

First report of brittle stars (Echinodermata: Ophiuroidea) from a seamount in the eastern Arabian Sea

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Abstract: This paper reports two species – *Ophiozonella molesta* (Koehler, 1904) and *Ophiothamnus venustus* Matsumoto, 1915, from a seamount in the Eastern Arabian Sea. This forms the first ever report of *Ophiothamnus venustus* from the Indian Ocean, and the first verified report of *Ophiozonella molesta* from Indian waters. This is the first ever work to document benthic invertebrates from seamounts in the Arabian Sea.

Keywords: biodiversity, Laccadive Plateau, Indian Ocean, benthos

Introduction

The deep-sea brittle stars of Indian seas are known based on relatively few works, from the earliest accounts of the RIMS Investigator surveys (Koehler 1897, 1910) to more recent publications (e. g. Parameswaran & Abdul Jaleel 2012; Stöhr *et al.* 2012a; Parameswaran *et al.* 2018, 2021). Stöhr *et al.* (2012a) reported six brittle stars species from two seamounts in the Andaman Sea (Andaman Back-Arc Basin) at depths of 373–1424 m, and this remains the only work to document brittle stars from seamounts in the northern Indian Ocean. The present work reports two species of brittle stars – *Ophiozonella molesta* (Koehler, 1904) and *Ophiothamnus venustus* Matsumoto, 1915, collected at 554 m depth on a seamount located on the Laccadive Plateau in the eastern Arabian Sea. It is the first ever account of benthic invertebrates from seamounts in the Arabian Sea and only the second account of brittle star fauna from a seamount in Indian waters. This is first ever report of *Ophiothamnus venustus* from the Indian Ocean, and the first verified report of *Ophiozonella molesta* from Indian waters.

Materials and methods

The Laccadive Plateau (eastern Arabian Sea) constitutes the northernmost section of the Chagos-Laccadive Ridge in the northern Indian Ocean, and the Lakshadweep atolls (India) form the prominent above-water features of this ridge section. Bijesh *et al.* (2018) described several submarine bathymetric highs (seamounts, guyots, hills, knolls etc.) in the Laccadive Plateau and surrounding areas. One of these, designated as seamount S3 (coordinates 72.212°E, 12.087°N), rises 1060 m above the seafloor (1500 m basal depth); it has a summit depth of 440 m and a summit area of 3.71 km² (Bijesh *et al.* 2018) (Figure 1). Specimens described in this paper were collected from this seamount (554 m depth) during cruise no. 148 of *ORV Sindhu Sankalp* in November 2022, using a modified naturalist dredge, having a metal frame (100 x 30 cm) and nylon mesh bag (1 cm). Species identification was carried out using standard taxonomic papers and descriptive accounts (e. g. Koehler 1922; O’Hara & Stöhr 2006; O’Hara *et al.* 2018). Descriptive terminology in this paper follows Stöhr *et al.* (2012b) for general morphological features, and Hendler (2018) for buccal armature. Diameter of the disc is abbreviated as “d.d.” Distribution ranges of species are based on cited literature, as well as records in the Ocean Biodiversity Information System (OBIS 2023a, b). All specimens are deposited at the reference collection of the Indian Ocean Biological Centre (IOBC), National Institute of Oceanography, Regional Centre–Kochi, India.

Taxonomic Account

Class Ophiuroidea Gray, 1840

Superorder Ophintegrida O’Hara, Hugall, Thuy, Stöhr & Martynov, 2017

Order Amphilepidida O'Hara, Hugall, Thuy, Stöhr & Martynov, 2017

Family Hemieuryalidae Verrill, 1899

Genus *Ophiozonella* Matsumoto, 1915

Ophiozonella molesta (Koehler, 1904)

(Figure 2)

Ophiozona molesta Koehler, 1904: 23–24, pl. VI (3–5). — Koehler 1906: 253.

