



## ANIMAL SCIENCE

# First record of a sea anemone of genus *Bunodosoma* with two oral discs: a clue to asexual reproduction?

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**Abstract:** Different reproductive strategies (both sexual and asexual) that may occur in individuals of the same species may explain the success of sea anemones (Cnidaria:Actiniaria) in colonizing different ecosystems around the planet. Here we provide the first record of a *Bunodosoma* specimen with two oral discs and discuss the possibility of asexual reproduction in this genus. One individual of *Bunodosoma cangicum* was found in Carneiros beach (Pernambuco state, Brazil) with two fully individualized oral discs but with column and pedal disc still connected. Our finding may represent a clue to longitudinal fission in *Bunodosoma*. Yet, despite the number of different studies carried out so far, the absence of data regarding asexual reproduction in *Bunodosoma* suggests that it might be rare in this genus, occurring only in sporadic cases such as recovery from injury.

**Key words:** Actiniaria, Actiniidae, Anthozoa, *Bunodosoma cangicum*, longitudinal fission.

## INTRODUCTION

Sea anemones (Cnidaria: Actiniaria) are a successful group in terms of spatial distribution (Fautin et al. 2013). They have colonized waters in different latitudes and are common in shallow and deep waters (González-Muñoz et al. 2016, Sumida et al. 2016). One strategy that may have facilitated such success is the ability to reproduce asexually, as it is rather common among Actiniaria (Bocharova & Kozevich 2011) and may provide adaptive advantages to marine invertebrates, like population growth, maintenance of adapted genotypes and resistance to desiccation (Ottaway 1973, McGovern 2003, Oliveira & Gomes 2005).

Although asexual reproduction does not favor genetic variability, it seems to be an important mean by which animals compete for space and respond to fine-scale environmental

heterogeneity (Williams 1975a, Sherman & Ayre 2008). Sea anemones reproduce asexually in a diversity of modes, including longitudinal fission, pedal laceration, transversal fission, and tentacle detachment (Bocharova & Kozevich 2011). Longitudinal fission seems to be the most common in Actiniidae, as it occurs in *Anthopleura* and *Anemonia* (Shick 1991, Gomes et al. 2003). The genus *Bunodosoma* Verrill, 1899 is present worldwide and although belonging to Actiniidae, has no record of asexual reproduction. Here we provide the first record of a *Bunodosoma cangicum* with two oral discs and discuss asexual reproduction in the genus.

## MATERIALS AND METHODS

One individual of *Bunodosoma cangicum* Belém & Preslercravo, 1973, was found in September

2018, at Carneiros beach in Pernambuco state, Brazil (08°42'15.6"S, 035°04'43.3"W), a rocky beach with a daily regime of two low and two high tides. At low tide, *B. cangicum* individuals can be easily observed fixed on consolidated substrates in tide pools, sharing space with different organisms such as algae turfs, corals, zoanthids, crustaceans and echinoderms. Water temperature was approximately 31°C and the salinity was 37 at the time of observation.

Due to the position on the reef, we were unable to remove the individual from the rock. Therefore, to verify that it was undergoing a longitudinal fission process, we removed the debris that were partially covering its column and induced contraction via mechanical contact, to visualize column more clearly. Since *B. cangicum* has non-adhesive vesicles on its column, removal of sediment was simple and did not harm the individual.

## RESULTS

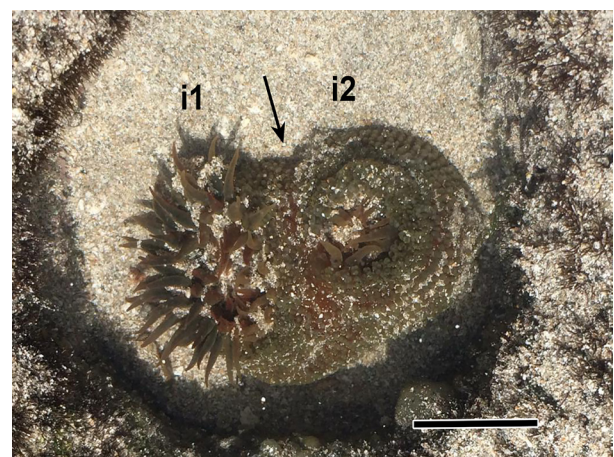
The observed individual of *B. cangicum* had two fully individualized oral discs with two mouths and complete cycles of tentacles. Both the column and the pedal disc were still fully connected. Therefore, this suggests that the individualization of the two future specimens (i.e. parental and clone) must begin at the distal portion of the individual. Since the oral discs were approximately the same size, it was not possible to recognize the parental organism (Figure 1).

