CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31565

Project Title

Incipient Speciation of the Mustached Bat Pteronotus parnellii in the West Indies

Abstract

Objectives/Goals

Populations of mustached bat Pteronotus parnellii on Hispaniola (H), Puerto Rico (PR), and geographic intermediate Isla Mona (IM) were studied through molecular, morphological, and echolocation analyses to determine the species' population structure in the West Indies.

Methods/Materials

DNA already extracted for specimens from 3 H, 2 IM, and 3 PR caves were PCR amplified for the mitochondrial cytochrome b gene. Amplicons were sequenced then aligned using Geneious Pro 4.8.3. Phylogenetic trees were constructed in PHYML and MrBayes 3.1.2. Fixed pairwise differences and migration rates among the islands were calculated using Arlequin 3.5.1.2 and Migrate-n 3.1.6, respectively.

Body, tail, ear, foot, and forearm length measurements for 78 total bats were analyzed through one-way analysis of variance (ANOVA) tests and unpaired t-tests implemented in R. Echolocation recordings for a total of 49 bats were analyzed for the constant frequency portion through ANOVA tests in R.

Results

Phylogenetic analyses of cytochrome b sequences indicate H and PR P. parnellii group in largely exclusive clades while IM bats are genetically similar to PR P. parnellii. Fixed pairwise differences indicate high and significant separation values between H and PR as well as between H and IM. There is no significant difference between PR and IM and migration occurs mainly from PR to IM, much less so from H to IM. All other inter-island gene flow was negligible.

Comparisons using ANOVA showed that H P. parnellii is significantly smaller and lighter, with smaller forearms and feet but longer tails than PR bats. IM bats are morphologically similar to either H or IM, depending on the measurement. H bats emit a significantly higher frequency than PR and IM in the constant frequency portion of their echolocation call, corroborating the genetic data.

Conclusions/Discussion

The results support classification of H P. parnellii population and the PR/IM population as separate species. Inter-island range expansion during the Wisconsinan glaciation followed by interglacial isolation is a possible incipient speciation mechanism. Determining this speciation event doubles the number of endemic species in Hispaniola, indicating the additional importance of conserving these species to maintain the full genetic diversity and population robustness of bats in the West Indies.

Summary Statement

A new bat species was discovered in the West Indies based on genetic, morphological, and echolocation analyses, thereby doubling the number of endemic species on Hispaniola.

Help Received

Used lab equipment at Stony Brook University under the mentorship of Dr. Liliana Davalos.

Preliminary