Ophiozonella molesta — Matsumoto 1915: 82; 1917: 294. — Koehler 1922: 425–428, pl. 78(3–4), 79(5, 8, 10). — H. L. Clark 1939: 129. — Paterson 1985: 150, fig. 59.

Material examined: Eastern Arabian Sea — Seamount S3, 12° 06' 01.8" N, 72° 13' 03.8" E, 554 m, 29.11.2022, naturalist dredge, 2 specimens (Voucher No. IOBC, 0511E-10-51-2023).

Description: Disc sub-pentagonal, d.d. 7.5–10 mm; arms about 2–3 times d.d., broader than high basally, and rapidly tapering to the tip. Disc scales thick and polygonal, with imbricating arrangement; unequal in size, larger ones interspersed with smaller ones; centrodorsal and primary scales distinct, larger than surrounding scales. Radial shields with an acute proximal angle and a convex distal edge, about twice as long as wide, their length about a third of the d.d.; pairs separated by a single row of 3–4 scales, sometimes meeting sub-distally; interradial space between radial shields occupied by about five rows of scales, of which the scales of the central row are distinctly larger. Disc scaling continuing in the ventral interradia, with scales decreasing in size towards the oral shield. Genital slits long, narrow. Oral shields longer than wide; spearhead-shaped, with an acute proximal angle, prominently rounded lateral angles, and a conspicuous distal lobe which is as long as broad or longer. Adoral shields narrow proximally, but broad distally, curving around the lateral angles of the oral shield and separating them from the first lateral arm plates. Ventral surface of oral plates visible as small, broadly triangular structures. Teeth broadly conical, with the ventral-most being much smaller. Five papillae along each side of the jaw – a pointed conical infra-dental papilla, a buccal scale, a primary and secondary adoral shield spine, followed by a pointed Lyman's ossicle; the primary adoral shield spine is twice as broad as the preceding papillae. First few dorsal arm plates extremely short, visible as short, very wide plates, distal to the radial shields; subsequent ones trapezoid, much wider than long, with proximal margins shorter than the distal, and divergent lateral margins; proximal margins decreasing in size along the arm, with plates becoming triangular at the distal end. First ventral arm plate short and broad; subsequent ones roughly quadrangular and about as long as broad, with straight or slightly convex proximal margins that are shorter than the distal, divergent lateral margins that are

conspicuously excavated by the tentacle scales, and a more or less convex distal margin; plates becoming triangular and widely separated at the distal end of arm. Lateral arm plates bearing three erect, rounded, conical spines, about as long as the segment; distal arm segments with only two arm spines, of which the ventral one is short and stout with a glassy hook at the tip. Tentacle pores large, covered completely by two large, rounded tentacle scales throughout most of the arm; some proximal pores with a small, additional tentacle scale; distal pores with one tentacle scale.

Distribution: North-eastern Atlantic Ocean (Koehler 1906; Paterson 1985), Arabian Sea (H. L. Clark 1939; present study), ‘Andamans’ [see remarks below] (Sastry 2005), South China Sea (Koehler 1922), Makassar Strait (OBIS 2023a), Sulu Sea (Koehler 1904, 1922), Bismarck Sea (OBIS 2023a), Solomon Sea (OBIS 2023a), and Coral Sea (OBIS 2023a); 68–2115 m.

Remarks: One of the collected specimens showed abnormal morphology as a result of regeneration, including conspicuously scalloped disc margin, absence of one pair of radial shields, abnormally shaped oral shields etc. *Ophiozonella molesta* (Koehler, 1904) is previously reported from around the north-eastern Atlantic Ocean, the north-western Arabian Sea, the South China Sea and around the Malay Archipelago. Its occurrence in the ‘Andamans’ was noted by Sastry (2005), but this was not substantiated by a description, photographs, collection location or any other details. Based on this record, it is nonetheless included in checklists of Indian echinoderms (e. g., Sastry 2007; Vijaykumar *et al.* 2017). The present report forms the first substantiated record of *O. molesta* from Indian waters, and its first report from the eastern Arabian Sea.

