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Feeding by larvae of *Strongylocentrotus intermedius* on *Cochlodinium polykrikoides*

Chang-Hoon Lee
Red Tide Research Center, Kunsan National University

Introduction

Strongylocentrotus intermedius is harvested commercially in Korea as an important source of roe. The feeding physiology or ecological function of *S. intermedius* larvae as a component of plankton community are not understood comprehensively yet. The red-tide dinoflagellate, *Cochlodinium polykrikoides* is known as the most harmful species in Korean coasts. A number of studies were conducted on various aspects of *C. polykrikoides*, such as biological and ecological characteristics, toxicity, removal by chemicals, clays, microorganisms, etc. Most of studies were based on the harmful effect of *C. polykrikoides*. However many evidences (Lee, 1996; Kim et al., 2000) tells that the harmful effect of *C. polykrikoides* is not by the toxicity from cellular metabolites but by the effects of high concentration itself. In other words, *C. polykrikoides* can play a positive role in the ecosystem if the concentration is not extremely high. Thus, the purpose of this study was established to find the positive role of *C. polykrikoides* as a food source for larvae of sea urchin, *S. intermedius*.

Materials and Methods

Experiments were conducted with 15-days old *Strongylocentrotus intermedius* larvae. Six different densities of prey-predator combination were prepared. After 96 hrs' feeding experiment, 10-ml aliquots were taken from each bottle and fixed with 5% Lugol's solution for enumeration of prey and predator. The abundance of prey and predator were determined by counting all or more than 400 cells in 1-ml SRC. Clearance rate and ingestion rate were calculated using the equation of Frost (1972). The functional response of *S. intermedius* larvae to the concentration of *C. polykrikoides* was determined by fitting ingestion rate data to a Michaelis-Menten equation.

Results and Discussion

Clearance rate of *S. intermedius* larvae ranged from 2.3 to 17.7 ml/larva/hr. There were significant differences in clearance rates among different prey concentrations ($P<0.001$). Clearance rate was highest when prey concentration was lowest. Clearance rate of *S. intermedius* larvae on *C. polykrikoides* is within the ranges reported for sea urchin larvae from previous studies (Rassoulzadegan et al., 1984; Fenaux et al., 1985). Ingestion rate of *S. intermedius* larvae ranged from 13.1 to 121.6 ngC/larva/d. There were significant differences in ingestion rates among different prey concentrations ($P<0.001$). Ingestion rate was lowest when prey concentration was lowest. Ingestion rate increased rapidly ($P<0.001$) when prey concentration increased below ca. 600 cells/ml, and slightly increased at higher prey concentrations. The highest ingestion rate was found when the mean prey concentration was 1767 cells/ml. There were no significant differences in ingestion rates when prey concentration was between 655 and 2720 cells/ml ($P=0.070$). Maximum ingestion rate (I_{max}) was estimated to be 131 ngC/larva/d. The I_{max} of *S. intermedius* larvae on *C. polykrikoides* is higher than 69 ngC/larva/d of mussel larvae *Mytilus galloprovincialis* (Jeong et al., submitted), but lower than 234 ngC/cell/d of ciliate *Strombidinopsis* sp. (Jeong et al., 1999).

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