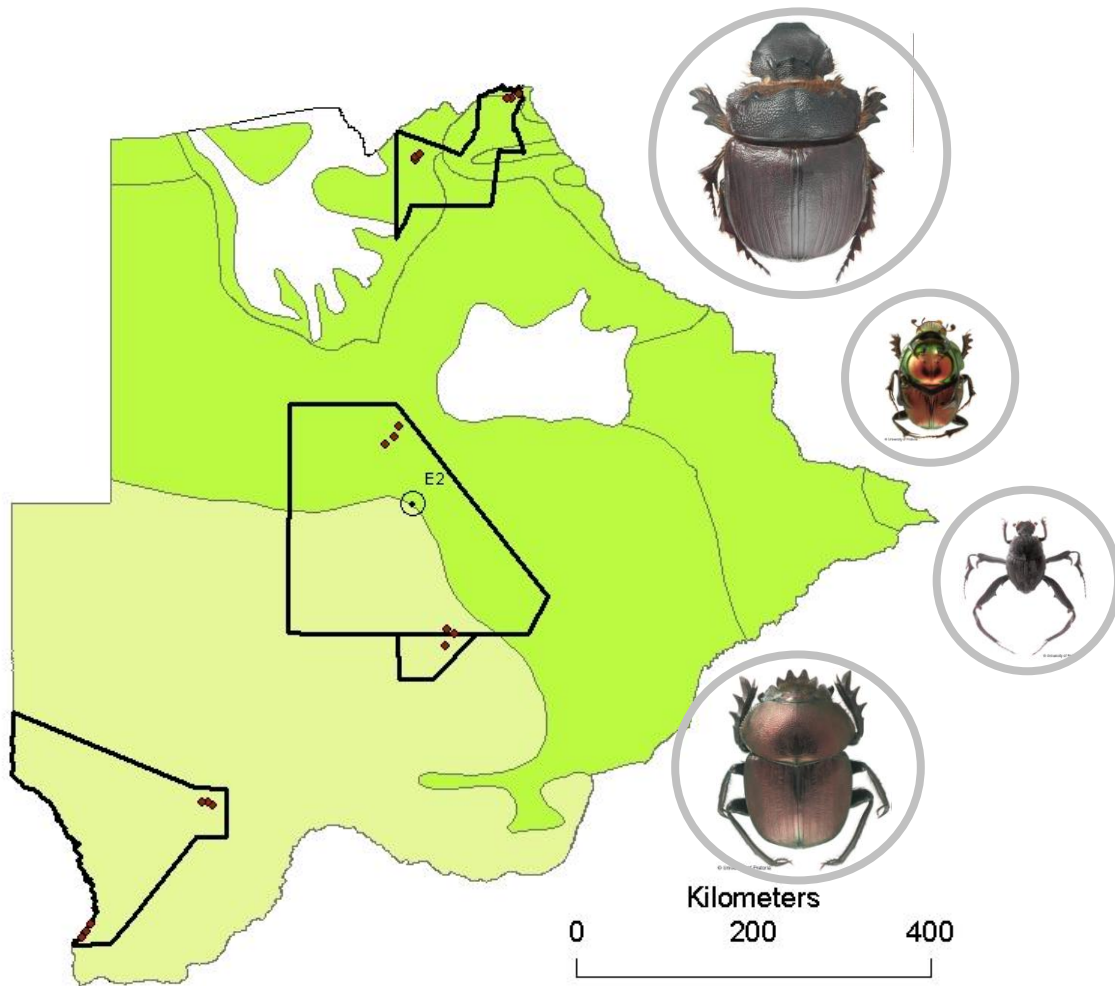


Local and regional factors influencing dung beetle assemblage structure across an environmental gradient in Botswana



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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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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.

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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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