Stimulation of filter feeding by amino acids in three porcelain crab species: *Petrolisthes cinctipes, Petrolisthes eriomerus,* and *Pachycheles rudis*

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Introduction

Petrolisthes cinctipes, a species of porcelain crab, is commonly found in the higher to mid-intertidal zones of the rocky shores of Oregon (Wicksten, 1973). *Petrolisthes eriomerus* and *Pachycheles rudis*, the other two species of porcelain crab found on the Oregon coast can be found in the low intertidal zone. All three species can be found under rocks and among mussels in mussel beds (Sept, 1999). The three species of porcelain crab filter feed, fanning plankton and detritus (*Petrolisthes cinctipes* and *Pachycheles rudis*) from the water, or pelagic diatoms, benthic diatoms, and green algal filaments from the water (*Petrolisthes eriomerus*) (MagGinite, 1937; Wicksten, 1973).

The mechanics of filter feeding in porcelain crabs has been thoroughly documented by Wicksten (1973). Food particles can be trapped by alternately flexing the endopodites of the third maxillapeds. The food particles are then removed from the setae on the third maxillapeds by the setose ends of the second maxillapeds. Food particles are then selected and sorted by the inner mouth parts.

Little research has been reported on compounds promoting feeding behavior in porcelain crabs. L-tyrosine has been shown to elicit a feeding response in *Petrolisthes cinctipes*, as have other amino acids. As there are no particles in the water when testing an amino acid, chemoreception of small compounds must stimulate the feeding response (Hartman et al., 1977). I hypothesize that the stimulation of the feeding response in *Petrolisthes cinctipes, Petrolisthes eriomerus,* and *Pachycheles rudis* will differ in response to various amino acids because of the their location in the intertidal.

Materials and Methods

Petrolisthes cinctipes was collected at Fossil Point, Charleston, Oregon. *Petrolisthes eriomerus* and *Pachycheles rudis* were collected at North Cove, Cape Arago, Oregon. Crabs were kept in a plastic tub with rocks, in a sea water table with flow through sea water. The crabs were starved for seven days prior to the experiment. The filter feeding response of each species was individually tested against glutamine, glycine, arginine, glutamic acid, glycyl glycine, aspartic acid, and serine (*Petrolisthes cinctipes* was not tested against glycyl glycin or serine due to a lack of solution). Each species was placed in a large finger bowl filled with 500 mL of filtered sea water and rocks, to provide a natural substrate for the animals to grip. Five mL of the 0.1 M amino acid was pipetted into the bowl and the feeding response of the crabs was observed

for five minutes. This procedure was repeated for each amino acid and the water was changed in between each amino acid test. A feeding response in porcelain crabs is defined as extending the third maxillapeds and fanning them through the water to extract minute food particles (Kropp, 1981).

Results

Petrolisthes cinctipes, Petrolisthes eriomerus, and *Pachycheles rudis* all responded, by filter feeding, differently to the seven amino acids (Table 1). The most stimulatory amino acids for *Petrolisthes cinctipes* were glycine then glutamine, arginine, and glutamic acid equally (80% of the crabs responded; Table 2). *Petrolisthes cinctipes* showed no feeding response to aspartic acid; glycyl-glycine and serine were not available to test. *Petrolisthes eriomerus* favored glutamine > glycine > glutamic acid > arginine > glycyl-glycine > aspartic acid. *Petrolisthes eriomerus* showed no feeding response to serine. *Pachycheles rudis* preferred glycine, glutamic acid, aspartic acid, and serine equally (100% of the crabs responded; Table 2), and then glycyl-glycine > arginine > glutamine.

Discussion

Petrolisthes cinctipes, Petrolisthes eriomerus, and *Pachycheles rudis* are all stimulated to filter feed by amino acids. The three species of porcelain crab demonstrated different responses to the various amino acids (Table 1 and 2), supporting my hypothesis. Both *Petrolisthes cinctipes* and *Pachycheles rudis* preferred glycine, while *Petrolisthes eriomerus* favored glutamine. Hartman et al. (1977) found that 77% of the *Petrolisthes cinctipes* that were tested were stimulated to feed with the introduction of glycine. However, he noted that the response of *Petrolisthes cinctipes* to glycine decreased as the concentration decreased. This suggests that the amino acids, at least for glycine, have to be at a concentration of at least 10^-3 M for chemoreception to occur. I think it is fair to draw the conclusion that *Petrolisthes eriomerus* and *Pachycheles rudis* would react the same way to low concentrations (< 10^-3 M) of amino acids.

For further investigation into the stimulation of filter feeding in the three species of porcelain crab, a study needs to be conducted testing the response to various concentrations of amino acids. Granted a study has already been completed with *Petrolisthes cinctipes*, information is lacking with concern to *Petrolisthes eriomerus* and *Pachycheles rudis*. It would be interesting to find out if those two species respond in a similar manner to low concentrations

(< 10^-3 M) of amino acids. It would also be interesting to test the porcelain crabs against a larger selection of amino acids; perhaps a pattern would evolve.

References

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Table 1: The feeding response of the three species of porcelain crab in reaction to the introduction of seven amino acids.

	Glutamine	Glycine	Arginine	Glutamic Acid	Glycyl-Glycine	Aspartic Acid	Serine
Petrolisthes cinctipes (5)*	4	5	4	4	N/A**	0	N/A**
Petrolisthes eriomerus (11)*	6	4	2	3	2	1	0
Pachycheles rudis (7)*	2	7	5	7	6	7	7

* Numbers in parenthesize correspond to sample size.

** Glyclyl-Glycin and Serine were not available for testing of *Petrolisthes cinctipes.*

Table 2: The percentage of response to introduced amino acids by the three species of porcelain crab.

	Glutamine	Glycine	Arginine	Glutamic Acid	Glycyl-Glycine	Aspartic Acid	Serine
Petrolisthes cinctipes	80%	100%	80%	80%	N/A*	0%	N/A*
Petrolisthes erimerus	55%	37%	18%	27%	18%	9%	0%
Pachycheles rudis	29%	100%	71%	100%	86%	100%	100%

* Glycyl-Glycin and Serine were not available for testing of *Petrolisthes cinctipes.*