

# **PREDATION BY YOUNG *Cassis tuberosa* LINNAEUS, 1758 (MOLLUSCA: GASTROPODA) ON *Mellita quinquesperforata* (CLARCK, 1940) (ECHINODERMATA:ECHINOIDEA), UNDER LABORATORY CONDITIONS**

Predação de *Mellita quinquesperforata* (Clarck, 1940) (Echinodermata: Echinoidea) por jovens de *Cassis tuberosa* Linnaeus, 1758 (Mollusca: Gastropoda), em condições de laboratório

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## **RESUMO**

Na praia de Redonda, Município de Icapuí (Estado do Ceará), encontram-se frequentemente jovens indivíduos de *Cassis tuberosa* Linnaeus, 1758 predando *Mellita quinquesperforata* (Clarck, 1940). Neste trabalho foi analisado o comportamento predatório de indivíduos jovens de *C. tuberosa* sobre *M. quinquesperforata*. Os predadores e as presas foram coletados na faixa intertidal e levados para laboratório. Cada *Cassis tuberosa* jovem foi colocado com vinte indivíduos adultos de *Mellita quinquesperforata* em um aquário de 60 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 cinco vezes sob temperatura de 28°C. Foram registradas a posição e as dimensões dos orifícios causados pela predação de *C. tuberosa* sobre *M. quinquesperforata*. 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 do 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, mas a maioria da predação ocorreu na superfície oral próxima da boca. O mecanismo de defesa da presa observado foi baseado em estratégias comportamentais, tais como fuga.

**Palavras-chaves:** predação, Mollusca, Gastropoda, Echinodermata, Echinoidea.

## **ABSTRACT**

In Icapuí County, Ceará State, Northeast Brazil, young individuals of *Cassis tuberosa* Linnaeus, 1758 are frequently found feeding on *Mellita quinquesperforata* (Clarck, 1940). In this study we analyze the predatory behavior of young *C. tuberosa* on the sand dollar *M. quinquesperforata*. Individuals of predator and prey were collected at low tide and were taken to the laboratory in aerated boxes. Each *Cassis tuberosa* was placed together with 20 adult individuals of *Mellita quinquesperforata* in 60-liter tanks. During the experiment the number of consumed prey was registered and the eaten individuals were replaced. This experiment lasted for one month at 28°C and was replicated five times. We registered the position and the dimensions of the bore holes on the sand dollars. The bore holes were complete, with 4 to 5 mm of diameter and had teeth marks of the radulae on their edge. We found, in every prey, a dark spot around the predation holes, which was probably a reaction of the calcium carbonate shell of the prey to the sulfuric acid from the predator. Statistically-significant preference for oral or aboral sides was not observed, but most predation by *C. tuberosa* on *Mellita quinquesperforata* was on the oral surface and close to the mouth. The defense mechanism of the prey was based on behavioral strategies.

**Key words:** predation, Mollusca, Gastropoda, Echinodermata, Echinoidea.

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## INTRODUCTION

Dietary generalists eat wider ranges of prey than dietary specialists (Curio, 1976). Specialization should be effective enough to achieve optimal hunting success but at the same time, it should not be so rigid as to prevent the predator from changing from a particular and originally preferred prey species when that species becomes rare (Curio, 1976).

The animals from the Cassidae family are specialist predators on Echinodermata (Hughes & Hughes, 1981). According to Fänge & Lidman (1976) the species of Cassidae family had 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 shell of echinoderms.

Previous studies have investigated the predation by *Cassia tuberosa* on echinoderms. Moore (1956) observed *Cassia tuberosa* feeding on *Tripneustes esculentus* and *Phalium granulatum* on *Mellita quinquesperforata*. MacClintock & Marion (1993) found *Cassia tuberosa* preying on *Leodia sexiesperforata*.

In the present study, the predatory behavior of the young *Cassia tuberosa* on *Mellita quinquesperforata* was investigated.

