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Gene Expression Analysis for Corals / Zooxanthellae under High Seawater Temperature Stress

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Abstract : Clarifying symbiotic relationships is one of the most important theme for understanding the marine eco-system. Coral reef has been regarded as an important environmental resource. Coral holobiont composed by coral, symbiotic microalgae zooxanthellae, and bacteria have complexed relationship. Zooxanthellae mainly supply organic matter to the host corals through their photosynthetic activity. The symbiotic relationship is indispensable for corals but may easily collapses due to the rise of seawater temperature. However, the molecular mechanism how seawater temperature influences their relationships still remain unclear. In this study, the transcriptomic analysis has applied to elucidate the coral-zooxanthellae relationships under high seawater temperature stress. To observe reactions of corals and zooxanthellae against the rise of seawater temperature, meta-gene expression in coral have been analyzed. The branches from six different colonies of a stony coral, Acropora tenuis, were sampled at nine times by 2016 at two locations, Ishikawabaru and South of Sesoko Island, Okinawa, Japan. The mRNAs extracted from the branches including zooxanthellae were sequenced by illumina HiSeq. Gene Set Enrichment Analysis (GSEA) based on hyper geometric distribution was performed. The seawater temperature at 2016 summer was unusually high, which was caused by El Niño event, and the number of zooxanthellae in coral was decreased in August. GSEA derived the several specific genes expressed in A. tenuis under heat stress conditions. The upregulated genes under heat stress highly related with infection immunity. The downregulated genes significantly contained cell cycle related genes. Thu, it is considered that heat stress cause disorder in cell metabolism of A. tenuis, resulting in serious influence to coral holobiont.

Keywords : coral, symbiosis, thermal stress response, transcriptome analysis
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