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Final Report

Spotted lanternfly affecting Virginia vineyards: Determination of expansion in vineyard areas, and chemical control of egg masses

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Final report for project involving spotted lanternfly range expansion, and control trials: Main accomplishments.

Introduction

Spotted lanternfly is an invasive insect that is severely damaging to vineyards. It was introduced into eastern Pennsylvania in 2014, where infestations have led to death of blocks, yield reductions of 80-90% with a tripling of insecticide use. SLF was found in northern Virginia in January 2018, initially limited to Winchester, but since it has expanded its range, now present in 11 counties plus the city of Lynchburg. The most effective insecticides are highly toxic to beneficial arthropods in the vineyard, and invasion of SLF will likely lead to induction of secondary pest outbreaks, especially mealybugs and spider mites.

Research in Virginia has included work on phenology, effects on plant growth, and sampling methods – some in Virginia alone, and some in collaboration with researchers at Penn State and USDA (Nixon et al. 2020, Smyers et al. 2021, Dechaine et al. *in press*). It will be critical to follow the spread of SLF in relation to Virginia vineyards, and to develop effective and selective control tools.

Part 1 - Continue to follow the expansion of geographical range of SLF relative to our vineyards

We have searched for SLF in selected sites in Virginia, concentrating along highways, rail lines and vineyard sites. Vineyards have been visited in Frederick,

Clarke, Loudoun, Warren, Shenandoah and Page counties. Figure 1 depicts the main infestation zone and several high-risk vineyards. The map was produced by a GIS system in the Entomology Dept, and includes observations by Entomology staff, VDACS and other sources. In this map, positive finds are shown in pink, negative finds are shown in black. Several vineyards are indicated by orange circles. Most vineyard sites have been negative so far, but we now have SLF in commercial vineyards. In fall 2020 my graduate student and I found SLF at a commercial vineyard site for the first time (Site 1). In 2021, we found SLF at two additional vineyards (Sites 2-3). These sites also expanded the local border of the SLF distribution. SLF also moved further into Clarke County, at Berryville. The Berryville site was along a rail line (Fig. 2) – rail lines appear to be a convenient dispersal route for this pest. No SLF were found at Site 4 (an operation with diverse fruit crops) nor Site 5 (a winegrape vineyard). However, SLF is now closer to these sites than in the mid-year report.

Part 2 - Conduct evaluations of potential ovicides against SLF egg masses, with comparison of applications at beginning of overwintering with approaching hatch in spring,

Spotted lanternfly egg masses have been collected and randomly selected to be divided into treatment groups (Tables 1 and 2 contain insecticides from which our trials have been selected. All are planned to be included). Egg masses must be treated in-field, after harvesting, and before leaving the quarantine zone in Frederick County. All applications will be at the highest label rate for grapes (if applicable) and using a spray rate of 378.5 L/acre. Applications are made with a small spray mister. Each mister will be calibrated for the average volume sprayed per trigger pull. Each egg mass will be sprayed approximately 10 - 15 cm from the egg mass surface until run-off of spray liquid from the surface of the egg mass. A major focus is on *Beauveria bassiana*, an entomopathogenic fungus that has shown promise against SLF. Work on this objective started in fall 2020 and is

ongoing.

Table 1: Objective 1 Applications

Treatment	(active ingredient, trade name)	% AI	g or mL per 378.5 L	IRAC group	PPM	OMRI Approved
UTC	NA	NA	NA	NA	NA	Water Control
NA	NA	NA	NA	NA	NA	Paraffinic Oil (JMS Stylet Oil)
NA	97.1	6510	19420	Yes		Methylated Soybean Oil and Surfactant Blend (MSO)
NA	100	832	2499	No		Mineral oil (Damoil)
NA	70	9765	21000	No		Mineral oil (Mite-E-Oil)
NA	90	9879	27000	No		Clarified Hydrophobic Extract of Neem Oil (Trilogy)
NA	70	7192	14000	Yes		Hexythiazox (Savey 50 DF)
10A	50	168	222	No		Hexythiazox (Onager optek)
10A	11.93	743	224	No		Buprofezin (Applaud DF)
16	70	672	1243	No		Chlorpyrifos (Lorsban 75 WG)
1B	75	602	1194	No		Dinotefuran (Scorpion 35 SL)
4A	35	165	137	No		Bifenthrin (Talstar S)
3A	7.9	1209	247	No		

Table 2: Objective 2 Applications

Treatment	(active ingredient, trade name)	% AI	g or mL per 378.5 L	Total conidia mL	diluted product	OMRI Listed
UTC	NA	NA	NA	NA	Water Control	
NA	NA	NA	NA	*Beauveria bassiana* GHA (Botanigard 22WP)	22	906
1.06E+08	Yes			*Beauveria bassiana* GHA (Botanigard ES)	11.3	1892
1.10E+08	Yes			*Beauveria bassiana* GHA (Technical Grade)	100	431
1.06E+08	NA					

