THE POTENTIAL FOR BIOLOGICAL CONTROL OF THRIPS IN GREENHOUSE CAPSICUMS USING THE PREDATORY MITE, *AMBLYSEIUS CUCUMERIS*

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SUMMARY

A laboratory colony of the predatory mite, *Amblyseius cucumeris*, was established from populations found on *Thunbergia alata* and strawberries in Auckland. Predatory mites were reared on the mould mite, *Tyrophagus putrescentiae* and released in a crop of greenhouse capsicums to control *Thrips tabaci* and *Thrips obscuratus*. Releases were made in September and November 1993 at a rate of 10.6 and 140 predators per plant respectively, and in February 1994 at 57 predators/plant. Low thrips populations and high predator numbers were maintained for 12 weeks. Neither thrips damage to plants nor viral infection of fruit were detected. Use of *A. cucumeris* will be restricted to growers using integrated pest management programmes.

Keywords: *Amblyseius cucumeris*, predatory mite, thrips, capsicums, integrated pest management

INTRODUCTION

The predatory mite, *Amblyseius cucumeris*, is produced commercially for use as a biological control agent for thrips in greenhouses in Europe (Netherlands, Denmark, England), Canada and the USA (Morewood and Gilkeson 1991). It is inundatively released on capsicum and cucumber crops where it preys on larvae of onion thrips, *Thrips tabaci*, and Western flower thrips (WFT), *Frankliniella occidentalis*.

In New Zealand, an integrated pest management programme is available for capsicum growers where the parasite, *Encarsia formosa*, is used for control of whitefly, *Trialeurodes vaporariorum*, and the predatory mite, *Phytoseiulus persimilis*, for control of two-spotted mite (TSM), *Tetranychus urticae*. The use of *A. cucumeris* to control thrips would extend this programme and make it more viable now that the insecticide-resistant strain of WFT has been found in New Zealand. This strain of WFT was first discovered in spring 1992 in west Auckland greenhouses, and by March 1994 it had spread to south Auckland and north to Albany. Both onion thrips and WFT cause silvering of leaves and minor surface damage to capsicum fruit. However, these thrips are also important as vectors of tomato spotted wilt virus (TSWV). This virus is particularly severe in capsicums where it causes young leaves to yellow before becoming necrotic, and fruit to develop large necrotic patches. Poor control of WFT using insecticides and the ability of this pest to become resistant to insecticides (Martin and Workman 1994) has given impetus to testing the use of *A. cucumeris* to control thrips in New Zealand greenhouses.

METHODS

Populations of *A. cucumeris* were collected in the Auckland area in February/March 1992 from strawberry and *Thunbergia alata*. They were reared on the mould mite, *Tyrophagus putrescentiae*, in a mix of bran, wheatgerm and brewers yeast. Colonies were kept in 250 mm diameter containers, 100 mm deep, under laboratory conditions with high humidity.

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For release, *A. cucumeris* were placed together with mould mites and bran mix in 40 ml waxed paper sachets (120 x 75 mm). The sachets were attached to capsicum branches at the base of the plant with plastic twist ties and had a small hole through which the predators could leave.

A. cucumeris were first released on greenhouse capsicums at Pukekohe on 14 September 1993. One sachet was placed per 15 plants and each sachet contained approximately 160 predatory mites. A second release of *A. cucumeris* was made on 17 November 1993 at a rate of 1 sachet per 5 plants with 700 predatory mites per sachet. A further release was made on 9 February 1994 at a rate of 1 sachet per 7 plants with 400 mites per sachet.

There were 3800 plants in the greenhouse which had been planted in May 1993 and were approximately 1 m in height at the start of the trial. Voucher specimens of the thrips and *A. cucumeris* have been lodged with the National Arthropod Collection.

The greenhouse was sampled once per week. The number of thrips on four blue, two-sided sticky traps (Horiver traps, 250 x 100 mm) were recorded. Presence or absence of *A. cucumeris* on a sample flower and leaf, and *T. tabaci* and *T. obscuratus* on the sample flower, was recorded on every tenth plant on every third row of plants (160 plants sampled). These plants were also checked for leaf damage by thrips and the presence/absence of TSWV on the fruit. Five release sachets were selected each week and a subsample of 1 ml of bran mix taken from each sachet. The bran mix was washed with alcohol and the number of mites recorded. In addition, separate samples of 15 flowers and 30 leaves were collected from plants with sachets and without sachets along one central row of capsicums. These were washed with alcohol and the number of predatory mites and thrips recorded.

RESULTS

14 September release

The number of *A. cucumeris* in the release sachets rose to a mean of 29.2/ml of bran mix after 2 weeks and then declined to 4/ml by 21 October. *A. cucumeris* reached a peak of 384 mites per 15 flowers sampled from sachet plants and were present in 9% of these flowers by 7 October but had rapidly declined to 2 mites per 15 flowers from sachet plants on 4 November after dichlorvos was sprayed in an adjacent house that was linked to the trial house by a walkway. The number of thrips on sticky traps increased steadily, and by 4 November had reached 179/trap. During the same period, thrips were found in a maximum of 42.5% of flowers sampled on 14 October.

