CORYMBIA SPECIES AND HYBRIDS: A SOLUTION TO QUEENSLAND HARDWOOD PLANTATIONS?

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INTRODUCTION

Hardwood plantations are relatively new in northern Australia. Of the species available, the spotted gums are the most important commercial hardwood plantation taxon for high quality timber in the humid and sub-humid zones of Queensland and northern New South Wales. The domestication and genetic improvement of the spotted gums (*Corymbia citriodora* subsp. *citriodora* (CCC), *C. citriodora* subsp. *variegata* (CCV) and *C. henryi* (CH) however only commenced in Queensland in 1997. Since then seed orchards and progeny trials have been established for all three species. One major failing of these species is all provenances are somewhat susceptible (Dickinson *et al* 2004) to the fungal disease, Ramularia Shoot Blight caused by *Quambalaria pitereka* (Simpson 2000). In amenity plantings and wind breaks of *C. torelliana,* hybrids with the spotted gum species were noticed that had great vigour, good form and resistance to Ramularia Shoot Blight. As a consequence a breeding program has been initiated in Queensland, to hybridise the spotted gum species with *C. torelliana* (CT). This paper reports on the genetic base of each species and presents preliminary result on the performance of these species and hybrids in trials.

THE *CORYMBIA* GENETIC BASE IN QUEENSLAND

A broad genetic base has been developed for the spotted gum species to underpin the long term genetic improvement of the three species that occur in northern Australia (Table 1). The fourth species in the spotted gum complex *C. maculata* has not been included in the program to date due to it's know high level of susceptibility to Ramularia Shoot Blight. A broad genetic base has also been established for *C. torelliana* to underpin further breeding and genetic development of the Corymbia hybrids.

Table 1. Genetic base of *Corymbia citriodora* subsp. *citriodora* (CCC), *C. citriodora* subsp. *variegata* (CCV) *C. henryi* (CH) and *C. torelliana* (CT) in seed orchards and progeny trials in Queensland. Ramularia Shoot Blight tolerance or resistance is indicated

Species	Number progeny / seed orchards	Number provenances	Number seed parents (nominally)	Ramularia tolerant provenances identified[1]
CCC	1	17	700	Yes
CCV	8[2]	44	656 (+27[3])	Yes
CH	1	7	47 (+29[4])	No
CT	3	6	113	All field resistant

[1] For CCC, CCV and CH, more Ramularia tolerant provenances are detailed in Dickinson *et al* 2004
[2] Trials range from Gatton, Gympie –Tiaro region, Miriam Vale and the southern Burnett.
[3] Four additional provenances are planted in taxa trials with an additional 27 seed parents.
[4] Three more provenances are represented in taxa trials with an additional 29 seed parents.

RESULTS AND DISCUSSION

Corymbia citriodora subsp. variegata

CCV height growth and Ramularia shoot blight were found to be highly correlated (R^2 = 0.83), with the average height growth at 2.8 years being 5.9 m across five progeny trials. These five progeny trials contain a subset (25 provenances and 319 half sib family seedlots) of the genetic base now planted for the species and all focus on high rainfall environments 900+ mm MAR. With the hardwood plantation industry transitioning to more marginal environments it is considered that this genetic base will need expansion to include CCV provenances from lower rainfall environments. This is now being address with the recent planting of progeny trial in the Burnett with further targeted CCV progeny / provenance collections planned. The progeny trial results support Dickinson's *et al*. (2004) findings that Woondum provenance (from the Gympie region) is generally better in terms of Ramularia Shoot Blight tolerance and height growth than lower rainfall provenances, however, in these progeny trials Richmond Range, Grange and additional Gympie region provenances perform as well as the Woondum source.

Corymbia citriodora subsp. citriodora and Corymbia henryi

Although the genetic base for both CCC and CH is broad, only one seed orchard / progeny trial has been established for each species. To ensure the security of the genetic base of these species, it is essential that further trials testing new environments be established. This will ensure the genetic bases are secure form catastrophic loss such as fire, pest and disease, etc. It is unlikely these species will be planted on a commercial basis however they will form a basis for the further development of the *Corymbia* hybrids.

Corymbia hybrids

Since 2000 a breeding program has been underway to evaluate the potential of hybrids between *C. torelliana* and the spotted gum species (CCC, CCV, CH and CM). The resulting *Corymbia* hybrids are promising across all sites where they have been planted. Currently progeny trials of the hybrids have been planted across 16 sites (46 hectare of progeny trials) ranging from Walkamin (Queensland) to Grafton (New South Wales). In these trials, the hybrids are exhibiting a range of beneficial growth and performance traits (Table 2), relative to their parental species including:

- Ramularia Shoot Blight tolerance,
- frost resistance,
- amenability to propagation as rooted cuttings,
- hybrid vigour for growth (height and diameter).

Commercial deployment of Corymbia species and hybrids

The spotted gum species (CCC, CCV and CH) are not amenable to propagation as rooted cuttings; hence the only practical option to deploy improved germplasm from the breeding program in routine plantations is via seed. However, in the seed orchards wide spread synchronous flowering has not occurred in the last five years. This along with the susceptibility of all species of spotted gum to Ramularia Shoot Blight has lead to a switch away from developing the species for operational development to developing the *Corymbia* hybrids for operational deployment. These hybrids combine the best attributes of the parental species and are amenable to propagation as rooted cuttings.

In three-year-old *Corymbia* hybrid progeny trials, a number of outstanding trees have been selected, based on growth, pest and disease tolerance and form attributes. Currently eight of these selects have been captured as cuttings to commence a clonal testing and deployment program. These hybrids represent the first release from the five-year-old breeding program

and are the best individual trees from five families. They have not been tested as rooted cuttings in clonal tests. Clonal tests are about to be initiated and their results will determine additional clones for commercial propagation in the future. The rolling front breeding program uses controlled crossings between known parents of *Corymbia torelliana* and *Corymbia citriodora* subsp *variegata* to generate improved hybrids. Hybridisation and clonal testing in preparation for commercial release is anticipated to continue over the next 20 years. Part of the breeding program aims to introduce parental varieties currently not under test to improve the growth, frost and pest and disease tolerances of Corymbia hybrids. This work forms part of an integrated program looking at all aspects of growth, silviculture and management of *Corymbia* hardwood plantations.

Table 2. Relative performance levels of the parent species and hybrids based on observations in trials at Amamoor Dam and Coolabunia. Taxon included are *C. torelliana* (CT), *C. citriodora* subsp. *variegata* (CCV) and the hybrid between these two species (F1 hybrid).

Trait × Taxon	**CT Kuranda**[5]	**CCV Woondum**[5]	**F1 hybrid**
Ramularia tolerance	Very high (immune?)	Moderate	High +
Erinose mite tolerance	Very high (immune?)	Very low	High +
Red Shouldered Leaf Beatle tolerance	Low	High	High
Longicorn tolerance	Moderate	High	Moderate
Swarming scarabs tolerance	High	Low	High
Sooty mould tolerance	Low	High	Moderate
Mycosphaerella tolerance	High	High	Moderate
Height and diameter growth	Low to moderate	Low to high	Low to very high
Straightness level	Moderate	Moderate	High
Taper (low desirable)	High	Low	Moderate
Branch quality, including shedding	Low	High	Moderate to high
Canopy density (high results in good site capture)	High	Low to moderate	High
Per cent abnormal seedlings	Very low	Very low	Low to high variable by family
Cold, drought hardiness	High	Low to moderate	High
Environmental plasticity	High	Moderate	High
Seedling / coppice rootability	Moderate	Very low	Moderate

Note: Giant wood moth does not attack *Corymbia*

REFERENCES

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[5] Relative level may vary depending on family and provenance.