NOTE

RELATIVE SUSCEPTIBILITY TO SLIDE-DIP APPLICATION OF CYHEXATIN IN THREE POPULATIONS OF *PANONCYHUS ULMI* (KOCH) IN VIRGINIA APPLE ORCHARDS[1,2]

Key Words: European red mite, *Panonychus ulmi*, resistance, cyhexatin, apple.

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Reduced efficacy of cyhexatin in control of European red mite, *Panonychus ulmi* (Koch), has been noted in some Virginia apple orchards in recent years. Cyhexatin has been widely used in the management of that species. Several factors could have affected apparent efficacy; these include decreased susceptibility to the acaricide, improper sprayer calibration, incorrect rates of application, and pH of water supplies.

A standard method of comparing relative susceptibility to acaricides is the slide-dip method (Brader, L. 1977. Resistance in mites and insects affecting orchard crops. pp. 353-376. *In* D. L. Watson and A. W. A. Brown [eds], Pesticide Management and Insecticide Resistance. Academic, N.Y.; Dennehy, T. J., J. Granett, and T. F. Leigh. 1983. Relevance of slide-dip and residual bioassay comparisons to detection of resistance in spider mites. J. Econ. Entomol. 76: 1225-1230), which compares effects of topical application (eliminating effects of mites walking across dried residue). Our study was done with the slide-dip method to determine whether reduced efficacy was the result of decreased susceptibility to cyhexatin.

Mites were collected in July, 1984, from 'Delicious' apple trees (*Malus* × *domesticus* Borkhausen) in an orchard at Shenandoah Valley Research Station (Orchard A) at Steeles Tavern (Rockbridge County, VA). Cyhexatin use had not been intensive in this research block; this acaricide had not been applied to the block in the previous 4 years. Small-scale tests (four single-tree replicates per treatment) showed that the acaricide still gave effective control (Pfeiffer, unpublished data). Mites were also collected from two commercial apple orchards in Nelson County, VA: Orchard B ('Delicious') at Roseland and Orchard C ('Delicious' and 'Golden Delicious') at Lovingston. Growers at these sites had noted a lack of control of *P. ulmi* by applications of cyhexatin (more than 20 mites per leaf following application of cyhexatin). Leaves were collected from at least ten trees selected at random per orchard. Before mites were collected, discussions were held with growers to rule out other possible reasons for control failure (improper application rates, etc.). Such discussions eliminated some orchards from this study. Cyhexatin use had been heavier in the commercial orchards (one to three airblast applications per season for at least 6 years, 0.75 kg AI/ha/application) than in Orchard A.

Infested leaves were transported to the laboratory in paper bags in a cooler chest. A camel's hair paintbrush trimmed to one or two hairs was used to transfer adult, female mites to double-sided cellophane tape mounted on glass microscope slides. Slides were dipped in a range of concentrations of cyhexatin (150, 300, 600,

[1] ACARI: Tetranychidae.

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1500 and 3000 ppm). Distilled water was used as a control. Slides were stored at room temperature in plastic boxes, lined with a damp paper towel. Mortality was assessed after 24 h. Cyhexatin is normally a slow-acting acaricide and ideally mortality should be assessed after 48 h. We first attempted 48-h tests, but control mortality was very high. These tests serve only to detect relative differences in the populations, and do not duplicate natural conditions. Ten slides each containing 15 mites provided 150 mites per concentration from each site.

The mites from the three locations differed in their response to cyhexatin (Fig. 1). The standard deviations of each mean become very large at concentrations of 300 ppm and above, reflecting greater heterogeneity in the populations. Standard deviations in the distilled water control and in the 150 ppm treatment are not exceptionally large. The labeled rate of 4 - 6 oz of cyhexatin 50W corresponds to range of 150 - 225 ppm. Differences in mortality were most pronounced at 150 ppm. There were never any clear differences in mortality between populations from Orchards B and C.

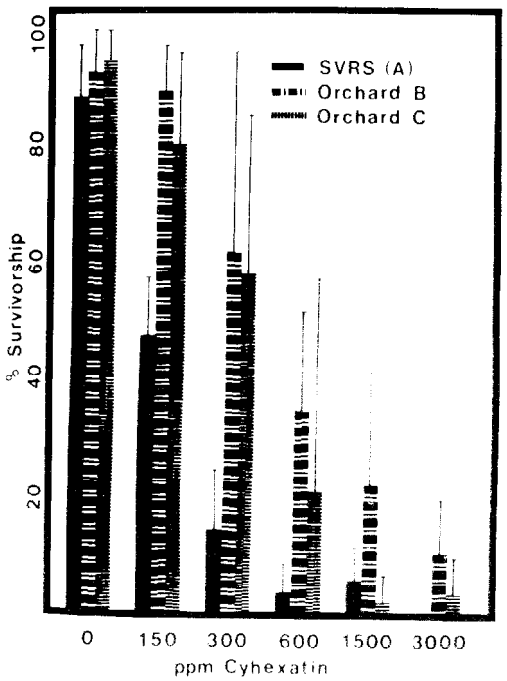

Fig. 1. Survivorship of *Panonychus ulmi* after topical application of several concentrations of cyhexatin. Lines indicate standard deviation based on ten replicates of 15 mites each per concentration.

These data confirm differences in susceptibility to topical application of cyhexatin in populations from the orchards tested. Documentation of lowered susceptibility of *P. ulmi* to cyhexatin is important considering the pest status of [illegible] applications are often needed for

suppressing early-season populations, before predators are effective. This is partly a consequence of *P. ulmi* overwintering in the tree, in contrast with the situation in *Tetranychus* spp., which overwinter in the orchard ground cover. Cyhexatin has been a suitable acaricide for integrated pest management programs because of its low toxicity to *Neoseiulus fallacis* (German), a predator of tetranychid mites (Tanigoshi, L. K., S. C. Hoyt, and B. A. Croft. 1983. Basic biology and management components for mite pests and their natural enemies. pp. 153-202. *In* B. A. Croft, and S. C. Hoyt [eds], Integrated Management of Insect Pests of Pome and Stone Fruits. Wiley, NY). Additional research is needed to further characterize the resistance of *P. ulmi* to cyhexatin, including resistance to dried residues and possible behavioral differences in response to this acaricide which is repellant to mites.

Monitoring of resistance is increasingly recognized as an important aspect of prolonging the effective life of a pesticide. Using such monitoring, resistance to cyhexatin in the related species, *Tetranychus urticae* Koch, has been found to be localized to a few field sites [Croft, B. A., R. W. Miller, R. D. Nelson, and P. H. Westigard. 1984. Inheritance of early-stage resistance to formetanate and cyhexatin in *Tetranychus urticae* Koch (Acarina: Tetranychidae). J. Econ. Entomol. 77: 574-578]. Knowledge derived from monitoring of resistance in its early stages will be of great use in resistance management. Resistance to cyhexatin in orchard populations of tetranychid mites may be subject to reversion to a susceptible state after use of the acaricide has been discontinued [Hoyt, S. C., P. H. Westigard, and B. A. Croft. 1985. Cyhexatin resistance in Oregon populations of *Tetranychus urticae* Koch (Acarina: Tetranychidae). J. Econ. Entomol. 78: 656-659].

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