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THE
REGENERATION OF
Eucalyptus pauciflora Sieb. ex Spreng.
FROM SEED

by

Douglas Graham Abrecht

A thesis submitted for the degree
of Doctor of Philosophy of the
Australian National University

February 1985



DECLARATION

The work presented in this thesis is my own. Specific contributions by others are acknowledged in the text and acknowledgements.

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DECLARATION

The work presented in this thesis is my own. Specific contributions by others are acknowledged in the text and acknowledgements.

A handwritten signature in black ink, appearing to read "Doug Abrecht". The signature is written in a cursive style with a horizontal line at the end.

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ACKNOWLEDGEMENTS

This study was conducted whilst I was a student in the Department of Environmental Biology and was financially supported by a Commonwealth Postgraduate Award. I am grateful to Professor C.B. Osmond for providing the opportunity to work in a department which offers such a breadth of expertise in plant biology.

I am indebted to my supervisors Dr. I.R. Noble and Professor R.O. Slatyer for their encouragement and assistance during the experimental work and the preparation of the thesis.

I thank the N.S.W. National Parks Service for permission to work in Kosciusko National Park and for the assistance of its officers, in particular Graeme Worboys. Many people have assisted me in the field, in particular I would like to thank Peter Cochrane. The skilled assistance of Win Coupland in the maintenance of the field meteorological instruments is also gratefully acknowledged.

The analysis and presentation of data was expedited by advice from Ross Cunningham who introduced me to Generalized Linear Models and in particular the Cox model and Hugh Comins who introduced me to GrafX, the program used to create the figures presented in this thesis.

Many people have assisted during the preparation of this thesis. In particular, I wish to thank Dr. Bruce Wellington who provided a good deal of critical comment and frank discussion of the drafts. Mike Austin, Mark Stafford Smith, Jill Landsberg and Helen Armstrong also commented on some sections. Jill Landsberg also proof read much of the thesis. Due to her efforts the number of errors has been greatly reduced.

Finally I wish to thank Trudy for her love, companionship and sense of humour even in the face of repeated attacks by March flies.

ABSTRACT

Eucalyptus pauciflora Sieb. ex Spreng. occurs over a wide range of altitudes from sea-level to treeline, but the most common occurrence of the species is in the high altitude environments of the Great Dividing Range in eastern Australia. There are gradual changes in the morphology and physiology of the species with increasing altitude. This study examined variation in the regeneration of Eucalyptus pauciflora from seed in populations from a range of sub-alpine environments between 960 m and 1900 m in the Snowy Mountains of New South Wales. The influence of climatic conditions, particularly temperature, on the seasonal timing of germination was investigated using observations of dormancy, germination and emergence from seed in the field, and laboratory manipulations of dormancy.

The dormancy of E. pauciflora seed varies with the origin and size of the seed. Seed from different altitudes has a similar degree of dormancy (i.e. proportion of dormant seed), with the exception of seed from treeline populations (1900 m) which has a greater degree of dormancy. The strength of dormancy increases with altitude of seed source and decreases with seed size within a population of seed. The increases in the strength of dormancy with altitude are not explained by the reduction in seed size with increasing altitude since the dormancy of seed of the same size also increases in strength with altitude of seed source.

Seasonal conditions during seed shedding are unlikely to have a large influence on the dormancy of the seed. However, exposure of capsules to temperatures of 80°C during seed shedding resulted in marked increases in the strength of dormancy of the seed. This indicates that there is a chance that the dormancy of seed shed following a fire may be greater than that of seed shed under normal conditions.

Moist seed may respond to the temperature environment in three ways; changes in dormancy, germination or death. Dormancy is broken at constant temperatures below 6°C and strengthened at temperatures above 9°C. Temperatures between 6°C and 9°C tend to break the dormancy of a portion of the seed sample and increase the strength of dormancy for the rest. The rate at which dormancy is broken declines rapidly as the availability of water declines from a water potential of -4 bars to -10 bars. The temperature at which the rate of breaking dormancy is highest (5.5°C) is similar in seed from altitudes above 1240 m. However, there is some indication that this temperature may increase in seed from lower altitudes.

As the dormancy of the seed is broken, the range of temperatures which is suitable for the germination of seed increases and the germination capacity at any temperature within the range also increases. The rate of germination shows similar increases to the breaking of dormancy. The differences in the temperature response of seed from different altitudes could be wholly attributed to differences in the strength of dormancy of the seed.

