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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

at Massey University, Palmerston North,
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 modern 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.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my “official” supervisors Peter Lockhart, Alastair Robertson and Phil Garnock-Jones. Without their patience, guidance and encouragement I doubt I would have made it this far.

I gratefully acknowledge those groups that have provided funding for this research project – the New Zealand Marsden Fund and Massey University (GRIF and MURF). Thanks also to the Ecology Department Development Fund and IMBS Travel Fund for contributions towards travel to the International Botanical Congress during 1999. I also acknowledge Prof. Dr. Uwe Jensen for sponsoring my stay at the Lehrstuhl Pflanzenökologie und Systematik (Universität Bayreuth) during the early part of this project.

I am very grateful to the many people who have supplied plant samples, especially Prof. Dr. Jürke Grau (Staatsherbarium München) for providing a large number of tissue samples from Northern Hemisphere *Myosotis*.

I have benefited from having many “unofficial” advisors in the DEBLab and “Boffin Lounge” – thanks for always putting the “official” advice into perspective. I wish all of you the best for the future, no matter where that might be.

A special thank you to Pete and Trish, you have made the last four years a wonderful experience. Thanks for your friendship and support.

I would also like to thank my friends throughout IMBS, those I have met here and those who “invaded” from Victoria. You have made working here an enjoyable experience.

Thanks to my family for providing motivation and support over the last four years. A special note to my Dad, in answer to your favourite question I can now say, “yes, it’s finally finished”.

My last thank you is for Cynthia, to whom this thesis is dedicated. Your love and support has played a large part in the completion of this thesis. Thank you.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
LIST OF FIGURES	viii
LIST OF TABLES	x
CHAPTER 1: INTRODUCTION	1
1.1 GEOLOGICAL AND CLIMATIC CHANGE IN NEW ZEALAND	1
1.1.1 The Cretaceous and early Tertiary	1
1.1.2 The middle Tertiary	2
1.1.3 The Pliocene and Pleistocene	4
1.1.4 The post-glacial period	5
1.2 THE CONTEMPORARY ALPINE ZONE	6
1.2.1 The New Zealand mountains	6
1.2.2 Alpine climates	7
1.3 THE NEW ZEALAND ALPINE FLORA	8
1.3.1 Diversity and endemism	8
1.3.2 Alpine plant communities	9
1.3.3 Specialised forms in the alpine flora	9
1.4 HYPOTHESES CONCERNING THE ORIGINS OF THE ALPINE FLORA	11
1.4.1 A long history in New Zealand	11
1.4.2 Recent dispersal from southern origins	12
1.4.3 Recent immigration of northern ancestors	13
1.5 OUTLINE OF THE THESIS	13
CHAPTER 2: MATERIALS AND METHODS	15
2.1 PLANT MATERIAL AND COLLECTION	15
2.1.1 Sources and collection of <i>Myosotis</i> and outgroup taxa tissue samples	15
2.1.2 Sources and collection of <i>Aciphylla</i> , <i>Anisotome</i> and <i>Gingidia</i> tissue samples	16
2.2 NUCLEIC ACID EXTRACTION	16
2.3 AGAROSE GEL ELECTROPHORESIS	18

2.4 GENOMIC DNA PURIFICATION FOR THE POLYMERASE CHAIN REACTION	18
2.5 AMPLIFICATION OF DNA MARKERS BY PCR	19
2.5.1 Double-stranded PCR amplifications of DNA marker loci using Q-solution	19
2.5.2 Semi-nested PCR amplifications of chloroplast <i>matK</i> , <i>JSAD</i> and <i>ndhF</i> loci	21
2.5.3 Double-stranded DNA amplification of the nuclear ITS locus using Enhancer solution	21
2.6 PURIFICATION AND QUANTIFICATION OF PCR AMPLIFIED FRAGMENTS FOR AUTOMATIC SEQUENCING OR CLONING	22
2.7 CLONING OF PCR PRODUCTS	23
2.7.1 Blunt-end ligation of purified PCR products into the pGEM-T vector or pGEM-T Easy vector	23
2.7.2 Preparation of selective agar plates	23
2.7.3 Transformation of ligated vector and insert into <i>E. coli</i> cells and plating out of cells	24
2.7.4 Isolation and culturing of transformant colonies	25
2.7.5 Extraction of plasmid DNA from <i>E. coli</i> cell culture by the rapid boil technique	25
2.7.6 Characterisation of cloned inserts by restriction enzyme digestion	26
2.7.7 Characterisation of cloned inserts by PCR	27
2.8 DIRECT AUTOMATIC SEQUENCING OF DNA TEMPLATES	27
2.8.1 Automatic sequencing reactions	27
2.8.2 Electrophoresis of automatic sequencing reactions	28
2.9 PHYLOGENETIC ANALYSIS OF DNA SEQUENCES	29
2.9.1 The data alignment	29
2.9.2 Tree reconstruction methods	30
2.9.3 Evaluating the recovered tree(s)	33
2.9.4 Molecular clock analysis	35
2.10 DNA FINGERPRINTING USING THE AFLP SYSTEM	36
2.10.1 Restriction enzyme digestion of genomic DNA	36
2.10.2 Preparation of oligonucleotide adapters	38
2.10.3 Addition of adapter sequences to genomic DNA fragments	38
2.10.4 Pre-selective PCR amplifications	38
2.10.5 Selective PCR amplifications	39
2.11 PREPARATION, ELECTROPHORESIS AND SILVER-STAINING OF DENATURING POLYACRYLAMIDE GELS	39
2.11.1 Preparation of polyacrylamide gels	39
2.11.2 Preparation of a DNA size standard for electrophoresis on polyacrylamide gels ...	41
2.11.3 Preparation of samples for electrophoresis on polyacrylamide gels	41
2.11.4 Sample loading and electrophoresis	41
2.11.5 Detection of DNA fragments by silver staining of polyacrylamide gels	42