17 November release

The mean number of *A. cucumeris*/ml of bran mix in the release sachets reached a maximum of 26/ml 2 weeks after release and then declined to 4/ml (Fig. 1a). Throughout December, the numbers oscillated around 8/ml reaching a maximum of 10/ml on 6 January with a steady decline thereafter to 1.6/ml on 3 February.

The percentage of flowers containing *A. cucumeris* rose to 83% 3 weeks after the release (Fig 1b) and remained at more than 90% for the following 4 weeks. By 20 January they began to decline (50% of flowers) and the week prior to the third release were found in 13.7% of the flowers sampled. Greater numbers of *A. cucumeris* were found on flowers than on leaves ($X^2=133.1$ df=3 $P<0.001$). The numbers of *A. cucumeris* in flowers and leaves sampled from plants with sachets were higher than those from plants without sachets ($X^2=37.9$ df=3 $P<0.01$). The numbers from sachet and non-sachet plants were combined in Fig. 1c. The numbers of *A. cucumeris* in flower samples peaked on 22 December at 890/30 flowers.

Throughout December and January, the number of *T. tabaci* and *T. obscuratus* caught by sticky traps remained less than 50/trap/week. The majority (90.8%) of these were *T. tabaci*. Similarly, the percentage of flowers with thrips remained at between 5.6 and 14.4%. Following the decline in *A. cucumeris* at the date of the third release, the mean number of thrips increased sharply to 177.2/trap and the percentage of plants with thrips increased to 18.1%. No damage to plants was recorded and no viral symptoms on the fruit were apparent throughout this time.

Figure 1: Seasonal trends in populations of the predatory mite, *Amblyseius cucumeris*, and the thrips, *Thrips tabaci* and *Thrips obscuratus*, in greenhouse capsicums. A.c = release of *Amblyseius cucumeris*

The capsicums were sprayed with pirimicarb on 20 January for aphid control. The miticide, amitraz, was applied to the capsicums in the adjacent greenhouse on 21 November, 6 and 14 January. Dichlorvos was also used in the adjacent greenhouse on 24 January and 6 February.

9 February release

The number of predatory mites increased after release from 10.4 to 22.8/ml of bran mix (Fig. 1a) then declined to 0.8 after 3 weeks. Numbers of thrips peaked at 281/trap on 16 February declined to between 158 and 175 then to 37/trap (Fig. 1b).

The percentage of plants with thrips remained at between 35 and 41% over this period (Fig. 1b) and the numbers in the samples of 30 flowers (sachet plus non-sachet plants) reached a maximum of 38 on 16 February (Fig. 1c). The numbers of *A. cucumeris* on the leaves were low at this time (10/60 leaves), and on flowers reached a maximum of 84/30 flowers in early March; a maximum of 27% of plants had *A. cucumeris* on 23 February (Fig. 1b). Thrips eggs were observed on the leaves in mid-February. There was no damage to foliage, and TSWV was not detected.

Amitraz was applied to capsicums in the adjacent greenhouse on 18 February and permethrin plus pirimiphos-methyl (Attack) on 25 February. A gradation of decreasing predatory mite numbers was recorded across the greenhouse towards the sprayed house. As the crop was due to be replanted in mid-March, no further releases were made.

DISCUSSION

These preliminary trials have demonstrated that *A. cucumeris* can suppress thrips populations to numbers below those causing damage to greenhouse capsicums for up to 12 weeks at least. Releases of the predatory mite were combined with introductions of *P. persimilis* for control of TSM. In comparison the neighbouring greenhouse required three insecticide applications to control thrips and four miticides for the control of TSM. Economic damage thresholds for thrips need to be determined for this crop.

Non-insecticidal control of aphids must be developed before a fully integrated pest management programme can be implemented on capsicums. Control of aphids using pirimicarb is known to have an adverse effect on *A. cucumeris* (Ravensberg and Roodenberg-Verschoor 1989). In our study, mites were also highly sensitive to spray drift from the neighbouring greenhouse. The dramatic increase in thrips caught by sticky traps in February may have reflected the high populations of thrips on field crops of onions nearby and also declining numbers of *A. cucumeris*.

In the trial *A. cucumeris* was able to build up to large numbers in the flowers even when thrips numbers were very low. This was due to the availability of pollen as an alternative food source. However, in crops where no pollen is available, as in cucumbers, a close predator/prey relationship between *A. cucumeris* and both *T. tabaci* and *F. occidentalis* has been found (Gillespie 1989). Following an inundative release of between 100 and 200 predators/plant, numbers of thrips were 30/leaf compared with 200/leaf on predator-free plants. The numbers of *A. cucumeris* declined in the absence of thrips prey, but the predator recovered quickly when prey was available. *A. cucumeris* persists well on capsicum crops in the Netherlands without further reintroductions.

In Europe and North America, problems with persistence during winter have arisen because *A. cucumeris* enters diapause under short day and cool night conditions (Morewood and Gilkeson 1991). However, non-diapausing *A. cucumeris* have been selected from mites collected in New Zealand by visiting Dutch scientists. These are now commercially available and give good control of thrips in winter (van Houten and van Stratum 1993). Our colony was obtained from the same source and a winter-active strain has been selected.

Further trials are planned using the lacewing, *Micromus tasmaniae*, for aphid control. Another predatory anthocorid bug, *Orius vicinus*, also has potential as a complementary biocontrol agent to control adult thrips.

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