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First record of predation on reproductive *Palythoa caribaeorum* (Anthozoa: Sphenopidae): insights on the trade-off between chemical defences and nutritional value

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During fieldwork at the Abrolhos reefs (north-east Brazil) the whitespotted filefish Cantherhines macrocerus *was observed predating a reproductive colony of the zoanthid* Palythoa caribaeorum. *Several fresh bite marks observed in the colonies suggest that other individuals and probably other species were also feeding on the zoanthid. This is the first record of predation on this zoanthid during its reproductive stage. Since* P. caribaeorum *contains anti-predation chemical defences, we discuss that the presence of egg-bearing polyps might increase the predator benefit in the predation trade-off, i.e. it might be more worthwhile to deal with such defences when the energy budget of eggs is also involved. Therefore, the reproductive stage of chemically defended organisms might shape the frequency and intensity of such interaction.*

Keywords: zoanthid predation, marine toxin, palytoxin, reproductive allocation

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INTRODUCTION

Predation on the zoanthid *Palythoa caribaeorum* Duchassaing & Michelotti, 1860 (Anthozoa: Sphenopidae) by vertebrates has been recorded in the literature for reef fishes (Francini-Filho & Moura, 2010) and sea turtles (Stampar *et al.*, 2007), despite this zoanthid being loaded with palytoxin (PTX), an anti-predator chemical defence (Moore & Scheuer, 1971; Gleibs *et al.*, 1995). Such records, however, do not provide information on the zoanthid's reproductive stage (e.g. presence of reproductive structures or eggs) which might represent an increase in the organism's nutritional value (Villinski, 2003) and imply a higher potential predation risk (Duffy & Paul, 1992; Rotjan & Lewis, 2005).

Here we report, for the first time, a predation on a reproductive *P. caribaeorum* by a reef fish. Although some reef fishes are known to eventually predate these zoanthids (Randall, 1967; Gleibs & Mebs, 1998; Francini-Filho & Moura, 2010), this is the first record of *P. caribaeorum* predation that provides information on the zoanthid's reproductive stage and discusses its potential implications.

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MATERIALS AND METHODS

Observations were taken during fieldwork in the coral reefs of the Abrolhos Archipelago, north-east Brazil (17°58′S 38°42′W) at the Santa Bárbara Island (Portinho Norte) in March 2010. These fringing reefs are not massive coralline formations but are constituted of reef organisms (e.g. corals, sponges and coralline algae) growing on rocky substrates around the islands, being defined as embryonic fringing reefs (Pitombo *et al.*, 1988). Benthic cover at the observation site was mainly algal turf, coralline algae, the scleractinian coral *Mussismilia braziliensis* and the zoanthid *Palythoa caribaeorum*. Photographs were taken using a Canon 5D camera with macro lens.

RESULTS

One individual of the whitespotted filefish *Cantherhines macrocerus* Hollard, 1853 was observed feeding on a reproductive *P. caribaeorum* colony at about 3 m deep (Figure 1A) and there were several fresh bite marks in other colonies around, suggesting that other individuals and probably other species were also feeding on the zoanthid. The colony's reproductive stage was visually assessed in the bite scar immediately after the observed predation, when it was possible to observe egg-bearing polyps (Figure 1B). There

