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Crosslandia daedali POORMAN & MULLINER, 1981 (NUDIBRANCHIA, DENDRONOTOIDEA, SCYLLAEIDAE) ASSOCIATED WITH BROWN ALGAE IN THE COASTAL ZONE FROM THE STATE OF PARAÍBA, NORTHEASTERN BRAZIL

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Abstract

Nudibranchs are marine gastropods with no shell and usually have a beautiful color pattern. The aim of this work was to record the scyllaeid *Crosslandia daedali* Poorman & Mulliner, 1981 associated with brown algae in the coastal zone from the state of Paraíba, northeastern Brazil. One individual of this species was collected in November 2019 at about 0.5 meters in depth in the subtidal zone of Cabo Branco Beach in the city of João Pessoa. Immediately after collection, the scyllaeid was transferred to a container with seawater, photographed still alive and then fixed in 70% alcohol. The individual measured about 15 mm in length, presented a typical orange-brown color pattern and was associated with brown algae of the genus *Padina* (Class Phaeophyceae). A large gap in knowledge remains on the richness of nudibranchs in coastal ecosystems of northeastern Brazil associated with algae and reef ecosystems, including the state of Paraíba, which needs to be studied due to the degradation of tropical coastal ecosystems.

Keywords: Biodiversity. Marine mollusks. South Atlantic. Nudibranch.

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1 Introduction

Nudibranchs are marine gastropods that lack a shell and often have colorful bodies (WÄGELE; WILLAN, 2000). Nudibranchs of the family Scyllaeidae Alder & Hancock, 1855 typically live well camouflaged among marine organisms, such as sponges, hydroids, ascidians, brown algae and sea grasses (POORMAN; MULLINER, 1981; RUDMAN, 1998; AJTAI; GARCÍA; WEHRTMANN, 2003; BEHRENS, 2004), and are recognized mainly for feeding on epiphytic hydroids (RUDMAN, 1998; POLA; CAMACHO-GARCÍA; GOSLINER, 2012).

The species *Crosslandia daedali* Poorman & Mulliner, 1981 is a benthic cryptic scyllaeid usually associated with algae of the genera *Halimeda*, *Padina* and seagrass *Zostera* (POORMAN; MULLINER, 1981; AJTAI; GARCÍA; WEHRTMANN, 2003; BEHRENS, 2004) in the intertidal zone to a depth of about five meters in a few localities between Mexico and Costa Rica, in the eastern Pacific Ocean (POORMAN; MULLINER, 1981; BERTSCH; CAMPILLO; ARREOLA, 2000; AJTAI; GARCÍA; WEHRTMANN, 2003; BEHRENS, 2004), the Caribbean of Costa Rica (VALDÉS et al., 2006) and the South Atlantic Ocean off northeastern Brazil (LIMA; DELGADO, 2011).

C. daedali is characterized by an elongated body (up to 25 mm in length) with bilobed parapodia (anterior lobe is larger); a blunt head with one pair of tentacle-like extensions and small rhinophores; elongated neck; a crest on the length of the tail (POORMAN; MULLINER, 1981); color range of orange, green and red with faint brown lines along the body (including brownish spots) and 5 to 6 blue spots in the lateral and dorsal regions (BEHRENS, 2004).

Epizoic and epiphytic nudibranchs have been studied in few algal and reef environments on the coast of northeastern Brazil (LIMA; DELGADO, 2011; PADULA et al., 2012; GALVÃO FILHO et al., 2015). In the present study, we report *C. daedali* from the state of Paraíba, northeastern Brazil, South Atlantic based on a specimen found on Cabo Branco Beach, João Pessoa, NE Brazil.

2 Material and Methods

Study Area

Cabo Branco beach (state of Paraíba, NE Brazil−Figure 1) is characterized by a terrace of marine abrasion bordered by a cliff with agglomerates of sandstone-ferruginous rocks forming part of the composition of reefs parallel to the coastline that give rise to several micro-habitats (DOMINGUEZ et al., 2016).

