Evaluation of Predator Mites for Control of Two-Spotted Spider Mites in Carrots Grown for Hybrid Seed in Central Oregon, 2014

Marvin Butler, Rich Affeldt, Megan Buck, Bruce Martens and Ralph Berry

Abstract

Two-spotted spider mites (TSSM) are an important pest on hybrid carrot seed production in central Oregon. Predator mites have been used to successfully control TSSM in peppermint production in central. This preliminary project was conducted to determine if there is potential for the use of predator mites in carrots. Circumstantial evidence from the results suggests predator mites were successfully established, they were successful in reducing TSSM populations, they were able to effectively disperse throughout the field, predators can be introduced in the fields with moderate amounts of TSSM and they may be able to keep populations at a commercially acceptable level.

Introduction

Two-spotted spider mites (TSSM) are a significant pest in hybrid carrot seed in central Oregon. Spider mite populations can increase dramatically during the time bees are present to pollinate the crop from late June until mid-August. During this time, no insecticide applications are made. Once bees are removed from the fields, a cleanup application to control insect pests often includes a combination of Orthene (acephate) and Comite (propargite). However, Comite is problematic due to the two weeks it takes for mites to die and the two week re-entry interval (REI) that prevents rouging crews from accessing the fields. If predator mites can be used effectively to control TSSM during crop pollination, elimination of the cleanup spray may be possible. A reduction in miticide applications would benefit the environment, worker safety, seed quality and grower profitability.

The objective of this preliminary project was to determine if there is potential for the use of predator mites for control of TSSM in hybrid carrots grown for seed.

Methods and Materials

Research was conducted in three commercial hybrid carrot seed fields, two near Madras and one near Culver, Oregon. Plots consisted of four female rows 10 ft x 50 ft replicated four times and alternating between treated and untreated plots near the two ends of the field. Plots in the female rows were separated by two male rows centered between blank rows that separate the male and female rows.

The three commercial fields were surveyed to determine TSSM populations on June 24, July 3 and July 10 to ensure there was an adequate food supply of TSSM before releasing predators. In addition, it was believed that a plant bridge was necessary for predator mites to disperse across the field. There was adequate plant growth for in-row plant bridging with the four adjacent female rows, but there was concern about predators being able to move across the field, particularly with blank rows on each side of the two male rows.

Protocol used for making mite counts including sampling a leaf from the bottom 6 to 12 inches of the plant, a leaf from the middle of the plant and a bract from a secondary flower head at the top of the plant. Ten plants were sampled per plot, with five plants accessed from each side of the four-row plot. Counts were made for TSSM adults, eggs and predator mites. Pre-counts were taken at each of the three locations during early morning on the day predator mites were released in the evening. Releasing predators in the evening was done to provide time for them to adapt to their new surrounding before exposure to the summer heat the following day. For logistical reasons, predators were released a day apart at the three locations from July 15 to 17. Post-release counts were taken 7, 14 and 21 days after treatment (DAT) at all three locations. Counts were taken only at the middle and top of the plant 21 DAT due to mites moving up the plant toward better plant material for feeding.

Results and Discussion

Results from all three locations consistently show no differences in TSSM or eggs between treated and untreated plots. However, at all locations the number of both mites and eggs dropped dramatically by 14 DAT. Location 2 had lower numbers from the pre-count, with both mite and egg counts near zero by 14 DAT and staying at that level through 21 DAT.

Unfortunately, there is no documentation of the presence of predator mites and how they dispersed through the fields. The fact that TSSM populations dropped at all three locations at the end of July, provides circumstantial evidence that predator mites were successfully established and provided control. The dramatic reduction in TSSM populations that occurred across both treated and untreated plots would seem to indicate that predator mites were able to disperse across the blank rows on either side of the two male rows without a plant bridge to reach the adjacent untreated plots. That TSSM populations were initially low at location 2 and were reduced to near zero 14 DAT provides an indication that having an adequate food source before releasing predators may not require as high of a population of TSSM as thought. The possibility of predator mites bringing the population down near zero creates hope that starting earlier in the season with lower populations of TSSM may provide an acceptable level of control through the remainder of the season.

This preliminary study doesn't provide the hard evidence hoped for, but it does provide circumstantial evidence that predator mites can be established, can provide control of TSSM in carrots grown for seed, may not require a plant bridge for dispersal across a field or as large of a food source as expected. Additional research is planned for 2015 to create the data needed to fully answer whether predator mites can adequately control TSSM in carrots grown for seed in central Oregon.

Table 1. Average number of TSSM per leaf or flower bract sampled from seed carrots in plots treated with predator mites compared to untreated plots near Madras and Culver, Oregon.

		Pre-Count				7 DAT				14 DAT				21 DAT		
Location	Treatment	Lower	Mid	Upper	**Total**	Lower	Mid	Upper	**Total**	Lower	Mid	Upper	**Total**	Mid	Upper	**Total**
Loc. 1	Predators	16.1	9.6	2.5	**28.2**	17.8	12.4	4.8	**35.0**	3.3	9.1	5.7	**18.1**	5.1	2.7	**7.7**
	Untreated	16.6	11.3	2.7	**30.6**	18.7	14.8	4.4	**37.9**	3.6	8.5	3.1	**15.2**	4.3	1.9	**6.2**
Loc. 2	Predators	4.7	2.3	2.9	**9.9**	6.3	1.5	0.9	**8.7**	0.0	0.1	0.1	**0.2**	0.0	0.1	**0.1**
	Untreated	4.5	1.6	1.6	**7.7**	3.9	0.4	0.5	**4.8**	0.1	0.2	0.1	**0.4**	0.1	0.2	**0.3**
Loc. 3	Predators	15.8	4.1	1.0	**20.9**	10.5	1.1	1.6	**13.2**	0.7	0.7	0.6	**2.0**	3.6	1.4	**5.0**
	Untreated	16.4	4.4	1.6	**22.4**	12.0	2.4	0.7	**15.1**	0.5	0.5	0.8	**1.8**	4.2	0.9	**5.1**

Table 2. Average number of TSSM eggs per leaf or flower bract sampled from seed carrots in plots treated with predator mites compared to untreated plots near Madras and Culver, Oregon.

		Pre-Count				7 DAT				14 DAT				21 DAT		
Location	Treatment	Lower	Mid	Upper	**Total**	Lower	Mid	Upper	**Total**	Lower	Mid	Upper	**Total**	Mid	Upper	**Total**
Loc. 1	Predators	12.3	10.4	1.9	**24.6**	10.9	8.5	3.0	**22.4**	0.5	3.9	3.7	**8.1**	2.3	0.6	**2.9**
	Untreated	12.7	9.4	3.2	**25.3**	16.8	10.0	5.1	**31.9**	0.2	6.4	2.4	**9.0**	1.6	0.9	**2.5**
Loc. 2	Predators	5.2	2.6	2.5	**10.3**	2.7	1.6	0.9	**5.2**	0.1	0.3	0.0	**0.4**	0.1	0.0	**0.1**
	Untreated	2.9	1.7	1.2	**5.8**	2.6	2.2	.04	**5.2**	0.0	0.4	0.0	**0.4**	0.0	0.0	**0.0**
Loc. 3	Predators	14.1	8.0	1.0	**23.1**	4.6	3.2	0.4	**8.2**	1.1	0.6	0.6	**2.3**	8.4	2.4	**10.8**
	Untreated	17.2	8.0	3.2	**28.4**	6.9	4.8	1.4	**13.1**	1.2	2.4	0.7	**4.3**	6.5	2.1	**8.6**

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