Unveiling the million-dollar loss in commercially cultivated red macroalga *Pyropia haitanensis* farms: The hidden impact of microalgal stress

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INTRODUCTION

- The red macroalga *Pyropia haitanensis* is one of the most important mariculture species (Guiry and Guiry, 2020), hence it has been cultivated in East and Southeast Asia for thousands of years (Wells et al., 2017).
- Primarily, it is used for human consumption, medicines, cosmetics, biofuel and potential source of the red pigments r-Phycoerythrin. (Bito et al., 2017).
- During our routine sampling, we observed dense attachments of diatoms on *P. haitanensis* thalli, especially on older thalli at end-of-season.
- Similar observation reported in Korean sea farms by Kim et al., 2014, who referred it as “Diatom felt”.
- Epiphytic diatoms cause serious damage to *Pyropia* thalli than other decease.
- Studies focusing on specific effect of diatoms on commercial macroalgae have not been reported, making it essential to observe and investigate.
- Hence, in our current study, we investigate the potential impacts of two ecotypic diatoms on macroalga *P. haitanensis*

OBJECTIVES

- To assess the specific effect of different ecotypic microalgae on commercial macroalga *P. haitanensis*.
- Analyse the effect of microalgal attachments on biochemical composition of macroalga *P. haitanensis*.

METHODS

- Observation of microalgal attachments on *Pyropia* in culture farm.
- Isolation of benthic microalga *Navicula climacospheniae* from the *Pyropia* thalli surface and maintain the unialgal culture for the experiments.
- Inoculate the exponentially grown benthic microalga and planktonic microalga *S. costatum* seperately with macroalga *P. haitanensis*.
- Measure the diatom density and nutrient profile alternatively during experiment.
- At the end of experiment microscopic observation of microalgal attachments and biochemical composition of *P. haitanensis* thalli.

RESULTS

The present study demonstrates the effect of diatoms on the growth and biochemical composition of macroalga *P. haitanensis* and the results revealed that benthic and planktonic diatoms have diffrential effects on macroalga. The result not only demonstrates a significant effect on macroalgal growth due to diatom presence and attachment but also indicate a change in macroalgal pigments and total protein.

- Metabolites of *P. haitanensis* inhibited *S. costatum* but not affected the growth of microalga *N. climacospheniae*.
- Benthic diatom formed dense attachment to the flasks and macroalgal thalli, which significantly affected its growth.
- Nutrients were significantly decreased in all treatments, but residual concentration was higher in the controls.
- Phycocyanin and phycoerythrin concentration of macroalga were significantly higher in certiain treatment at day 12.
- Benthic microalga affected total protein concentration of macroalga in higher density treatments.