## DISCUSSION

Our finding suggests the possibility of asexual reproduction in *Bunodosoma*, which is until now, unknown to occur in this genus. Although the presence of two oral discs in an individual could be the result of recovery process from an injury

(Hand & Uhlinger 1995), this could also be related to asexual reproduction by longitudinal fission. Previous studies have reported anatomical irregularities and external scars in representatives of *Bunodosoma* (e.g. Daly 2004, Barragán et al. 2019), which indicated that asexual reproduction could occur in the genus.

Currently, there is little evidence on the phylogenetic signal of longitudinal fission within Acnitiinidae or any genera of the family. Geller et al. (2005) proposed that in *Anthopleura*, longitudinal fission has arisen independently at least four times. However, *Anthopleura* was regarded as a very problematic genus and the most recent study have shown that it is in fact paraphyletic (Daly et al. 2017). Therefore, the potential homoplasy of longitudinal fission found by Geller et al. (2005) may be an artifact of the sampling or the method. Therefore, until the relationships within the genus are properly understood, evolutive studies regarding the occurrence of asexual reproduction in *Anthopleura* may not be considered conclusive. That is the same case for *Bunodosoma*, which was also found to



**Figure 1.** Individual of *Bunodosoma cangicum* during the process of longitudinal fission. a: Both clones with open oral disc. b: After mechanical contact, individual two (i2) contracted, while individual one (i1) kept oral disc fully open. As can be seen, both individuals are still connected in the middle column (arrow). Scale bars: 50mm.

be paraphyletic by Daly et al. (2017). This result along with the little data regarding the biology of *Bunodosoma* species hinders any attempt to understand the existence of a phylogenetical signal of asexual reproduction in the genus. Even though our finding is a strong indication on the occurrence of longitudinal fission, at least in *B. cangicum*, we cannot imply further based on the current scenario.

Longitudinal fission is considered an efficient method of asexual reproduction, because daughters can perform the functions of an adult right after separation (Bocharova & Kozevich 2011). Like other asexual processes, longitudinal fission contributes to population increase and maintenance when occurring frequently (Ottaway 1973). If this is the case for *B. cangicum*, it is not possible to infer frequency based on a single observation. However, such behavior may favor species in environments with oscillating conditions, like intertidal zones, where this strategy could maintain the genotype that is already established in the environment (e.g. Williams 1975b, Sherman & Ayre 2008).

Among species that occur in Brazil, longitudinal fission has been described in detail for *Bellactis ilkalypseae* Dube, 1983, and *Anthopleura varioarmata* by Belém & Monteiro (1981), a species later identified as *Anthopleura dalyae* González-Muñoz, Garese & Acuña, 2019. In both cases, it started at the pedal disc (proximal end) and resulted in individuals of slightly different sizes (Belém & Monteiro 1981, Oliveira & Gomes 2005). In the individual of *B. cangicum* observed, fission was not yet concluded but the individualized oral discs were of similar size, indicating that the separation seems to begin at the oral disc (distal end). Among sea anemones, fission usually begins at the proximal end, but for some species such as *Metridium senile* (Linnaeus, 1761) the process begins at the distal end (Bocharova & Kozevich 2011).

Despite its abundance along the Brazilian coast there are few studies on *B. cangicum* and various aspects of its basic biology are still unknown (Gomes et al. 1998, Beneti et al. 2019). Further studies including field observations, histological data and *in-lab* induced injuries to observe regeneration process are required to confirm the occurrence of asexual reproduction in *Bunodosoma*. Recording information on reproductive strategies of species of superfamily Actinioidea will enable us to test whether these characters are informative to understand the evolution of asexual reproduction withing Actiniidae. This may help to clarify taxonomic issues, especially in paraphyletic genera like *Bunodosoma* (Daly et al. 2017).

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### Author contributions

José Guilherme A. da Silva Junior and Rafael Antônio Brandão - collected field data and wrote the manuscript. Paula Braga Gomes - Created the paper concept and wrote the manuscript.