In a field test of laboratory results seed was planted in the field at 1610 m and dormancy and germination were monitored. Moist conditions and high temperatures induced dormancy in the seed in within

a week of planting and prevented the germination of a large proportion (98%) of the seed sample until late winter. Low soil temperatures and moist soil conditions led to a progressive reduction in the strength of dormancy in late autumn. Germination occurred when the soil temperatures were low (mean 5°C) and took 30 days to complete. The first seedlings emerged around 30 days after the first germination in the field.

The relevance of differences in the strength of dormancy of seed from different altitudes was tested in a 'reciprocal' transplant experiment. Seed collected at four altitudes was planted at four altitudes between 960 m and 1740 m in autumn 1983. Very few seedlings emerged in autumn or winter. In spring there was a decrease in the number of seedlings emerging from seed from low altitudes, and an increase in the number of seedlings emerging from seed from high altitudes with increases in altitude.

The increase in the innate strength of dormancy of seed with altitude appears to be associated with a greater capacity of the environment to break dormancy at higher altitudes. Thus the timing of germination and emergence ensures that the seedling is less likely to be exposed to either the snow and needle ice as a result of premature germination during winter or drought and high temperatures associated with delaying germination until late spring or summer.

- CONTENTS -

	PAGE
<u>CHAPTER 1 Introduction</u>	
1.1 Regeneration of plants	1
1.2 Regeneration of <u>Eucalyptus</u>	2
1.3 Regeneration of <u>Eucalyptus pauciflora</u>	5
1.4 A study of the regeneration of <u>Eucalyptus pauciflora</u>	13
1.5 Outline of the thesis	15
1.6 Location of seed collection and experimental sites	16
<u>CHAPTER 2 Terms and Methods</u>	
2.1 Seed dormancy	17
2.2 Seed germination	19
2.3 Methods used in seed germination experiments	23
2.3.1 Collection of seed	23
2.3.2 Extraction and storage of seed	23
2.3.3 Cleaning of seed	24
2.3.4 Sampling of seed for experiments	24
2.3.5 Conditions of stratification	25
2.3.6 Conditions of germination	25
2.3.7 Temperature manipulation using a gradient plate	25
2.3.8 Counts of germinated seeds	26
2.3.9 Assessing the viability of ungerminated seed	27
2.4 Statistical analysis of germination	28
2.4.1 Analysis of germination capacity	28
2.4.2 Analysis of times-to-germination	31
2.5 The parameters of the temperature response	35
2.6 The form of summary of methods and results (Chapter 4,5,6)	36
2.7 SUMMARY OF TERMS	37
<u>CHAPTER 3 Innate dormancy</u>	
3.1 Changes in innate dormancy with altitude	41
Methods	41
Results and Discussion	41
3.2 Changes in innate dormancy with seed size	43
Methods	43
Results and Discussion	44
(i) Seed size and altitude	44
(ii) Seed size and germination capacity	47
(iii) Seed size and times-to-germination	57
Discussion	66

- CONTENTS -

	PAGE
CHAPTER 3 ...cont'd	
3.3 Dormancy and temperature of seed extraction	69
3.3.1 Extraction of seed under ambient conditions	70
Methods	70
Results	71
(i) The temperature environment	71
(ii) Seed shedding	71
(iii) Germination capacity	74
(iv) Times-to-germination	76
Discussion	80
3.3.2 Treatment of capsules at 80°C	82
Methods	83
Results and Discussion	84
(i) Seed shedding from capsules	84
(ii) Germination capacity	86
(iii) Times-to-germination	88
(iv) Seed mortality	89
3.4 Treatment of dry seed at 80°C	91
Methods	91
Results	91
(i) Germination capacity	91
(ii) Times-to-germination	93
(iii) Seed mortality	94
Discussion	95
3.5 Conclusions	97
<u>CHAPTER 4 Breaking dormancy</u>	98
4.1 Response to water during stratification	100
4.1.1 The influence of water potential	100
Methods	100
Results	101
(i) Germination capacity	101
(ii) Times-to-germination	103
Discussion	105

