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

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

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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 $\mu\text{mol m}^{-2} \text{s}^{-1}$ 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*.

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List of Abbreviations

ABA	abscisic acid
ACC	1-aminocyclopropane-1-carboxylic acid
A/Ci	CO ₂ assimilation over intercellular CO ₂ concentration
AOA	aminooxyacetic acid
AVG	aminoethoxyvinylglycine
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'