



# New data on the feeding of deep Sea Mediterranean Chitons

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## ABSTRACT

A living specimen of the rare deep-sea polyplacophoran *Bathychiton biondii* Dell'Angelo & Palazzi, 1988 was found in a dredge sample from the Santa Lucia Bank, Ligurian Sea. Since the specimen was observed in association with the sponge *Hamacantha johnsoni* (Bowerbank, 1864), its potential spongivorous diet was evaluated by examining the contents of stomachs, gut and faecal pellets. A specimen of *Ischnochiton dolii* Van Belle & Dell'Angelo, 1998, another Mediterranean deep sea chiton, was studied for comparison. The results suggest that sponges are a common but possibly not exclusive food items in the diet of both chiton species.

## RIASSUNTO

Un esemplare vivente del raro chitone di profondità *Bathychiton biondii* Dell'Angelo & Palazzi, 1988, è stato rinvenuto in un campione di sedimento prelevato mediante draga dal Banco di Santa Lucia (Mar Ligure). Dal momento che l'esemplare è stato rinvenuto ancora aderente alla spugna *Hamacantha johnsoni* (Bowerbank, 1864), il suo stomaco, intestino e pallottole fecali, sono stati separati ed esaminati al fine di poter stabilire l'eventuale spongivoria nella specie. Un esemplare di *Ischnochiton dolii* Van Belle & Dell'Angelo, 1998, un altro chitone tipico delle comunità profonde del Mediterraneo, è stato analizzato per confronto. I risultati ottenuti suggeriscono come, in entrambe le specie, le spugne costituiscano parte integrante ma probabilmente non esclusiva della dieta.

**KEY WORDS:** Polyplacophora, Mediterranean bathyal, feeding, spongivory, *Bathychiton biondii*, *Ischnochiton dolii*

## INTRODUCTION

Very little is known about the ecology of deep-sea Mediterranean chitons and their feeding is virtually unknown. While littoral chitons are generally considered to be herbivores (Hyman, 1967), there are evidences that some species can also feed on protozoans, sponges, cnidarians, molluscs, arthropods, rotifers, annelids, and bryozoans (Langer, 1983 and bibliography therein). Deep sea chitons seem to have specialized to feed on decaying wood (e.g. Wolff, 1979; Shirenko, 2001) or sponges.

In the latter case, however, there exist only one detailed study by Warén & Klitgaard (1991), in which is clearly demonstrated that the large east-Atlantic deep-sea species *Hanleya nagelfar* (Lovén, 1846), from deep-coral banks, exclusively feeds on sponges belonging to the genus *Geodia*.

The finding of living specimens belonging to two rare Mediterranean Bathyal chitons (*Bathychiton biondii* Dell'Angelo & Palazzi, 1988 and *Ischnochiton dolii* Van Belle & Dell'Angelo, 1998) lead us to investigate their stomach, gut and faecal pellet contents, in order to assess the diet of these two deep sea chitons and to discuss their potential spongivory.

## MATERIAL AND METHODS

A single specimen of *Bathychiton biondii* Dell'Angelo & Palazzi, 1988 was found on a hardground slab collected at station LM99-34 (43°34.73' Lat N, 009° 9.60' Long E; 303-180 m), Santa Lucia Bank, Ligurian Sea (Fig. 1). The specimen was observed still adhering to its possible prey, the sponge *Hamacantha johnsoni* (Bowerbank, 1864) (Fig. 2a), after the washing of the muddy sediment from the sample collected by a

