

Publication

Leapfrogging into new territory: How Mascarene ridged frogs diversified across Africa and Madagascar to maintain their ecological niche

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The Mascarene ridged frog, *Ptychadena mascareniensis*, is a species complex that includes numerous lineages occurring mostly in humid savannas and open forests of mainland Africa, Madagascar, the Seychelles, and the Mascarene Islands. Sampling across this broad distribution presents an opportunity to examine the genetic differentiation within this complex and to investigate how the evolution of bioclimatic niches may have shaped current biogeographic patterns. Using model-based phylogenetic methods and molecular-clock dating, we constructed a time-calibrated molecular phylogenetic hypothesis for the group based on mitochondrial 16S rRNA and cytochrome b (cytb) genes and the nuclear RAG1 gene from 173 individuals. Haplotype networks were reconstructed and species boundaries were investigated using three species-delimitation approaches: Bayesian generalized mixed Yule-coalescent model (bGMYC), the Poisson Tree Process model (PTP) and a cluster algorithm (SpeciesIdentifier). Estimates of similarity in bioclimatic niche were calculated from species-distribution models (maxent) and multivariate statistics (Principal Component Analysis, Discriminant Function Analysis). Ancestral-area reconstructions were performed on the phylogeny using probabilistic approaches implemented in BioGeoBEARS. We detected high levels of genetic differentiation yielding ten distinct lineages or operational taxonomic units, and Central Africa was found to be a diversity hotspot for these frogs. Most speciation events took place throughout the Miocene, including “out-of-Africa” overseas dispersal events to Madagascar in the East and to São Tomé in the West. Bioclimatic niche was remarkably well conserved, with most species tolerating similar temperature and rainfall conditions common to the Central African region. The *P. mascareniensis* complex provides insights into how bioclimatic niche shaped the current biogeographic patterns with niche conservatism being exhibited by the Central African radiation and niche divergence shaping populations in West Africa and Madagascar. Central Africa, including the Albertine Rift region, has been an important center of diversification for this species complex.

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