## MATERIALS AND METHODS

The predator and prey were collected at low tide in Redonda Beach (04° 40' S, 37° 20' W), Icapuí County, Ceará State, Northeast Brazil and taken to the laboratory in aerated boxes. Each *Cassia tuberosa* was placed with 20 individuals of *Mellita quinquesperforata* in 60-liter water tanks. During the experiment the number of consumed prey was noted and the eaten individuals were replaced. This experiment lasted for one month at 28 °C and was replicated five times. The position and the dimensions of the bore holes on the sand dollars were registered. The predators had in average, 75 mm in length and the preys 26.9 mm in diameter (Figure 1). The observations of the predatory behavior were done for seventy two hours.

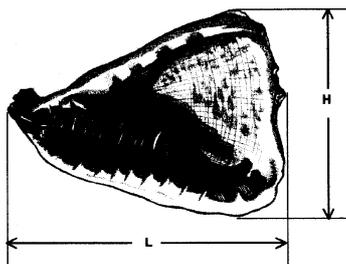


Figure 1 – Measurement of *Cassia tuberosa* (Linnaeus, 1758): L = length; H = height.

## RESULTS

In a total of 63 registered predation attacks of *Cassia tuberosa* on *Mellita quinquesperforata*, 50 (79%) were on oral surface and 8 (13%) were on the aboral surface (Figure 2). In the remaining 5 attacks (8%) the bore holes trespassed the prey body (Figure 3). The bore holes had 4 to 5 mm in diameter and teeth marks of the radulae on the edges (Figure 4). In every prey, a dark spot around the predation holes was also found (Figure 5). Most of the attacks by *C. tuberosa* on *M. quinquesperforata* were closer to the mouth (85%) than to the edge of the sand dollar.

Individuals of *Cassia tuberosa* initiated the attacks moving very fast in the direction of the prey with the foot under the sand removing it. When the predator catches the prey, the proboscide touches it and begins the acid liberation as indicated by the appearance of bubbles. During the experiments, the following defensive behavior by the individuals of *Mellita quinquesperforata* when attacked by *Cassia tuberosa* was observed in the water tanks. *M. quinquesperforata* individuals unburied themselves when noticed the approximation of the predator and moved to the opposite side of the predator. Another defense behavior by *Mellita quinquesperforata* was forming a pile of individuals that moved towards the predator and passed over it.

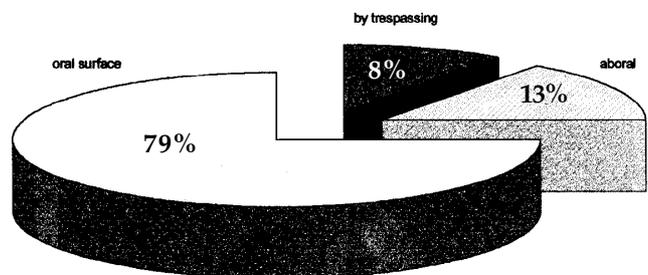


Figure 2 – Attacks of *Cassia tuberosa* (Linnaeus, 1758) on *Mellita quinquesperforata* (Clarck, 1940) .

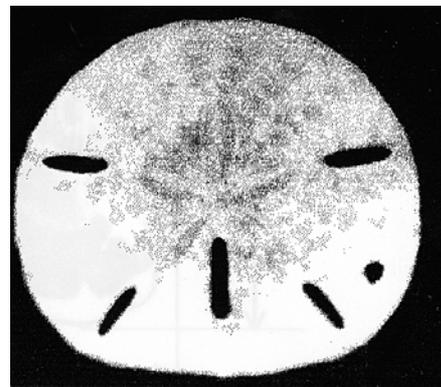


Figure 3 – Bore hole by trespassing in *Mellita quinquesperforata* (Clarck, 1940) resulting from predation by *Cassia tuberosa* (Linnaeus, 1758) .

