

Filtration of Red-Tide Dinoflagellates by Juvenile Purple Clam, *Saxidomus purpuratus*

Chang-Hoon Lee, Jin-Woo Choi, Yong-Suk Choi¹, Ee-Yung Chung²

South Sea Institute, Korea Ocean Research and Development Institute
¹West Sea Fisheries Research Institute, NFRDI
²School of Marine Life Science, Kunsan National University

Introduction

Although there were many studies on the effects of red tide dinoflagellates (RTDs) on shellfish populations (Luckenbach *et al.*, 1993; Li *et al.*, 2001), most studies focused on the acutely adverse effects of RTDs during severe red tide events. Effects not lethal to shellfish and not apparent during the red tide such as physiological dysfunction, reduced population growth, reproductive defects were not comprehensively understood yet. Therefore, The purpose of this study was established to know the change in filtration potential of a bivalve when fed on RTD as food species. Clearance rate and ingestion rate of the juvenile purple clam, *Saxidomus purpuratus* were measured by laboratory experiments using unialgal cultures of 11 RTD species (*Prorocentrum minimum*, *P. triestinum*, *Amphidinium carterae*, *Gymnodinium impudicum*, *Cochlodinium polykrikoides*, *Alexandrium catenella*, *A. affine*, *Scrippsiella trochoidea*, *G. catenatum*, *Akashiwo sanguinea*, *Lingulodinium polyedrum*) plus a standard food (*Isochrysis galbana*). We compared the feeding parameters among different algal species, and discussed the potential impacts of red tide (including both severe and mild cases) on feeding physiology of *S. purpuratus*.

Materials and Methods

One-year old juveniles (5-6 mm in shell length, 1.3-1.5 mg in flesh dry weight) of *Saxidomus purpuratus* reared at Taean Marine Hatchery, NFRDI were used for the experiments. RTDs were grown at 20°C with f/2 medium (Guillard and Rhyther, 1962) without silicate, with continuous illumination of 100 mE/m²/sec provided by cool-white fluorescent lights.

Clearance rate (CR) and ingestion rate (IR) was measured by indirect method with 6 different algal concentrations for each food species. Algal concentrations before and after the feeding experiments were determined by counting in a Sedgwick-Rafter Counting chamber. CR and IR were calculated using the equation of Coughlan (1969). Functional responses were obtained for each RTD by fitting CR and IR data to an exponential (for CR, Riisgård, 1988) or the Michaelis-Menten (for IR, Båmstedt et al., 2000) equation.

Results and Discussion

In general, the CR and IR of juvenile *S. purpuratus* fed on RTDs were lower than those fed on standard food (*I. galbana*). CR and IR were not affected by either the size of food species or the toxicity of RTDs. Higher CR and IR were found when food was even a toxic RTD, *Amphidinium carterae*. But IR was greatly reduced when the foods were chain-forming RTDs (*Alexandrium affine*, *A. catenella*, *Cochlodinium polykrikoides*, *Gymnodinium impudicum*, *G. catenatum*). Clearance rate began to decrease at substantially lower concentrations of RTDs than those could be found in the field during severe red tides. The maximum ingestion rate was expected to decrease to 2-25% of standard condition during red tides. According to the duration of red tide and dominant species of RTDs, growth rate of *S. purpuratus* may be adversely affected, even in mild cases.

References

- Båmstedt U. et al. 2000. Feeding. pp. 297-399. In: R. P. Harris et al. (eds.) *Zooplankton Methodology Manual*. Academic Press. London, UK.
- Coughlan, J. 1969. The estimation of filtering rate from the clearance of suspensions. *Mar. Biol.*, 1: 356-358.
- Guillard, R.R.L. and J.H. Ryther. 1962. Studies of marine planktonic diatoms. I. *Cyclotella nana* Hustedt and *Detonula confervacea* (Cleve) Grun. *Can. J. Microbiol.*, 8: 229-239.
- Riisgård, H.U. 1988. Feeding rates in hard clam (*Mercenaria mercenaria*) veliger larvae as a function of algal (*Isochrysis galbana*) concentration. *J. Shellfish Res.*, 7: 377-380.
- Li, S.C. et al. 2001. Feeding and absorption of the toxic dinoflagellate *Alexandrium tamarense* by two marine bivalves from the South China Sea. *Mar. Biol.*, 139: 617-624.
- Luckenbach, M.W. et al. 1993. Effects of two bloom-forming dinoflagellates, *Prorocentrum minimum* and *Gyrodinium uncatenum*, on the growth and survival of the eastern oyster, *Crassostrea virginica* (Gmelin 1791). *J. Shellfish Res.*, 12: 411-415.