

RESEARCH ARTICLE

Impact of elevated temperature on the physiological and biochemical responses of *Kappaphycus alvarezii* (Rhodophyta)

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Abstract

The eucaeumatoids *Kappaphycus* and *Eucaema* are cultivated in tropical or subtropical regions for the production of carrageenan, a hydrocolloid widely used in the food and cosmetic industries. *Kappaphycus alvarezii* is a highly valued economic crop in the Coral Triangle, with the Philippines, Indonesia and Malaysia ranked among the largest producers. In the absence of measures to mitigate climate change, extreme events including heatwaves, typhoons, severe El Niño and La Niña, are expected to increase in frequency and magnitude. This inadvertently brings adverse effects to the seaweed cultivation industry, especially in the tropics. Temperatures are rapidly reaching the upper limit of biologically tolerable levels and an increase in reports of *ice-ice* and pest outbreaks is attributable to these shifts of environmental parameters. Nevertheless, few reports on the response of eucaeumatoids to a changing environment, in particular global warming, are available. Understanding the responses and possible mechanisms for acclimation to warming is crucial for a sustainable seaweed cultivation industry. Here, the physiological and biochemical responses of *K. alvarezii* to acute warming indicated that the strain used in the current study is unlikely to survive sudden increases in temperature above 36°C. As temperature increased, the growth rates, photosynthetic performance, phycocolloid quality (carrageenan yield, gel strength and gel viscosity) and pigment content (chlorophyll-*a*, carotenoid and phycobiliproteins) were reduced while the production of reactive oxygen species increased indicating the occurrence of stress in the seaweeds. This study provides a basis for future work on long term acclimation to elevated temperature and mesocosm-based multivariate studies to identify heat-tolerant strains for sustainable cultivation.