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Short Communication

An insight on the distribution of *Evelineus mcintoshii* (Langerhans, 1880) (Nemertea, Heteronemertea, Lineidae) along the Eastern Arabian Sea

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Ribbon worms are mostly free-living benthic invertebrates, which are one of the least studied groups along the Indian coast. A single specimen of a rare heteronemertean, *Evelineus mcintoshii* was collected from the mussel beds of eastern Arabian Sea. The present article gives a first report of this species from Karnataka coast and second occurrence along the eastern Arabian Sea as well as from the Indian coast.

[**Keywords**: Arabian Sea, *Evelineus mcintoshii*, Karnataka, Nemertea, Ribbon worm]

Introduction

Nemertea is a phylum of lophotrochozoan invertebrates, commonly known as ribbon worms or proboscis worms[1,2]. These worms are primarily marine organisms, inhabiting benthic ecosystems like rocky intertidal zones and sandy regions including algal beds, seagrass beds and dead coral grounds[3,4]. They are distributed vertically from the supra-littoral to the abyssal zone up to a depth of 9000 m[1,5] and are mostly free-living benthic animals, but pelagic as well as symbiotic species are also known[5]. About 1300 species of Nemertea have been described around the world[5,6]. These worms are bilaterally symmetrical, elongated to thread-like, and the body is unsegmented.

The studies on the nemerteans diversity and distribution records around the world are limited[1,5-7]. In the Indian scenario, the nemertean fauna has been investigated rather irregularly, with spares data available on the species composition[8-13]. *Evelineus mcintoshii* (Langerhans, 1880), (reported as *Lineus mcintoshii* (Langerhans, 1880)) was reported for the first time from the Indian Ocean from seaweed bed near to the peninsular tip of India[14]. This species has been earlier reported by various researchers from the Atlantic Ocean[15-17], Pacific Ocean[18,19] and from South China Sea[1]. The present paper reports the northern range extension of the species, *E. mcintoshii* (Langerhans, 1880) to Karnataka coast along the eastern central Arabian Sea.

Materials and Methods

Sample collection and preservation

As a part of the regular monitoring of the mussel bed, a sampling survey was conducted on 6th April, 2019 at Someshwara (Site location: 12°47'41.5" N 74°50'47.4" E). Along with green mussel and other associated organisms, a single specimen of nemertean worm was observed. The specimen was examined for length, breadth and coloration patterns in live condition. The identification of this species was done using the published taxonomic keys[1,19]. The sample was preserved in 4 % formalin and is deposited in the marine museum maintained at the research centre of ICAR-CMFRI, Mangalore (Accession no: CMFRI-MRC/12).

Results

Material examined

Single specimen of *Evelineus mcintoshii* (Langerhans, 1880) (Fig. 1) was incidentally observed from benthic sample collected from a mussel bed from intertidal region of 12°47'41.5" N 74°50'47.4" E along the eastern Arabian Sea. The worm was associated with the green mussel, *Perna viridis* along with polychate worm, *Nereis* sp. and seaweed *Gracilaria* sp.

Systematics

Class: Pilidiophora (Thollesson & Norenburg, 2003)
Order: Heteronemertea (Bürger, 1892)
Family: Lineidae (McIntosh, 1874)
Genus: *Evelineus* (Corrêa, 1954)
Evelineus mcintoshii (Langerhans, 1880)

Synonyms

Cerebratulus mcintoshii Langerhans, 1880
Evelineus tigrillus Corrêa, 1954
Lineus mcintoshii (Langerhans, 1880)
Lineus mcdntoshii [sic]: Takakura (1898)
Lineus mintoshii

Fig. 1 — *Evelineus mcintoshii* (Langerhans, 1880) (Distinguishing characters: Reddish orange curve patch on the posterior portion of the cephalic tip (yellow arrow) and translucent yellowish white colour of the ventral surface of the body (pink arrow))

