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**Regeneration of the native sand dune plant  
*Pimelea arenaria* in the lower North Island, New  
Zealand**

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

**Master of Science  
in**

**Ecology**

**at Massey University, Palmerston North,  
New Zealand**

**Phillip Arthur Charles Dawson**

**2003**

## Abstract

New Zealand has 300,000 ha of coastal sand dunes in which many native species and introduced plant and animal species are established. One native plant inhabiting dune ecosystems is *Pimelea arenaria* (Thymeleaceae), the native sand daphne, which is gynodioecious with female and hermaphrodite flower types and listed as nationally declining. The cause of the decline is unknown, but anecdotal evidence suggests recruitment failure is occurring. This thesis looked at four *P. arenaria* populations in the lower North Island of New Zealand. The aims were (1) examine the population structure and establish whether recruitment failure was evident, (2) whether any failure was due to problems with pollination, and (3) whether house mice (*Mus musculus*) or birds had any impact on *P. arenaria* by removing fruit.

The *P. arenaria* populations ranged from 0.53-4.05 plants/ha, with female plants comprising the smaller portion of each population, the exact sex ratios varying between the sites. The standing crop of nectar of hermaphrodite flowers is modest and varies from 24 to 56  $\mu\text{g}/\text{flower}$ . The pollen:ovule ratio (1987: 1), as well as casual observations, suggest that insects are the main pollen vectors. Recruitment failure in *P. arenaria* occurred with few or no seedlings found at any site, the maximum height above substrate and the surface area of substrate covered suggesting an adult biased population. Profuse flowering occurred (360-510 flowers/ $\text{m}^2$ ), leading to viable seed from both female and hermaphrodite plants. Less than 50% of seed germinated from either flower type, regardless of pollination method (natural, hand out-crossed, or autonomously selfed). Female plants observed higher germination success in seeds in both hand out-crossed and natural pollination. *P. arenaria* seed weight remained constant between sexes and treatments, however the pulp weight was variable, with hermaphrodite autonomously selfed fruit having the smallest amount of pulp, but this was not significant ( $p=0.37$ ).

Graded exclosures showed that fruit was removed but this was preventable by bagging the fruit ( $p<0.001$ ). However, the results from the exclosures were unable

to distinguish between mice and birds suggesting that both have similar, possibly cumulative, effects on fruit loss. Within the bagged fruit there were peaks of fruit loss at the start and end of the fruiting season suggesting that selective abortion of ovules is occurring, possibly because of low abundance of pollen sources or pollen vectors. Fruit loss occurred, but there was no direct field evidence of predation by mice and birds. A feeding trial with mice established that both female and male mice eat and destroy *P. arenaria* fruit and seed, and at a low dose rate (3 fruit/mouse) the fruit of *P. arenaria* was not poisonous.

Areas for future work are discussed for each section.

## Acknowledgements

To God who gave me the abilities I have, who helped me and carried me through this thesis, and without whom nothing could have been accomplished.

To my Mother, Father, and my sister Rowena for all their support and help throughout my university career and especially through the thesis year.

To my supervisors: A/Prof Robin Fordham, whose kindness and patience never faltered, Dr Gill Rapson, who will never be the same after being subjected to my english (or lack there of), although my english has now vastly improved as a result. And Dr Alastair Robertson who preparatory skills helped me survive the ordeal of presenting my research to a wider audience.

To the many other staff members of Massey University who have provided help during this thesis. Especially Jens Jorgenson (Ecology Dept), for his much appreciated technical help with the exclosure frame work, Dr Ian Henderson for his help with SYSTAT and statistics. To Mr Peter van Essen for his ideas regarding the design of the exclosure frames, Barbara Just (Ecology Dept), whose help with technical support and her smile smoothed the way enormously and to the Ecology secretaries particularly Erica whose little tips in using Microsoft Office saved much frustration. Thanks are also due to Craig McGill (Seed Technology) whose advice regarding the germination of *P. arenaria* seed was invaluable. To Carlos Lehnbach who provided advice for calculating nectar amounts. And to Prof. Patrick Hesp (Geology Dept) who provided advice on site location and also knowledge of the general geological processes of sand dunes in the Manawatu. Grateful thanks are also extended to the Animal Ethics Committee, chaired by Professor Hugh Blair, who gave permission for the feeding trial to proceed.

