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RESEARCH ARTICLE

Photoacclimation of corals in the turbid waters of the Northern Malacca Straits, Malaysia

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Abstract

Reefs in the Northern Straits of Malacca are exposed to low-light conditions mainly due to sedimentation. Corals can be found in the urban reefs of Pulau Kendi (PK) and Pulau Songsong (PS) despite being exposed to low-light stress. Rapid Light Curve (RLC) measurements were performed in situ using a Diving Pulse Amplitude Modulated (PAM) fluorometer to investigate the photoacclimation of hard corals in the turbid waters of the non-protected reefs in PK and PS. The photosynthetic responses of corals suggested two distinct patterns of photoacclimation which are preferential dynamic non-photochemical quenching and preferential photochemical quenching. When the light response curves were plotted against E/E_k, all coral species from PK and *Pavona danai* from PS were light saturated ($E/E_k > 1$) indicating the activation of the NPQ mechanism. However, *Goniastrea aspera* and *Cyphastrea chalcidicum* exhibited a different trend of photoacclimation in which the light did not reach saturation (light is limited ($E/E_k < 1$) indicating the preferential photochemical quenching as photoacclimation strategy. The results indicated that the photoacclimation mechanism may vary between species and corals can acclimate to changes in the environment. However, the extent of the acclimation may depend on other physiological factors such as *Symbiodiniaceae* type which needs to be investigated in the future.

Keywords Photosynthesis · Photoacclimation · Non-photochemical quenching · Photosynthetically active radiation (PAR) · Symbiont density · Diving-PAM fluorometer

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Introduction

Turbidity can negatively affect photosynthetic organisms, including corals, by limiting light penetration and reducing photosynthesis and net productivity (Edinger et al. 1998; Bessel-Browne et al. 2017; Jones et al. 2020). Corals have developed various morphological strategies to survive in different light regimes (Anthony and Hoegh-Guldberg 2003a; Hennige et al. 2008; Tavakoli-Kolour et al. 2023). They can alter their shape to capture more light in low-light environments and to maximize sediment shedding in high-light environments (Hoogenboom et al. 2008). For example, *Porites sillimaniani* can change from a plate-like to a branching form in high light and remain flat in low light (Muko et al. 2000). Corals can also adjust the photosynthetic apparatus of their symbiotic dinoflagellates to adapt to the light changes (Anthony & Hoegh-Guldberg 2003b; DiPerna et al. 2018). These adjustments include the modification of photosynthetic pigment concentration, photon absorption rates and symbiont density (Hennige et al. 2008; Ambarsari