Optimization of coral aquaculture (Scleractinea and Alcyanacea) *Montipora digitata and Sinularia flexibilis*: for reef restoration proposal

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Coral reefs represent one of the most diverse ecosystems in the world, with critical importance for organisms which live and interact with them. People also depend heavily on this marine ecosystem for ecological, economic and cultural purposes. However, coral reefs are experiencing recent rapid change, partially from natural but mainly human factors. One such factor is coral trade, practiced in several tropical and sub-tropical regions for different purposes, mostly for ornamental aquaria. Many communities harvest wild organisms, providing basic incomes for several people, but depleting wild populations with serious impacts to this ecosystem. Coral aquaculture is therefore proposed to be important to biodiversity preservation, but also for restoration and rehabilitation purposes. Additional benefits include enhancement of biomedical research and reef ecology. Coral culture is still a new practice that need further research and optimization.

This study aimed to investigate the role of light (Photosynthetic Active Radiation - PAR and Spectra) in the metabolism, growth and photobiology of the Scleractinea and Alcyanacea corals *Montipora digitata* and *Sinularia flexibilis* for the optimization of aquaculture. 56 replicas of each species were acclimated for two months before being submitted to a four months culture experiment in a recirculating system, using two treatments: red and blue light spectra with two PAR intensities, high light (120 ± 10 µmol quanta.m^{-2}.s^{-1}) and low light (60 ± 10 µmol quanta.m^{-2}.s^{-1}). *In vivo* chlorophyll fluorescence activity (*Fv/Fm*), zooxanthellae counts, and biomarkers of cellular energy allocation (energy available (Ea) and energy consumption (Ec)) were measured at the beginning and end of the experiment. Coral tissue samples were individually homogenized on ice using ultra-pure water. From each sample, three aliquots were taken for the spectrophotometric analysis of lipid, sugar and protein contents, and ETS activity.

It was observed that corals in low blue light exhibited enhanced growth compared to their high red light counterparts. Zooxanthellae concentrations in *S. flexibilis* and *M. digitata* were higher in fragments reared under low blue light compared to the ones reared under high blue light. Significant differences in energy consumption were observed in blue light. (PAR 70). F*v*/F*m* were significantly different in red and blue light. These results suggest that blue light at low intensity is better for coral health and growth. Further optimization of such coral culture techniques is necessary in order to help reduce wild harvest of corals for the aquarium trade.

Key words: *Montipora digitata, Sinularia flexibilis*, Cellular energy allocation, Photobiology, Zooxanthellae, Coral aquaculture, Coral trade.