Controlling Dogwood Borer Using an Antagonistic Sex Pheromone Blend to Disrupt Mating

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If you're growing apples on dwarfing rootstocks such as M.26 or M.9, you've likely seen aggregations of root initials, commonly known as burrknots, growing from the rootstock portion of the trunks of those trees. And, you've most likely also seen signs, in the form of reddish brown frass or translucent, golden-brown, empty pupal cases, that these burrknots were infested by an insect (Fig. 1). With the recent increase in acreage of apple trees grown on dwarfing rootstocks that are prone to the development of burrknots, we've also seen an increase in the population of a borer (a clearwing moth) that inhabits burrknots, called the dogwood borer, *Synanthedon scitula* (Harris) (Fig. 2). Burrknots apparently provide an ideal environment for dogwood borer larvae and easy entry into the trunk. Dogwood borer larvae feed on the root initials that make up the burrknot, but, as that tissue is consumed, may move into the bark of the trunk, where their feeding may eventually cause a decline in the vigor and thriftiness of the tree and possibly even girdling and death. Dogwood borer occurs throughout the state. On average, about half of the trees in an orchard on dwarfing rootstock will have burrknots and, on average, about a third of those burrknots will be actively infested by dogwood borer larvae.

"On average, about half of the trees in an orchard on dwarfing rootstock will have burrknots and, on average, about a third of those burrknots will be actively infested by dogwood borer larvae. Although Lorsban insecticide very effectively controls dogwod borer larvae, increasing restriction of its use make it less attractive. Our research has shown that dogwood borer can be effectively controlled by mating disruption with the Lesser peach tree borer pheromone."

The insecticide chlorpyrifos (Lorsban, Dow AgroSciences) very effectively controls dogwood borer larvae that infest burrknots. Control is usually nearly 100% and may last through two seasons. But, alternatives to Lorsban may be attractive for a number of reasons. Lorsban (and other insecticides) must be applied with a handgun sprayer to ensure these results. This requires setting up a dedicated sprayer rigged specifically for trunk spraying. This tactic is labor-intensive and, because the operator must be on the ground handling the spray gun, holds a greater potential for worker exposure to the insecticide. In addition, the future registration status of Lorsban is questionable. Other insecticides will control dogwood borer but generally are not as effective, and require two applications each season to get control equal to that with Lorsban. So, while we do have some effective chemical controls for dogwood borer, we're always on the lookout for alternatives that may be easier and cheaper to apply, and with fewer restrictions.

One possibility recently identified is the use of a commercially available pheromone mating disruption product that, while not specifically containing dogwood borer pheromone, can disrupt dogwood borer mating by repelling male moths, rather than confusing them. A team of researchers discovered this phenomenon while searching for an improved dogwood borer pheromone formulation (Leskey et al. 2009). They found that a contaminant in the blend that they were testing repelled male moths, and that this contaminant was a component of the pheromone of lesser peachtree borer, a related species. Lesser peachtree borer pheromone mating disruption dispensers are commercially available (Isomate-LPTB, CBC America) so they subsequently tested these dispensers against dogwood borer in the field (Fig. 3). Trap capture of male dogwood borer moths in their trial, using very attractive sex pheromone lures, was almost completely shut down, which was strong evidence that mating disruption had taken place. This approach seemed promising enough to field test it in New York as well.

Figure 1. Burrknots infested with dogwood borers. The frass on the lower 2 burrknots is from the borers.

Figure 2. Adult dogwood borer clearwing moth *(Synanthedon scitula).*

Materials and Methods

Three orchards on size-controlling rootstocks, all with abundant burrknots showing varying levels of dogwood borer infestation, were selected for this trial. We felt that effective control of dogwood borer using mating disruption would require starting with a low population; a high population would be unmanageable in one season using this method. So, we selected a young orchard

Figure 3. Lesser peachtree borer pheromone mating disruption dispensers tested against dogwood borer.

that was determined to have a relatively low level of infestation. But, we also wanted to see to what extent the population could be reduced in a heavily infested orchard so we selected a heavily infested orchard. To round out the picture, we selected a third orchard with a population ranking somewhere between the other two. Pretreatment sampling indicated that dogwood borer larvae infested approximately 25%, 35% and 40% of the trees in the three orchards.

