



Final Report

On Farm Series | Cotton Research & Development Corporation

Part 1 - Summary Details

CRDC Project Number: CSE113

Project Title: Release and post-release monitoring and follow up release of *Eretmocerus hayati* in cotton production areas

Project Commencement Date: 01/07/2005 **Project Completion Date:** 30/06/2008

CRDC Program: 3 Crop Protection

Part 2 – Contact Details

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Part 3 – Final Report Guide (due 31 October 2007)

(The points below are to be used as a guideline when completing your final report.)

Background

Silverleaf whitefly is an important pest of cotton production in Central Queensland. While it is capable of affecting yield, a more serious threat is posed by the capacity of its honeydew to cause sticky cotton. The occurrence of sticky cotton or even the perception that there may be a risk of sticky cotton is sufficient cause for mills to either avoid purchasing cotton from regions with silverleaf whitefly or demanding significant discounts. In 2004 sticky cotton was detected in a shipment of lint from Central Queensland and there is now a justifiable concern the further detections will lead to severe penalties being placed on Central Queensland cotton.

In order to reduce the threat of sticky cotton, effective management of silverleaf whitefly is essential. Effective insecticides combined with an insecticide resistance management program are key components of a sustainable management program, but alone are insufficient as SLW has the capacity to develop resistance to insecticides even with effective resistance management programs. Natural enemies have been shown to contribute a significant benefit to the management of SLW. In subtropical areas similar in climate to the Central Queensland production areas, parasitoids have been shown to play an important role in suppressing SLW.

Studies in Australia of the contribution of parasitoids to control of SLW have demonstrated that levels of parasitism (on average 38% Oct 2002 - Feb 2004, Shield *et al.* 2004) are well below what is needed to suppress SLW. In contrast, parasitism levels in the Lower Rio Grande Valley average well above 90% throughout the year. As a consequence SLW is no longer considered a serious pest in this region.

On 29 October 2004, CSIRO commenced releasing the exotic parasitoid of the silverleaf whitefly, *Eretmocerus hayati*. Releases to date have focused on the Lockyer Valley and Bundaberg. Within 4 weeks of release, parasitism levels were 70% within 10 m of the release sites. By 8 weeks the parasitoids had spread to around 320 m from the release site and were achieving levels of parasitism of 98% at the point of release down to 5% at 320m from the release site. At week 12 the parasitoid had spread 1.5 km from the release sites and adult parasitoids were readily observed foraging for whiteflies at densities as low as 1 nymph per 2 leaves of soybean. The parasitoid has proved to be extremely easy to establish and to show a remarkable capacity to spread. In contrast the native parasitoids including *Eretmocerus mundus* were either absent or present at extremely low levels (<0.001%). Further, the levels of parasitism observed are comparable to those observed in the Lower Rio Grande Valley and there is every expectation that there will be a significant reduction in SLW numbers as a result.

Objectives

The project had one objective, release *Eretmocerus hayati* and evaluate establishment. This has been completed in full

Methods

CSIRO developed a release program that was put into action on 29 October 2004. The program involved exposing seedling soybeans to adult whiteflies so that they laid eggs on the

plants. The eggs then hatch and the resulting 1st instars were then exposed to the parasitoid. The parasitised whiteflies were then allowed to develop until they are 2-3 days away from emerging. The leaves from the plants were then transported to the field where they were placed into the release site. These sites ranged from commercial crops through to patches of weeds.

Between releases establishment was assessed by collecting leaves with 4th instar nymphs. The numbers of nymphs present were assessed with the aid of a microscope; leaves were then placed in emergence containers the emerging parasitoids counted and identified. Releases were the primary focus throughout 2005/6 and the first half of 2006/7. In the latter half of 2006/2007, assessments of establishment was the main activity.

