

TWO NEW BIO-CONTROL AGENTS FOR COTTON APHID

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Introduction

In the past three years two biological control agents, new to Australia, have been discovered attacking cotton aphid, *Aphis gossypii*. The agents are the parasitic wasp (parasitoid), *Lysiphlebus testaceipes* and the spotted amber ladybird, *Hippodamia variegata*.

The parasitoid was first found attacking cotton aphids on the Darling Downs in the 2000/01 season and the ladybird in 2001/02. Both insects are now spread throughout the cotton growing areas of eastern Australia.

The Parasitoid

Female wasps lay eggs into young aphids and the wasp larva eats the inside of the aphid. After completing development the wasp larva pupates inside what has now become a swollen brown hard shell (the mummy) of the aphid. The adult wasp emerges by chewing through the mummy shell and females begin to lay eggs into aphids within an hour after emergence. Females lay 150-200 eggs. The whole life cycle, from egg to adult, takes about 10 days in summer.

As well as cotton aphids, the parasitoid also commonly attacks the corn aphid (*Rhopalosiphum maidis*) on sorghum, the cowpea aphid (*Aphis craccivora*) on grain legumes and the oat aphid (*Rhopalosiphum padi*) on winter cereals.

Lysiphlebus testaceipes has now become the dominant parasitoid of cotton aphids in Australia. Up until its arrival another parasitoid, *Aphidius colemani* was common, however in the last two seasons the new parasitoid has dominated suggesting that it is displacing *A. colemani*.

The new parasitoid is a very important biocontrol agent of cotton aphids in many parts of the world. In the USA it was judged recently to be the most important of all the natural enemies found in cotton (McGriff *et al.* 1999).

The Ladybird

Both adults and larvae of *H. variegata* feed voraciously on aphids. They have been found attacking a wide variety of aphids in many crops and weeds (Franzmann 2002).

Laboratory feeding studies show that larvae consume a total of about 600-800 aphids during their 9-10 day larval development period (Fig 1). In the trials shown on Fig. 1 the larvae were fed excess aphids. When the larvae were fed only 10 aphids per day they lived for about two weeks but failed to develop to pupation.

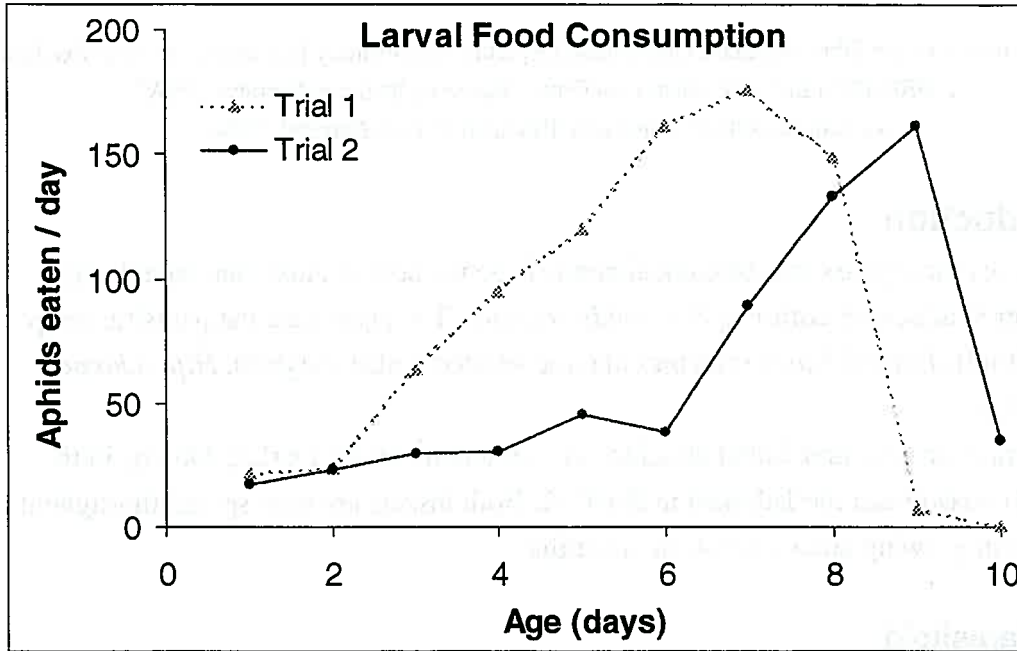


Figure 1. Cotton aphid consumption by larvae of the spotted amber ladybird.

