

REDESCRIPTION OF *IDANTHYRSUS BIHAMATUS* (SABELLARIIDAE, POLYCHAETA): AN ENDEMIC SPECIES OF INDONESIA

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ABSTRACT

The endemic polychaete species *Idanthyrsus bihamatus* is redescribed based on a new material collected from Bali, Indonesia. All key diagnostic characters of the genus were used to describe the species. Both photo- and SEM micrographs were used to illustrate the species. Additionally, a map was created to show the distribution of the species across the geographic region. The material of the present study is deposited at the Museum Zoologicum Bogoriense in Cibinong, Bogor, and is the first sabellariid collection of the museum.

Key words: Annelida, endemism, marine biodiversity, species description, taxonomy

INTRODUCTION

The sabellariid *Idanthyrsus bihamatus* (Caullery, 1944) is an endemic polychaete species from Indonesia. The animals were collected during the *Siboga* Expedition (1899–1900) from a number of subtidal habitats in the central and eastern parts of the country, including Bali, Banda, Molucca and Savu Seas (Caullery, 1944). The species was reported to inhabit both subtidal and deep-sea habitats, yet the latter habitat may be incorrect, i.e., it was attributed to a labeling error as pointed out by Caullery (1944). Moreover, the animals' tube is made of discoidal *Sorites* sp., which also suggests that they are unlikely to occur at such a great depth (Kirtley, 1994).

Since its original publication, *I. bihamatus* has not been reported to occur in Indonesian waters despite the species being common on rocky shores and many marine benthic studies conducted in the country (pers. obs.), and neither has been cited in other parts of the world. This is partly because the original species description is in French (this is particularly a barrier for most local researchers), lacks illustrative photo- and SEM micrographs, and most importantly none of the type specimens of the species has been deposited in local zoological repository, just like other polychaete materials obtained from the same expedition (Pamungkas & Glasby, 2019). The original description of the species is also rather difficult to obtain (at the time of writing, the literature cannot be found at any Indonesian libraries and is not available on the Biodiversity Heritage Library at www.biodiversitylibrary.org). These factors make it more difficult for local researchers to recognize the species. A redescription of *I. bihamatus*, along with specimen deposition in a local zoological museum, is therefore of importance as the basis of *Idanthyrsus* species identification.



MATERIALS AND METHODS

The material of the present study was collected on January 23–24, 2018, from the intertidal rocky shore of Pemutih Beach, which is situated in Pecatu Village, South Kuta Subdistrict, Badung Regency, Bali Province, Indonesia (Fig. 1). As these tubicolous worms were attached firmly under rock, a chisel and a hammer were used to separate the animals from the substrate. The animals were then put directly in a jar with 70% alcohol. The *Idanthyrsus* specimens were identified under *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. SEM micrographs were taken using the scanning electron microscope *JSM-IT200*. Due to national postal restrictions, i.e., the Indonesian post cannot send biological specimens immersed in any liquid abroad, examination of type specimens of *I. bihamatus* through specimen loan from the Naturalis Biodiversity Center (NBC), Leiden, cannot be performed. The *Idanthyrsus* specimens of the present study were considered topotypes and were identified and compared to the other *Idanthyrsus* species through Table 1 listing major distinguishing characters of the species in Hutchings et al. (2012). The material of the present work is deposited at the Museum Zoologicum Bogoriense (MZB) and is the first sabellariid collection of the museum. A map showing the geographic distribution of the species (Fig. 1) was created using *SimpleMappr* (www.simplemappr.net).

