CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
S1603

Project Title
A Taxonomic Reassessment of the Orders Ectocarpales and Scytosiphonales Based on Ribosomal Small Subunit DNA Sequences

Abstract

Objectives/Goals
Evolutionary relationships within the Class Phaeophyceae (brown algae) have long been a source of discussion and speculation. Previously the Orders Ectocarpales and Scytosiphonales had been defined as sister orders, however recent analysis of the Order Scytosiphonales nullified its existence and grouped these species within the larger Order Ectocarpales. This taxonomic hypothesis has been put forth with limited taxon sampling. Due to apparent morphological differences and molecular data based research, I predict that sufficient speciation has occurred so that Scytosiphonales is monophyletic and sister to the Ectocarpales.

Methods/Materials
After selecting a set of morphologically diverse species for the Orders Scytosiphonales and Ectocarpales, I chose Laminariales as outgroup set based on taxonomic divergence. After undergoing DNA isolation, purification with Phase Lock Gel, Polymerase Chain Reaction (PCR), PCR Purification, Cycle Sequencing, Cycle Sequence Reaction Purification, lyophilizing and finally sequencing I obtained DNA sequence of two species. I used both sequences along with several other species of Scytosiphonales, Ectocarpales and Laminariales, from GenBank and analyzed them using Parsimony and Maximum Likelihood systematics.

Results
After employing the parsimony and the maximum likelihood approaches, two consensus trees resulted. Although the species from Order Scytosiphonales formed their own clade, they were not independently monophyletic of the entire Order Ectocarpales, disproving my hypothesis.

Conclusions/Discussion
This experiment based on the 18S SSU has confirmed the nonexistence of the Order Scytosiphonales. Because previous studies, based on alternate DNA regions, have indicated that sufficient speciation had occurred, perhaps the level of conservation on the small subunit is too great to make valid analysis of this ordinal divergence. Since, the taxon sampling of this study is double the quantity of previous studies; the broader range of species also suggests that Ectocarpales on the basis of the 18S region is inclusive of Scytosiphonales. The original tree which separated Order Scytosiphonales and Ectocarpales based on morphological differences is also nullified based on this experiment.

Summary Statement
A study on the extent of evolutionary divergence of Phaeophyceaen Orders Ectocarpales and Scytosiphonales based on Ribosomal Small Subunit comparative DNA sequences.

Help Received
I would like to thank Fresno State University for allowing me to work as an independent researcher with assistance from graduate student Matt Ashworth