SPIDER MITES IN ARKANSAS: WILD HOST PLANTS AND CHEMICAL CONTROL

Don Steinkraus and Jon Zawislak
University of Arkansas
Fayetteville, AR
Gus Lorenz III and Jeff Welch
Arkansas Cooperative Extension Service
Lonoke, AR

Abstract

Spider mites in Arkansas cotton fields and adjacent weeds were sampled weekly between 2 June and 23 July 1998 to determine when mites colonized weeds and cotton and what weed species supported early mite populations. The most important weed host was palmer amaranth, *Amaranthus palmeri*. Mites appeared to move from palmer amaranth to cotton. Control of this weed on field borders in May and early June may reduce mite infestations in cotton. Selected miticides were tested in a commercial cotton field for efficacy against a heavy mite population. Overall, Kelthane, Zephyr, and Comite provided the best control of mites. Pirate and Capture provided equal control to Kelthane, Zephyr and Comite at 7 days posttreatment but by 14 days mite populations were higher. Curacron appeared to flare mite populations.

Introduction

Spider mites (Acarina: Tetranychidae) are important worldwide cotton pests (Leigh 1985) and can cause yield losses (Wilson et al. 1991). Every year some fields in Arkansas, particularly fields in the the northeast, have spider mite problems. Spider mite problems will undoubtedly increase during boll weevil eradication in Arkansas because mite outbreaks are frequently initiated by application of insecticides to cotton (van den Bosch & Hagen 1966, Gonzales & Wilson 1982, Gonzales et al. 1982). Generally, once a field has been treated with insecticide, little natural control remains to attack spider mites. Insecticides also cause mite outbreaks by stimulating mite reproduction, either directly or indirectly through the plant (Bartlett 1968, van de Vrie et al. 1972, Iftner & Hall 1984).

Spider mites have a greater potential for rapid population growth than most cotton pests. The life cycle of spider mites during summer is 7-10 days (Whitcomb & Bell 1964). Mites consume the contents of epidermal cells of leaves, bracts, and fruit of cotton, interfering with the photosynthetic efficiency of leaves (De Angelis et al. 1983) and resulting in lower yield and lint quality. In extreme infestations leaves and bolls are shed and plants may be killed.

Host plants influence mite biology. Total number of eggs laid and life span of twospotted spider mites, *Tetranychus urticae*, varied depending on the host plant inhabited (Jeppson et al. 1975). Nothing has been published on the weeds serving as spider mite hosts in Arkansas. Identification of the most important weed hosts of spider mites may help Arkansas growers reduce mite colonization of cotton fields.

The objectives of this study were to identify the weed species surrounding Arkansas cotton fields colonized by mites and to test selected miticides in the field for control of spider mites in Arkansas cotton. A long-term goal of this project is to determine why certain areas and fields in Arkansas are prone to mite infestation.

Materials and Methods

Survey of Mites in Arkansas Weeds and Cotton

Two commercial fields, located in northeastern Arkansas near Lepanto in Poinsett Co. were chosen because this area has mite outbreaks every year. Field 1 was planted 16 May and Field 2 was planted 20 May 1998, both with Stoneville BXN-47 cotton. Counts of mites on weeds and cotton were made weekly between 2 June and 23 July 1998. On 2 June the cotton was just emerging from the cotyledon stage. Fields were very dry and dusty throughout most of the observational period. Weeds growing within 25 meters of the edges of the cotton fields were identified to species and searched for spider mites. When possible, at least 5 specimens of each weed species and 5 leaves on each plant were examined with 10x hand lenses and the number of mites counted. Each week, mites were counted on 80 cotton leaves from each of the two cotton fields. Ten leaves were collected from randomly selected plants along each side of the field, at 3 meters and 25 meters inside the field edge. Each cotton sample consisted of a single fully expanded leaf from the middle of the canopy because such samples are indicative of the numbers of mites present in a cotton field (Carey 1982, Wilson et al. 1983). Spider mites were counted on these leaves with dissecting microscopes at 10x.

Miticide Tests

A test was conducted in a commercial cotton field heavily infested with mites, near Blakemore, Lonoke Co., AR, to compare the efficacy of 6 miticides on spider mites. Cotton (Stoneville BXN-47) was planted 27 April in 38-inch rows in Rilla silt loam. Plots, 4 rows by 30 ft long, were marked with flags in the field. Each plot was separated by 4 rows on the sides and 15 ft on the ends. Treatments were arranged in a RCB design with 4 replications. Miticides were applied on 17 June 1998 with a six-nozzle handboom CO_2-charged backpack sprayer calibrated to deliver 10.5 gpa at 40 psi with TX-6 nozzles. The 6 miticides selected

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for these tests and the rates applied were: Capture, 6.4 oz/acre; Comite, 2 pts/acre; Curacron, 1 pt/acre; Kelthane, 3 pts/acre; Pirate, 4.2 oz/acre; Pirate 6.4 oz/acre; and Zephyr, 6 oz/acre. Water was used as a treatment for the control plots. The plants were an average height of 12 nodes on 17 June. Conditions on the date of treatment included variable winds from the south, and a temperature of about 100° F. No rain fell during the test, providing excellent conditions for evaluating the miticides. Mite counts were made prior to treatment and at 3, 7, and 14 DAT. Mite counts were made on 10 randomly-selected leaves from the center two rows of each plot using mainstem leaves 6 nodes beneath the first fully expanded leaf. Counts were made by placing a linen tester immediately to the left of the midrib vein on the underside of each leaf and counting all live immature and adult mites within a 1.5cm^2 area. Data were analyzed by ANOVA and LSD t-tests (SAS 1988).

