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# New Distribution Record of Mud Owls (Polychaeta Sternaspidae) in Mangrove Ecosystem at Lubuk Damar, Aceh Tamiang, Aceh Province, Indonesia

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**ABSTRACT** The uniqueness of the Sternaspidae family was discovered in the intertidal area of the mangrove ecosystem, Lubuk Damar, Aceh Tamiang, Aceh Province. This study reports the occurrence of the mud owl Polychaete in the mangrove ecosystem as a new record in Indonesia. Samples were obtained at low tide (0–500 m) using cores with a diameter of 12.7 cm and a depth of 0–20 cm. The Sternaspidae family had morphological character differences from other Polychaeta in the form of a short and puffy body. The genus *Sternaspis* Otto, 1821 Lubuk Damar has two types of caudal shields, outward and deep grooves. The specimen was collected from a substrate with a percentage range of 26.67%–43.33% (sand), 46.67–56.00% (silt), and 8.00–15.33% (clay). The total 54 individual samples showed an average body length, width, and weight of 1.8–18 mm, 1–1.4 mm, 0.0009-0.1462 g, correspondingly. This research confirms that the genus *Sternaspis* is a cosmopolitan macrozoobenthos across the broad.

**KEY WORDS** Caudal shield; intertidal; introvert hooks; mangrove; short and swollen.

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## INTRODUCTION

Polychaetes play an essential role in holding the infauna, recycling nutrients from the water column, and as biological indicators in the ecology of benthic communities (Fernández-Rodríguez et al., 2016). They are essential in the marine food chain (Yusron, 1985) and their role in the energy flow (Yu et al., 2022). Therefore, this broadly distributed species recirculates organic materials (Fernández-Rodríguez et al., 2019) and is estimated to participate in the recycling of mangrove litter decomposition material actively (Hutchings, 1998). In addition, polychaetes are highly abundant and a critical invertebrate group in biodiversity and monitoring studies (Schuller, 2007; Dong et al., 2023; Miri et al., 2023). Sekar et al. (2016) say abundance, distribution, and diversity are used as indicators of ecosystems and to analyze impaired environmental presence. The *Sternaspsis* Otto, 1821 genus is a crucial polychaete and influences coastal and marine sediment ecosystems. One of

them is *Sternaspis scutata*, the dominant species in the estuary (Li et al., 2023). Besides that, Polychaetes dominate the macrofauna in the harbor (Zhang et al., 2023). Shelley et al. (2008), in a mesocosm study, postulate a pull-out in nitrite ($NO2^-$) degradation and increased ammonium release ($NH4^+$) from sediments, with the significant environmental addition of *Sternapsis scutata.*

Generally, Sternaspidae classification is determined by the ventro caudal shield and introvert hook features (Sendall & Salazar-Vallejo, 2013; Salazar-Vallejo, 2017; Wu et al., 2015; Drennan et al., 2019). Furthermore, the morphological characteristic comprises three genera (Salazar-Vallejo & Buzhinskaja, 2013), while studies from other countries reported various species, including *S. capillata* (Nonato, 1966), *S. scutata* (Townsend et al., 2006; Junardi & Wardoyo, 2008; Jose et al., 2014; Abdelnaby, 2020), *S chinensis, S. ilui* (Wu et al., 2015), *S. thorsoni* (Loghmani, 2016), *S. costata* (Yoshino et al., 2016), *S. lindae, S. londognoi*, and *S. sherlockae* (Salazar-Vallejo, 2017). Several recent reports regarding the existence of this family were found at depths between 180–6489 m (Fiege & Barnich, 2020).

The Indonesian Polychaetes studies on various ecosystems are concerned with distribution and diversity (Indarjo et al., 2005; Junardi & Wardoyo, 2008; Irmawan et al., 2010; Widianwari & Widianingsih, 2011; Munairi & Abida, 2012; Hadiyanto, 2013; Romadhoni & Aunurrohim, 2013; Sahidin & Wardiatno, 2016; Rahman, 2016; Pamungkas, 2017). Apart from that, another research related to this group found fouls at Tanjung Priok Port, Jakarta (Hadiyanto, 2018). In addition to the distribution and diversity of reports related to the morphology and function of Polychaeta in Indonesia previously done by Yusron (1985), a recent publication identified neglected and unpublished genera from Indonesian waters comprised of about 713 species and 55 families. However, while the existing research has several specimens and is ecologically Redundant, the regional guide limitations resulted in imperfect identification (Pamungkas & Glasby, 2019). For this reason, studies related to Polychaeta are needed to provide more complete data and information.

