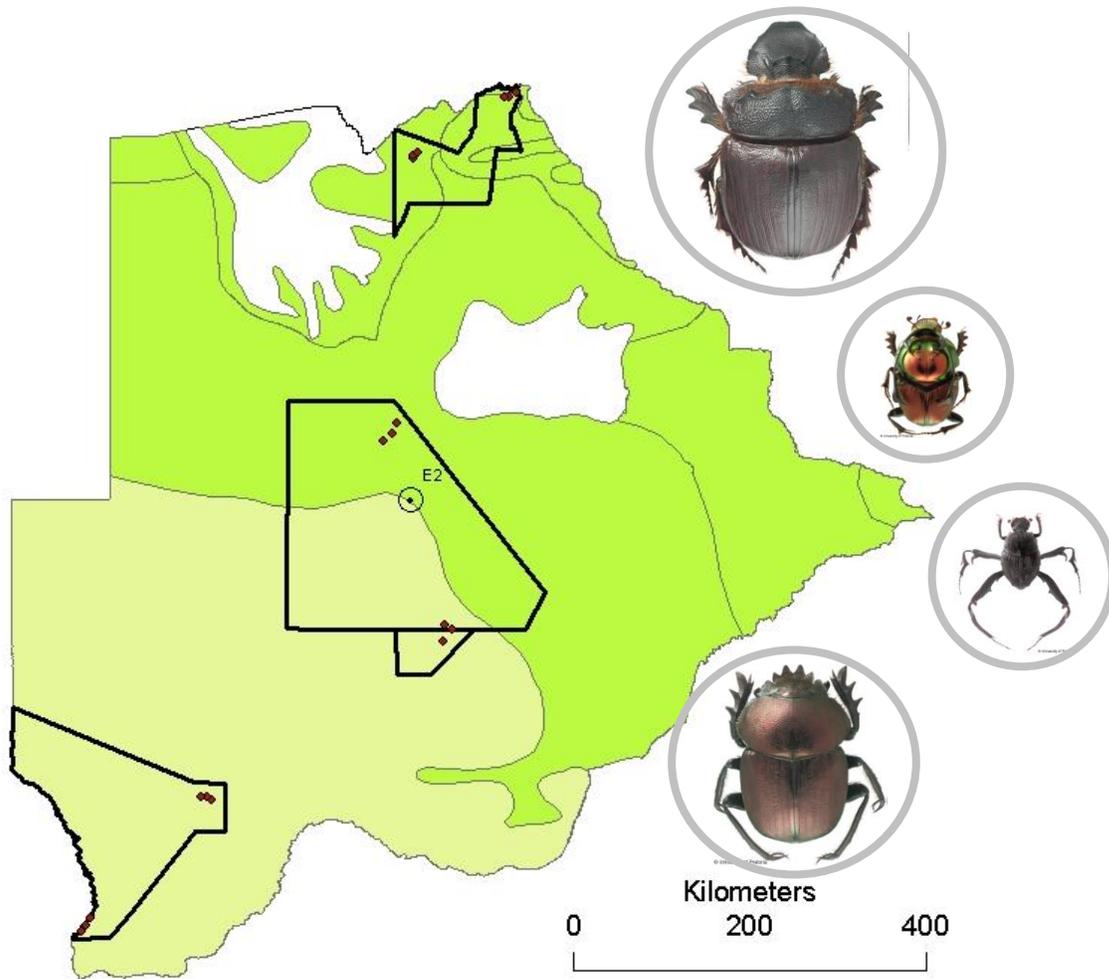


Local and regional factors influencing dung beetle assemblage structure across an environmental gradient in Botswana



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March 2011

**Local and regional factors influencing dung beetle assemblage
structure across an environmental gradient in Botswana**

By

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Submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy (Entomology) in the Faculty of Natural and
Agricultural Science University of Pretoria

Pretoria

March 2011



DEDICATION

To my late father-Kelobilwe, brother-Kelopemang and sister-Masefako

To all my teachers and mentors with love.....

