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In situ lesion recovery of Scleractinian branching coral wild colonies from asexual coral propagation

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ABSTRACT

As coral reefs worldwide continue to degrade due to natural and anthropogenic threats, coral restoration efforts have been rapidly growing in recent decades to maintain the ecological function of coral reefs. In Malaysia, asexual propagation by fragmenting branches from healthy *Acropora* wild colonies is becoming the norm, but other coral genera are rarely considered in restoration efforts despite the need to enhance diversity and reef resilience. Additionally, restoration efforts in Malaysia mainly focus on the recovery of coral fragments in nurseries while overlooking the wild coral colonies they were sourced from. Lesion recovery from physical damage should be investigated to maximise restoration success and to ensure the wild coral populations do not degrade due to fragmentation from coral propagation efforts. To address this, we investigated the recuperation capabilities of two branching coral species, *Acropora muricata* and *Echinopora horrida,* in a shallow reef (<8 m) of Pulau Rawa, Johor, Malaysia. Coral colonies were induced with physical damage, and lesion recovery was measured via lesion site closure, colour score and relative growth of the broken colonies (n=30) over 129 days. The lesion site of *A. muricata* closed significantly more at 99.94±0.04SE%, compared to *E. horrida* with 86.97 ±3.53SE%. When compared to *E. horrida*, *A. muricata* had achieved full colour recovery by day 27 and more than double the value of relative growth (9.7 %). The differences in lesion recovery capabilities between *A. muricata* and *E. horrida* are hypothesised to be attributed to their different life adaptive strategies where *A. muricata* is an r adaptive strategist and *E. horrida* is a K adaptive strategist. The findings imply that future coral restoration efforts should investigate the recovery capabilities of the wild coral colonies before starting coral propagation efforts to prevent partial mortality of wild colonies and maintain species diversity and ecological functions of the reef.

1. Introduction

Coral reefs are one of the most biodiverse ecosystems (Hoegh--Guldberg, 2010; Willig et al., 2003), inhabited by approximately 34 % of described marine species (Reaka-Kudla, 2001). They offer various ecosystem benefits ranging from coastal protection (Harris et al., 2018; Spalding et al., 2014), food security (Cabral & Geronimo, 2018; Foale et al., 2013; Hughes et al., 2012), tourism and recreational income (Ahmed et al., 2007; Spurgeon, 1992; Spalding et al., 2017; Yeo, 2004) and medicinal use (Bruckner, 2002; Cooper et al., 2014). Within 1687 km^2 of coral reefs in Malaysia (Coral Triangle Atlas, 2019), approximately 525 species of Scleractinian corals from 82 genera and 14 families have been recorded, of which 413 species can be found on the east coast of Peninsular Malaysia (Affendi & Rosman, 2012; Akmal et al., 2019; Huang et al., 2015; Lee et al., 2022).

Over the past few decades, hard corals that make up the structural complexities of coral reefs have rapidly declined worldwide due to various threats ranging from destructive fishing practices, water pollution, disease outbreak, and climate change (Bruno & Selig, 2007; Goldberg & Wilkinson, 2004; Pandolfi, 2009). In Malaysia, coral reefs have experienced long-term degradation from anthropogenic stressors such as climate change, coastal development, unsustainable fishing practices, and physical damage from recreational activities (Burke et al., 2002; Harborne et al., 2000; Praveena et al., 2012; Reef Check Malaysia, 2020). These threats have reduced the live hard coral cover by 4 % between 2009 and 2019 in the East Asian Sea region, which includes Malaysia (Global Coral Reef Monitoring Network, 2021). Reef Check Malaysia's annual surveys also observed a similar trend, which showed

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