- CONTENTS -

	PAGE
CHAPTER 4cont'd	
4.1.2 Water uptake, seed weight and dormancy	107
Methods	107
Results and Discussion	107
4.2 The breaking of dormancy by low temperatures	114
4.2.1 Response of seed from different altitudes	115
Methods	115
Results	116
(i) Temperature gradient	116
(ii) Germination capacity	117
(iii) Times-to-germination	119
(iv) Seed mortality	122
Discussion	123
4.2.2 Changes in dormancy with duration of treatment	126
4.2.2.1 Seed from Waste Point (960 m)	126
Methods	126
Results	127
(i) The temperature gradient	127
(ii) Germination capacity	127
(iii) Times-to-germination	133
(iv) Seed mortality	139
Discussion	140
4.2.2.2 Seed from near Dicky Cooper Ck. (1740 m)	142
Methods	142
Results	142
(i) The temperature gradient	142
(ii) Germination capacity	143
(iii) Times-to-germination	146
(iv) Seed mortality	148
Discussion	149
4.3 Conclusions	153
4.4 Diagrammatic summary of methods and results	154

- CONTENTS -

	PAGE
<u>CHAPTER 5 Induction of dormancy</u>	155
5.1 Induction of dormancy in moist seed	157
5.1.1 After treatment at 15°C for 0,1,3 days	157
Methods	157
Results	157
(i) Germination capacity	157
(ii) Times-to-germination	159
5.1.2 After treatment for 0,5,10,15 days at 15°C	162
Methods	162
Results	162
(i) Germination capacity during treatment	162
(ii) Germination capacity after stratification	163
(iii) Times-to-germination	166
(iv) Seed mortality	168
Discussion	170
5.2 The induction of dormancy in seed set to germinate	172
Methods	173
Results	174
(i) Germination capacity during pretreatment	174
(ii) Times-to-germination during pretreatment	175
(iii) Germination capacity after stratification	179
(iv) Total germination capacity	184
(v) Times-to-germination after stratification	186
(vi) Seed mortality	190
Discussion	192
5.3 The induction of dormancy by drying non-dormant seed	195
Methods	195
Results	196
(i) Germination capacity	196
5.4 Conclusions	199
5.6 Appendix	201
5.5 Diagrammatic summary of methods and results	204

- CONTENTS -

	PAGE
<u>CHAPTER 6 Temperature of germination</u>	205
6.1 Temperature response of seed stratified for different periods	
Methods	206
Results	207
(i) Temperature conditions	207
(ii) Germination capacity on the gradient plate	208
(iii) Times-to-germination on the gradient plate	211
(iv) Incremental germination capacity at 15°C	212
(v) Total germination capacity	215
(vi) Seed mortality	218
Discussion	219
6.2 Temperature response of seed from two altitudes	222
Methods	222
Results	222
(i) Temperature conditions	222
(ii) Germination capacity on the gradient plate	223
(iii) Incremental germination capacity at 15°C	225
(iv) Total germination capacity	227
(v) Seed mortality	229
Discussion	230
6.3 Conclusions	234
6.4 Diagrammatic summary of methods and results	235
<u>CHAPTER 7 Dormancy, germination and emergence in the field</u>	236
7.1 Changes in dormancy and germination in the field	238
Methods	238
Results	239
(i) Weather measurements	239
(ii) Changes in dormancy during autumn	240
(iii) Changes in dormancy and germination in spring	242
(iv) Seed mortality	242
Discussion	243

- CONTENTS -

	PAGE
CHAPTER 7 ...cont'd	
7.2 Seedling emergence from seed planted at four altitudes	246
Methods	246
Results	249
(i) Emergence of seedlings during autumn	249
(ii) Emergence of seedlings during spring	250
Discussion	257
7.3 The influence of time of planting on emergence	261
Methods	261
Results	262
(i) Emergence of seedlings during autumn	262
(ii) Emergence of seedlings during spring	264
Discussion	267
7.4 Conclusions	270
<u>CHAPTER 8 General Discussion</u>	271
8.1 Evaluation of statistical techniques	272
8.2 Synthesis	274
8.3 The mechanism of dormancy	283
8.4 The regeneration of <u>E. pauciflora</u>	288
<u>BIBLIOGRAPHY</u>	291
<u>APPENDIX 1- Details of seed collection sites</u>	301

Corrigenda

page	line	Change <u>from</u>	<u>to</u>
6	8	suitable place	<u>a</u> suitable place
11	25	flooding, frosting	flooding <u>and</u> frosting
12	7	was influenced	<u>were</u> influenced
34	7	was edited	<u>were</u> edited
37	34	required break	required <u>to</u> break
50	4	data is	data <u>are</u>
97	13	lower	intermediate
120	24	iteration	<u>inter</u> action
172	6	Anlogous	an <u>a</u> logous
249	26	later	<u>earlier</u>
261	10	This study	This <u>section</u>
268	26	Seedlings in	Seedlings <u>from</u>