Phase change, flowering and postharvest characteristics of *Metrosideros excelsa* (Myrtaceae)

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

Doctor of Philosophy
in
Plant Biology

at the
Institute of Molecular BioSciences
Massey University, Palmerston North,
New Zealand

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2001

Abstract

The development of *Metrosideros excelsa* (pohutukawa) as an ornamental crop has been limited by a lack of knowledge on the cultural requirements and underlying physiological processes associated with: (a) vegetative phase change (maturation) following micropropagation, (b) the environmental control of flowering, and (c) the postharvest characteristics of the cut-flower. These three concerns were addressed in this thesis.

First, plantlets of *M. excelsa* that had undergone rejuvenation following micropropagation, were subjected to shoot and root restriction treatments to accelerate vegetative phase change. Leaves of shoot-restricted, single-stemmed plants became progressively more adult with increasing node position, whereas root restriction reduced root growth but did not accelerate vegetative phase change. In single-stemmed plants, light saturated maximum rate of photosynthesis and leaf carbon isotope discrimination decreased within increasing node position. However, carbon isotope composition in leaves of these plants diverged away from those exhibited by leaves of adult plants, possibly reflecting physiological changes resulting from altered source/sink relations.

Second, the effects of photoperiod, temperature and irradiance on floral initiation and development were examined in *M. excelsa* by manipulating these parameters in controlled and greenhouse environments. *M. excelsa* responded as a facultative short-day plant with maximum flowering occurring following a 15 weeks cool (mean 15°C) short-day (10 h) inductive treatment. An irradiance of 567 $\mu mol\ m^{-2}\ s^{-1}$ during induction provided the optimal conditions for floral primordial growth and subsequent flower development. Buds initially 2.0-3.0 mm in diameter had the highest probability of becoming floral, whilst those less than 2.0 mm in diameter were more likely to remain vegetative or to not break.

Finally, the postharvest characteristics of *M. excelsa* as a cut flower were assessed. Generally, holding solution treatments containing sucrose extended vase life, whereas those containing HQC (applied alone or as a pulse) were detrimental. Cut flowers were sensitive to exogenous ethylene and pre-treatment with inhibitors of ethylene action (STS and 1-MCP) conferred significant protection.

This thesis has contributed significantly to furthering our understanding and knowledge of cultural and physiological factors that underlie vegetative phase change, flowering and vase life characteristics in flowers of *M. excelsa*.

Acknowledgements

My sincerest gratitude goes to my supervisors for providing not only the opportunity to undertake this project but also for the guidance provided throughout. Specifically, I would like to thank my main supervisor Dr. John Clemens for the countless discussions, encouragement, expertise and most of all his friendship. I am also especially thankful to my co-supervisor Professor Paula Jameson whose advice, encouragement and expertise throughout my thesis has been extremely appreciated. A special thanks also goes to my co-supervisor Mr. Garry Burge (The Crop and Food Research Institute) for providing a friendly and supportive role, including access to laboratory space and equipment.

Thank you to Dr. Dennis Greer (The Food and Horticultural Research Institute) for providing technical support with the use of photosynthetic equipment, laboratory space and interesting discussions.

Thank you to members of the Institute of Molecular BioSciences who have contributed to this project. This includes those who have provided technical support, helpful advice and assistance. Thank you to my lab colleagues Lehka, Suzanne, Ivan, Greg (and many others) who have provided wonderful company over the years.

I would also like to thank the expert statistical advice provided by Duncan Hedderley and Dr. Steve Haslett from Institute of Social Sciences, and to Ray Johnstone and assistants, Lindsey and Lesley, at the Plant Growth Unit, Massey University.

I am extremely appreciative of the moral and loving support provided by my parents, Ernesto and Jill. Thank you to all my friends including lab colleagues, Atawhai flatmates and close friends away from home for providing the support and confidence.

Last but not least, I gratefully acknowledge funding provided by the Public Good Science Fund, the Institute of Molecular BioSciences, the New Zealand Society of Horticultural Science and the Royal Society of New Zealand for contributing financially to either the research, conference travels or living expenses incurred throughout my studies.