To staff of the Department of Conservation who have been involved and aided this project from its inception, especially Dr John Sawyer (Wellington), Dr Astrid

Djikgraaf (CAS Whanganui), Gary Foster (Masterton Area Office), Jim Campbell (Whanganui Area Office), Tony Roxburgh (Waikato Area Office), and Viv Nicolls (Palmerston North Area Office).

Many thanks are also due to Colin Ogle and Colin Burrows who proved readily approachable and who expressed great interest and provided valuable advice and assistance during my thesis

And of course to all my friends both in the University and out side with whom many, many wonderful memories have been forged and who will never be forgotten. I would especially like to thank Clare Brown, Rebecca Boulton, Dorothee Dupoix, Anna Grant, Bekky Lewis, Yvan Richards, Nikky Pindour. All whom are my valued and esteemed colleagues of the Wildlife Ecology Lab who kept me on the straight and narrow and who made research that much more fun than it would have been otherwise. Also Rownea Teal and her folks who looked after my exclosure frames at Castlepoint, gathered density data, and also fed me when the need arose.

Ich möchte auch Kristina Salzer und Herr Doktor Billy Badger danken. Ich habe Deutsch gelernt und ich habe auch meine Vernunft behalten. Ich bin jetzt eine besser Person. Eine Tage wurde ich nach Deutschland fliegen und ich wurde Sie helfen.

Undoubtedly I will have accidentally missed someone and for this I am truly sorry, it was certainly not my intention to leave anyone out. All I can say to everyone, both named and unnamed, is THANK YOU.

## Table of Contents

Abstract .....	ii
Acknowledgements .....	iv
List of Illustrations .....	viii
List of Figures and Tables .....	ix
List of Appendices .....	xi
Chapter 1 : General Introduction .....	1
1.1 Introduction .....	2
1.2 Sand daphne ( <i>Pimelea arenaria</i> ) .....	3
1.3 Potential predators .....	5
1.4 Thesis Aims .....	6
1.5 Study areas .....	6
1.6 References .....	11
Chapter 2 : Population structure and pollination in <i>P. arenaria</i> .....	16
2.1 Abstract .....	17
2.2 Keywords .....	17
2.3 Introduction .....	18
2.4 Method .....	20
2.5 Statistical analysis .....	24
2.6 Results .....	24
2.7 Discussion .....	32
2.8 References .....	42
2.9 Appendix 1 .....	50
2.10 Appendix 2 .....	52
Chapter 3 : Fruit set and fruit loss in <i>P. arenaria</i> – an enclosure experiment .....	53
3.1 Abstract .....	54
3.2 Keywords .....	55
3.3 Introduction .....	55
3.4 Method .....	57
3.5 Statistical analysis .....	59
3.6 Results .....	60
3.7 Discussion .....	64
3.8 References .....	68

Chapter 4 : An experimental investigation into the palatability of <i>P. arenaria</i> .	74
4.1 Abstract .....	75
4.2 Keywords .....	75
4.3 Introduction. ....	76
4.4 Method .....	79
4.5 Results .....	79
4.6 Discussion .....	81
4.7 References .....	86
 Chapter 5 : General Discussion	 89
5.1 General discussion .....	90
5.2 Recommendations for future work .....	93
5.3 References .....	97

## List of Illustrations

Illustrations	Page
<b>Figure 1.1.</b> The North Island of New Zealand showing the four study sites of this thesis.	8
<b>Figure 1.2.</b> The sand dunes at Himatangi looking south-east from the fore dune.	9
<b>Figure 1.3.</b> The sand dunes at Tangimoana looking inland from the fore dune over the study site.	9
<b>Figure 1.4.</b> The environment of <i>P. arenaria</i> at Castlecliff, the sea cliff is in the background, the rear most dune in the middle of the photograph.	10
<b>Figure 1.5.</b> The Castlepoint reef showing the location of <i>P. arenaria</i> plants used in Chapters 2 and 3.	10
<b>Figure 2.1.</b> The four study sites around the lower North Island, New Zealand	20
<b>Figure 2.2.</b> A <i>Pimelea arenaria</i> individual (arrowed), showing the typical half sphere growth shape of this species in sand dunes.	21
<b>Figure 2.8.</b> <i>P. arenaria</i> seed that germinated after a 5 month period through the fruit pulp while being stored at 4°C.	35
<b>Figure 3.1.</b> A typical example of an exclosure frame used in this experiment.	59
<b>Figure 4.1.</b> Ripening fruit of <i>P. arenaria</i> . Tangimoana, February 2003.	78
<b>Figure 4.2.</b> A ripe fruit of <i>P. arenaria</i> showing the fleshy pulp and single seed. The fruit is slightly bleached from the alcohol preservative.	80
<b>Figure 4.3.</b> Seed case remains from the feeding trial. The yellow material seen in the fragments are the remains of the seed embryo.	81
<b>Figure 4.4.</b> Seed cases found under <i>P. arenaria</i> plants at Tangimoana, January, 2003.	82
<b>Figure 4.5.</b> Seed cases obtained from seeds germinated in the laboratory, November, 2003.	83

