# SPIDER MITES ON ARKANSAS COTTON: WILD HOST PLANTS AND CHEMICAL CONTROL

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## Abstract

Spider mites in Arkansas on weeds adjacent to commercial cotton fields were sampled weekly between 3 June and 29 July 1999 to determine which weed species supported early mite populations. The most important weed hosts were pitted morningglory, *Ipomoea lacunosa*, and palmer amaranth, *Amaranthus palmeri*. Mites appeared to move early in the season from these and other weeds to cotton. Control of these weeds on field borders in May and June should help to 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.

## Introduction

This is the second year of a study of mites on Arkansas cotton. For more detail on the study and 1998 results, see Steinkraus *et al.* (1999). Spider mites (Acarina: Tetranychidae) are important cotton pests worldwide (Leigh, 1985). Every year some fields in Arkansas, particularly fields in the the northeast, have spider mite problems. Spider mite problems will increase during boll weevil eradication in Arkansas because mite outbreaks are frequently initiated by application of insecticides to cotton (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; Iftner and Hall, 1984).

Little has been published on the weeds serving as spider mite hosts in Arkansas. In 1998, Steinkraus *et al.* (1999) found the most important early season weed host adjacent to cotton in Arkansas for spider mites was Palmer amaranth. Identification of 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. Long-term goals of this project are to determine why certain fields and regions in Arkansas are prone to mite infestations and to determine the most efficacious miticides for mite control.

## Materials and Methods

### Survey of Mites in Arkansas Weeds

We chose two commercial cotton fields in Poinsett Co., Arkansas, near Lepanto AR, that have had a history of mite infestations in cotton in most recent years. Each week between 3 June and 29 July 1999 we sampled weeds surrounding these two fields to identify weed hosts of spider mites that may be the source of mites infesting the cotton fields. The weed species complex and abundance varied each week due to natural factors and grower efforts to control weeds. 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 were counted.

### Miticide Test 1999

The test was conducted in a commercial cotton field heavily infested with mites, near Leachville, Poinsett Co., AR. The plants were an average height of 17 nodes (n=10) on 23 July. The cotton field had had no rain since before 4 July, but was furrow irrigated every few days. Temperature was 100˚F the day the plots were sprayed. The efficacy of 6 miticides for spider mite control were compared. Plots were 4 rows by 30 ft long and 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 23 July 1999 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 for these tests and the rates applied were: Kelthane, 3 pts/acre; Comite, 2 pts/acre; Bifenazate D2341, 1lb/acre; Zephyr, 6 oz/acre; Trilogy/neem oil, 1.5%; and Capture, 6.4 oz/acre. Water was used to treat the control plots. 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 5 nodes beneath the first fully expanded leaf. 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). Counts were made by placing a linen tester hand lens 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).

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## Results and Discussion

### Survey of Mites in Arkansas Weeds

As in 1998, most mites encountered in this study were twospotted spider mites (*T. urticae*). A total of 26 weed species were identified and examined for mites adjacent to cotton fields in Poinsett Co., AR. Of these, 2 species were most important; pitted morningglory and Palmer amaranth (Table 1). Throughout June and July, tiny, stunted specimens (ca. 1" high) of these two weeds served as spider mite hosts much more frequently than large vigorous plants of the same species. These tiny specimens are easily overlooked. The undersides of the leaves of these tiny plants were frequently covered with sand and dust which appeared to favor spider mites on both weeds and cotton. Dusts are known to reduce natural enemies, resulting in pest outbreaks along dusty roads (Bartlett 1951).

Certain weed species that were abundant in the fields were not observed to be colonized by spider mites, even when the cotton field around them was heavily infested. Weeds such as velvetleaf, cocklebur, and redvine, were abundant, but except for cocklebur, were never observed as hosts for spider mites in Arkansas. This result differs from that of Hightower and Martin (1956) in Texas, where they found that cocklebur could be an important host.

In both 1998 and 1999 we have observed that early season mites are significantly more abundant in the two cotton fields 3 meters from the edge than 25 meters. This suggests that aerially-borne mites are less important in colonizing these cotton fields than close contact with infested weeds. If aerial movement of the mites was most important, as has been shown by Hightower and Martin (1956), we would expect a more generalized pattern of infestation.

Based on our study we recommend that growers control pitted morningglory and Palmer amaranth during May and June along the borders of their cotton fields, particularly tiny specimens that almost go unnoticed. We think that this will reduce the numbers of mites colonizing cotton fields. In areas with perennial mite problems we also suggest that the edges (0-25 m) of cotton fields be treated with effective miticides in late May and June to hold mite numbers down.

### Miticide Test 1999

Immediately prior to treatment, means of 10.2 eggs (SE=1.5) and 13.7 live mites (SE=1.2) per 1.5cm$^2$ (n=40) were found in the field. All miticides except Trilogy (neem oil) significantly reduced mite numbers at 3 DAT compared with the water-treated check plots (Table 2). At 3 DAT Kelthane, Comite, Zephyr and bifenazate provided the best control, statistically. By 7 DAT all the miticides had significantly reduced mite numbers compared to the check plots and Kelthane, Comite, Bifenazate, and Zephyr all provided good control.

The 14 DAT mite counts were made but are difficult to understand. The grower reported that he had treated the field with Kelthane, but had carefully avoided treating the test area. There is some evidence that the mite specific fungus, *Neozygites floridana*, may have wiped out the mite population. The 14 day data is included, but should not be used to compare the miticides given these uncertainties. The mite egg data showed no significant differences between miticide treatments by day, and the data is presented but provides little useful information (Table 3).

