

**Systematics and diversity of Australian pygopodoid geckos
(Pygopodoidea, Gekkota, Squamata).**

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Abstract

Lizards and snakes (squamates) are the most diverse endemic component of the Australian terrestrial vertebrate fauna; and three families of Pygopodoid gecko (Carphodactylidae, Diplodactylidae and Pygopodidae) together comprise the third most species rich squamate lineage within Australia. In this thesis I present the results of an analysis of the systematics and species diversity of components of the Australian pygopodoid gecko radiation; specifically, I focus on establishing an overall systematic and temporal framework for the evolution of the entire clade, examining estimates of species diversity and interrelationships within three genera, and using the resultant phylogenetic framework to advance our understanding of how the onset and expansion of aridification across Australia may have affected evolution with this lineage.

In chapter two the phylogenetic relationships of all Australian pygopodoid genera (except *Orraya*) are examined, and temporal scale for their diversification is estimated based on Bayesian and Likelihood analyses of two nuclear genes. This work demonstrates that at least five extant lineages within this radiation diverged before the final separation of Australia from Antarctica, and that the clade has a long history within Australia equivalent to famous Gondwanan elements of the fauna, such as the Marsupials.

An analysis of systematic relationships within the genus *Diplodactylus* based on mitochondrial DNA and morphological data indicate that as recognised previously, it comprises two genetically distinct and morphologically diagnosable clades; we resurrect the name *Lucasium* for one of these clades. Both genera appear to represent moderately diverse and broadly overlapping radiations of multiple taxa largely restricted

to arid and semi-arid Australia, but absent from relatively mesic coastal areas, especially along the east, suggesting semi-arid to arid habitats have a long history within Australia.

A multilocus (mitochondrial, allozyme and karyotypic) examination of species boundaries within the newly defined *Diplodactylus* increases estimates of species diversity from 13 to 29. A similar study of the single recognised species of *Crenadactylus*, reveals it to comprise a surprisingly ancient radiation of at least ten candidate species. The diversification of *Crenadactylus* species, some of the oldest cryptic vertebrate taxa yet identified, dates back to the estimated onset of aridification and has important insights into this process. Together, these two studies demonstrate that species diversity in many Australian vertebrates remains significantly underestimated, and that this inadequate taxonomy is masking important conservation and evolutionary information.

In chapter five I present a combined mitochondrial and nuclear phylogenetic analysis of the ecologically widespread genus *Nephrurus* (*sensu* Bauer 1990). Based on this phylogeny we propose a revised generic arrangement for this clade assigning the two most plesiomorphic and basal lineages to monotypic genera. Molecular dating reveals a strong correlation between the age of a specialised arid-zone clade and independent estimates for the major expansion of the arid zone.

Declaration

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