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Session 1: Biodiversity in ecophysiological scales

Flexibility of cnidarian-zooxanthellae symbiosis and its implication for stress tolerance

Michio Hidaka
Faculty of Science, University of the Ryukyus

The bleaching of corals and other zooxanthellate cnidarians has had major impact on coral reef communities; it has changed species composition and resulted in extinction of some species in affected areas. If bleached cnidarians recover, they might change their algal partner and become associated with algal genotypes that are more stress tolerant (adaptive bleaching hypothesis). This may also reduce the diversity of cnidarian-zooxanthellae symbiotic systems. Thus coral bleaching has profound effects on biodiversity on coral reefs.

The objectives of our study were to investigate how flexible the symbiotic relationship between cnidarians and zooxanthellae might be and how differently zooxanthellae of different genotypes respond to environmental stresses. To study the stress response of genetically identical hosts harboring zooxanthellae of different genotypes, we established an experimental system using a jellyfish, *Cassiopea* sp. We infected clonal, aposymbiotic polyps (scyphistome stage) of *Cassiopea* sp. with zooxanthellae isolated from various hosts. Infection was successful and symbiotic association was established in six out of seven zooxanthellae genotypes. Polyps infected with algae from five hosts (Clade A, B, Cx2, D based on 18S or 28S rDNA RFLP) formed normal medusae by strobilation. We used newly formed medusae for stress experiments and measured photochemical efficiency *(Fv/Fm)*, as a measurement of damages to photosystem II, and release rate of zooxanthellae during the stress treatment and subsequent recovery period. Different genotypes of zooxanthellae within the genetically identical jellyfish suffered different degrees of damages to PSII when exposed to the same stress treatment. The genetically identical jellyfish harboring different zooxanthellae showed different rates of algal expulsion in response to the stress. The host tended to expel more zooxanthellae when the algae suffered severe PSII damage. The results suggest that the flexibility of cnidarian-zooxanthellae symbiosis is high but that the diversity of the symbiotic systems might decrease as they adapt to adverse environments.