Coral host responses to heat and sediment stress

July 26 2019

Pocillopora acuta, a common and widely distributed reef building corals in the greater Indo-Pacific region, is the species used for this study. Credit: National University of Singapore

NUS marine ecologists have discovered changes in the gene expression of corals subjected to short-term heat and sediment stress which provide critical insights for more effective reef management strategies.

Coral communities are facing greater environmental pressures due to global warming effects. Those located in coastal waters in close proximity to land are often exposed to other stressful conditions, such as increased sedimentation rates due to land-based activities. The ability of corals to respond to different environmental stress factors is still not clear. Although transcriptomics-based research focused on a single variable such as heat has improved understanding regarding the capacity of corals to respond to environmental changes, multiple co-occurring stressors in marine systems have been understudied.

Prof Peter Todd and Dr. Rosa Celia Poquita-Du from the Department of Biological Sciences, NUS have studied the impacts of two major stressors on corals (heat and sediment) extracted from three reef sites among the Southern Islands of Singapore. The study involved an ex situ experiment (~3 weeks), molecular lab work, and bioinformatics which took about a year to complete. They have discovered that exposure of Pocillopora acuta corals to short-term heat and sediment stress causes a significant change in their gene expression patterns. They found that heat stress is the main driver causing these changes in gene expression, rather than sediment stress. However, in the presence of both heat and sediment stressors, the combined effect is much larger than expected, indicating synergistic effects.

The researchers also found that a particular gene that is associated with cilium development responds specifically to combined stressors. Cilia are the small thread-like appendages on the coral that perform important functions (e.g. sediment rejection and feeding) and they are an essential component for coral survival. This finding suggests that the ability of the coral to continuously maintain its ciliary structures could be affected when heat stress is exacerbated by sedimentation.

Prof Todd said, "The available knowledge about gene functions in corals is presently very limited. The suite of genes responding to heat and

sediment reported in this work is a starting point to better understand their functions. This is important for developing genetic markers that can be targeted to monitor responses of corals to specific environmental stress conditions."

In the next phase of their research, the research team plans to examine the relationships between coral gene expression levels and coral fitness (e.g. growth, calcification, lipid production) to gain a better understanding of the functions performed by key genes in corals. This is essential for intervention strategies involving the enhancement of selected attributes in corals so that they can continue to survive when environmental conditions become more stressful.

More information: Rebecca S. Welch et al. Charge Carrier Mobility of Alkali Silicate Glasses Calculated by Molecular Dynamics, *Frontiers in Materials* (2019). DOI: 10.3389/fmats.2019.00121

Provided by National University of Singapore