Progress Report

This is year __4__ of a __4__year proposed project.

For the Washington Grape & Wine Research Program

These reports must be written so they will be suitable for distribution to the general public.
Please limit length to 4 pages per research objective.

Date: January 31, 2014
Project Titles:
1.Grapevine leafroll associated viruses in Washington State vineyards and the role of the Grape Mealybug and European Fruit Lecanium Scale as vectors.
2. Biology and Management of Spotted Wing Drosophila in Washington Vineyards

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Project Budget Number: 13C 3343-3534 for mealybugs
13B 3343-3206 for spotted wing drosophila

Objective(s) of Proposed Research:
1. Develop commercial-scale demonstration plots using pheromone-based monitoring traps for mealybugs.
2. Test novel methods for monitoring scale insect populations in the vineyard.
3. Conduct efficacy studies with reduced-risk candidate insecticides for scale insect control.
4. Test vineyards that have populations of mealybugs and/or scale insects for the presence of leafroll viruses.
5. Evaluate the movement of virus-infected mealybugs and scales between vineyards and assess the economic impact of potential transmission and control
6. Monitor vineyards for detection of and abundance of spotted wing drosophila and brown marmorated stink bug

Project Summary:

1. Develop commercial-scale demonstration plots using pheromone-based monitoring traps for mealybugs.

   In 2009, field sites were established in the Yakima Valley and Paterson, WA to monitor for the presence of the grape mealybug, *Pseudococcus maritimus*. This mealybug is the dominant species of mealybug in Washington State vineyards and represents a serious threat to grape growers due to their ability to transmit grapevine leafroll associated viruses. From 2010 to 2012, 30-acre plots were sampled weekly through the growing season and it was determined that one pheromone baited trap per 30 acres of vineyards was adequate to monitor for the presence or absence of the grape mealybug as well as the population phenology. In 2013, pheromone baited lures and sticky traps were distributed to commercial growers willing to collaborate and were placed in vineyards that were infected with leafroll, infested with mealybugs, or both. During the 2013 growing season, growers monitored traps weekly and provided us with information on the status of mealybug populations in their vineyards. All growers found mealybugs in pheromone baited traps and produced data that agreed with that produced from 2010 to 2012 where two distinct flights occurred throughout the season. The occurrence of these flight peaks occurred about two weeks earlier than those that we found from 2010 to 2012, however, this is likely due varying climatic conditions, including a warmer than average winter and a warm spring.

2. Test novel methods for monitoring scale insect populations in the vineyard.

   Two methods were tested in 2013 during the active period for scale insect first instars. The first involved placing double-sided sticky tape on vines with scale infestations, the second involved placing yellow sticky traps on poles surrounding infested vineyards. Both methods were established in hopes of detecting movement of crawlers on the vine by the latter method and between vineyards by the former method. Twenty yellow sticky traps were placed around five different infested vineyards and double-sided tape was placed on five different vines within each vineyards. The yellow sticky traps did not detect any first instar crawlers and the doubled-sided tape only detected two crawlers.

3. Conduct efficacy studies with reduced-risk candidate insecticides for scale insect control. No progress to report on this objective for 2013.

4. Test vineyards that have populations of mealybugs and/or scale insects for the presence of leafroll viruses.

   From 2010 to 2012, Concord vineyards in the Yakima valley were surveyed for the presence of viral pathogens that have been detected in wine grapes. Five different viruses were detected; grapevine fanleaf virus, grapevine leafroll associated virus -2, -3, -4, and -9. As consistent with all virus surveys, GLRaV-3 was the predominant virus and present in every vineyard sampled. In 2013, when growers sampled new blocks and found infestations of mealybugs and/or scales, plant samples were brought in to test for the presence of virus. A total of 14 samples were tested, 11 from Concord vineyards and three from wine grapes. Of the 11 new Concord samples, seven tested positive for GLRaV-3 and one of the wine grape samples tested positive for GLRaV-3. No other viruses were detected in these samples.

