

Pear Psylla Management Strategies: Investigating the Use of Kaolin Clay and Summer Oil For Commercial and Organic Pest Management in NY Pear Production

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Pear production in NYS is managed on nearly 2000 acres, with yearly crop yields producing roughly 16,500 tons valued at 3.85 million dollars. In the Hudson Valley region, pears comprise about 800 acres. While NYS is ranked 4th in the U.S., it comprises only 2% of the nation's pear production (USDA, 2005). Pear psylla and *Fabreaa* leaf spot are the primary pest management concerns of pear producers in the Northeastern United States, followed by fire blight, codling moth and the Comstock mealybug (CIPM, 2000). Pear psylla adults have been implicated in the spread of *Fabreaa* leaf spot caused by a fungus, *Fabreaa maculata*, that is managed using bi-weekly fungicide applications beginning at pre-bloom and continuing through the season depending on weather conditions. The presence of these pests will in most years result in significant losses to pear growers.

Pear psylla, *Psylla pyricola* (Foerster), overwinters as an adult on pear and along the wooded edge surrounding orchards, producing three distinct generations (Figure 1). Adults can be observed very early in the spring and begin their egg laying before pear foliage is present. Psylla nymph hatch is synchronized closely with tree phenology and leaf development, at which time they begin to feed on newly emerging foliage and developing fruit. As they feed, they produce droplets of 'honeydew' used to protect the early nymph

stages of development from desiccation (Figure 2). Feeding by this insect causes 'psylla shock' which leads to pear decline and tree mortality in more sensitive varieties such as Bosc, while the honeydew itself causes leaf scorch. Honeydew acts as a good medium for sooty mold growth resulting in unsightly fruit for pick-your-own operations. Large amounts of honeydew result in russetting of the skin, making the fruit unsaleable (Agnello, 1997). Sooty mold development on fruit and foliage often leads to early leaf drop and reduced fruit size and yields (Figure 3).

Strategies to manage pear psylla include pre-bloom applications of ovipositional deterrents, ovicides and insecticides aimed at the adult and nymph populations. Recently management strategies during the pre-bloom period have diversified as new materials with different modes of action become available in NYS. The traditional pre-bloom oil application is applied as an ovipositional deterrent, and is done as soon as the first eggs are observed in a three-minute observation of pear buds and bark crevasses (Figure 4). During the 2006 growing season in the Hudson Valley we experienced sustained oviposition on 1 April and first hatch of nymphs occurred on 24 April. By making an application of oil at that time, growers can reduce adult oviposition and delay oviposition which subsequently forces the population to synchronize egg

deposition and subsequent nymph hatch. By doing so we can make a timely application against the nymphs as they hatch more uniformly, as they are more susceptible to insecticides at this early instar stage. To be effective, oil should be applied well before significant egg laying begins. If only one oil application is planned, then a dormant application of 3% oil would be made. This rate will also reduce overwintering populations of San Jose scale, European red mite, pear leaf blister mite, and Comstock mealybug. A second approach would be the use of two sprays of 2% oil at 7 to 14-day applications, allowing for somewhat longer inhibition of egg laying.

Another pre-bloom approach would be to use an ovicide as the adult psylla begin their spring egg laying. Esteem 35WP can be used during the pre-bloom period to kill the egg stage of psylla and reduce the viability of eggs laid by treated adults. It should be applied prior to sustained egg laying, about the time oil applications would be made, with 0.25% v/v horticultural spray oil. Esteem 35WP may be applied at 4-5 oz/acre as a tactic for both psylla reductions and as a resistance management strategy incorporated into yearly rotational programs. Remember its mode of action is as an ovicide so it will not reduce the adult or nymph population directly and it is most effective if the material is on the wood or foliage prior to the eggs being deposited.

Given the multi-generational biology of pear psylla, it is essential to use control strategies that employ the rotation of pest management tools so as to maintain the efficacy of materials such as AgriMek. Although we have not experienced a failure or loss of efficacy with AgriMek in NYS, it's all the more reason to consider rotational programs of materials for resistance management purposes.

