GRAZER SELECTIVITY FOR *THALLASIA* BLADES ACROSS A NATURAL GRADIENT OF EPIBIOTIC COVER

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Abstract. Past studies suggest that parrotfishes and sea urchins grazing on *Thallasia testudinum* gain their primary nutritive benefit from epibiota and therefore selectively feed on *Thallasia* blades with high epibiotic cover. We tested the hypothesis that grazers exhibit differential selection for leaves with varying levels of epibiotic cover. We found no significant preference of grazers for blades with varying degrees of epibiotic growth. This finding indicates that grazers do not feed selectively, and suggests that grazers may gain a significant nutrient reward from the *Thallasia* host as well as from the epibiotic community. Grazers may best satisfy their nutrient requirements by feeding on leaves with varying levels of epibiotic cover and may at the same time minimize energy costs of blade selectivity.

INTRODUCTION

Previous studies have suggested that *Thalassia testudinum* grazers benefit primarily from the ingestion of epibiota on the *Thalassia* blade, rather than the blade itself. Manipulation experiments, such as blade inversion and blade coloration have shown that grazers are selective for blades with high epibiont load (Levesque and Stewart 1995, Berry et al. 1994). Both parrotfishes (Scaridae) and sea urchins digest only the *Thallasia* blade cell contents and epibiota. They cannot break down *Thallasia* leaf structure since they lack the ability to digest cellulose (Ogden 1980). Studies on temperate sea urchins grazing on seagrass showed that sea grass accounted for less than ten percent of their adult biomass (Kikuchi 1980). In an isotopic study of Florida sea grass beds, $^{13}C/^{12}C$ ratios for herbivorous fishes and other fauna associated with seagrass beds resembled the isotopic ratios of epiphytes, particulates, and sediments, and did not resemble the isotopic values of the *Syringodium filiforme* seagrass (Fry 1984). Together, these studies suggest that parrotfishes and sea urchins grazing on *Thallasia* fulfill their nutritive requirements almost entirely from epibiota and therefore select blades with higher epibiotic cover.

Both the abundance of *Thallasia* blades with high epibiotic cover and grazing evidence on blades with low epibiotic cover (pers. obs.) led us to suspect that parrotfishes and sea urchins may derive significant benefits from *Thallasia* digestion. There may be some trade off between epibiotic load and nutritive quality of the *Thallasia* blade. Tomasko and Lapointe (1991) found that *Thallasia testinudum* in areas with higher epibiont growth rates had lower shoot density, rhizome growth rates, leaf area indices, and blade turnover rates. Blades hosting a high epibiotic load may also have a low nutritional value due to competition for light and nutrients with the epibiotic communities.

We used a natural gradient of blade epibiotic load to test the hypothesis that grazers would exhibit differential selection for leaves with varying levels of epibiotic cover. If grazers benefit primarily from epibiotic communities and gain little benefit from *Thallasia*, we expected to see a strong preference for blades with high epibiotic load. If grazers gain significant benefits from *Thallasia*, and a trade off exists between epibiotic load and nutritive quality of the blades, we expected to see either an overall lack of selectivity or a preference for blades with intermediate epibiotic cover.

METHODS

We collected over 300 *Thallasia* blades from dense beds in the backreef adjacent to Discovery Bay Marine Laboratory, Jamaica, from 1400-1500 on 21 Feb. 1995. Blades were separated into three classes according to a visual estimation of epibiotic cover: high epibiotic cover (>66% cover on both sides of blades; thick, multiple-layer growth), medium epibiotic cover (33-66% cover; only one layer of growth), and low epibiotic cover (<33% cover; one thin layer of growth). Blades were stored overnight in running sea water.

Five *Thallasia* blades of a single epibiotic cover class (high, medium, low) were placed on a single clothespin, and two clothespins of the same epibiotic cover class were anchored to a single bolt. We prepared nine bolts for each of the three epibiotic cover classes (high, medium, and low) for a total of 90 blades per class.

We placed the bolts in the west backreef along a transect approximately 30 m from shore in 1.5 m of water. At nine points along the transect, spaced approximately 3 meters apart, we placed a floating marker and one bolt from each of the three epibiotic cover classes. The three bolts at each point were spaced about 20 cm apart. All points were surrounded by thick *Thallasia* growth. The *Thallasia* blades were left out for 24 hours, starting 1000, 22 Feb.

Grazing damage was quantified in terms of square centimeters leaf area removed. We visually distinguished parrotfish damage from sea urchin damage. We considered the mean leaf area removed from the ten blades on each bolt as an independent replicate for Kruskal-Wallis statistical analysis.

