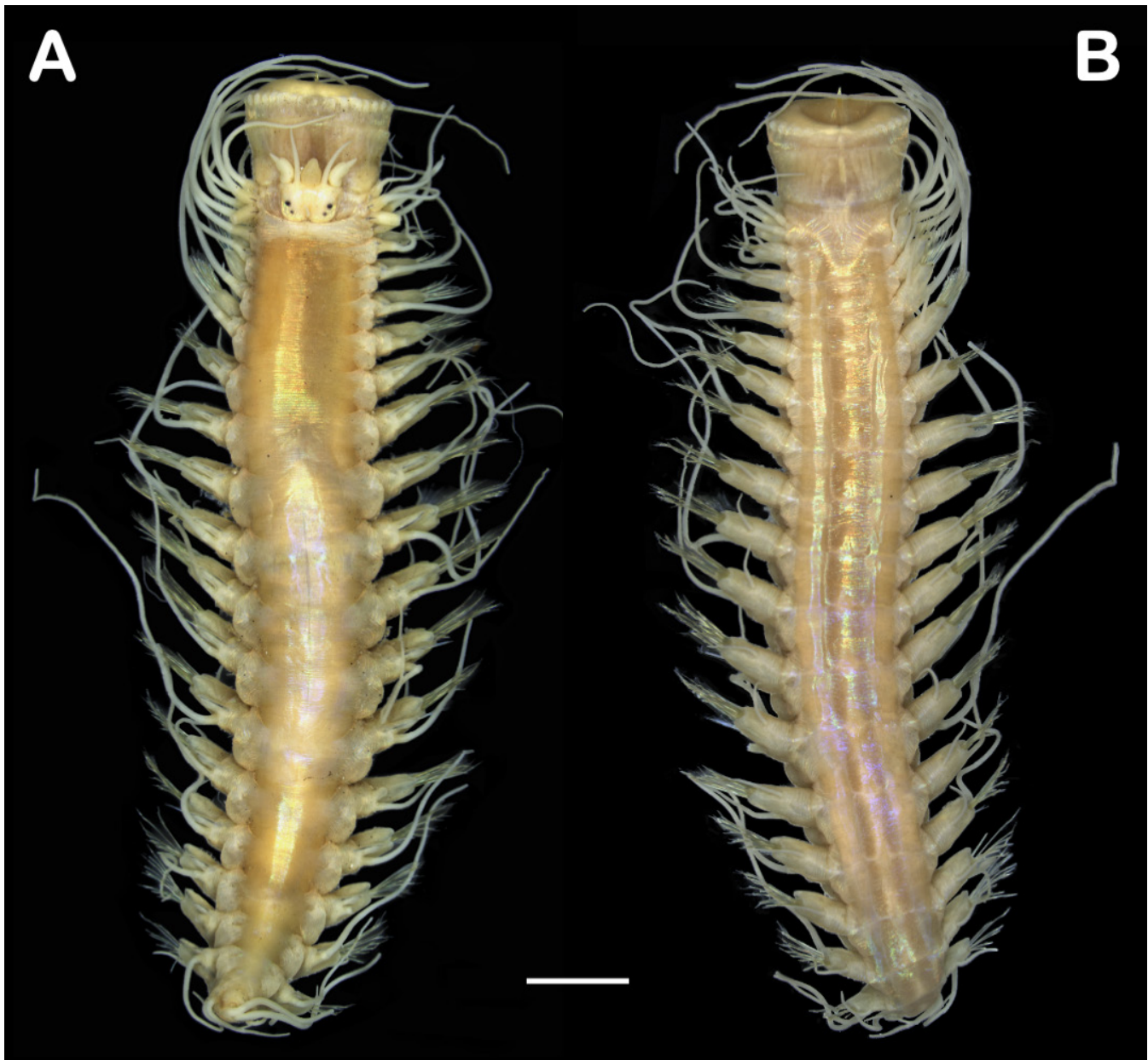


Fig. 2. Whole body of *Leocrates bitungensis*, new species. A, dorsal view; B, ventral view. Scale bar = 1 mm.

increasing posteriorly up to chaetiger 11, then becoming smaller again towards the last chaetiger (Figs. 2 & 3). A faint mid-dorsal longitudinal groove seen around middle part of body (Fig. 2A). Anterior end of ventrum muscular and V-shaped, followed posteriorly by a very shallow but wide longitudinal furrow measuring about half of body width (excluding lateral cushions and parapodia) starting from chaetiger 2 to posterior end. Transverse striae seen along body length, connecting parallel lateral cushions (Fig. 2B).

