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Biological Control of Twospotted Spider Mite on Greenhouse Foliage Plants

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Introduction

There have been several reports of successful use of augmentative releases of biological controls for pest problems. *Phytoseiulus persimilis*, a predatory mite, is sold commercially for controlling twospotted spider mite in greenhouse and outdoor plants. The goal of this project was to test the use of these predatory mites for control of twospotted spider mites (TSSM) in greenhouse production of dieffenbachia. Cornell Cooperative Extension IPM Specialist Dan Gilrein cooperated on this project.

Materials and Methods

The project was conducted in a commercial 27,500 ft² greenhouse range on three dieffenbachia cultivars ('Camille', 'Compacta' and 'Tropic Snow') grown to various sizes in different areas of the greenhouse. At the initiation of the project (5/26/95), approximately 7,300 dieffenbachia were grown in 3,000 ft². Although other mite-susceptible hosts such as English ivy, croton and schefflera were also grown in the greenhouse, they were not included in this study due to time limitations. According to prior arangement, no potentially disruptive insecticides were applied within a month of the project, to avoid affecting biological controls. A list of 'approved' materials was agreed on beforehand, with the understanding that the trial could be ended at any time.

Beneficial mites were shipped in vials mixed with corn cob grit from a supplier (IPM Labs, Locke, NY) starting 6/13/95, via next-day delivery and released the day of arrival. Releases were made every two weeks and the predator vials were inspected on arrival for activity. Rough counts were taken from the first two shipments to verify consistency between numbers stated and received. Later shipments were carefully examined prior to release for activity and to detect any obvious problems in quality or quantity. Initial release rates were based on a recommended 1 mite/ft² but increased later to 2-3/ft² or more, with infested areas receiving more and uninfested plants fewer. *P. persimilis* were released within several hours of receipt onto middle-aged leaves of dieffenbachia.

A hygrothermograph placed in the greenhouse monitored ambient temperature and relative humidity throughout the trial.

Dieffenbachia (150 - 190 plants each time) were randomly scouted Wednesdays of every other week for infestation, damage and predator activity starting 6/9/95; all areas and varieties were sampled by selecting five leaves on each plant and noting the number of TSSM, infested leaves and predator mites found. Plants were also given an overall subjective quality rating, based on agreement beween the grower and the cooperator:

0 = no damage
1 = slight injury
2 = stippling scattered but not affecting quality
3 = injury moderate and noticeable with webbing; quality beginning to decline
4 = injury severe, quality reduced
5 = plant severely damaged, unmarketable

Predator mite releases were made on alternate Wednesdays starting 6/16 through 8/30/95, when the project was concluded.

Prior to this project, miticides were applied every 1-2 weeks, depending on the season, throughout the range with each treatment costing approximately $80 ($30 for dieffenbachia portion of treated crop), excluding labor. Predator treatments for dieffenbachia (excluding labor, about 1-2 hours) usually cost $69-86, depending on quantity ordered.

Results

During the first month of this study, both *P. persimilis* and *Neoseiulus occidentalis* were released. *P. persimilis* can quickly reduce TSSM populations but dies out in the absence of prey. *N. occidentalis* can survive on other hosts, pollen, etc. in the absence of spider mites and might continue to provide control at low pest levels. However, since no *N. occidentalis* were observed after releases were made, *Mesoseiulus longipes* was substituted in its place. Since this species was also not observed again after two additional releases only *P. persimilis* was released thereafter. Figure 1 shows the progress of the trial on variety 'Camille' (bench 3L), including TSSM and *P. persimilis* levels, plant injury ratings and average infested leaves per plant. This was fairly representative of most dieffenbachia through the rest of the greenhouse. TSSM populations started quite low but after early to mid-July levels increased significantly; predators were present but unable to overcome the TSSM. Some predation and reproduction (eggs) were observed whicle scouting. Mite damage was becoming fairly

noticeable (leaf edges become somewhat chlorotic, stippling and webbing visible under leaves) and since TSSM populations appeared to increase faster than the predators, the project was terminated at the end of August.

The most apparent reasons for the inability of the predators to overcome the TSSM population are probably related to the unusually high temperatures and low humidities during the trial period. Table 1 shows that temperatures often exceeded the 80°F threshold, where TSSM reproduces faster than *P. persimilis*. Particularly in July, humidity levels were sufficiently low at times (below 60%) to kill any *P. persimilis* eggs that might have been deposited. *P. persimilis* were found primarily in denser-canopied areas close to the bench but never observed in 'Tropic Snow' on bench 5R (fig. 2), which is grown as a taller, more open-canopied plant than the other two varieties. This cultivar is more widely spaced on the bench (fewer leaf 'bridges' for predator dispersal) and its architecture probably exposes leaf surfaces (and predators) to even lower humidities and possibly higher temperatures than indicated by the hygrothermograph, which measures the environment closer to bench level.

Effective release rates in June were probably too low, since only *P. persimilis* was observed on infested foliage while monitoring. Using higher rates of this species at the beginning would probably provide some preventive control.

Conclusions

Although we did see some predation of TSSM with *P. persimilis*,, performance might have been improved in several ways. The extremely warm conditions of the 1995 summer created a long unfavorable period for *P. persimilis* . In most years this is expected to be shorter or less severe. This project might be repeated at other times of the year when condtions are less extreme. Where TSSM outbreaks occur during warm, dry periods selective pesticides might be needed unless effective adapted predators are found. Misting benches or wetting walkways to maintain higher levels would help increase humidity levels and perhaps also reduce temperatures. Monitoring random plants seemed to work well, but was time consuming (>3 hours per visit) and might be refined by noting only mites per plant or number of infested leaves, both of which seem to similarly measure severity. Other susceptible plants should be monitored and either included in the biocontrol program or receive preventive treatments compatible with the beneficials. Pots were drenched with metalaxyl (Subdue) several weeks to months prior to releasing *P. persimilis*; it is not clear what, if any, effect this may have had (foliar sprays are considered moderately toxic to nymphs and adults).

