THE TAXONOMY, ECOLOGY AND BIOLOGY OF THE *BANKSIA SPINULOSA* SM. COMPLEX (PROTEACEAE)

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Declaration

I, Margaret Leith Stimpson, declare that the substance of this thesis has not been previously submitted for any degree or qualification and is not currently being submitted for any other degree or qualification.

I certify that any assistance received and all sources used in the preparation of this thesis have been acknowledged in this thesis.

Margaret L. Stimpson

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PROLOGUE

Format

The main layout of the thesis follows the Style Guide of the University of New England http://www.une.edu.au/research-services/forms/thesis-submission-instructions.php.The bibliographic style was formatted using Endnote X7 software. Formatting of the papers which constitute the major part of the thesis follows the editorial style of the relevant journal. For other chapters the format follows that of *Australian Systematic Botany*. Figures and tables are located throughout the text, which is left hand justified, and one and a half line spacing is used throughout the thesis.

Status of nomenclature

Following Articles 29 and 30 (especially 30.5) of the International Code of Botanical Nomenclature (http://ibot.sav.sk/icbn/main.htm), names presented in chapters of this thesis are not to be regarded as validly published.

Project statement

This study is a comprehensive examination of the named and putative entities in the *Banksia spinulosa* complex, addressing the taxonomy, ecology, and biological interactions among species within the complex.

Thesis layout

The main body of the thesis is made up of a series of related papers. The current status of each paper is presented in the table of contents. My percentage contribution is given at the end of each paper, as is, the statement of originality. Each published paper is presented as a printed PDF carrying the original pagination from the journal. **Chapter 3** has been published in *Australian Systematic Botany* (Stimpson *et al.* 2016). Chapters 4–6, although destined for different journals are all presented here according to *Australian Systematic Botany* format. All tables and figures are incorporated into the text in appropriate positions. This renders redundant a separate "List of Tables" and "List of Figures" for the thesis as a whole. References are presented for each chapter rather than in a final cumulative bibliography, in line with the chapters being prepared as manuscripts for separate publication. The introduction (**Chapter 1**) provides general introduction and aims and sets up the links between the papers. The general conclusion (**Chapter 7**) ties the thesis together and presents some general conclusions about the project.

Table of contents

Abstract

The *Banksia spinulosa* complex ranges from Mossman in north Queensland down the east coast of Australia to Wilsons Promontory in Victoria, with four isolated populations in central Queensland. A morphometric analysis (SSH-MDS ordination and UPGMA clustering) of individuals for 34 characters and 234 specimens from mature plants collected across the full geographic and morphological range of the *B. spinulosa* complex supports the recognition of *Banksia vincentia* (Chapter 2), the recognition of the four other named entities (*B. neoanglica*, *B. spinulosa*, *B. collina sens. str*., *B. cunninghamii*), and of 12 putative entities, viz. *B*. Julatten, *B*. Mount Mee, *B*. Tewantin, *B.* McPherson Range, *B*. Kungala, *B*. Putty Road, *B*. Carnarvon Gorge, *B*. Robinson Gorge, *B*. Isla Gorge, *B*. Cockatoo, *B*. Croajingolong, *B*. Wilsons Promontory (Chapter 3).

The results in chapters 2–3 are considered and discussed in the context of competing species concepts. The integrated species concept of De Queiroz is favoured and informs the need for the study undertaken on seedling morphology (Chapter 4). Examination of seedling morphology illustrates the importance of looking at both adult and seedling morphology when delimiting species. While most entities in the *B. spinulosa* complex are heteroblastic several are homoblastic. Aside from these developmental changes, leaf morphology is relatively fixed for entities in the *B. spinulosa* complex regardless of biotic or abiotic influences (Chapter 4).

High Performance Liquid Chromatography with Diode Array Detection (HPLC-DAD) at 520 nm and 455 nm was performed to identify chemical differences across entities in the *B. spinulosa* complex. Entities were grouped by style colour (Chapter 5). HPLC analysis demonstrated that flower colour correlated with chemical differences in the anthocyanins and is not a pH mediated ionic state, as with many other plants. Soil samples were taken at a depth of 100 mm and analysed for pH and nitrogen. Regression analysis showed there were some statistically significant differences in floral colour and pH and N and statistically significant differences in the edaphic environments for each of the putative entities.

Most of the named and putative entities in the *B. spinulosa* complex are resprouters, with capacity to resprout from a subterranean lignotuber. This study demonstrates that cotyledons and the cotyledonary node play a vital role in the development of lignotubers and survival of seedlings, and therefore the regeneration of taxa in the *B. spinulosa* complex (Chapter 6).