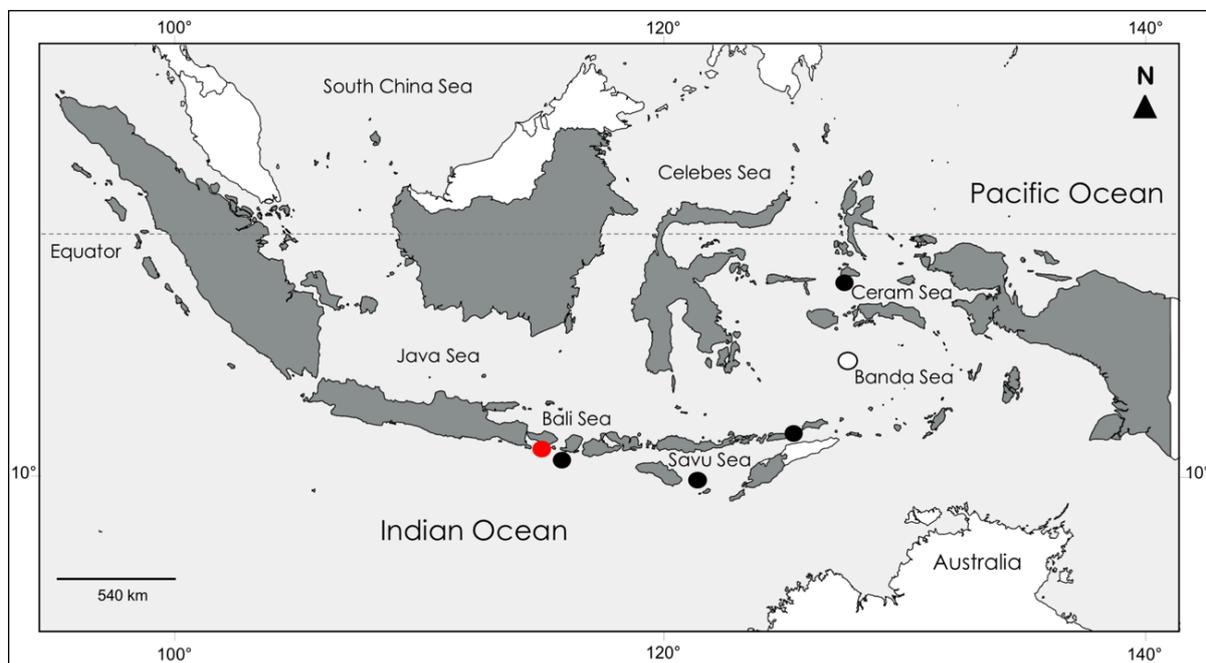


Figure 1. Map of *Idanthyrsus bihamatus* geographic distribution. Red circle is the locality of the specimens described in the present study; black and white circles are the localities of the specimens collected during the Siboga Expedition; white circle suggests that the locality may be an error.

RESULTS

As many as 42 individuals of *Idanthysus* were collected from the field. All of the specimens were found to be identical to *I. bihamatus* originally described by Caullery (1944) despite a number of morphological variations attributed to the animals' maturation. Several additional characters were also observed in this study, complementing the description of the species.

SYSTEMATICS

Family SABELLARIIDAE Johnston, 1865

Genus *Idanthysus* Kinberg, 1866

Idanthysus bihamatus (Caullery, 1944)

(Figs 2–4)

Material examined. Topotypes: 1 (MZB. Pol. 00233), Pemutih Beach, Bali, 8°48'29.9"S, 115°06'27.3"E, coll. J. Pamungkas, January 24, 2018; 33 (MZB. Pol. 00234), Pemutih Beach, Bali, 8°48'29.9"S, 115°06'27.3"E, coll. J. Pamungkas, January 24, 2018; 8 (MZB. Pol. 00235), Pemutih Beach, Bali, 8°48'29.9"S, 115°06'27.3"E, coll. J. Pamungkas, January 23, 2018.

Redescription. Specimens complete and anterior fragments (losing cauda). Body width tapering from middle posteriorwards. Body flesh in alcohol creamy white with light brown striae on dorsal area of parathoracic region extending anterior– and laterally toward opercular region, medium brown nuchal spines and tentacular filaments, and dark brown cauda (Fig. 2). Tubes thick, resistant and made of tightly agglutinated discoid foraminifera (Fig. 2D).