5. Evaluate the movement of virus-infected mealybugs and scales between vineyards and assess the economic impact of potential transmission and control

   During the growing season of 2013, 20 yellow sticky traps were placed on poles surrounding five vineyards that had tested positive for GLRaV-3 as well as having infestations of mealybugs and/or scale insects. A total of 100 traps were sampled three times a week during the active phase of the crawlers for both mealybugs and scale insects. No mealybug or scale insects were found on any of the yellow sticky traps during the study period. Scale and mealybug crawlers were collected from virus infected plants and tested for the presence of virus. A total of 52 scale crawlers were collected and 19 mealybug crawlers were collected. About 20% of scale crawlers tested positive for GLRaV-3 and 5% of mealybugs tested positive.

6. Monitor vineyards for detection of and abundance of spotted wing drosophila *Drosophila suzukii* and brown marmorated stink bug

Collectively 40 traps were monitored throughout 2013 in Yakima Valley/ Columbia Basin Concord and wine grape vineyards to asses the flight behaviors and seasonal phenology of *Drosophila suzukii* persisting in these vineyards. Fifteen traps were monitored in conventionally-grown Concord vineyards and six were monitored in organically-grown Concord vineyards. Twelve traps were monitored in conventionally produced winegrape vineyards and 4 in organically produced wine grape vineyards. In most vineyards pairwise comparisons were made between two different bait formulations. The first bait tested was apple cider vinegar (ACV) and the second was a sugar & yeast (SY) bait that was initially developed by F.G. Zalom at UC Davis.

Details of trapping locations

Crop	Org/Conv	Bait	Latitude	Longitude
Concord	Conventional	ACV	46.17482	-119.44361
Concord	Conventional	ACV	46.17485	-119.44385
Concord	Conventional	SY	46.17492	-119.44414
Concord	Conventional	SY	46.17485	-119.44449
Concord	Conventional	ACV	46.18136	-119.41308
Concord	Conventional	ACV	46.18125	-119.41305
Concord	Conventional	SY	46.18115	-119.41304
Concord	Conventional	SY	46.18111	-119.41304
Concord	Conventional	ACV	46.15151	-119.44048
Concord	Conventional	ACV	46.15162	-119.44047
Concord	Conventional	SY	46.15172	-119.44051
Concord	Conventional	SY	46.15181	-119.44053
Concord	Conventional	ACV	46.162141	-119.43748
Concord	Conventional	ACV	46.162818	-119.422717
Concord	Conventional	ACV	46.153126	-119.424059
Concord	Conventional	ACV	46.17343	-119.373543
Concord	Organic	ACV	46.162344	-119.372693
Concord	Organic	ACV	46.163459	-119.371166
Concord	Organic	ACV	46.163476	-119.372783
Concord	Organic	ACV	46.163179	-119.37477
Concord	Organic	ACV	46.162361	-119.374679
Concord	Organic	ACV	46.17588	-119.373877
Wine_Grape	Conventional	ACV	46.17022	-119.47853

Wine_Grape	Conventional	ACV	46.17027	-119.47853
Wine_Grape	Conventional	SY	46.17033	-119.47854
Wine_Grape	Conventional	SY	46.1704	-119.47853
Wine_Grape	Conventional	ACV	46.15248	-119.44866
Wine_Grape	Conventional	ACV	46.15237	-119.44847
Wine_Grape	Conventional	SY	46.151317	-119.44531
Wine_Grape	Conventional	SY	46.151244	-119.44508
Wine_Grape	Organic	ACV	45.59084	-119.38728
Wine_Grape	Organic	ACV	45.59099	-119.38742
Wine_Grape	Organic	SY	45.59087	-119.38752
Wine_Grape	Organic	SY	45.59095	-119.38752
Wine_Grape	Conventional	ACV	45.57107	-119.36642
Wine_Grape	Conventional	ACV	45.57104	-119.36641
Wine_Grape	Conventional	SY	45.57096	-119.36639
Wine_Grape	Conventional	SY	45.57089	-119.36639

Collectively we collected hundreds of *D. suzukii* in these traps and due to the mild wilter of 2012-2013 we actually captured D. *suzukii* in the cold winter months of November, December, January, February and March. Interestingly a sharp frost in early April had a substantial impact on subsequent trap capture in the ACV-bated traps. No D. suukii were captured for roughly a month and it was not until mid-june that fly captures recovered to levels seen in earlier years.

