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On the identity of *Hyastenus inermis* (Rathbun, 1911), and description of a new species from Sulawesi, Indonesia (Crustacea: Decapoda: Majoidea: Epialtidae)

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Abstract. The poorly known epialtid spider crab, *Hyastenus inermis* (Rathbun, 1911), from the Indian Ocean is re-described on the basis of the types. Specimens of a similar species from North Sulawesi, Indonesia, collected from among zoanthid polyps are here assigned to a new species, *H. tabolongi*. It differs from *H. inermis* by its more prominent gastric region, more slender and smooth chelipeds and structure of the male first gonopod. In life, the dorsal surfaces of the carapace and appendages of *H. tabolongi*, new species, are completely covered by zoanthid polyps.

Key words. spider crab, Epialtidae, Majoidea, taxonomy, new species, Indonesia, Philippines, associate of Epizoanthidae

INTRODUCTION

Hyastenus White, 1847, currently consists of 38 recognised species (Ng et al., 2008; Windsor & Ahyong, 2013; Lee et al., 2018) from across the Indo-West Pacific region (Griffin & Tranter, 1986). The type species of this genus is *H. sebae* White, 1847, by monotypy. *Hyastenus* was revised by Griffin & Tranter (1986) who remarked that the genus "contains several groups and subgroups." (Griffin & Tranter, 1986: 122). Griffin & Tranter (1986) proposed splitting the genus into three main groups based on the morphology of the male first gonopod (G1), although the groupings were not formalised and no new names were proposed. Given that there are three types of the G1 morphology, as discussed by Griffin & Tranter (1986), it is likely that the genus is heterogeneous. There is a key need for a revision for this genus, and to reconsider the taxonomy of related genera to *Hyastenus* (see also Griffin & Tranter, 1986).

Several years ago, Andrew Podzorski, an avid underwater photographer and SCUBA diver, showed many photographs of an interesting species of *Hyastenus* associated with zoanthid colonies in Sulawesi. Without specimens, however, it was not possible to identify the species at the time. As part of an on-going revision of *Hyastenus* by the present authors, all the majoid material in the old Raffles Museum (now the Lee Kong Chian Natural History Museum) in the National University of Singapore was sorted and studied. Fortuitously, a number of previously uncatalogued specimens donated to the museum many years ago from Sulawesi, proved to be conspecific with Podzorski's interesting species. These specimens still had the zoanthid polyps attached and agreed very well with the specimens and host photographed by him. The Indonesian specimens most closely resemble the poorly known *Hyastenus inermis* (Rathbun, 1911) from the Indian Ocean but can be distinguished by a number of distinct characters.

MATERIAL AND METHODS

Specimens examined are deposited in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (LKCNHM) (formerly the Raffles Museum of Biodiversity Research), National University of Singapore, Singapore; Museum Zoologicum Bogoriense (MZB), Research Centre for Biology, Indonesian Institute of Sciences, Bogor, Indonesia; the Natural History Museum (NHM), London, United Kingdom; and the U.S. National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A. (USNM). Measurements, in millimeters, are of the maximum carapace length (excluding the pseudorostral spine) and the maximum carapace width. The following abbreviations are used: coll. = collected by; G1 = male first gonopod; P2 = first walking leg; and stn = station.

