

Assessing new biological control agents in greenhouse capsicums and tomatoes

By Peter Workman

Crop & Food Research has tested the ability of five natural enemies to adapt to greenhouse conditions and control greenhouse pests in crops of capsicums and tomatoes. This testing was done across the 2007-08 summer season at the Pukekohe Research Centre. Particular emphasis was placed on finding an effective biological control agent for the potato/tomato psyllid, which was first found in New Zealand in 2006 and is proving to be a major pest of greenhouse and outdoor solanaceous crops.

The crops of capsicums (cv. Ferrari) and tomatoes (cv. Clarence) were planted in a plastic greenhouse at the Pukekohe Research Centre in mid December and the trial continued until mid April.

Although the trial showed the potential of some of the natural enemies to control the psyllid on capsicum, none of them proved effective on tomatoes. Two of the natural enemies may improve whitefly control on tomatoes and a new predatory mite gave excellent control of thrips on capsicums.

This trial was undertaken with the support of Horticulture New Zealand. Crop & Food Research funded the identification and selection of the natural enemies.

Report card for natural enemies



***Amblydromalis limonicus*:**

Predatory mite

Very impressive performance on capsicums - should be given another chance on tomatoes

This predatory mite was collected from New Zealand and taken to The Netherlands where trials demonstrated that it was a very effective thrips predator. It has also been shown to feed on whitefly and psyllid eggs and larvae.

In this trial, *Amblydromalis limonicus* established well on the capsicums and may have been responsible for the low populations of thrips and psyllids seen on this crop. If the ability of this predatory mite to control psyllids is confirmed it will give complementary control to the planned introduction of the psyllid parasitoid, *Tamarixia triozae*. The predator attacks the eggs and early instar larvae, whereas the parasitoid attacks the 4th and 5th instar larvae. Even though *Amblydromalis limonicus* was collected off tomato plants and has been seen in other tomato crops, it did not establish on the tomatoes in this trial. The type and density of glandular hairs (trichomes) varies between tomato cultivars and may have influenced the establishment of *Amblydromalis limonicus* in this trial.



Eretmocerus warrae:

Australian whitefly parasitoid

Did extremely well on its first trial, but can it perform in winter?

This yellow parasitoid of whitefly was found in natural enemy surveys by Crop & Food Research in 2007. It was identified as *Eretmocerous warrae*, an Australian species that was first described in 2000. There has been no research in Australia to determine whether this parasitoid will give effective control of whitefly in greenhouse crops.

In this trial *E warrae* achieved levels of parasitism of about 80% despite large numbers of whitefly migrating into the greenhouse. Further trials will be required to see how this new parasitoid compares with *Encarsia formosa* for the control of whitefly throughout the year.



Macrolophus pygmaeus:

Predatory mirid

A promising start

This predatory mirid was found by Zonda Resources Ltd at the Botanic Gardens at Manurewa. This mirid is a generalist and feeds on a wide range of arthropods, but it will not attack psyllids. Overseas it is used particularly for controlling whitefly.

Macrolophus pygmaeus was released on both the tomato and capsicum plants, but it was rarely found on the capsicums. Research has shown that it can survive and reproduce on capsicums, but in this trial it definitely preferred the tomato crop. Although the mirid was introduced relatively late into the trial, large numbers of second generation larvae were seen on the tomatoes.



Drepenacra binocular:

Hook tipped lacewing

Failed to impress

This Australasian lacewing was selected as a potential biological control agent for the potato/tomato psyllid because it feeds on psyllid larvae on both tomatoes and capsicums in small cage trials in the laboratory.

In the greenhouse trials the lacewing established on both the capsicum and tomato crops but populations failed to increase to a level to give significant control of psyllids. Many of the lacewing pupae were found to be parasitised by either of two parasitoid wasps, which may explain the low numbers of lacewing seen in this trial.



Cleobora mellyii:

Southern ladybird

Has potential for psyllid control in capsicum crops

Investigations by Zonda Resources indicated that the Australian southern ladybird, *Cleobora mellyii*, was a voracious predator of the potato/tomato psyllid. This ladybird was introduced to New Zealand in 1977 for the control of the eucalyptus tortoise beetle, but is also known to feed on *Acacia* psyllids.

