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Short Communication: First record of *Onuphis eremita* (Onuphidae: Annelida) from Buntal Beach, Sarawak, Malaysia

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Abstract. *Mohamad FA, Amran AA. 2024. Short Communication: First record of* Onuphis eremita *(Onuphidae: Annelida) from Buntal Beach, Sarawak, Malaysia. Biodiversitas 25: 3768-3774.* Since the early 1990s, much research on polychaetes has been conducted across various regions in Malaysia, particularly in Peninsular region, leading to the discovery of numerous new species record. A comprehensive inventory of polychaete species in Malaysia documents records from 1866 to 2013, revealing a total of 57 species in a revised checklist. However, studies focusing on coastal habitats in East Malaysia have been limited, particularly those identifying species at the lowest taxonomic level. This study presents the discovery of a new intertidal species of the family Onuphidae, *Onuphis eremita* Audouin and Milne- Edwards 1833, which has been newly recorded from South China Sea, specifically in the Buntal Beach, the eastern coast of East Malaysia. The identification is based on the analysis of 19 specimens collected from Buntal Beach, Santubong, Sarawak. These specimens were found in soft sediments characterized primarily by fine sand. Notably, the specimens exhibit large and vividly colored chaetae, which serve as critical identification features. The morphological characteristics of the Malaysian specimens align closely with previous descriptions of *O. eremita*, confirming their classification. Additionally, the pseudocompound hooks of the specimens display tridentate tips, consistent with earlier descriptions of the species. To enhance understanding, this study includes illustrations and scanning electron microscope (SEM) images of *O. eremita*, providing valuable visual references for future research. This finding not only contributes to the existing knowledge of polychaete diversity in Malaysia but also highlights the need for further exploration of coastal ecosystems in East Malaysia.

Keywords: Buntal Beach, morphology, *Onuphis emerita*, pseudocompound hooks, Scanning Electron Microscope, tridentate

INTRODUCTION

Buntal Beach, near Kuching, Sarawak, is a vital ecological hotspot with diverse ecosystems, including mangroves and coastal waters, supporting rich biodiversity of polychaetes, mollusks, and insects, which are crucial food sources for birds and fish (Orenstein et al. 2010). This area is part of the Bako-Buntal Bay Important Bird and Biodiversity Area, providing essential breeding and feeding grounds for migratory shorebirds (Teepol et al. 2021).

Despite its ecological significance, research on polychaetes at Buntal Beach is limited. The study by Zakirah et al. (2019) is the only one focusing on macrobenthos abundance and its environmental connections, identifying various species at the family and genus levels. While Malaysia has seen increased polychaete research since the early 1990s, resulting in the discovery of new species (Idris and Arshad 2013; Idris et al. 2014; Ibrahim et al. 2019), documentation remains inadequate. A comprehensive inventory by Idris and Arshad (2013) recorded 57 polychaete species from 1866 to 2019, updated by Shah et al. (2023) to include new findings and some uncertain species lacking validation.

The Onuphidae family of polychaetes is known for its unique adaptations for burrowing in soft sediments (Paxton et al. 2023). These tubiculous scavengers build diverse tubes from local materials, resulting in various types, including fragile debris tubes and decorated ones with shell fragments (Fauchald and Rouse 2005). They are characterized by large, colorful chaetae, which aid in identification. Common features include a prostomium with two globular palps, short frontal antennae, and longer occipital antennae (Fauchald and Rouse 2005). Pseudocompound hooks on the first segments are also important for species identification (Zanol et al. 2021).

Two of the earliest described species in the Onuphidae family are *Onuphis eremita* Audouin and Milne-Edwards 1833 and *Onuphis pancerii* Claparède 1868. *O. eremita* is the type species of the genus *Onuphis*, which was named and objectively defined the family Onuphidae (Malmgren 1866). The term "*onuphis*" is derived from ancient Greek, with *on* meaning sun and *ophis* meaning snake, reflecting the slender shape and iridescent coloration commonly golden or opaline of these organisms. A notable case of taxonomic confusion involved a specimen of *Onuphis pancerii* from Noiremoutier, France, which was initially identified as *O. eremita* (Fauvel 1923). This confusion was clarified by Arias and Paxton (2015), who re-described the specimen, emphasizing the differences in pseudocompound hooks specifically, that only the tridentate tips are associated with *O. eremita*. The ecological importance of *O. eremita* extends beyond its unique morphological

characteristics. As a tubiculous scavenger, *O. eremita* plays a crucial role in sedimentary ecosystems. By constructing and maintaining its tubes in soft sediments, this species contributes to the physical structure of the habitat, providing refuge for various microorganisms and invertebrates (Fauchald 1977).