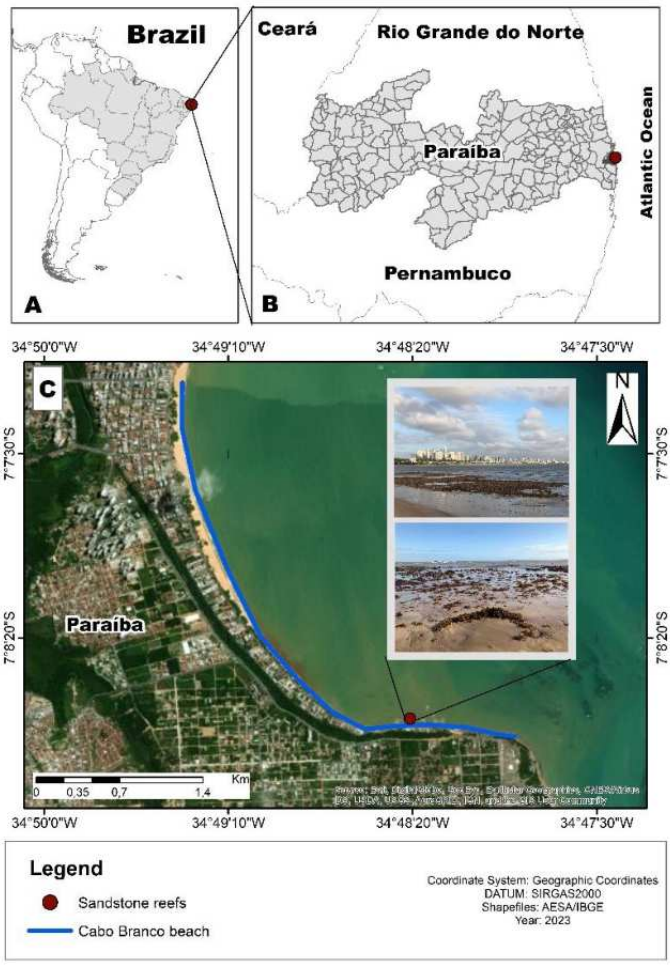

Figure 1. A. Map of Brazil highlighting state of Paraíba; B. State of Paraíba showing the collection point on a large scale; C. Satellite photo showing stretch of Cabo Branco beach and sampling area.

Data collection and identification

Marine invertebrates were collected in the intertidal to subtidal zones of Cabo Branco Beach, João Pessoa, Paraíba, Brazil (07°08'42"S, 34°48'14"W) during field activities between 2017 and 2019 at low tide.

One individual of *C. daedali* was collected manually (Figure 2A) at about 0.5 meters in depth in the subtidal zone on November 07, 2019. The specimen was placed in a container with seawater, photographed alive and then preserved in 70% alcohol. Drawings (Figure 2B–C) were made using the shading and pointillism techniques (EEEP, 2013; RAPATÃO; PEIRÓ, 2016) and then digitized using the MediBang software (MEDIBANG PAINT, 2022). The individual was identified based primarily on Lima and Delgado (2011).

The material studied is deposited in the Aquatic and Terrestrial Metazoan Collection of the Academic Unit of Exact and Natural Sciences of the Teacher Training Center of the Federal University of Campina Grande, Cajazeiras, Paraíba, Brazil (UFCG_MOLL).

The collection was authorized by the "Sistema de Autorização e Informação em Biodiversidade" (SISBIO), "Instituto Chico Mendes de Conservação da Biodiversidade" (ICMBio 63971), Ministry of Environment, from the Federative Republic of Brazil.

3 Results and Discussion

The individual of *C. daedali* was collected in association with brown algae of the genus *Padina* (Class Phaeophyceae Kjellman, 1891). Previous studies corroborate the association between this scyllaeid species and *Padina*, as nudibranchs often feed on epiphytic hydroids growing on this brown alga (AJTAI; GARCÍA; WEHRTMANN, 2003; BEHRENS, 2004).

The individual measured about 15 mm in length and had a typical orange-brown color pattern (Figure 2A), with darker heterogeneous spots on the dorsal part (Figure 2B–C). These morphological characters associated with other descriptive information and illustrations (see POORMAN; MULLINER, 1981; BEHRENS, 2004; LIMA; DELGADO, 2011) allow the species to be recognized unequivocally.

