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

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A thesis submitted in fulfilment of the

requirements for the degree of

Doctor of Philosophy

School of Earth and Environmental Sciences

The University of Adelaide

December, 2009

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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 radation; 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 the 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, alloyme 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 backs to the estimated onset of aridification and has important insights into this process. Together, these two studies demostrate 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 arrangment 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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Paul Oliver

February 2009

Acknowledgements

First and foremost I thank my official supervisors Mike Lee and Steve Cooper, and my unofficial supervisor Mark Hutchinson, for their advice, time, support and encouragement. I equally express my enormous gratitude to my labmates in the Lee lab - Andrew Hugall, Kate Sanders and Adam Skinner, without the enthusiasm, advice, support and not least of all patience of these people, it is certain that this thesis would be of lesser quality than it is. I also thank Mark Adams for his encouragement and producing great data that no-one else does anymore, and Steve Richards for the incredible career and life opportunities he has given me, just a small portion of which can be seen in the appendices of this paper. I would also like to take this opportunity to thank many co-authors on the papers that I present in this thesis (most of whom are listed above) who have all contributed enormously to the successful completion of this work.

I extend my further gratitude to a host of other students and staff at the Australian Centre for Evolutionary Biology and Biodiversity (ACEBB) that contributed time and advice towards this project, namely, but not limited to Kathy Saint, Terry Bertozzi, Andrew Breed, Takashi Kawikami, Duncan Taylor, Leanne Wheaton, Gaynor Dolman, Ralph Foster, Mark Sistrom, Racheal Dudaneic, Luke Price, Lizzie Perkins, Jaro Guzinski and many, many other people who made the long hours in the lab less onerous and more enjoyable.

I thank the staff from a number of Australian Museums for providing access to specimens and tissues in their care; namely Paul Doughty, Brad Maryan and Claire Stevenson (WAM), Paul Horner and Dane Trembath (NTM), Ross Sadlier and Glenn Shea (AM), Patrick Couper and Andrew Amey (QM), and of course Mark Hutchinson and Carolyn Kovach at SAM. I also thank Aaron Bauer and Todd Jackman for hosting me in the USA and providing some important advice and opportunities over the last three years.

Lastly, and on a more personal front, I would like to thank my wonderful family, and especially parents, for their unstinting support and encouragement over the last two and a half decades, this work is in many ways a culmination of that support. In a similar vein I extend my heartfelt thanks to a number my friends outside work who have been extremely supportive throughout this process; namely Sandy Foo, Praneet Keni, Navin Das, Beata Kucaba and Ian Wong.

This work was supported by grants from the Australia Pacific Science Foundation, Mark Mitchell Foundation and Australian Biological Resources Study. All SA Museum and University of Adelaide animal research is carried out under the supervision of the Wildlife and University of Adelaide (respectively) Animal Experimentation Ethics Committees.