Results and Discussion

Survey of Mites in Arkansas Weeds and Cotton

Most mites encountered in this study were twospotted spider mites (*T. urticae*); a few carmine spider mites (*T. cinnabarinus*) were observed but only on horse nettle (*Solanum carolinense*) and entireleaf morningglory (*Ipomoea hederacea*). A total of 29 weed species were identified and examined for mites adjacent to cotton fields in Poinsett Co., AR. Of these, only 9 species were found hosting mites (Table 1). Twospotted spider mites were first found on 3 June (Table 1). The most important weed host on all dates was Palmer amaranth, *Amaranthus palmeri*. When goose grass (*Eleusine indica*), curled dock (*Rumex crispus*), and hedge bindweed (*Convolvulus arvensis*) occurred in close proximity to infested *A. palmeri*, they also supported mite populations. Overall, an average of 2.2 mites per leaf (n=418) were found on *A. palmeri* between 2 June and 23 July. On 18 June and 10 July, means of 10.1 (n=18) and 16.4 (n=25) mites per leaf were found on *A. palmeri*. Frequently small (1 inch), inconspicuous individuals of *A. palmeri* supported heavy mite populations. It appeared that mites left heavily-colonized *A. palmeri* and moved onto other weed species and onto cotton. This suggests that early season control of *A. palmeri* might lessen mite infestations in cotton. The situation is not completely understood, because we found many fields in Poinsett Co. fields, surrounded by large mite-free populations of *A. palmeri*. There appeared to be an interaction between dusty roads and development of mite populations on weeds and cotton. Dusts are known to reduce natural enemies, resulting in pest outbreaks along dusty roads (Bartlett 1951).

Few mites were observed in the cotton fields even though the 2 fields had experienced severe mite problems in previous years. Those that were seen occurred near borders. Few mites were observed in Fields 1 and 2 (Figs. 1 and 2). Mite numbers peaked near the end of June in Field 2, but were never numerous. In 1998 the growers took extra precautions against mites, perhaps because we continually shared our observations with them. In both fields, the growers maintained wide, clean areas between the cultivated fields and the borders near where they had previously reported recurring mite problems. These areas were kept relatively free of weeds and consequently mite numbers were low.

Miticide Tests

Immediately prior to treatment a mean of 4.85 mites/1.5cm^2 (SE=0.71, n=40) were found in the field. All miticides significantly reduced mite numbers at 3 DAT compared with the water-treated check plots, however, Curacron @ 1pt/acre and Zephyr @ 6 oz./acre provided significantly less control than the other 5 miticide treatments (Table 2). By 7 DAT all the miticides had significantly reduced mite numbers compared to the check plots. However, significantly more mites were present in Curacron plots than the other miticide treated plots. By 14 DAT mite counts were lowest in the Kelthane and Zephyr plots and mite counts were significantly higher in Curacron treated plots than check plots. Zephyr took several days to affect the mite population, but at 7 and 14 DAT it provided excellent control of mite populations. Overall, Kelthane, Zephyr, Comite, and Pirate all provided good control of spider mites on cotton, with Capture providing intermediate control, and Curacron appearing to flare mite numbers. There did not appear to be any advantage to using higher rates than 4.2 oz./acre of Pirate. In California the use of pyrethroids and organophosphates for mite control on cotton is not recommended (Godfrey et al. 1996). They report that these materials frequently result in short-term population reductions followed by rapid resurgence of mite populations that can exceed pretreatment levels. Because Capture (bifenthrin) is a pyrethroid and Curacron (prophenofos) is an organophosphate, these materials may have a similar effect in Arkansas.

Summary

The survey of weed species surrounding cotton fields in Poinsett Co., AR, revealed that Palmer amaranth, possibly in conjunction with dusty conditions, is an important host of twospotted spider mite. Early season control of this weed may help reduce mite infestations in cotton. This information could enable growers and scouts to identify and destroy potential mite habitats before mite populations develop and subsequently enter cotton fields. Zephyr, Comite, and Kelthane all provided excellent control of spider mites for 2 weeks. In this test, Curacron appeared to have the potential to flare mite populations. The results of this miticide test may enable Arkansas growers to make better informed decisions regarding which commercial chemicals to use when treating fields for infestations of spider mites.

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Table 1. Weeds adjacent to cotton fields in Poinsett Co. AR, and the extent to which they supported twospotted spider mites during June and July 1998.