Additionally, *O. eremita* aids in nutrient cycling within these ecosystems. Its feeding habits, which include the consumption of organic detritus, help break down and recycle nutrients, making them available for other organisms (Snelgrove and Smith 2002; Zanol and Hutchings 2022; Paxton et al. 2023). This process is vital for maintaining the health and productivity of benthic communities, as it supports the food web and enhances overall biodiversity. Furthermore, the presence of *O. eremita* can indicate the health of the local environment. As a species sensitive to changes in sediment quality and pollution levels, fluctuations in its population can serve as a bioindicator for ecosystem health (Rouse and Pleijel 2001). Monitoring the abundance and distribution of *O. eremita* can provide valuable insights into the impacts of human activities, such as coastal development or pollution, on marine habitats.

This study initially aimed to investigate the distribution of polychaete species at Buntal Beach, Sarawak. Through random sampling, we identified a new record of the cosmopolitan species *Onuphis eremita*, highlighting the need for further exploration of East Malaysia's coastal ecosystems. The paper describes this species, offering insights into its morphological characteristics and habitat preferences. Taxonomic research on *Onuphis eremita* is crucial for understanding its ecological roles and interactions, which are essential for evaluating its contributions to nutrient cycling and overall ecosystem function.

MATERIALS AND METHODS

Sample and data collection

Sampling was conducted during low tide on March 2023 in Buntal Beach, Kuching (1°42’05’ N, 110°22’34” E) located in East Malaysia, the southern part of Sarawak state, Malaysian Borneo (Figure 1). To capture the variability of polychaete distribution across the intertidal zone, samples were collected randomly within a depth of 15 cm using an acrylic perspex corer at different tidal elevations (e.g., high tide zone, mid-tide zone, low tide zone).

This method helps to ensure that the sample is representative of the entire population, reducing bias and increasing the reliability of the results (Field et al. 2012). The polychaete retained on the sieve was transferred into a labeled plastic bag and preserved prior to further analysis in laboratory. The samples were labeled and fixed with 5% buffered formalin for further morphological analysis. The dehydration methods employed afterward, particularly the gradual immersion in increasing concentrations of ethanol, served as a preventive measure against discoloration. By carefully controlling the dehydration process, the risk of significant color alteration can be minimized, allowing for better preservation of the sample's original coloration while effectively removing formalin and other preservatives.

Morphological observation

The samples were sorted and observed for taxonomical analysis. The polychaetes were sorted using a Nikon Stereo Microscope (SMZ-745), enumerated and identified following the keys of Fauchald (1977). In total, 19 individuals of were obtained, but only two complete and undamaged samples were isolated for further analysis. The number of body segments were recorded, and any variations or modifications were documented. Observations of the full body were used to create taxonomic drawing, providing a comprehensive depiction of the studied species. For smaller body parts that could not be adequately visualized with optical microscopy, a scanning electron microscope (SEM) was utilized to achieve better resolution and detail.