Opercular region consists of operculum and first two segments. Operculum with two completely separate lobes, longer than wide, and with distal end sloped posteriorly on both dorsal and ventral sides (Figs 2A–C). Translucent golden paleae present, arranged in a pair of elliptical patterns along distal edges of opercular lobes. Outer paleae 18–22 pairs with cylindrical shaft and straight or slightly arcuate pinnate, flat blade. Blade has straight or gently curved denticles with wide base and pointed distal end, situated opposite along lateral margins and distal tip. Denticles short at proximal and distal ends, increasing in length toward mid area (Figs 3A & B; Fig. 4A). Inner paleae 12–17 pairs, cylindrical, robust and straight with smooth surface and pointed tip (Figs 3C & D; Fig. 4A). Tentacular filaments branching, arranged in 9–11 rows, filling up space between opercular lobes (Figs 2A & B). Median organ brown pigmented and raised, extending to dorsal edge of opercular lobes junction (Fig. 2I). Numerous eyespots on lateral sides of median ridge (Fig. 2I). One pair of palps present, about half length of operculum (Fig. 2I). One pair of sturdy hook-shaped nuchal spines with limbations on concave margins, situated at most proximal margin of dorsal lobes (Fig. 2H). Opercular papillae 8–13 pairs, conical, situated along outer margin of dorsal lobes, next to outer paleae. First pair situated around base of nuchal spines slightly bigger (Figs 2A & C).

Segment 1 chaetigerous with reduced neuropodia bearing capillary chaetae and neuropodial cirri, flanking a protruding U-shaped building organ (Fig. 2B). Capillary neurochaetae flattened with denticulated margins; denticles arranged opposite along lateral margins, widest at base and tapering toward fine tip (Fig. 4B). Notochaetae absent. Segment 2 with segregated neuropodia,

situated more laterally and not longitudinally aligned with neuropodia of segment 1, bearing capillary chaetae morphologically similar to those of segment 1, two pairs of triangular lateral lobes and first pair of branchiae arising dorsally. Notochaetae absent (Fig. 2C). Branchiae lanceolate and elongate, tapering to a pointed tip; length increases posteriorwards, longest at around mid body then gradually decreases to last posterior abdominal segment (Fig. 2E).

Parathoracic region comprises three chaetigerous segments (3–5) with translucent lanceolate chaetae criss-crossed with translucent smooth capillary chaetae (Figs 2C & E; Figs 3E & F; Figs 4C & D). Lanceolate notochaetae wider and shorter than lanceolate neurochaetae; capillary notochaetae shorter than capillary neurochaetae (Figs 4C & D). Abdominal region with 16–51 chaetigerous segments with notouncini and capillary neurochaetae, starting from segment 6 to posterior end of abdomen (Fig. 2E). Notopodia as transverse tori with uncini, decreasing in number posteriorly (Fig. 2F). Each uncinus with a small proximal tooth, 4 rows of 2 paired teeth of equal size, 2 rows of 3 teeth of equal size and distal crest of around 7 teeth alternating in size (Fig. 4E). Capillary neurochaetae with thin and flattened blades ornamented with thecal laminar extensions, forming oblique rows and splayed tips distally (Fig. 4F). Segments 13 and 14 with longest and most capillary neurochaetae per fascicle, brushy and crossing each other (Fig. 2G). Cauda smooth, about 1/3 of total length of species (Fig. 2F).