Overall, Kelthane, Comite, Bifenazate, and Zephyr provided excellent control of spider mites on cotton, with Capture and Trilogy providing intermediate control.

In 1998, Steinkraus et al. (1999) tested miticides in central Arkansas. The test reported here was made in northeastern Arkansas. In both areas of the state Kelthane, Comite, and Zephyr provided good control indicating that resistance does not appear to be a problem at present.

## Summary

The survey of weed species surrounding cotton fields in Poinsett Co., AR, revealed that pitted morningglory and Palmer amaranth, possibly in conjunction with dusty conditions, are important hosts of twospotted spider mite. Early season control of these weeds 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. 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. Presence or absence of spider mites on weed hosts found adjacent to cotton fields in Poinsett Co. during June and July 1999.

| Family | Scientific name | Common Name |
|---|---|---|
| **Spider Mites Frequently Present** | | |
| Convolulaceae | *Ipomoea lacunosa* | pitted morningglory |
| Amaranthaceae | *Amaranthus palmeri* | Palmer amaranth |
| **Spider Mites Occasionally Present** | | |
| Polygonaceae | *Polygonum pensylvanicum* | smartweed |
| Euphorbiaceae | *Euphorbia maculata* | spotted spurge |
| Gramineae | *Echinochloa crusgalli* | barnyard grass |
| Gramineae | *Eleusine indica* | goose grass |
| Polygonaceae | *Rumex crispus* | curled dock |
| Compositae | *Xanthium strumarium* | cocklebur |
| Chenopodiaceae | *Chenopodium album* | lambsquarters |
| Leguminosae | *Vicia american* | purplevetch |
| Solanaceae | *Solanum carolinense* | horsenettle |
| **Spider Mites Not Observed** | | |
| Amaranthaceae | *Amaranthus hybridus* | pigweed |
| Amaranthaceae | *Amaranthus retroflexus* | redroot pigweed |
| Apocynaceae | *Trachelospermum difforme* | dogbane |
| Bignoniaceae | *Campsis radicans* | trumpetcreeper |
| Compositae | *Ambrosia artemisiifolia* | ragweed |
| Compositae | *Ambrosia trifida* | giant ragweed |
| Compositae | *Conyza canadensis* | mare's tail |
| Compositae | *Erigeron annuus* | daisy fleabane |
| Compositae | *Taraxicum officinale* | dandelion |
| Convolulaceae | *Ampelamus albidus* | honeyvine milkweed |
| Convolulaceae | *Ipomoea turbinata* | purple morningglory |
| Graminae | *Sorghum halepense* | Johnson grass |
| Malvaceae | *Abutilon theophrasti* | velvetleaf |
| Polygonaceae | *Brunnichia ovata* | redvine |
| Solanaceae | *Solanum carolinense* | horse nettle |

Table 2. Mean number of live spider mites observed per 1.5cm$^2$ area of cotton leaf, after treatment with selected miticides in 1999.

| | | Mean no. live mites/1.5cm$^{2a}$ | | |
|---|---|---|---|---|
| **Treatment** | **Rate/acre[b]** | **3 DAT** | **7 DAT** | **14 DAT** |
| Control | water | 10.8 a | 5.35 a | 0.1 b |
| Trilogy/Neem oil | 1.5% | 12.7 a | 3.6 b | 0.05 b |
| Bifenazate D2341 | 1 lb | 3.7 bc | 0.5 c | 0.02 b |
| Capture 2 EC | 6.4 oz | 4.9 bc | 2.4 b | 1.3 a |
| Kelthane MF-B | 3 pts | 3.6 bc | 1.2 c | 0.0 b |
| Zephyr 0.15 EC | 6 oz | 2.8 c | 0.4 c | 0.3 b |
| Comite 73.6% | 2 pts | 2.8 c | 0.9 c | 0.0 b |
| LSD ($P$ = 0.05) | | 2.04 | 1.23 | 0.49 |
| $F$ | | 31.04 | 17.75 | 7.57 |
| $P > F$ | | 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.

Table 3. Mean number of live spider mite eggs observed per 1.5cm$^2$ area of cotton leaf, after treatment with selected miticides in 1999.

| | | Mean no. live eggs/1.5cm$^{2a}$ | | |
|---|---|---|---|---|
| **Treatment** | **Rate/acre[b]** | **3 DAT** | **7 DAT** | **14 DAT** |
| Control | water | 5.37 | 1.85 | 0.07 |
| Zephyr 0.15 EC | 6 oz | 2.62 | 1.05 | 0.07 |
| Comite 73.6% | 2 pts | 3.60 | 1.52 | 0.02 |
| Bifenazate D2341 | 1 lb | 4.37 | 1.07 | 0.02 |
| Trilogy/Neem oil | 1.5% | 4.07 | 1.17 | 0.12 |
| Capture 2 EC | 6.4 oz | 4.62 | 2.45 | 0.50 |
| Kelthane MF-B | 3 pts | 3.55 | 1.97 | 0.25 |
| | | | | |
| LSD ($P$ = 0.05) | | 2.18 | 1.05 | 0.38 |
| $F$ | | 1.27 | 1.99 | 1.59 |
| $P > F$ | | 0.2712 | 0.0673 | 0.15 |

Means within a column followed by the same letter(s) are not significantly different (LSD, $P$=0.05), no significant differences were found with mite egg counts.

[a] All live spider mite eggs 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.