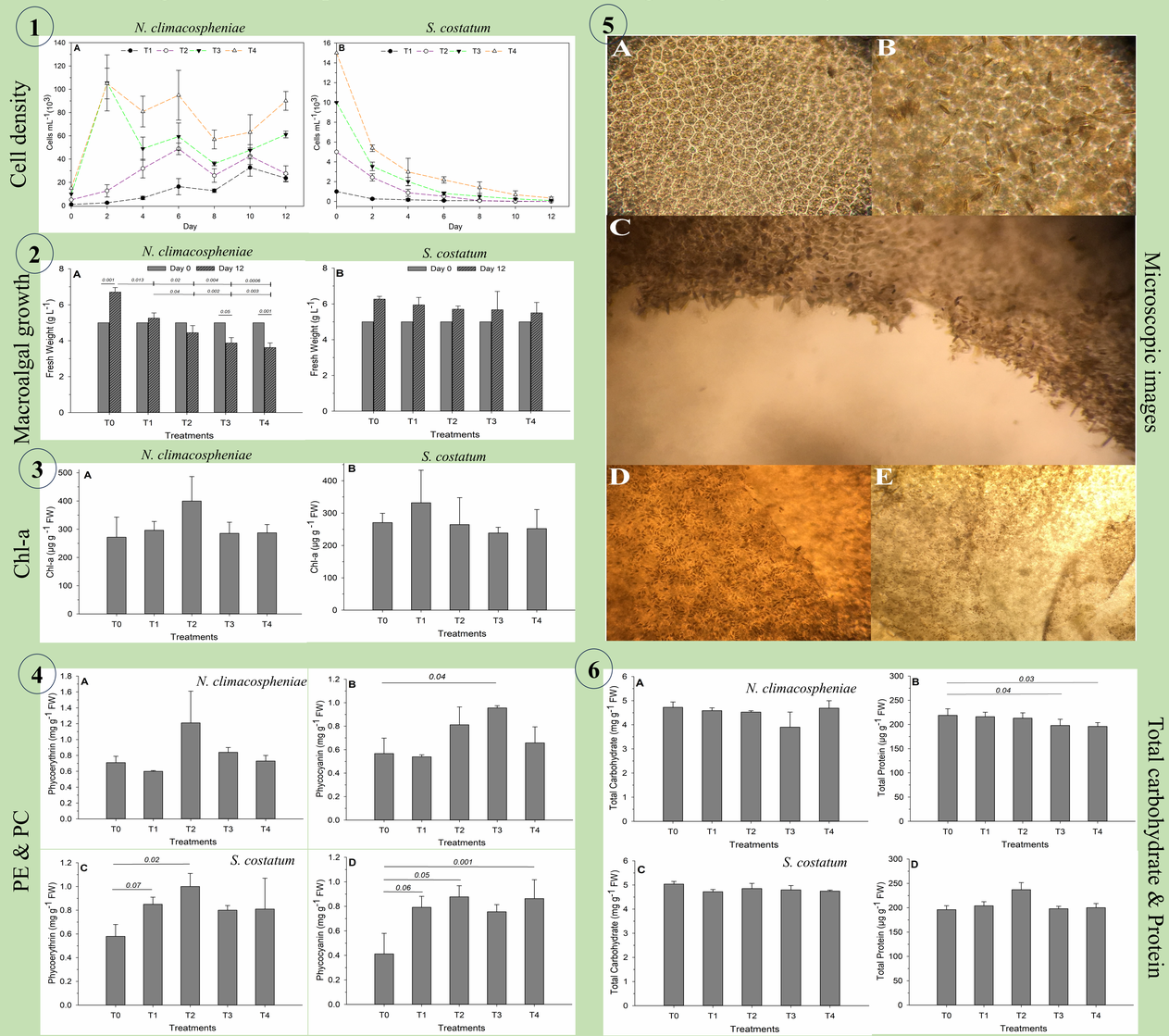

Figure shows, **1.** Microalgal cell density, **2.** Macroalgal growth, **3.** Chlorophyll-a, **4.** Phycoerythrin and Phycocyanin, **5.** Microscopic images (A-Control & B-E Benthic microalgal attachments) and **6.** Total carbohydrate and Total protein during co-culture of macroalga *P. haitanensis* with benthic microalgae *Nitzschia climacospheniae* and planktonic microalgae *Skeletonema costatum* at T0-0 (Control), T1-1.0, T2- 5.0, T3-10.0, T4-15.0 × 10^3 cells mL^{-1}.

CONCLUSIONS

- Different cell densities and species of diatoms have differential effect on the macroalgal growth and biochemical composition.
- In contract, diatoms compete with macroalgae for nutrients, light availability and metabolites released during interaction.
- Isolated benthic species *N. climacospheniae* have strong potential for attachment to macroalgal thalli.
- In contrast, metabolites from *P. haitanensis* affected the planktonic microalga growth but it have no effect on benthic microalga.
- Further studies, with transcriptomics and metabolomics will help to provide better understanding of the inhibitory effet of diatoms on the macroalgae at a molecular level.

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