Thermal stress tolerance differences between two giant clam species in Mauritius

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Giant clams are the largest of all bivalve molluscs, partly due to their symbiotic photosynthesising micro-algae (zooxanthellae). Several giant clam species are listed as 'Vulnerable' on the IUCN RedList of threatened species due to over exploitation and climate change poses an additional threat to them. Ocean warming-induced mass mortalities of giant clams have been reported from the Pacific Ocean. However, little is known about giant clams stress physiology from the Indian Ocean. This study investigated the stress tolerance of Tridacna maxima and Tridacna squamosa from Mauritius to thermal exposure at temperatures of ~28oC and ~32oC and at a constant light level (22 µmol quanta m-2 s-1) for 72 hrs (3 d). To estimate the stress susceptibility, the maximum quantum yield of photosystem II (Fv/Fm), relative electron transport rate (rETR) and non-photochemical quenching (NPQ) of the in hospite Symbiodinium of both giant clam species were recorded at 15, 24, 40 and 72hrs intervals using a diving Pulse-Amplitude-Modulated fluorometer (D-PAM). The ~28oC treated specimens acted as control and, at this temperature, the chlorophyll a fluorescence parameters, Fv/Fm, rETR and NPQ, did not vary significantly. However, at ~32oC differential responses between the two tested species, both at the photo-physiological and survivorship levels were observed. After 15 hrs of exposure at 32oC, T. squamosa specimens showed significant decline in Fv/Fm, rETR and NPQ and exhibited signs of disintegration, indicative of mortality. T. maxima started to be affected after 40 hrs of exposure. These results indicate that T. squamosa was less tolerant to heat-stress as compared to T. maxima, which may partially explain the low density of T. squamosa as compared to T. maxima recorded during previous field surveys. Further studies on zooxanthellae genetic type may also provide some insight regarding the role of the symbionts in stress tolerance of these two giant clam species.