INTEGRATED CONTROL OF TWO—SPOTTED MITE ON GLASSHOUSE ROSES

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SUMMARY

The predatory mite *Phytoseiulus persimilis* was released onto four commercially grown rose crops in glasshouses to test its ability to control two-spotted mite (*Tetranychus urticae*). Two of the houses received intensive applications of miticides in addition to the predator. Monitoring of mite populations and leaf damage showed the superiority of *P. persimilis* over chemicals in controlling two-spotted mite. Preliminary action thresholds for chemical and biological control are presented.

INTRODUCTION

The control of two-spotted mite (TSM) on glasshouse crops has become increasingly difficult in recent years as TSM has developed resistance to a growing number of miticides (Georghiou 1981). In New Zealand, severe outbreaks have frequently occurred on commercial crops, such as roses, and research has recently been directed towards developing a system of integrated control using the predatory mite, *P. persimilis*. Such systems have been implemented overseas on several glasshouse crops including roses (Woets and van Lenteren 1982). However, before integrated control can be adopted here, three problems must be addressed. The predator must be shown to be effective under New Zealand conditions, predator-compatible chemicals for controlling other pests need to be identified, and suitable monitoring systems must be devised.

Preliminary research has confirmed the practical potential of the predator (Wearing and Proffitt unpublished), and screening of a range of agricultural chemicals for integrated control is currently underway (M.L. Bryham pers comm).

This paper describes the effectiveness of *P. persimilis* released on glasshouse roses in 1983 and 1984, a monitoring system for assessing the results, and tentative action thresholds for chemical and biological control.

METHODS

P. persimilis was mass reared on TSM-infested dwarf beans (*Phaseolus vulgaris*) cv. 'Seminole' in temperature-controlled glasshouse units. The method used was adapted from that described by the Glasshouse Crops Research Institute (GCRI 1975). *P. persimilis* were harvested once a week by cutting 110 infested dwarf bean plants growing in each of 20 seed trays. Each plant harboured approximately 200 to 500 active stages of *P. persimilis*. Stems were cut when the predator population reached peak levels, having consumed the majority of the TSM population. They were then stored at 5°C until required for release into glasshouses.

Releases were made on roses in two glasshouses on each of two commercial properties in Auckland. The first grower (Houses 1 and 2) had collaborated since 1982 and when monitoring began in house 1 in January 1983, *P. persimilis* was already established there from previous releases. The crop in house 2 (on the same property) had recently reached maturity and had been free of TSM before sampling was initiated in September 1983. Monitoring began the same month in house 3 on the second property, and in house 4 at the grower's request in November when chemical control in that house failed. The growers were requested to apply selective miticides only if recommended (based on mite monitoring) and only to apply other pesticides which were compatible with *P. persimilis*. Co-operation was received on this from the first grower, and no miticide was applied in house 1 or 2, but the second grower continued to spray against recommendations in houses 3 and 4.

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The insecticides and fungicides used for other pests, and compatible with *P. persimilis*, included diazinon (Basudin 50WP), pirimicarb (Pirimor 50DG), dichofluanid (Euparen 50WP), zineb (Dithane Z-78WP), bupirimate (Nimrod 25WP), captan (Captan 80WP), vinclozolin (Ronilan 50WP), iprodione (Rovral 50WP), triforine (Saprol 19EC), and the bacterial insecticide *Bacillus thuringiensis* Dipel 16000 IU/mg).

The crops were monitored on a weekly basis for levels of the mites and leaf damage. Previous results had indicated that sampling should be concentrated on leaves infested with TSM, rather than being strictly random throughout the house (Burgess unpublished). Each bed (double or triple row) of plants was divided into five areas of equal length. Two samples were taken from each area, one from either side of every bed (i.e. ten samples per bed). Samples were chosen from those flower stems in each area which harboured the worst infestation of TSM. The three most infested leaves on the chosen stem comprised the sample, and were examined in situ for the presence of damage, TSM, and *P. persimilis*. The selection of "worst infested" stems rendered the sampling method highly sensitive to low levels and first appearance of the mites, a feature essential for effective control by introduction of the predator.

Releases of *P. persimilis* were made by spreading the infested dwarf beans over the rose bushes throughout the house, concentrating releases in areas with greater numbers of TSM. The size of releases varied (depending on supply and demand) from approximately 100,000 to 900,000 active stages per house (i.e. the harvest from 6-16 trays of beans). Releases were initiated when TSM first appeared in the crops and thereafter when the percentage of sampled flower stems harbouring TSM, but without *P. persimilis*, was greater than or equal to 25% (with the exception of the first release in house 1 where the margin was less than 25%). A few additional releases were made after control had been achieved, to absorb some of the predators continually supplied from the rearing system.

Because the experiments were conducted on commercial crops it was not possible to include a 'control' treatment i.e. without *P. persimilis* or miticides. This was because experience has shown repeatedly that in these circumstances TSM increases rapidly to occupy all stems and causes severe defoliation and stunting (Wearing *et al* unpublished).