Family Ophiothamnidae O'Hara, Hugall, Thuy, Stöhr & Martynov, 2018

Genus *Ophiothamnus* Lyman, 1869

Ophiothamnus venustus Matsumoto, 1915

(Figure 3)

Ophiothamnus venustus Matsumoto, 1915: 63–64. — Matsumoto, 1917:126–129, fig. 32.— Koehler 1922: 100–102, pl. 23(3–4).

Material examined: Eastern Arabian Sea — Seamount S3, 12° 05' 33.5" N, 72° 12' 36.5" E, 554 m, 29.11.2022, naturalist dredge, 8 specimens (IOBC, 0511E-10-52-2023)..

Description: Disc moderately excavate interradially; d.d. 1.75–2.5 mm; arms strongly moniliform, up to 10 times d.d. Disc covered by numerous, small, imbricating, thin rounded scales, beset sparsely with short, conical spines having thorny tips. Radial shields large, twice as long as wide, their length about two-thirds of d.d.; pairs separated by disc scales for their proximal half, contiguous in their distal half.

Disc scaling continuing to the small ventral interradii. Genital slits narrow, short. Oral shields very small, somewhat teardrop shaped, twice as long as wide, with an acute proximal angle, straight lateral margins and a rounded distal margin. Adoral shields large, extending well beyond the oral shield; tapering at the proximal end and much wider at the distal ends; separating the oral shields from the first ventral arm plate. Oral plates visible as very small, triangular area. Ventral-most tooth thick, wide with a tricuspid outer margin. Three papillae along each side of the jaw – corresponding to an infra-dental papilla, a lateral oral papilla and an adoral shield spine; the first two short, square-tipped, the latter very large, operculiform, 2–3 times as wide as the other papillae. Dorsal arm plates small, triangular with a more or less convex distal margin, widely separated. Ventral arm plates rectangular, wider than long, widely separated. Lateral arm plates meeting dorsally and ventrally, separating succeeding dorsal and ventral arm plates from the base of the arm. Arm spines numbering 12–15 basally; which meet dorsally in the first 2–3 segments; the dorsal-most spines are longest, and slightly curved dorsal-ward, 3–4 times as long as the corresponding segment. One long, spiniform tentacle scale, approximating the length of the ventral arm plate.

Distribution: Eastern Arabian Sea (present study), Molucca Sea (Koehler 1922), Sagami Bay (Matsumoto 1915, 1917), Solomon Sea (OBIS 2023b); 137–796 m.

Remarks: Genus *Ophiothamnus* comprises ten accepted species; however, the limits between these species are poorly defined. The characters used to distinguish between species have been known to show intra-specific variations as well, influenced by regeneration (Mortensen 1933, O’Hara & Stöhr 2006). The present specimens are assigned to *O. venustus* on account of the weakly lobed disc, relatively numerous disc scales, short disc spines, and long tentacle scales which equal the length of the ventral arm plates. One other species of *Ophiothamnus* is known from the Indian Ocean – *Ophiothamnus longibrachius* H. L. Clark, 1939, which was described from the north-eastern Arabian Sea (1046 m), and is distinguished by its ‘very long and slender arms’ (20 times d.d.) and ‘extraordinarily narrow oral shield’ (H. L. Clark 1939). With the present report, the distribution range of *Ophiothamnus venustus* is extended significantly westwards, into the Indian Ocean.

Discussion

Seamounts are reported to harbour higher diversity relative to the surrounding seafloor (Richer de Forges *et al.* 2000). Yet seamounts and other bathymetric high features in the Northern Indian Ocean are very poorly explored from the biodiversity standpoint (Sautya *et al.* 2011). Among echinoderms, four species of echinoids have been recorded from a few seamounts in the north-western Indian Ocean (Gebruk *et al.* 2004). Six species of ophiuroids were documented by Stöhr *et al.* (2012a) from two

seamounts in the Andaman Sea (Andaman Back-Arc Basin). The present paper is only the second work to document brittle stars from seamounts in the northern Indian Ocean and the first report of benthic invertebrate species from a seamount in the Arabian Sea.