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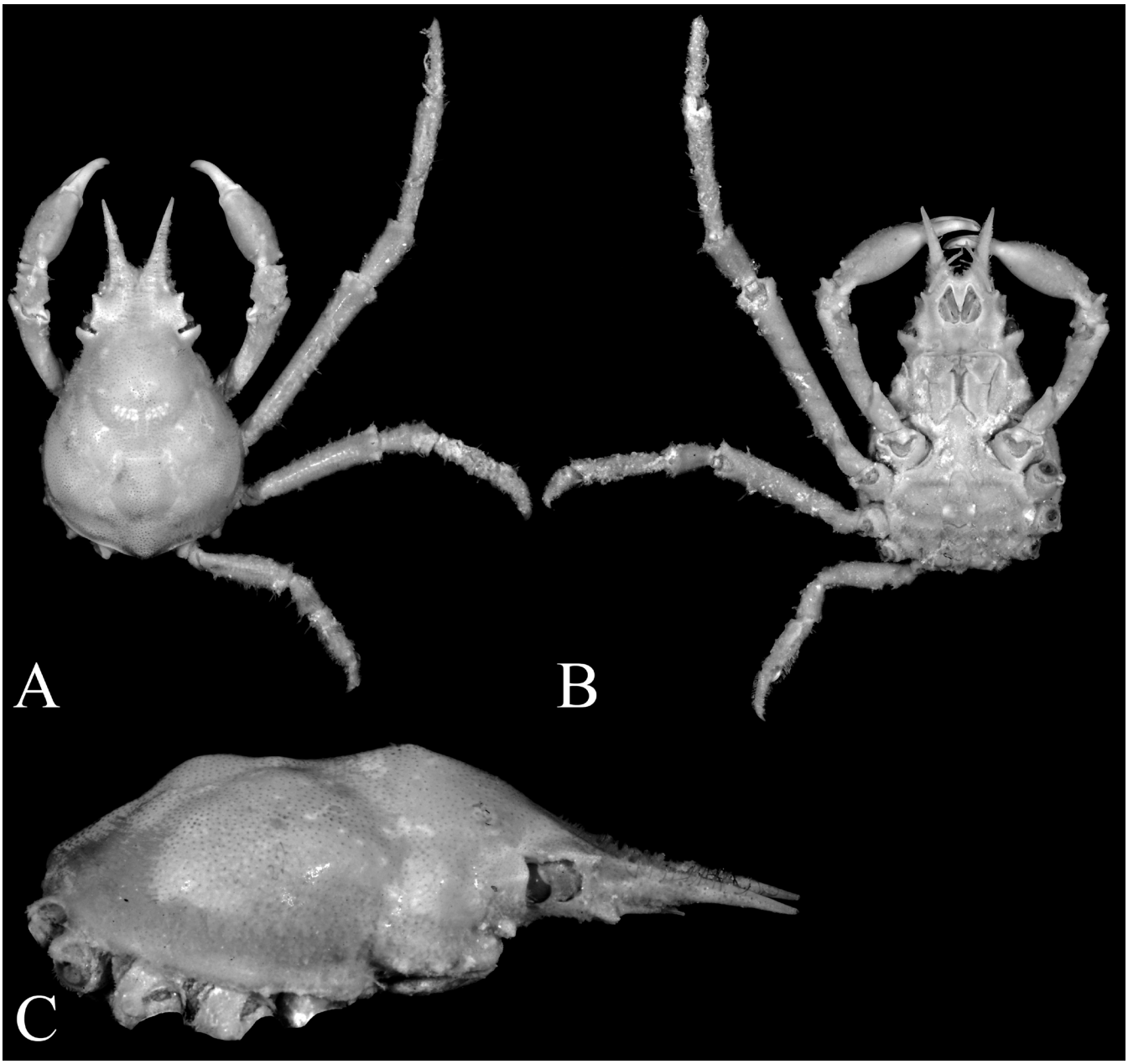

Fig. 1. *Hyastenus inermis* (Rathbun, 1911), holotype male (15.5 × 10.6 mm) (USNM 41402), Indian Ocean. A, overall dorsal view of carapace; B, overall ventral view; C, lateral view of carapace.

SYSTEMATIC ACCOUNT

Superfamily Majoidea Samouelle, 1819

Family Epialtidae MacLeay, 1838

Hyastenus White, 1847

Hyastenus inermis (Rathbun, 1911)

(Figs. 1, 2A–F)

Halimus inermis Rathbun, 1911: 194 (list), 250, pl. 20 fig. 6 (type locality: Amirante Islands, outer islands of Seychelles).

Hyastenus inermis – Balss, 1935: 123 (list). – Guinot, 1967: 294 (list). – Griffin, 1974: 15. – Griffin & Tranter, 1974: 171. – Griffin & Tranter, 1986: 124 (list), 125 (key), 148. – Ng et al., 2008: 103 (list).

Hyastenus convexus var. *hendersoni* – Monod, 1938: fig. 4H, I [not *Hyastenus convexus* var. *hendersoni* Laurie, 1906].

