# Chapter 4

## Summary

Spider mites are indirect pests on grape, as they do not directly attack the fruit. However they can cause damage that negatively impacts harvest quality (Jubb et al. 1985). Pesticides applications are often necessary to produce a high quality grape crop. There are currently only three acaricides registered for use on grapes and resistance to these materials is already apparent in some vineyards. If there are no alternative control available, spider mites could become a more serious problem in the near future. Biological control is one possible alternative control. If predators could be established in the vineyards eliminating the need for acaricides this could also lead to financial savings. In this study, *Neoseiulus fallacis* (Garman), (Acari: Phytoseiidae), a predatory mite, was investigated for its potential as a biological control agent in Virginia vineyards. There were two main components to this investigation. First, pesticides commonly used in the vineyards were tested for toxicity to the predator. Second, inoculative releases were made into three commercial vineyards that were then monitored to examine dispersal and establishment of the predator.

Growers in Virginia use herbicides, fungicides and insecticides to protect the crop from weeds, diseases, and arthropod pests. The use of these materials is anobstacle to establishing *N. fallacis* in the vineyards. In the laboratory bioassays, five of seven insecticides, no fungicides, and three of six herbicides were found to cause significantly higher mortality to the predator than the control treatment. This confirms the hypothesis that pesticide use in the vineyards could have a negative effect on predators released in the system. At this point it may be impossible to develop a compatible spray program because there may be no viable alternative for some of the toxic materials used. This especially is true in the insecticide category where all materials used against Japanese beetle and grape berry moth were toxic to *N. fallacis*. However, if restrictions on pesticide use occur, this would force the development of alternatives that may be more compatible with the predator. It is encouraging that none of the fungicides were directly toxic because there are few alternate controls for most grape diseases. In addition,

diseases are a significant problem in the humid eastern climate, therefore eliminating fungicide applications would be impractical at this time. The herbicide results indicate that the overwintering habits of the predator in the vineyard should be studied further. *Neoseiulus fallacis* would probably overwinter in the ground cover as they have been reported to in other crops. However, they may overwinter on the vines as they have been found to on trees in apple orchards (Nyrop et al. 1994). If this is the case they would be somewhat sheltered from the effects of herbicide applications. Avoiding oxyfluorfen, glufosinate and paraquat would be advisable as all three were toxic to the predator. Diuron appears to be a compatible choice for a preemergent herbicide, but in this study, no compatible post emergent herbicides were found.

These experiments only examined direct toxicity to the predator. There could be indirect effects on fecundity and growth. Testing of residual effects is also advisable as perhaps some of the materials found to be directly toxic may not be a detrimental to the predator if only residues are encountered.

The results of the field releases were variable. In two of the vineyards, recovery of the predator was very low following the releases. In the third vineyard, higher numbers of predators were recovered. The field sites were sampled as grids in order to perform geostatistical analyses to examine the dispersal and distribution of both predator and prey in the plots. At the sites with low recovery, the prey populations were also very low. This may be why few predators were found. In the third vineyard there was a *P. ulmi* population near the threshold at the time of the release and prey were available throughout the sampling period for the predator. In this vineyard there appeared to be no clearly similar pattern of spatial aggregation between the predator and prey at the same point in time at least on the spatial scale that I sampled. There may have been a time lag effect with the predator spreading in response to the prey. Before the spatial dynamics of the two populations can be conclusively determined, further investigation over an entire season should be conducted.

From the three releases conducted in 1999 and 2000 it is difficult to conclude that *N. fallacis* will be able to establish and disperse in the vineyards. In 1999 no predators were found in the vineyard after the first few weeks of sampling. In 2000 both vineyards had predators present through the end of the season but it has not yet been determined if

they will overwinter in the vineyards. The 2000 releases indicate that dispersal throughout the vineyard is possible at the release rates used although a higher release rate or more release points may help in making the dispersal faster. If the predators disperse throughout the vineyard and can overwinter there, the use of pesticides that I have shown to be toxic to the predator may eliminate *N. fallacis* from the system if these materials are used next season. Additional field experiments need to be performed before the release of *N. fallacis* in Virginia vineyards as a control method for spider mites can be recommended.

**References**

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## Vita

Jessica Ann Metzger

Jessica A. Metzger was born March 11, 1975 in Southfield, Michigan. She attended Mercy High School in Farmington Hills, Michigan from 1989-1993. She received a four-year tuition scholarship from The Ohio State University, so after graduation she moved to Columbus, Ohio to begin a bachelors degree there. She majored in Environmental Science with a specialization in water related topics and earned a B.S. in Natural Resources in August 1997. During her four years at Ohio State she had the opportunity to study agricultural development in the Dominican Republic as well as work and study at F.T. Stone Laboratory, Ohio State's aquatic field station on Lake Erie. She was employed for two years by Dr. Celeste Welty in the Extension Entomology Department as a student research assistant working on a variety of fruit and vegetable IPM research projects. After graduation she began a graduate program in the department of entomology at Virginia Polytechnic Institute and State University in Blacksburg, VA. Her thesis research involved looking at a predatory mite, *Neoseiulus fallacis* (Garman), as a potential biological control agent of spider mites in Virginia vineyards. In addition to her research she spent a year as departmental tour coordinator which involved doing educational programs for children. She also had the opportunity to study natural resources issues in Nicaragua and Panama. While at Virginia Tech she received the 1999 Virginia Crop Production Association Scholarship and the 2000 David R. Spence Graduate Tuition Scholarship. Upon completion of her M.S. in Entomology she plans to enter the Peace Corps.