

REPORTS

Part 1 - Summary Details

Please use your TAB key to complete part 1 & 2.

CRDC Project Number: DAN158C (now DAN164C)
Annual Report: Due 30-Sep-03
Progress Report: Due 29-Jan-03
Final Report: Due 30-Sep-03
(or within 3 months of completion of project)

Project Title: Mechanisms of insecticide resistance in the cotton aphid, *Aphis gossypii*

Project Commencement Date: 1/7/2002 **Project Completion Date:** 30/6/2004
Research Program: Insect Management

Part 2 – Contact Details

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Part 3.2 – Annual Reports

(Maximum four pages)

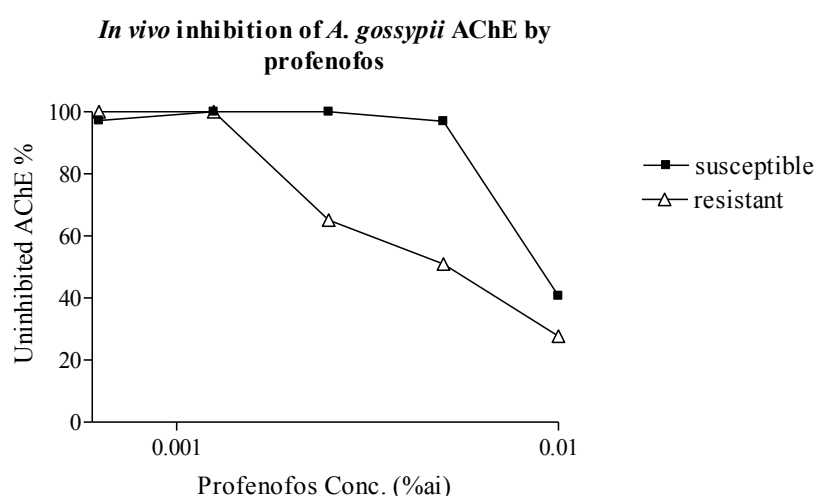
1. What were your major project objectives, milestones and performance indicators for the past year? (Please list these and any project results).

One of the major milestones was the development of a field based kit to detect pirimicarb resistance in cotton aphid populations. This kit identifies pirimicarb resistant cotton aphids by a simple colour change - squashed resistant aphids turn yellow, susceptible aphids stay clear. This kit provides the grower valuable information in making spray decisions.

Major project objectives for the past year include:

- Determine the mechanisms of profenofos resistance in *A. gossypii*.

Profenofos resistance is due to esterase mediated metabolism. Preliminary research suggests that an insensitive acetylcholinesterase is also involved. However, during the course of these experiments, the resistant strain being used lost its resistance. The strain has been replaced and all experiments are being repeated to verify these results.



- Investigate the genetics of profenofos resistance *A. gossypii*.
This project objective is underway, although progress has also been delayed by the problems experienced with the first profenofos resistant strain.

- Determine the mechanisms of pyrethroid and endosulfan resistance in *A. gossypii*

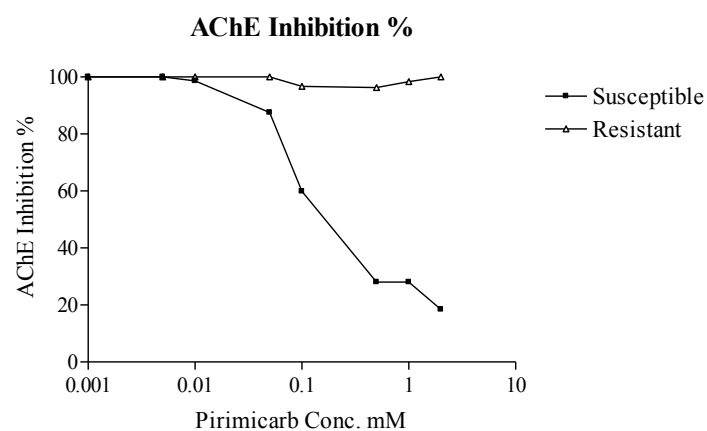
Preliminary research indicates that 'knock down resistance' (kdr) is not involved in bifenthrin resistance, although further experimentation is needed. It is thought that metabolic resistance mechanisms are involved.

Research into potential resistance mechanisms to endosulfan (no endosulfan resistant cotton aphid strains are available yet, so any current research is speculative) indicate that esterase mediated resistance may be involved. Preliminary research indicates that an insensitive AChE is not likely to be involved.