A few days after emergence from the pupa adults consume about 200 aphids per day and the continue feeding at this rate for 8-9 weeks (Fig. 2).

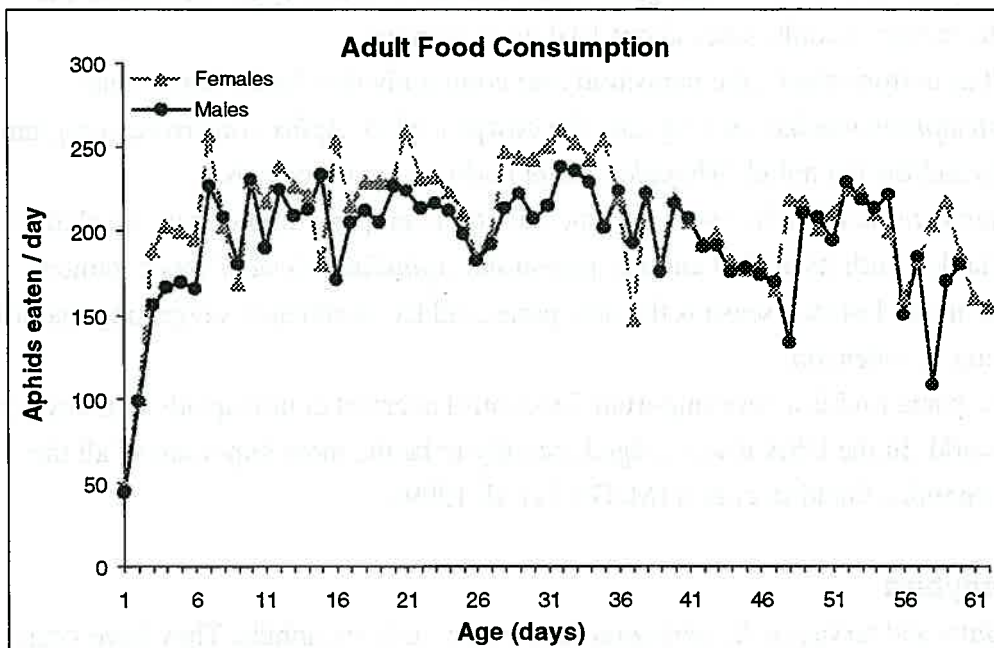


Figure 2. Cotton aphid consumption by adults of the spotted amber ladybird.

Although in cotton crops aphids are probably the most favoured and essential food for the ladybird, they have also been shown overseas to be predaceous on other soft bodied insects such as leafhoppers (Singh *et al.* 1991) and larvae of loopers (Araya *et al.* 1997).

Our laboratory studies have shown that larvae can also fully develop to adult on a diet of heliothis (*Helicoverpa armigera*) eggs but die within a few days on a diet consisting only of newly hatched heliothis larvae (neonates) (Fig. 3). However when fed aphids, heliothis eggs and neonates on alternate days, development proceeds normally but at a lower rate than when fed cotton aphids alone.