2.12 ISOLATION, CHARACTERISATION AND USE OF NOVEL DNA MARKER SYSTEMS IDENTIFIED USING THE AFLP SYSTEM	43
2.12.1 Isolation of polymorphic bands from silver stained polyacrylamide gels	43
2.12.2 PCR amplification of polymorphic bands isolated from silver stained polyacrylamide gels	43
2.12.3 Purification of PCR amplified polymorphic bands	43
2.12.4 Cloning of re-amplified polymorphic AFLP bands	44
2.12.5 Characterisation of cloned polymorphic AFLP bands	44
2.12.6 Primer design	44
2.12.7 PCR amplification and characterisation of AFLP derived marker loci	45
CHAPTER 3: THE EVOLUTION AND BIOGEOGRAPHY OF THE GENUS <i>MYOSOTIS</i> L. (BORAGINACEAE)	46
3.1 INTRODUCTION	46
3.1.1 The family Boraginaceae (A. L. de Jussieu)	46
3.1.2 The genus <i>Myosotis</i>	47
3.2 MATERIALS AND METHODS	52
3.2.1 Collection of DNA sequence	52
3.2.2 Phylogenetic analysis of DNA sequence	52
3.2.3 Morphological analysis	53
3.3 DATA ANALYSIS	53
3.3.1 Aligned sequence data	53
3.3.2 Phylogenetic gene trees	54
3.3.3 Relative genetic diversity and outgroup rooting	58
3.3.4 Morphological diversity	59
3.3.5 Age of the Australasian lineage in the Southern Hemisphere	59
3.3.6 Dispersal in the Southern Hemisphere	62
3.3.7 Dispersal in the Northern Hemisphere	63
3.4 DISCUSSION	63
3.4.1 Aligned sequence data	63
3.4.2 The similarity between gene trees: phylogeny?	64
3.4.3 Relative genetic diversity and outgroup rooting	64
3.4.4 Morphological diversity	65
3.4.5 Age of the Australasian lineage in the Southern Hemisphere	65
3.4.6 Dispersal in the Southern Hemisphere	66
3.4.7 Dispersal in the Northern Hemisphere	66
3.4.8 Implications of molecular analyses for the intrageneric classification of <i>Myosotis</i> ..	67
3.4.9 Taxon sampling	67