Results of the project will be shared with other growers and an article summarizing recommendations for testing *P. persimilis* for biocontrol of twospotted spider mite has been written to assist other growers who may be interested.

Table 1. Ranges in temperature and relative humidity, Kawasaki Greenhouses, June - August 1995.

Dates	Temperature (°F) (min - max)	Relative Humidity (%) (min - max)
6/28 - 7/13	72 - 88	60 - 95
7/13 - 19	70 - 90	50 - 95
7/19 - 26	72 - 90	50 - 95
7/26 - 8/2	74 - 95	55 - 90
8/2 - 9	76 - 90	60 - 90
8/9 - 16	74 - 96	60 - 95
8/16 - 23	74 - 92	60 - 95

Fig. 1: Biocontrol of Twospotted Spider Mite on Dieffenbachia 'Camille': Bench 3L

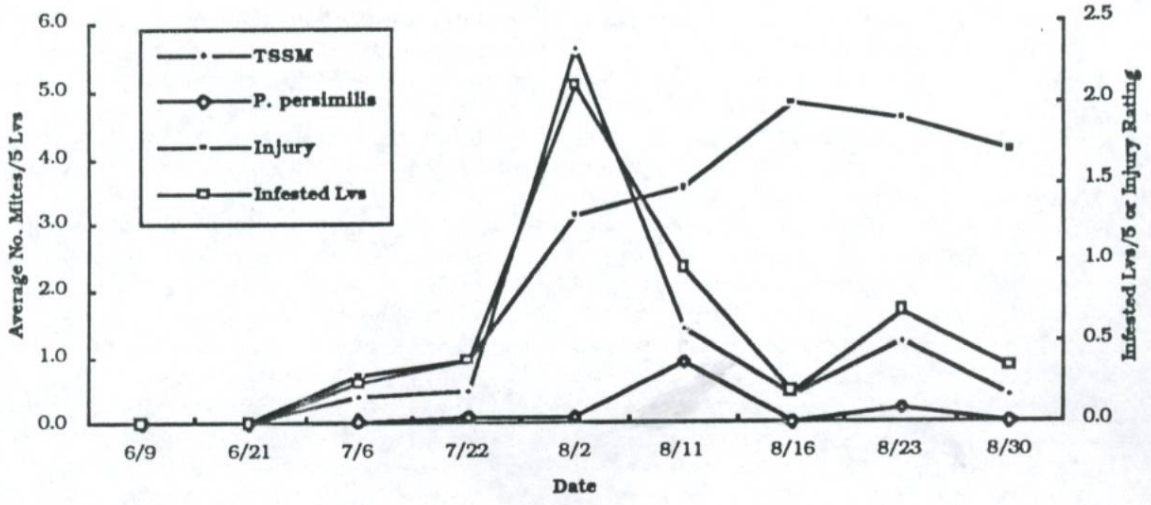
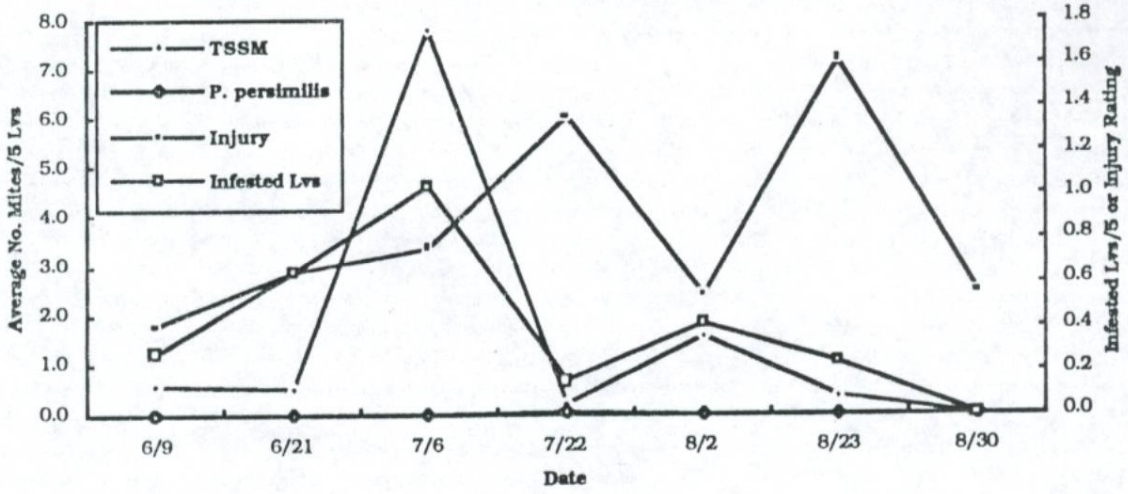


Fig. 2: Biocontrol of Twospotted Spider Mite on Dieffenbachia 'Tropic Snow': Bench 5R



The following slides are included:

1. 'Camille' dieffenbachia nearing sale. Overlapping canopy aids in dispersal of predatory mites.
2. Twospotted spider mite - close-up.
3. TSSM injury and residue (cast skins) on dieffenbachia leaf
4. Applying *Phytoseiulus persimilis* as received
5. *P. persimilis* on dieffenbachia leaf - to see size (small red mite indicated on diagram)

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