ABSTRACT

Under current and previous global climate change, environments are changing and have changed at a rapid rate. Species with the potential to undergo adaptive radiation are likely to survive environmental change. The genus *Rhabdomys* is widespread in southern Africa, occurring along the east-west rainfall gradient in South Africa. *Rhabdomys* may have undergone adaptive radiations in the past, which may have resulted in the current suite of species in various habitats of different aridity. Some *Rhabdomys* species also occur in sympatry in some locations in South Africa. The aim of my study was to investigate adaptive variation in *Rhabdomys* by studying the behaviour of 5 populations, representing 3 *Rhabdomys* species, across South Africa. Using selected taxa, my approach was, firstly, to describe variation in two traits, personality and spatial cogntion, well known for showing environmentally-linked (i.e. adaptive) variation. Secondly, I manipulated the development of exploratory and anxiety behaviour to assess the limits of the adaptive variation (i.e. test the nature of the reaction norm of the characters measured). I first established the taxon-level personality of 4 taxa (2 sympatric) in 5 standard behavioural tests. Generally, the semi-desert living *R*. *pumilio* was the boldest together, surprisingly, with *R. d. dilectus* occurring in grasslands of central South Africa, contradicting previously published results. Comparatively, *R. bechuanae* from central South Africa and *R. dilectus* from far north-eastern South Africa, also occurring in grasslands were less bold, even though *R. bechuanae* is sympatric with *R. dilectus* in central South Africa. My data indicate adaptive variation at the extreme populations and possibly character displacement in the sympatric populations. In the next chapter, I investigated whether early rearing environment shapes exploratory behaviour and anxiety responses of *R. pumilio* and *R. bechuanae*. I predicted that using an interspecies cross-fostering protocol would reveal a gene x environment interaction on behaviour, so that fostered offspring would display an intermediate behaviour phenotype compared to their non-fostered siblings. I showed that a novel rearing environment mostly did not influence the adult behaviour of cross-fostered inidividuals. This indicates genetic constraints on exploratory behaviour and anxiety responses. Next, I tested whether physical rearing

environment shapes exploratory behaviour and anxiety responses. I reared semi-desert *R. pumilio*, sympatric *R. bechuanae* and *R. dilectus* and allopatric *R. bechuanae* under either no cover or high cover for 2 generations. The taxa were mostly similar and altering the phyical housing condition did not alter behaviour, but there were small differences between the taxa in exploratory behaviour. In the final experimental chapter, I established whether the environment predicts the spatial cognition in semi-desert *R. pumilio*, sympatric *R. bechuanae* and *R. dilectus* and an allopatric population of *R. dilectus* from far north-eastern South Africa. The populations showed very similar performance in a modified Barnes maze, indicating a possible phylogenetic constraint on spatial cognition. Overall, my study suggests that there is adaptive variation in personality but not spatial cognition. In contrast to previous studies in the genus, alterations to the social and physical environments failed to separate out genetic and environmental effects (i.e. reaction norm) that would potentially provide the mechanisms for adaptive variation within and between species. The similarity in spatial cognition between taxa and similar responses to environmental modification indicate phylogenetic constraints on traits that were predicted to vary geographically.