CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S2408

Project Title

Hidden in Plain Sight: Description of a New Species of Spurilla in the Caribbean with a Proposed Mechanism of Speciation

Abstract

Objectives/Goals

By using both morphological and molecular analyses of tropical Atlantic and Pacific populations of Spurilla neapolitana, the first such study conducted in the Aeolidiidae family, a cryptic species was identified in the Bahamas. This new species is described in detail and possible mechanisms of speciation are analyzed.

Methods/Materials

Specimens from 5 Caribbean, 2 Pacific, and 4 European locations were analyzed. Diagnostically reliable features including the radulae, jaws, reproductive organs, and external morphology were compared through the use of SEM micrographs and camera lucida. Partial 16S rRNA and H3 histone coding genes were extracted from non-cerata tissue using Chelex, then amplified through PCR. Filtered and diluted amplicons were sequenced then aligned using Geneious Pro 4.8.3. Phylogenetic trees were constructed in PAUP*4.0b10 and date estimates for uncalibrated nodes were derived using r8s 1.5.

Results

Qualitative morphological evaluation of the external morphology, radulae, and reproductive system indicated the Bahamas population of S. neapolitana as the most divergent and a likely cryptic species. Radulae were further analyzed quantitatively with a Mann-Whitney U Test (P=0.01) using cusp and denticle length and width ratios and the statistical data confirmed qualitative observations. Maximum likelihood phylogenetic trees (100 bootstrap replicates) constructed from 16S rRNA and H3 histone gene sequences revealed the Bahamas population to be in a separate clade from all other S. neapolitana, providing further evidence that this population is a cryptic species.

Conclusions/Discussion

By utilizing a molecular clock constructed using the Langley-Fitch likelihood method and calibrated by the formation of the Isthmus of Panama, the divergence of this new species from S. neapolitana was determined to be 5.88 million years ago. Paleogeographic data indicate that during this time, in the Late Miocene, ocean current flow in the Caribbean was altered by the closure of a major channel. This created greater geographical isolation of the Bahamas population from the rest of S. neapolitana, likely leading to subsequent speciation. These results provide crucial insight into the biodiversity of this genus and provide a better understanding of how geological phenomena affect the evolution of marine populations.

Summary Statement

A cryptic species, discovered through morphological and genetic analyses of Spurilla neapolitana populations, is described with a comparison to S. neapolitana and a mechanism of speciation based on changes in ocean currents is proposed.

Help Received

Used lab equipment at California State Polytechnic University, Pomona under the mentorship of Dr. Angel Valdes.