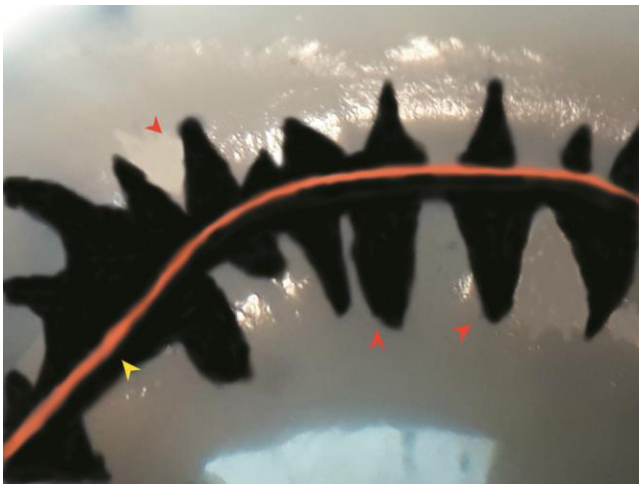

Fig. 2 — Microscopic figure (2X) of anterior portion of *Evelineus mcintoshii* (Langerhans, 1880) showing the transverse black triangular patches (red arrows) interrupted by thin reddish-orange mid dorsal stripe (yellow arrow)

Diagnosis

In live condition, the specimen was about 10 cm in length and 1 mm maximum in width near to the foregut. The body of worm was stretchable up to 5 times its resting length. Head is not demarcated and the tip is rounded bluntly. The body gets tapered to the tail region. The body is observed to be slightly compressed ventrally. The body colour is pale yellowish white, with 40 to 45 triangular patches which are proximally wide and distally narrow. These transverse black triangular patches are on either side of the thin orange colour mid dorsal stripe (Fig. 2). A reddish-orange transverse curve patch is seen on the posterior portion of the cephalic tip (Fig. 1). From the center of this patch arise the mid dorsal stripe which extends up to the tip of the tail. There were two small black dots in front of the reddish-orange curve patch on the tip of the head. The cephalic tip as well as the ventral surface of the body is translucent yellowish white (Fig. 1). Eyes as well as distinct neck are not seen. The length of the cephalic grooves extends up to the second transverse patches.

Discussion

Based on the distributional pattern reported for *Evelineus mcintoshii*, it is observed that the organism is seen near to the shore, in the intertidal belt to a maximum depth of 2 m (Fig. 3 and Table 1). In the current study as well, the sample was obtained from the rocky intertidal coast, where the depth was less than 1 m. The mussel beds in the tropical waters are hotspots of diversity, dominated by seaweeds and invertebrates like crustaceans and annelids[20]. Ribbon worms are top predators feeding on various organisms which include crustaceans, annelids and mollusks[21]. This corroborates the occurrence of the species in the mussel beds and rocky intertidal area on account of its feeding habits.

The characters of the current specimen match with the previous description of Takakura, 1898, except for the shape of the reddish orange patch on the posterior portion of the cephalic tip[18]. In the current study, the patch was observed as a curve or semi-circle rather than a triangle. The reddish orange curve patch on the posterior portion of the cephalic tip is said to be specific to specimens from Asian coast[1]. The specimen reported from Brazilian waters was observed to have a slightly curved patch on the tip of the head[17] and on the contrary, specimen collected from Mullur coast has reported with “a flattened, triangular, reddish patch on