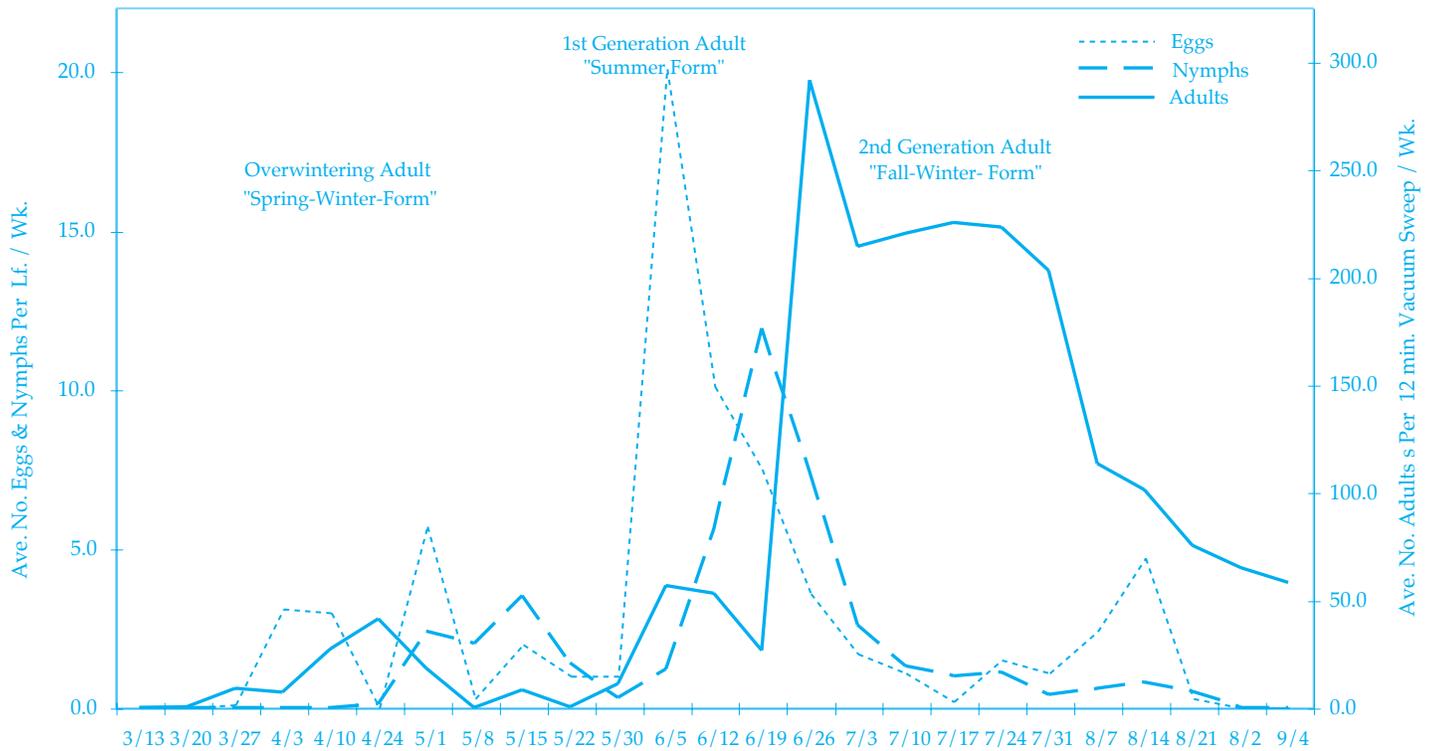


Figure 1. Seasonal development of pear psylla at Highland, NY in 2006.

The use of the post-bloom pear psylla management tool, AgriMek 0.15EC, has been the standard method of psylla management in New York since 1996. AgriMek can be used from petal fall to about four weeks post PF, but its effectiveness decreases as the foliage hardens off. It requires the use of 0.25% v/v horticultural spray oil to penetrate the waxy cuticle of the leaf and be retained within the leaf for optimum nymph feeding uptake. AgriMek has been used successfully in multiple applications of 20 oz/acre beginning at 10 to 14 days after petal fall with a follow-up application 21 days post petal fall per label requirements, totaling

no more than 40 oz/season. The later application was targeted at new foliage preferred by psylla nymph populations. Although we have not seen a loss of AgriMek efficacy in NYS, it's all the more reason to consider rotational programs of materials for resistance management purposes.