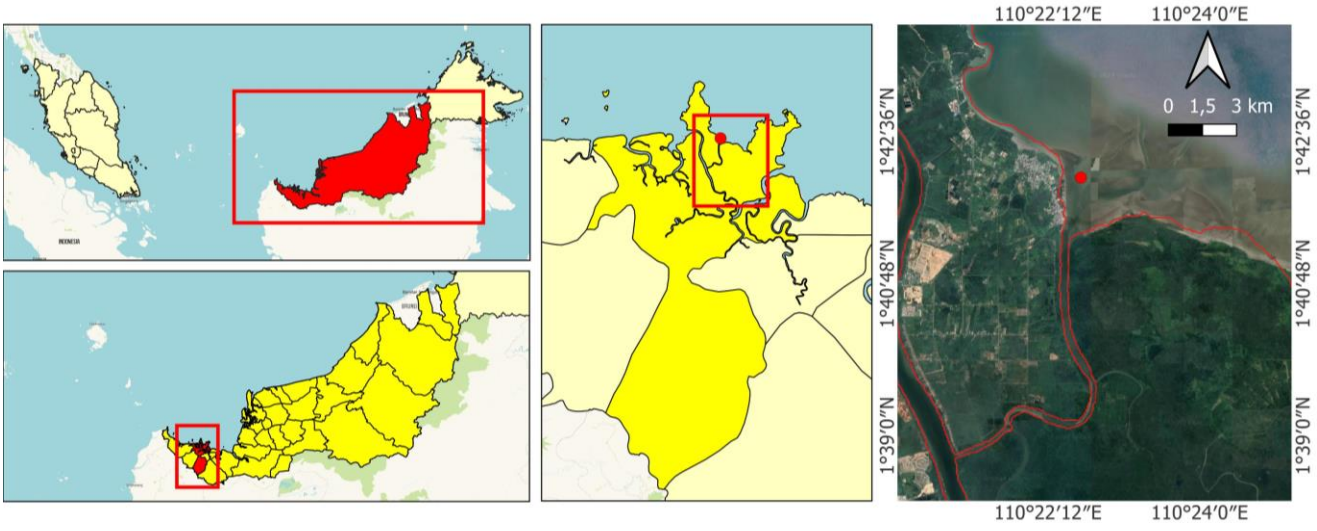

Figure 1. Sampling locations at the intertidal area in Buntal Beach, Kuching, Sarawak, Malaysia

For SEM sample preparation, specimens were dehydrated using a series of increasing ethanol concentrations (60%-100%) and critical-point dried by using carbon dioxide with Quorum K850 Critical Point Dryer to ensure total water removal. The dried samples were sputter-coated with platinum and examined with a JEOL JSM-6390LA Analytical Scanning Electron Microscope (Jeol, Tokyo, Japan). Photographs of the specimen were taken from different angles to capture important features. The sample was identified using dichotomous keys from identification books, scientific papers, and reference collections in museums, research institutions, or online databases specializing in polychaetes.

Morphological descriptions were primarily based on the holotype, supplemented by information from microscope and SEM micrographs to illustrate structural details and variations among the specimens. The use of SEM imaging in this study provides high-resolution insights into the microstructural features of these polychaetes, enhancing the accuracy of species identification and our understanding of their adaptive mechanisms in various environmental conditions (Gonçalves et al. 2023). Types are deposited in the Aquatic Science Museum of Universiti Malaysia Sarawak (UNIMAS), Sarawak, Malaysia.

RESULTS AND DISCUSSION

Onuphis eremita (Audouin and Milne-Edwards 1833) (Figures 2-7)
Family Onuphidae (Kinberg 1865)
Genus *Onuphis* (Audouin-Milne Edwards 1833)

Material examined

Paratype (2 samples): Malaysia: East Malaysia: Sarawak: Bornean water: Buntal Beach, Kuching: 1°42’40’ N, 110°22’35” E, 20 March 2021; 1 km off Buntal coast. 19 specimens of this species were collected in Buntal coast. Out of 19 specimens, only 2 complete specimens were chosen as paratypes for detailed morphological description.

Description

The sample is about 15 mm to 20 mm long, with about 80 segments (Figure 2). Tube is thin and encrusted with sand and shell particle debris. The body is iridescent, dark in colour, with brown or dark pattern continuing posteriorly. Brown pigment forming 4-6 circular spots on underside of ceratophores of antennae and palps.

Prostomium subtriangular with pair of conical frontal lips. Prostomium anteriorly extended with anterior segment slightly rounded compared to the rest of the body (Figure 3). Presence of a pair of thick, triangular and stouted frontal palp. Median occipital antennae shorter than the inner lateral antennae but its ceratophore is long and closely ringed (Figure 4). Ceratophores are closely ringed, palpal ceratophores with 15-20 rings, median antennae with 20-25 rings and lateral antennae with 25-30 rings.