Common name	Scientific name	Family
Most Important Host		
Palmer amaranth	*Amaranthus palmeri*	Amaranthaceae
Occasional Hosts		
goose grass	*Eleusine indica*	Gramineae
entireleaf morningglory	*Ipomoea hederacea*	Convolvulaceae
hedge bindweed	*Convolvulus arvensis*	Convolvulaceae
curled dock	*Rumex crispus*	Polygonaceae
common cocklebur	*Xanthium strumarium*	Compositae
common lambsquarters	*Chenopodium album*	Chenopodiaceae
purple vetch	*Vicia americana*	Leguminosae
horsenettle	*Solanum carolinense*	Solanaceae
Non-hosts		
velvetleaf	*Abutilon theophrasti*	Malvaceae
redroot pigweed	*Amaranthus retroflexus*	Amaranthaceae
pigweed	*Amaranthus hybridus*	Amaranthaceae
trumpetcreeper	*Campsis radicans*	Bignoniaceae
dandelion	*Taraxicum officinale*	Compositae
poison ivy	*Toxicodendron radicans*	Anacardiaceae
dogbane	*Trachelospermum difforme*	Apocynaceae
pokeweed	*Phytolacca americana*	Phytolaccaceae
elm	*Ulmus* sp.	Ulmaceae
daisy fleabane	*Erigeron annuus*	Compositae
ragweed	*Ambrosia artemisiifolia*	Compositae
geranium	*Geranium* sp.	Geraniaceae
buttercup	*Ranunculus hispidus*	Ranunculaceae
hemlock-parsely	*Conioselinum chinense*	Umbelliferae
Pennsylvania smartweed	*Polygonum pensylvanicum*	Polygonaceae
mint	*Mentha* sp.	Labiaceae
prostrate spurge	*Euphorbia supina*	Euphorbiaceae
wood sorrel	*Oxalis corniculata*	Oxalidaceae
tickseed	*Coreopsis tinctoria*	Compositae
wild garlic	*Allium* sp.	Liliaceae

Table 2. Mean number of live mites observed per 1.5cm^2 area of cotton leaf, after treatment with selected miticides in 1998.

			Mean no. live mites/1.5cm^{2a}		
Treatment	Rate/acre[b]	AI/acre[c]	3 DAT	7 DAT	14 DAT
Capture 2 EC	6.4 oz	0.1	0.57 c	1.25 c	1.80 c
Comite 73.6%	2 pt	1.6	1.02 c	0.65 c	0.40 cd
Curacron 8 EC	1 pt	1.0	2.87 b	5.27 b	11.10 a
Kelthane 35 MF-B	3 pt	1.5	0.25 c	0.12 c	0.17 d
Pirate 3 SC	4.2 oz	0.1	0.30 c	0.70 c	1.55 cd
Pirate 3 SC	6.4 oz	0.15	0.55 c	0.47 c	1.52 cd
Zephyr 0.15 EC	6 oz	0.009	3.22 b	0.15 c	0.20 d
Control	water	-	6.32 a	7.15 a	4.72 b
LSD (P = 0.05)			1.0	1.1	1.4
F			29.2	43.9	52.4
$P > F$			0.0001	0.0001	0.0001

Means within a column followed by the same letter(s) are not significantly different (LSD, P=0.05).

[a] All live mites were counted in a 1.5cm^2 leaf area to left of midvein beneath leaf, on 10 randomly chosen mainstem leaves 6 nodes below first fully expanded leaf per plot.

[b] Formulation/acre.

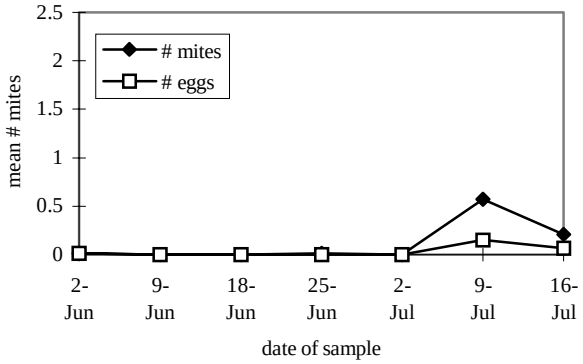

Figure 1. Mean number of spider mites observed per leaf in Field 1, 1998.

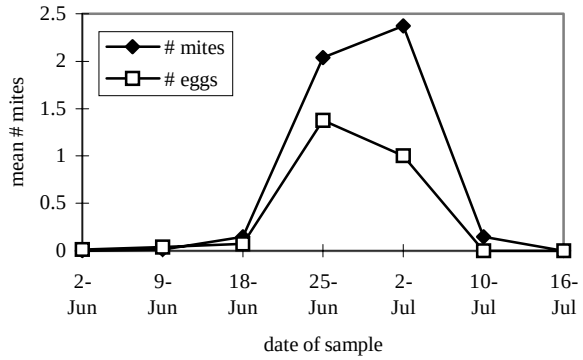

Figure 2. Mean number of spider mites observed per leaf in Field 2, 1998.