## List of Figures and Tables

<b>Figures and Tables</b>	<b>Page</b>
<b>Figure 2.3.</b> Height distributions of hermaphrodite (gray) and female (hollow) <i>P. arenaria</i> plants at each of the study sites (December, 2002).	25
<b>Figure 2.4.(a)</b> Surface area distributions for hermaphrodite and female <i>P. arenaria</i> plants at Castlepoint and Castlecliff (December, 2002).	26
<b>Figure 2.4.(b)</b> Surface area distributions for hermaphrodite and female <i>P. arenaria</i> plants at Himatangi and Tangimoana (December, 2002).	27
<b>Table 2.2.</b> Approximate densities of <i>P. arenaria</i> at the four study sites, December, 2002.	28
<b>Figure 2.5.</b> Average Nearest Neighbour Distance (NND) of 10 randomly selected <i>P. arenaria</i> plants at each study site (September 2003).	28
<b>Table 2.1.</b> Population sex ratios of adult <i>P. arenaria</i> plants for each site (December, 2002).	29
<b>Table 2.5.</b> Average amounts of sucrose equivalent present in <i>P. arenaria</i> flowers from Castlecliff and Castlepoint (January – March, 2003).	29
<b>Figure 2.6.</b> Average proportion of fruit produced by each sex at Castlepoint (December, 2002) for each of the natural, hand out-crossed and autonomous self pollination treatments.	30
<b>Figure 2.7.</b> The average weight of fruit, seed, and pulp from the three pollination treatments (January - March, 2003).	31
<b>Table 2.4.</b> The germination success of seeds obtained through the pollination manipulation experiment (January – March, 2003) with the seeds at a constant 20°C and in 24hr light conditions.	32
<b>Table 2.5.</b> Comparison of the pollen:ovule ratios in different breeding systems.	34
<b>Table 2.6.</b> Pollination vectors of New Zealand plants and associated standing crops of nectar.	34

<b>Figures and Tables</b>	<b>Page</b>
<b>Figure 3.2.</b> Fruit loss/day for bagged fruit at all sites. All the treatments were averaged and the replicates combined.	60
<b>Figure 3.3.</b> Fruit loss/day for un-bagged fruit at all sites. All the treatments were averaged and the replicates combined.	61
<b>Figure 3.4.</b> Percentage fruit loss/day for bagged fruit at all sites. All the treatments were averaged and the replicates combined	61
<b>Figure 3.5.</b> Percentage fruit loss/day for un-bagged fruit at all sites. All the treatments were averaged and the replicates combined.	62
<b>Figure 3.6.</b> Total % fruit loss in each treatment at each site. Replicates are averaged for each treatment	62
<b>Table 3.1.</b> All significant effects of the statistical analysis on the effects of treatments on the amount of fruit loss from the variables looked at in all sites using three measures of fruit loss.	63
<b>Table 4.1.</b> The number of mice with the number of <i>P. arenaria</i> fruit presented to each group and number of fruit and seed that remained after the experiment, together with the number of mice that died as a result of <i>P. arenaria</i> fruit consumption.	80

## List of Appendices

Appendix	Page
<b>Appendix 1.1.</b> Birds that are potential frugivores on <i>P. arenaria</i> . Adapted from Robertson & Heather (1999).	15
<b>Appendix 2.1.</b> Total carbohydrate detection procedure using the anthrone colorimetric assay (modified from Kearns & Inouye 1993).	50
<b>Appendix 2.2.</b> Standard glucose calibration curve.	52