Tentacular cirri inserted dorso-laterally and shorter than the peristomial segment. Branchiae from the first foot as simple filaments; they increase to two filaments by the 22nd to 24th foot, reach a maximum of four to five filaments (Figure 5). Awl-shaped ventral cirri in first four to five chaetigers, distinct slender and pointed postchaetal lobes in first 10-15 chaetigers. Anterior hooded pseudocompound appendaged hooks have three teeth; they extend over chaetiger 1 to 5.

Posterior setae include winged capillaries, comb-setae with flat, distally oblique blades with about 12 teeth and three bidentate acicular setae with short stalk, two acicular setae located dorsally and one aciculae seta on ventral side (Figure 6). Subacicular hooks start from chaetiger 15. Presence of 4 anal cirri on pygidium, 2 cirri shorter and 2 cirri longer in length.

Distribution

Indonesia, India, Korea, Brazil, USA, France, in this study, *O. eremita* was found in very fine sand to medium sand type of sediment of intertidal Buntal Beach.

Discussion

Onuphis is a cosmopolitan taxon, with most species typically found in intertidal and shallow waters of warm-temperate regions as evidence it had been reported found in Indonesia (Calabuig 2019), India, Korea (Kwon 2023), Brazil (Salim 2022), USA (Kampf 1986) and France (Paxton 1986). The type locality for this species is reported to be an intertidal to shallow subtidal fine to medium sand community, similar to the habitats identified in this study (Pérès and Picard 1964; Imajima 1986).

Figure 2. Complete specimen of *Onuphis eremita,* slender shape along with opaline coloration

The specimens examined exhibited some variation but generally aligned with previous research. Notable differences included the maximum number of branchial filaments and ceratophoral rings on the antennae. The specimens showed a maximum of 25 to 30 ceratophoral rings on the lateral antennae and 20 to 25 on the median antennae, consistent with findings by Arias and Paxton (2014), which suggest that this variance correlates with size.

Previous studies have reported five to six anterior chaetigers with subulate ventral cirri, aligning with the five ventral cirri observed in this study. Arias and Paxton (2014) noted that specimens from similar collections and size ranges often displayed either five or six subulate ventral cirri. In a study of 93 specimens from Mediterranean subtidal sediments, approximately 26% exhibited subulate ventral cirri on the first five chaetigers, while 74% displayed them on the first six chaetigers.

Another critical diagnostic feature for identification is the branchial filaments. From the first chaetiger to chaetiger 21, branchiae typically consist of a single filament, eventually increasing to a maximum of five filaments. Additionally, five chaetigers contained hooded pseudocompound hooks that were notably tridentate. These findings are consistent with previous studies by Arias and Paxton (2014) and Gil and Machado (2014).

A significant factor in species differentiation is the presence of eyespots on the prostomium. The specimens examined in this study lacked eyespots, which aligns with the conclusions of Arias and Paxton (2014). Historically, it was hypothesized that *O. eremita* possessed two eyespots based on earlier descriptions. The difficulty in observing these eyespots may be attributed to several factors, including the lack of melanin in larger specimens and the thickening of the cuticle, which complicates visualization through confocal microscopy. Additionally, in preserved specimens, the cuticle often separates, resulting in internalized eyespots (Arias and Paxton 2014).

The variability in prostomial features and branchial structures observed in the Buntal Beach specimens highlights the need for further study and careful consideration of morphological variations within *Onuphis* species. This ongoing research is essential for enhancing our understanding of their taxonomy and ecological roles (Fauchald 1977; Fauchald and Rouse 2005).

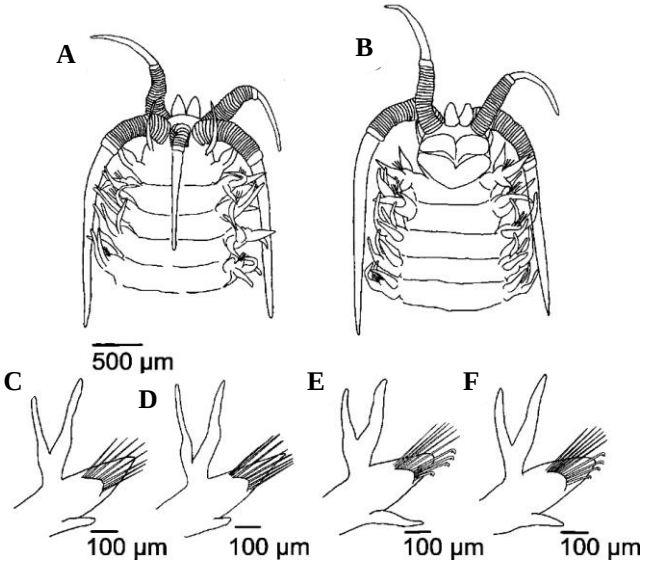

Figure 3. *Onuphis eremita.* A-B. Dorsal and ventral view of the posterior body part; C-F, 1st to 4th parapodia