The species diversity needs to be better reported, and therefore, notable data about Polychaeta and the Sternaspidae in Aceh Province is required to reduce the information gap. The research location in Lubuk Damar, Aceh Tamiang, Aceh Province, is covered with mangrove vegetation. Previous research by Darmarini et al., (2019) identified mangrove vegetation types, including *Aegiceras floridum, Excoecaria agalocha*, *Bruguiera sexangula, Xylocarpus granatum,* and *Rhizophora apiculata.* Lubuk Damar coast has a large intertidal area at low tide, up to 1 km towards the sea. The most significant percentage of mangrove species found was *Aegiceras floridum* (Darmarini et al., 2022). Some areas have substrate texture types of 39.67% sand, 50.95% silt, and 11.45% clay (Darmarini et al., 2017).

In this area, various types of Polychaeta from various genera are founded. One of the genera of interest is the emergence of the genus *Sternaspis*. Therefore, this study shows information reports on the Polychaeta (Sternaspidae) occurrence in a mangrove ecosystem in Aceh, Indonesia.

## MATERIAL AND METHODS

Specimens in an intertidal area of the mangrove ecosystem were collected from the Lubuk Damar, Aceh Tamiang, Aceh Province (Fig. 1). Furthermore, this was acquired at 0–500 m low tide, divided into five distances (A. 0–100 m, B. 101-200 m, C. 201–300 m, D. 301–400 m, and E. 401-500). Also, with four recurrences at 12.7 cm core diameter from 0–20 cm depth, the Sternaspid was sorted with a 1 mm mesh size filter, preserved using 5% formaldehyde, transported to the laboratory, and stored in 70% ethanol before identification. Lastly, the substrate was analyzed in the Soil Chemical Physics Laboratory of Syiah Kuala University, Aceh. The specimen was observed using Olympus stereo microscope type SZ60 at the Biology Micro Laboratory, Department of Aquatic Resources Management, Faculty of Fisheries and Marine Science, IPB University, Bogor.

