

First record of the marine nemertean *Evelineus mcintoshii* (Langerhans, 1880) (Heteronemertea, Lineidae) in Northeastern Brazil

Rodrigo Vinícius de Almeida Alves¹, Cecili B. Mendes², Nykon Craveiro¹ & José S. Rosa Filho¹

- (1) Universidade Federal de Pernambuco, Departamento de Oceanografia, Laboratório de Bentos, Avenida Prof. Moraes Rêgo, Cidade Universitária 50670-901, Recife, Pernambuco, Brazil. E-mail: rodrigoalves@gmail.com, nykoncraveiro@gmail.com, soto.rosa@ufpe.br.
- (2) Universidade de São Paulo, Instituto de Biociências, Laboratório de Diversidade Genômica, Rua do Matão 277, Butantã 05508-090, São Paulo, Brazil. E-mail: cecilimendes@ib.usp.br

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Primeiro registro do nemertino marinho *Evelineus mcintoshii* (Langerhans, 1880) (Heteronemertea, Lineidae) no Nordeste do Brasil

Resumo: O presente trabalho é o primeiro registro do nemertino *Evelineus mcintoshii* (Langerhans, 1880) no Nordeste do Brasil. O espécime foi coletado em bancos da macroalga *Palisada perforata* (Bory de Saint-Vincent) K. W. Nam, 2007 na Praia de Enseada dos Corais (08°19.07' S, 34°56.88' W). O presente trabalho também representa o primeiro estudo a nível específico sobre Nemertea do Estado de Pernambuco, e a distribuição global atualizada do táxon é provida.

Palavras chave: Novo registro, fital, costa brasileira, praia arenosa.

Abstract: The present work is the first record of the nemertean *Evelineus mcintoshii* (Langerhans, 1880) in the Northeastern Coast of Brazil. The specimen was collected among beds of the seaweed *Palisada perforata* (Bory de Saint-Vincent) K. W. Nam, 2007 at Enseada dos Corais beach (08°19.07' S, 34°56.88'W). The present work also represent the first species-level study on Nemertea of Pernambuco State, and the taxon's updated global distribution is provided.

Key words: New record, phytal, Brazilian coast, sandy beach.

Introduction

Ribbon worms (Phylum Nemertea) are unsegmented bilaterians belonging to a group mainly characterized by the presence of an eversible proboscis located inside a unique body cavity, called rhynchocoel (Thollesson & Norenburg 2003). They occur in a multitude of habitats in limnic, terrestrial and especially in marine environments, where some species act as important predators in food webs (Thiel & Kruse 2001; Gonzalez-Cueto *et al.* 2014). To date, there are more than 1.300 described species worldwide (Norenburg *et al.* 2019).

Nemertean taxonomy is known to be demanding and requires specific techniques and infrastructure (Sundberg *et al.* 2016a). In addition, nemerteans can be relatively hard to collect in their habitats. The combination of such factors could underlie on the lack of detailed bibliography (Gonzalez-Cueto *et al.* 2014) and poor representation of nemerteans in many

faunistic assessments. In Brazil, one of the most biodiverse countries in the world, the lack of attention on the group is particularly notable. The first study on Brazilian nemerteans was published in 1942 focusing on freshwater habitats (Marcus 1942; Santos & Norenburg 2011). Later works by Diva Corrêa were responsible for the record and description of about 30 species, most of them in the Southeastern coast (Gibson 1995; Mendes *et al.* 2016). At present, 50 nemertean species have been recorded in Brazil (Mendes *et al.* 2016). The work of Mendes *et al.* (2016) in Ceará State increased the number of species known for the Brazilian Northeastern coast from only two, *Baseodiscus delineatus* (Delle Chiaje, 1825) and *Coenemertes caravela* Corrêa, 1966, to nine records (Mendes *et al.* 2016).

