Arquivos de Ciências do Mar

PREDATION BY YOUNG *Cassis tuberosa* (MOLLUSCA: GASTROPODA: CASSIDAE) ON *Lytechinus variegatus* (ECHINODERMATA: ECHINOIDEA), UNDER LABORATORY CONDITIONS

Predação por jovens de *Cassis tuberosa* (Mollusca: Gastropoda) sobre *Lytechinus variegatus* (Echinodermata: Echinoidea), em condições de laboratório

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ABSTRACT

In this study we analyze the predatory behavior of young Cassis tuberosa *on the sea urchin* Lythechinus variegates *by means of observations carried out on Redonda Beach, Icapuí, Ceará. Individuals of predator and prey were collected at low tide and were taken to the laboratory in aerated boxes. Each juvenile of* C. tuberosa *was placed together with one* Lythechinus variegatus *in a 50-liter tank. During the experiment the number of consumed prey was registered and the eaten individuals were replaced. This experiment lasted for one month at 26-28ºC and 35 of salinity and was replicated ten times. We registered the position and the dimensions of the bore holes on the sea urchins. The bore hole were complete, with 4 to 5 mm in diameter and had teeth marks of the radula on their edge. We found, in every prey, a dark spot around the predation holes, which was probably a reaction of the calcium carbonate test of the prey to the sulfuric acid from the predator. No statistical significant preference for oral or aboral sides was observed. The defense mechanism of the prey was based on behavioral strategies.*

Key words*: predation,* Cassis tuberosa, Lythechinus. variegatus.

RESUMO

Nesse trabalho foi analisado o comportamento predatório de indivíduos jovens de Cassis tuberosa *sobre o ouriço-do-mar,* Lythechinus. variegatus *por meio de observações realizadas na Praia de Redonda, Icapuí – Ceará. Os predadores e as presas foram coletados na faixa entre marés e levados para o laboratório. Cada indivíduo jovem de* C. tuberosa *jovem foi colocado com um* Lythechinus variegatus *em um aquário de 50 litros. Durante o experimento o número de presas consumidas foi registrado e os indivíduos predados eram repostos. Este experimento durou um mês e foi replicado dez vezes sob temperatura de 26-28 ºC e salinidade de 35. Foram registradas a posição e as dimensões dos orifícios causados pela predação de* C. tuberosa sobre L. variegatus*. Os orifícios mediam de 4 a 5 mm de diâmetro e tinham marcas da rádula em suas bordas. Foi encontrada, em cada presa, uma mancha escura ao redor do orifício, provavelmente devido à reação no carbonato de cálcio da carapaça da presa ao ácido sulfúrico do predador. Não foi observada estatisticamente preferência na predação entre o lado aboral e o oral da presa. O mecanismo de defesa da presa observado foi baseado em estratégias de fuga.*

Palavras-chaves: *predação,* Cassis tuberosa, Lythechinus. variegatus.

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INTRODUCTION

The relationships between predator and prey are of great importance in the control of both populations. Predation may prevent a prey population from depleting its food resources. On the other hand, the capacity to change diet when a prey population density decreases below certain levels may represent a mechanism for preservation of the most favorable food resource by that predator population (Matthews-Cascon, 2001).

In a harsh environment with a low prey density, the search time tend to be longer. Therefore, pursuit time for nearly all items encountered is irrelevant in terms of decision making, and the animal has to become a generalist. On the other hand, in a productive environment with short search times, specialization is favored. MacArthur (1972), using his optimal foraging model, was able to predict that a species should become more specialized in a productive environment in comparison to a harsh one.

Nevertheless, specialization should be effective enough to achieve optimal predation success, but at the same time, it should not be too rigid to prevent the predator from changing from a particular and originally preferred prey species when that species become rare (Curio, 1976).

The animals from the Cassidae family are specialist predators on Echinodermata (Hughes & Hughes, 1981). This family have developed efficient strategies in catching the prey, as well as, morphological and physiological adaptations in their digestive system for producing sulfuric acid that make easy to bore on the test of echinoderms. In the present study, the predatory behavior of young *Cassis tuberosa* on *Lytechinus variegatus* was investigated.

MATERIAL AND METHODS

Cassis tuberosa and *Lytechinus variegatus* were collected at low tide in Redonda Beach (04º40'S - 37º20'W), Icapuí County, Ceará State, Northeast Brazil and taken to the Laboratory of Marine Invertebrates of the Department of Biology, Universidade Federal do Ceará in aerated boxes. Each specimen of *C. tuberosa* was placed with one specimen of *L. variegatus* in a 50-liter aquarium in the temperature 26-28ºC and 35 of salinity and provided with a 4-cm layer of sand. During the experiment the number of consumed prey was noted and the eaten individuals were replaced. This experiment lasted for one month and was replicate 10 times. The position and the dimensions of the bore holes on the sea urchins were registered. The animals were measured with a vernier caliper to 0.1 mm of precision with the predators being in average, 75 mm in length and the preys 65 mm in diameter.

RESULTS

A total of 29 registered predation attacks of *C. tuberosa* (Figure 1) on *L. variegatus* (Figure 2) were observed. Most of the attacks (18 = 62%) were on aboral surface whereas eleven (38%) were on oral surface, but this difference was not statistically significant. The bores holes had 4 to 5 mm in diameter and teeth marks of the radulae on the edges of the holes were observed (Figure 3). In every prey a dark spot around the predation holes was also found.

