Spider Mites on Cotton in the Midsouth

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What are spider mites?

Twospotted spider mite

Carmine spider mite

Spider mites are tiny eight-legged arthropods in the family Tetranychidae and are more closely related to ticks and spiders than insects. Less than 0.5 mm long, they are just barely visible to the naked eye and are best seen with a 10x hand lens or microscope. Several species of spider mites occur on cotton in the Midsouth. The most important are *Tetranychus urticae* (twospotted spider mite), *T. desertorum* (desert spider mite), *T. turkestani* (strawberry spider mite) and *T. cinnabarinus* (carmine spider mite). While spider mites have always caused sporadic problems in Midsouth cotton, in recent years spider mite outbreaks have become more widespread.

Life cycle

Spider mites on underside of leaf

The spider mite life cycle starts with a small, round egg. There are three active immature stages, each separated by a resting stage before the final molt to adult. The life cycle of spider mites is temperature driven and proceeds more rapidly at warmer temperatures. At 77˚F it takes about nine days for a spider mite to mature. Females may live for four weeks and lay 100 eggs. Because of their short life cycle, spider mite populations can increase very rapidly in hot weather. For example, the potential progeny of one female mite in one month increases from 20 at 60˚F, to 12,000 at 70˚F, to 13 million at 79˚F!

Spider mites are usually found in colonies on the underside of the leaves where they are protected from rain (which washes them off) and where temperatures are moderated. The mites spin silk, which they attach to leaf veins, to protect the eggs and adults from predators.

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Spider mite damage to cotton

Spider mites feed on epidermal cells on the underside of cotton leaves. The mites penetrate the cells with their stylets and remove the cell contents. This mechanical injury to the cells results in light colored punctures that, when the feeding is severe, cover large areas of the leaf. Feeding results in water loss and drying of the damaged leaves. Photosynthesis is reduced due to damage to the chloroplasts. One species, *T. turkestani*, injects a toxin that causes severe damage to the plant in addition to mechanical injury and makes it the most destructive species. The population density of the mites, species involved, duration of infestation and environmental factors all affect the potential damage to the crop. When spider mite feeding is severe, defoliation and a total loss of squares and fruit may result.

The first sign of spider mites damage is a light tan or yellowish "russeted" or "bronzing" discoloration of the underside of the leaves, particularly at the junction of the main leaf veins. Often infested areas of a field can be spotted from outside of the field as reddish or yellowish areas in the field. When *T. turkestani* is involved, leaves may turn bright red and orange.

Moderate mite populations caused this russeting on the underside of leaves.

Cotton leaves infested with spider mites may turn red and orange.

Severe mite infestations can cause defoliation.

Factors favoring mite outbreaks

Hot, dry, dusty conditions favor spider mites.

Mite infestations are favored by hot, dry weather. Very high relative humidities and rain tend to help the farmer by killing spider mites during molting, washing them off leaves and favoring the pathogenic fungus, *Neozygites floridana*, that can cause rapid declines in mite populations. On the other hand, spider mite infestations are favored by application of broad spectrum pesticides that reduce populations of predators that help keep mite populations in check. Dust produced by vehicular movement on unpaved roads adjacent to cotton fields and within fields during dry conditions, and blown by wind during drought conditions, favors spider mites, possibly by interfering with predator searching efficiency. Animals, humans and farm equipment can also spread mites from field to field and within fields. Therefore, care should be taken to avoid spreading mites between and within fields. Plants suffering from nutritional stress, particularly potassium deficiency, may be especially prone to spider mite infestations.

Spider mites and weed hosts in the Midsouth

Border weeds can support spider mites and are sources of mite infestations in cotton fields.