Evelineus mcintoshii (Langerhans, 1880) has a controversial taxonomic history. Its first record in Brazilian waters was from São Paulo State by Corrêa (1954), who described it as a new species, *Evelineus tigrillus* Corrêa, 1954, belonging to a new genus, *Evelineus* Corrêa, 1954. Recently, Chernyshev (2016) suggested that *Evelineus tigrillus* is actually a synonym of *Cerebratulus mcintoshii* Langerhans, 1880, described from Madeira and later synonymised as *Lineus mcintoshii* (Herrera-Bachiller *et al.* 2015). According to Kajihara (2007), the material named as *Lineus Mcdntoshii* [sic] by Takakura (1898) differs from Langerhans' (1880) original description and should receive a different denomination. In contrast, Chernyshev (2016) argued that *L. mcintoshii* sensu Takakura possibly is another synonym of *C. mcintoshii*, which corresponds to Langerhans' (1880) description. Also according to Chernyshev (2016), *L. mcintoshii* is a synonym of *Evelineus* cf. *mcintoshii*, found in Vietnamese waters. Therefore, *Evelineus mcintoshii* is considered the valid name for this species so far (Norenburg *et al.* 2019).

Based on that, the aim of this work is to report the first occurrence of *Evelineus mcintoshii* in Northeastern Brazil. As far as we know, this work also represents the first species-level study on Nemertea in the State of Pernambuco.

Material and Methods

The specimen was occasionally collected in beds of the red seaweed *Palisada perforata* (Bory de Saint-Vincent) K. W. Nam, 2007 on intertidal sandstone rocks (Figure 1) at Enseada dos Corais sandy beach (08°19.07' S, 34°56.88' W) in November of 2017.



Figure 1. Sandstone rocks of Enseada dos Corais (Pernambuco, Brazil).

The sampling procedure consisted of enclosing algae thalli with plastic bags to prevent the escape of motile fauna. Then, each thallus was physically detached from the substratum and preserved in 4% saline formalin for a few weeks. The specimen was later sorted from one of the

collected thalli and conserved in 70% ethanol. Material was collected under license number 17490-1 issued by Instituto Chico Mendes de Conservação da Biodiversidade (ICMbio). We deposited the voucher specimen in the Marine Invertebrates collection of the Museum of Zoology of the University of São Paulo (MZUSP).

Results

Class Pilidiophora Thollessen & Norenburg, 2003
Order Heteronemertea Bürger, 1892
Family Lineidae McIntosh, 1874
Genus *Evelineus* Corrêa, 1954

Evelineus mcintoshii (Langerhans, 1880)
(Figure 2)

Cerebratulus mcintoshii Langerhans, 1880: 138

Lineus Mcdintoshii [sic]: Takakura (1898: 187, fig. 10).

Lineus mcintoshii (Langerhans, 1880) sensu Takakura (1898); Kajihara (2007: 316).

Evelineus tigrillus Corrêa, 1954: 27-32, figs 19-29.