As a general rule SY proved to be a more effective lure then ACV in hot summer day conditions while *D. suzukii* populations were quite low. D. suzukii populations peaked in mid-fall after the majority of grape harvest was completed. Based on trap counts in other crops and in riparian habitats we conclude that this fall peak in D. suzukii trap capture is associated with a population peak of D. suzukii emerging from wild blackberries that are getting over-ripe in fall.

Although there have been reports of substantial *D. suzukii* infesting grapes in other grape growing regions of the world, to date the introduction and subsequent invasion of eastern Washington State has proved inconsequential to grape growers regionally. Current theories involve that it is a combination of fruit skin thickness with firmness that predicts host availability to *D. suzukii*. The grape varieties that have proved susceptible to *D. suzukii* oviposition when not injured have had thin skins.

Our current USDA-SCRI grant on *D. suzukii* will afford us to continue another final year of sampling vineyards in eastern Washington State. This SCRI grant terminates on February 28, 2015. After that we anticipate putting very little effort into D. suzukii research on Washington Grapes.

Several detections within the region have been made of Brown Marmorated Stink Bug within the region. In other areas where BMSB has been initially detected there has been a 7 to 10 year lag from detection to BMSB reaching population densities that result in economic damage. Our clock has started. In subsequent years we will place greater emphasis on BMSB research and Extension.

Publications 2013

Steffan, S., J. Lee, M.E. Singleton, A. Vilaire, D. Walsh, L. Lavine, K. Patten. *Accepted.* Susceptibility of cranberries to *Drosophila suzukii* (Diptera: Drosophilidae). J. Econ Entomol.

Lee, J.C., P. W. Shearer, L. D. Barrantes, E. H. Beers, H. J. Burrack, D. T. Dalton. A. J. Dreves, L, J. Gut, K. A. Hamby, D. R. Haviland, R. Isaacs, A. L. Nielsen, T. Richardson, C. R. Rodriguez-Saona, C. A. Stanley, D. B. Walsh, V. M. Walton, W. L. Yee, F. G. Zalom, and D. J. Bruck. 2013. Trap Designs for Monitoring *Drosophila suzukii* (Diptera: Drosophilidae). Environ. Entomol. 42(6): 000Ð000 (2013); DOI: http://dx.doi.org/10.1603/EN13148

Bahder, B.W., S. Poojari, O. J. Alabi, R. A. Naidu, & D. B. Walsh. 2013. Pseudococcus maritimus (Hemiptera: Pseudococcidae) and *Parthenolecanium corni* (Hemiptera: Coccidae) are capable of transmitting Grapevine leafroll-associated virus 3 between *Vitis labruscana* and *Vitis vinifera*. Env. Entomol. http://dx.doi.org/10.1603/EN13060

Bahder, B.W., O. Alabi, S. Poojari, D. B. Walsh, R. A. Naidu, 2013 A Survey for Grapevine Viruses in Washington State ‘Concord’ (Vitis x labruscana L.) Vineyards. Plant Health Prog. doi:10.1094/PHP-2013-0805-01-RS

Bahder, B. W. R. A. Naidu, K. M. Daane, J. G. Millar, &D. B. Walsh. 2013. Pheromone-based Monitoring of Pseudococcus maritimus (Hemiptera:Pseudococcidae) Populations in Concord GrapeVineyards. J. Econ,.Entomol. 106: 482-490