Material examined. Holotype: male (15.5 × 10.6 mm) (USNM 41402), stn E6, Amirante islands, Indian Ocean, 51 m, coll. 9 October 1905. Paratypes: 3 males (12.5 × 7.8 mm, 11.6 × 7.6 mm, 10.3 × 6.4 mm), 3 females (13.9 × 9.1 mm, 10.3 × 6.2 mm, 7.6 × 4.8 mm), 1 ovigerous female (11.6 × 7.0 mm), 1 juvenile, same locality data as holotype; 1 male (9.5 × 5.5 mm) (USNM 41403), stn C12, Saya de Malha, 86 m, coll. 6 September 1905; 1 male (11.9 × 7.1 mm), 1 female (10.2 × 6.1 mm) (USNM 41404), stn B15, Cargados Carajos, 55 m, coll. 30 August 1905; 3 males (15.0 × 9.3 mm, 11.6 × 7.5 mm, 11.1 × 6.8 mm) (USNM 41401), stn F5, Seychelles, 80 m, coll. 20 October 1905. Others: 1 juvenile male (3.0 mm × 5.0 mm), 2 females (9.8 × 6.0

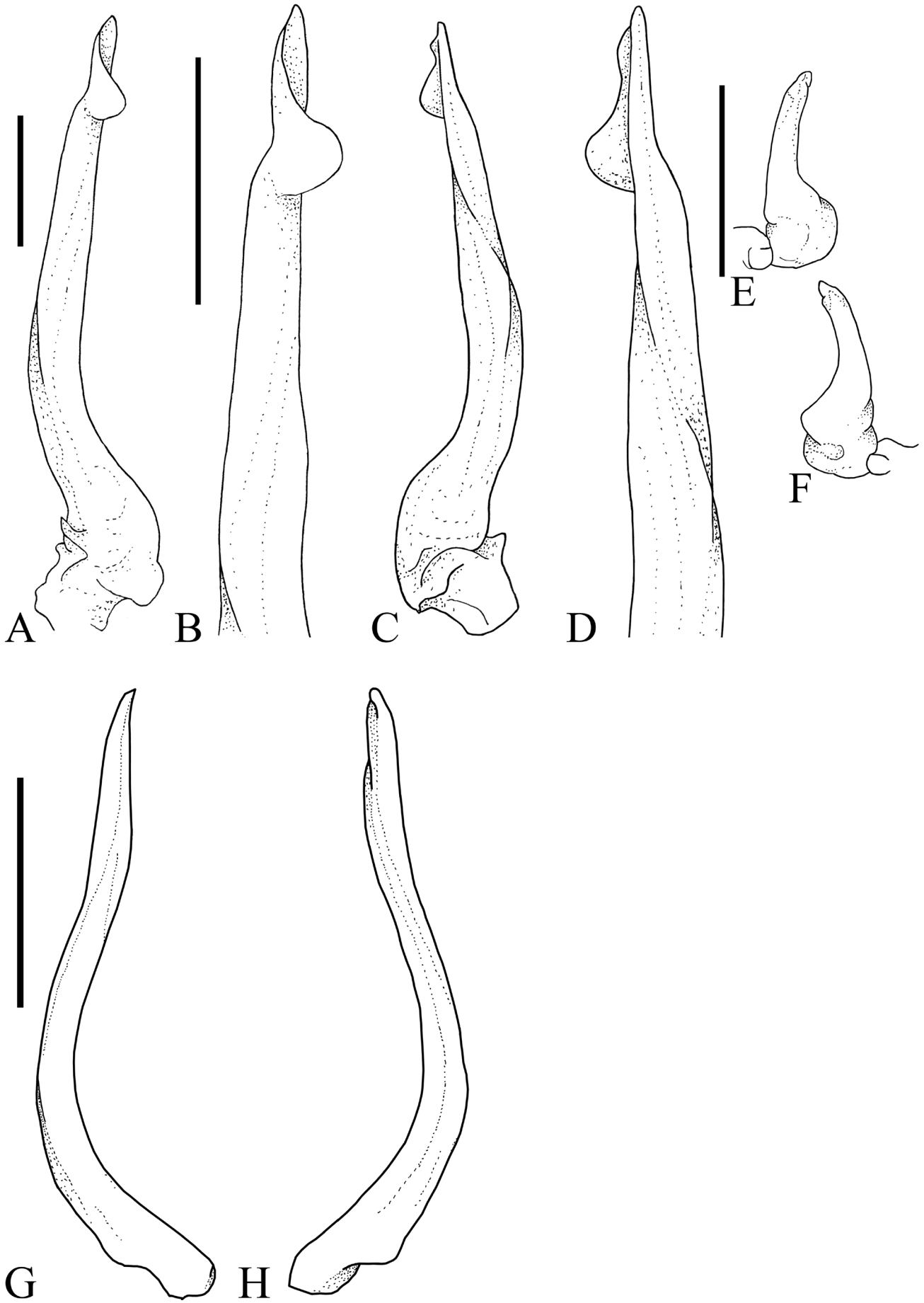

Fig. 2. Drawing of left G1 and G2. A–F, *Hyastenus inermis* (Rathbun, 1911), holotype male (15.5 × 10.6 mm) (USNM 41402), Indian Ocean; G, H, *H. tabolongi*, new species, holotype male (10.7 × 6.6 mm) (MZB Cru 5010), north Sulawesi. A, G, ventral view; B, ventral view of distal portion; C, H, dorsal view; D, dorsal view of distal portion; E, ventral view of G2; F, dorsal view of G2. Scale bars = 1 mm.