According to O'Hara (2007), seamounts do not harbour significantly higher diversity or endemism for Ophiuroidea, but rather reflect the diversity found in the surrounding seafloor, including continental slopes. Limited survey (two dredge operations) in seamount S3 (Bijesh *et al.* 2018) has yielded two species of ophiuroids which have not been reported from the Indian waters so far. This is noteworthy, since this seamount is located close to the western continental margin of India, a region where upper bathyal ophiuroids are relatively well sampled (Parameswaran *et al.* 2018).

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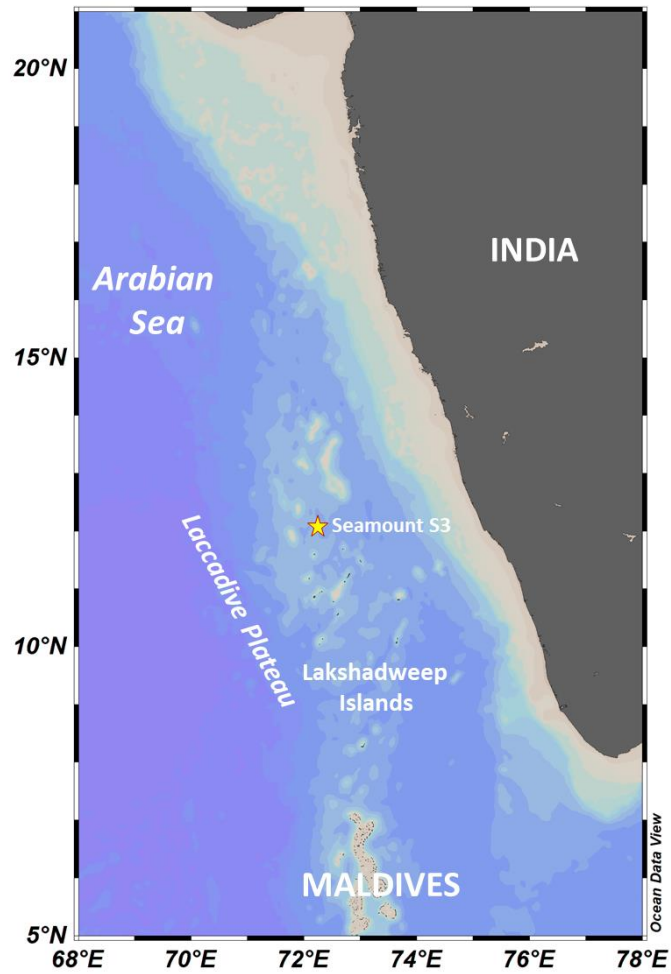


Figure 1. Map of the eastern Arabian Sea showing the location of seamount S3 on the Laccadive Plateau where the samples were collected.

