HYPERHYDRICITY OF *IN VITRO* CULTURED STURT'S DESERT PEA (*Swainsona formosa*) AND TECHNIQUES FOR ITS MINIMISATION

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Sturt's Desert Pea

(Swainsona formosa)

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Declaration

The work presented in this thesis contains no material which has been accepted for award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and my belief, contains no material previously published or written by another person, except where due reference is made in the text.

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Summary

Swainsona formosa (Sturt's desert pea) is the subject of this study. A member of the family Fabaceae, it has brilliant flowers of varied colour, and has excellent potential as a cut flower and flowering pot plant. Until now, propagation has been by seeds or cuttings. However, seedlings lack genetic uniformity, and cuttings require large numbers of stock plants and the method is time consuming.

Tissue culture techniques offer the most efficient method for producing large numbers of plants quickly, but have produced high rates of hyperhydricity (more than 50 % of cultures). Remedial techniques, such as increasing agar concentration, varying the support matrix, improving aeration and reducing cytokinin concentration have been examined in other species and have given satisfactory results.

In this study, the effects of agar concentration, support matrix, tube closure and 6- benzyl aminopurine (BAP) regime on hyperhydricity and other growth parameters were examined. A high gel concentration, and a tube closure with high gas exchange rate effectively minimised hyperhydricity and increased shoot vigour, but reduced the rate of proliferation. To overcome this problem, these treatments were tested together with different concentration of, and exposure time to, 6-benzylamino purine (BAP). The treatment combination that gave optimal growth and minimised hyperhydricity was 10 g/l agar (Sigma Chemical Company) together with low rate of BAP (1 - 5 μM) and semipermeable closures which allowed some gas and water vapour exchange (eg. cap with a hole fitted with a double layer of Whatman paper number 1).

To understand more clearly how hyperhydricity develops, the anatomy of hyperhydric shoots was studied. Abnormal tissue in between the two guard cells in the stomata, a low density of stomata, unclear differentiation of structural components of the meristem, and a large starch granule and reduction in numbers of thylakoid stacks in the chloroplast were found in hyperhydric shoots of Sturt's desert pea when compared to in vitro normal shoot.

This thesis describes, therefore, the establishment of *in vitro* tissue culture techniques for minimisation of hyperhydricity and maximisation of growth, together with an anatomical study of hyperhydricity in *Swainsona formosa*.