



FINAL REPORT TEMPLATE

CRDC ID: UO1703

Project Title: Biology of Amaranthus retroflexus and Amaranthus viridis

Confidential or for public release? For Public Release

Part 1 – Contact Details & Submission Checklist

Principal Researcher: Asad Muhammad Khan, HRD Student

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Researcher 2: (Name & position of additional researcher or supervisor).

Organisation:

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Submission checklist.

Please ensure all documentation has been completed and included with this final report:

- Final report template (this document)
- Final Technical Report (see Part 3)
- Final Schedule 2: IP register
- Final financial report
- PDF of all journal articles (for CRDC's records)

Signature of Research Provider Representative:

Date submitted: 27/09/2021

Part 2 - Monitoring & Evaluation

This data forms part of CRDC's M&E data collection. Please complete all fields and add additional rows into each table if required.

Achievement against milestones in the Full Research Proposal

Milestone	Achieved/ Partially Achieved/ Not Achieved	Explanation
<i>Confirmation</i>	<i>Achieved</i>	<i>Achieved</i>
<i>Mid-Candidature</i>	<i>Achieved</i>	<i>Achieved</i>
<i>Thesis Review</i>	<i>Achieved</i>	<i>Achieved</i>

Outputs produced (*Please refer to examples document to assist in completing this section*).

Output	Description
<i>Publications</i>	Two publications on the biology of the two weed species: <ul style="list-style-type: none"> • Effect of soil moisture regimes on the growth and fecundity of slender amaranth (<i>Amaranthus viridis</i>) and redroot pigweed (<i>Amaranthus retroflexus</i>). Weed Science 69:82-87. • Effect of emergence time on growth and fecundity of redroot pigweed (<i>Amaranthus retroflexus</i>) and slender amaranth (<i>Amaranthus viridis</i>): emerging problem weeds in Australian summer crops. Weed Science 69:333-340

Outcomes from project outputs (*Refer to examples document*).

Outcome	Description
Increased knowledge	<i>Increased knowledge of the biology of <i>Amaranthus retroflexus</i> and <i>Amaranthus viridis</i> by researchers and consultants.</i>

Part 3 – Technical Report

We were advised that the final thesis would be considered as the Technical Report.

Part 4 – Summary for public release

This summary will be published on Inside Cotton, CRDC's digital repository, along with the full final report (if suitable for public release). It is designed to provide a short overview of the project for all interested parties. Please complete all fields, ensuring that this exceeds no more than two pages.

Project title:		Biology of <i>Amaranthus retroflexus</i> and <i>Amaranthus viridis</i>
Project details:	CRDC project ID:	UO1703
	CRDC goal:	<i>1. Increase productivity and profitability on cotton farms</i>
	CRDC key focus area:	<i>1.3 Protection from biotic threats and environmental stresses</i>
	Principal researcher:	<i>Asad Khan</i>
	Organisation:	<i>The University of Queensland</i>
	Start date:	<i>21-01-2017</i>
	End date:	<i>13-08-2021</i>
Objectives	<ul style="list-style-type: none"> • The overall project aim is to establish knowledge on the biology of the two <i>Amaranthus species</i>. Specific aims are to: <ul style="list-style-type: none"> • Identify maternal environment effects on weed seed dormancy and germination • Evaluate seed bank persistence of the <i>Amaranthus species</i> • Evaluate phenological development of the <i>Amaranthus species</i> when grown at different temperatures and day length • Determine the effect of moisture conditions on the growth and seed production of <i>Amaranthus species</i> • Screen different populations of the three <i>Amaranthus species</i> to glyphosate • Determine mechanisms of resistance in case resistant biotypes are found 	
Background	<p>Weeds are one of the most important biological constraints to Australian agriculture. They cost Australian agriculture up to \$4 billion per annum in control measures and yield losses. Growers use herbicides to manage weeds, but there are increased cases of development of resistance in weeds against commonly used herbicides. This has increased interest in the development of integrated weed management (IWM) practices to manage weeds more effectively. The development of IWM practices, however, needs information on weed</p>	

	<p>ecology and biology. Knowledge of the phenology of weed species will help growers and researchers to develop better weed management tools. Stages can be identified when weeds are most susceptible to control measures. <i>Amaranthus species</i> continue to be a significant problem for the cotton crop in Queensland and New South Wales. Both weeds are very competitive and produce a lot of seeds. Studies are not available on the ecology and biology of these two species, and this project will address this research gap.</p>
Research activities	<ul style="list-style-type: none"> • Investigate the current knowledge of seed dormancy, seed bank persistence, and phenology in a desktop study • Evaluate dormancy in <i>Amarathus retroflexus</i> and <i>Amaranthus viridis</i> • Evaluate persistence of seed banks buried at different depths • Investigate phenology of <i>Amarathus retroflexus</i> and <i>Amaranthus viridis</i>. • Investigate the effect of soil moisture on <i>Amarathus retroflexus</i> and <i>Amaranthus viridis</i>
Outputs	<ul style="list-style-type: none"> • Deliver a review of the existing knowledge of seed dormancy, seed-bank persistence, and phenology of the three weeds. • Deliver new knowledge on the biology of the three weeds covering seed dormancy, seed-bank persistence, and phenological development • Deliver knowledge on the level of resistance to glyphosate in the three weed species • Deliver knowledge on the mechanism of resistance in the three species • Publish articles in the Australian magazine, conferences, and journals.
Impacts	<p>Research has also established that during the process of evaluation of the potential weed threat in a region, it is important to take into account the existence of multiple biotypes. In this study, it was established that when different biotypes of a species demonstrating insignificant morphological differences are introduced in a foreign environment, they demonstrate various degrees of weediness. Therefore, although various species of weed are present in Australia, it is important to be vigilant and prevent even more introductions of the same species in the soil. That is because it could</p>

	enhance the genetic variability in the population, while also introducing an array of aggressive biotypes.
Key publications	<p>Khan AM, Mobli A, Werth JA, Chauhan BS (2021) Effect of soil moisture regimes on the growth and fecundity of slender amaranth (<i>Amaranthus viridis</i>) and redroot pigweed (<i>Amaranthus retroflexus</i>). <i>Weed Science</i> 69:82-87.</p> <p>Khan AM, Mobli A, Werth JA, Chauhan BS (2021) Effect of emergence time on growth and fecundity of redroot pigweed (<i>Amaranthus retroflexus</i>) and slender amaranth (<i>Amaranthus viridis</i>): emerging problem weeds in Australian summer crops. <i>Weed Science</i> 69:333-340</p>