Variation. *Idanthysus bihamatus* specimens in the present study vary in body sizes. The smallest specimen is an anterior fragment, measuring 19 mm long by 1 mm wide at the widest area around the parathoracic region. The biggest specimen is intact, measuring 65 mm long from the operculum to the last abdominal segment by 4 mm wide, followed posteriorly by a 25 mm long cauda. The specimens also vary in the numbers of chaetigerous segments (21–56), outer paleae (18–22), inner paleae (12–16), opercular papillae (8–10) and segments bearing branchiae (20–55). Bigger specimens tend to have more intense brown pigmentation in certain body areas, yet the size does not seem to be always related to more numbers of particular diagnostic features. For instance, the biggest specimen in this study has fewer numbers of outer and inner paleae as well as opercular papillae compared to some smaller specimens. However, some features such as body size, number of chaetigers and body color intensity may be attributed to the maturity level of the species as more mature specimens tend to have longer and wider body with more number of chaetigers and more intense color.

Remarks. *Idanthysus bihamatus* can be distinguished from other *Idanthysus* species by having distinct outer paleae and uncini denticulation. The outer paleae of this species has a cylindrical shaft and a straight or slightly arcuate pinnate, flat blade. The blade is occupied by straight or gently curved denticles with a wide base and a pointed distal end, situated opposite along the lateral margins and the distal tip. The denticles are short at the proximal and the distal ends, and the length of these features increases toward the mid area of the blade. The uncini of *I. bihamatus* have a small proximal tooth, 4 rows of 2 paired teeth of equal size, 2 rows of 3 teeth of equal size and distal crest of around 7 teeth alternating in size. Moreover, the presence of showy brushy capillary neurochaetae on segments 13 and 14 – crossing each other between the two paired fascicles – as well as the brown pigmentation pattern of the body are also a striking feature of the species. *Idanthysus bihamatus* has a creamy white body with

light brown striae on the dorsal area of the parathoracic region, extending anterior– and laterally toward the opercular region. The nuchal spines and the tentacular filaments are medium brown, and the cauda is dark brown.

Idanthyrus bihamatus has a number of features in common with *I. australiensis* (Haswell, 1883) such as similar morphologies of capillary neurochaetae of segments 1 and 2, lanceolate and capillary chaetae of parathoracic segments and abdominal capillary neurochaetae. However, *I. bihamatus* consistently has one pair of limbate nuchal spines and two pairs of lateral lobes, whereas *I. australiensis* has 2–3 nuchal spines without limbation and three pairs of lateral lobes (Table 1 in Hutchings *et al.*, 2012). *Idanthyrus bihamatus* is also morphologically similar to *I. okudai* Kirtley, 1994, yet the latter species has more than two nuchal spines without limbation and without branchiae in posterior segments (Table 1 in Hutchings *et al.*, 2012).

While Caullery (1944), Kirtley (1994) and Hutchings *et al.* (2012) provided no information about the eyespots in the median ridge and the neuropodial cirri of segment 1 in *I. bihamatus*, both characters are observed in this study. The present work also provides additional taxonomic illustrations that are not available in the original publication of the species, i.e. photomicrographs showing the detailed body coloration, the nuchal hooks, the median organ (including the eyespots) and the parathoracic and abdominal chaetae of the species. The SEM micrographs in the present work particularly reveal the morphology of the species' chaetae in great detail.

Distribution. *Idanthyrus bihamatus* was exclusively found in Indonesian waters, including Bali Sea (in Pecatu, Bali Province), Indian Ocean (off south west of Lombok Island, West Nusa Tenggara Province), Savu Sea (west of Sawu Island, East Nusa Tenggara Province), Banda Sea (south of eastern part of Alor Island, East Nusa Tenggara Province) and Seram Sea (off south west of Obi Island, North Maluku Province).

Habitat. *Idanthyrus bihamatus* inhabits both intertidal and subtidal rocky shores, attached firmly to rock in colonies. Deep sea records of this species are most likely an error as pointed out by Caullery (1944) and Kirtley (1994).