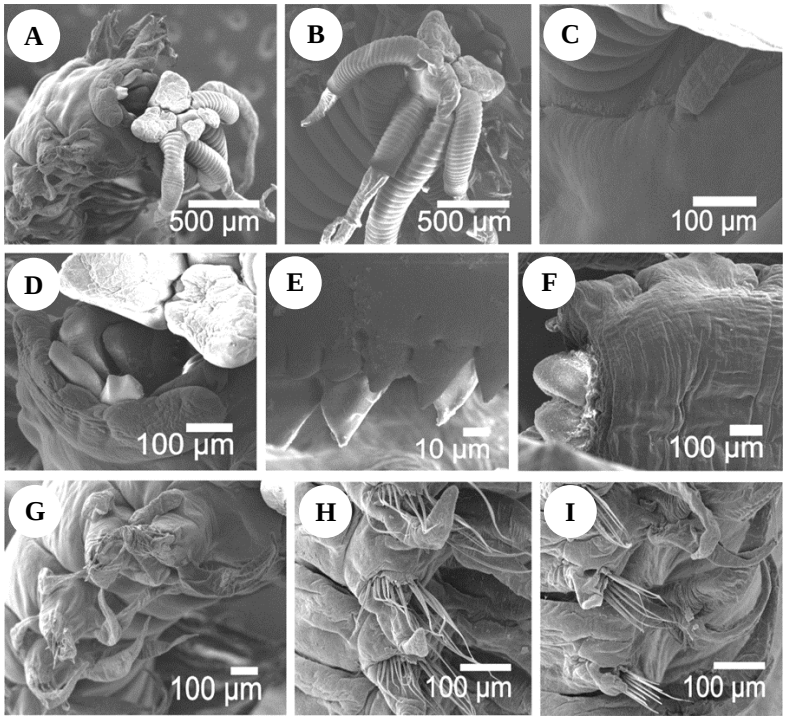

Figure 4. *Onuphis eremita.* A. Head; B. Antennae, dorsal view; C. Tentacular cirri; D. Upper and lower lips; E. Maxillae; F. Pygidium; G. 1st to 4th parapodia; H. 7th to 9th parapodia; I. 14th to 15th parapodia