Egg Mass Incubation and Hatching

All SLF egg masses must be stored and analyzed in the invasive species quarantine facility in Blacksburg, VA. Each individual egg mass is held in its own labeled, sealed container. Egg masses collected before spring are held in a climate-controlled incubator. The incubator is set to approximately 10 ° C, 65% relative humidity, and a 16:8 light-dark cycle for a minimum of 100 days; this cold storage is required for sufficient hatch rates of SLF (Keena and Nielsen 2021). After cold storage, SLF egg masses are transferred to another climate-controlled incubator to induce hatch. This incubator is set to approximately 25 ° C, 65 % relative humidity, and a 16:8 light-dark cycle until emergence occurs (Keena and Nielsen 2021). Emergence is defined as a minimum of one SLF hatching from the entire egg mass. Eggs masses are visually inspected each day after being put into the 25 ° C incubator for emergence. For *Beauveria* trials, once

emergence has occurred, that individual egg mass will be taken out of the incubator and transferred to a caged, potted tree-of-heaven seedling and monitored daily. A weather logger recording temperature and relative humidity will be left with the egg masses in each incubator.

Part 3 - Print SLF educational posters for posting at vineyards and wineries. This activity is in planning. We will modify our plans for distribution since it is not likely we will have a face-to-face winter conference.

We currently have several publications that can be distributed to growers, including fact sheets, phenology charts, and management guides for vineyards and residential areas in both English and Spanish (Pfeiffer et al. 2018, Dechaine et al. 2019a, Dechaine et al. 2019b, Pfeiffer et al. 2019a, Pfeiffer et al. 2019b). Some material was made available at the summer technical meeting.

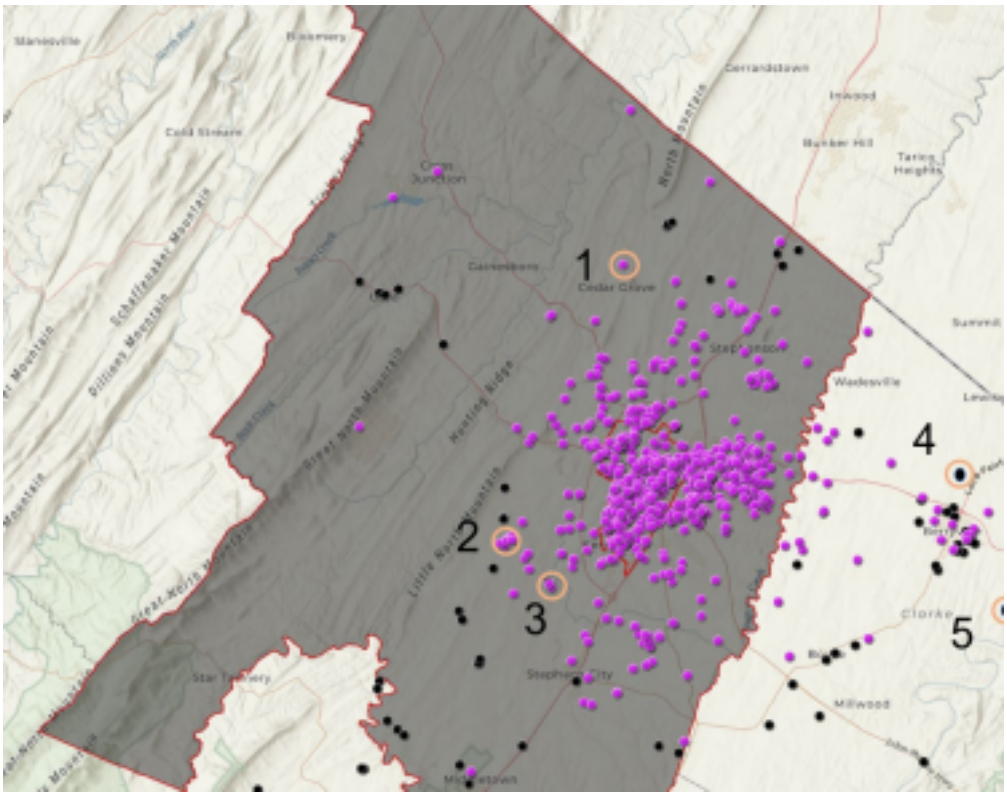

Fig. 1. Positive detections of spotted lanternfly in the main infestation zone as of August 2021. Orange circles denote vineyards previously noted as high risk.

Fig. 2. Berryville site with spotted lanternfly established in tree of heaven stands. Jason Bielski shown at site.

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