Response of Symbiodiniaceae to a Bacterially Produced Compound

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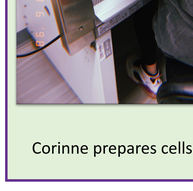
Introduction

- HHQ is a bacterially produced quinone shown to increase mortality in phytoplankton by limiting algal growth (Harvey 2016)
- HHQ influences ocean processes on a broad scale through controlled chemical interactions that change phytoplankton population size and structure (Harvey 2016).
- Symbiodiniaece contributes to coral health (Mathews et al., 2020)
- In the state of our climate crisis, it is crucial to understand how marine algae responds to different conditions considering the important role phytoplankton play in regulating CO_2 and O_2



Source: *Todd Lalveunesse*, doi:10.1038/nmiddleeast.2021.42

Research Question

How does HHQ impact the growth rate of members of the Symbiodinaceae?

Methods/Materials

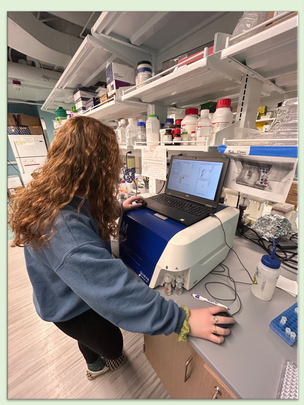
Symbiodiniaceae growth conditions

- 1mL of algae with 10mL F/2-Si (medium with enriched seawater)
- 200µL used to gather data on the flow cytometer
- Cultures with the highest cell concentrations were chosen for analysis

HHQ trials

- 1 mL of F/2 media + 500 µL of culture, and 1.5 µL of either DMSO or HHQ
- HHQ concentrations used (ng mL^{-1}): 1, 10, 50, 100, 250, 500, 1000
- Analyzed on flow cytometer in triplicate on trial day 0
- Cell abundance was tracked with daily measurements over 4 days total

Corinne prepares cells for counting



Cassidy uses the flow cytometer

HHQ causes 'static' growth in marine phytoplankton

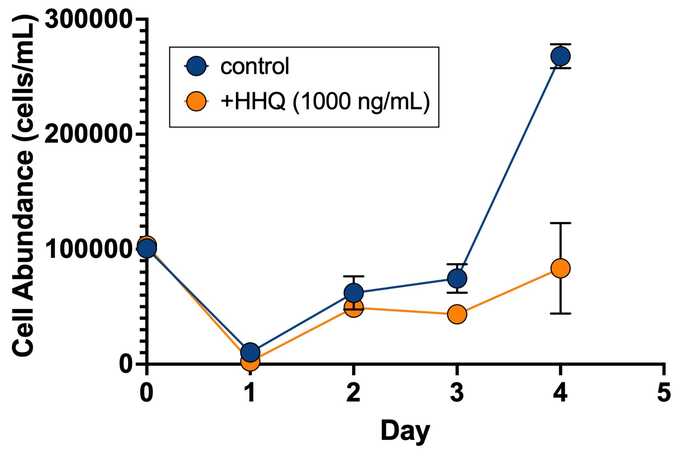


Figure 1. Mean cell abundance (cells mL^{-1}) over 5 days for *B. psygmophilum* in response to exposure of a 1000 ng mL^{-1} concentration of HHQ [orange line] and DMSO control [blue line]. Symbols are the mean of triplicates and error bars are the standard deviation.

When screening against the highest HHQ concentrations only one species exhibited susceptibility