Spider mite outbreaks in cotton are related to population levels on other host plants such as corn, soybeans, or other crops, or weeds where they overwinter and develop in May and June. Spider mites move from these alternate hosts to cotton by crawling over the soil or from plant to plant, carried by wind, man or his equipment, or by animal movements. Historically, spider mite infestations often begin in cotton adjacent to field borders or uncultivated areas that project into the field or near trees or building sites located within the field border. This is because spider mite populations develop on weeds growing in these areas during the early spring and then move to adjacent cotton. However, with the increased utilization of no-till planting that has occurred due to the availability of herbicide tolerant cotton, spider mite infestations are occasionally encountered in very young cotton, and these infestations are often distributed throughout the field. This situation is due to spider mite infestations that developed on weeds that were growing within the field. The mites then move to established cotton seedlings when these in-field weeds are killed with herbicides. Applications of pyrethroid insecticides, which are often applied at the time of planting for cutworm control in no-till systems, may contribute to this situation because pyrethroids are known to "flare" spider mite populations.

In order to determine which weeds were sources of spider mites in cotton fields a study was conducted on weeds adjacent to two commercial cotton fields in Poinsett County, Ark., on a weekly basis during June and July in 1998 and 1999. The two fields were chosen because of a long history of mite infestations.

Small specimens of Palmer amaranth, left, and pitted morningglory, right, were identified as frequent hosts of spider mite populations.

The results are shown in the table on page 4. A total of 38 weed species were commonly found adjacent to the two cotton fields. Most of these (25 species) did not support spider mite populations even when the cotton fields adjacent to them were heavily infested with mites. Spider mites were occasionally found on 11 weeds, such as lambsquarters and cocklebur, but these weeds did not appear to be important early-season sources for mites. Two weeds, Palmer amaranth and pitted morningglory, appeared to be the major sources of spider mite infestations in these fields. Frequently, extremely tiny individuals of these two weed species, only inches high, were heavily infested with mites. Mite populations were not observed on redroot pigweed (a close relative of Palmer amaranth) or velvetleaf (a relative of cotton).

Occasionally larger Palmer amaranth plants were mite infested.

Early season (May and early June) control of Palmer amaranth and pitted morningglory on the borders of cotton fields with herbicides or other methods should be helpful in reducing mite movements into Midsouth cotton fields. To be effective, weed control must be done before mites enter the cotton.

Spider mites were not found colonizing velvetleaf even when surrounded by infested cotton.

Weed hosts of spider mites

Presence or absence of spider mites on weeds adjacent to cotton fields in Arkansas during June and July, 1998 and 1999

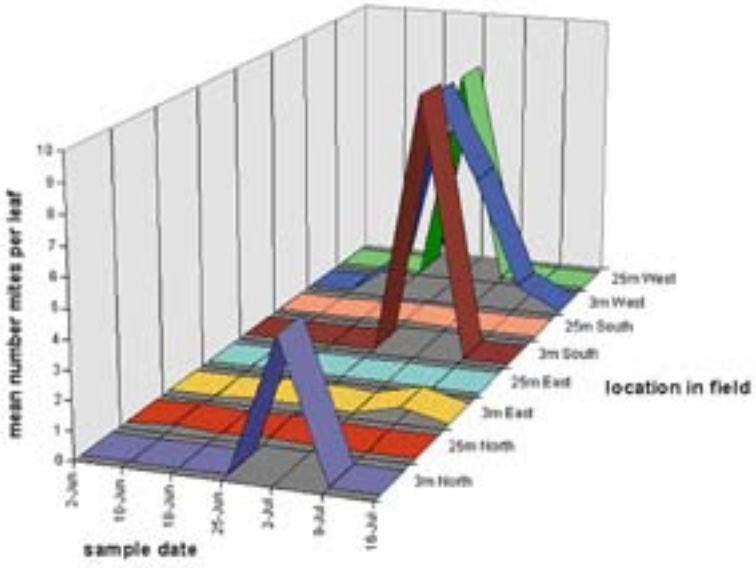
Family	Scientific Name	Common Name
Spider Mites Frequently Present		
Amaranthaceae	*Amaranthus palmeri*	Palmer amaranth
Convolvulaceae	*Ipomoea lacunosa*	pitted morningglory
Spider Mites Occasionally Present		
Chenopodiaceae	*Chenopodium album*	lambsquarters
Compositae	*Xanthium strumarium*	cocklebur
Convolvulaceae	*Convolvulus arvensis*	hedge bindweed
Convolvulaceae	*Ipomoea hederacea*	entireleaf morningglory
Euphorbiaceae	*Euphorbia maculata*	spotted spurge
Gramineae	*Echinochloa crus-galli*	barnyard grass
Gramineae	*Eleusine indica*	goose grass
Leguminosae	*Vicia american*	purple vetch
Polygonaceae	*Polygonum pensylvanicum*	smartweed
Polygonaceae	*Rumex crispus*	curled dock
Solanaceae	*Solanum carolinense*	horsenettle
Spider Mites Not Observed		
Amaranthaceae	*Amaranthus hybridus*	pigweed
Amaranthaceae	*Amaranthus retroflexus*	redroot pigweed
Anacardiaceae	*Toxicodendron radicans*	poison ivy
Apocynaceae	*Trachelospermum difforme*	dogbane
Bignoniaceae	*Campsis radicans*	trumpetcreeper
Compositae	*Ambrosia artemisiifolia*	ragweed
Compositae	*Ambrosia trifida*	giant ragweed
Compositae	*Conyza canadensis*	mare's tail
Compositae	*Coreopsis tinctoria*	tickseed
Compositae	*Erigeron annuus*	daisy fleabane
Compositae	*Taraxicum officinale*	dandelion
Convolvulaceae	*Ampelamus albidus*	honeyvine milkweed
Convolvulaceae	*Ipomoea turbinata*	purple morningglory
Euphorbiaceae	*Euphorbia supina*	prostrate spurge
Geraniaceae	*Geranium* sp.	geranium
Graminae	*Sorghum halepense*	Johnson grass
Labiaceae	*Mentha* sp.	mint
Liliaceae	*Allium* sp.	wild garlic
Malvaceae	*Abutilon theophrasti*	velvetleaf
Oxalidaceae	*Oxalis corniculata*	wood sorrel
Polygonaceae	*Brunnichia ovata*	redvine
Phytolaccaceae	*Phytolacca americana*	pokeweed
Ranunculaceae	*Ranunculus hispidus*	buttercup
Ulmaceae	*Ulmus* sp.	elm
Umbelliferae	*Conioselinum chinense*	hemlock-parsely