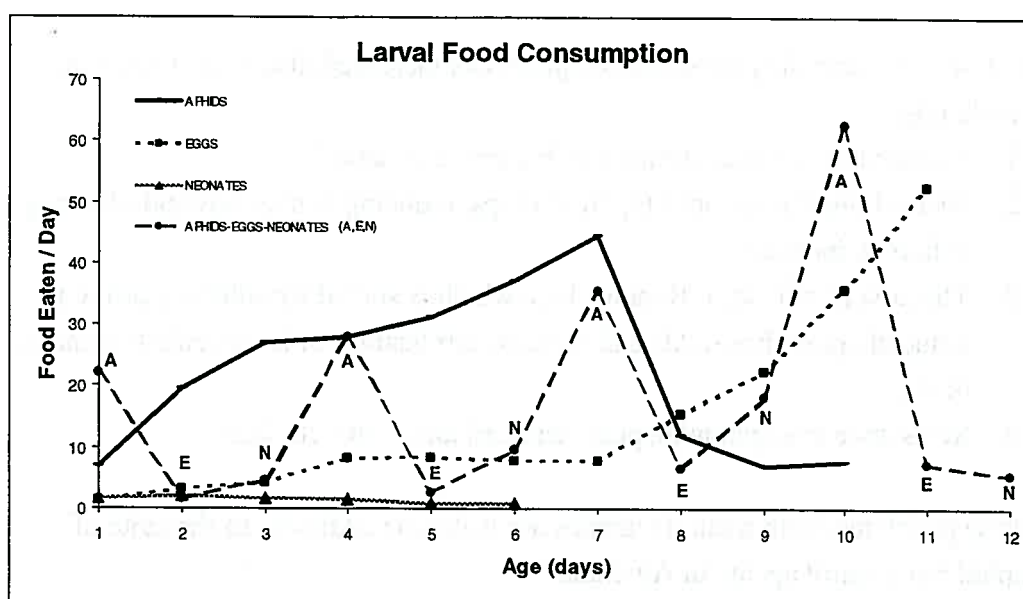


Figure 3. Prey items consumed by larvae of the spotted amber ladybird when fed cotton aphids, heliothis eggs, heliothis neonates, or aphids, eggs and neonates (A,E,N) on alternate days. Neonate line finishes on day six when all larvae had died and other lines finish when all larvae had pupated.

These data suggest that the ladybird has the potential to be an important bio-control agent for cotton aphids, and may also have some impact on other pests, including heliothis.

The results of our sampling of cotton agroecosystems this past season suggest that the spotted amber ladybird may be active earlier in the spring than the other ladybirds that attack cotton aphid. The ladybirds also seemed to virtually disappear from cotton crops during the hot mid-summer period. This means that they may have their greatest role in helping to control aphid populations on young cotton early in the season.

Discussion

Suppression of early aphid populations has benefits in reducing or delaying the risk of aphid outbreaks, thereby also reducing selection for insecticide resistance and possibly in reducing the spread of Cotton Bunchy Top.

Management strategies used for control of other pests will also be important in conserving the parasitoid and predator. Research by Wilson *et al.* (1998) showed that early application of broad-spectrum insecticides can lead to aphid outbreaks due to suppression of natural enemies. It is important to factor the abundance and activity of beneficials against aphids when making the decision to spray and in the selection of insecticides.

Over the last four years the pest status of aphids has increased, due to a number of factors including

1. Reduced use of endosulfan which suppresses aphids,
2. Drift of insecticide onto Ingard® crops, reducing beneficials and allowing aphids to increase,
3. The advent of Cotton Bunchy Top, which is spread by aphids, leading to reduced aphid thresholds and increase application of insecticide to control them,
4. Resistance to organophosphate and carbamate insecticides.

Given these problems, both natural enemies are welcome additions to the suite of cotton aphid bio-control agents in Australia.

Acknowledgements

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The first part of the report is devoted to a description of the
 general situation in the country. It is found that the
 economy is in a state of depression and that the
 government is unable to meet its financial obligations.
 The second part of the report deals with the
 social conditions of the population. It is found that
 the majority of the population is living in poverty
 and that the social services are inadequate.
 The third part of the report discusses the
 political situation. It is found that the
 government is corrupt and that the political
 system is undemocratic.