The Biology and Systematics of 
*Bowenia* Hook ex. Hook f. 
(Stangeriaceae: Bowenioideae)

Thesis submitted by

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STATEMENT OF ACCESS

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DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text.

…………………………..        ………………
Gary Whittaker Wilson      Date
Statement of Systematic intent

It should be noted that, according to article 29 of the International Code of Botanical Nomenclature, this thesis does not qualify as an effective and valid publication. Therefore, descriptions of new genera, species or new combinations contained herein are not validly published.

I, the undersigned, the author of this thesis, recognise that descriptions of new genera, species or new combinations must be published in recognised and peer reviewed journals.

.................................................           ............
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Abstract

The contents of this thesis describe a study of the Biology and Systematics of *Bowenia* Hook. ex Hook. f. (Cycadales, Stangeriaceae, Bowenioideae). The genus contains two recognised extant species, *B. spectabilis* (Hook. ex Hook.) and *B. serrulata* (W. Bull) Chamberlain. They are restricted to small areas of tall moist and closed forests of central and northeast Queensland, Australia, respectively. The genus was named after Sir George Ferguson Bowen (1821-1899), the species epithet *spectabilis* refers to the spectacular leaves with pinnules (1st order leaflets) with entire margins in the first case and *serrulata* to the serrate margins of the pinnules in the second. The species are unique in the extant cycads in having bipinnate foliage.

Surprisingly little is known about the biology of the members of this genus and this study redresses that situation. In addition, the systematics of *Bowenia* currently present difficulties for taxonomists and management authorities, as there is confusion about the number and distribution of species of *Bowenia* and the status of disjunct and morphologically different populations in northeast Queensland. As there is considerable interest in harvesting *Bowenia* leaves for the Australian and international ‘cut flower’ markets, clarification of the systematics of the genus is necessary for its effective management, and this study addresses this need.

The strategy adopted for the study was to undertake intensive fieldwork in central Queensland, become familiar with the taxon growing there, and then use that knowledge to facilitate studies in north Queensland. Studies in the field were complimented by work in the laboratory and in the greenhouse.

*Bowenia* contains a suite of toxins, is slow growing, reproductive events occur once a year and immediately prior to the onset of the ‘wet’ season, and access to study populations at the appropriate times was often difficult. These factors meant that the fieldwork required collecting sufficient data for analysis extended for a decade. The sequence of events in the study was to collect data on the morphology, reproductive biology, insect associations and genetic profiles of the taxa and integrate them in a database that could latter be used to provide characters for a phylogenetic analysis and a subsequent review of the systematics of the genus.
Studies of the morphology of plants in six populations representing the two
recognised species and both morphological forms found in north Queensland,
found that they could not readily be differentiated on the basis of leaf, pinnae
and pinnule number or morphometrics or the size and branching habit of the
subterranean stem. As these characteristics had initially been used to
distinguish the two species, a search was made for other characters on which to
base a phylogenetic analysis.

The pollination of the taxa was found to be obligate entomophilic and mediated
by Molytine weevils involved in species-specific ‘brood site reward’ pollination
syndrome. *Miltotranes protermalis* (Lea) was demonstrated to be the pollination
vector of all northern populations and *M. subopacus* (Lea) to be the pollination
vector of plants in Central Queensland. In addition, it was discovered that the
leaf beetle *Lilioceris nigripes* (Fabricius), whose range includes that of *Bowenia*,
distinguished between the populations in central and northeast Queensland but
not the northern populations.

Studies of the karyomorphology of representatives of the two currently named
species and the disjunct and morphologically variable northern populations
indicated the presence of two taxonomic entities. The first was the population in
central Queensland corresponding to the currently recognised *B. serrulata* and
the second comprised all the populations, irrespective of their pinnule and root
morphology, in northeast Queensland.

A phylogenetic analysis using twelve characters across the six populations of
*Bowenia* confirmed the presence of just two species, conforming to those
previously named. A comparison of the result of the phylogenetic analysis with
the distribution of the two taxa show that *Bowenia serrulata* (W. Bull)
Chamberlain is restricted to central Queensland and *B. spectabilis* Hook. ex
Hook. is restricted to northeast Queensland, and the two are and have been
divided for millions of years by the intervening megathermal Burdekin Gap. In
addition, the results show that *B. spectabilis* is morphologically variable and that
plants with pinnules with serrate margins in northeast Queensland are
examples of phenotypic variation within this species.
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Paul Gadek provided access to laboratory space and facilities on the JCU Cairns campus. Eda Addicott, Principal Botanist of the Queensland Herbarium, Mareeba, provided her support and a pleasant working environment during the preparation of this thesis.

Dr Robyn Wilson assisted me in the field, advised on matters statistical, reviewed drafts of this thesis and papers resulting from this study, and good-naturedly tolerated my enthusiasm for all things ‘cycad’. Paul Forster, of the Queensland Herbarium, provided friendship and intellectual support, and was ably assisted in this regard by Lou Randall and Dr Roy Osborne. Dr Gordon Guymer, Director of the Queensland Herbarium, gave permission for access to the collection. I collaborated with Dr Goro Kokubugata of Tsukuba Botanic Gardens on the karyological studies reported here, and it was a pleasure to work with him at JCU and the Queensland Herbarium while he was a visiting fellow in 2000. Dr Elwood Zimmerman, Dr Rolf Oberprieler and Tom Weir of the ANIC, Canberra, and Ross Storey of QDPI, Mareeba, advised on the entomological aspects of this study and I thank them all.

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I particularly wish to express my gratitude to my family, Robyn and Cleo, who provided physical and intellectual support during a study involving a good deal of discomfit and far too many ticks and leaches - I owe them both more than I can ever express.
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__________ (1993b) The relationship between Cycas ophiolitica K.D. Hill Cycadaceae), the butterfly Theclinesthes onycha (Lycaenidae), the beetle Lilioceris nigripes (Coleoptera: Chrysomelidae) and the ant Iridomyrmex purpureus. 1991 Symposium Series. UCQPGSA, Rockhampton.


Poster papers


Technical Reports