

Biological Control

EARLY-SEASON RELEASE OF *GALENDROMUS OCCIDENTALIS* ONTO APPLE ORCHARD GROUND COVER FOR CONTROL OF SPIDER MITES IN TREES

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Abstract: Inundative releases of insectary-reared *Galendromus occidentalis* onto the ground cover in a ‘Ginger Gold’ apple orchard in April, May and June were evaluated for their suppression of twospotted spider mite (*Tetranychus urticae*) densities. Spider mite densities were generally low on ground cover, on tree trunks and in trees from April through August and did not exceed 1.5 motile stages per leaf in trees. Predator mite densities were very low throughout the trial and no different among release treatments. Despite low mite densities, release of predator mites in April and May did significantly lower spider mite densities on sticky trunk bands and tree leaves in late June and July below densities in June release and no release plots. In addition, cumulative spider mite days and prey to predator mite ratios in trees were significantly greater in June and no release plots than in April and May release treatments. Low spider mite densities and arid conditions in the orchard likely reduced establishment of predaceous mites on ground vegetation.

Introduction

Despite the widespread occurrence of the western predatory mite, *Galendromus occidentalis*, in northern Utah orchards, economically damaging populations of spider mites still occur. The apple rust mite, *Aculus schlechtendali*, which can serve as alternative prey for predaceous mites and help “coax” predators into trees before spider mites exceed economically damaging levels, has been nearly absent in recent years. A greater proportion of orchards are treated with acaricides now than 10 years ago when there was more reliance on natural biological control. This study was undertaken to determine whether inundative releases of predaceous mites onto orchard ground vegetation could suppress spider mite densities and thus reduce their dispersal into apple trees. Typically, July and August are the months when spider mite densities increase rapidly due to warm temperatures and may exceed economic thresholds in trees (5-10 motile stages per leaf).

Materials and Methods

The trial was conducted in an approximately 5-acre commercial ‘Ginger Gold’ apple orchard in Santaquin (Utah County), UT, in 2001. Codling moth control was maintained with an organophosphate insecticide program. *Galendromus occidentalis* (Benemite tm) was purchased from Rincon-Vitova (Ventura, CA) and released at a rate of 19,000 predaceous mites per acre on 17 April, 17 May and 20 June. The cost was \$28.70 per 1,000 mites, and 2,000 mites were

released into plots on each release date. The experimental design was completely randomized with four treatments (3 release dates and an untreated control) and four replications. Plot size was 2 row-middles (28 ft wide) by 40 ft long with untreated buffers of 40 ft within rows and 5 row-middles (70 ft) between rows around all plots. Orchard ground vegetation was predominantly fescue grass with low to moderate abundance of broadleaf weeds (predominantly dandelion, common mallow and field bindweed).

Phytophagous and predaceous mite densities were sampled on seven dates: 17 April, 1 May, 17 May, 5 June, 20 June, 19 July and 21 August. Mites were sampled on ground vegetation by selectively clipping a large handful of broadleaf weeds (30-50 g fresh weight and 5-11 g dry weight) in each plot and placing the sample on Berlese funnels in the laboratory to collect active arthropods in 70% ethanol. Mites were continuously sampled on one tree trunk per plot by encircling the trunk with a band of 5-cm-wide duct tape coated with tangle trap. Sticky trunk bands were collected and replaced on each sampling date. Mites on apple leaves were sampled by collecting 20 leaves from the four center trees per plot on each date. The number of phytophagous and predaceous mites in each sample was counted in the lab with the aid of a 10-30X stereomicroscope. The only spider mite species present was twospotted spider mite, *Tetranychus urticae*. Very few apple rust mites were found. The only predaceous mite found on ground vegetation and tree trunks was the western predatory mite, *Galendromus occidentalis*. Low densities of *G. occidentalis* and the Stigmaeid, *Zetzellia mali*, were found on tree leaves.

Comparison of mite densities among treatments was performed by repeated measures analysis of variance to elucidate effects of release treatment and sampling date (Proc Mixed, SAS). Significantly different treatment means were separated with Tukey's studentized range test ($\alpha=0.05$).

Results and Discussion

Twospotted spider mite densities were generally low in all sample types from April through early June, but increased on late June and July sample dates in June release and no release plots (Figs. 1-3). Low densities of predaceous mites were found throughout the trial, especially on trunk bands and in trees, and no population increases were observed following *G. occidentalis* releases (Figs. 1-3).

On ground vegetation, spider and predator mite densities did not differ among treatments but did differ across sampling dates (Table 1). Dips in mite densities in early May and late June (Fig. 1) were likely caused by recent mowing of the ground cover that removed 5-7 cm height of vegetation as compared to previous sampling dates. The ground cover was often dry on sampling visits. Although not significantly different, numbers of spider mites on vegetation did increase in July in no release and June release plots above numbers in April and May release plots.

Spider mite densities were significantly different among treatments and dates on trunk band and tree leaf samples (Table 1). For trunk band samples, spider mite densities were significantly greater in June release and no release plots than in April and May release plots (Fig. 2). For tree leaf samples, spider mite densities were significantly greater in June release

than April and May release plots (Fig. 3). In addition, cumulative spider mite days (cumulative sum of mean number of *T. urticae* per leaf on each date X number of days between sampling dates) and ratio of prey to predator mites (ratio of mean number of prey [*T. urticae*] to mean number of predators [*G. occidentalis* + *Z. mali*] on leaves) in trees were significantly greater in June release and no release treatments than April and May release treatments (Table 1). Densities of predaceous mites were not different among treatments for any sample type but did differ among sampling dates (Table 1).

