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Do fungicides control two-spotted spider mites, and what is the effectiveness of miticides and strobilurin-based fungicides on them?

Taking Out Spider Mites

by **RAYMOND A. CLOYD**

TWO-SPOTTED spider mite, *Tetranychus urticae*, is still one of the most destructive mite pests of greenhouse-grown crops. Because it is so destructive, greenhouse producers use miticides to alleviate problems and avoid excessive mite outbreaks. Several commercially available miticides are called mitochondria electron transport inhibitors, or METIs, which disrupt the production of energy

Table 1. The common name (active ingredient), trade name and rate of the pesticides (miticides and fungicides) evaluated in the study for control of the twospotted spider mite.

Treatment Common Name	Trade Name	Rate
Acequinocyl	Shuttle	10.0 fl oz/100 gallons
Azoxystrobin	Heritage	8.0 oz/Acre
Clofentezine	Ovation	2.0 fl oz/100 gallons
Fenpyroximate	Akari	20.0 fl oz/100 gallons
Kresoxim-methyl	Cygnus	1.6 oz/100 gallons
Pyridaben	Sanmite	4.0 oz/100 gallons
Spiromesifen	Judo	4.0 fl oz/100 gallons
Trifloxystrobin	Compass O	4.0 oz/100 gallons
Untreated Check	----	----
Water Control	----	----

or adenosine triphosphate (ATP).

But before any specifics are addressed, it's important to note the significance of the mitochondria. The mitochondrion is a membrane-bounded organelle that is associated with intracellular respiration. It is a major site of ATP production and oxygen consumption in cells, and it retains enzymes involved in the citric-acid cycle and in oxidative phosphorylation.

Overview

Miticides active on mitochondria include acequinocyl (Shuttle), pyridaben (Sanmite) and fenpyroximate (Akari). These miticides either inhibit NADH dehydrogenase (complex I) associated with electron transport, act on the NADH-CoQ reductase or bind to the Qo center or cytochrome bc1 (complex III) in the mitochondria.

This leads to a reduction in energy production by preventing the synthesis of ATP. The basic difference among these miticides is the target site. Shuttle works on complex III, whereas both Sanmite and Akari work on complex I. In addition, the strobilurin-based fungicides such as azoxystrobin (Heritage), kresoxim-methyl (Cygnus) and trifloxystrobin (Compass O) are considered mitochondria electron transport inhibitors and are active on complex III in the mitochondria of many different fungi.

Although spider mites and fungi are different organisms, we thought it would be interesting (as researchers) to determine if these types of fungicides actually have miticidal properties. In

fact, certain fungicides have shown to negatively impact spider mites.

For example, the benzimidazole fungicide benomyl (Benlate) actually inhibits the development of spider mites directly, as well as reducing female fecundity. However, the strobilurin-based fungicide trifloxystrobin (Compass) does not appear to have any harmful effects on female two-spotted spider mites. As such, we wanted to pursue this further, so we conducted a study to simultaneously evaluate the efficacy of both mitochondria electron transport inhibiting miticides and fungicides against the two-spotted spider mite.

Materials and Methods

Marigold 'Antiqua Yellow' plants were transplanted into 1.0-quart (0.9-liter) containers filled with Fafard 3B growing medium (peat moss, perlite, vermiculite and processed pine bark). No pesticides had been applied to the test plants before conducting the study.

The test plants were placed in a research greenhouse to allow a "natural" population of two-spotted spider mites to build-up. The treatments and rates are presented in Table 1. There were five replications per treatment. Treatments were applied using a fine mist spray bottle with the plants approximately 12 inches in height at the time of application.

After application of the treatments, the test plants were placed into another research greenhouse on a wire-mesh raised bench and arranged in a completely randomized design. One

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plant was equal to one replicate. The temperature ranged from 87 to 72°F (30 to 22°C) with a relative humidity between 50 and 90 percent. Test plants received natural lighting during the course of the study. All marigold plants were watered with a handheld sprinkler. There was no overhead irrigation in order to avoid washing off any two-spotted spider mites.

Plants were evaluated before application of the treatments (precourt). They were also evaluated three, seven and 14 days after treatment (DAT). Four leaves were randomly selected and harvested from each plant. The number of live and dead nymphs, and live and dead adults of two-spotted spider mites were recorded. The precourt reading was performed to ensure the test plants had similar populations of two-spotted spider mites so that any effects were solely due to the treatments and not confounded with variable numbers of two-spotted spider mites on the marigolds. All data was subject to analysis using a statistical program in SAS (Statistical Analysis Software).

Results

None of the METI fungicides evaluated provided any control of two-spotted spider mite nymphs or adults, whereas the three METI miticides eventually resulted in some level of control of two-spotted spider mite nymphs 14 days after treatment.

However, the miticides were only slightly effective against two-spotted spider mite adults with less than 70 percent mortality among all three miticides across the three evaluation periods – three, seven and 14 days after treatment. Judo (spiromesifen) was very effective against both the nymphal and adult stage of two-spotted spider mite with greater than 95 percent mortality across all three evaluation periods for nymphs and greater than 70 percent mortality across the three evaluation periods for adults.

The miticide Ovation (clofentezine) failed to control both life stages (nymphs and adults) of the two-spotted spider mite. This is likely due to the fact that Ovation is an ovicide (egg killer), with activity primarily on spider mite eggs.

The fungicide Cygnus (kresoxim-methyl) had a somewhat marginal

effect on both life stages (nymph and adult) with mortality values greater than 10 percent seven and 14 days after treatment for nymphs, and 14 days after treatment for adults.

It appears due to the specific mode of action associated with fungi, the strobilurin-based fungicides will have negligible if any negative effects on the metabolism and/or population growth of two-spotted spider mite based on the results of the study.

About the author: Raymond A. Cloyd is an associate professor and Extension specialist in ornamental entomology/integrated pest management at Kansas State University. He can be reached at rcloyd@ksu.edu.

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For more information, including graphs depicting nymphal mortality rate and adult mortality rate over three, seven and 14 days with various treatments, go to www.GreenhouseGrower.com



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