Dorsal cirri whip-like and much longer than ventral cirri; longest dorsal cirri at chaetigers 10 and 11, i.e., nearly 0.4 times body length (Fig. 2A). Length of ventral cirri almost similar in all chaetigers (Fig. 2B). Parapodia of chaetigers 1–4 uniramous with dorsal and ventral cirri (Fig. 4A). Parapodia of chaetigers 5–16 subbiramous, i.e., notopodia considerably smaller than neuropodia (Fig. 4B & C). Notoacicular lobes with a blunt tip bearing a jet-black aciculum (Fig. 4B & C).

Notochaetae delicate and sparse (Fig. 4B). Neuroacicular lobes projected, with a blunt tip, wider than long (Fig. 4B & C). Neurochaetae compound falcigers with bidentate blades, guards approaching subdistal tooth (Fig. 4D); about 20 chaetae per bundle, blade length decreasing in size ventrally (Fig. 4A–C).

Posterior region tapered. Prepygidial segment with two pairs of dorsolateral cirri. Pygidium with a dorsoterminal anus bearing two paired anal cirri (Figs. 2A & 3B). Oocytes not seen.

Remarks. *Leocrates bitungensis*, new species, differs from all other *Leocrates* species in that its anterior eyes are small, i.e., approximately 1/15 of the prostomial width, and larger than the posterior ones. In addition, the distal end of the notoacicular lobes is blunt, and the number of neurochaetae are scarce, with about 20 chaetae per bundle.

