

INTERSPECIFIC HYBRIDISATION OF *CORYMBIA* SPP.

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This presentation summarises the proposed experimental activities as described in my 'Research Proposal for Confirmed Candidature – Doctor of Philosophy' to be submitted for adjudication with the University of the Sunshine Coast in mid June 2005. I acknowledge the supervision and support from my PhD supervisors Dr. Helen Wallace (SCU) and Dr. David Lee (DPI&F).

The *Corymbia* are a related but phylogenetically separate group from the *Eucalyptus* (Hill and Johnson 1995), yet have had comparatively little research published in the fields of reproductive biology, breeding systems and inter-specific hybridisation. Over the past 10 years, interest in the use of *Corymbia* species for plantation establishment in the tropics and sub-tropics has increased, and this has resulted in the gradual emergence of supporting research programs in these regions (Nikles *et. al.* 2000; Dickinson and Lee 2005). Initial *Corymbia* tree improvement activity focussed primarily on the improvement of pure species lines, with particular selection for disease tolerance to *Quambalaria pitereka* (Dickinson *et. al.* 2004). In more recent times, the great potential of *Corymbia* hybrids as first observed as spontaneous hybrids within pure-species planting, but more recently within DPI&F controlled pollination trials has been recognised, resulting in the initiation of an inter-specific *Corymbia* hybrid program (Lee *et. al.* in press). While existing *Corymbia* hybrids show grow potential, investigations to date have involved hybrid crossing between relatively few parent individuals of only a few *Corymbia* species, with variable success.

The research objectives and activities within this PhD research proposal investigate a range of innovative research questions within the field of *Corymbia* hybridisation. This research will form an important component within the existing DPI&F *Corymbia* hybridisation program and will provide original results to identify the factors which influence the compatibility, incompatibility or incongruity of different *Corymbia* hybrid crosses. It will also improve the understanding of paternal and specific factors which influence the heritability of desirable traits amongst *Corymbia* hybrid progeny. This information will be utilised to develop new methods and strategies to support the DPI&F *Corymbia* hybridisation program, increasing the available genetic resource of useful character combinations and potentially producing superior F1 hybrid and advanced generation hybrid individuals.

The five primary objectives of this Doctor of Philosophy research project are detailed below and will be investigated in a series of five coordinated experiments.

1. To quantify the effects of taxonomy and species relatedness on the hybridising potential of the main *Corymbia* species, sections and related genera.
2. To quantify maternal and paternal effects on the heritability of morphological traits within *Corymbia* hybrids.
3. Identify efficient and effective controlled-pollination techniques for the commercial hybridisation of the *Corymbia* group.
4. To identify the factors which influence the compatibility, incompatibility or incongruity of a range of inter-specific *Corymbia* hybrid crosses.
5. To assess the suitability of a basic range of advanced generation hybrid crosses, to maximise the heritability of desirable traits within progeny.

Experiments investigating objectives 1, 2 and 3 will be initiated in Spring 2005, with experimental methodologies presently well advanced. Experiments investigating objectives 4

and 5 follow-on from the activities in the preceding three experiments and will be initiated in Spring 2006. Hence experimental methodologies for these two experiments are currently in the early development stage. A brief description of the three experiments planned for establishment this year is presented below.

EXPT. 1: INTERSPECIFIC HYBRIDISATION WITHIN THE CORYMBIA AND RELATED SPECIES

Where possible, pollen will be collected or sourced for individual species (3 parents/species), representing six of the seven sections within the *Corymbia* group, as well as one or two individual species from the closely related *Angophora* and *Eucalyptus* genus. As the *Corymbia* sections *Rufaria*, *Politaria* and *Blakearia* contain a greater number of commercial timber species, it is planned to include a greater number of species from these sections in this experiment. Controlled pollinations will be conducted using the one-stop pollination technique with *C. torelliana* as the mother for all treatments. Fertilisation success will be monitored through assessment of % capsule set, seeds/capsule and seed viability. Germinated seedlings will be grown through to age 12 months and will be assessed for growth, survival and seedling morphology.

EXPT. 2: PATERNAL EFFECTS ON HERITABILITY OF TRAITS WITHIN HYBRID PROGENY

This experiment will investigate reciprocal interspecific hybridisation between the two species *C. torelliana* and *C. citriodora* subsp. *variegata*. Reciprocal crosses will be made between a minimum of two unrelated parents of each species. Additional controls of open-pollination, controlled self-pollination and intra-specific pollination will be conducted for each of the four parent individuals. Assessments of fertilisation success and early seedling morphological and growth traits (disease tolerance, clonal propagation) will be conducted for each treatment to an age of 12 months. The results for each hybrid combination will be compared with those measured for pure parent species to quantify the relative influences of paternity or species, on trait heritability.

EXPT. 3: CONTROLLED POLLINATION TECHNIQUES FOR THE CORYMBIA

In recent years controlled pollination operations for eucalypts have been conducted using two main methods; three-stop pollination (Van Wyk 1977) and one-stop pollination or OSP (Harbard *et. al.* 1999). In recent years a third method; artificially induced protogyny (AIP) has been developed which does not involve flower emasculation (Assis *et. al.* 2005). In the limited trials with *Eucalyptus* spp., AIP has proven to be considerably faster than the traditional techniques, achieving similar seed yields, with low contamination levels.

This trial will investigate the efficiency and effectiveness of the AIP technique for a range of inter-specific *Corymbia* hybrid crosses. For each inter-specific hybrid combination, pollination treatments will include the standard 3-stop and OSP methods and the application of the AIP technique on a range of bud maturity classes. The time required for the operator to conduct each pollination technique will be closely monitored. After pollination, measurements of % capsule set, seed viability and contamination levels will be conducted for each treatment. Analysis of these results will determine the efficiency and effectiveness of the AIP technique as compared to the traditional methods, for use in a range of *Corymbia* hybrid crosses

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