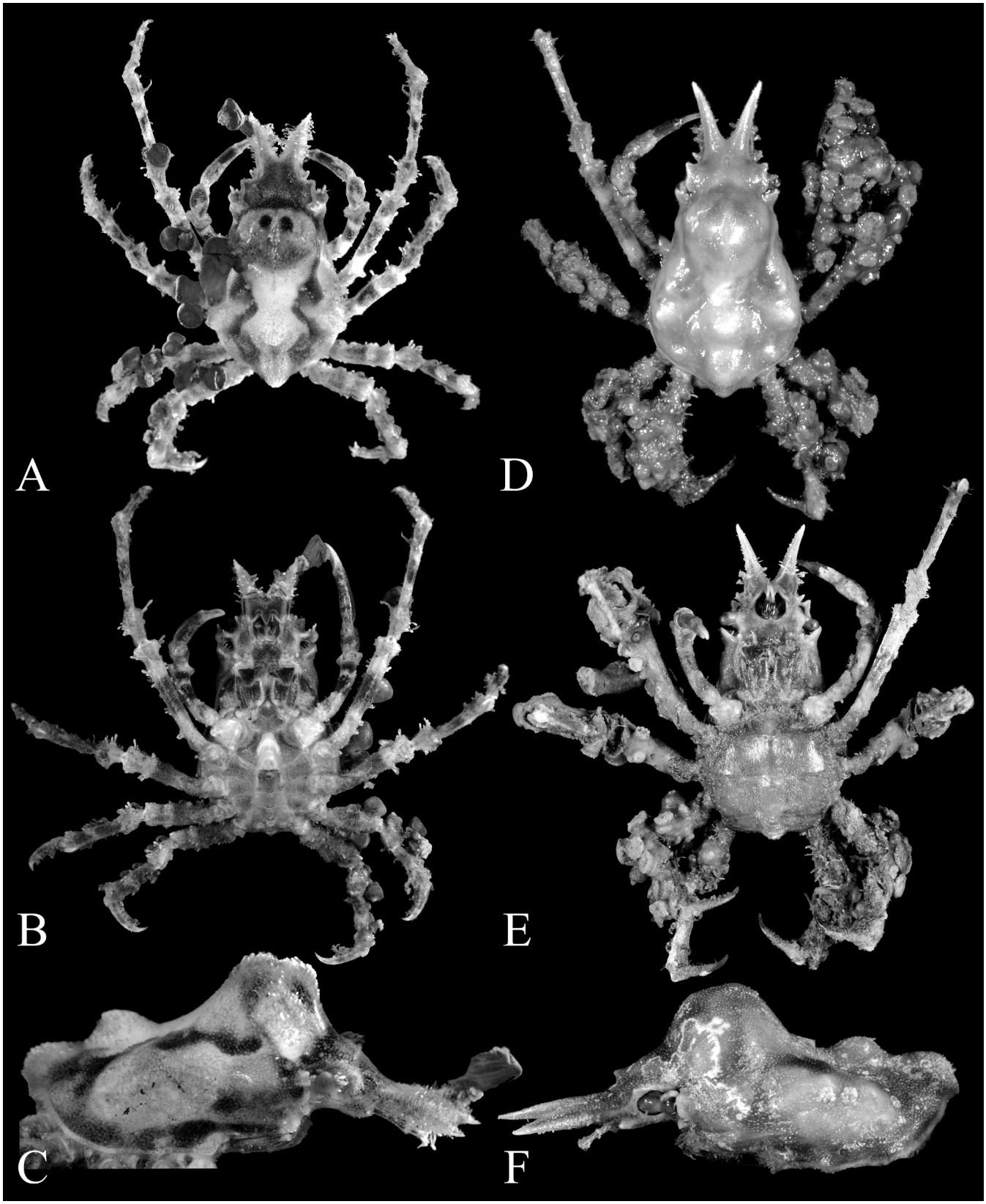

Fig. 3. *Hyastenus tabolongi*, new species, A–C, holotype male (10.7 × 6.6 mm) (MZB Cru 5010), north Sulawesi; D–F, paratype female (12.3 × 7.2 mm) (ZRC 2019.1324), north Sulawesi. A, D, overall dorsal view of carapace; B, E, overall ventral view; C, F, lateral view of carapace.

mm, 11.6 × 7.6 mm) (NHM 1912.2.10.85-87), Seychelles, "Sealark" expedition, coll. JS Gardiner.

Diagnosis. Carapace pyriform; covered with setae, carapace surface smooth when denuded. Carapace region defined; gastric region swollen with 2 granules on edge of distinctly swollen gastric region; cardiac region slightly swollen, intestinal region slightly swollen (Fig. 1A, C). Antennal flagellum slightly shorter than or nearly as long as pseudorostral spines. Basal antennal article longer than broad; sharp distolateral angle, outer margin concave, slightly constricted, base of distal lateral margin of article rounded. Pterygostomial region with 2 granules on outer margin (Fig. 1B). Male thoracic sternum slightly concave anteriorly; sternites 3, 4 constricted proximally, widest basally, with lateral margin slightly constricted. Male pleon slender, triangular, telson triangular (Fig. 1B). G1 straight, with ear-like lobe at tip, distal half slightly twisted (Fig. 2A–D).

Description. Carapace pyriform; covered with setae, carapace surface smooth when denuded. Pseudorostral spines straight, diverging; approximately 0.2–0.4 of carapace length. Supraorbital eave forms rectangular lobe; preorbital angle distinct, antorbital angle short, blunt; orbital hiatus between supraorbital and postorbital lobes form narrow U-shape; postorbital lobe cup-shape. Carapace regions defined; gastric region prominently swollen with 2 granules on edge of swollen gastric; cardiac region slightly swollen, intestinal region slightly swollen (Fig. 1A, C).

