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Oxidative stress responses of the scleractinian coral *Acropora digitifera* from the tropical Bidong Island, Malaysia - focus on protein thiol groups' detection

Muhammad Arif Samshuri [a], Che Din Mohd Safuan [a], Siti Nurtahirah Jaafar [a,b,*], Chui Pin Leaw [c], Li Keat Lee [c], Mathinee Yucharoen [d], Zainudin Bachok [a]

[a] Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia
[b] Institute of Oceanography and Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia
[c] Bachok Marine Research Station, Institute of Ocean and Earth Sciences, University of Malaya, 16310 Bachok, Kelantan, Malaysia
[d] Marine and Coastal Resources Institute (MACORIN) and Coastal Oceanography and Climate Change Research Center (COCC), Faculty of Environmental Management, Prince of Songkla University, Hat Yai, Songkhla, Thailand

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ABSTRACT

Over the past 40 years, recurrent episodes of coral bleaching have been observed around the world, which have led to coral reef degradation. The investigation of several biomarkers' responses is essential to understand the phenomenon. The present field experiment study was conducted on nine healthy colonies of the scleractinian coral *Acropora digitifera* collected in Bidong Island (north-eastern Peninsular Malaysia) between 2019 and 2020 to evaluate their oxidative stress status through the assessment of Symbiodiniaceae (SD) density, antioxidant enzyme activities, lipid oxidation, and protein thiol, with special emphasis on temperature. This study revealed that the presence of the dominant SD ITS2 type C3 from 2019 to 2020 suggests that the relationship between *A. digitifera* and the genus *Cladocopium* remains unaffected by the temperature. Concomitantly, there was no significant increase in antioxidant enzyme activities (glutathione S-transferase and catalase) with temperature, indicating that *A. digitifera* was capable of managing oxidative stress even in a warm environment. The monthly mean antioxidant enzyme activities and malondialdehyde (MDA) levels were lowest in July 2020 and then increased significantly in the subsequent sampling month, indicating a biochemical regulation to maintain cellular homeostasis. Meanwhile, the level of sensitive protein thiol was highest at 30.8 °C and significantly reduced up to 60% as temperature fluctuated, showing that proteins undergo only a small range of oxidative modifications. In addition, we found a weak negative correlation between SD density and thiol content, which may indicate that (1) the presence of SD constantly causes subtle oxidative pressure on coral hosts and (2) the presence of high SD density increases the potential for thiol oxidation. We conclude that there is no direct evidence of *A. digitifera* experiencing considerable oxidative stress and cellular damage, provided the rate of disturbance remains low.

1. Introduction

The issue of global warming gets worldwide attention when the ocean experiences a significant increase in temperature over the last decade and causes threats to coral reefs. The warmest record dated back to 2016 during the natural warming of tropical Pacific Ocean water, known as El Niño (Hughes et al., 2018), which caused several coral bleaching events (Claar et al., 2018; Dove and Hoegh-Guldberg, 2020; Hughes et al., 2018; Quimpo et al., 2020). Coral bleaching is a visible phenomenon in which the photosynthetic pigments of symbiotic algae, or Symbiodiniaceae (SD), are reduced following the drastic reduction of SD density from coral tissue, revealing the appearance of the whitish coral skeleton (Glynn, 1991; Williams and Bunkley-Williams, 1990). Regulating the SD population in the coral tissue requires a huge amount of energy. As most of the energy is supplied by SD, the reduction in SD density can compromise the energy reserves of the coral host (Maor-Landaw and Levy, 2016; van Oppen and Gates, 2006; Xu et al., 2020).

The cellular mechanism underlying coral bleaching is tightly coupled

* Corresponding author at: Faculty of Science and Marine Environment, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia.
E-mail address: tahirah@umt.edu.my (S.N. Jaafar).

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