Ecology and integrated control of spider mites in San Joaquin vineyards

INTEGRATED CONTROL

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THE SPIDER MITES, *Tetranychus pacificus* McGregor and *Eotetranychus willamettei* (Ewing) have increased to abundance in vineyards since World War II. In at least some cases it appears that organic pesticides have caused an imbalance in the occurrence of spider mites and their natural enemies, particularly by inhibiting action by *Metaseiulus occidentalis* (Nesbitt)—a predatory mite. Chemicals may cause imbalance in vineyards by differential kill of predators and prey, by conferring an advantage to the prey (by stimulating reproduction), or by a combination of the two.

General studies in the southern San Joaquin Valley showed that the distribution patterns of Willamette mites and Pacific mites differ geographically within the Valley, in the vineyard, and on the vine itself. In general, Pacific mite does best under hot and dry conditions, while Willamette mite prefers cooler and more humid conditions, although the lines are not sharply drawn. Both species are conspicuously restricted in eastern Tulare and Fresno Counties—the Willamette mite less so. In these areas, both species seem to be limited by similar conditions (perhaps in relation to soil conditions). Pacific mite in particular appears quite responsive to changes in soil type. Outbreaks of this species often occur year after year in the same spots in a vineyard. The vigor of the vines and soil water penetration in these spots is generally poor.

Pacific mites increase most rapidly on foliage exposed to direct sunlight, aggregating on shoots growing upward from the tops of vines. Willamette mites are more dispersed over the vine although they do better in the shady, more humid areas. Because of their gregarious nature, Pacific mite populations are seemingly more attractive to predators than the more dispersed Willamette mites.

Detailed population studies in vineyards, both with and without pesticide histories, revealed striking differences in predator and prey relationships, especially where Pacific mites have become serious pests. In vineyards where pesticides had not been used, predator and prey population trends fluctuated moderately in amplitude, while in treated vineyards the population fluctuations in amplitude were often great. The wide fluctuations often lead to summer population collapses and consequent poor predator-prey ratios the following spring. Predator action is often badly lagging in treated vineyards during periods when Pacific mites are increasing and approaching damaging densities. Later serious leaf injury and increased predator action lead again to population collapses.

These population collapses, along with the lagging predator action the following spring, make the task of correcting such imbalance difficult. For example, serious vine injury caused by Pacific mite outbreaks occurred yearly in the Biola area of Fresno County over a four-year period following the cessation of all chemical treatments before any semblance of balance returned. During this period, population collapses in the summer and consequent poor action of predators occurred in the spring every year.

In recent years, acaricide resistance has made it increasingly difficult to economically control spider mites. Cessation of disturbing pesticide treatments and correction of predator-spider mite imbalances present an encouraging approach to the otherwise discouraging situation. Stopping all chemical treatments may not be practical in some cases. To correct imbalances while avoiding vine injury, Pacific mites must somehow be supressed with as little dependence on chemicals as possible. A broad ecological approach is needed, and this does not preclude the use of all chemicals. Treatments with sulfur for mildew are not disturbing to biological balance. Limited use of certain other pesticides may not be too disturbing.

In contrast to clean cultivated vineyard plots—a normal practice in many vineyards—Sudangrass plots require fewer treatments for Pacific mites. Vineyards where grass culture is practiced have higher humidities and fewer problems with dust. Dust-covered foliage and dry vineyard conditions apparently favor Pacific mite outbreaks. Also, a more diverse fauna and improved predation of spider mites have been recorded in vineyards where grasses and other weeds are not removed by cultivation.

Willamette mites pose only a minor problem for grape growers, and many of the treatments for control of this species are not only needless expenses but are also ecologically harmful. Recent studies designed to gather information on yields and fruit quality showed that Willamette mite is seldom an economic pest. Moreover, we now recognize that by acting as an alternative prey, this species helps to maintain active predation with respect to the seasonally restricted but severely damaging Pacific mite. It is most important to preserve alternate prey for the maintenance of the predator, *M. occidentalis*, in a good distributional pattern throughout the vineyard.

The possibility of using selective acaricides as tools to help restore balance, once it is disrupted, also shows promise. For example, a 1968 test showed that *M. occidentalis* is quite tolerant to TEPP (tetraethylpyrophosphate) while the active stages of Pacific mites are fairly susceptible; thus, timely applications of this material can be used to check damaging Pacific mite increases during the period when the predator is slowly regaining a controlling position in the vineyard.

It has been observed that conditions which contribute to poor vine growth are conducive to thriving Pacific mite infestations. In some cases, water stress seems to account for the occurrence of weak vines and subsequent Pacific mite outbreaks. Use of winter and summer covercrops has been noted to improve water penetration in vineyard soils and to lessen these outbreaks. The judicious use of fertilizers, altering of pruning practices, and nematode control, all designed to improve vine vigor, might also reduce Pacific mite susceptibility and should be investigated.

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