Antennal flagellum slightly shorter than or nearly as long as pseudorostral spines. Antennules completely retractable in deep fossae. Basal antennal article longer than broad; sharp distal angle of article, outer margin concave, slightly constricted, base of distal lateral margin of article rounded with a granule. Buccal frame covered by third maxilliped. Pterygostomial region with 2 granules on outer margin (Fig. 1B).

Male cheliped with propodus slightly swollen, 3 granules on dorsal surface, 1 granule on posterior margin, 1 granule on outer surface; carpus with 4 granules on outer surface; merus with spine on distal angle. Female cheliped slender and smooth. Ambulatory legs slender, surface smooth; P2 longest (Fig. 1A).

Male thoracic sternum slightly concave anteriorly; sternites 3, 4 constricted proximally, widest basally, lateral margin slightly constricted. Male pleon slender, triangular, telson triangular, somites 1–6 and telson free (Fig. 1B). G1 straight, with ear-like lobe at tip, distal half slightly twisted; G2 slightly curved, with rounded distal tip (Fig. 2A–F).

Remarks. *Hyastenus inermis* was described by Rathbun (1911) from 16 males, 14 females and 13 juvenile specimens collected from Cargados carajos, Saya de Malha, the Amirante Islands, and Seychelles, in the Indian Ocean. In the material listed provided by Rathbun (1911: 250), one male specimen collected from the Amirante Islands, station E6, was designated as the type for the species, and in the captions of her plates (Rathbun, 1911: 261), she also identified a male as the "type". This male specimen (USNM 41402) is regarded as the holotype, while the remaining specimens should be treated as paratypes. Out of the series of material listed by Rathbun (1911), a total of seven males, two females and one juvenile specimen, inclusive of the holotype, were examined in this study.