Unfortunately, spider mite densities were too low in the trial (peak density of 1.5 motile stages per leaf in June release plots in late June) to demonstrate that early-season (April and May) releases of *G. occidentalis* onto ground cover can prevent economically damaging populations of *T. urticae* from building up in trees later in the summer. However, *G. occidentalis* releases in April and May did result in lower densities of *T. urticae* crawling up trunks and establishing in trees in late June and July than in treatments with a late June release or no release of predators. In addition, early-season releases of *G. occidentalis* lowered cumulative spider mite days and prey to predator mite ratios in trees. These findings suggest that ground cover releases of predaceous mites should be made earlier in the season (April and May) versus later (June) to allow time for suppression of spider mites. Because we did not observe increases in *G. occidentalis* populations following releases, suppression of spider mites by predaceous mites in early release treatments can only be inferred. Low spider mite densities and arid conditions in the orchard likely reduced establishment of predaceous mites on ground vegetation.

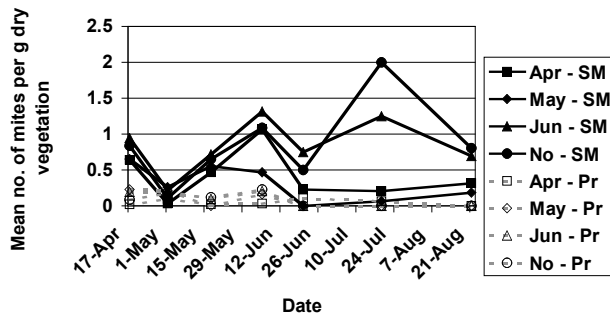


Figure 1. Effect of date of predaceous mite release (Apr, May, Jun or No) on densities of twospotted spider mite (SM) and predaceous mites (Pr) on ground vegetation.

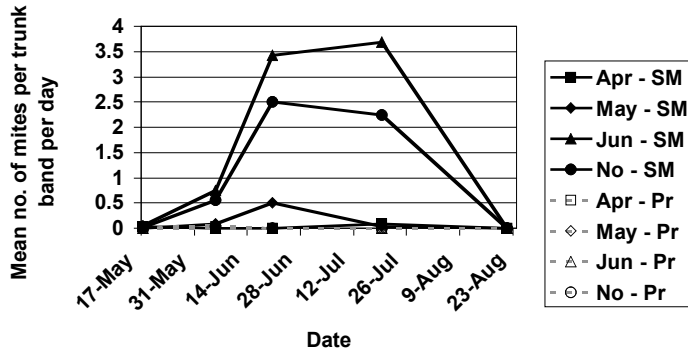


Figure 2. Effect of date of predaceous mite release (Apr, May, Jun or No) on densities of twospotted spider mite (SM) and predaceous mites (Pr) on sticky trunk bands.

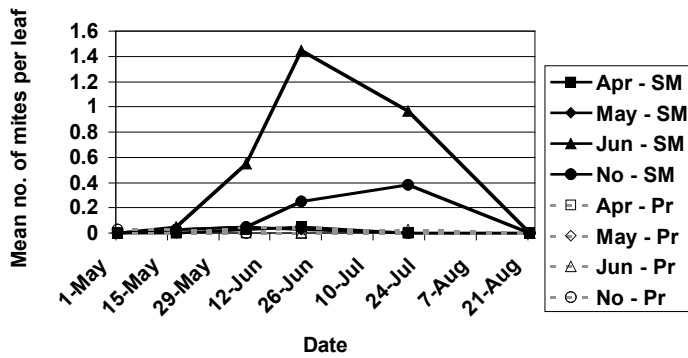


Figure 3. Effect of date of predaceous mite release (Apr, May, Jun or No) on densities of twospotted spider mite (SM) and predaceous mites (Pr) on leaves in trees.

Table 1. Probability values from repeated measures analysis of variance (Proc Mixed, SAS) for effects of treatment (*G. occidentalis* release date) and sampling date on mean mite densities on ground vegetation, tree trunks, and tree leaves (17 April to 21 August 2001).

Source	df	$P \geq F^a$							
		Ground vegetation ^b		Trunk bands		Tree leaves		Cumulative	Prey:pred
		SM ^c	PM	SM	PM	SM	PM	SM days	ratio
Treatment (release date)	3	0.1813	0.6952	0.0338	0.7524	0.0393	0.4322	0.0001	0.0537
Sampling date	6	0.0002	0.0032	0.0123	0.0011	0.0002	0.2520	0.0003	0.0001

^aAll data were square-root(x+1) transformed before analysis; N=112.

^bGround vegetation = Mean no. of mites per g dry ground vegetation; Trunk bands = Mean no. of mites per trunk band per day; Tree leaves = Mean no. of mites per leaf; Cumulative SM days = Sum of the mean no. of *Tetranychus urticae* per leaf on each sampling date X no. of days between sampling dates; Prey:Pred ratio = Ratio of mean no. of prey (*Tetranychus urticae*) to no. of predators (*Galendromus occidentalis* + *Zetzellia mali*) on tree leaves.

^cSM = twospotted spider mite, *Tetranychus urticae*; PM = predaceous mite, *Galendromus occidentalis*.