Treatments were applied in 2008 and 2009, with the intention of determining whether there was a cumulative decrease in larval numbers over that period. Two orchards that were approximately 20 acres each were divided in half; one half was treated with the pheromone dispensers and one half served as an adjacent, untreated check plot. Also, one 11-acre orchard was treated with pheromone and compared with an untreated orchard that was nearby, but not adjacent to it. Orchards were treated at a rate of 100 Isomate-LPTB dispensers per acre on June 5 and 6, before the dogwood borer flight began. In addition, in untreated orchards, 5 subplots, with 10 trees in a row in each subplot, were sprayed with Lorsban 4EC at a rate of 1.5 qt/100 gal as a standard treatment. Sticky traps, baited with the same pheromone blend used by Leskey et al. (2009), were hung in treated and untreated plots in early June, prior to the beginning of the dogwood borer flight, and monitored weekly until the end of the flight.

Results and Discussion

Capture of male dogwood borer was substantial in the untreated plots, but almost completely shut down in the treated plots, indicating that mating disruption had taken place (Table 1). In addition, in October, when larvae that would spend the winter in burrknots were actively feeding, burrknots were examined for fresh, reddish-brown larval excrement (frass), indicating that a burrknot was infested. Fifty tree trunks (5 subplots, with 10 trees in a row in each subplot) were sampled in each treated and untreated plot. Results (Table 1) indicated that infestation was reduced by about 50% in each treated plot in 2008, when compared with the untreated plot at each site. As expected, where infestation was highest to begin with (as indicated by infestation level in the untreated plot at each site), the percentage of burrknots infested in the treated plot, while reduced, was still relatively high. This implied that treatment with Isomate-LPTB would work best when infestation is low or moderate. However, it does appear as though higher levels can be reduced to a manageable level by treating with the pheromone for more than one season.

Table 1. Trap capture of adult male DWB and active infestation of apple burrknots by larvae in Isomate LPTB treated and untreated plots

Plot	Total # male DWB/season	Prop. burrknots infested	% Control
2008			
Orchard 1 S (CK)	103	0.132 a	–
Orchard 1 N (TRT)	0	0.065 ab	51
Orchard 1 STD (Lorsban)		0.000 b	100
Orchard 2 S (CK)	502	0.079 a	–
Orchard 2 N (TRT)	5	0.038 b	52
Orchard 2 STD (Lorsban)		0.000 b	100
Orchard 3 S (CK)	833	0.274 a	–
Orchard 3 N (TRT)	3	0.129 b	53
Orchard 3 STD (Lorsban)		0.00 c	100
2009			
Orchard 1 S (CK)	1103	0.220 a	–
Orchard 1 N (TRT)	2	0.048 b	78
Orchard 2 S (CK)	751	0.153 a	–
Orchard 2 N (TRT)	0	0.013 b	92
Orchard 3 (CK)	1994	0.060 a	–
Orchard 3 (TRT)	2	0.017 b	72

Means followed by the same letter are not significantly different (Fisher's LSD, $P < 0.05$)
CK, check; TRT, pheromone-treated; STD, standard

Reduction of the larval population in all treated plots was greater in 2009 than in 2008, compared with the respective untreated check plots. The larval population in the most heavily infested plot in 2008 had the lowest numbers in 2009. However, because larval numbers in the check plot at this site were also lower than in 2008, it's unclear whether this may have been due to natural fluctuation, an effect of the treatment, or some unknown factor. Another season's trial may clarify whether there is some cumulative effect on population of several years treatment, but control in 2009 appears to have been greater than that in 2008, in terms of percent reduction of infestation in treated versus untreated plots (70-90% vs. 50%). Another option for control in a heavily infested orchard would be to first bring the pressure down by spraying with an effective insecticide a year or more prior to treating with the pheromone.

We have estimated the cost of applying chlorpyrifos (Lorsban 4E), based on plant density of 800 trees/A, a cost of $8.00/hr for labor, and a price of $30.00/gallon for Lorsban 4E, at about $25.00/A. Treatment with Isomate-LPTB dispensers at a rate of 100/A, using the same labor rate, costs approximately $42/A ($40/100 dispensers). Assuming that efficacy of treatment with the pheromone is adequate, the ease of applying the pheromone dispensers, plus the fact that no special equipment is needed, and presumably its greater worker safety, may make this tactic attractive to growers looking for a good alternative approach.

Reference

Leskey, T. C., J. C. Bergh, J. F. Walgenbach, and A. Zhang. 2009. Evaluation of Pheromone-Based Management Strategies for Dogwood Borer (*Lepidoptera: Sesiidae*) in *Commercial Apple Orchards. J. Econ. Entomol. 102(3): 1085–1093.*

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