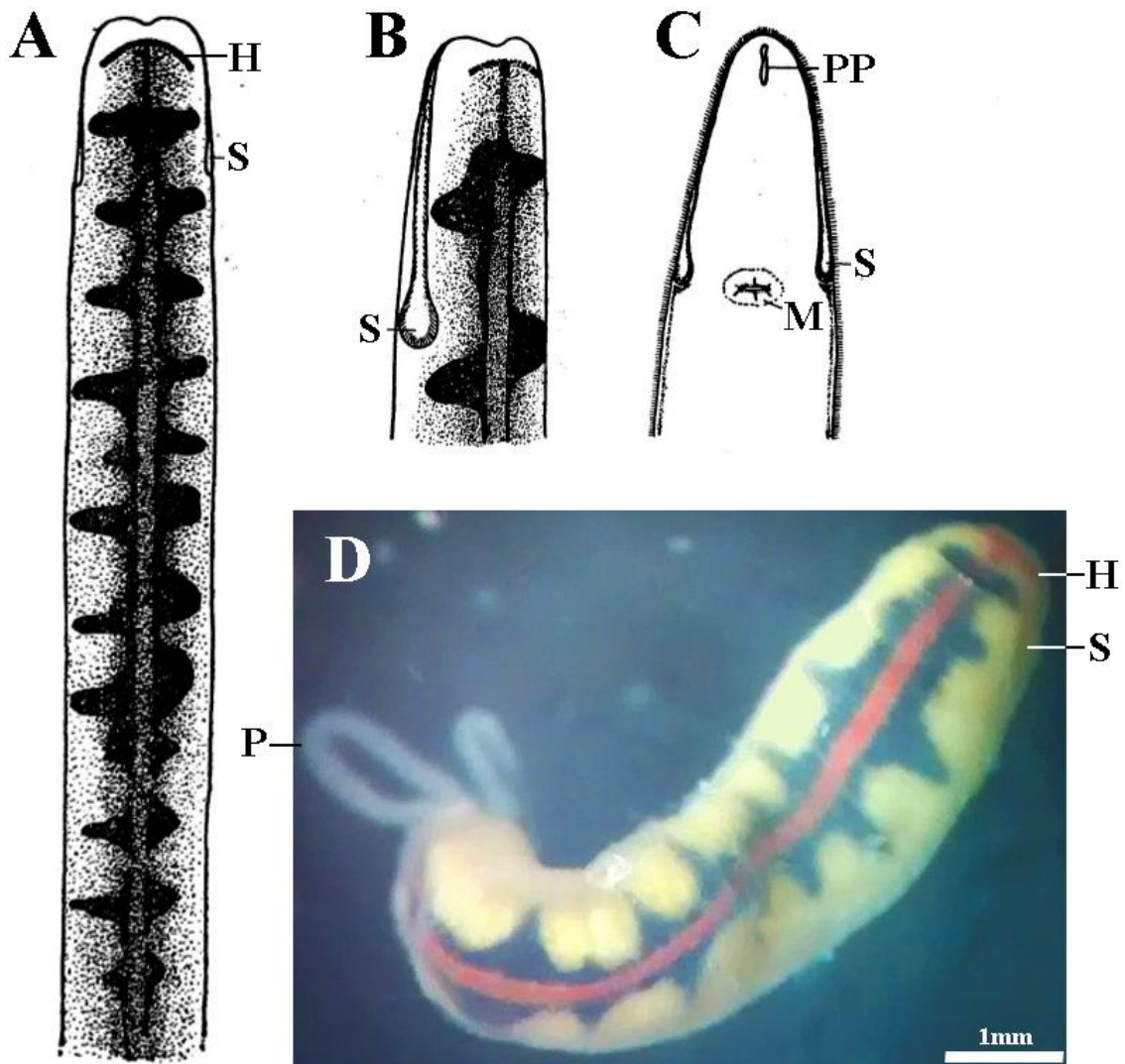


Figure 2. *Evelineus mcintoshii* (Langerhans, 1880): **A.** Anterior third in dorsal view; **B.** Lateral view, showing the cephalic slits; **C.** Ventral view of anterior region; **D.** Picture of the collected specimen after fixation in 4% formalin. There are no photos of living specimen because we fixed the algal sample soon after the collection. A, B and C adapted from Corrêa (1954). H: head pattern, S: cephalic slits, PP: proboscis pore, M: mouth, P: proboscis.

Type species: *Evelineus tigrillus* Corrêa, 1954

Material examined: One individual, non-sexed, five millimeters long (after fixation), anterior region only. Brazil, Pernambuco, Cabo de Santo Agostinho, Enseada dos Corais beach, 08°19.07' S, 34°56.88' W, 03.XI.2017, collector Rodrigo Alves (MZUSP 609) (**Figure 2**).