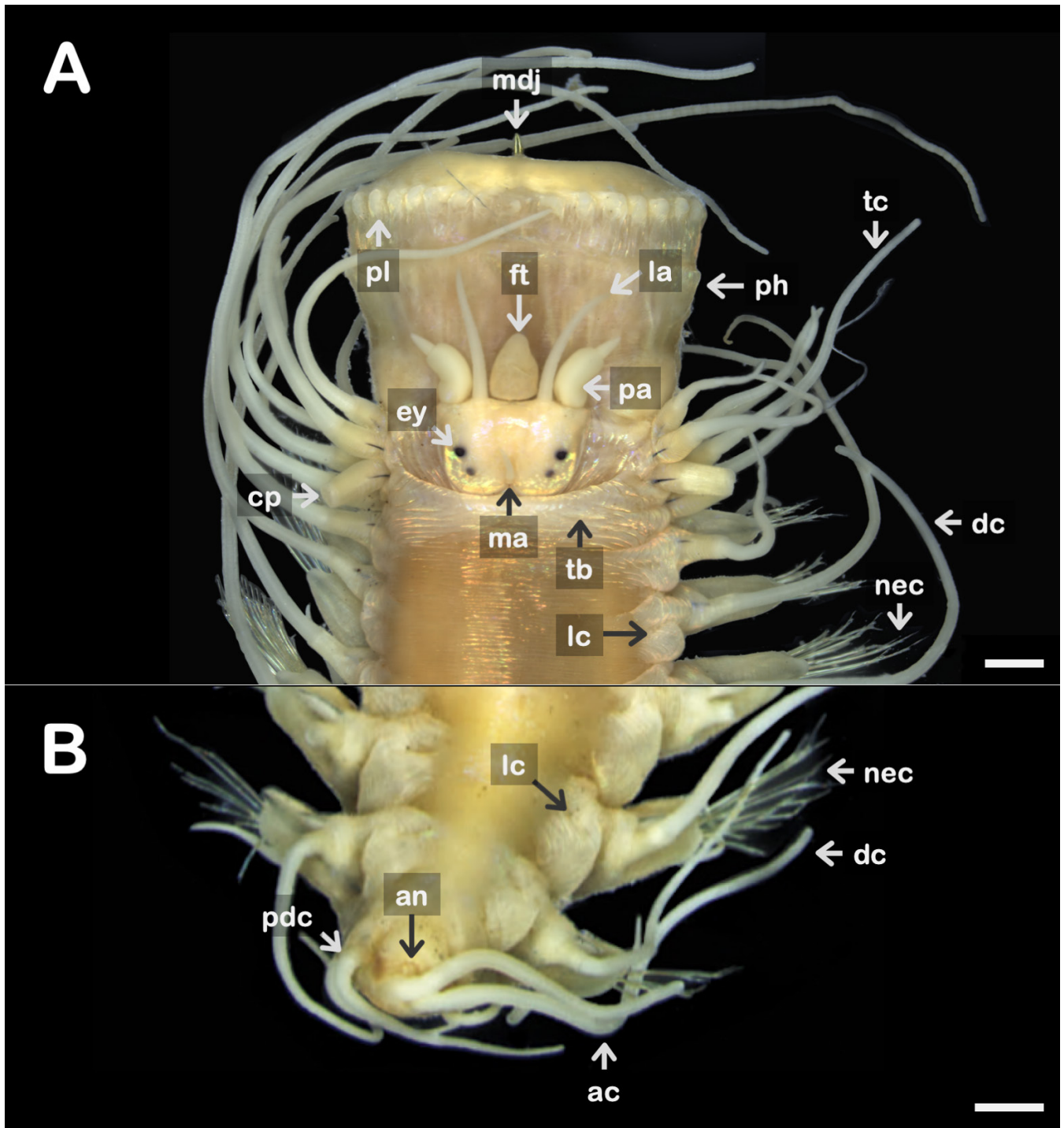


Fig. 3. Close-ups of *Leocrates bitungensis*, new species. A, anterior end; B, posterior end. Abbreviations: an = anus; ac = anal cirrus; cp = cirrophore; dc = dorsal cirrus; ey = eye; ft = facial/frontal tubercle; la = lateral antenna; lc = lateral cushion; ma = median antenna; mdj = mid-dorsal jaw; nec = neurochaetae; pa = palp; pdc = prepygidial dorsolateral cirrus; ph = pharynx; pl = pharyngeal lobe; tb = tentacular belt. Scale bar = 0.5 mm.

Based on these characteristics, *L. bitungensis*, new species, closely resembles *L. reishi* Salazar-Vallejo, 2020. *Leocrates bitungensis*, new species, however, possesses: (1) lateral antennae with indistinct ceratophores, (2) a pharynx without lateral vesicles, (3) lateral cushions situated at the base of each parapodium, (4) projected neuroacicular lobes with a blunt tip that is wider than long, and (5) the body colour (in alcohol) that is shiny pale yellow with a more intense colouration on the dorsum. *Leocrates reishi*, by contrast, possesses: (1) lateral antennae with distinct ceratophores, (2)

a pharynx with lateral vesicles, (3) lateral cushions situated between parapodia, (4) projected neuroacicular lobes with a blunt tip that is as long as wide, and (5) the body colour (in alcohol) that is shiny brownish with a more intense colouration on the dorsum.

Leocrates bitungensis, new species, is also similar to *L. ahlfeldae* Salazar-Vallejo, 2020 from India, *L. chinensis* Kinberg, 1866 from Hong Kong, and *L. giardi* Gravier, 1900 from the Red Sea. Nevertheless, *L. bitungensis*, new

