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OPTIMISING THE SEED PRODUCTION
CYCLE OF *Delphinium elatum* L.

A thesis presented in partial fulfilment of the requirements for the
Degree of Master of Science in Plant Biology
at Massey University,
Palmerston North

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2005

ABSTRACT

Delphinium elatum L. (Ranunculaceae) hybrids are developed by Dowdeswell's Delphiniums located at 692 Brunswick Road, Wanganui (www.delphinium.co.nz), who grow delphiniums for seed export. Development of new cultivars is important for commercial purposes, and requires development of high quality breeds. The main objectives of this study were to determine reasons for variable seed set and low germination in commercial *D. elatum* hybrids and determine optimal parameters for seed germination and storage.

Seed set was investigated by examining pollen viability, carpel structure, and pollen tube growth *in vitro* and *in vivo*. Seed structure was determined by paraffin embedding and sectioning of seeds. Results investigating variable seed set were inconclusive. Seed set is limited by pollen viability and age. Pollen viability is low (below 50%) in most cultivars, and pollen tubes growth rate is variable between cultivars and individual pollen grains. Ovule development showed no abnormalities.

Germination-promoting treatments were used to improve germination in *D. elatum*. Stratification (5°C) and application of gibberellic acid both improved germination in *D. elatum* cultivars. Chilling at 5°C reduced germination time in all cultivars, and increased total germination in cv. LB01130x. Storage trials were carried out for 12 months, with seeds stored at room temperature or 5°C in open and closed, water impermeable, aluminium bags. Storage trials determined that at low temperature storage (5°C) seed germinability is retained for up to 12 month. Storage at room temperature leads to seed deterioration and viability loss. Application of GA₃ improved germination in seed stored at 5°C.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Associate Professor D.W. Fountain, for his support and assistance in designing experiments and writing my thesis. His guidance was greatly appreciated. I would also like to thank Dr. Craig McGill and Dr. Robert Southward for their assistance in research, and the rest of the team at the Centre for Plant Reproduction and Seed Technology, Massey University, for all the help they provided me with.

I would also like to thank Terry and Janice Dowdeswell for their help and assistance in supplying plants and information regarding their operations at Dowdeswell's Delphiniums. I hope they find this information useful.

Finally I wish to acknowledge Technology New Zealand for the assistance they provided in the form of funding.

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1.0 GENERAL INTRODUCTION

The *Delphinium* genus (Ranunculaceae) consists of over 300 species of annual and perennial herbs (Edwards, 1981; Hosokawa et al, 2001). Wild species of *Delphinium* are distributed within the North Temperate Zone and the North Frigid Zone (Honda and Tsutsui, 1997; Honda et al, 2003). *Delphinium* species have been in cultivation for over 300 years although only three species are commonly grown today; *Delphinium elatum* L., *D. ajacis*, and *D. naudicaule* (Legro, 1963). Of these three species, *D. elatum* is by far the most widely grown, with over 4000 named cultivars of *D. elatum* in existence by 1960 (Legro, 1961).

D. elatum is a clump-forming perennial usually flowering from early to late summer. Cultivars comprise of many flower shades and colour combinations formed from whites, blues and pinks. Yellow, orange and red flower colours are not found in this species (Legro, 1961). The leaves of *D. elatum* are deeply pinnatisect and flowers are zygomorphic (Tutin et al, 1964). Flowers are showy (Plate 1.1; Plate 1.2), occurring on tall spikes with numerous flowers per spike. The wild-type flower typically has a calyx of 5 showy sepals and a corolla of 4-5 petals (small or absent) known as the 'bee'. Hybrids may be double, semi-double, or single (Tutin et al, 1964). *Delphinium elatum* hybrids produce around 75-100 florets per floral spike, with each floret producing 3-5 pods. Seeds are harvested January-May in New Zealand.

This research focuses on aspects of pollination, seed set, and storage and germination in commercial *Delphinium* cultivars. *Delphinium* cultivars examined are those grown by Dowdeswell's Delphiniums, a business located in Wanganui, New Zealand, which produces delphinium seed for export. *Delphinium* cultivars are developed through hand-pollination, with new varieties produced on a regular basis. Development of new cultivars is important for commercial purposes, and requires development of high quality breeds. Several key problems limiting seed production have been identified by Dowdeswell's Delphiniums. These problems range from seed set through to seed storage. At present

seed set in *Delphinium* hybrids tends to be variable between cultivars. Many hybrids show poor germination, and seeds deteriorate in storage. The aims of this research are:

- To determine reasons for variable seed set in commercial *Delphinium* hybrids following controlled pollinations.
- To determine reasons for low germination of *Delphinium* seed and define optimal conditions for germination.
- To determine optimal storage conditions for *Delphinium* seed. *Delphinium* seed is known to deteriorate in storage. Seed exported from New Zealand has shown losses in germinability compared with pre-export performance.

Determining the most advantageous conditions for seed set, germination and growth will allow the business to optimise seed production and increase economic output.



Plate1.1 Blue and pink flowering *D. elatum* hybrids



Plate 1.2 Dark blue *D. elatum* cultivar