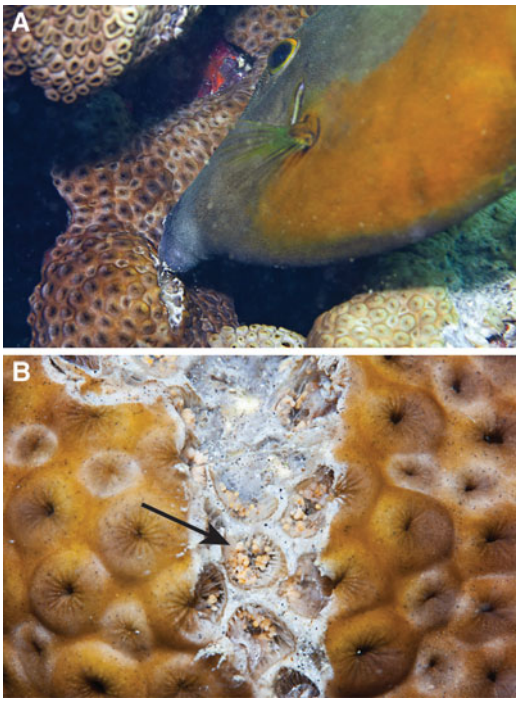

Fig. 1. Targeted predation on a reproductive *Palythoa caribaeorum* colony by *Cantherhines macrocerus*: (A) *C. macrocerus* scraping the colony; (B) scraped colony containing egg-bearing polyps indicated by the black arrow. Photographs: J.P. Krajewski.

was no other morphological trait on the colony that could previously indicate its reproductive stage.

DISCUSSION

Few vertebrates are known to feed on *Palythoa caribaeorum* colonies (e.g. Gleibs & Mebs, 1998; Stampar *et al.*, 2007; Francini-Filho & Moura, 2010) and most parts of them are reef fishes. The first reef fish species recorded feeding on *Palythoa* sp. was the confamilial scribbled leatherjacket filefish *Aluterus scriptus* in Puerto Rico (Randall, 1967). Most recently, predation on *P. caribaeorum* was recorded for other reef fish species, including the whitespotted filefish *Cantherhines macrocerus* at the same study site in the Abrolhos Archipelago (Francini-Filho & Moura, 2010). This relatively rare species (<0.1% of fish biomass at the reefs of Abrolhos (Francini-Filho & Moura, 2010) is regarded as a sessile invertebrate feeder, with sponges comprising the major part of its diet (Randall, 1967). Therefore, the novelty of this record is for discussing the potential effect of *P. caribaeorum* reproductive stages on predators' choice, since none of the previous records acknowledged the zoanthid reproductive stage at the time of predation.

The zoanthid *P. caribaeorum* is abundant at the study area and widely known for containing PTX, one of the most poisonous marine toxins known to date, acting as an anti-predation chemical defence (see Gleibs *et al.*, 1995). Although primarily found on *Palythoa* spp., evidences also suggest a bacterial origin for the PTX production (see Ramos & Vasconcelos, 2010) and the presence of this toxin in organisms living in close association with colonial zoanthids (Gleibs & Mebs, 1999). Additionally, it is known that organisms from different trophic levels might be differentially affected by PTX, some of them even accumulating the toxin in their tissues (see Ramos & Vasconcelos, 2010). The entrance, diffusion and sequestration of PTX into the food chain of coral reefs are further discussed by Gleibs & Mebs (1999).

Even though there is little available information on PTX geographical and/or seasonal variation in *Palythoa* species (Gleibs *et al.*, 1995), a positive correlation between the PTX content and the reproductive cycle of polyps was found for *Palythoa tuberculosa* in the Pacific (Kimura *et al.*, 1972). Conversely in *Palythoa* species from the Caribbean Sea (*P. caribaeorum* and *P. mammillosa*), PTX is distributed among polyps independently of their reproductive stage (Gleibs *et al.*, 1995). If this is true, potential predators would benefit more by selectively targeting reproductive colonies since egg-bearing polyps might increase the predator benefit in the predation trade-off.

Similarly to our observation, parrotfishes may selectively target areas of *Montastrea annularis* with higher reproductive allocation and thus increased nutritional value (Rotjan & Lewis, 2005). The predation on reproductive cnidarians by reef fishes suggests that fishes might detect a prey's reproductive stage, increasing the predation pressure on these benthic cnidarians loaded with eggs.

Differences in nutritional quality within the natural range occurring among coral reef organisms are suggested to be among the main forces modelling predator–prey interactions in such habitats (Duffy & Paul, 1992). Therefore, reproductive stages of chemically defended organisms should be recorded in predation events, since they might shape the frequency and intensity of such interactions.

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