Michigan Grape & Wine Industry Council

2016 Research Report

BIOLOGY AND MANAGEMENT OF GRAPE MEALYBUG

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ABSTRACT

This continuing project focuses on understanding the biology of grape mealybug, a vector of Grapevine Leafroll Virus (GLRaV), and then uses this knowledge to improve vineyard pest management programs. Adult mealybugs were detected before nymphs, and mealybugs were present throughout season. There was not a clear relationship between ant abundance and mealybug infestation, but we are still analyzing samples to determine if certain ants are more common in mealybug infested vineyards. An attractive but toxic ant bait is being tested to reduce ants and promote mealybug parasitism in treated vineyards, although it showed no reduction in ants or mealybugs in 2016. In an insecticide trial, Movento applied right after bloom appears to be the best option for mealybug control.

GOALS & OBJECTIVES

This study was designed to provide information on the seasonal phenology, biology and control of grape mealybug, the main vector of Grapevine leaf roll virus (GLRaV). This information will be used to develop management tactics and programs that Michigan wine grape growers can use to limit the spread of this pest and the associated virus. The specific objectives of this project are to:

1) **Determine the seasonal activity of grape mealybug and other potential virus vectors in Michigan vineyards.**
2) **Determine which ant species are interacting with mealybug populations and how their control affects mealybug populations.**
3) **Compare different insecticide approaches for control of grape mealybug in Michigan vineyards.**
4) **Communicate the results of this work to industry partners through MSU Extension meetings, workshops, newsletters and the grapes.msu.edu website.**

PROJECT PERIOD

This project was conducted during 2016, with fieldwork occurring from May to October. A timeline for the completion of this project is included below.

WORK ACCOMPLISHED DURING THE PERIOD - by Objective

1) Determine the seasonal activity of grape mealybug and other potential virus vectors in Michigan vineyards. We performed detailed weekly assessments of mealybug populations from May through August of 2016 at six grape farms where evidence of grape mealybug infestation was detected in 2015. At each farm, two to five vineyards were selected (17 vineyards total); a five row section of each vineyard was marked and a temperature probe was installed to track degree-days at each farm. Each week one vine in each row was sampled for mealybug eggs, crawlers, nymphs and adults by peeling and inspecting under a 1x12 inch strip of bark on the trunk and a 30-second visual scan of cordons, shoots, clusters and leaves. The number and location of each life stage and the presence of ants or other insects on the vines was recorded during the sampling. Mealybugs were found at five of the six farms, and in 12 of the 17 vineyards that were sampled. Vineyards without mealybugs were not used in data analysis.

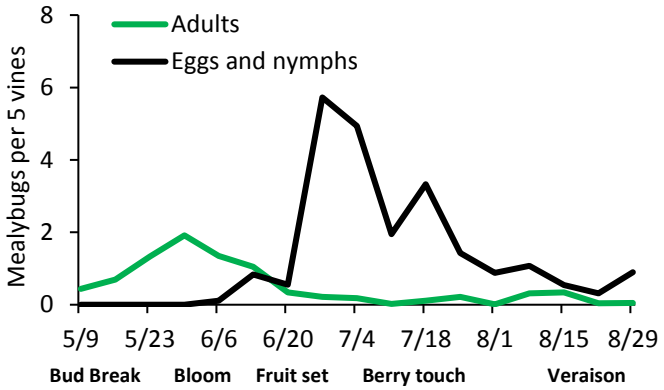

Figure 1. Grape mealybug phenology at southwest Michigan vineyards in 2016.

Adult mealybugs were first found during bud break on May 9th whereas immature mealybugs were first seen on June 6th right before bloom (Figure 1). This was unexpected based on observations of immatures around bud break in other regions, and may be an artefact of the visual sampling method. Our plan for monitoring seasonal activity in 2017 is to continue weekly sampling, as described above, at the 12 vineyards with mealybugs. In addition, at each monitoring vineyard, we will wrap double-sided cellophane tape around five vine trunks to capture newly hatched nymphs (crawlers) to get an additional estimate of first observation of this life stage. The data from the two years will be standardized using growing degree-days to allow for better comparison between years and to help construct a better understanding of the seasonal phenology of grape mealybug in Michigan.

