Cloning and sequencing of a red-soil responsive gene from the scleractinian coral *Pocillopora damicornis*

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Abstract

Coral reefs are among the most diverse ecosystems in the world, however, environmental condition of coral reefs is getting worse in the last decades. Deterioration of water quality caused by human activities has damaged a variety of organisms inhabiting coral reefs. Specifically, depletion of scleractinian corals (Phylum Cnidaria, Class Anthozoa) is a serious problem because they are major components of coral reef ecosystems. In Okinawa Prefecture, Japan, red soil discharged into the sea has been a major factor damaging corals though the mechanism how red soil adversely affects them remained to be resolved. In order to shed light on the mechanism, we conducted the differential display analysis and identified nine candidate clones supposed to be red soil-responsive genes from the scleractinian coral *Pocillopora damicornis* (Hashimoto et al. 2004). One of the clones, pPd9-1, had high similarity with GRP78 that is a member of HSP70 gene family. In the present study, full length cDNA cloning was carried out to characterize the whole sequence of pPd9-1. The cloned cDNA (designated as GRP78-like gene) was 2,467 base pair (bp) long, including an open reading frame of 2,010 bp. A GRP78 homologue of *Aplysia* (Phylum Mollusca, Class Gastropoda) had the highest amino acid sequence homology (78.2%) with the GRP78-like gene. The GRP78-like gene contains a hydrophobic segment at the N terminus and the endoplasmic reticulum (ER) retention signal tetrapeptide at the C terminus, indicating that it should be an ER-resident protein. RT-PCR analysis revealed that expression of the GRP78-like gene was up-regulated by red soil (ca. 2.0fold compared to control) and heat shock (ca. 10fold). Red soil might cause ER dysfunction in coral cells just like heat shock does. Red soil discharged into the sea contributes to water turbidity which reduces light penetration and photosynthesis by algal symbionts in corals. Red soil in water column deposits onto corals, therefore corals need extra energy to remove the soil from their surface. These two explanations have been considered as major mechanisms of the mortality of corals caused by red soil, however, the present study strongly indicates that red soil also needs to be studied as an adverse factor in terms of cell physiology.