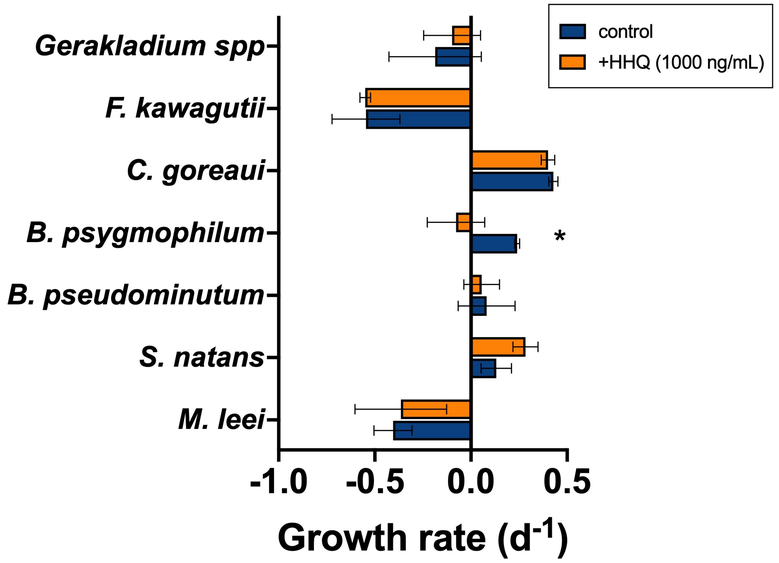
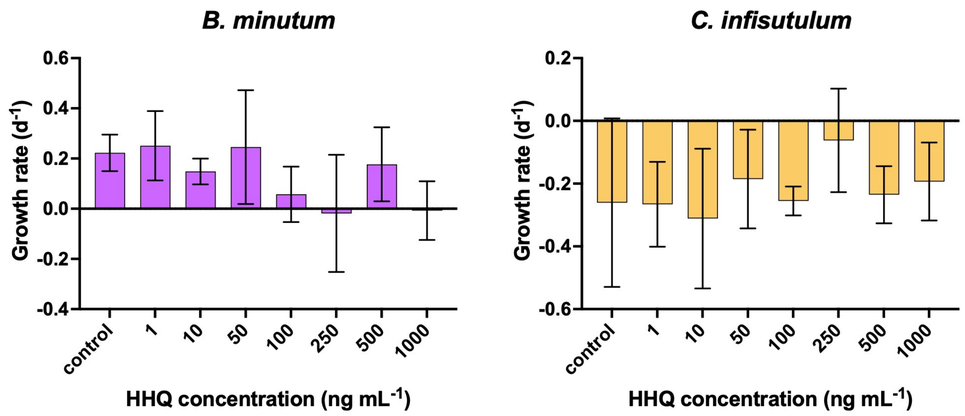


Figure 3. Growth rates across 7 species after being exposed to HHQ (1000 ng mL^{-1}) or a DMSO control for 5 days. Negative growth rate indicates death. The star denotes algal treatment that was significantly different from the control. P-value was set at 0.05, bars are the mean of triplicates, error bars are the standard deviation.

Many members of the Symbiodiniaceae are not susceptible to HHQ



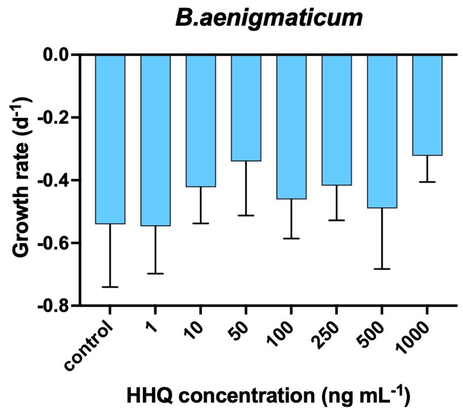


Figure 2. Growth rates for three species across a range of HHQ concentrations. Negative growth rates indicate death. No significant differences were observed across all HHQ concentrations examined. Bars are mean growth rates from triplicates, and error bars are the standard deviation.

Major Findings

- In general, Symbiodinaceae is resistant to the impact of HHQ on cell growth.
- One species, *B. psygmophilum* exhibited 'static' growth (e.g. cells are not dying, but not dividing and accumulating either) in the presence of 1000 ng mL-1 of HHQ.
- Additional experiments to be conducted will involve standardization of starting algal cell concentrations, additional HHQ concentrations, and a range of different culture volumes to assess the impact of HHQ on algal growth dynamics.

References

Harvey, E. L., Deering, R. W., Rowley, D. C., El Gamal, A., Schorn, M.,Moore, B. S., & Whalen, K. E. (2016). A bacterial quorum-sensing precursor induces mortality in the marine coccolithophore, *Emiliania huxleyi*. Frontiers in Microbiology, 7, 59.

Matthews, J. L., Raina, J. B., Kahlke, T., Seymour, J. R., van Oppen, M. J., & Suggett, D. J. (2020). Symbiodiniaceae-bacteria interactions: rethinking metabolite exchange in reef-building corals as multi-partner metabolic networks. Environmental Microbiology, 22(5), 1675-1687.

Acknowledgements

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