A genetic variant of delta-9 desaturase is associated with thermal tolerance in a coral from the Great Barrier Reef

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Abstract

Coral populations across the Great Barrier Reef (GBR) could rapidly adapt to the warming climate if they have standing genetic variation for thermal adaptation. Here, we describe a locus likely involved in acclimatization and adaptation of Acropora millepora to cooler temperatures at higher latitudes. This locus shows a strong signal of selection in the A. millepora genome, with a steep latitudinal gradient of derived allele frequency, and harbors a cluster of eight tandemly repeated Δ9-desaturase genes adjacent to a region where a hard sweep likely occurred. In colonies reciprocally transplanted across 4.5 degrees of latitude, the expression of Δ9-desaturase was upregulated at the cooler high-latitude reef. Furthermore, corals from the warmer low-latitude reef with one or two copies of the "cold-adapted" Δ9-desaturase allele expressed the gene more and grew faster than their peers when transplanted to the cooler reef. In other organisms ranging from bacteria to fish, Δ9-desaturase is upregulated under cold conditions to adjust membrane fluidity by introducing double bonds into fatty acid chains of membrane lipids. While all these lines of evidence are suggestive rather than conclusive, they collectively make Δ9-desaturase a strong candidate marker gene for coral thermal acclimatization and adaptation.

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