SUBSTRATE SELECTION OF TWO SEA CUCUMBER SPECIES AND THEIR EPITHELIAL ALGAE COMMUNITIES

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Abstract: Two species of sea cucumber (*Isostichopus badionotus* and *Holothuria mexicana*) occur in Discovery Bay, Jamaica, and some individuals have macroalgal communities growing on them. We hypothesized that habitat differentiation may allow these two species to exist on similar resources, and we also tested for patterns in body algae growth. We found little evidence of habitat differentiation, but macroalgae was found almost exclusively on *H. mexicana*. There was no relationship between macroalgae coverage and habitat type. It is possible that differences in epithelial characteristics between the two sea cucumber species result in a disparity in suitability for algal colonization and growth.

Key words: Holothuria mexicana, Isostichopus badionotus, *macroalgae, niche differentiation*

INTRODUCTION

Two species of diurnally active holothurians occur in the backreef lagoon at Discovery Bay, Jamaica. Both species, *Holothuria mexicana* (donkey dung) and *Isostichopus badionotus* (three-rowed), are deposit feeders in shallow water (Hammond 1982). However, little else is known about the ecology of either species. Though *H. mexicana* and *I. badionotus* do not occupy separate temporal or food niches, it is possible that there is some other form of ecological differentiation between the two species. For example, these two species of sea cucumber may occupy different substrates and so be able to coexist in the same environment.

Casual observations revealed that some sea cucumbers have macroalgae growing on them. To our knowledge, no studies have examined this phenomenon on sea cucumbers, though this association has been identified in other marine organisms (e.g., Ballantine et al. (2001) identified 30 species of macroalgae growing on spotted scorpionfish, *Scorpaena plumieri*). We tested for interspecific and habitat-related patterns in the macroalgal communities associated with *H. mexicana* and *I. badionotus*.

METHODS

We sampled the sea cucumber community in the backreef lagoon at Discovery Bay, Jamaica on 24 - 26 February 2004. For all sea cucumbers located along three 150 m transects, we recorded species, percent macroalgae coverage on dorsal half of body, and depth at which the cucumber was found. We estimated the percent of four different substrate types in each cucumber's habitat (a 1 m radius circle around the cucumber); substrate categories were bare sand, seagrass, rock/coral, and macroalgae. We haphazardly selected nine sea cucumbers with percent algal coverage ranging from 5 to 80%, and identified the epithelial macroalgal species on each.

RESULTS

The substrate around *H. mexicana* consisted of a significantly higher percentage of rock/coral than that around *I. badionotus* ($t = 2.03$, $df = 34$, $P = 0.05$). Amounts of other substrate types did not differ between the two species (sand: $t = -1.4$, $df = 34$, $P = 0.17$; grass: $t = -0.28$, $df = 34$, $P = 0.78$; macroalgae: $t = 0.19$, $df = 34$, $P = 0.85$; Fig. 1).

Sixteen of 19 *H. mexicana* had some macroalgae growth on the body (mean coverage of all 19 = 27%; range 0 - 95%), while only one of 17 *I. badionotus* showed algae growth (5% coverage on this individual). For *H. mexicana*, percent of body algal coverage was not correlated with depth (r = 0.04) or percent of macroalgae in the surrounding substrate (r = -0.06). Seven of ten macroalgae species identified were found on multiple cucumbers (Table 1). Macroalgal species richness on an individual cucumber ranged from two to six.

Table 1. Species and frequency of occurrence of macroalgae growing on nine cucumbers examined (eight *H. mexicana* and one *I. badionotus*). Asterisk (*) denotes algal species found on both sea cucumber species; all other species were found only on *H. mexicana*.

Species	Occurrence (# cucumbers)
Laurencia intricata	8*
Dictyota cervicornis	6
Lobophora variegata	3
Hypnea valentiae	2*
Laurencia filifornis	2
Cladophora prolifera	2
Polysiphonia sp.	2
Ceramium sp.	1
Gelidiella acerosa	1
Amphiroa fragilissima	1

DISCUSSION

Mean percent cover of rock/coral was significantly higher for habitats in which *I. badionotus* were found than for *H. mexicana* habitats; however, this substrate type was only a small component of the overall habitat substrate composition for both species. Furthermore, there was substantial overlap in the ranges of habitat