Diagnosis: Body pale, yellowish; dorsal mid-line orange bordered by thin black line, connected with lateral black different sized triangles in both sides. Head tip Orange, bordered connected, with dorsal mid-line. Deep cephalic slits. Long slim body, up to four centimeters long, but never more than two millimeters wide. Anterior third of body wider. No eyes or caudal cirrus present (Modified from Corrêa 1954).

Geographic distribution: North Pacific Ocean (Kajihara 2007; Chernyshev 2016); Indian Ocean (Shynu *et al.* 2015; Chernyshev 2016); Madeira (Langerhans 1880); North Atlantic (Gibson 2001); Southeastern Brazil (Corrêa 1954) and Northeastern Brazil (present study; **Figure 3**).

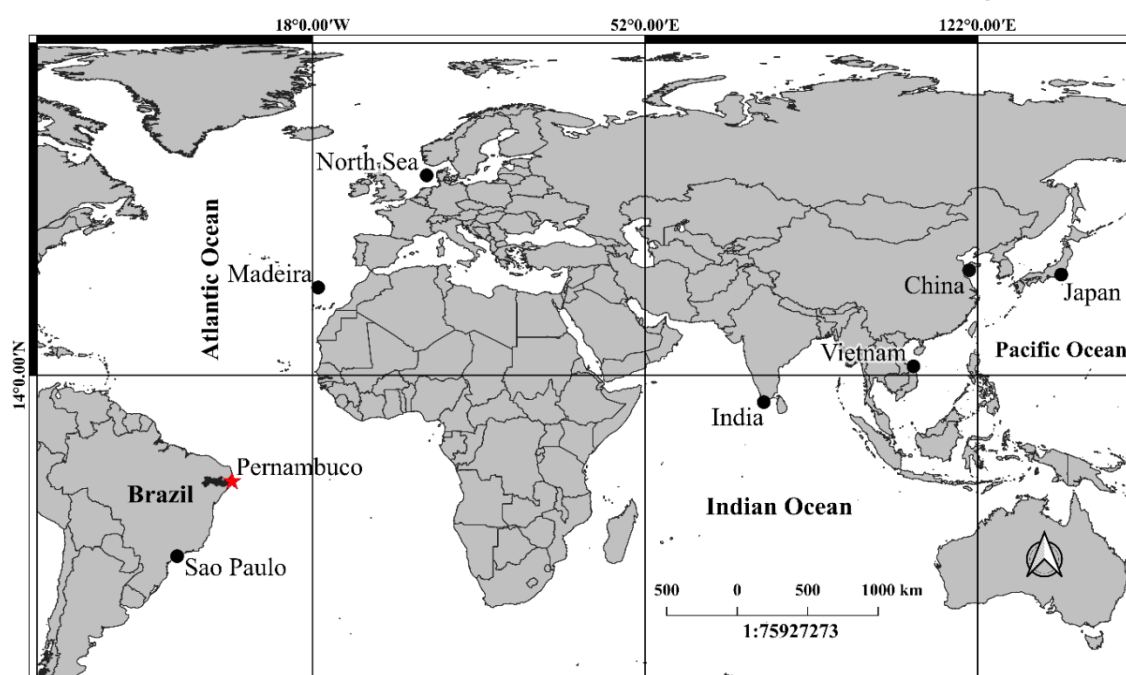


Figure 3. World distribution of *Evelineus mcintoshii* (Langerhans, 1880) based on literature (Corrêa 1954; Kajihara 2007; Shynu *et al.* 2015; Chernyshev 2016). The red star represents the new record for the species.

Remarks: Like our record, *Evelineus tigrillus* Corrêa, 1954 possesses a curve line, resembling an arch, on the head and the dorsal mid-line is bordered by a black line in the first third of the body. Both Brazilian specimens differ from *Evelineus cf. mcintoshii* found in Vietnam in the color pattern of the dorsal surface. The Vietnamese one has dorsal black lines, whereas the Brazilian specimens have black triangles. Furthermore, the Brazilian specimens also differ from the one found in Madeira, which has a semicircle on the cephalic region and no black border along the dorsal mid-line.