Results

Eretmocerus hayati is now established across all northern New South Wales and southern and central Queensland cotton production areas. All releases led to establishment. Prior to the releases parasitism of the B biotype over the period 1995-1999 averaged 0.04±0.01 total parasitism. By April-May 2007, 2.5 years since the first release, parasitism had increased to 0.23±0.02 by *E. hayati* with other parasitoids contributing <0.01. Further over the period 1995-1999 in none of the 585 samples collected did the percentage of silverleaf whitefly parasitised exceed 60% whereas in April/May 2007, 68 of the 478 samples collected exceeded 60% parasitised 4th instars (Fig. 1).

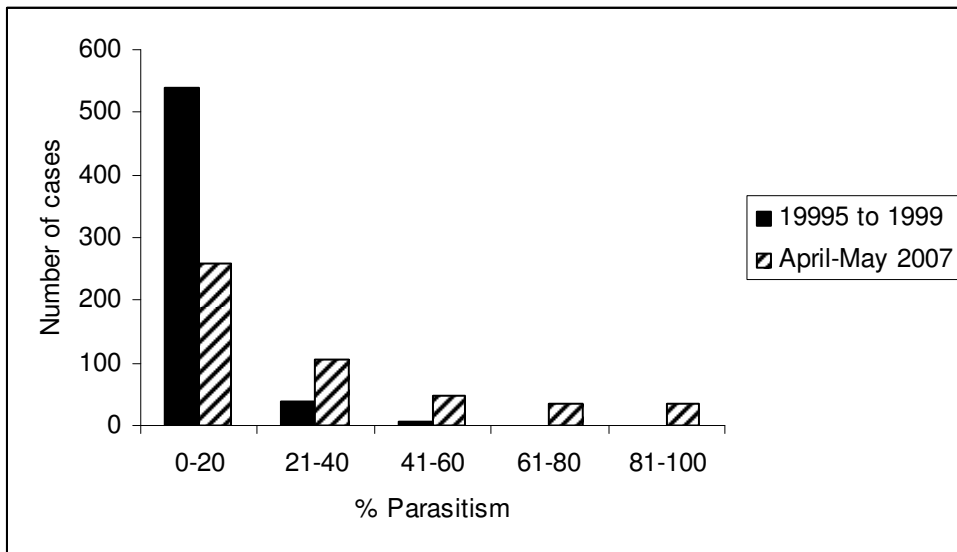


Fig. 1 Percentage parasitised 4th instar nymphs

Outcomes

1. Describe how the project’s outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

The project had a single output, Improved control of SLW by having a widely established parasitoid that is more effective than any natural enemy currently available. Since the releases started the parasitoid has spread as far south as the Sydney Basin, west into the northern NSW cotton production areas and in Qld from the NSW border to the Burdekin and as far west as St George, Roma and Emerald; coverage throughout this area is now complete. In all areas levels of

parasitism are well in excess of those previously recorded. While it is still early in the post-release phase, the increase in parasitised observed over the past 2.5 years suggests that the parasitoid holds considerable promise. Further, the recent survey by Growcom of vegetable producers in Queensland noted a significant decline in the abundance of silverleaf whitefly since the release of the parasitoid and this has seen a considerable reduction in the need to apply insecticides. The current drought has made an overall assessment of impact difficult as the lack of crops and weeds has made the distribution of both the whitefly and the parasitoid extremely patchy. This will affect the capacity of the parasitoid to colonise crops more so than the whitefly as recent work in Bundaberg, funded through HAL has shown that silverleaf whitefly is better able to colonise crops at a distance to the nearest source. This data is still preliminary, but suggests a distance <2 km from the nearest source may be needed in order to achieve optimal colonisation by the parasitoid.

This delivered to the one industry outcome, effective suppression of silverleaf whitefly to the point that intervention by growers will be significantly reduced compared with current levels of intervention. It is too early to claim that *E. hayati* is delivering effective areawide suppression. The effects of the drought and the short time that has elapsed since the first release have not enabled any stability to assert itself over the system. However, we can state that the release to data has seen an approximately 6 fold increase in parasitism as well as an increase in the overall percentages of observed parasitism.