Research has also been done to determine whether aldicarb and carbosulfan can be separated into two separate groups in the resistance management strategy. This has turned out to be a very difficult problem to solve. Preliminary research indicates that the two chemicals could be separated out without a great risk of cross resistance occurring.

Additional results produced by the project include:

- Pirimicarb resistance in the cotton aphid is due to insensitive acetylcholinesterase and detoxification by esterases.



Inhibition of AChE by pirimicarb in the cotton aphid

- Dimethoate resistance is due to an altered acetylcholinesterase.
- Omethoate resistance is due to an altered acetylcholinesterase.
- Chlorpyrifos-methyl resistance involves an altered acetylcholinesterase.

The ongoing project of typing acetylcholinesterase variants within different aphid populations is continuing.

Work has also been conducted on DAN 162C (Insecticide resistance management in B-biotype *Bemisia tabaci*). This includes assisting with field trials, investigating field populations and collecting native susceptible *B. tabaci*. Considerable time and effort has been put into maintaining whitefly colonies. Laboratory work includes the identification of species (B-biotype versus native) by electrophoresis and determining the effect of buprofezin on the acetylcholinesterase of native *B. tabaci*.

2. Which of these have been achieved?

All objectives have been achieved, with the exception of research involving the original profenofos resistant strain, which needs to be repeated to ensure validity.

3. Which were not achieved and why? (Please provide detail of any problems you have had during the year and how you plan to address these problems).

Genetic studies of profenofos resistance have been completed as yet. This is due to:-

- problems with the resistant strain, which have now been solved.
- having to adapt the research goals in order to incorporate and meet the recommendations of the review committee (Pesticide Resistance review, March 2002). It is hoped to conduct this research in the coming year.

4. What are your specific project objectives, milestones and performance indicators for the coming financial year? Have any of these changed

Specific project objectives for the coming year remain unchanged and include:-

- Investigating the genetics of pyrethroid and endosulfan resistance in *A. gossypii*
- Investigating potential resistance mechanisms in *A. gossypii* to novel control agents, such as imidacloprid and diafenthiuron.
- Developing an effective cotton aphid resistance management strategy, in collaboration with Grant Herron and Lewis Wilson.

5. What aspects of your research project do you envisage having problems with in the coming year and what is your contingency plan?

No problems are anticipated at this stage.

6. Are changes to the Intellectual Property Register required? (You may also submit a separate confidential report of information, which should be included in the report but which you reasonably consider is confidential information).

No.

7. How has your research addressed the Corporation's three outputs: Sustainability of natural resources, and/or profitability and competitiveness and/or people and communities?

This research has addressed CRDC Output 2, of profitability and competitiveness, under the category of more effective pest management through increasing the efficiency of aphid control.

Pirimicarb resistance is very patchy, varying from paddock to paddock. Knowing the resistance status before spraying has enormous potential to help growers in their

spray decisions. The development of the pirimicarb resistance detection kit has enabled the detection of pirimicarb resistance, and through cross-resistance patterns, omethoate and dimethoate resistance as well. The results are shown by obvious colour differences within 20 minutes.

Aldicarb and carbosulfan are currently in the same resistance management group with pirimicarb and the organophosphates. Work conducted on these two products suggests that they may be able to be separated out into a separate group for resistance management purposes.

8. To what extent have your research results to date been disseminated to other researchers, growers or the industry? Please provide details and list any publications.

A poster promoting the resistance detection kit was presented at the World Cotton Research Conference-3 in March earlier this year. The kit has also been trialled by various industry personnel as part of its development.

9. How do you intend to communicate these results or findings to other researchers /growers /industry in the next year? What assistance will you need?

Results will be communicated via the Australian cotton conference next year and the Australian Cotton Grower. It is planned that the kit will be used in the IPM short course as well. An article is being prepared for the November issue of Ag Today (NSW Agriculture newspaper), which comprises part of The Land newspaper.

10. Were there major highlights in your work over the last six months? Please give a brief outline.

Highlights include the development of a field based kit for pirimicarb resistance in cotton aphid populations. This kit identifies pirimicarb resistant cotton aphids by a simple colour change – squashed resistant aphids turn yellow, susceptible aphids stay clear. This kit provides valuable information in making spray decisions.