A viable alternative to AgriMek is Actara 25WDG applied at 5.5 oz/acre. Actara 25WDG is in the neonicotinoid class of insecticides and is effective against both nymph and adult populations. We have found it has slightly better efficacy when used with 0.25% v/v horticultural spray oil. It will also control

plum curculio and Comstock mealybug when applied at petal fall. It is not registered for use in Nassau or Suffolk Counties and the label allows only one application of Actara per season.

A recent development, registration and use of a particle film known as kaolin clay (Surround WP™), has provided protection against pear psylla for orchardists on the west coast to produce organically grown pears (Elkins et al., 2001). Its use in apple production in the northeast has also been shown to have suppressive effects on plum curculio (Jentsch, 2005). Highly refined 'summer oil' has been used successfully on apple for mite man-



Figure 2. Pear Psylla nymph on Bartlett leaf.



Figure 3. Sooty mold and honeydew on pear leaf.

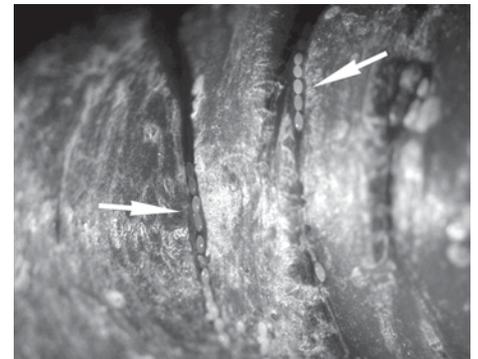


Figure 4. Pear Psylla eggs along growth folds on four-year-old Bartlett stem.

agement and to enhance the activity of certain insecticides for the control of San Jose scale (Agnello, 2002). The combination of these two components would allow for greater resistance management through the rotation of pest management tools and provide potential management practices for movement towards organic pear production in the northeast.

2006 Study Objectives

The objective of our study was to determine the effectiveness of a single dormant application of Surround WP when compared to the standard application of a 2% dormant oil for ovipositional inhibition of eggs by pear psylla adults. We were also interested in determining the effectiveness of season-long applica-

tions of 1% Damoil for the control of pear psylla adults, its ovipositional inhibition of eggs and its effectiveness in controlling nymphs when compared to standard and experimental materials. Along with these objectives we wanted to determine the secondary effects of these materials on *Fabreaea* leaf spot and fruit russetting.

Procedure

In 2006 we applied treatments to four-tree plots replicated three times in an experimental design. Each plot contained two trees each of 'Bartlett' and 'Bosc' cultivars, spaced 12 x 18 ft, 12 ft in height that were 32 years old. All dilutions are presented as amt/100 gal. based on 400 gallons/acre. Treatments were applied dilute to runoff using a high-pressure

handgun sprayer operated at 300 psi delivering approximately 350 GPA.

Application schedules (Tables 1 & 2) were made against three generations of pear psylla with evaluations being made to determine the treatment effects on adult, egg and nymph populations. During the period from swollen bud through petal fall, evaluations were used to determine treatment effects on springform adult ovipositional deterrence, including subsequent 1st generation nymph emergence. Application phenology for both trials beginning at observation of 1st egg and swollen bud (SB) on 30 March; bud burst on 10 April, white bud (WB) on 20 April; 100% bloom on 29 April; PF application on 1 May @ 10-30% PF of Bartlett, 10dp PF application on 23 May, 2C on 6 June, 3C on 21 June, 4C on 30 June for a

TABLE 1

Evaluation of insecticides for controlling pear psylla on Bartlett pear¹, N.Y.S.A.€S., Hudson Valley Lab., Highland, N.Y.-2006

Formulation Treatment	Application amt.	Application date	Eggs / bud or leaf				
			3 April ^B	10 April ^L	24 April ^L	1 May ^L	19 May ^L
Damoil	2.0 gal. / 100	SB	1.0 b	0.9 a	1.5 a	0.6 ab	0.3 a
Surround WP	12.5 lbs. / 100	SB	0.4 a	0.8 a	0.3 a	0.2 a	0.2 a
Untreated control			2.8 c	3.5 b	9.0 b	1.2 b	0.9 a
B = buds, L = leaves							
Formulation Treatment	Application amt.	Application date	Nymphs / leaf				
			24 April	1 May	19 May		
Damoil	2.0 gal. / 100	SB	0.13 a	0.42 a	0.60 b		
Surround WP	12.5 lbs. / 100	SB	0.04 a	0.04 a	0.20 a		
Untreated control			0.14 a	1.92 b	1.40 c		

1. Swollen bud (SB) on 30 March, late swollen bud on 3 April, bud burst on 10 April, TC on 14 April, 30% bloom on 24 April, PF on 1 May @ 10-30% PF of Bartlett. 10dp PF on 23 May, 2C on 6 June, 3C on 21 June, 4C on 30 June. Mean separation by Fishers Protected LSD ($P < 0.05$). Treatment means followed by the same letter are not significantly different. Untransformed means are presented.