## RESULTS AND DISCUSSION

### *Systematics*

Phylum ANNELIDA Lamarck, 1809

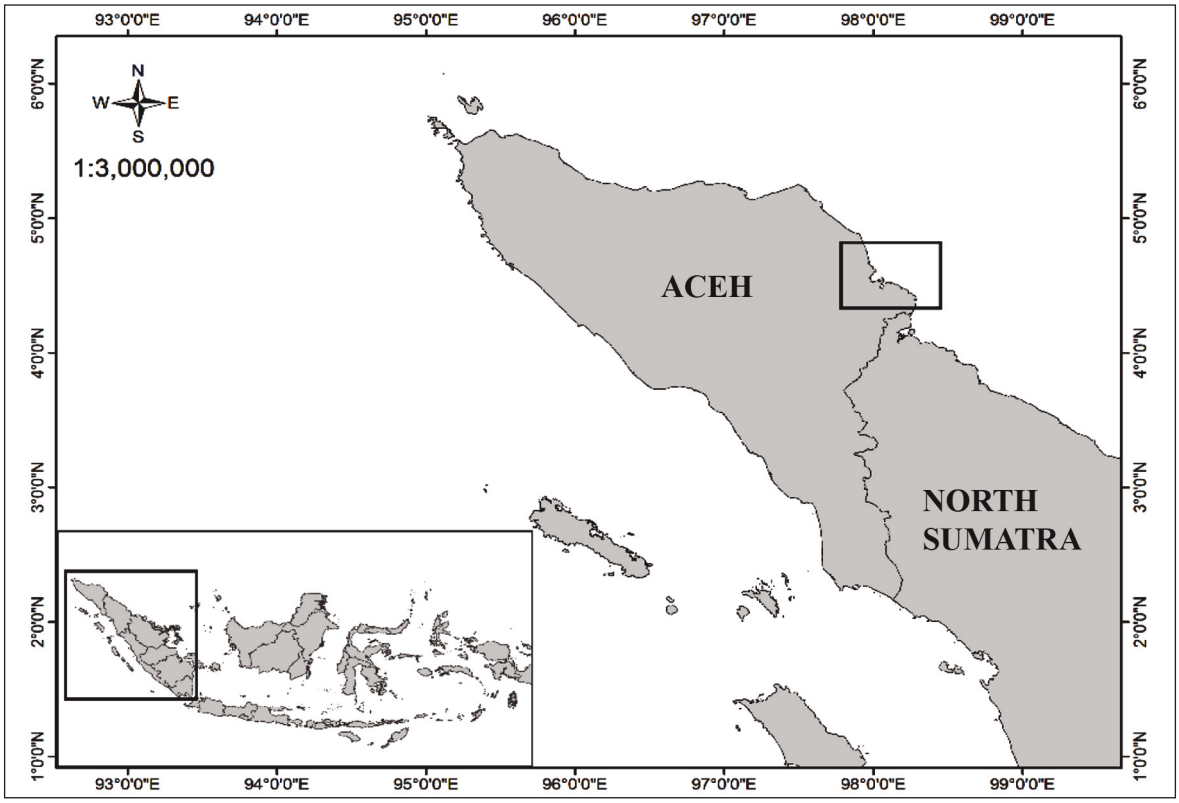



Figure 1. The sampling location of the genus Sternaspis in Lubuk Damar, Aceh Tamiang, Aceh province, Indonesia. A black square indicates the study sites.

Classis POLYCHAETA Grube, 1850
Ordo STERNASPIDA Dales, 1962
Family STERNASPIDAE Carus, 1863

Genus *Sternaspis* Otto, 1821

### *Description and biology*

The characteristic body was short, swollen, without eyespot, milky white, and had seven abdomen segments. Furthermore, there was a stiff caudal shield with ribs and concentric lines, or either. The caudal shield is usually mud-coated, comprising a fan with a shallow and deep median notch. Also, numerous gills with orange color, elongated and spiral-shaped were found.

For this study, 54 individual *Sternaspis* were obtained with an average body length, width, and weight of 1.8–18 mm, 1–1.4 mm, and 0.0009–0.1462 g, respectively. In addition, the Sternaspidae family had morphological character differences from other Polychaeta in the form of a short and puffy body. Also, the color is whitish-dark (Fig. 2) with a rounded head and three-segment introvert hooks (Fig. 3). The introvert hooks extend like a thorn with a darker tip than the base (Fig. 5). The introverts anterior comprises the prostomium, mouth, hooks and genital papillae (Figs. 3, 4, 9, 10). Furthermore, the genital papilla is between the seventh and 8th segments in the ventral. Genital papilla are pair of lumps with a length of about ± 3 mm (Fig. 9) and has a milky white color. The prostomium has a mouth in the middle and three rows of introvert hooks on the side (Fig. 10). Introvert hooks are shiny brownish. The posterior abdomen possesses a caudal shield, branchiae, and interbranchial papillae (Figs. 7, 8, 9, 11). In Lubuk Damar intertidal, two different types of the Sternaspidae caudal shield were found. However, both are thought to be in the same genus. Both shields have different shapes and fretwork. The caudal shield is visible in type 1 (Fig. 12), while in type 2 (Fig. 13), there is a hollow on both sides with a deep groove. Moreover, this possessed a different com-

plicated pattern of ribs and concentric lines, with shallow and deep median notch fans (Figs. 12, 13). The caudal shield is orange-colored. There is a bundle of setae on the caudal shields, a kind of set of elongated spines located at the edge of the shields. The bundle of setae is brownish-orange colored.

This report illustrates the genus *Sternaspi*s characters by seven segments and tapered hooks. Also, while 54 samples had *Sternaspis* sp. proposed characteristics, the body shape was distinct from other polychaeta. Rouse & Pleijel (2001), Sendall and Salazar-Vallejo (2013) affirmed a unique peanut body shape. Furthermore, the *Sternaspis* sp. body is short and swollen, prostomium oval, without eyes, and transparent (Fig. 2), as confirmed by Diaz-Diaz & Rozbaczylo (2017); Abdelnaby, (2020). The features of *Sternaspis* sp. caudal shield includes ribs and concentric line, rounded anterior margin, and fan with shallow or deep notches (Fig. 4). About shield with a rigid surface with radial ribs, concentric lines, or both confirmed by Sendall and Salazar-Vallejo (2013). On the caudal shield, there is long branchia, spiral-shaped, colored orange (Fig. 11), this is also confirmed by Nonato, (1966); Salazar-Vallejo (2017), and Drennan et al. (2019).