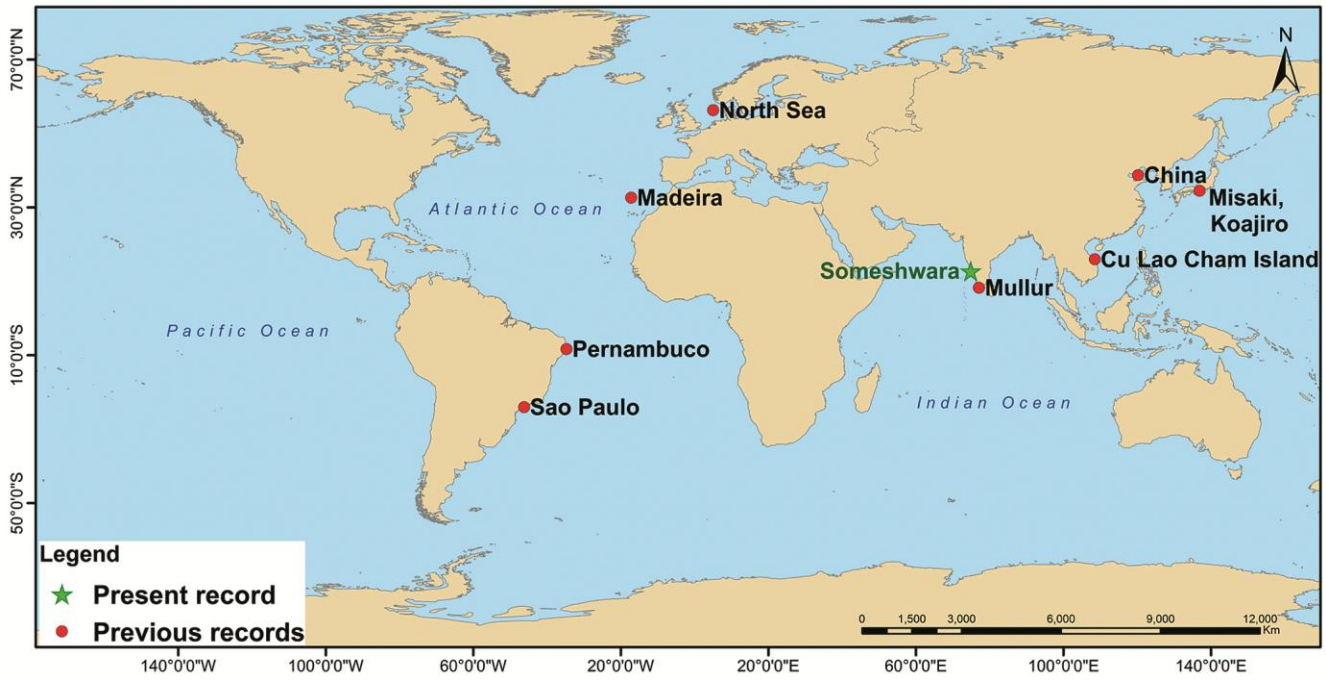

Fig. 3 — Map depicting distribution records of *Evelineus mcintoshii* (Langerhans, 1880) from different parts of the world

Table 1 — Distribution records of *Evelineus mcintoshii* (Langerhans, 1880) and corresponding ecosystems around the world

Sl. No	Substrate	Locality	Depth	Reference
1	Rocky shore	Madeira	-	Langerhans[15]
2	Intertidal region	Misaki, Koajiro	-	Takakura[18]
3	Seaweed bed	Mullur coast	-	Shynu *et al*.[14]
4	Dead corals	Cu Lao Cham Islands	1 – 2 m	Chernyshev[1]
5	-	Coast of China	-	Chernyshev[1]
6	Seaweed bed	Pernambuco	-	Alves *et al*.[17]
7	Intertidal sandstone rocks	Sao Paulo	-	Corrêa[16]
8	Mussel bed in intertidal region	Someshwara coast	< 1 m	Present record

the posterior portion of the cephalic tip"[14]. Hence it could be concluded that both the morphotypes are available along the coast of eastern Arabian Sea and these morphotypes might not be necessarily region specific.

The first scientific reporting of *Evelineus mcintoshii* from Indian Ocean was from the Mullur coast (8°22′ N; 77°00′ E) in 2015(ref. 14). A comprehensive report of 81 nemertean species along the coast of Vietnam was published, which mentioned the occurrence of *Evelineus mcintoshii* from the coast of Gujarat and Maharashtra (north eastern Arabian Sea) based on a blog, but no scientific publication was observed based on this photograph[1]. Hence there is no information on the substratum and depth of occurrence of this species along the north eastern Arabian Sea. Based on the previous reports and current study, it can be concluded that *Evelineus mcintoshii* has a continuous distribution along the eastern Arabian Sea[1,14].

The occurrence of the organism in its distributional range is rather "Rare" as the infaunal diversity of the region is continuously monitored since 2015(ref. 20) and this is the first record of the current species from the mussel bed of eastern central Arabian Sea. This species has been reported 'Rare' in Japan coast[19]. Considering the previous reports[1,14,20] and current study, it can be concluded that *Evelineus. mcintoshii* has a continuous distribution along the eastern Arabian Sea but the occurrence is 'Rare". The present report confirms the presence of *Evelineus mcintoshii* upto the eastern central Arabian Sea as well as gives an insight to the distributional records of this species along the region.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

SM: Sampling, species taxonomy, literature review and writing – original draft; DV: Investigation, writing – original draft, review & editing; and GS: Funding acquisition, supervision, and writing - review & editing.

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