

Proceedings of the Concluding Workshop on Coral Reef Studies, Kochi, November 1993

Bacterial Growth in Coral Reef Seawater Supplemented with Coral Mucus and Ammonium

FUKAMI Kimio

Laboratory of Aquatic Environmental Science, Kochi University, Nankoku, Kochi 783, Japan

Coral mucus consists mainly of polysaccharide and protein (Meikle et al., 1988), and during the series of our observation and experiments in Great Barrier Reef, it was suggested that mucus released from coral was a good growth substrate for bacteria. However, very little information is available on the effectiveness of coral mucus for bacterial growth (Vacelet and Thomassin, 1991). As coral mucus contains relatively high amount of refractory N-acetyl glucosamine (Meikle et al., 1988), it would be some possibility that nitrogen in mucus is not ready to be utilized by microorganisms. In this study, bacterial growth in seawater with supplementation of mucus and/or ammonium as nitrogen source was followed to assess the substrate values of mucus for bacterial growth.

Materials and Methods

Seawater sample was collected from a station in the lagoon of Heron Island on October 3, 1992. Surface water collected and brought back to the laboratory was distributed into four 400ml aliquots. Mucus from *Acropora nobilis*, which seemed to produce and release much amount of mucus into seawater when it was kept in a bucket (Fukami, 1994), was collected by using a syringe. After well-mixing in a bottle, 40 ml of mucus was added into the first aliquot. The second one was supplemented with 36 μM of NH_4Cl . To the third one was added similar amount of both mucus and NH_4Cl . The last aliquot was without any supplementation as blank. These 4 systems were incubated at room temperature (ca. 25°C), and a part of seawater was withdrawn at some time intervals for up to 48 h from each incubation systems. Bacterial abundances in the samples were determined by DAPI-stained direct count with epifluorescence microscopy.

Results and Discussion

Fluctuations of bacterial numbers in 4 systems were illustrated in Fig. 1. Bacterial abundances in unsupplemented seawater increased from initial density of 8×10^5 cells/ml to 1.5×10^6 cells/ml in 48 h incubation period. When either mucus or ammonium was supplied into seawater, bacteria showed a slight growth, the final cell densities were 1.8×10^6 and 1.4×10^6 cells/ml, respectively. On the other hand, bacterial abundance increased at most when seawater was enriched with both mucus and ammonium. The final cell yield of bacteria was 2.5×10^6 cells/ml. These results indicate that mucus is functioning as carbon source for bacterial growth substrate, however, nitrogen should be enriched for better growth. Nevertheless, increase in bacterial abundances was not so large than expected prior to experiments. In oligotrophic seawater of coral reef area, not only nitrogen but also phosphorus are limited (Miyoshi, personal communication). Moreover, as we incubated natural seawater without any filtration before

starting the experiments, grazers such as heterotrophic nanoflagellates and ciliates would contaminate in cultures. Vacelet and Thomassin (1991) reported the changes in microbial communities during the incubation of seawater enriched with mucus released from corals of several different species and indicated that growing bacteria were consumed by eukaryotic grazers. The reason why the number of bacteria did not increase so much in the present study has not clarified yet but it was probably due to the shortage of phosphorus and /or existence of grazers.

Although the bacterial abundance in seawater enriched with mucus and ammonium did not change so drastically, bacterial community structure changed obviously when observed under epifluorescence microscopy. That is, after 24 h most bacteria shifted to be of large cell size, with the length of 2-3 μm and the width of 1 μm indicating the increase in bacterial biomass. This result suggests that mucus has a selective role for microbial communities and some special flora may be structured on mucus detritus.

References

- FUKAMI, K., J. G. GREENWOOD and N. IWASAKI, 1995. Utilization of coral mucus by Crustacea living in reef. *Bull. Mar. Sci. Fish., Kochi Univ.*, **14**, 37-38.
- MEIKLE, P., G. N. RICHARDS and D. YELLOWLEES, 1988. Structural investigations on the mucus from six species of coral. *Mar. Biol.*, **99**, 187-193.
- VACELET, E. and B. A. THOMASSIN, 1991. Microbial utilization of coral mucus in long term *in situ* incubation over a coral reef. *Hydrobiologia*, **211**, 19-32.

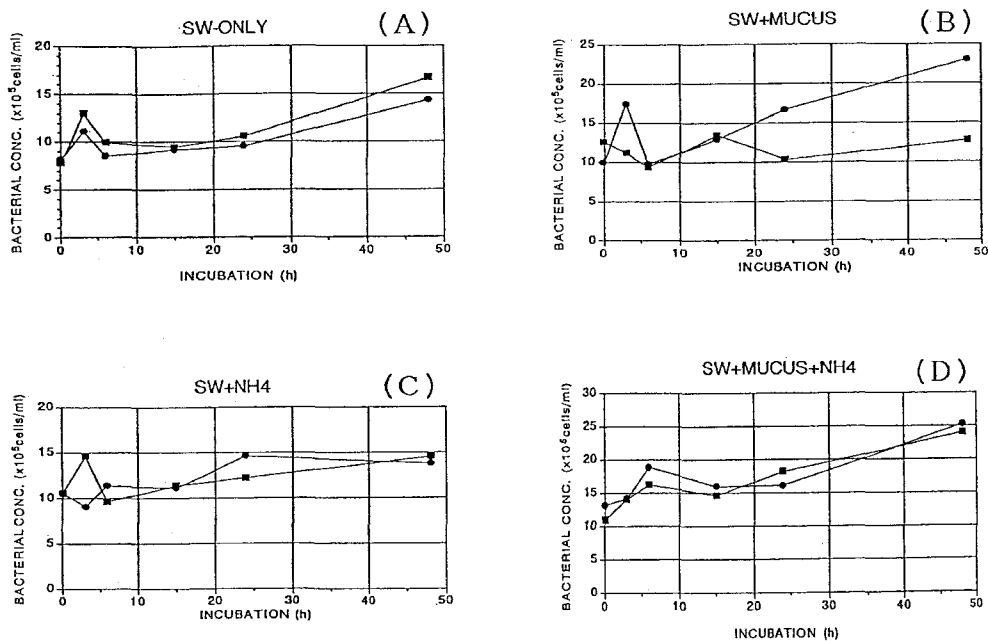


Fig. 1. Increases in bacterial abundances incubated in seawater enriched with coral mucus (B), 36 μM of NH_4Cl (C), and both mucus and NH_4Cl (D). Changes in unsupplemented seawater was used as blank (A). Circles and squares indicate duplicate experiments.

(Received 30 November, 1994)