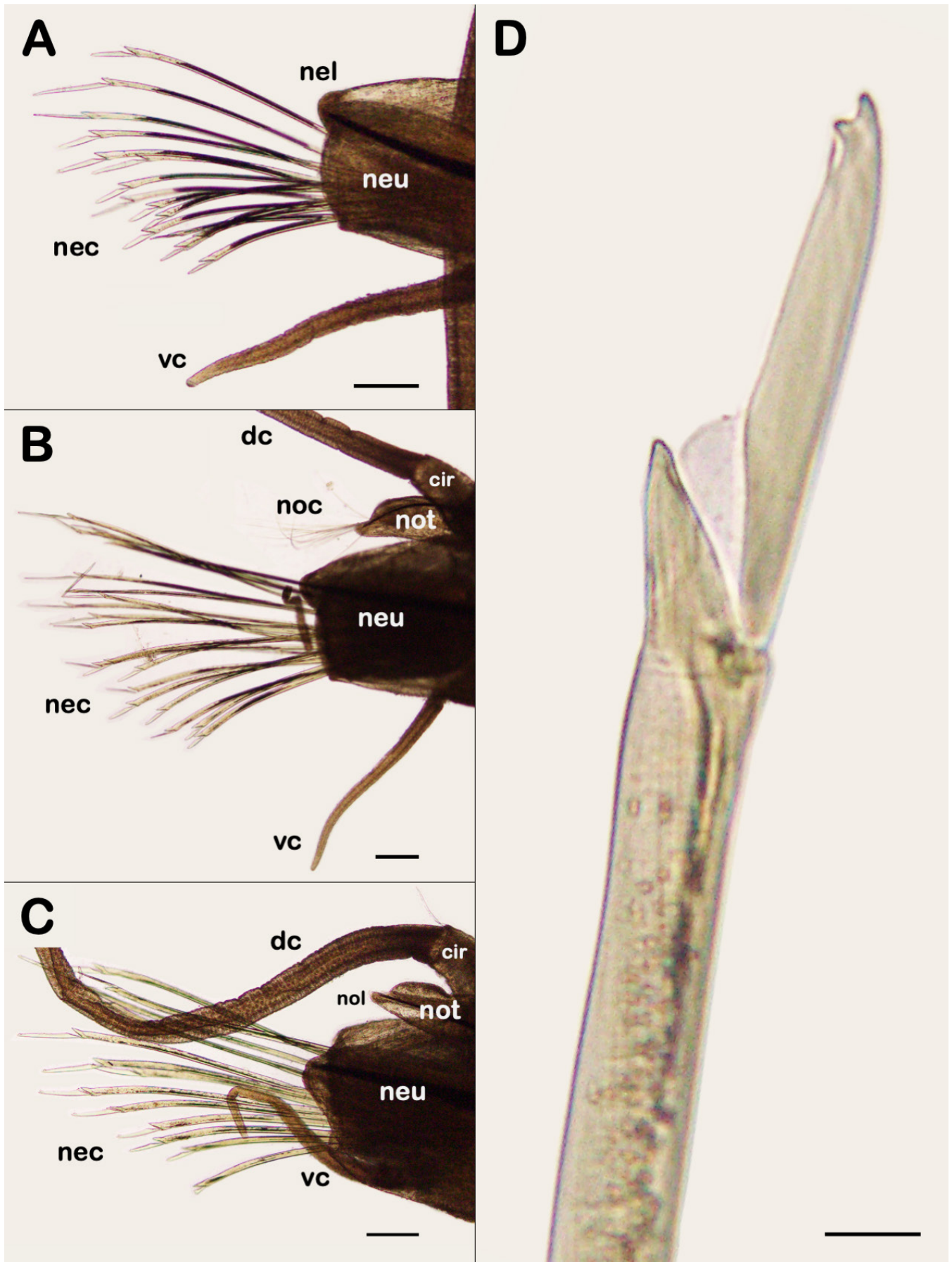


Fig. 4. Parapodia and chaetae of *Leocrates bitungensis*, new species. A, anterior parapodium (chaetiger 3); B, middle parapodium (chaetiger 8); C, posterior parapodium (chaetiger 15); D, close-up of a mid-parapodial neurochaeta (chaetiger 8). Abbreviations: cir = cirrophore; dc = dorsal cirrus; nec = neurochaetae; nel = neuroacicular lobe; neu = neuropodium; noc = notochaetae; nol = notoacicular lobe; not = notopodium; vc = ventral cirrus. Scale bar A, B, C = 200 μ m; D, 25 μ m.

species, along with *L. reishi*, are the only species with blunt notoacicular lobes, whereas the other three species have tapered notoacicular lobes. A small number of neurochaetae (15–20 per bundle) in *L. bitungensis*, new species, also distinguishes this species from both *L. ahlfeldae* and *L. chinensis*. The number of neurochaetae in *L. giardi* is comparable to those in *L. bitungensis*, but in the former, the notoacicular lobes are tapered.

Etymology. The species is named after the city of Bitung where it was collected.

Distribution. Known only from the type locality.

Habitat. The species inhabits crevices in reef rubble in the intertidal zone.

DISCUSSION

Identifying members of the family Hesionidae to the genus level is relatively easier compared to other polychaete families due to various and obvious distinguishing features. These include the presence or absence of antennae and their position, the presence or absence of palps and their articulation, the presence or absence of a facial tubercle and its shape, the papillation of the pharynx, the number of tentacular cirri, the number of chaetigers, and the division of parapodia (Rizzo & Salazar-Vallejo, 2014). Identifying the animals to the species level, by contrast, is more challenging as no single body part can be used as a stand-alone diagnostic feature to distinguish hesionid species. As a result, a combination of several different characters is essential. Salazar-Vallejo (2020), for instance, utilised the relative size of both anterior and posterior eyes, the shape of prostomium, pharyngeal vesicles and notoacicular lobes, as well as the number of neurochaetae to differentiate *Leocrates* species. While these features are useful, the detailed shape and position of the animals' lateral cushions, as well as the morphology of the animals' ventrum may be additional diagnostic features that can be used for species discrimination.

There were only four hesionid species described from Indonesia between the 1860s and the 1970s (Table 1). This number is disproportionately small in comparison to the number of hesionid species described to date from elsewhere in the world, which is about 200 species (Pamungkas et al., 2019). No new hesionid species has been reported from Indonesia since the last century until the present work. While polychaete taxonomic investigations by local researchers have been wanting (Pamungkas & Glasby, 2019), members of the family Hesionidae appear to be so rare in Indonesia that even local benthic studies employing quantitative sampling methods have failed to document the occurrence of these animals (see summary by Siallagan et al., 2023), possibly because they live in poorly sampled habitats. However, considering that the country is a significant global marine biodiversity hotspot, marine species discoveries should be encouraged, especially for polychaetes as the cumulative

number of species described from the region has been levelling off over the past few decades (Siallagan et al., 2023).