When, where and how spider mites enter cotton fields

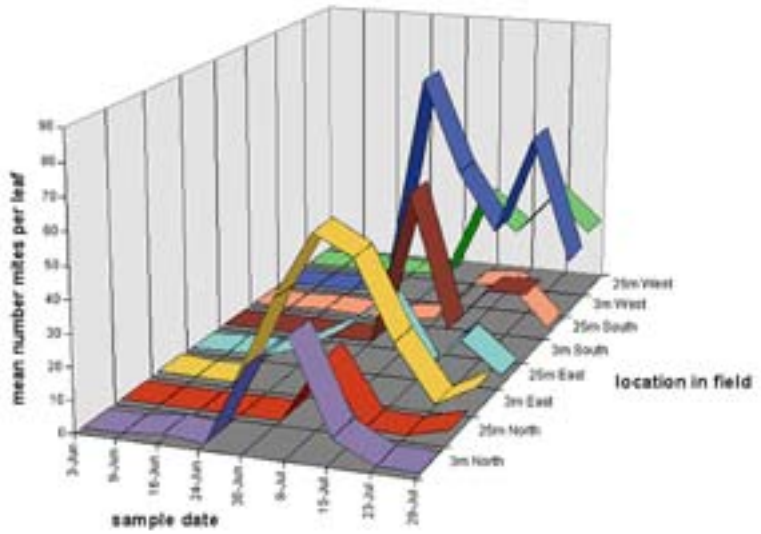
In order to find out when, where and how spider mites were entering cotton fields, we sampled two commercial conventional-till cotton fields in northeast Arkansas that consistently had spider mite infestations. For two consecutive seasons (1998 and 1999) the mite populations in the fields were monitored weekly for numbers of mites and their eggs. Each week randomly-selected cotton leaves were collected from all sides of each field, approximately three and 25 yards within each field. Ten leaves were collected at each distance from each field side, for a total of 80 leaves per field per week. The number of mites and mite eggs on each leaf were counted using a dissecting microscope.