Discussion

All specimens of *Evelineus mcintoshii* (Langerhans, 1880) so far were found on hard substrata at shallow, coastal areas (Corrêa 1954; Gibson 1995; Shynu *et al.* 2015; Chernyshev 2016). Almost all records indicate some sort of habitat association with macroalgae, or dead corals as observed by Chernyshev (2016). There is minimal to no information on the biology of the species. Corrêa (1954) reported more than 30 individuals after samplings in different

localities along the coast of São Paulo. In the present study, we did not apply the common techniques for sampling nemerteans in the field. This may explain the low abundance observed for the species in the sampling location (only one individual found). However, in 2019, one of the authors (CBM) collected in the same localities visited by Corrêa and was not able to find more than two specimens, despite extensive sampling and appropriate technique. Corrêa (1954) also noticed the presence of dense amounts of polychaete setae inside the intestine of one specimen, which can give some information on the feeding preferences of this animal.

The family Lineidae is part of a monophyletic group (Pilidiophora) characterized by a unique, long-lived larva called pilidium (Maslakova 2010). Although data on nemertean dispersal are scarce, species with this kind of larva, e.g. *Parborlasia corrugatus* (McIntosh, 1876), can probably cross relatively long distances (Thornhill *et al.* 2008). However, it is also known that oceanic currents and land masses can act as important physical barriers to dispersal in the marine environment, which can decrease the gene flow between geographically distinct populations and result in allopatric speciation (Thornhill *et al.* 2008). We doubt that the two known populations of *Evelineus mcintoshii* in the Brazilian Coast (from São Paulo and Pernambuco, respectively) are different species due to several similarities of their external features and habitats. However, genetic studies are necessary to evaluate the genetic connectivity between the “southern” and “northern” populations in Brazil. Considering the lack of studies on the diversity of Brazilian ribbon worms, we would not be surprised by new findings of this same species in different sites along the Brazilian coast, forming sort of stepping stones connecting in some degree both populations through gene flow.

New findings as observed in this paper also raise the hypothesis of possible introduction driven by anthropogenic forces. That hypothesis is supported by the sampling site's location between two important commercial shipping ports of Pernambuco: Suape and Recife harbors. The Harbor of Recife receives a considerable amount of ships and boats from different parts of Brazil and other countries, and unidentified nemerteans have already been found associated with seaweeds as fouling organisms attached to the hulls of different vessel types operating in this area (Farrapeira *et al.* 2007). Considering the relatively long lifespan of the typical pilidium larva, we also regard the possibility of transport and accidental introduction through discharge of ballast water from ship's tanks near the coast.

According to Corrêa (1954), the species possesses “the most beautiful set of colors and drawings among the known Nemertini species of the Brazilian littoral” (authors' translation). Herein, we pointed out differences on the coloration pattern between the specimens collected in Brazil so far and the specimens from Vietnam and Madeira, respectively. It is known that external features are very important in Nemertean taxonomy and can be used to discriminate species, especially if combined with DNA techniques, rather than internal characters (Sundberg *et al.* 2016b). Therefore, we suggest further investigation using molecular tools to unravel whether such color differences are in fact only intra-specific variations or represent different species. Such information could be of major importance to evaluate the taxon's conservation status. Finally, to clarify if all populations found worldwide so far are in fact the same species, we suggest recollections in the locations cited here (if not done yet), since many of the specimens are either missing, like the original materials examined by Takakura (Dr. Kajihara's personal communication) and Corrêa, or not correctly preserved for molecular analysis (like our specimen). Due to the current lack of molecular data, we accepted *Evelineus mcintoshii* as the valid name of our specimen, in agreement with recent views (Chernyshev 2016). With the present study, we record the nemertean *Evelineus mcintoshii* for the first time in the Northeastern Coast of Brazil.

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