Seed Storage Behaviour of New Zealand's Threatened Vascular Plants

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ABSTRACT

At least 38% of New Zealand's approximately 2300 vascular plant taxa (species and subspecies) are threatened *in situ* and are vulnerable to extinction. It has become increasingly important that a number of different complementary conservation approaches and methods are used to insure against this loss of species. However, limitations exist for the development of *ex situ* storage techniques due to a lack of basic research on seed biology, including seed storage behaviour and germination requirement of many rare and threatened species.

Seven New Zealand native species, *Carmichaelia williamsii*, *Clianthus puniceus*, *Clianthus maximus*, *Hibiscus diversifolius*, *Myosotidium hortensium*, *Tecomanthe speciosa* and *Dysoxylum spectabile* are a priority for investigation for *ex situ* conservation strategies because of their conservation priority and lack of corresponding techniques for their long term *ex situ* conservation. This study reports on seed storage behaviour, dormancy mechanisms and potential *ex situ* conservation strategy including conventional seed storage and cryopreservation of these New Zealand indigenous species to facilitate germplasm storage.

C. williamsii, *C. puniceus*, *C. maximus*, *H. diversifolius*, *M. hortensium* and *T. speciosa* were found to tolerate low seed moisture content (<5%) and thus can potentially be stored for long periods under conventional seed bank conditions, whilst *Dysoxylum spectabile* displayed essentially recalcitrant seed storage behaviour i.e. loss of viability when desiccated below 25%. There is a need to consider alternative *ex situ* conservation strategies, such as cryopreservation, to conserve this species.

Both *C. maximus* and *M. hortensium* displayed 'essentially' orthodox seed storage behaviour i.e. tolerance to desiccation and low temperature. However, viability of *M. hortensium* seeds declined after 12 months in all storage treatments and may be defined as sub-orthodox.

This study demonstrated embryonic axis cryopreservation in *D. spectabile* using a method based on rapid desiccation, encapsulation-dehydration and vitrification. This is the first report of the successful cryopreservation of New Zealand native species. In *D. spectabile*, encapsulation-dehydration or vitrification-based cryopreservation gave higher levels of survival (20%) than rapid desiccation cryopreservation. However, further optimisation of the protocol for plantlet recovery is needed to improve efficiency before it can be considered suitable for conservation purposes.

It is essential to understand dormancy mechanisms and to have effective methods of seed germination so seed banks can increase their efficiency and enhance their role in biodiversity conservation. However, germination requirements for many native species are either incomplete or not available. Unlike *T. speciosa* and *D. spectabile*, seeds of *C. williamsii*, *C. puniceus*, *C. maximus*, *H. diversifolius* and *M. hortensium* were dormant and that this dormancy was found to be of function of the seed coat. Dormancy in *C. williamsii*, *C. puniceus*, *C. maximus* and *H. diversifolius* is a result of the seed coat preventing water uptake by the dry seed. While physical constraint of embryo growth by the seed coat is the cause of dormancy in *M. hortensium* seeds.

The findings of this study will facilitate the *ex situ* conservation of New Zealand native species, to complement *in situ* conservation and help secure the future of the New Zealand's native flowering plants.

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