***Distribution***

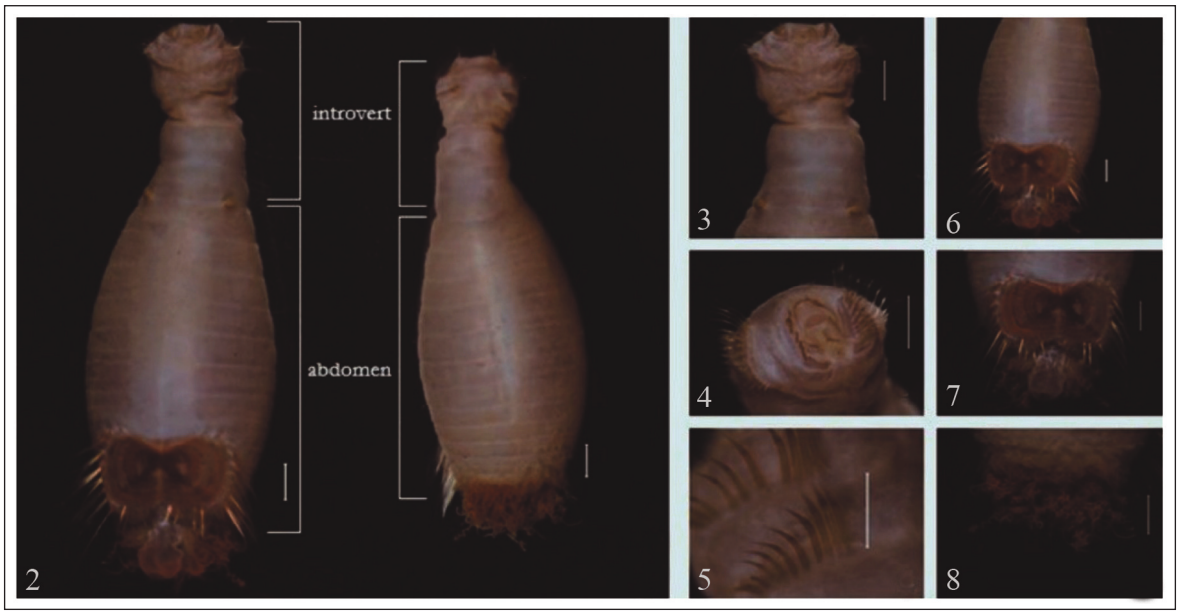
Some species were recorded at a location of 20 cm depth with some substrate percentage variation and sited at low tide distance (Table 1). Furthermore, several studies indicate this is found between 100–200 m depth (Fauchald, 1977), and in 5–14 m, 8.6–10 m, and 7–36 m depth on muddy gravel, mud, and sandy mud respectively (Townsend et al., 2006). Also, this is collected from depths 30–150 m for sandy, silty and silty sands texture class (Joydas & Damodaran, 2009), 180-1345 m (Mendez & Yanez-Rivera, 2015) and 160 m depth (Salazar-Vallejo, 2017). Some species are widespread in many oceans, with depths varying from low tide to around 4400 m (Sendall & Salazar-Vallejo, 2013). There is worldwide distribution of genus *Sternaspis*; comprising Brazilian waters (Nonato, 1966), Bima and Buton Srait, Madura (Bleeker & Spoel, 1992), Chinhae Bay, Korea (Lim & Hong, 1996), Shallow water marine of Florida (Camp et al., 1998), Mamberamo Estuary, Irian Jaya (Kastoro et al., 2000), Indian Estuaries ( Khan & Murugesan, 2005), English Channel (Townsend et al., 2006), South West England UK (Shelley et al., 2008), Peniti Mangrove Coastal Water, South Kalimantan (Junardi & Wardoyo, 2008), Pacific Ocean (Salazar-Vallejo & Buzhinskaja, 2013), Sundarban mangrove, West Bengal, India (Jose et al., 2014), Trang and Satun Philiphina (Jitpukdee et al., 2015), intertidal zone Satun Province, Thailand (Tantikamton et al., 2015), Mexican Pacific Waters (Mendez & Yanez-Rivera, 2015), Oman Sea, Iran (Loghmani et al., 2016), Tangerang coastal water, Banten, Indonesia (Sahidin & Wardiatno, 2016), Ariake Bay, Japan (Yoshino et al., 2016), South China Sea (Wu & Xu, 2017), Chilean Channels and Fjords (Diaz-Diaz & Rozbzczylo, 2017) and the Northern part of Arabian Gulf, Kuwait (Al-Kandari et al., 2019), Egyptian waters (Abdelnaby, 2020).

