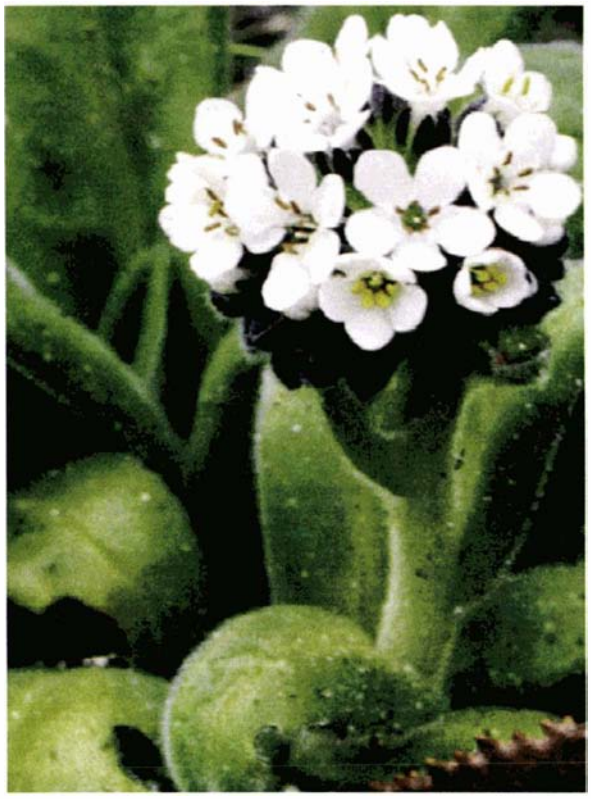

*Myosotis rakiura*

*"With regard to general problems of biogeography, the biota of New Zealand has been, perhaps, the most important of any in the world. It has figured prominently in all discussions of austral biogeography, and all notable authorities have felt obliged to explain its history: explain New Zealand and the world falls into place around it."*

*Gareth Nelson (1975)*

# Evolution of the New Zealand Alpine Flora:

# Origins, Diversification and Dispersal

A thesis presented in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy
in
Plant Biology and Biotechnology

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New Zealand.

Richard Charles Winkworth

2000

# ABSTRACT

This thesis describes molecular systematic studies that test hypotheses concerning the age and origins of the New Zealand alpine flora. Analyses of nuclear and chloroplast DNA markers for two plant groups that have radiated extensively in the alpine zone of New Zealand – the genus *Myosotis* (Boraginaceae) and the Australasian apioid Umbelliferae – are reported. The molecular results suggest that the diversification of these groups in New Zealand has occurred since the late Tertiary. This finding corroborates recent molecular systematic studies on other New Zealand plant groups. Taken together, these studies suggest that New Zealand's modem floristic diversity was greatly influenced by dramatic global climate change during the late Tertiary and Quaternary. These results are also consistent with those reported for plant groups overseas. In these, recent diversification has occurred with Quaternary climatic fluctuations (Comes & Kadereit, 1998) and colonisation of insular environments (Crawford & Stuessy, 1997)

The molecular analyses also suggest that since the late Tertiary, *Myosotis* and the Australasian Apioideae have been involved in transoceanic dispersal events both to and from New Zealand. However, while most other molecular studies have provided evidence for the importance of circum-polar westerly winds, the present data suggests that, for *Myosotis* and with less confidence the apioid genera, some dispersal events have been in a westerly direction. Since this finding was made, late Tertiary and Quaternary westward dispersal has also been inferred for other New Zealand alpine plants. These observations suggest that passive eastward wind dispersal can not explain the distributions of all southern Pacific plant groups.

The present study, as well as other recent studies, has highlighted the need to develop molecular tools and analytical approaches for describing the potentially complex evolutionary relationships between taxa that have originated since the late Tertiary. Here, the amplified fragment length polymorphism (AFLP) method was investigated as a means of identifying fast evolving genome regions in New Zealand *Myosotis.* Preliminary analyses suggest that this is a useful approach for locating highly variable molecular markers. However, like other rapidly evolving regions (e.g. Buckler *et al.*, 1997) some of the derived markers were multiple copy and polymorphic at different loci within a single genome. This feature of fast evolving genome regions is problematical since bifurcating evolutionary analysis models will poorly represent such complex data. For this reason split-decomposition was investigated as an alternative method for data representation. This approach was found to have both advantages and limitations for studying late Tertiary or Quaternary radiations.

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# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES