# Morphological and molecular characterisation of *Echinochloa* species in the northern grain region of Australia and implications for weed management

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A thesis submitted for the degree of
Doctor of Philosophy
of the University of New England
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June 2010

Abstract

Barnyard grasses (*Echinochloa* species) occur as major summer weeds in farming systems of the northern grain region (NGR) of Australia. Farmers report difficulty in achieving effective control of *Echinochloa* using current management practices, with varied levels of success being reported. This study was undertaken to identify what species were present in the farming systems of the NGR, and to investigate if the varied levels of control could be attributed to morphological variations and/or the genetic diversity present within populations. It is important to identify correctly the *Echinochloa* species present in order to achieve better control and reduce the current threat of glyphosate resistance evolution in these weeds in the NGR.

This study commenced at the end of 2004 with field surveys being undertaken at three major cropping centres of the NGR; Wowan (central Queensland), Dalby (southern Queensland) and Narrabri (northern New South Wales). Two species were identified as occurring in the NGR, *Echinochloa colona* (L.) Link and *Echinochloa crus-galli* (L.) Beauv.. *Echinochloa colona* was the most widespread species accounting for 93 percent of the plants sampled. Both species were morphologically diverse across the region with *E. colona* categorised into 20 growth categories and *E. crus-galli* into six categories. The most common growth form in *E. colona* was semi-erect to prostrate (50%) while the majority of *E. crus-galli* plants were erect (84%).

With regard to genetic diversity, more polymorphism was evident in *E. colona* than in *E. crus-galli*, and the *E. colona* polymorphisms related largely to regional collection centres. Of the five microsatellites or simple sequence repeats (SSRs) used to detect genetic diversity, three were able to clearly distinguish between the two species. Intra-species variation was evident in *E. colona* with two SSRs proving informative while only one SSR was able to detect a minor variation in *E. crus-galli*.

A dose-mortality experiment was conducted as a pot trial to determine the level of control of both species to four rates of glyphosate, and if the responses were related to regional centres or populations. Three days after the treatments were applied, 82 percent of the *E. crus-galli* plants treated with the recommended rate had some degree of visual damage compared to 51 percent of the *E. colona* plants. At 14 days after

treatment (DAT), control of both species was achieved with all plants sprayed with the recommended rate dying. However, treatments applied at the lower rates did not provide total control of either species.

There were no clear relationships between the observed genetic groupings of *E. colona* or *E. crus-galli* and their observed morphology or response to glyphosate.

The results of this study show that genetics and morphology cannot be reliably used to develop a weed management plan, due to the diversity found in both characteristics and no clear connection with herbicide susceptibility. However, molecular techniques can be used to clearly distinguish between *E. colona* and *E. crus-galli* and morphology can be used to distinguish between the mature plants of both species.

**Declaration**

I certify that the substance of this thesis has not already been
submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used,
have been acknowledged in this thesis.

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**Acknowledgements**

There are so many people I have to thank for their continued support and persistent belief that I could finish this project.

Firstly I want to acknowledge and thank the Co-operative Research Centre for Australian Weed Management and the University of New England (UNE) for the scholarship I received to undertake this research, and the support I received from both organisations. I want to thank my supervisors: Professor Brian Sindel (UNE), Drs Michael Widderick, Mandy Christopher, and Steve Walker (DEEDI, Toowoomba), and Drs Ian Taylor and Hanwen Wu in the early days of my study. I have benefited and developed as a researcher from the contributions each of my supervisors has made to this project and the ultimate completion of this thesis. I want to especially express my sincere thanks and gratitude to Michael, Mandy and Brian for continuing to hang in there and support and motivate me through to the end of this project. Michael, I couldn't have done it without you, the home visits and the chocolate biscuits.

In addition I want to thank the staff at the Leslie Research Centre in Toowoomba for their friendship over the years. Thanks to the members of the Weed Science team and the Biotech team for their help in setting up trails and keeping me motivated. David, Geoff, Churchie, Jeff and Luke thanks for your help and support, and Raelene and Tracey when it to came to laboratory work, I couldn't have coped without your guidance and patience. I also want to thank the administration staff Sue-Ellen, Kathy and Kelly for their help and good humour over the years. Additionally I need to thank Kerry Bell for stepping in at the last moment to finalise my statistics; she made me appreciate how important getting good statistical advice at the beginning of your research is.

Finally I can't express how important the support of my family and friends has been during this period. Everyone has encouraged me to complete this thesis and every time I considered giving up you were there saying 'not a good idea'. Thanks guys, you didn't have to but you kept reminding me of what my goal should be and not to leave things unfinished. Dad, Debbie and Lance, Alana and John, Jacinta, Dawn,

Esmae and Raels -you've been my main protagonists over these long years and thank you so much for persevering. Love you all.

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