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POPULATION STRUCTURE, GENETIC DIVERSITY AND CONSERVATION OF SELECTED SPECIES OF *BARLERIA*

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A thesis submitted to the Faculty of Science, University of the Witwatersrand Johannesburg, in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

OCTOBER 2005

TO MY SON, MPHO

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Abstract

Barleria argillicola and *B. greenii* are two rare endemics restricted to the midlands of KwaZulu Natal at Estcourt. They were studied for allozyme variation and differentiation, pollination biology, management strategies and red data re-assessment. The population genetic structure of these endemics was compared using allozymes with that of a related more widespread species (*B. saxatilis*) in order determine the baseline genetic data for conservation management of the rare species, and to test current theory regarding population genetics of rare species. The endemics are sympatric although ecologically separated in different habitats. Their populations occur in areas with different fire and grazing regimes; a two year burning cycle on privately owned land and four year burning cycle in the Weenen Game Reserve. Livestock grazes on the privately owned land but stocking rates are very low in the Nature Reserve. The proposed Gongolo Reserve will include most populations currently in the privately owned land. Allozyme variation and differentiation was studied using starch gel electrophoresis. The relationship between the observed levels of allozyme diversity and plant mating systems is discussed. The effects of the management regimes *B. greenii* were studied in eight 15m by 15m quadrats from three populations in the four year burning cycle, three populations in the two year burning cycle and one population from the annual burn. In *B. argillicola*, three populations from eroded areas and two from non-eroded flat areas were studied.

Results for *B. argillicola* showed low allozyme diversity, low reproductive effort, an IUCN rating of Critically Endangered, short flowering season, high within-flower pollen transfer and habitat loss through erosion and road maintenance. *Barleria greenii* also merits high conservation priority but is not as threatened as *B. argillicola*. It is locally abundant with an IUCN rating of Vulnerable. Fire is the major disturbance in *B. greenii*. Both endemics are self-compatible, facultative breeding system and set fruits when pollinators are excluded but *B. argillicola* has also shown reduced demographic reliance on seeds through vegetative growth of genets (branching of the vegetative body in the sporophyte through clonal growth of roots). The management regime that favours the two species is different: a two year burning cycle with moderate grazing favours *B. greenii* but a four year burning cycle with light grazing favours *B. argillicola*. It is recommended that the two endemics be managed differently through block burning.

Comparison of population genetic structure using allozyme data between the two endemics and their widespread congener (*B. saxatilis*) revealed very low genetic diversity in the widespread congener. It is possible that cleistogamy in this species facilitates its widespread distribution. Low levels of allozyme variability could not be associated with the rarity of the endemics but rather with their mating systems that favour inbreeding.

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Declaration

I declare that this thesis is my own work and is being submitted for Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any University. Where any part of what is presented is the work of someone else, it is duly acknowledged.

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Tsepang Miriam Makholela