“I ‘m glad I have run the course to the finish”

Abstract

The taxonomic composition, structure, and diversity of current local species assemblages results from an interacting complex of historical, regional ecological and local ecological factors. Structural differences between such current species assemblages are primarily determined by changing ecological conditions across spatial gradients. These conditions may change abruptly or they may represent a gradual divergence. Across the Botswana Kalahari basin there is a gradual northeast-southwest aridity and dung type gradient, which was demonstrated to strongly influence dung beetle assemblage structure at six study sites from Chobe National Park to the Central Kalahari Reserve to the Kgalagadi Transfrontier Park using carrion and four dung types as bait (pig, elephant, cattle, sheep). Regional patterns were primarily influenced by climate (rainfall) while dung type mainly showed a local influence on patterns of variation. Four distinct biogeographical groups were defined for the study region comprising widespread, northeast/widespread, northeast, and arid southwest Kalahari-centred species. Biogeographical diversity was higher in the more mesic NE than the arid SW but varied somewhat between bait types. In the SW, Kalahari endemics dominated all bait types. In general, abundance and species richness declined along the aridity gradient although the pattern was uneven due to low numbers in the north of the Central Kalahari Game Reserve. Species showed high turnover (beta – diversity), particularly between the moister NE and the Kalahari/Savanna ecotone. Hierarchical Analysis of Oblique Factors showed statistically distinct separation between assemblage structure at the six study sites and that the proportion of mesic NE shared influence on assemblage composition declined towards the SW where there was an increase in Kalahari endemics. Similarly the proportion of arid SW shared influence declined towards the NE. Plotting these results onto a map showed that the point of intersection between shared NE or SW influence lay very close to the ecotone between SW (Kalahari Xeric Savanna) and NE-centred ecoregions (*Acacia-Baikiaea* Savanna) defined for the area by Olson et al. (2001). In terms of dung type diversity, increasing aridity across the Kalahari represents a gradient of diminishing resources with the loss of large dung types to the SW and increasing dominance of dung pellets. Several different patterns of response were shown using different methods. Four principal patterns of bait type association were indicated by one method. Another method showed that, rather than diminishing numbers of competing species leading to widening niche widths to the

SW, niche widths were narrowest at the Kalahari / mesic Savanna ecotone. Using several other multivariate techniques, three different patterns of dung type resource partitioning were demonstrated that paralleled the aridity gradient, one common to the NE and two to the SW. The historical, regional and local ecological factors influencing these patterns of dung beetle assemblage structure are discussed as well as implications and recommendations for conservation.

Keywords: *Acacia-Baikiaea*, beetles, biogeographical patterns, Botswana, carrion, dung association, ecotone, environmental gradient, Kalahari-basin, local factors, regional factors, Scarabaeinae, xeric savanna.

ACKNOWLEDGEMENT

I would like to thank my family, especially my wife, Christina and mother, Gobotswamang. Despite the ill health and challenges, you never stopped believing in me. You have been a pillar of support and your faith in me was a source of encouragement. Thank you for your patience, tolerance, and whole hearted support. My daughter, Kabo and the boys; Reatile (Timothy) and Rebakaone (Nathan) also deserve a specially thank you. While it was difficult to work at a time you were all awake and playing in the house, you have filled my life with purpose. You have made it so meaningful that each passing day with you around me brought great joy and happiness to my heart.

Thanks are due to my supervisors; Prof. Clarke H. Scholtz and Dr. Adrian L.V. Davis, for introducing me to the magnificent and interesting world of the six legged creatures. I consider myself privileged to have learnt at the feet of such highly experienced persons. Your mentorship and encouragement has been great and you made me believe that it was possible to run the course to the finish.

I would like to thank Prof. C.T. Chimimba, Mohlamatsane Mokhatla and Tsungai Zengeya for their assistance with statistical analysis. Mr Mokhatla is also thanked for his assistance in sorting and pinning of specimen.

I would like to thank the NRF, GEF- Small Grant Programme for funding this study and Kalahari Conservation Society for administering the funds. The Government of Botswana, Ministry of Environment Wildlife and Tourism gave permission to work in protected areas. I would like to extend gratitude to all their staff for the hard work and making facilities available when necessary.

Last but not least I would like to thank all members of the Scarab Research Group for their social support. Some have been with me in the field under challenging situation where some of the big five roam freely. Christian is remembered for making a joke and laughing to attract the attention of an elephant bull while I tiptoed under small shrubs to pick up trap. I am indebted to Clarke for his father like relationship. You instilled in me a sense of belonging and going an extra mile in helping others.

DECLARATION

I, **Balathane Power Tshikae** declare that the thesis/ dissertation, which I here by submit for the degree of **Doctor of Philosophy in Entomology** at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

SIGNATURE:

DATE:

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