We did not observe gill tufts along the edges of the lobes on the individual studied. This feature was reported by Poorman and Mulliner (1981: 96, figure 2), Behrens (2004: 23) and Lima and Delgado (2011: 14, figs. 1–2) for individuals of *C. daedali* from the Pacific coast of Mexico, Gulf of California and northeastern Brazil, respectively.

C. daedali was first recorded in shallow waters of northeastern Brazil by Lima and Delgado (2011) during collections carried out in the coastal zone of the state of Rio Grande do Norte, region in which a number of sea slugs have been recently registered (DELGADO et al., 2022). The present study expands the record of the scyllaeid *C. daedali* for the coastal zone of the state of Paraíba.

Despite some recent contributions (e.g., PADULA et al., 2012; GALVÃO FILHO et al., 2015), a gap in knowledge remains on nudibranchs associated with reef ecosystems and algae in northeastern Brazil, especially on the coast of the state of Paraíba, where the species *C. daedali* recorded here was found. The biodiversity of benthic invertebrates in this coastal zone needs to be studied urgently due to the increasing degradation of the region, with the accelerated erosion and collapse of the cliffs in the study area, harming all marine life in the area in question.

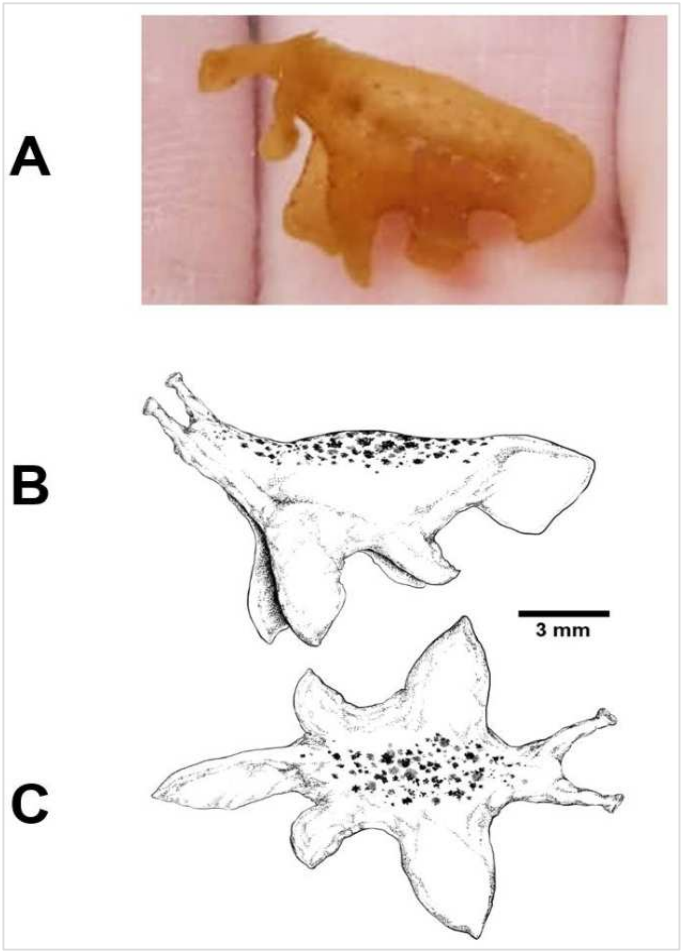

Figure 2. *Crosslandia daedali* Poorman & Mulliner, 1981 found on Cabo Branco Beach, coast of state of Paraíba, northeastern Brazil: A. Living specimen (15 mm); B. Lateral view; C. Dorsal view.

4 Conclusion

The knowledge about nudibranchs from the Atlantic coast of South America, mainly from the northeast of Brazil, remains underestimated, with many species to be recorded (case of *C. daedali* studied here) and described for science.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

AAP, ELF and SFBL conceived the research ideas and designed the study. AAP, ELF, SFBL, JHS and VP performed data analysis. All authors wrote and approved the final manuscript.

DECLARATION OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence this study.

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