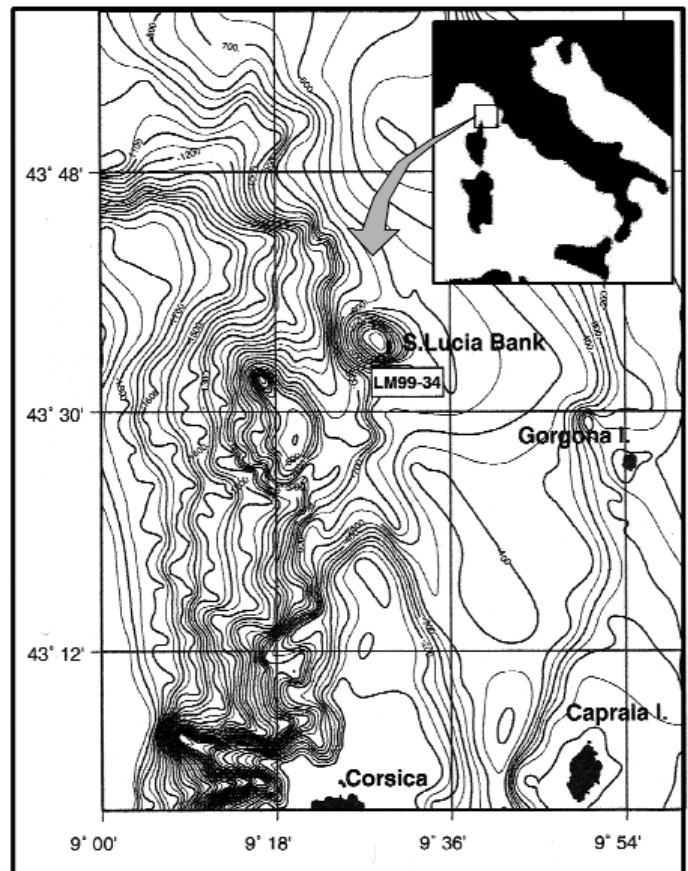


Fig. 1. Map of the Ligurian sea with the location of the station LM99-34.

Fig. 1. Mappa del Mar Ligure, con la posizione della stazione LM99-34.



| Species                    | Gut              | Stomach          | Faecal pellets  |
|----------------------------|------------------|------------------|---|
| <i>Bathychiton biondii</i> | Oxea (fragments) | Oxea (fragments) | No spicules   |
| <i>Ischnochiton dolii</i>  | No spicules      | Acanthostyles    | Acanthostyles (complete)<br>Styles (fragments and complete)<br>Strongyloxeas (complete)<br>Tylostyles (fragments) |

Tab. 1. Spicule tipologies found in the digestive systems of the two deep water chiton species.

Tab. 1. Tipologie di spicole trovate nel sistema digestivo delle due specie di chitoni di profondità.

dredge. The specimen was photographed, fixed in ethanol 75% in seawater, and dissected under a stereomicroscope in the laboratory. Gut, stomach and the single faecal pellet present in the rectum were mounted separately on standard glasses for microscopy and dissolved in boiling  $\text{HNO}_3$ , over a Bunsen flame, to obtain the spicules. These were then observed and identified at the optical microscope.

One dried specimen of *Ischnochiton dolii* Van Belle & Dell'Angelo, 1998, collected 480 m off the Latium coasts, was available for comparison. This specimen was re-hydrated in the laboratory, dissected and treated as the previous species.

