Diversity and Distribution of Limno-Terrestrial Microfauna from Antarctica

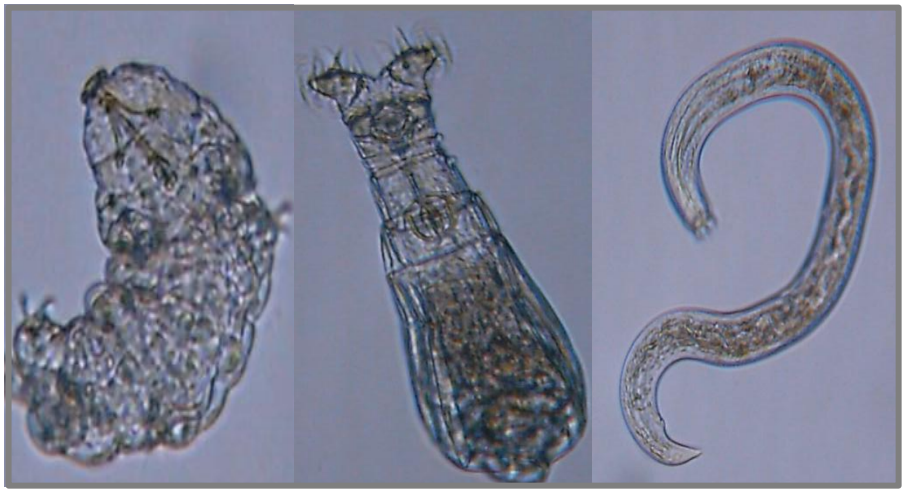

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TABLE OF CONTENTS

ABSTRACT

Antarctic terrestrial life has been described as some of the simplest on Earth. The terrestrial animals that have survived the harsh Antarctic environment are composed mostly of microfauna, such as rotifers, tardigrades and nematodes. Numerous studies have hypothesised about the lack of diversity, but few have examined this using empirical data. Molecular studies have been shown to be useful in determining relationships among populations, delineating species boundaries, dispersal patterns, and biogeographic connectivity. However, such studies of these ecologically-important animals are still limited because original taxonomic work has not been revised broadly across Antarctica. It is apparent that species diagnoses are difficult in many cases due to the minute size and conservative morphology of these animals. Here I compile a species diversity list from the microfaunal groups (Chapter I), and also examine morphological and molecular (using the mitochondrial cytochrome *c* oxidase I gene) data from 371 nematodes (Chapter III), 438 tardigrades and 526 bdelloid rotifers (Chapter IV). These data suggest that a molecular strategy is vital to discern among cryptic species and to delineate species boundaries for microfaunal groups from Antarctica compared to the sub-Antarctic and global distributions. Sequence comparisons showed local endemic and widespread distributed species, even beyond the Antarctic continent. Those widespread species and the wider range of habitats in which they were found may reflect the ability to withstand environmental stresses. Correlations of soil geochemistry and environmental variables were also established with abundance and distribution data for sites as far as 2000 km from Framnes Mountains (67.78° S- 62.79° E) to Bailey Peninsula (66.28º S-110.54º E) in East Antarctica. These data reveal bdelloid rotifers as the most diverse and widespread group inhabiting a broader range of habitats followed by tardigrades and nematodes. In this study I have uncovered potential new species as well as revealing abiotic habitat requirements and distribution levels for Antarctic limno-terrestrial microfauna. Such information is vital in future conservation and land management plans, and in identifying new putative species and detecting exotic introductions. By using the current knowledge on microfaunal diversity together with the species delimited and the distributional records presented in this study, it will help to better understand biogeography and to provide information on the species mobility in short and long term climatic changes.

DECLARATION

I, Alejandro Velasco Castrillón certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Alejandro Velasco Castrillón

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Notes on chapter format

This thesis is a combination of conventional and publication formats, therefore Chapters have been formatted in different styles. Chapter I is a review paper submitted to the journal *Polar Biology* and thus follows the journal format. Chapter II is a research article published in the journal *PLoS ONE*, and follows precisely the formatting required for the journal. Chapter III is also a research article published in the journal *Soil Biology and Biochemistry* and thus follows the style of the journal. Chapter IV compiles two research manuscripts (rotifer and tardigrade). The rotifer manuscript has been accepted in the journal *Biodiversity*, and the tardigrade manuscript has been submitted to the journal *Invertebrate Systematics*. The style used in Chapter IV follows the guidelines required by the journal *Biodiversity*. Chapter V is the General Discussion of thesis and it has not been submitted to any journal.

The format of this thesis complies with the outlined in 'Specifications for Thesis' supplied by the University of Adelaide Graduate Centre: http://www.adelaide.edu.au/graduatecentre/program-rules/docs/specifications_thesis_2013.pdf.

Statements declaring Co-Author contributions preludes each chapter published, accepted or submitted for publication.