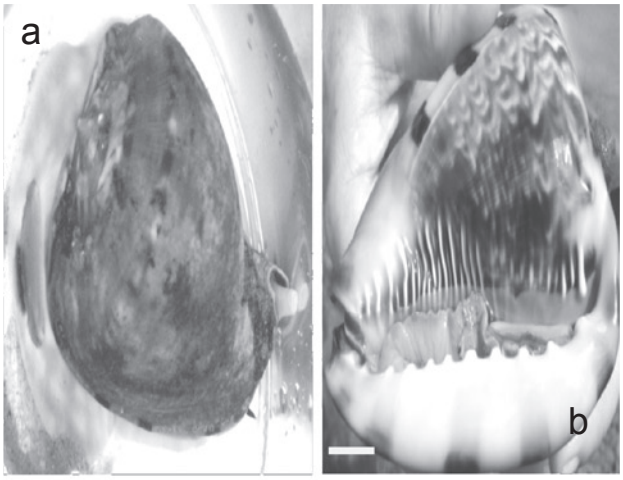

Figure 1 - *Cassis tuberosa*: a - dorsal view; b - ventral view. (bar = 1 cm).

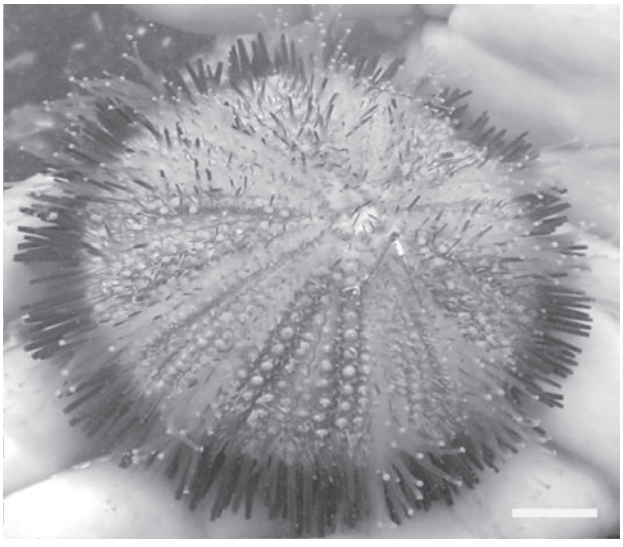
Figure 2 - *Lytechinus variegate* (bar = 1 cm).

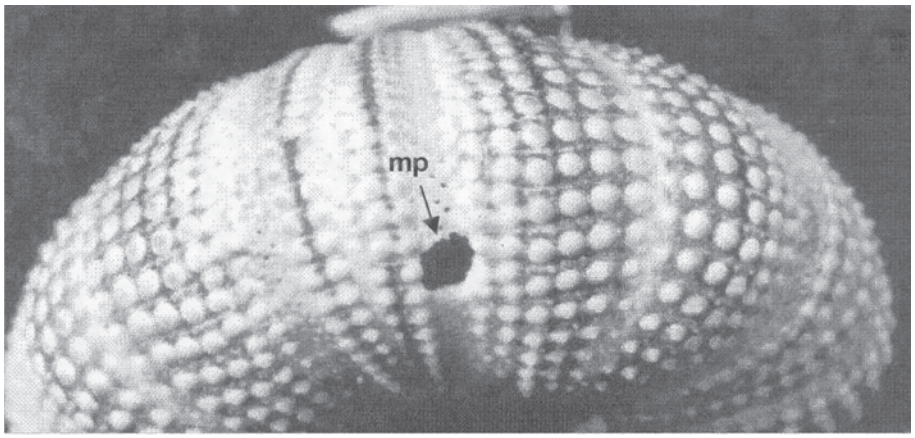

Figure 3 - Predation mark (mp) of *Cassis tuberosa* on *Lytechinus variegatus*.

The young individuals of *C. tuberosa* initiate the attacks moving very fast in the direction of the prey (*L. variegatus*) with the foot under the sand removing it. When the predator gets near the prey the siphon bends forward and the tentacles become fully extended, then it raises the foot in a high arch and get over the prey using a significant amount of mucus produced in the foot before the attack.

When the predator catches the prey, the proboscide touches the latter, and begins the acid liberation as indicated by the appearance of bubbles. During the experiments, the defensive behavior presented by *L. variegatus* individuals when attacked by *C. tuberosa* was trying to escape and search for shelter or crawled to the top of the predator shell, preventing this way, the predator to reach the prey.

DISCUSSION

Predators are designed by natural selection to maximize the net rate of food intake usually seen in cases of a predator's choices among prey while foraging (Krebs, 1977, Hughes, 1980). Most of predation by *C. tuberosa* on *L. variegatus* was on the aboral surface, probably because this area has more tissue with energetic content such as the gonads, this way maximizing the food intake. Nebelsick & Kowalewski (1999) investigated drilling predation on echinoids and found that predators drill preferentially the aboral side of the test as observed for *C. tuberosa* on *L.variegatus*.

The chemical etching process of tonnacean proboscis gland secretion is a high concentration of sulfate and a relatively low concentration of chloride ions (Fange & Lidman, 1976). The dark spot around the predation holes found in every prey, probably was a reaction of the calcium carbonate test of *L. variegatus* to the sulfuric acid from *C. tuberosa.* This dark spot around the predation holes were also found in the study of predation by *C. tuberosa* on *Mellita quinquiesperforata* (Pequeno & Matthews-Cascon, 2001).

According to Hughes & Hughes (1981) echinoderms predominate in the diets of tonnaceans and Cassidae specialize on echinoids. Some animals increase their preference during prolonged exposure to a particular prey involving a conditioning process additional to the more immediate effects of learning called ingestive conditioning (Hughes, 1986), which could delay the response of predators to changes in the abundance of prey. A severe delay in this response may cause the local extinction of a prey before preference for it has been lost (Hughes, 1986).

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