RESULTS

An augmentative release was made in house 1 when the TSM population began to increase late in January 1983 (Fig. 1A). By the end of March, TSM were present on only one in ten of the plants sampled even though sampling involved searching for infestations. Leaf speckling from mite feeding peaked at only 34% of sample plants in January, and declined thereafter.

A further release was made when TSM levels rose in May. As the predator population increased, TSM again declined without the need for chemical intervention. No miticide applications were required in this house through the entire season and the grower reported no loss in numbers of marketable blooms.

When TSM was eventually detected in house 2 in November 1983, releases of *P. persimilis* were initiated. The first was concentrated in the areas where TSM occurred, and later releases were more evenly distributed as TSM spread through the house. Sampling showed that the *P. persimilis* population spread rapidly to occupy TSM-infested leaves, and the pest population was reduced to undetectable levels by early February (Fig. 1B). As with house 1 no chemical intervention was necessary and no loss of yield was detected.

When monitoring began in house 3, the resident TSM population was increasing (Fig. 1C) despite previous weekly applications of miticide including dicofol (Kelthane 35W), cyhexatin (Plictran 50W), dienochlor (Pentac 50WP) and bromopropylate (Neoron 50EC). Permethrin and pirimiphos-methyl (Attack) had also been applied on four occasions within the previous 3 months. In response to mite monitoring two releases of *P. persimilis* were made in September and four releases in the period from November to January 1984. However, the grower did not follow the recommendations for only two selective miticide applications, and instead applied 12 sprays in the period

from September to January, and even a further spray after TSM had been reduced to extremely low levels in February. Some of the sprays were only 3 days apart.

In house 4 on the same property, 11 applications of five different miticides had been made between the beginning of September and the end of November 1983, but these did not prevent a serious outbreak of TSM. Four large releases of *P. persimilis* were made during December, and the predator was present on 43% of sample plants by the end of that month (Fig. 1D). The grower continued to spray intensively (eight applications in December) even after the introduction of the predator. The TSM population fell rapidly in January.

Fig. 1: Proportion of sample plants infested with TSM, *P. persimilis* and leaf spotting from mite feeding, found by deliberately searching for TSM-infested flower stems (see text). A. House 1; B. House 2; C. House 3; D. House 4.

DISCUSSION

In houses 1 and 2 good biological control of TSM was achieved by *P. persimilis* with no use of miticides. The changing population densities of TSM and *P. persimilis* followed typical predator/prey oscillations in which prey increases and decreases were followed rapidly by those of the predator (Varley *et al* 1973). The levels of damage by TSM to the rose crops remained sufficiently low for the local marketing of blooms to be unaffected.

A comparison of the results from houses 3 and 4, where miticides were applied intensively, with those from houses 1 and 2 demonstrates the relative ineffectiveness of chemical control methods. In house 3 (Fig. 1C), although the extent of control afforded by the predator cannot be clearly determined because of possible spray effects, the population trends suggest that predation could have provided control of TSM with minimal or no chemical intervention as in houses 1 and 2 (Fig. 1A and 1B). The excessive spraying illustrates the problem of the conventional grower approach to mite control, which wastes chemicals and greatly increases the risk of mite resistance. The initial presence of TSM on all sample shoots in house 4 showed the total failure of regular chemical control to keep TSM at acceptable levels. The serious damage to the crop had prevented the export of any blooms from this house for several months, and even when mite populations were reduced by the combined effect of miticides and predation, the problem of low level contamination remained. A technique is required to free cut blooms of such contamination by both TSM and *P. persimilis* where export marketing is contemplated. Currently, mechanical stripping of leaves near the base of stems removes much of the problem, but further disinfestation (e.g. by fumigation) may sometimes be necessary.

Fig. 2: Preliminary action thresholds for release of *P. persimilis* and application of selective miticides to glasshouse roses for the control of TSM. Proportion of infested sample plants is based on deliberately searching for TSM-infested flower stems (see text).

In the following flow chart, preliminary thresholds for the application of chemical and biological control strategies are presented (Fig. 2). These have been derived from the sample results presented above, and are only applicable to the described sample method. Further research is required to test the thresholds, to define optimum procedures and size of *P. persimilis* releases, and to determine the economics of integrated control.

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REFERENCES

- Georghiou, G.P., 1981. The occurrence of resistance to pesticides in arthropods, an index of cases reported through 1980. FAO of UN, Rome, 172 pp. FAO plant protection and production series.
- Glasshouse Crops Research Institute, 1975. Biological pest control. Rearing parasites and predators. GCRI growers' bulletin No. 2, 12 pp. Glasshouse Crops Research Institute, Littlehampton, Sussex.
- Varley, G.C., Gradwell, G.R. and Hassell, M.P., 1973. Insect population ecology, an analytical approach. Blackwell Scientific Publications. 212 pp.
- Woet, J. and van Lenteren, J.C., 1982. List of areas with application of beneficial insects in greenhouses per country and per crop in 1981. *Sting, Newsletter on Biological Control in Greenhouses*, 5. September 1982, 16 pp.