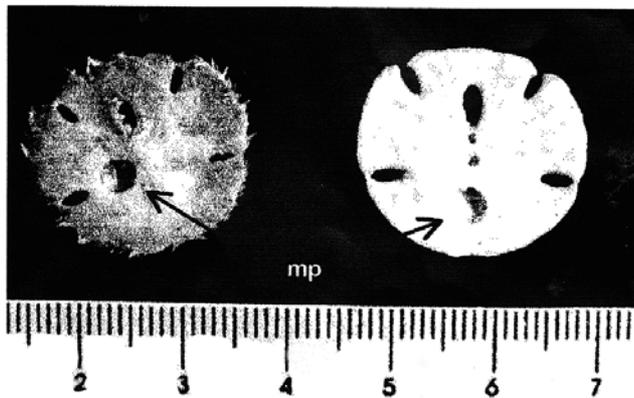


Figure 4 – Predation mark (mp) of *Cassis tuberosa* (Linnaeus, 1758) on *Mellita quinquiesperforata* (Clarck, 1940) .



Figure 5 – Dark spot on *Mellita quinquiesperforata* (Clarck, 1940) resulting from predation by *Cassis tuberosa* (Linnaeus, 1758).

## DISCUSSION

Moore (1956) observed predation by *Phalium granulatum* on *Mellita quinquiesperforata* and *Cassis tuberosa* on *Tripneustes esculentus*. We found in Redonda Beach, Icapuí County, these two predators preying on *Mellita quinquiesperforata*.

MacClintock & Marion (1993), while studying predation by *Cassis tuberosa* on *Leodia sexiesperforata*, observed that the attack of *C. tuberosa* was more often on the oral surface the same way as we observed for *C. tuberosa* on *M. quinquiesperforata*. They also reported that most attacks were done at day time. In our study many attacks were seen to take place at day time but

some also at night. Hughes & Hughes (1981) observed *Cassis tuberosa* preying only at night, and thought it to be a probable way to avoid predators like fishes.

According to Moore (1956), the bore holes observed by predation of *Phalium granulatum* on *Mellita quinquiesperforata* had less than 2 mm and no teeth marks of the radulae were found. Since this was different from our observations on the predation by *Cassis tuberosa* on *Mellita quinquiesperforata*, it may be that the bore hole can be specific of each kind of predator.

The stain and the bubbles found on the shell of the prey could be caused by the acid produced by the predator. According to Fänge & Lidman (1976) bubbles could be due a strong acid.

## CONCLUSIONS

- 1 - The dark spot around the predation holes found in every prey, probably was a reaction of the calcium carbonate shell of *Mellita quinquiesperforata* to the sulfuric acid from *Cassis tuberosa*.
- 2 - Most of predation by *Cassis tuberosa* on *Mellita quinquiesperforata* was on the oral surface and close to the mouth, maybe because this area has more tissue with energetic content.

## REFERENCES

- Curio, E. *The ethology of predation*. Springer-Verlag, , 250p., New York, 1976.
- Fänge, R. & Lidman, U. Secretion of sulfuric acid in *Cassidaria echinophora* Lamarck (Mollusca: Mesogastropoda) marine carnivorous snail. *Comp. Biochem. Physiol.*, v. 53, p. 101-103, 1976.
- Hughes, R. N. & Hughes, H. P. Morphological and behavioural aspects of feeding in the Cassidae (Tonnacea, Mesogastropoda). *Malacologia*, v. 20, p. 385-402, 1981.
- McClintock, J. B. & Marion, K. R. Predation by the king helmet (*Cassis tuberosa*) on six-holled sand dollars (*Leodia sexiesperforata*) at San Salvador, Bahamas. *Bull. Mar. Sci.*, Miami, v. 52, p. 1017-1021, 1993.
- Moore, D. R. Observations of predation on echinoderms by three species of Cassidae. *The Nautilus*, v. 69, p. 73-76, 1956.