2) Determine which ant species are interacting with mealybug populations and how their control affects mealybug populations. We monitored ant abundance using test tubes containing either tuna fish or a 10% sucrose solution at each of the above vineyards where mealybug assessments took place. Tubes were deployed below vines and left in vineyards overnight. Tubes containing ants were collected, capped, labeled and returned to the lab for sorting, counting and identifying the ants. Ants were abundant in all vineyards we sampled, and there does not appear to be a clear relationship between ant and mealybug abundance across vineyards. Samples are still being assessed, but preliminary results indicate there were six different species of ants found in the vineyards in this study. Correlation analysis will determine if particular species are more

common in mealybug-infested vineyards. We plan to continue the same plan sampling for ants in 2017.

To assess if ant control can affect mealybug populations, a trial was set up at three farms in southwest Michigan. At each farm, one vineyard was divided into thirds, and one third of the acreage received Gourmet Liquid Ant Bait, a sugar + protein bait containing a toxicant, deployed in 12 KMAntPro bait stations per acre (Figure 2). Another vineyard section did not receive the bait treatment and was used for comparison, while the final section of vineyard was used as a buffer to separate the treated and untreated areas. Ant bait stations were deployed from June through August and refilled as necessary to allow foraging ants to collect the toxic bait and carry it back to the nest where it is shared with other ants including the queen. This sharing of poisonous food eventually kills the ant colony.

Figure 2. Ant bait station and Gourmet Liquid Ant Bait.

To determine if the ant bait treatment affected ant or mealybug abundance, we assessed those insects in each vineyard as described above. In 2016, we did not see a reduction in ant or mealybug numbers in plots treated with ant bait compared to that in untreated plots. However, ant control with baiting is a slow process, and it is likely that we will not see effects of the treatment until this coming season. This experiment will be repeated in 2017, and in addition to monitoring mealybugs and ants as described above, we plan to collect to mealybugs to see if they have been parasitized. We expect a higher rate of parasitism in plots where ants have been removed because ants protect mealybugs from parasites and predators.

3) Compare different insecticide approaches for control of grape mealybug in Michigan vineyards.

We tested the efficacy of six mealybug control tactics in a field trial in southwest Michigan in 2016 (Figure 3). Using three vine plots and four replicates, we compared control using a contact insecticide (Danitol 16oz/ac) applied twice around bud break to Movento (6oz/acre) applied after bloom, at veraison, at both bloom and veraison, or a combination of two Danitol and two Movento applications. All applications were made with a backpack sprayer at 50 psi, 150 gallons of water per acre and mixed with 0.5% Stylet oil to help the spray penetrate the bark. To assess mealybug abundance, we sampled one vine in each plot as described above two weeks after each application. Treatments were compared with one-way ANOVA at each sample date.

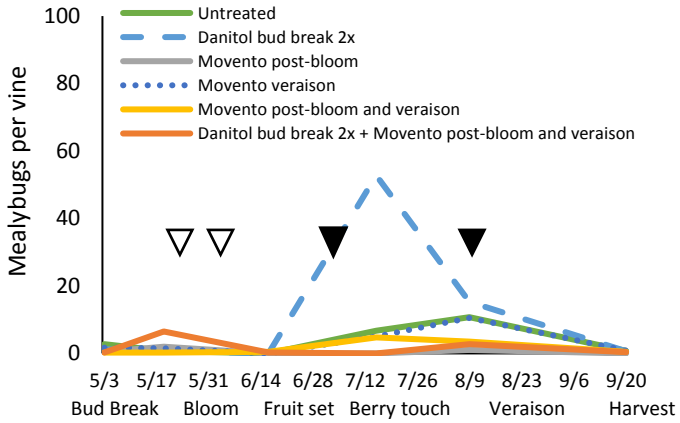

Figure 3. Mealybug abundance in plots using different control tactics. Open triangles show Danitol application timings and closed triangles show when Movento was applied.