TABLE 2

Evaluations of insecticide schedules against spring and summerform pear psylla adult and 2nd generation nymph on Bartlett pear^{1,2}. Hudson Valley Lab., Highland, N.Y.-2006.

Treatment	Formulation amt./100 gal.	Application Dates	Springform Adults # / 3 min.	2 June		Summerform Adults ² # / 3 min.	12 June	
				Nymph	Eggs		Nymph	Eggs
1.Damoil	2.0 gal. / 100	SB	15.3 a	0.3 a	2.2 a	15.8 a	2.3 abcd	8.3 bc
Assail 30SG + Damoil	2.0 oz./100 0.5% V/V	10dp PF, 4C 10dp PF, 4C						
2.Damoil	2.0 gal. / 100	SB	20.3 abc	0.3 a	3.6 ab	23.3 a	0.8 a	3.0 a
AgriMek 0.15EC + Damoil	2.5 oz. / 100 0.5% V/V	10dp PF, 4C 10dp PF, 4C						
3.Surround	12.5 lbs. / 100	SB	10.8 a	0.5 a	4.2 abc	33.3 a	1.2 abc	2.4 a
Damoil	2.0 gal. / 100	10dp PF						
Damoil	1.0 gal. / 100	2-4C						
4.Untreated control	-	-	56.3 d	1.3 b	13.5 d	26.5 a	7.8 e	14.3 c

1 Data taken of egg and nymph populations on 2, 12 June; vacuum sweeps made on 6 and 19 June of spring and summerform adults respectively. Swollen bud (SB) on 30 March, late swollen bud on 3 April, bud burst on 10 April, TC on 14 April, 30% bloom on 24 April, PF on 1 May @ 10-30% PF of Bartlett. 10dp PF on 23 May, 2C on 6 June, 3C on 21 June, 4C on 30 June.

2 Mean separation by Fishers Protected LSD ($P < 0.05$). Treatment means followed by the same letter are not significantly different.

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Evaluations of insecticide schedules against spring and summerform pear psylla adult and 2nd generation nymph on Bartlett pear^{1,2}.
Hudson Valley Lab., Highland, N.Y.-2006.

Treatment	Formulation amt./100 gal.	Application Dates	Summerform Adults - 19 June # / 3 min.	26 June		Summerform Adults - 5 July # / 3 min.	% reduction	5 July	
				Nymph	Eggs			Nymph	Eggs
1. Damoil	2.0 gal. / 100	SB	15.8 a	3.2 bc	3.6 a	6.0 c	62.0	1.3 bc	2.3 a
Assail 30SG + Damoil	2.0 oz./100 0.5% V/V	10dp PF, 4C 10dp PF, 4C							
2. Damoil	2.0 gal. / 100	SB	23.3 a	2.4 ab	3.7 a	2.5 ab	89.3	0.2 a	0.6 a
AgriMek 0.15EC + Damoil	2.5 oz. / 100 0.5% V/V	10dp PF, 4C 10dp PF, 4C							
3. Surround	12.5 lbs. / 100	SB	33.3 a	1.3 a	2.7 a	1.8 a	94.7	0.3 a	2.3 a
Damoil	2.0 gal. / 100	10dp PF							
Damoil	1.0 gal. / 100	2-4C							
4. Untreated control	-	-	26.5 a	6.1 c	2.8 a	15.3 d	42.5	1.5 c	1.1 a

1 Data taken of egg and nymph populations on 2, 12 June; vacuum sweeps made on 6 and 19 June of spring and summerform adults respectively. Swollen bud (SB) on 30 March, late swollen bud on 3 April, bud burst on 10 April, TC on 14 April, 30% bloom on 24 April, PF on 1 May @ 10-30% PF of Bartlett. 10dp PF on 23 May, 2C on 6 June, 3C on 21 June, 4C on 30 June.
2 Mean separation by Fishers Protected LSD ($P < 0.05$). Treatment means followed by the same letter are not significantly different.

