

# Monitoring Silverleaf Whitefly and Its Natural Enemies in Cotton Areas of Queensland

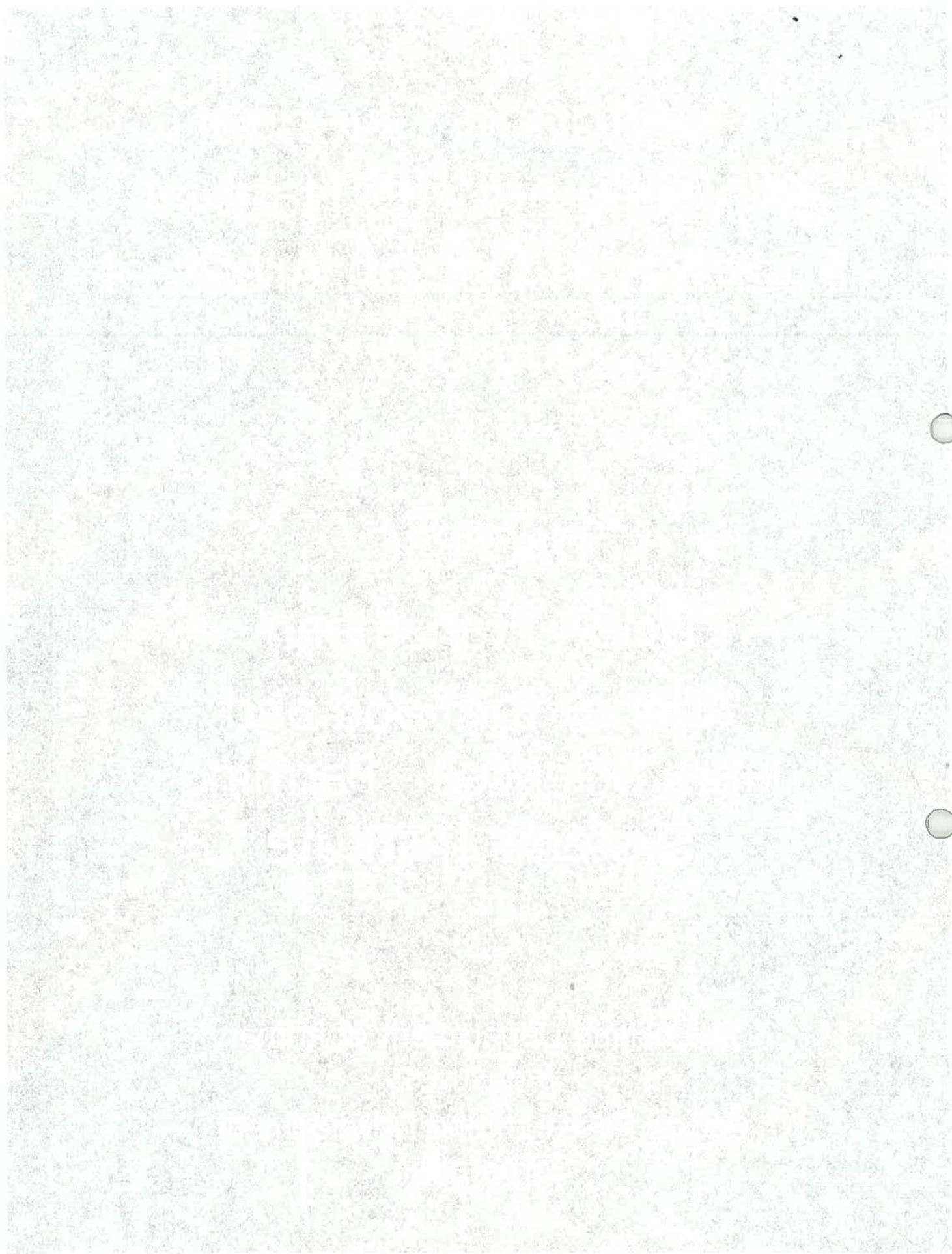
DAQ 83C

Dr BA Franzmann

Agency for Food and  
Fibre Sciences - Farming  
Systems Institute

Queensland Department of Primary  
Industries

Cotton Research and Development  
Corporation





## January, August & Final Reports

# REPORTS

### Part 1 - Summary Details

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

CRDC Project Number: **DAQ 83C**

January Report:  Due 29-Jan-01  
August Report:  Due 03-Aug-01  
Final Report:  Due within 3 months of project completion