3.4.10 Other recent studies	67
CHAPTER 4: DIVERSIFICATION OF THE AUSTRALASIAN APIOID UMBELLIFERAE (JUSS.)	68
4.1 INTRODUCTION	68
4.1.1 The Umbelliferae	68
4.1.2 The Australasian apioid Umbelliferae	71
4.2 MATERIALS AND METHODS	78
4.2.1 Data collection from <i>Aciphylla</i> , <i>Anisotome</i> and <i>Gingidia</i>	78
4.2.2 Additional DNA sequences	78
4.2.3 Phylogenetic analysis	78
4.3 DATA ANALYSIS	79
4.3.1 Aligned sequence data	79
4.3.2 Phylogenetic gene trees	80
4.3.3 The level of genetic diversity	81
4.3.4 Age of the Australasian lineage in the Southern Hemisphere	83
4.3.5 Dispersal in the Southern Hemisphere	83
4.4 DISCUSSION	84
4.4.1 Aligned sequence data	84
4.4.2 Phylogenetic gene trees	84
4.4.3 The level of genetic diversity and outgroup rooting	85
4.4.4 Age of the Australasian lineage in the Southern Hemisphere	85
4.4.5 Dispersal in the Southern Hemisphere	86
4.4.6 Implications of molecular analyses on the generic level taxonomy of the Australasian Apioideae	86
4.4.7 Taxon sampling	87
4.4.8 Other recent studies	87
CHAPTER 5: PHYLOGENETIC ANALYSIS OF LATE TERTIARY AND QUATERNARY PLANT RADIATIONS	88
5.1 OBSERVATIONS ON RECENT SPECIES RADIATIONS	88
5.2 RECONSTRUCTING PHYLOGENY IN RECENT SPECIES RADIATIONS	89
5.2.1 Are bifurcating methods useful for studying recent radiations?	89
5.2.2 Networks: an alternative method	89
5.2.3 Desirable properties of split-decomposition representation	90
5.2.4 Edge length estimation in split-decomposition representation	91
5.2.5 Heteroplasmic sites	96

5.3 DEVELOPING NOVEL MOLECULAR MARKERS FOR STUDYING RECENT SPECIES	
RADIATIONS	99
5.3.1 Using DNA fingerprint profiles to locate sequence specific markers	99
5.3.2 Conversion of AFLP markers to sequence specific PCR markers	100
5.3.3 Characteristics of AFLP derived markers in <i>Myosotis</i>	100
5.3.4 Potential limitations of this approach	102
5.3.5 Future development of approaches to locating sequence specific PCR markers for studying recent species radiations	103
CHAPTER 6: SYNTHESIS OF MOLECULAR STUDIES CONCERNING THE EVOLUTION OF THE NEW ZEALAND ALPINE FLORA	104
6.1 THE AGE AND ORIGINS OF THE NEW ZEALAND ALPINE FLORA	104
6.1.1 The age and origins of New Zealand alpine lineages	104
6.1.2 Could dispersal account for the presence of all extant plant groups in New Zealand?	105
6.1.3 The importance of New Zealand in Southern Hemisphere dispersal	107
6.2 RAPID MORPHOLOGICAL DIFFERENTIATION IN GENERA OF THE NEW ZEALAND ALPINE FLORA	109
6.2.1 Recent evolution of plant biodiversity in insular environments	109
6.2.2 Evolution of specialised forms in the New Zealand alpine flora	110
6.2.3 Plant developmental genetics: A basis for understanding Pliocene and Pleistocene speciations	111
6.2.4 Have hybridisation and polyploidy had roles in the rapid evolution of the New Zealand alpine flora?	111
6.2.5 The importance of environmental change in the evolution of alpine biodiversity in New Zealand	113
REFERENCES	115
APPENDIX I: <i>Myosotis</i> and outgroup accessions	127
APPENDIX II: Australasian Apioideae and outgroup accessions	129
APPENDIX III: Oligonucleotide primers	131
APPENDIX IV: Oligonucleotides used in AFLP	132
APPENDIX V: DNA primers for AFLP derived markers	132
APPENDIX VI: Data files and analyses	133
APPENDIX VII: Morphological data set for <i>Myosotis</i>	134
MANUSCRIPTS	After page 138
DISC APPENDIX I	Inside Back Cover