The habitat of this genus was muddy. Table 1 shows substrate particle percentage and the number of samples found, based on distance. The research location comprised a substrate texture range of 26.67%–43.33% sand, 46.67%–56.00% silt, 8.00%–15.33% clay. This is classified as a silt loam type. At sampling points, A and B had a range between 28.67%–39.67% sand, 46.67–56.00% silt, and 13.67%–15.33% clay; 4 and 6 individuals were found in each location. The number of species found in C, D, and E was 12–17 individuals found at the sampling point with a percentage of around 36.00%–43.00% sand, 48.00%–52.00% silt, and between 8.00%–12.00% clay.

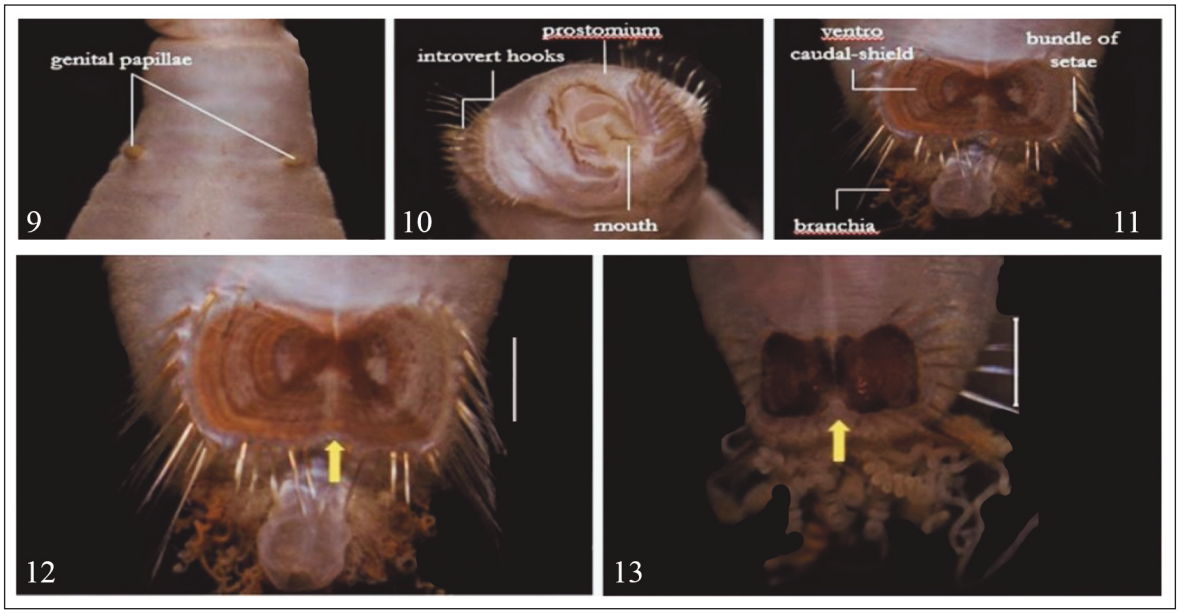
| Point of sampling | Sand (%) | Silt (%) | Clay (%) | Number of samples (ind) |
|---|---|---|---|---|
| A | 28.67 | 56.00 | 15.33 | 6 |
| B | 39.67 | 46.67 | 13.67 | 4 |
| C | 43.33 | 48.33 | 8.33 | 17 |
| D | 42.00 | 50.00 | 8.00 | 15 |
| E | 36.00 | 52.00 | 12.00 | 12 |

Table 1. Percentage (%) of substrate type and quantity of *Sternaspis* samples in Lubuk Damar, Aceh Tamiang, Aceh Province, Indonesia. The sampling points are distinguished based on the highest tidal distance A: 0–100 m, B: 101–200 m, C: 201–300 m, D: 301–400 m, and E: 401–500 m.