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**Project Title: Monitoring silverleaf whitefly and its natural enemies in cotton areas of Queensland**

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Project Commencement Date: 01-07-98      Project Completion Date: 30-06-01  
Research Program: Insect Management

### Part 2 - Contact Details

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**Signature of Research Provider Representative:** \_\_\_\_\_

## **Part 3 – Final Report Format**

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### **1. Outline the background to the project.**

#### **Background:**

The silverleaf whitefly (SLW) was first discovered in Australia in 1994. At the commencement of the project (July 1998) it occurred in all cotton areas, where it was readily found on a range of ornamental plants in nurseries. In the field in Queensland during 1996/97 – 1997/98 it was found sporadically in very low numbers in towns in cotton areas, but not in cotton fields. It is a significant pest of cotton in other countries including the USA where production losses in some areas have averaged about 20%. A computer model (Climex) analysis of its potential geographic distribution in Australia indicated that the cotton areas of Queensland should be highly suitable environments for this pest.

The SLW is characterised by an exceptionally wide host range, a high rate of reproduction and a capacity to detoxify both natural and synthetic xenobiotics, making it resistant to many insecticides.

Apart from the issues surrounding insecticidal control and insecticide resistance management, the other major considerations in silverleaf whitefly management and development of IPM strategies are cultural control, the use of natural enemies and host-plant resistance.

An important issue in cultural control is the influence of alternative crops and weed hosts (particularly overwintering hosts) on whitefly population development.

The tritrophic interactions of whiteflies, host plant and beneficials have to be considered in assessing the role of the two other relatively innocuous whiteflies in the cotton system, the greenhouse whitefly and the indigenous *B. tabaci*.

#### **Industry significance/commercial impact**

The SLW is a major threat to cotton production in Queensland. It has caused enormous losses in cotton production in a number of other countries. A computer model (Climex) analysis indicated that the cotton areas of Queensland should be highly suitable environments for this pest. (DeBarro 1995)

### **2. List the project objectives and the extent to which these have been achieved**

Year1: To sample and record populations of whiteflies and their natural enemies in cotton agroecosystems in Queensland.

Year2: To sample and record populations of whiteflies and their natural enemies in cotton agroecosystems in Queensland.

Year3: To sample and record populations of whiteflies and their natural enemies in cotton agroecosystems in Queensland.

All these objectives have been fully achieved. The towns of Emerald, Biloela, Theodore, Oakey, Dalby, Warra, Goondiwindi and St. George were sampled four times per year. During the growing season cotton crops were also sampled in these areas. Parasitism percentages were recorded for all collections and all parasitoids identified.

**3. How has your research addressed the Corporation's three outputs: Sustainability, profitability and international competitiveness, and/or people and community?**

The development of sustainable Integrated Pest Management (IPM) systems is a fundamental plank in the CRDC's platform for the sustainability of natural resources. Outcomes of this project will assist in the progressive development of IPM in cotton.

Effective management of the silverleaf whitefly will reduce production losses which will lead to increased profitability and competitiveness.

**4. Detail the methodology and justify the methodology used.**

Regular and systematic monitoring for SLW and its natural enemies was carried out in all the cotton production areas of Queensland.

All major Queensland cotton growing areas were sampled. The Central Highlands, Dawson/Callide, St. George and Goondiwindi were sampled four times per year (once per season), whereas the Darling Downs was sampled approximately once each month.

Sampling focussed on the towns of Emerald, Biloela, St. George and Goondiwindi as SLW had previously been found in plant nurseries in these towns in 1995. On the Darling Downs sampling was centred on the towns of Oakey, Dalby and Warra.

At least one hour was spent searching for *B. tabaci* on host plants in and around each town.

In addition, nearby rural areas were also sampled. Where whiteflies were found, adults and 'pupae' were collected. Pupae were held in vials at 25°C to allow parasitoids to emerge.

Emerging parasitoids were identified. Putative predators encountered were recorded.

In addition consultants from each area were coordinated to regularly collect cotton leaf samples during the growing season. Cotton leaves from around the fifth node were taken from various farms in each major production area.

*B. tabaci* were identified as SLW or IBW using RAPD PCR (De Barro and Driver 1997).