2. Please describe any:-
 - a) technical advances achieved (eg commercially significant developments, patents applied for or granted licenses, etc.); Not applicable
 - b) other information developed from research (eg discoveries in methodology, equipment design, etc.); Not applicable
 - c) required changes to the Intellectual Property register. Not applicable

Conclusion

3. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

It is too early to claim that *E. hayati* is delivering effective areawide suppression. The effects of the drought and the short time that has elapsed since the first release have not enabled any stability to assert itself over the system. However, we can state that the release to data has seen an approximately 6 fold increase in parasitism as well as an increase in the overall percentages of observed parasitism. However, the recent outbreak in St George suggests that more is needed to understand what factors contribute to successful and unsuccessful colonisation of crops. To date no data is being collected on this.

Extension Opportunities

4. 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.
 - (c) for future research.

At this stage the data is being prepared for publication in an ISI journal. A PRP has been submitted which aims to collect baseline data in an attempt to identify the factors contributing to success and failure by *E. hayati*.

8. A. List the publications arising from the research project and/or a publication plan.
- A publication is planned for Biological Control. This paper will summarise the importation, host testing and release and post-release evaluation of *E. hayati*.
- B. Have you developed any online resources and what is the website address?
- No

Part 4 – Final Report Executive Summary

Provide a one page Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web. Explain the main outcomes of the research and provide contact details for more information. It is important that the Executive Summary highlights concisely the key outputs from the project and, when they are adopted, what this will mean to the cotton industry.

Eretmocerus hayati was first released in late Oct 2004 and over the next 2.5 years it has since spread has far south as the Sydney Basin, west into the northern NSW cotton production areas and in Qld from the NSW border to the Burdekin and as far west as St George, Roma and Emerald; coverage throughout this area is now complete. Levels of parasitism of 4th instars across cotton production areas prior to the releases (1995-1999) averaged 0.04 ± 0.01 . In April and May 2007 this had increased to 0.23 ± 0.02 an approximately 6 fold increase. Prior to the releases parasitism of the silverleaf whitefly in 585 samples did not exceed 60% of 4th instars whereas in April/May 2007, 68 of the 478 samples exceeded 60% parasitised 4th instars. *Eretmocerus hayati* is now the most widespread and abundant parasitoid of silverleaf whitefly in Australia.

Assessing impact is not been straightforward, however, a recent survey by Growcom showed that in coastal vegetable production areas growers observed that silverleaf whitefly numbers were considerably lower and many had either not had to intervene against the whitefly or had greatly reduced the need to apply insecticides. However, the drought and the subsequent lack of crops and weeds have made it more difficult to assess probable impact. The reason is that our work in the vegetable production system in Bundaberg has shown that silverleaf whitefly is better able to colonise crops at a distance to the nearest source. This data is still preliminary, but suggests a crop needs to be <2 km from the nearest source in order to achieve optimal colonisation by the parasitoid. The lack of suitable crops and weed refuges is likely to have considerably changed the landscape from what would normally be expected, this is likely to inturn significantly affect the way both the parasitoid and the whitefly interact with the landscape, but the Bundaberg study suggests that parasitoid will be more affected by habitat fragmentation than the pest.

In, the release of *E. hayati* has been a remarkable success. To be able to demonstrate such wide coverage in a short period of time and a ready capacity to establish suggests that *E. hayati* holds considerable promise as a control agent. The next step is to combine on farm management decisions with our knowledge of landscape features such as farm layout and cropping composition in order to understand the circumstances which increase or decrease the capacity for the parasitoid to effectively control silverleaf whitefly numbers. Through this we will be able to develop a grower management guide to how best to encourage the parasitoid to colonise crops and in so doing help achieve a sustainable reduction in the use of pesticides to manage silverleaf whitefly and an overall reduction in the impact of the pest on producers' bottom line.