No significant differences were detected in mealybug abundance at any sample date due to low population size and considerable variability between plots. However very few mealybugs were found in any of the plots that received Movento at the post bloom timing, so

these results support the manufacturer's recommended application timing. This experiment will be repeated in 2017 using larger plots to reduce variability and to allow for more sampling.

4) Communicate the results of this work to industry partners through MSU Extension meetings, workshops, newsletters and the grapes.msu.edu website. A mealybug workshop at Lemon Creek Winery on June 2, 2016 provided training on scouting, identifying, and controlling mealybugs in vineyards. Results from this project were presented at the 2016 MSU Viticulture Field Day (July 27), and at the Great Lakes EXPO (December 6). We will continue to present results from this project at 2017 MSU Extension meetings organized by Brad Baughman, Parallel 45, and through MSU Grape and Wine Industry News.

COMMUNICATIONS ACTIVITIES, ACCOMPLISHMENTS, AND IMPACTS

This project is providing clarity to the Michigan grape industry on how best to manage grape mealybug, the chief vector of GLRaV. The results of this work have been communicated via MSU Extension and this has included research presentations, hands-on workshops and newsletter reports. We will continue to inform the industry by sharing project results and recommending effective techniques for managing grape mealybug and GLRaV. The details of meetings and presentations are given above under Objective 4. The conclusions from this work are expected to help reduce the incidence of grape mealybug and GLRaV in Michigan vineyards.

RESULTS & CONCLUSIONS

Grape mealybug is the main vector of Grapevine Leafroll Virus (GLRaV), and this virus is present in Michigan and a substantial threat to wine grape vineyards. This current project focuses on understanding when grape mealybug becomes active in the spring; when the generations develop through the season; the relationship between ants and mealybugs and the effect this has on mealybug biological control; and to test control strategies targeting susceptible stages during the life cycle. In 2016, adults were detected before nymphs, and mealybugs were detected throughout season. Ants were very abundant in all vineyards irrespective of the presence of mealybugs at those sites. Therefore there is not a clear relationship between the number of ants and the severity of mealybug infestation. We are still sorting samples to determine if certain ant species are more common in vineyards with high mealybug populations. An experiment using a bait that is attractive to ants and contains a toxicant is underway, and we expect to see reduction of both ants and mealybugs, and an increase in parasitized mealybugs in vineyards treated with toxic bait. A field trial compared chemical control tactics, but no significant differences were found between treatments. However the use of Movento right after bloom appears to be the best option for mealybug control.

BUDGET NARRATIVE

This project was conducted in accordance with the approved budget, as outlined in the original grant agreement and funds were used to accomplish the objectives of the proposal. Our grower cooperators made in-kind contributions of labor, materials and equipment costs to manage their

vineyards to allow for this research. This is estimated to be between $1,500 and $2,000 per acre, and we used approximately 60 acres for this project. Pesticides provided to the Isaacs lab for use in this project, represent an additional $2,500 of in-kind contribution.

ACKNOWLEDGEMENTS
Many thanks to the growers, Jeff Lemon, Jim Shafer and Ed Oxley, for their cooperation with this study, and for providing access to their vineyards. We also thank Holly Drankhan, Josh Paavola, Guy Procopio and Chris Worst, and for their work scouting vineyards, checking traps and assessing fruit for this project. Bayer CropScience provided Movento for use in this project.

EXTERNAL GRANTS
Biology and Management of Grape Mealybug in Michigan Vineyards. Project GREEEN (GR16-052). Awarded $39,200 (2016) $39,908 (2017 pending)

TIMELINE
Outline plans for remainder of project.

Objective	Win 2017	Spr 2017	Sum 2017	Fall 2017	Win 2018	Spr 2018
1) Seasonal Activity		**X**	**X**	**X**		
2) Ant Interactions		**X**	**X**	**X**		
3) Control Trials		**X**	**X**	**X**		
4) Education	**X**	**X**	**X**	**X**	**X**	**X**
Analysis and Reporting	**X**				**X**	**X**