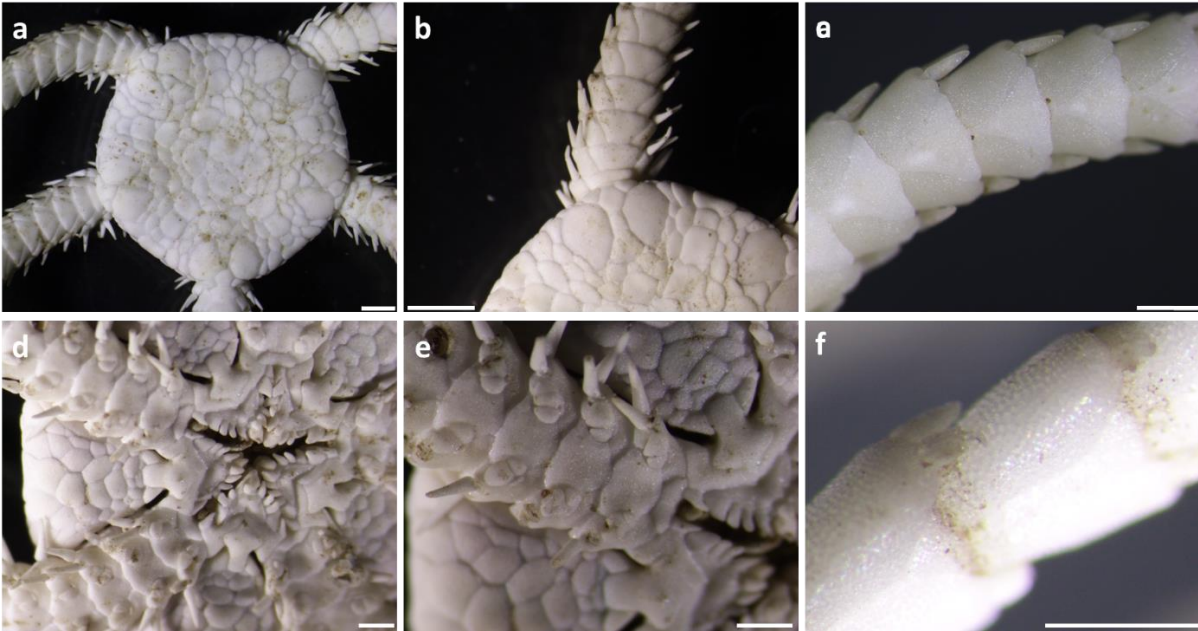


Figure 2. *Ophiozonella molesta* (Koehler, 1904). (a) disc, dorsal view, (b) disc margin and proximal arm, dorsal view, (c) distal arm, dorsal view, (d) disc, ventral view, (e) basal arm, ventral view, (f) distal arm, ventral view showing modified arm spine. Scale bar: 0.5 mm.

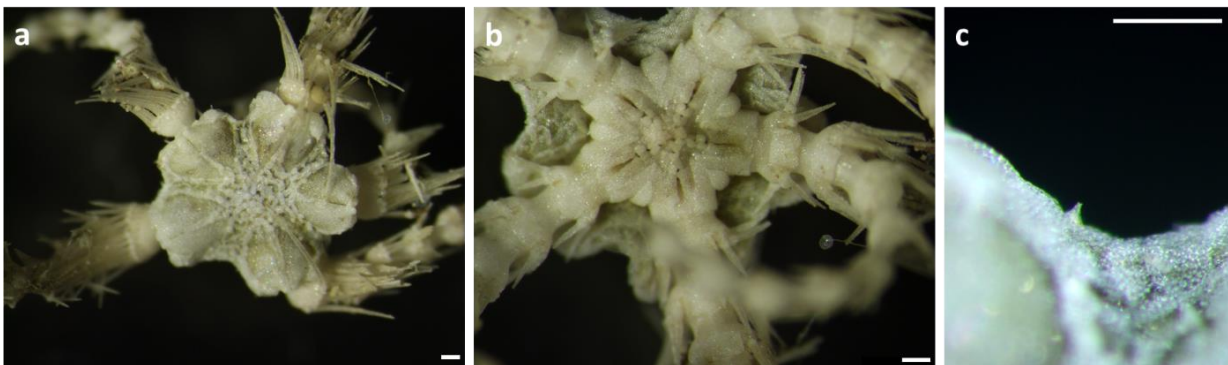


Figure 3. *Ophiothamnus venustus* Matsumoto, 1915. (a) disc and proximal arm, dorsal view, (b) same, ventral view, (c) disc margin, dorsal view, showing short disc spine. Scale bar: 0.2 mm.