Resistance Management

Insecticide Resistance in Codling Moth to Azinphosmethyl, Fenpropathrin and Acetamiprid

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Abstract: Resistance levels in populations of codling moth were determined from pear and apple orchards in California for 2002 and 2003. Three insecticides were screened for patterns of resistance including azinphosmethyl in 2002 and 2003 (Guthion), fenpropathrin in 2003 (Danitol) and acetamiprid in 2003 (Assail) using pheromone-assisted topical bioassays of field populations collected in pheromone traps. The number of moths used to develop the probit lines ranged from 80 to 605 moths per line in 2002 and from 111 to 340 moths in 2003. Specific concentrations of insecticides were applied topically to adult moths in pheromone traps at 1 µl per moth. The most susceptible orchard to azinphosmethyl in 2002 was an organic apple orchard in Sacramento which has been used as a reference orchard since the early 1990s, whereas the most susceptible orchard in 2003 with sufficient numbers to monitor was in the Anderson Valley.

Resistance levels to azinphosmethyl were slightly higher with a LC$_{50}$ of 0.089 µg/µl in 2002 compared to historical levels around 0.06 µg/µl. However, the most susceptible orchard in 2003 found in the Anderson Valley had a higher LC$_{50}$ level of 0.146 µg/µl. Azinphosmethyl resistance levels in 2002 for the three test orchards were statistically significant ranging from 0.39 to 0.59 µg/µl, whereas higher resistance levels were recorded in 2003 at 0.81 and 0.86 µg/µl for 2 test orchards. Using the 2002 apple data as the reference level for a susceptible orchard, resistance ratios ranged from 4.3 to 9.6 for all data from 2002 and 2003. If the most susceptible orchard in 2003 is used as the reference line for the two other orchards sampled in 2003, the resistance ratios were 5.6 and 5.9.

Statistically significant but low levels of resistance to Assail were found in 2003 in 4 orchards when compared to the most susceptible orchard, which also had the lowest levels of azinphosmethyl resistance. Resistance ratios ranged from 1.7 to 4.8. A similar pattern was observed for Danitol resistance with statistically significant resistance detected in 4 orchards in 2003. Resistance ratios were variable, but relatively low, at 1.9 to 8.1 in comparison to populations collected in the orchards with the lowest levels of azinphosmethyl resistance.