Control of Pear Psylla with Neonicotinyls, and Implications for Resistance Management

Bruce M. Greenfield, Tara M. Madsen and John E. Dunley
Washington State University, Tree Fruit Research and Extension Center
1100 N. Western Ave. Wenatchee WA. 98801
dunleyj@wsu.edu

WASHINGTON STATE UNIVERSITY
World Class. Face to Face.

Introduction

Pear psylla (*Cacopsylla pyricola*) (PP) is an economically important pest of pear. Historically, pear psylla (PP) has developed resistance to most insecticides used to control it. Resistance to organophosphate and pyrethroid insecticides occurred rapidly after their introduction. For example, fenvalerate (Pydrin) and esfenvalerate (Asana) were introduced through the 1980's; resistance was found within 2 years of recommended use. High levels of resistance still occur to these pyrethroids.

Over the past fifteen years our laboratory has been monitoring populations of adult PP from the Wenatchee valley and surrounding area for evidence of new resistance or reversion of existing resistance. During this time, abamectin (Agri-Mek) has been the primary control tactic. Despite considerable use and observed changes in field efficacy, resistance to abamectin has not yet been documented. The recent development of the neonicotinyl insecticides has provided an effective alternative to abamectin for pear psylla management. The first neonicotinyl, imidacloprid (Provado, Bayer), was introduced in 1995, with thiamethoxam (Actara, Syngenta) following in 2001, acetamiprid (Assail, Cerexagri) in 2002, and thiacloprid (Calypso, Bayer) in 2004. These insecticides are widely recommended in pear IPM programs, not only for pear psylla but also for grape mealybug and codling moth (acetamiprid and thiacloprid). With this widespread use, resistance is predicted to evolve rapidly. Bioassays have been conducted in recent years to determine the resistance status of pear psylla to neonicotinyls.

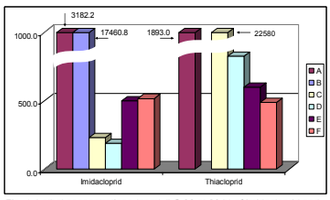


Fig. 1. Lethal concentrations (ppm) (LC 90 at 96 h) of imidacloprid and thiacloprid for winterform adult PP from subpopulations in commercial pear orchards (sites A-E) and from a research pear orchard (site F), determined with bioassays in 2004.

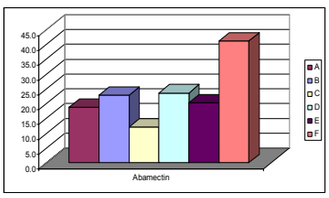
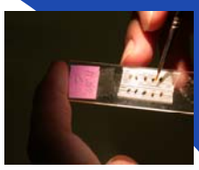


Fig. 2. Lethal concentrations (ppm) (LC 90 at 96 h) of abamectin for winterform adult PP from subpopulations in commercial pear orchards (sites A-E) and from a research pear orchard (site F), determined with bioassays in 2004.

Materials and Methods

Adult bioassay

Bioassays of female winterform PP from a minimum of six orchards are done annually in an attempt to document early changes in resistance levels. For bioassays, PP were affixed to glass slides, then dipped in pesticide of appropriate concentration for 5 seconds. The subjects were examined for death at 48 and 96 hours post treatment. Death was determined by observing a lack of rapid leg movement or reflexive jump motion when stimulated with a camel's hair brush. All tests were replicated four times at several concentrations per insecticide.



Nymph bioassay

Third instar PP nymphs were removed from infested shoots and placed onto pear leaf discs in groups of ten. Infested leaf discs were treated with 2 ml of an appropriate concentration of pesticide using a Potter Spray Tower. The treated nymphs were examined for death at 48 and 96 hours post treatment. Death was determined by observing a lack of response to stimulation with a camel's hair brush. All tests were replicated four times.

Spray Trials

Spray trials were conducted on single trees, replicated four times in a randomized complete block design. Each was sprayed to drip with a handgun @ 200 psi to simulate a rate of 400 gpa. Sampling for PP was done weekly.

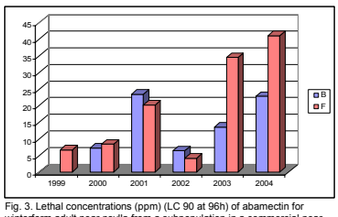


Fig. 3. Lethal concentrations (ppm) (LC 90 at 96h) of abamectin for winterform adult pear psylla from a subpopulation in a commercial pear orchard (site B) and from a research pear orchard (site F), determined with bioassays over six years.

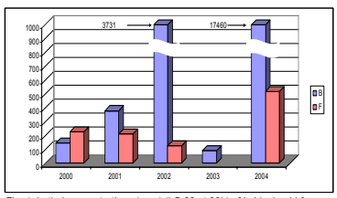


Fig. 4. Lethal concentrations (ppm) (LC 90 at 96h) of imidacloprid for winterform adult pear psylla from a subpopulation in a commercial pear orchard (site B) and from a research pear orchard (site F), determined with bioassays over five years.

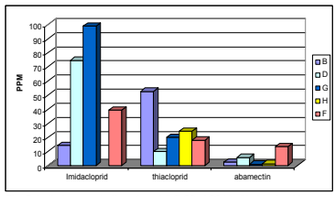


Fig. 5. Lethal concentrations (ppm) (LC 90 at 96 h) of imidacloprid, thiacloprid and abamectin for PP nymphs from subpopulations in commercial pear orchards (sites B,D,G,H) and from a research pear orchard (site F), determined with bioassays in 2004.

Discussion

This year (2004) there was a significant increase in the lethal concentration (LC) values from 2003 levels for imidacloprid and thiacloprid in four of the six orchards sampled (Fig. 1). There was no significant increase in resistance to abamectin among these same populations (Fig. 2). There is, however, some variation in response to abamectin, which may indicate a degree of resistance occurring heterogeneously in the populations. When one looks at a block of our research station (site F) that has seen continued exposure to abamectin since before it became registered, we see a gradual increase in resistance (Fig. 3). We see a much more variable response in a commercial orchard (site B) that has been exposed to fewer applications of abamectin.

Adult resistance to imidacloprid was particularly high in one orchard for two of the past three years (Fig. 4), even compared to the levels in the research orchard.

Bioassays of the nymphal stage found a similar pattern, although the magnitude of the resistance was relatively lower (Fig. 5).

The suggested occurrence of resistance to the neonicotinyls is not unexpected. However when one looks at the results of one of our spray trials (Figs. 6 and 7), we can see the continued efficacy of these compounds on the damaging stage of this pest.

Summary Points

➔Neonicotinyl resistance likely has occurred in pear psylla (this is preliminary)

➔Field level resistance has not been demonstrated yet

➔Abamectin resistance has not increased greatly over years, but early resistance is still indicated

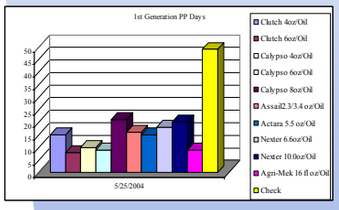


Fig. 6. Accumulated densities of PP nymphs per leaf for 1st generation, in 11 treatments for control of PP.

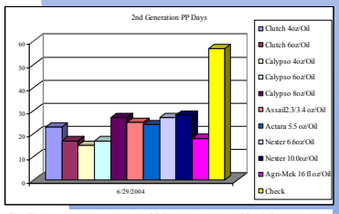


Fig. 7. Accumulated densities of PP nymphs per leaf for 2nd generation, in 11 treatments for control of PP.