RESULTS

Of the 250 *Thallasia* blades recovered (20 blades were lost) 179 had partial blade removal due to grazing. Parrotfish damage was evident on 140 blades; sea urchin damage was evident on 50 blades.

The mean amount of blade removal by parrotfish was highest for blades with high epibiont load, and roughly equal for medium and low epibiotic cover (fig. 1), though this trend was not significant (KW= 5.091, df=2, p= 0.078). Sea urchins exhibited no apparent preference between the three epibiotic cover classes (KW=1.153, df=2, p=0.562). There was no difference in total grazing damage between the three epibiotic cover classes (KW=0.811, df=2, p=0.667).

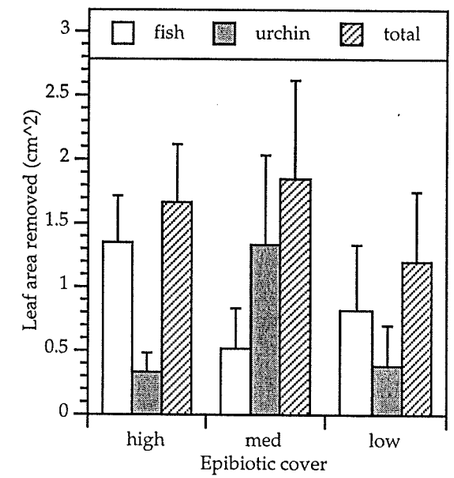

FIG. 1. Mean leaf area eaten by parrotfishes, sea urchins, and total grazers for *Thallasia* blades with high, medium and low epibiotic cover (error bars show SE).

DISCUSSION

Though we found a slight trend in parrot fish preference for leaves with high epibiotic cover, the lack of significant preference of parrot fishes, sea urchins and total grazers for blades with varying degrees of epibiotic cover indicates that grazers do not feed selectively. Our finding conflicts with past studies (i.e., blade inversion and blade coloration) which indicate that grazers selectively feed on *Thallasia* leaves with high epibiotic growth (Levesque and Stewart 1995, Berry et al. 1994). Our data suggests that both the epibiotic communities and the host *Thallasia* blades may offer significant nutrient rewards.

If grazers benefit from both epibiota and *Thallasia*, they may pursue one of two foraging strategies to satisfy their nutrient requirements. Grazers may feed selectively on leaves with moderate epibiotic cover, presumably maximizing nutrient uptake from both the leaf and the epibiota. Alternatively, grazers may feed on leaves with a range of epibiotic cover, thereby minimizing energy costs of grazing selectivity. Our results seem to support the latter prediction, though future study should examine the relationship of *Thallasia* and epibiota nutrient contents to grazer foraging behavior. More specifically, future study should investigate (1) the nutrient content of leaves with varying degrees of epibiotic growth, (2) the nutrient requirements of parrotfishes and sea urchins, and (3) the grazers' capacity to digest and take up nutrients from epibiota relative to their capacity to digest and take up nutrients from *Thallasia*. These studies may help to explain the apparent lack of selectivity in the foraging behavior of parrotfishes and sea urchins.

LITERATURE CITED

Berry, M. E., D. Gardella, A. Swanson. 1994. The importance of visual cues in Scaridae selection of *Thallassia testudinum* blades. *In* J. Bykowski, ed. Dartmouth Tropical Studies. Hanover, NH, USA

Fry, B. 1984. $^{13}C/^{12}C$ ratios and the trophic importance of algae in Florida *Syrmojadium filiforme* seagrass meadows. Marine Biology 29: 11-19.

Kikuchi, T. 1980. Faunal Relationships in temperate seagrass beds. Pages 153-172 *in* R. C. Phillips and C. P. McRay, ed. Handbook of seagrass biology. Garland STPM Press, New York.

Ogden, J. C. 1980. Faunal relationships in Caribbean seagrass beds. Pages 172-198 *in* R. C. Phillips and C. P. McRay, ed. Handbook of seagrass biology. Garland STPM Press, New York.

Stewart, I. J., V. R. Levesque. 1995. Grazer selection for inverted *Thallasia testudinum* blades. Dartmouth FSP 95. pages 147-149 *in* C. D. Wray, ed. Dartmouth Tropical Studies. Hanover, NH, USA

Tomasko, D. A., B. Lapointe. 1991. Productivity and biomass of *Thallasia testudinum* as related to water column nutrient availability and epiphyte levels. Mar. Ecol. Prog. Ser. 75:9-17.