LIST OF FIGURES

Figure 1.1	The changing geographic outline of New Zealand during the Tertiary and Quaternary Periods (modified from Suggate <i>et al.</i> , 1978).	3
Figure 1.2	Alpine areas of New Zealand (from Fisher, 1965)	7
Figure 2.1	A comparison of the amounts of information evaluated by different phylogenetic methods.	31
Figure 2.2	Split-decomposition.	34
Figure 2.3	Path length comparison for the relative rates test of Steel <i>et al.</i> (1996).	36
Figure 2.4	Example of the AFLP procedure using one primer pair (modified from the AFLP™ Analysis System I instruction manual [Gibco BRL])	37
Figure 3.1	Bootstrap consensus trees using parsimony, edge lengths estimated under ACCTRAN (using PAUP 4.0b3a).	56
Figure 3.2	Quartet Puzzle trees with edge lengths estimated using maximum likelihood (using Swofford, 199X; PAUP 4.0b3a).	57
Figure 3.3	Scattergraph for a Principal Components Analysis (PCA) involving 17 morphological characters which could be scored for 16 representative taxa.	60
Figure 3.4	Estimating the possible age of the Southern Hemisphere ancestor.	60
Figure 3.5	Quartet puzzle tree with edge lengths estimated using maximum likelihood (PAUP 4.0b3a), made using a data set of 634 nucleotides from the nrITS locus for 22 <i>Myosotis</i> taxa.	63
Figure 4.1	Inflorescence types in the New Zealand apioideae Umbelliferae.	73
Figure 4.2	Parsimony bootstrap consensus tree of ITS1 and ITS2 regions of the nrDNA (374 nucleotides) for 30 Apioideae, edge lengths estimated under ACCTRAN (using PAUP 4.0b3a).	81
Figure 4.3	Quartet Puzzle trees with edge lengths estimated using maximum likelihood (using PAUP 4.0b3a) for <i>Aciphylla</i> , <i>Anisotome</i> and <i>Gingidia</i> .	82
Figure 5.1	A comparison of the information that can be represented by different types of tree building procedure.	90
Figure 5.2	Splits-graphs (using Huson, 1998; SplitsTree 3.1) made using nuclear ITS data sets from representatives of the Southern Hemisphere radiation of <i>Myosotis</i> and the most closely related Northern Hemisphere taxa.	92
Figure 5.3	Splitsgraphs (using Huson, 1998; SplitsTree 3.1) made using nuclear ITS data sets from representatives of the Australasian apioideae Umbelliferae and outgroup genera.	93
Figure 5.4	Splits-graphs (using Huson, 1998; SplitsTree 3.1) made using nuclear ITS data sets from representatives of the Hawaiian silversword alliance and outgroup genera.	94
Figure 5.5	Splits-graphs (using Huson, 1998; SplitsTree 3.1) made using nuclear ITS data sets from representatives of the Juan Fernandez Island endemic genus <i>Dendroseris</i> and outgroup genera.	95

<i>Figure 5.6</i>	An example of the calculation of isolation indices for internal edges of a splits-graph.	96
<i>Figure 5.7</i>	Splits-graphs (using Huson, 1998; SplitsTree 3.1) made using a data set of 610 nucleotides from the ITS region of the nuclear ribosomal DNA for 34 <i>Myosotis</i> taxa.	97
<i>Figure 5.8</i>	Splits-graphs (using Huson, 1998; SplitsTree 3.1) made using a data set of 867 nucleotides from the 3' region of the chloroplast maturase K gene locus for 34 <i>Myosotis</i> taxa.	98
<i>Figure 5.9</i>	Electrophoretic profiles of amplified alleles from the AFLP derived markers MYOAT3 and MYOGC5.	101

LIST OF TABLES

Table 1.1	General patterns in the composition of mid Tertiary to Quaternary floras of New Zealand.	4
Table 1.2	Plant communities of the New Zealand alpine zone (following Dawson, 1998; Mark & Adams, 1995).	10
Table 2.1	Oligonucleotide primers and thermocycling conditions used in the PCR amplification of established DNA marker loci.	20
Table 2.2	Oligonucleotide primers and thermocycling conditions used in the nested PCR amplification of established DNA marker loci.	22
Table 2.3	Combinations of selective amplification primers used for AFLP analysis.	40
Table 3.1	Outline of de Candolle's (1846) infrageneric classification of <i>Myosotis</i> (following Grau & Schwab, 1982).	49
Table 3.2	Outline of the infrageneric classification of <i>Myosotis</i> proposed by Grau & Schwab (1982).	51
Table 3.3	Statistics from the aligned data matrices of <i>Myosotis</i> DNA sequences.	54
Table 3.4	Major groupings of <i>Myosotis</i> sequences indicated by gene trees derived from chloroplast and nuclear DNA markers.	55
Table 3.5	<i>P</i> values from partition homogeneity test with 1000 replicates for various partitions in the combined data set.	59
Table 3.6	Age estimates for the origin and diversification of the austral lineage of <i>Myosotis</i> .	61
Table 4.1	Characteristic features of the Apiaceae (from Heywood, 1993; Downie <i>et al.</i> , 1998).	69
Table 4.2	Outline of Drude's (1897-1898) classification of the Umbelliferae (modified from Heywood, 1993).	70
Table 4.3	Broad groupings of the Australasian genera of the subfamily Apioideae (following Dawson, 1971).	72
Table 4.4	Taxonomic history of the Australasian apioid Umbelliferae (following Dawson & Webb, 1978).	75
Table 4.5	Statistics from the aligned data matrices of DNA sequences from the Australasian apioid genera <i>Aciphylla</i> , <i>Anisotome</i> and <i>Gingidia</i> .	79
Table 4.6	Age estimates for the origin and diversification of the austral lineage of the Apioideae.	84
Table 6.1	Recent molecular studies that have inferred long distance dispersal in the Southern Hemisphere.	108