Enhancement of bleaching stress tolerance in coral endosymbiotic microalgae using genetics

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Abstract

Frequent and persistent high surface seawater temperature, often coupled with high light intensity, results in coral bleaching. Coral bleaching is caused by the exocytosis of endosymbiotic dinoflagellates due to overproduction of reactive oxygen species (ROS) in the symbionts. Strategies to reduce ROS production and enhance ROS scavenging efficiency in coral symbionts are crucial for preventing the collapse of coral reef ecosystems. However, cell physiology and genetics studies of coral symbionts have been hampered by the difficulty of cloning the symbionts. The present study presents a new method developed for cloning coral symbionts using a simple procedure. Experiments performed with two species of symbionts cloned from Turbinaria sp. revealed that high salinity activated endogenous tolerance against bleaching stress under high temperature (36 °C) and high light intensity (340 mol photon/m2/s). Pretreatment at 50 ppt salinity reduced the proportion of cells stained for ROS by 59% and 64% in the two species exposed to bleaching stress compared with those incubated at 30 ppt. These findings suggest that the genomes of coral symbionts have developed mechanisms for ameliorating damages caused by environmental stress through their evolution. The cloned symbionts were mutagenized using EMS and selected for tolerance against high temperature and high light stress. These mutants were characterized and fresh data in this regard will be presented in this symposium.