Assessing the Thermotolerance of Coral Recruits Fused in Early Settlement in Two Species of Caribbean Corals

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Introduction
The settlement and survival of reef-building, Scleractinian coral recruits is important to maintain coral reef resilience in our changing climate. Coral recruits are more vulnerable to stressors like high temperatures until they exceed a “size-escape threshold”[20]. However, they have demonstrated longer endurance and higher survival rates under thermal stress when settled in clusters or as fused individuals when compared to individual recruits[23]. This could be due to higher collective size and pooled genetic diversity.

Fused coral recruits may have unique responses to heat stress when compared to individual recruits. This study compared the survival rates of fused and individual coral recruits under thermal stress for two Caribbean brain coral species: Colpophyllia natans and Pseudodiploria strigosa

Methodology
- Coral larvae were born from parent colonies at Florida Aquarium and settled into two algal symbiont inoculation treatments, Breviolum minutum and Durusdinium trenchii.
- Conducted month long thermal stress exposure when recruits were four months of age from December 2022- January 2023.

Data Collection:
- Measured photochemical health through Imaging Pulse Amplitude Modulated (IPAM) fluorometry
- Assessed visual degree of bleaching
- Observed size and extent of tissue regression (ImageJ)

Fusion Status and Initial Size at Four Months of Age
- 384 recruits of C. natans and 158 recruits of P. strigosa were assessed for fusion status, initial size, status after thermal stress, and photochemical health throughout thermal stress
  - 31% of C. natans recruits and 34% of P. strigosa recruits demonstrated signs of fusion.
- Fusion status had a significant effect on initial measurements of photochemical health (Fv'/Fm') (ANOVA, p = 0.0238), most notably in C. natans recruits hosting Durusdinium.
- When assessed individually, fusion status did not have a significant effect on initial size (ANOVA, p = 0.274), with the significant driving factor being symbiont inoculation treatment (p = 4.32e-05). However, when multiple fused recruits were measured as a single entity, these coral conglomerates were significantly larger than their individual conspecifics (p <2e-16).

Results

Response to Long-Term Thermal Stress at 32.2°C
- By analyzing declines in photochemical health (Fv'/Fm') relative to accumulated heat stress, we compared the photochemical health of fused vs. individual recruits through use of a dose response curve.
- Fusion status demonstrated a significant effect in later heat stress (>20 days) (ANOVA, p = 0.002).
- Aligning the degree and timing of declines for each comparison produced an algebraic adjustment: the calculated change in thermal threshold attributable to fusion status.

Future Directions
- Given mixed results, it would be valuable to study the rate of rejection among fused coral recruits after ontogeny to assess how long these potential benefits would remain relevant.
- Continuing to investigate differential response in other coral host species with Breviolum. Determining which species benefit from coral fusion in early development and prioritizing or discouraging these settlement behaviors could be a valuable intervention in coral reef conservation efforts.

References

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- Experience (SURGE)

Discussion
- We hypothesized fused coral recruits would have a higher thermotolerance than individual recruits in both C. natans and P. strigosa, due to literature on non-Caribbean coral species.
- Our results indicate a species-specific response. This effect of differentiation was significant only in coral recruits inoculated with Breviolum when compared to those with Durusdinium.
  - We hypothesize that the higher observed bleaching resistance of Durusdinium when compared to Breviolum outweighed the potential effect of coral fusion status.
- In early ontogeny, fusion can benefit recruits through successful long-term feeding and occupying a larger territory. However, these benefits may only extend to initial survivorship. Rejection is common (up to 53%) after transitory fusion[23].
- This temporal trade-off may explain why only one of the two study species demonstrated a significant benefit of fusion.