



Diversification of the African legless skinks in the subfamily Acontinae (Family Scincidae)

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ABSTRACT

Cladogenic diversification is often explained by referring to climatic oscillations and geomorphic shifts that cause allopatric speciation. In this regard, southern Africa retains a high level of landscape heterogeneity in vegetation, geology, and rainfall patterns. The legless skink subfamily Acontinae occurs broadly across the southern African subcontinent and therefore provides an ideal model group for investigating biogeographic patterns associated with the region. A robust phylogenetic study of the Acontinae with comprehensive coverage and adequate sampling of each taxon has been lacking up until now, resulting in unresolved questions regarding the subfamily's biogeography and evolution. In this study, we used multi-locus genetic markers (three mitochondrial and two nuclear) with comprehensive taxon coverage (all currently recognized Acontinae species) and adequate sampling (multiple specimens for most taxa) of each taxon to infer a phylogeny for the subfamily. The phylogeny retrieved four well-supported clades in *Acontias* and supported the monophyly of *Typhlosaurus*. Following the General Lineage Concept (GLC), many long-standing phylogenetic enigmas within *Acontias occidentalis* and the *A. kgalagadi*, *A. lineatus* and *A. meleagris* species complexes, and within *Typhlosaurus* were resolved. Our species delimitation analyses suggest the existence of hidden taxa in the *A. occidentalis*, *A. cregoi* and *A. meleagris* species groups, but also suggest that some currently recognized species in the *A. lineatus* and *A. meleagris* species groups, and within *Typhlosaurus*, should be synonymised. We also possibly encountered "ghost introgression" in *A. occidentalis*. Our inferred species tree revealed a signal of gene flow, which implies possible cross-over in some groups. Fossil evidence calibration dating results showed that the divergence between *Typhlosaurus* and *Acontias* was likely influenced by cooling and increasing aridity along the southwest coast in the mid-Oligocene caused by the opening of the Drake Passage. Further cladogenesis observed in *Typhlosaurus* and *Acontias* was likely influenced by Miocene cooling, expansion of open habitat, uplifting of the eastern Great Escarpment (GE), and variation in rainfall patterns, together with the effect of the warm Agulhas Current since the early Miocene, the development of the cold Benguela Current since the late Miocene, and their co-effects. The biogeographic pattern of the Acontinae bears close resemblance to that of other herpetofauna (e.g., rain frogs and African vipers) in southern Africa.

1. Introduction

Two main goals of systematic biology are using the reconstruction of

phylogenies: (1) to demarcate species boundaries and unravel the systematic relationships among taxa, and (2) to address evolutionary or biogeographic questions (Wiens, 2007). In recent decades, modern

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