Mitey Resistant

by **RAYMOND A. CLOYD**

How do twospotted spider mites develop resistance to miticides? And what can you do about it?

Despite all the currently available miticides, the twospotted spider mite, *Tetranychus urticae*, continues to plague growers. That's due, in part, to the fact that many products have become less effective in controlling twospotted spider mites due to resistance.

It's important to understand that resistance develops at the population level, not within an individual. The genes for resistance may already be present in a twospotted spider mite population before you apply a miticide, although these genes generally occur at low frequencies in the population. An individual doesn't become resistant to a miticide, but multiple applications of the same miticide across several mite generations result in the removal of susceptible individuals from the population, leading to a population that has a high proportion of resistant individuals and is thus more difficult to control.

Continual reliance on miticides increases the probability of twospotted spider mites populations developing resistance. In fact, populations of twospotted spider mite have developed resistance to more than 80 miticides. A number of these miticides are commercially available for use in greenhouses, including fenbutatin-oxide (ProMite), clofentezine (Ovation), hexythiazox (Hexygon), chlorfenapyr (Pylon), etoxazole (TetraSan), pyridaben (Sanmite), and fenpyroximate (Akari). In addition, twospotted spider mite populations have exhibited resistance to miticides not available for use in greenhouses in the U.S. such as tebufenpyrad (Pyranica) and fenazaquin (Magister).

Factors such as rapid reproduction rates and dispersal behavior contribute to the ability to develop resistance. Because twospotted spider mites can't fly, greenhouses tend to have isolated populations with limited movement of susceptible individuals into the mite population to dilute resistance levels. Long-term crops such as cut roses remain in place for years, along with any twospotted spider mite populations, which are continuously exposed to a variety of miticides, thus increasing the potential for resistance developing.

In addition, the genetics and breeding system of twospotted spider mite impacts the rate of resistance. Twospotted spider mites reproduce through a combination of sexual and asexual means, resulting in offspring from both unfertilized and fertilized eggs. In general, within a twospotted spider mite population, males only have one copy of a resistant gene, whereas females have two copies. This often indicates that females are more tolerant to miticide applications or may develop resistance more quickly than males.

When discussing resistance, there are two terms you should know. **Cross resistance** is when there's selection for resistance to miticides with similar modes of activity. A twospotted spider mite population resistant to pyridaben (Sanmite) and fenpyroximate (Akari), for example, would constitute cross resistance, since both miticides are mitochondria electron transport inhibitors (METIs). Although there are a number of resistance mechanisms that may occur, the resistance mechanism that's common among twospotted spider mite populations, in regards to cross resistance, is called metabolic detoxification. This means the active ingredient is fragmented or broken apart once it enters the body of the mite. Enzymes detoxify or convert the material into a non-toxic form that's excreted with other waste products.

Multiple resistance occurs when there's selection for resistance to miticides with dissimilar modes of action. A twospotted spider mite population resistant to abamectin (Avid) and chlorfenapyr (Pylon) would be an example. Abamectin is a GABA (gamma-amino butyric acid) chloride channel activator, whereas chlorfenapyr is an oxidative phosphorylation uncoupler.

Dealing with a twospotted spider mite population demonstrating multiple resistance is difficult. Remember that selection for resistance occurs within each generation. This is why rotating miticides with different modes of activity is essential to preserve our currently available miticides.

Resistance is real, and you should take note to implement proper stewardship of currently available products, many of which have resistance management information on the label. This may include the number of applications per crop cycle, number of sequential applications and total amount of product that can be applied per crop cycle or a combination of these. ■

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