The southern ladybird established on the capsicums but was not found on the tomatoes. It is known that many ladybird species are unable to cope with the glandular hairs that are found on tomato leaves. Although this ladybird persisted in the capsicum crop, no eggs or second generation larvae were observed during the trial. At this stage it is not known whether the failure to reproduce was because releases were made relatively late in the season and *C mellyii* were building up fat reserves for their winter hibernation, or because the ladybird found the food or the crop unacceptable. The number of psyllid eggs and larvae that these ladybirds can consume needs to be evaluated so that the impact they have on psyllid populations can be established.

The combined effect of pest control

Some control of psyllids on capsicums

Although psyllids were found on capsicums one week after the trial was planted, numbers only increased after adult psyllids were released into the greenhouse in late January. The numbers of psyllids remained relatively low, with numbers peaking on 11 March with a mean of 32 larvae per plant. Thereafter, numbers declined and at the end of the trial there were only 8.7 larvae per plant. The predatory mite *A limonicus* established well on the capsicum crop and may have reduced psyllid populations. *Cleobora mellyii* established in low numbers on the capsicums, but although the adults persisted in the crop no eggs or second larvae were observed. The hook tipped lacewing *Drepanacra binocular* established in the capsicums, but numbers remained too low to have a significant impact on the psyllid population.

Failure to control psyllids on tomatoes

The failure of any psyllid predators to establish on tomatoes was disappointing. In some part this was due to the inability of some of the species to cope with the glandular hairs on the tomato leaves. At the end of the trial the mean number of psyllid larvae on tomatoes was 171 per plant. Despite this large psyllid infestation there was no indication of psyllid yellows or other disorders. *Drepanacra binocular* was found occasionally on tomatoes, but only in very small numbers.

Good control of whitefly

Even though *E warrae* achieved levels of parasitism of around 80%, the whitefly population continued to increase throughout the trial. At the end of the trial there was a mean of 131.5 adult whitefly per plant. In the first five weeks of the trial it is estimated that about 1200 whitefly migrated on to the tomatoes, because the mean number of whitefly per plant was 11.9 at the end of this period. It is probable that this migration continued throughout the trial, which underlines the problems that greenhouse growers face with continual invasion of whitefly, especially over the warmer months.

Despite the high numbers of whitefly, *Eretmocerus warrae* achieved high levels of parasitism. At the end of the trial there were approximately 30 adult *Eretmocerus warrae* per plant. Although the predatory mirid, *Macrolophus pygmaeus*, was released late in the trial (26.2.08), it established well on the tomato crop and increasing numbers of second generation larvae and adult were found during the last weeks of the trial. The strain of whitefly that invaded the trial was not adapted to feeding or reproduction on capsicums. Whitefly adults were only rarely seen on the capsicum plants and no whitefly larvae were observed on this crop.

Excellent control of thrips on capsicums

The largest number of thrips in the capsicum crop occurred on 5 February, with a mean of 1.25 thrips per flower. After this date thrips numbers declined to a very low level and for the last 5 weeks of the trial the mean thrips population was around 0.1 thrips per flower. The main thrips species on the capsicums was western flower thrips, *Frankliniella occidentalis*, although significant numbers of onion thrips, *Thrips tabaci*, were also present.

The decline in the number of thrips coincides with the rise of the predatory mite *A limonicus* in the capsicum crop. Although most of the thrips were found in the flowers, the predatory mites were mainly found on the leaves and rarely seen in the flowers.

This trial has demonstrated that existing natural enemies from within New Zealand have potential to improve the biological control of whitefly and thrips in greenhouse crops. Two natural enemies, *Amblydomalus limonicus* and *Cleobora mellyii*, may assist in the control of psyllids on capsicums. However, none of the natural enemies trialled gave control of psyllids on tomatoes.

Consequently, attention has turned to the possibility of importing a natural enemy such as the psyllid parasitoid, *Tamarixia triozae*, which like the potato/tomato psyllid, comes from America. Horticulture New Zealand is now seeking the appropriate approvals from the Environmental Risk Management Authority (ERMA) to allow controlled host-range testing of this species to assess its suitability for release in New Zealand.