The genus *Sternaspis* Lubuk Damar is found with two types of caudal shield, outward and deep groove. In addition, the Sternaspidae family had morphological character differences from other Polychaeta, in form of a short and puffy body. Also, the color is whitish-dark (Fig. 2) with rounded head




Figures 2–8. Genus *Sternaspis* from Lubuk Damar, Aceh Tamiang, Aceh Province, Indonesia. Fig. 2: ventral and dorsal view; Fig. 3: introvert; Fig. 4: anterior; Fig. 5: introvert hooks; Fig. 6: abdomen view; Fig. 7: ventro caudal-shield; Fig. 8: branchia from dorsal view. Scale bars Figs. 1–8 = 1 mm, except Fig 5 = 0.5 mm




Figures 9–11. Introvert part of genus *Sternaspis* from Lubuk Damar, Aceh Tamiang, Aceh Province, Indonesia. Fig. 9: genital papillae; Fig. 10: part of introvert; Fig. 11: part of ventro caudal-shield. Figures 12, 13. Idem, two types of caudal shield of Sternaspis. Fig. 12: type 1 fan with a shallow median notch; Fig. 13: type 2 fan with a deep median notch (yellow arrow). Scale bars 1 mm.

and 3 segment introvert hooks (Fig. 3). The introvert hooks extend like a thorn with a darker tip than the base (Fig. 4). The introverts anterior comprises prostomium, mouth, hooks and genital papillae (Figs. 3 and 4, 9 and 10). Furthermore, the genital papilla is between the 7th and 8th segments in the ventral. Genital papilla is a pair of lumps with a length of about ± 3 mm (Fig. 9), and has a milky white color. In the prostomium, there is a mouth in the middle and three rows of introvert hooks on the side (Fig. 10). Introvert hooks are shiny and brownish. The posterior abdomen possesses a caudal shield, branchiae, and interbranchial papillae Sendall & Salazar-Vallejo (2013) postulated three different patterns on the introverted hook and caudal shield of the sternaspid body. Furthermore, there are seven abdominal segments and tapered hooks in two genera, while one genus has eight segments and spatulates. However, the prostomium has two types of introvert hooks and is tapered and spatulate. The stuffy characteristic of the ventro caudal shield specimen indicates the genus *Caulleryaspis* was not found. Carus (1863) corroborates a soft ventro-caudal shield of the genus *Caulleryaspis*, while the other two genera, *Sternaspis* and *Petersenaspis,* are complex.

The Sternaspidae family in this study was found at 0–20 cm depth in the intertidal area. Sternaspidae is infaunal deposit feeders (Faucald & Jumars, 1979; Rouse & Fauchald, 1997; Rouse & Pleijel, 2001; Shelley et al., 2008; Junardi & Wardoyo, 2008), and therefore, feed by absorption of food at the bottom of the water. Sternaspidae is infaunal deposit feeders (Faucald & Jumars, 1979; Rouse & Fauchald, 1997; Rouse & Pleijel, 2001; Shelley et al., 2008; Junardi & Wardoyo, 2008), and therefore, feed by absorption of food at the bottom of the water. Jose et al. (2014) affirm this ingestion of fine substrate particles for food. The specimens found at the highest tidal showed distances >200 m had more numbers than in the <200 m range. Also, the average percentage of substrate texture at distances > 200 m (C, D, and E) sand was 40.44%, silt 50.11, and clay 9.44% at the study site. This is classified as a silt loam type. However, the above texture percentage is not the only location of the family as Junardi & Wardoyo, (2008) had findings from 2%–13% sand, 55%–75% silt, and 14–38% clay with a loamy clay texture. Based on these results, it can be noticed that comparing the substrate texture from each location has a different impact on the number of sternaspis found. It is true that statistically, it has not been studied in this paper, but from Table 1, we get a common thread that the percentage of texture type affects the presence of Sternaspis at the study site. Therefore, *Sternaspis* sp. is found in various substrate types, including findings by Loghmani et al. (2016) of *S. thorsoni* at a range of 67.80%–71.05% silt and 5.09-6.42% clay. So it is assumed that this family can be found in various percentages of the substrate. This study contributes to previous data to show a broad living habitat of *Sternaspis* based on depth level, substrate type, and distribution in several water areas. Also, the uniqueness of the Sternaspidae family, recorded at a low depth level of 20 cm texture percentage and highest tidal distance, was shown.

## CONCLUSIONS

In the Lubuk Damar intertidal, Aceh Tamiang, two different types of Sternspidae shield tails were found. However, both are thought to be in the same genus *Sternaspis*. The genus *Sternaspis* is located in the intertidal area of the mangrove ecosystem at a shallow substrate depth of 0–20 cm. The percentage of silt texture was found to be higher than that of sand (<45%) and clay (<15%). In addition, these results confirm that the genus *Sternaspis* is a cosmopolitan macrozoobenthos, and its widespread presence requires studies and reports to clarify its taxonomic characteristics and ecological role in the waters.

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