Rathbun (1911) compared *H. inermis* to *Thusaenys irami* (Laurie, 1906), due to both species lacking a lateral branchial spine on the carapace. *Thusaenys irami*, however, has a granule on the outer margin of the carapace between the preorbital and postorbital lobes, and long pseudorostral spines (approximately 0.5–0.6 of carapace length) (Laurie, 1906: 379, pl. 1 fig. 4), characters which are absent in *H. inermis*. Rathbun (1911) also suggested that a specimen from the Philippines identified as *H. diacanthus* (De Haan, 1837) by Miers (1886) is more likely *H. inermis* instead. Rathbun (1911), however, also commented that even though the orbital, antennal and pterygostomial regions of *H. inermis* are similar to *H. diacanthus*, the latter has a carapace surface covered with granules and lateral branchial spines, subparallel pseudorostral spines, and attains a larger adult size. In addition, Miers (1886) commented that young specimens of *H. diacanthus* are more similar to *H. planasius* (Adams & White, 1848) but differ in the degree of setation on the carapace, the divergent pseudorostral spines, and the structure of the distal angle of the basal antennal article. As such, it seems unlikely that the Philippine material is *H. inermis*.

Comparison of the holotype G1 morphology of *H inermis* s. str. to that of the Iranian specimen as figured by Naderloo (2017: fig. 16.4e) shows that the latter lacks the characteristic ear-like lobe at the tip observed in *H. inermis* (Fig. 2A–D). It is likely that the Iranian specimens (see Naderloo & Sari, 2007a; 2007b; Naderloo et al., 2015) are a separate species, but as we do not have access to this material, we cannot be certain.

Hyastenus inermis is distinct among congeners in that it lacks the typical lateral branchial spines on the carapace, which is observed on other species of *Hyastenus* either as weak or strong spine; and has a very distinct swollen gastric region (Fig. 1A). It is most similar to *H. tabolongi*, new species, but the two species can easily be separated by several distinct differences (see next species).

The biology of *H. inermis* is not known, and we do not know if it has the same habits as *H. tabolongi*, new species. All the type specimens have been cleaned and no epibionts were visible.

Distribution. *Hyastenus inermis* is known from its type locality, Amirante, Indian Ocean, and between Mauritius and Cape Guardafui (Rathbun, 1911; Griffin, 1974).

Fig. 4. *Hyastenus tabolongi*, new species**,** observed in situ from Bunaken, Lekuan on different dates. A, B, photographed in November 2011; C, D, photographed in July 2018. Photographs by: AC Podzorski

***Hyastenus tabolongi* new species**
(Figs. 2G, H, 3, 4)

Material examined. Holotype: male (10.7 × 6.6 mm) (MZB Cru 5010), North Sulawesi [= Sulawesi Utara], Indonesia, coll. local divers, 2000s. Paratypes: 1 female (12.3 × 7.2 mm) (ZRC 2019.1324), Poh Poh, Tanahwanko village, North Sulawesi, Indonesia, 1°25.120'N 124°37.788'E, coll. local divers, 5 December 2014; 1 ovigerous female (10.6 × 6.6 mm) (ZRC 2019.1325), North Sulawesi [= Sulawesi Utara], Indonesia, coll. local divers, 2000s; 1 juvenile female (5.3 × 3.1 mm) (ZRC 2019.1326), North Sulawesi [= Sulawesi Utara], Indonesia, coll. local divers, 2000s; 1 male (9.8 × 5.7 mm), 2 female (10.0 × 5.8 mm, 5.0 × 2.7 mm) (ZRC 2019.1327), North Sulawesi [= Sulawesi Utara], Indonesia, coll. local divers, 2000s.

Diagnosis. Carapace pyriform, regions defined. Pseudorostral spines straight, divergent. Supraorbital eave forming rectangular lobe; preorbital angle rounded, antorbital angle rounded, outer margin slightly constricted; orbital hiatus between supraorbital and postorbital lobes form narrow U-shape; postorbital lobe cup-like. Carapace lacking granules; gastric region prominently swollen; small tubercle on mesogastric region; epibranchial region swollen, slightly arched; cardiac region swollen; intestinal region swollen with 3 slightly swollen areas; 2 on metabranchial region and 1 medially on intestinal region (Fig. 3A, D). Antennal flagellum shorter than pseudorostral spine. Basal antennal article longer than broad, distolateral angle of article sharp, outer margin distinctly constricted medially. Pterygostomial region with single granule on outer margin (Fig. 3B, E). Cheliped slender; surface smooth (Fig. 3A, D). Ambulatory legs slender; P2 longest (Fig. 3A, D). Male thoracic sternum slightly concave anteriorly; sternites 3, 4 with lateral margin constricted. Male pleon slender, triangular, telson triangular (Fig. 3B). G1 slightly curved, distal tip sharp (Fig. 2G, H).