## RESULTS AND DISCUSSION

In the digestive systems of both chiton species, either fragments

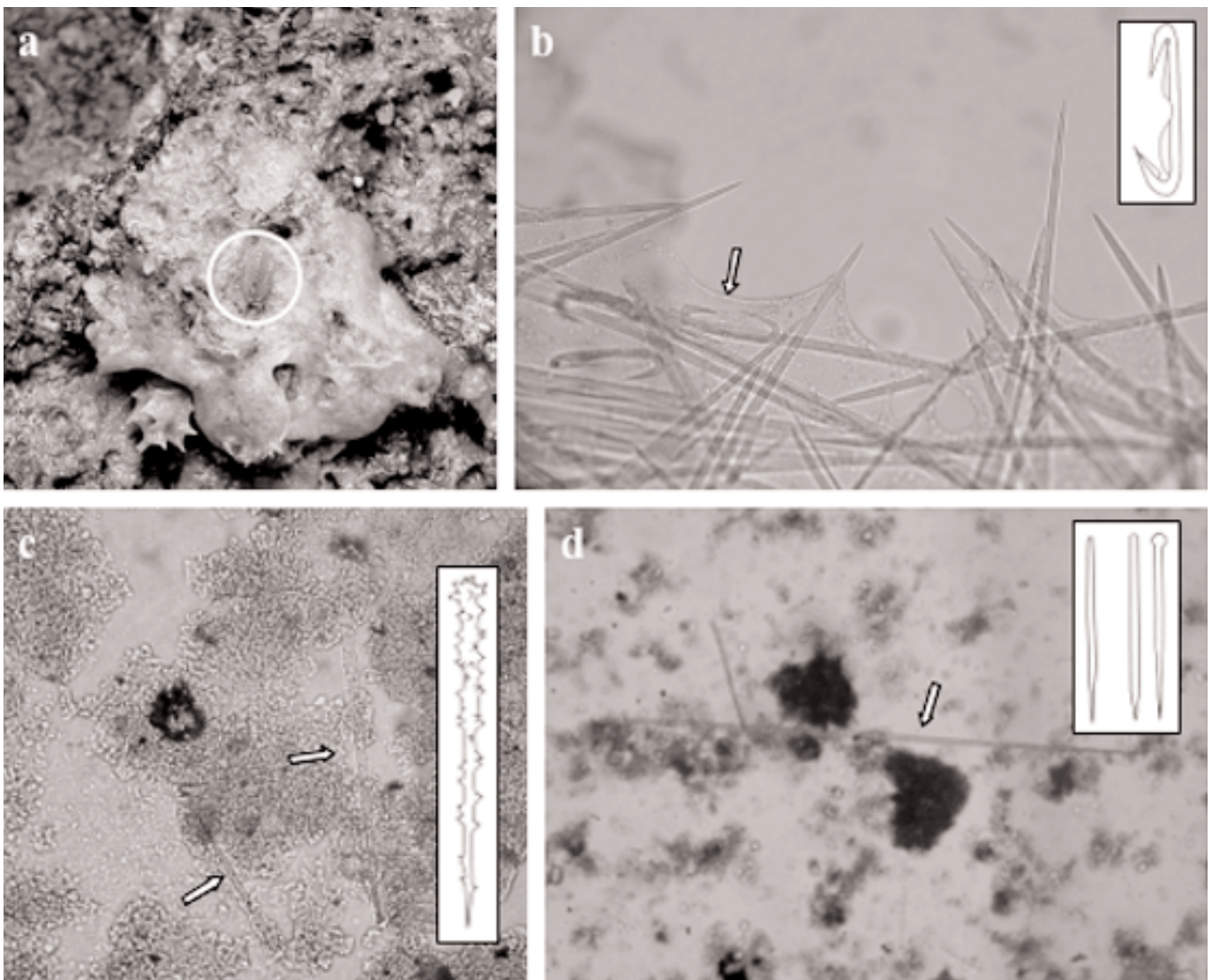


Fig. 2. a) *Bathychiton biondii* on the sponge *Hamacantha jobnsoni*, at St. LM99-34; Different types of spicules: b) Oxea and diancistræ in situ from a slice of *Hamacantha jobnsoni* fixed tissues; c) Acanthostyle spicules; d) Tylostile spicules.

Fig. 2. a) *Bathychiton biondii* sulla spugna *Hamacantha jobnsoni*, alla Staz. LM99-34; Tipi differenti di spicole: b) Oxee e diancistre in situ come appaiono in una sezione di tessuto di *Hamacantha jobnsoni*; c) Acanostili; d) Tilostili.



and entire sponge spicules were found (Tab. 1). Only in the gut of *I. dolii* and in the single faecal pellet of *B. biondii* there were no traces of spicules.

The oxeas' fragments found in the gut and stomach of *B. biondii*, although probably belonging to a single sponge species, cannot be ascribed to *Hamacantha johnsoni*, the sponge onto which the chiton was found, due to a great difference in the spicule size (M. Pansini, *pers.com.*). Moreover, no diancistrae, the other spicule type characteristic of the genus *Hamacantha* (Fig. 2a, arrow), were found, making therefore highly unlikely that *Hamacantha* could be a food item of this chiton. Whether *B. biondii* is monophagous, it cannot be hypothesized yet, since gut and stomach contents were too poor to assess it. Other food items in fact, not preserved by the nitric acid, could be part of its diet as well.

On the contrary, *I. dolii* shows a great diversity of spicule types: acanthostyles (Fig. 2c), styles, strongyloxeas and tylostyles. Acanthostyles are typical of the sponge order Poecilosclerida, styles are ubiquitous, while strongyloxeas and tylostyles are very common in Hadromerida. Tylostyles (Fig. 2d) were present in the digestive apparatus of *I. dolii*. In this chiton species, spongivory seems to be clear, as is for a not monophagic diet.

Strict spongivorous diet was previously reported in literature only for two Atlantic deep sea chiton species: *Hanleya hanleyi* (Bean, 1844), living also in the Mediterranean sea, and the closely related species *H. nagelfar* (Lovén, 1846) (Warén & Klitgaard, 1991); at present, this record constitutes the only one to exhaustively documented chiton monophagy. Although spongivory is clear in the two deep water Mediterranean chitons herein studied, its relative importance vs other food sources has still to be quantified.

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## REFERENCES

- HYMAN L.H., 1967. The Invertebrates, Volume 6, Mollusca 1. New York, McGraw-Hill Book Co.: 792 pp.
- LANGER P.D., 1983. Diet analysis for three subtidal coexisting chiton species from the Northwestern Atlantic (Mollusca: Polyplacophora). *The Veliger*, 25 (4): 370-377.
- SIRENKO B.I., 2001. Deep-sea chitons (Mollusca, Polyplacophora) from sunken wood off New Caledonia and Vanuatu. *Mémoires du Muséum National d'Histoire Naturelle*, 185: 39-71.
- WARÉN A. & KLITGAARD A., 1991. *Hanleya nagelfar*, a sponge-feeding ecotype of *H. hanleyi* or a distinct species of chiton? *Opbelia*, 34 (1): 51-70.
- WOLFF T., 1979. Macrofaunal utilization of plant remains in the deep sea. *Sarsia*, 64: 117-136.