Temple University
Department of Biology

-Final Doctoral Thesis Defense-

TITLE

"Influence of abiotic environmental factors on physiological responses and mixotrophy in freshwater and marine chrysophytes"

Chia-Mei Chang

TIME AND PLACE

Tuesday, March 26, 2024
9:00 AM
Bio-life Building, room 234

Light refreshments starting at 8:30 am
Any questions, please contact the Biology Department @ 215-204-8854

Dissertation Committee
Dr. Robert Sanders, Advisory Chair, Department of Biology, Temple University
Dr. Amy Freestone, Examining Committee Chair, Department of Biology, Temple University
Dr. Erik Cordes, Committee Member, Department of Biology, Temple University
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Abstract: Global climate change represents one of the greatest threats to biodiversity. Phenomena such as rising surface water temperature, increased UV radiation, and ocean acidification have brought negative impacts to ecosystems and their inhabitants. Sensitive to various abiotic factors, microbial eukaryotic communities in aquatic systems are particularly being affected by these environmental changes. Specifically, warming temperature not only can directly affect plankton through limiting growth and inhibiting physiological processes, but can also indirectly impact these organisms by altering light and nutrient availability via loss of sea ice and changes in thermal stratification in various environments. Mixotrophic chrysophytes are an important lineage of protists that often dominate phytoplanktonic blooms in both freshwater and marine systems. Studies have shown mixotrophic organisms, species that can combine phototrophy and phagotrophy, are influenced by abiotic environmental factors. Temperature in particular, is known to alter growth rate and bacterivory. In response to rising temperature, mixotrophs can either become more phototrophic or more heterotrophic, depending on species, resulting in changes of their role in aquatic food webs and potentially leading to shifts in overall community composition and structure. The objective of this research is to investigate the influence of different environmental factors on primary production and heterotrophic ingestion in marine and freshwater chrysophytes, providing an understanding on how climate change may alter physiological response and survival, with indicative changes in community structures and food webs.
The influence of irradiance, nutrient concentrations, and temperature on mixotrophic responses of the Arctic marine chrysophyte *Dinobryon faculiferum* was investigated, where results demonstrated an increase in heterotrophic ingestion in response to rising temperature. We also found bacterivory contributes a major proportion of *D. faculiferum*'s carbon budget in comparison to primary production, which is different from previous studies on *Dinobryon* species that appeared to be more reliant on phototrophy.
Conversely, the freshwater chrysophyte *Chrysolepidomonas dendrolepidota*, exhibited the opposite temperature effect. The freshwater species was more reliant on primary production and ingested less as temperature increased. Such varying responses showcased diverse nutrient strategies on the mixotrophic spectrum, suggesting generalization of mixotrophic mode in predictive models should be approached with caution. Additional work was done to gain insight on the biogeography of *C. dendrolepidota*, of which little is known about its distribution. The presence of *C. dendrolepidota* was not detected through metadata analysis, nor was it detected across several waterbodies sampled in this study. Our results suggested possible rare distribution and endemism of *C. dendrolepidota*.