DISCUSSION

According to WoRMS Editorial Board (2022), a total of 22 *Idanthyrus* species have been described between the mid 19th century and 2021. One autapomorphy of this genus is the presence of straight outer paleae, i.e., the paleae show no angle between the shaft and the blade (e.g., Capa *et al.*, 2012; Hutchings *et al.*, 2012). However, about half of the species show slightly curved outer paleae, typically around the distal end of the blade. The species include *I. australiensis*, *I. bicornis* (Schmarda, 1861), *I. bihamatus* (Caullery, 1944), *I. cretus* Chamberlin, 1919, *I. kornickeri* Kirtley, 1994, *I. luciae* (Rochebrune, 1882), *I. mikeli* Chávez-López, 2021, *I. okudai*, *I. pennatus* (Peters, 1854), *I. valentinei* Kirtley, 1994 and *I. willora* Hutchings, Capa & Peart, 2012. Although the curve may be associated with the divergence of opercular lobes in reaction to fixation (as outer paleae are typically flat, thin and not as robust as inner paleae), this, as in Kirtley (1994), needs to be mentioned to clarify the genus' diagnostic character.

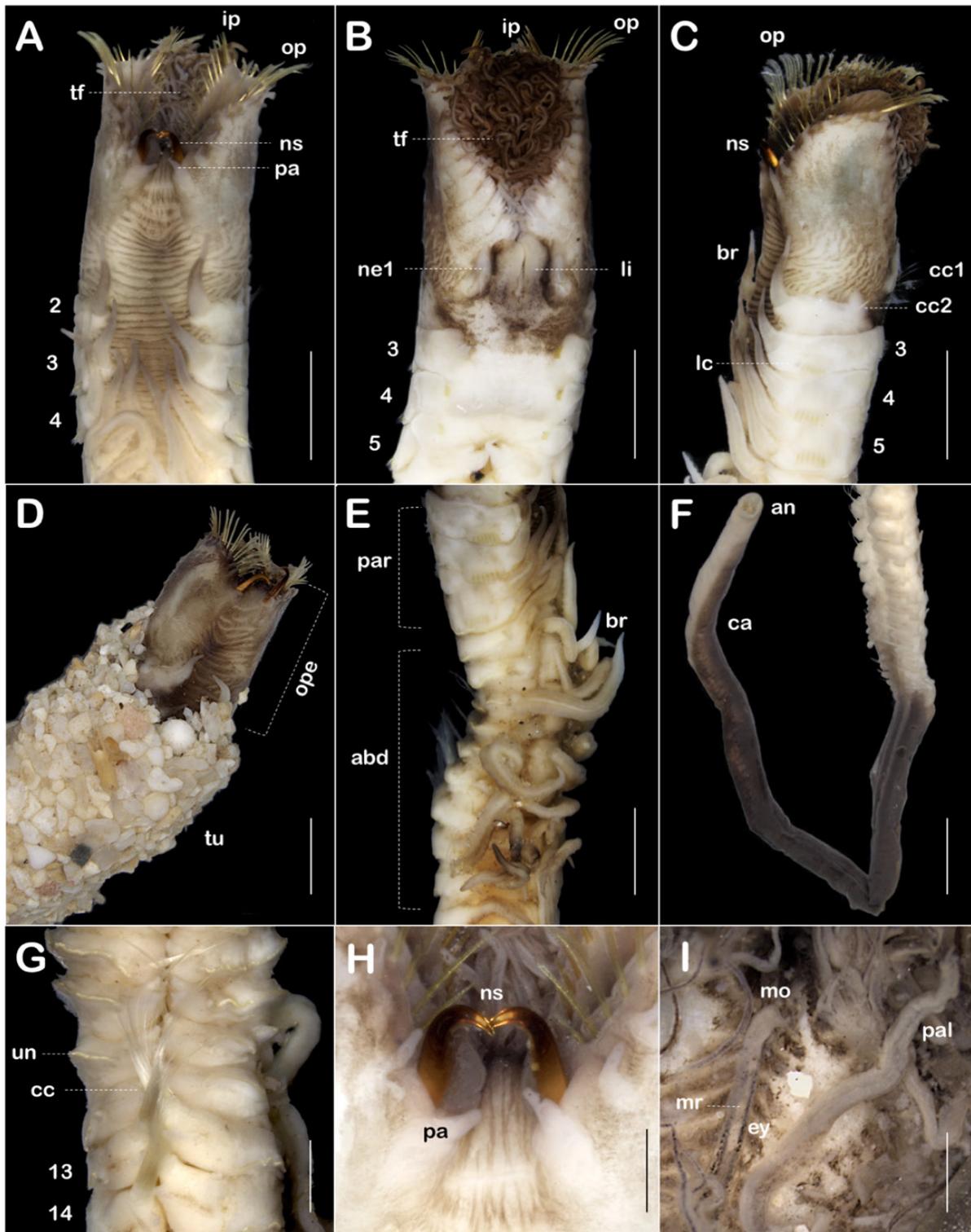


Figure 2. Photomicrographs of *Idanthysus bihamatus*: (A) operculum and anterior segments, dorsal view; (B) operculum and anterior segments, ventral view; (C) operculum and anterior segments, lateral view; (D) tube and opercular region; (E) mid dorsal branchiae (F) posterior abdominal segments and cauda; (G) longest brushy capillary neurochaetae on segments 13 and 14; (H) nuchal spines and opercular papillae; (I) eyespots, median organ, median ridge and palp. Abbreviations: abd, abdomen; an, anus; bo, building organ; br, branchiae; ca, cauda; cc, capillary chaetae; ey, eyespots; ip, inner paleae; lc, lanceolate chaetae; mo, median organ; mr, median ridge; ns, nuchal spines; op, outer paleae; ope, operculum; pa, opercular papillae; pal, palp; par, parathorax; tf, tentacular filaments; un, uncini. Numbers indicate segment order. Scale bars: A–F, 2 mm; G, 1 mm; H, 0.25 mm; I, 0.5 mm.