Table 3

Evaluations of insecticide schedules on foliar phytotoxicity on Bartlett pear^{1,2}.
Hudson Valley Lab., Highland, N.Y.-2006.

Treatment	Formulation amt./100 gal.	Application Dates	7/5 Leaf scorch rating 0-5 scale	% Leaf drop	% of lvs. With Fabraea L.S.
Assail 30SG + Damoil	2.0 oz./100 0.5% V/V	10dp PF, 4C 10dp PF, 4C			
2. Damoil	2.0 gal. / 100	SB	0.3 a	56.8 bcd	87.9 b
AgriMek 0.15EC + Damoil	2.5 oz. / 100 0.5% V/V	10dp PF, 4C 10dp PF, 4C			
3. Surround	12.5 lbs. / 100	SB	0.3 a	6.7 a	56.8 a
Damoil	2.0 gal. / 100	10dp PF			
Damoil	1.0 gal. / 100	2-4C			
4. Untreated control	-	-	1.5 d	70.6 d	96.6 bc

1 Data taken of egg and nymph populations on 2, 12 June; vacuum sweeps made on 6 and 19 June of spring and summerform adults respectively. Swollen bud (SB) on 30 March, late swollen bud on 3 April, bud burst on 10 April, TC on 14 April, 30% bloom on 24 April, PF on 1 May @ 10-30% PF of Bosc. 10dp PF on 23 May, 2C on 6 June, 3C on 21 June, 4C on 30 June. Leaf rating for phytotoxicity caused by pear psylla honeydew from 0-5 on Bosc leaves on 5 July. Percent leaf drop on 28 September, % Fabraea leaf spot on 3 October.

2 Mean separation by Fishers Protected LSD ($P < 0.05$). Treatment means followed by the same letter are not significantly different.

'rescue' treatment. Applications over the entire block for disease control, plum curculio and crop size management included: Dithane DF 3 lbs/acre on 19 April, 3, 10 May, 8, 22 June, NAA 2.1 oz./acre on 3 May, Nova 40WP 4.0 oz./acre, on 8 June, Ziram 3.0 lbs/acre on 20 July, Imidan 70WP 3.0 lbs/acre on 4 May.

Results and Discussion

Against the early-season adult population for ovipositional deterrence, we observed that the single application of Surround WP at swollen bud exhibited numerically lower numbers of pear

psylla eggs than the 2% Damoil application and significantly lower numbers of nymph populations shortly after petal fall as a result of reduced oviposition (Table 1).

Applications directed against 1st generation nymph and adult population on 23 May demonstrated that the standard, AgriMek 0.15EC, provided very good management of the adult and nymph population early in the season (Table 2). Yet both the Assail 30SG / oil and the standard AgriMek exceeded post-bloom threshold of 1-2 nymphs / leaf by 26 June requiring a 'rescue' treatment on 30 June, whereas the 1% Damoil treatments applied as bi-weekly

cover applications remained below threshold throughout the season. The lowest sustained numbers of psylla nymphs were observed in the 1% Damoil treatment. AgriMek and 1% Damoil treatments exhibited the least degree of leaf scorch and had the least amount of both leaf drop and Fabraea leaf spot, which may indicate a degree of fungicidal suppression on the spread of this leaf spot disease (Table 3). No rust mite or codling moth damage was observed in the research plots in 2006.

Although the use of 1% Damoil provided good control of psylla in our trial last season, it was not without its drawbacks. In Bartlett we saw enlarged len-

ticels at the calyx end of fruit in harvest evaluations and on the wood during our winter pruning (Figure 5). This may not be a problem in pick-your-own blocks where fruit finish is not as critical as fruit 'on the shelf'. As with most materials, markets will dictate much of the pest management protocols we use. Maintaining an informed adherence to the label and label changes for pear management is vital for sustainability in an ever-changing agricultural environment.

We will be continuing our evaluation of oil for pear psylla management this 2007 growing season, replacing Damoil with the more highly refined summer oil, PureSpray Spray oil 10E by Petro-Canada. Dr. David Rosenberger and I will also be investigating the mechanism of decreased *Fabraea* leaf spot, *Fabraea maculata*, observed in the oil treated Bosc pear this season.

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