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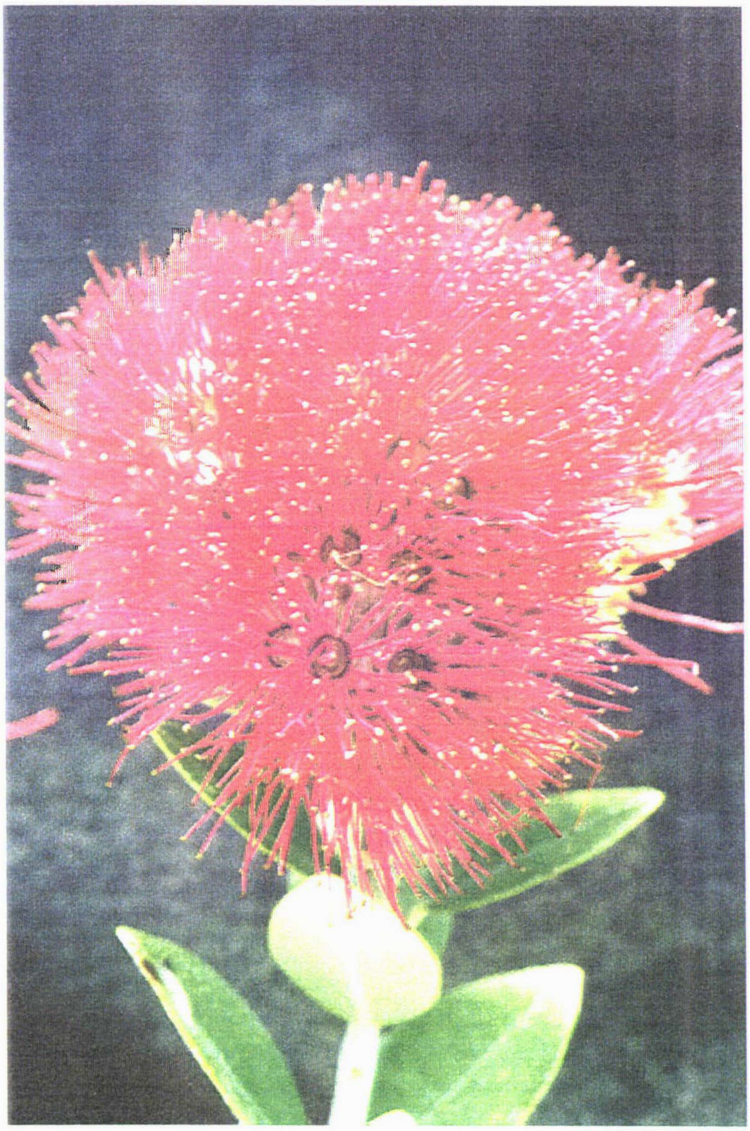
List of Abbreviations

ABA	abscisic acid
ACC	1-aminocyclopropane-1carboxylic acid
A/Ci	CO_2 assimilation over intercellular CO_2 concentration
AOA	aminooxyacetic acid
AVG	aminoethoxyvinylgycine
φ_{app}	apparent (CO_2-limited) photon yield
Δ	carbon isotope discrimination
CK	cytokinin
DL	daylength
DNA	deoxyribonucleic acid
DMF	dimethylformamide
GA	gibberellin
IAA	indole-3-acetic acid
FAA	90% formalin, 5% acidic acid and 5% alcohol fixative solution
GENMOD	generalised linear model using maximised likelihood estimations
HQC	8-hydroxyquinoline citrate
HQS	8-hydroxyquinoline sulfate
J_{max}	maximum electron transport rate
LD	long-day
1-MCP	1-methylcyclopropene
NBD	2,5-norbornadiene
PPF	photosynthetic photon flux
P_{max}	maximum photosynthetic photon flux at 99% light saturation
PPF_{sat}	light saturated maximum rate of photosynthesis
PP333	paclobutrazol
RH	relative humidity
Rubisco	ribulose-1,5-bisphosphate carboxylase/oxygenase
SD	short-day
STS	silver thiosulfate
V_{cmax}	maximum rubisco carboxylation rate
WUE	water-use efficiency



Metrosideros excelsa 'Vibrance'