In both years the data showed that spider mite populations became detectable in the cotton fields early in June and reached high levels during the last week of June, then remained high until the end of July. The data indicated that mites entered the fields from the north and west sides in one field and from all sides in the other field. Mites were consistently more abundant in mid-June three yards from the field edge than at 25 yards within the fields. Because mites were found earlier and more abundantly at three yards from the field edge, it is likely that mites entered the fields by crawling from weed hosts adjacent to the field borders or were carried by wind from close range sources (weeds) rather than being carried in by wind from distant sources. Therefore, treatment of mite-infested field edges or "hot spots" during early to mid-June with a miticide may help prevent mite infestations from developing or spreading.

1998 Spider Mite Populations



1999 Spider Mite Populations



Scouting spider mites

Mites should be scouted in cotton on a weekly basis starting in early June. The most accurate sampling plans are based on random samples. In other words, do not choose plants based on visible mite damage. Take samples from 25 to 50 paces into the field. From a randomly-chosen plant, collect a mainstem leaf, the bottom leaf when plants have less than nine mainstem leaves, or a mainstem leaf approximately six nodes below the terminal when plants are larger. Using a 10x hand lens, examine the entire underside of the leaf for mites. Approximately 30 plants, at least 20 meters apart, should be sampled from various areas of the field. If the percentage of infested plants exceeds 50%, the field may need to be treated.

Spider mite infestations can be determined more rapidly by direct examination of suspected infestations while walking the fields. The mite populations should be classified according to the following criteria:

- None — no spider mites present;
- Light — spider mites found on occasional plants, one to 10 per leaf, some leaf damage (russeting, bronzing, speckling) present;
- Medium — 11 to 50 spider mites per leaf present on numerous plants, leaves speckled, mottled yellow or red;
- Heavy — more than 50 spider mites per leaf on most plants, many leaves reddish-brown in color.

A 10x hand lens or linen tester is extremely useful in making counts of spider mites.

Spider mite colonies usually start at the junction of the main leaf veins.

Spider mites are small! From left to right, a spider mite is compared to a collembolan, a thrips, a cotton aphid and the head of an insect pin.

Natural enemies of spider mites

Many predators are valuable enemies of spider mites. Thrips of various species are considered some of the most important predators of spider mites and mite eggs. Unfortunately, in the Midsouth thrips are cotton pests and are usually controlled early in the season. Thrips control most likely contributes to spider mite problems later in the season. Hemipteran predators such as the minute pirate bugs (*Orius* spp.), big-eyed bugs (*Geocoris* spp.) and predaceous phytoseid mites can also be important. In our studies, as well as others, phytoseid mites were not common in cotton and apparently play little role. Parasitoids are unknown from spider mites. The entomopathogenic fungus, *Neozygites floridana*, is an extremely important natural enemy of spider mites and can rapidly reduce populations when the humidity is high. Because fungal epizootics can rapidly reduce mite populations, it is important that scouting shows that live mites are still abundant before treating a field.

Often a thrips is found in the middle of spider mite colonies.

Chemical control of spider mites

When spider mite infestations develop to threshold levels, treatment with an effective miticide is often necessary to prevent economic damage. There are several specific miticides available that control spider mites but have little or no activity against insect pests. These products are usually somewhat costly, but are also usually quite effective and often will provide control with only a single application. Certain cotton insecticides have activity against spider mites. However, these insecticides are usually less effective than the specific miticides, and multiple, successive applications applied at four- to five-day intervals are usually required to obtain control. When attempting to control spider mites, it is important to know whether or not the product you are using requires multiple applications. Multiple applications may be necessary to control unusually heavy or persistent infestations regardless of the product used. Keep in mind that spider mite infestations are often "spotty" and treatment of hot spots, rather than treating the entire field, is often effective. Check your local cotton insect control recommendations for current information on miticides.

When making spider mite treatment decisions it is important to keep in mind that spider mite infestations are often controlled by naturally occurring epizootics of fungal disease. Also, heavy rainfall or irrigation can cause spider mite populations to drop sharply. Symptoms of spider mite infestation — stippled leaves, webbing, etc. — will continue to be evident after spider mite populations have declined. Therefore, it is important to verify that treatable spider mite infestations are still present immediately before applying a spider mite treatment.

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