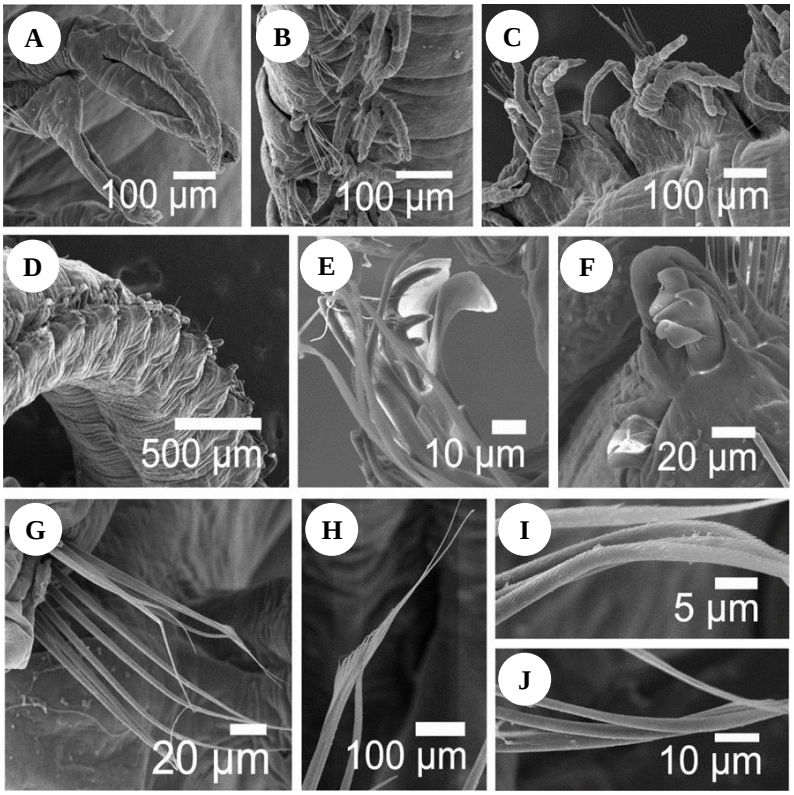

Figure 5. *Onuphis eremita*. A. Branchiae of 15th parapodia; B. Branchiae of 24th to 26th parapodia; C. Branchiae of 40th to 41st parapodia; D. Anterior end of the body; E. Tridentate pseudocompound hooked chaetae on 1st parapodia; F. Bidentate acicular setae; G. Neurochaetae on 40th parapodia; H. Pectinate chaetae and capillaries; I-J. Capillaries slightly serrated on one side on upper margin

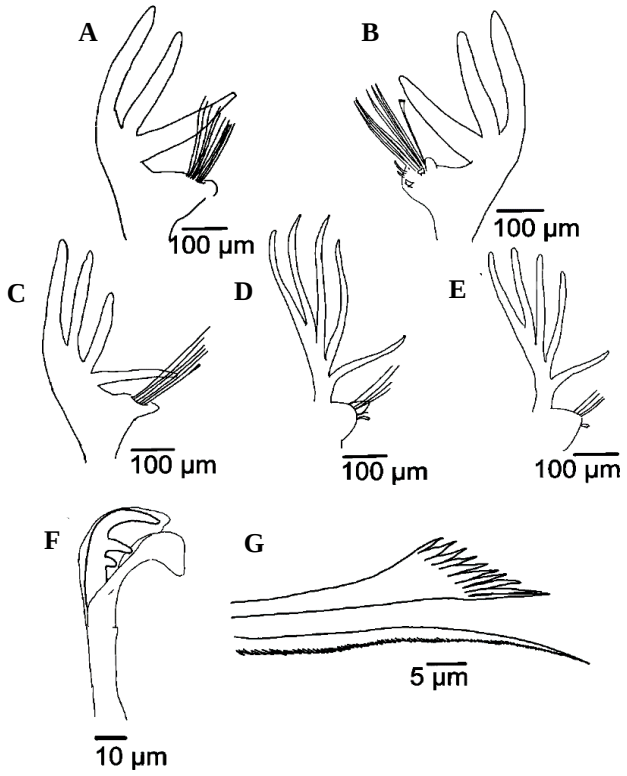

Figure 6. *Onuphis eremita.* A-B. 45th parapodia, left and right view; C. 50th parapodia; D. 55th parapodia; E. 70th parapodia; F. Tridentate pseudocompound hooked chaetae on 1st parapodia; G, distal end of pectinate chaetae and serrated capillary

Onuphidae species are known to inhabit a range of marine environments, from shallow coastal areas to deeper offshore habitats (Gil and Machado 2014; Wu and Xu 2017; Shaban and Abdel-Gaid 2019). This broad distribution underscores their ecological versatility and the importance of habitat-specific adaptations, such as tube composition and dietary preferences (Giere 2008). Understanding the distribution and specific morphological traits of Onuphid species, particularly those observed in Malaysian waters, enriches taxonomic knowledge and enhances our comprehension of their ecological interactions and the overall health of marine ecosystems (Paxton 2009).

In conclusion, this study represents a significant advancement in the documentation of polychaete diversity by identifying and recording the intertidal species *Onuphis eremita* from Buntal Beach, marking its first discovery in the South China Sea. The analysis of 19 specimens, distinguished by their large, vividly colored chaetae and characteristic morphological traits, substantiates their classification within the Onuphidae family. Accompanied by detailed illustrations and high-resolution scanning electron microscope (SEM) images, this research not only enriches the existing knowledge of polychaete diversity in Malaysia but also emphasizes the imperative for further exploration of coastal ecosystems in East Malaysia to uncover additional biodiversity and ecological insights.

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