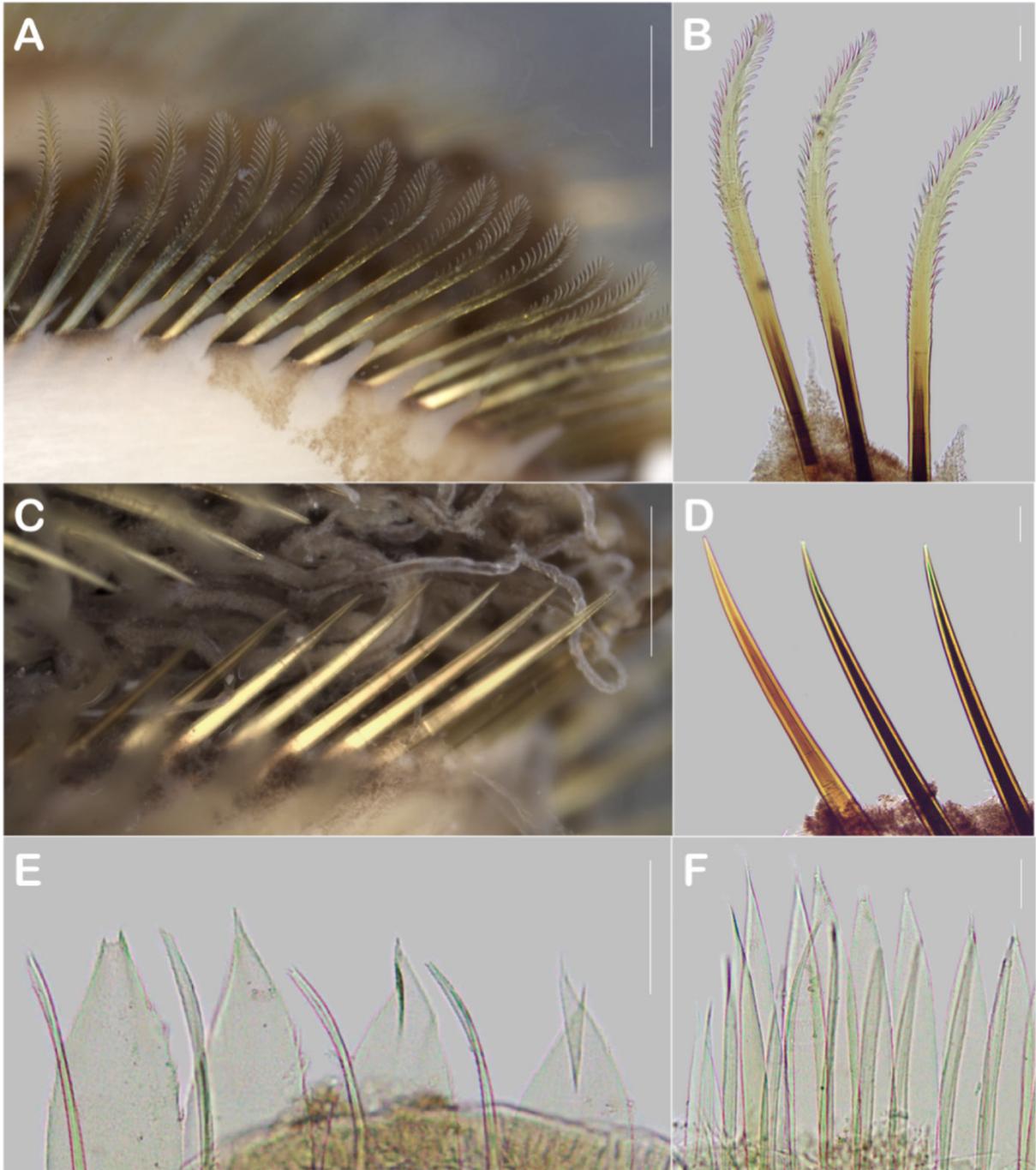


Figure 3. Photomicrographs of *Idanthyrus bihamatus*' paleae and parathoracic chaetae: (A) outer paleae; (B) close-up of outer paleae; (C) inner paleae; (D) close-up of inner paleae; (E) lanceolate and capillary notochaetae; (F) lanceolate and capillary neurochaetae. Scale bars: A & C, 0.5 mm; B, D & E, 100 µm; F, 50 µm.