Key to Indonesian hesionid species*

1. Tentacular belt with 6 pairs of tentacular cirri; prostomium wider than long with 3 antennae, median antenna situated around anterior region of prostomium; palps biarticulated; anterior eyes larger than posterior ones, lip glands absent; neurochaetae bidentate *Oxydromus angustifrons*
 - Tentacular belt with 8 pairs of tentacular cirri 2
2. Body with fewer than 20 chaetigers 3
 - Body with more than 20 chaetigers 13
3. Palps absent 4
 - Palps present 6
4. Neurochaetal blade guards approaching distal tooth 5
 - Neurochaetal blade guards surpassing distal tooth; dorsal cirrophore twice as long as wide *Hesione eugeniae*
5. Dorsal surface usually shiny, often areolated; dorsal cirrophore 2–3 times as long as wide *Hesione splendida*
 - Dorsal surface opaque; dorsal cirrophore variable; anterior eyes circular; acicular lobes tapered without basal tine; dorsum rugose to microtuberculated at least along posterior chaetigers; neurochaetal blades 3–4 times as long as wide *Hesione intertexta*
6. Parapodia uniramous, notochaetae absent 7
 - Parapodia biramous, notochaetae present 8
7. Peristomial dorsolateral tubercles with smooth margin or with 1–2 thick, low, round lobes; ventrum with pigmentation; neuroacicular lobes twice longer than wide, triangular, not mucronate; mid-ventral pigmentation continuous brownish longitudinal band, rarely with round spots in some anterior to middle chaetigers *Leocratides ehlersi*
 - Peristomial dorsolateral tubercles with 2–5 thick digitate lobes; ventrum without pigmentation; neuroacicular lobes longer than wide, tapered into small mucro *Leocratides filamentosus*
8. Nuchal organs U-shaped or horizontal C-shaped 9
 - Nuchal organs L-shaped; peristomial dorsolateral tubercles lobulate; basal pharyngeal ring with minute papillae (often hidden under dorsolateral tubercles) *Paralamprophaea diplognatha*
9. Nuchal organs U-shaped, as long as wide; pharynx with double dorsal/upper jaws; eyes brownish; anterior eyes reniform to semilunar, up to twice larger than posterior ones *Leocrates indicus*
 - Nuchal organs horizontal C-shaped 10
10. Notochaetae start from chaetiger 4 with smooth surface; neurochaetal blades unidentate sometimes with guards surpassing denticle 11
 - Notochaetae start from chaetiger 5, subdistally spinulose; neurochaetal blades bidentate 12
11. Anterior eyes slightly larger than posterior ones; lateral antennae as long as palps; neurochaetae without guards, taper progressively into delicate fine tips *Paraleocrates wesenberglundae*
 - Anterior eyes twice larger than posterior ones; lateral antennae 1/3 longer than palps; neurochaetae with guards extended far beyond tips as thin aristas *Paraleocrates djangkarensis*
12. Each anterior eye measuring about 1/15 prostomium width; pharyngeal vesicles absent; notoacicular lobes blunt; neuroacicular lobes wider than long; neurochaetae scarce (15–20 per bundle) *Leocrates bitungensis*, new species
 - Each anterior eye measuring about 1/10 prostomium width; pharyngeal vesicles present; notoacicular lobes tapered;

- neuroacicular lobes longer than wide; neurochaetae abundant (20–50 per bundle).....*Leocrates chinensis*
13. Prostomium with a median antenna; mouth surrounded by two large tubercles (lip glands)..... *Gyptis* sp.
- Prostomium without a median antenna; nuchal organs connected middorsally *Psamathe* sp.

* Modified after Rizzo & Salazar-Vallejo (2014), and Salazar-Vallejo (2018; 2020)

ACKNOWLEDGEMENTS

I would like to thank Sergio I. Salazar-Vallejo from the Depto. Sistemática y Ecología Acuática, El Colegio de la Frontera Sur, Chetumal, México for providing relevant literature and taxonomic advice. This work was part of 'Polychaetes (Annelida) of Wallacea' project funded by the Postgraduate Research Student Support (PRESS) provided by the University of Auckland, and the New Zealand ASEAN Scholarship (NZAS). I am grateful to Prof. Mark J. Costello for his consent to use the PRESS funding to conduct the project.

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