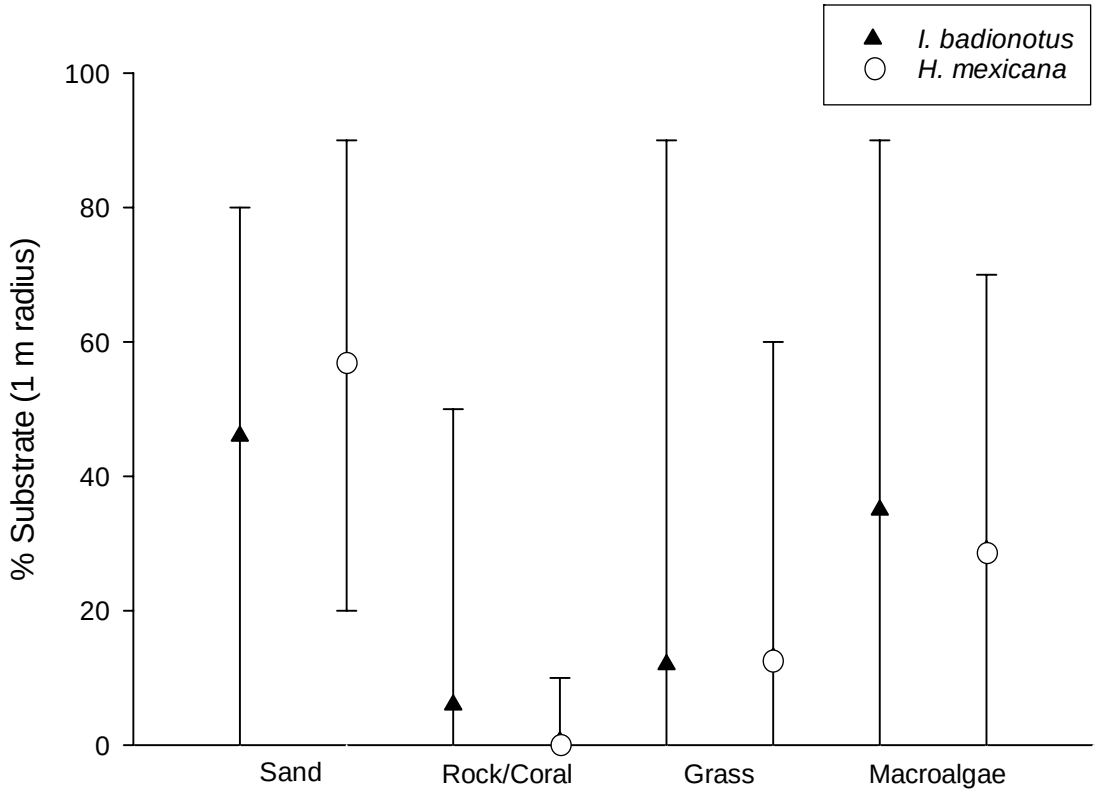

Figure 1. Mean microhabitat composition in a 1 m radius circle around each sea cucumber (circles and triangles represent means; bars represent maximum and minimum). *H. mexicana*: n = 19; *I. badionotus*: n = 17.

types in which the two species were found (Fig. 1). Thus, *H. mexicana* and *I. badionotus* did not differ in their microhabitat distributions, suggesting that there is no niche partitioning by habitat type between these two species. Also, it is unlikely that the two species have temporal or food resource niche partitioning, because they are both primarily nocturnal feeders and both ingest sediment (Hammond 1982). Because we found no evidence for niche partitioning, it is possible that resources for sea cucumbers at Discovery Bay are not limiting, and the populations are instead regulated by other mechanisms such as predation.

A majority of *H. mexicana* had algal communities growing on them. In contrast, algae were only found on a single *I. badionotus*, suggesting that there is some mechanism preventing algal colonization and/or growth on *I. badionotus.* Many fish possess a mucopolysaccharide layer on their epithelial cells that prevents algal growth, though scorpionfish harbor a high diversity of macroalgae species, which may enhance their cryptic appearance (Ballantine et al. 2001). It seems that a similar range of responses to algal growth exists in sea cucumbers. Conceivably, *I. badionotus* produces a compound that limits algal growth, while *H. mexicana* may benefit from improved camouflage. Future studies could compare epithelial characteristics of the two sea cucumber species to determine if this is the case. Furthermore, potential costs and benefits of algal growth to sea cucumbers should be examined.

The community of algae growing on the sea cucumbers was surprisingly diverse. Clearly, numerous species are capable of colonizing and growing on sea cucumbers, though we found a wide range of occurrence frequency: the most common macroalgae species was found on eight of nine cucumbers, while three species were found on only one of nine. Further studies could examine whether sea cucumber algae communities are a reflection of the surrounding algae community (i.e., whether relative abundances of algae species are similar on cucumbers and surrounding substrate), or if there are characteristics of certain algae species that are conducive to growth on sea cucumbers. For example, algal species that are commonly found on loose rocks or coral rubble may be better able to grow on sea cucumbers, which offer a superficially similar substrate. Also, it is possible that various successional stages of algae communities found on sea cucumbers contribute to the diversity of algae observed. This sea cucumber-macroalgae system is an unexplored relationship and merits further study.

LITERATURE CITED

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