Etymology. This species is named after Maxi Tabolong, a senior dive guide who first showed the crab to Andrew Podzorski, who was then able to photograph it over the years.

Type locality. North Sulawesi, Indonesia.

Remarks. *Hyastenus tabolongi*, new species, is most similar to *H. inermis*, with both species completely lacking the lateral branchial spines and possessing a swollen gastric region (Figs. 1, 3). The gastric region in *H. tabolongi*, new species, however, is prominently more swollen (Fig. 3A, C, D, F) (versus distinctly less swollen in *H. inermis*; Fig. 1A, C); the posterolateral region of the carapace is proportionately narrower (Fig. 3A, D) (versus the posterolateral region of carapace wider in *H. inermis*; Fig. 1A); the outer margin of the basal antennal article is more constricted (Fig. 3B, E) (versus

the outer margin of the basal antennal article is relatively less constricted in *H. inermis*; Fig. 1B); the chelipeds are proportionately more slender and smooth (Fig. 3A, D) (versus the chelipeds propodus slightly swollen and granulate in *H. inermis* with; Fig. 1A); and the G1 is slightly curved with the distal tip sharp (Fig. 2G, H) (versus G1 straight with ear-like lobe at distal tip in *H. inermis*; Fig. 2A–F).

Ecology. Andrew Podzorski (pers. comm.) observed and photographed *H. tabolongi*, new species, from three sites in Indonesia, namely, the islands of Bunaken and Poh Poh, Tombariri in North Sulawesi, and Pulau Molana in Ambon. His many excellent photographs leave no doubt that his specimens are conspecific with the type material of *H. tabolongi*, new species. Amongst the three sites, the species is frequently observed on the island of Bunaken in North Sulawesi (Fig. 4). Despite this, *H. tabolongi*, new species, is not commonly observed on the south side and only once on the north side of the Bunaken island. *Hyastenus tabolongi*, new species, has also been photographed from Poh Poh, Tombariri, North Sulawesi (1°25′6.00″N 124°37′48.95″E). In Ambon, it has also been photographed at Pulau Molana (3°39′5.43″S 128°36′53.88″E). Andrew Podzorski (pers. comm.) notes: "The habitat of this crab is very specialised and to date, absolutely consistent. It is found exclusively on a sparsely branched species of black *Epizoanthus illoricatus* Tischbierek, 1930 [Hexacorallia: Epizoanthidae]. The crab places many polyps of *Epizoanthus illoricatus* all over its body, so much so it is almost impossible to distinguish the crab from the colony (Fig. 4B). The only suggestion that a crab is there, is a thickening of the branch. This species of *Epizoanthus illoricatus* is common across western Indonesia, growing up to 15 cm high, and generally occurs in areas that are influenced by strong currents. The zoanthid can also be found on flat rocky bottoms and on drop-offs. The only locations where the crab lives on the colonies, is on drop-offs, where the zoanthid grows in small hollows or caves on the face of the drop-offs. Here, the colonies are protected from direct currents. *Hyastenus* specimens have been found from depths of 11 to 30 m, but most often around 20 m."

Distribution. Currently only known from its type locality, north Sulawesi, and Pulau Molana, Ambon, Indonesia.

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The discovery of this new species has been driven by Andrew Podzorski who first asked the second author about an "interesting crab" he photographed in Sulawesi many years ago and subsequently sent him many more excellent photographs and ecological observations. Without his enthusiasm and persuasion, we would not have undertaken this study. It is also fortuitous that the authors were in the process of revising the genus and older material was available so the species could be compared with its closest congener (*H. inermis* from the Indian Ocean) and described. The first author would also like to thank James Reimer and Hiroki Kise from the Reimer Lab (MISE), University of the Ryukyus, Japan, for their help in identifying the zoanthid specimens found on the crabs. The authors would like to thank the National Museum of Natural History, Smithsonian Institution, Washington D. C. (Karen Reed and Rafael Lemaitre), MZB collection team (Daisy Wowor), the Natural History Museum (NHM), London, United Kingdom (Paul Clark), and the Lee Kong Chian Natural History Museum (Muhammad Dzaki Bin Safaruan), for their help in making important specimens available for this study. The authors would also thank the reviewers, Shane Ahyong and Amanda Windsor, as well as the editor, J.C.E. Mendoza, for their comments, which have helped improved this paper.

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