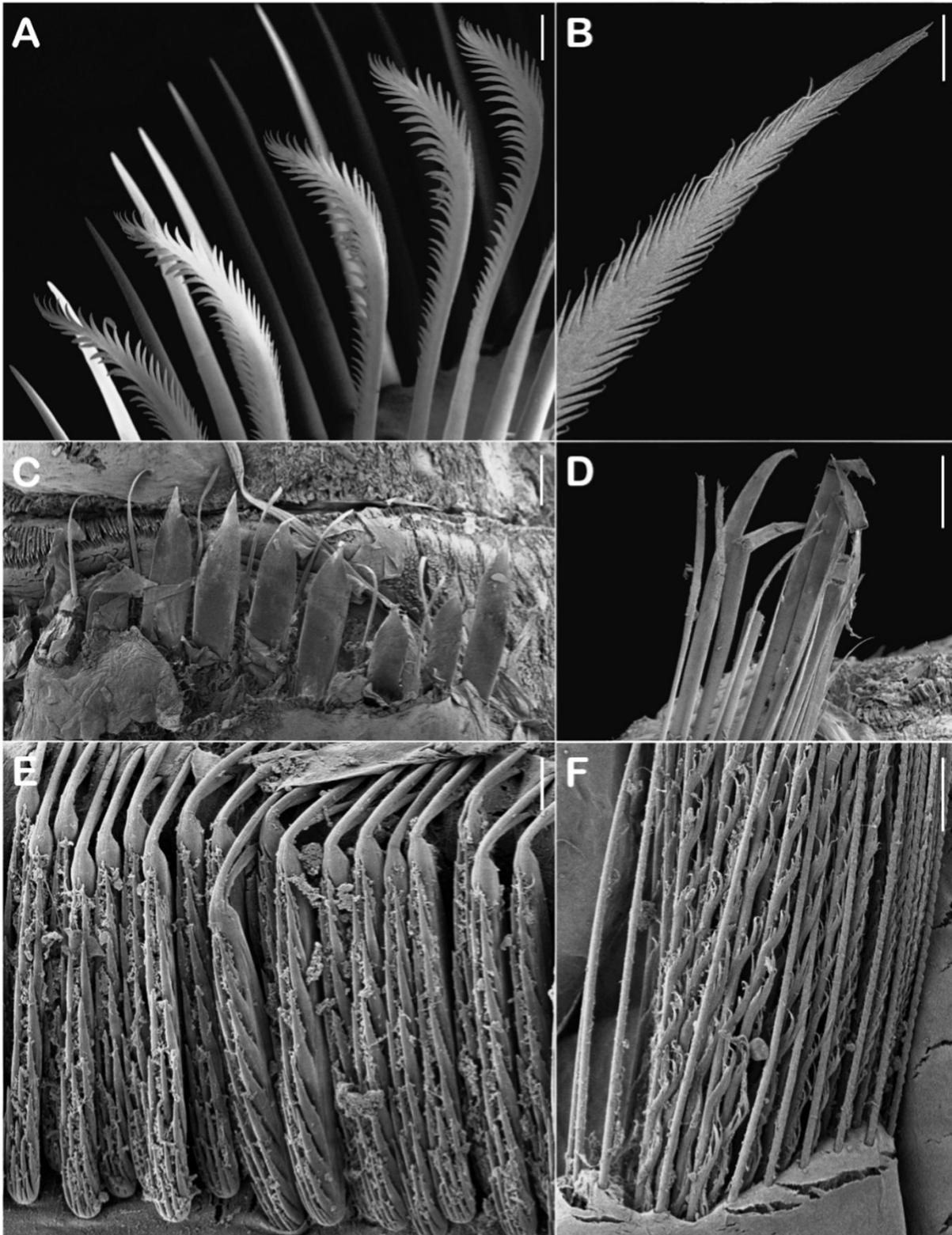


Figure 4. SEM micrographs of *Idanthyrus bihamatus*: (A) inner and outer paleae; (B) capillary neurochaeta of chaetiger 1; (C) lanceolate and capillary notochaetae of parathoracic segments; (D) lanceolate and capillary neurochaetae of parathoracic segments; (E) abdominal notouncini; (F) abdominal capillary neurochaetae. Scale bars: A, C & D, 100 μm ; B & E, 10 μm ; F, 50 μm .

Furthermore, Kirtley (1994) seems to rely on the details of outer paleae to describe *Idanthyrus* species. While the feature is one key diagnostic feature of the species, I found that the morphology, the number and the arrangement of denticles on both concave and convex margins that are seen are visually affected by the angle at which the paleae are observed. A seemingly different shape and fewer number of denticles on one margin compared to the other one could be due to the denticles bending to another direction. This may be less clear when a single palea is examined through a compound microscope, but is more obvious when a group of paleae is observed using both photo- and SEM micrographs (e.g. Fig. 3A & Fig. 4A; see also the SEM micrographs of the outer paleae of *I. australiensis* in Hutchings et al. (2012)). Relying merely on a single character to identify *Idanthyrus* spp. may eventually lead to misidentification as the species share similar characteristics among each other. The examination of complete diagnostic characters, along with the use of photo- and SEM micrographs, is therefore essential to identify and describe *Idanthyrus* species accurately. In addition, type localities may give a clue about the species identity as the geographic distribution of polychaetes has been found to be generally restricted (e.g. Hutchings & Kupriyanova, 2018).

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