Effect of short-term exposure to elevated temperatures and light levels on photosynthesis of different host-symbiont combinations in the Aiptasia pallida / Symbiodinium symbiosis

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ABSTRACT: The physiology exhibited by symbioses between dinoflagellates (zooxanthellae) and hosts such as reef corals may be dictated by the host, the symbiont, or the synergistic effect of both partners. We compared the oxygen fluxes of two laboratory populations of the symbiotic sea anemone Aiptasia pallida, originally collected from Bermuda and Florida. *A. pallida* from Bermuda contained clade B zooxanthellae and *A. pallida* from Florida hosted clade A zooxanthellae. Both freshly isolated zooxanthellae and intact anemones were compared as a function of light intensity at culture (25° C) and elevated (32° C, 34° C) temperatures. Zooxanthellae isolated from the Florida anemones had higher net photosynthetic rates at 32° C (P_{max}: 6.2 ± 0.9 μmol O2 h^{-1} μg chlorophyll *a* [Chl *a*]$^{-1}$ vs. 0.7 ± 3.6 for Bermuda algae), with the Bermuda algae exhibiting pronounced photoinhibition at higher irradiances. At 34° C, the clade A (Florida) symbionts had lower net photosynthesis than at 32° C (P_{max}: 3.6 ± 2.2 μmol O2 h^{-1} μg Chl a^{-1}), but the Bermuda symbionts had high rates of net O2 consumption at all irradiances. The intact Bermuda anemones, however, exhibited much less pronounced effects at elevated temperatures than did the isolated Bermuda zooxanthellae. Bermuda anemones containing the Florida symbionts had higher net oxygen fluxes than those with the Bermuda symbionts at elevated temperatures and irradiances. This study demonstrates that the physiology of the intact symbiosis is dictated by both partners and that studies of the intact symbiosis may not fully reveal the thermal liability of the algae.

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