De Barro, P.J. and Driver, F. 1997. Use of RAPD PCR to distinguish the B biotype from other biotypes of *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae). Australian Journal of Entomology. 36:149-152.

**5. Detail results including the statistical analysis of results.**

The indigenous biotype (IBW) was common all year in all areas. Silverleaf whitefly (SLW) was readily found in most of the towns. During the past three cotton-growing seasons 7700, 8900 and 6600 cotton leaves were sampled and SLW was found on only one occasion at Theodore, however IBW was quite common in these samples. **(Note however that large populations of SLW were found on regrowth cotton at Emerald in May 2001).**

Hybrids between SLW and IBW were found on two occasions.

No specialist whitefly predators and very few generalist predators were found in association with whitefly populations. Fifteen species of parasitoids were found and parasitism levels above 50% were common for both biotypes and 100% parasitism was occasionally recorded.

**6. Discuss the results, and include an analysis of research outcomes compared with objectives.**

The results showed that SLW did not establish in commercial cotton crops to any significant extent until the end of the growing season in the Emerald area in 2001.

Discovery of hybrids adds weight to the theory that high populations of IBW hamper the establishment and spread of SLW.

The relatively slow spread of detectable populations of the SLW in the cotton areas of Queensland may be attributed also to the activities of its parasitoids.

Predators seem to be of very minor importance in the biological control of SLW.

The monitoring program found the large population of SLW in Emerald in May 2001 and pointed to the imminent risk to the 2001/2002 crop.

**7. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. Where possible include a statement of the costs and potential benefits to the Australian cotton industry and future research needs.**

The project has provided an assessment of the whitefly situation in the cotton areas of Queensland for the past three years. Further developments can be compared with this base line study. Data on the identity, distribution and abundance of parasitoids has also been gained, providing a basis for any assessment of the need for importation of exotic parasitoids.

Monitoring of whitefly populations must continue in order to provide early warning of possible outbreak situations.

If and when SLW becomes an economic problem in cotton crops new studies of whitefly IPM will be required.

**8. Describe the project technology (eg. commercially significant developments, patents applied for or granted licenses etc).**

Nil

**9. Provide a technical summary of any other information developed as part of the research project. Include discoveries in methodology, equipment design, etc.**

Nil

**10. Detail a plan for the activities or other steps that may be taken;**

(a) to further develop or to exploit the project technology.

(b) for the future presentation and dissemination of the project outcomes.

Talks, press articles, etc. have been provided and will continue. Papers will be written.

**11. List the publications arising from the research project.**

Franzmann, B.A., Lea, D.R. and De Barro, P.J. 1998. The distribution and parasitism of biotypes of the whitefly *Bemisia tabaci* in cotton areas of Queensland. Proceedings of the 9<sup>th</sup> Australian Cotton Conference. pp 461-463.

Franzmann, B.A., and Lea, D.R.. 2000. Silverleaf whitefly in cotton – the Queensland situation 98/99-99/00. Proceedings of the 10<sup>th</sup> Australian Cotton Conference. pp 157-159.

**12. Are changes to the Intellectual Property register required?**

No

#### ***Part 4 – Final Report Plain English Summary***

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Provide a half to one page Plain English Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web.

The silverleaf whitefly (SLW), *Bemisia tabaci* B-biotype, was first discovered in Australia in 1994. SLW is a major pest of cotton in many overseas countries and poses a considerable threat to cotton in Australia. A closely related indigenous biotype (IBW) also occurs on cotton in Australia but it is not a pest and is no threat to cotton.

During the past three years systematic monitoring of whitefly populations and their natural enemies has been carried out in all cotton areas of Queensland.

IBW was found commonly in all situations. On the other hand SLW, although commonly found on weeds and ornamental plants in restricted areas in the towns of Emerald, Biloela and Oakey, was not found in commercial cotton crops until right at the end of the monitoring period when a large infestation was found on regrowth cotton in the Emerald area in May 2001.

This signals an imminent threat to cotton crops in the Emerald area in the 2001/2002 season. Predators were found to provide insignificant biological control of the whiteflies as no specialist and very few generalist whitefly predators were found in association with whitefly populations. Parasitoids however play a very significant role. Fifteen species of parasitoids were found parasitising the immature stages of the whiteflies. Parasitism levels above 50% were common for both biotypes and 100% parasitism was recorded on a number of occasions.

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