Michigan Grape & Wine Industry Council

2017 Research Report

BIOLOGY AND MANAGEMENT OF GRAPE MEALYBUG

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ABSTRACT

This two year project focused on understanding the biology of grape mealybug, a vector of Grapevine Leafroll Virus (GLRaV), and then used this knowledge to improve vineyard pest management programs. Mealybug crawlers are active around bud break and they can be monitored using double sided sticky tape. Adult mealybugs were detected at the same time as nymphs, and mealybugs were present throughout season. Two species of ants appear to be more abundant in vineyards with mealybug infestations. Ant baits did not reduce the number of ants or mealybug in treated vineyards, although lower numbers of crawlers and higher numbers of predatory mites were seen early in the season. In an insecticide trial, Movento applied right after bloom appears to be the best option for mealybug control, and adding an additional Movento application does not improve control.

GOALS & OBJECTIVES

This two-year 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). The results of this project can be used by Michigan wine grape growers to help limit the spread of this pest and the associated virus. The specific objectives of this project were 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

2017 was the second year and final year of this project. Field work was conducted from May to October. Experimental design, equipment preparation and site selection occurred before May,

and sample sorting, data entry and analysis and reporting were performed during the fall and winter of 2017.

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 October 2017 at five grape farms where evidence of grape mealybug infestation was detected in 2015. At each farm, two to five vineyards were selected (12 vineyards total); a five row section of each vineyard was marked and a temperature probe was installed to track degree-days at each farm. Beginning April 25th, two inch wide bands of two-sided clear sticky tape were wrapped around the trunk and one cordon of three haphazardly chosen vines to monitor for newly hatched mealybug nymphs (crawlers). We deployed bands on the vines for one week and then collected and examined them under a dissecting microscope. The number of mealybug crawlers, mites and any insects were recorded. In addition, each week, one vine in each row was visually sampled for mealybug eggs, crawlers, nymphs and adults by peeling and inspecting under a 1x12 inch strip of bark on the trunk and during 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 four of the five farms, and in 10 of the 12 vineyards that were sampled. Vineyards without mealybugs were not used in data analysis. We found fewer adults and nymphs but more eggs in 2017 than in the previous year. Some of the growers used the insecticide Movento for mealybug control during 2016 and this may likely reduced the mealybug populations. In addition, as a part of trunk renewal, many of the older trunks were removed from our sampling sites during pruning in 2016. This may also have reduced the number of mealybugs in 2017 by limiting the availability of spaces under loose bark, or by making it more difficult to peel bark during sampling.

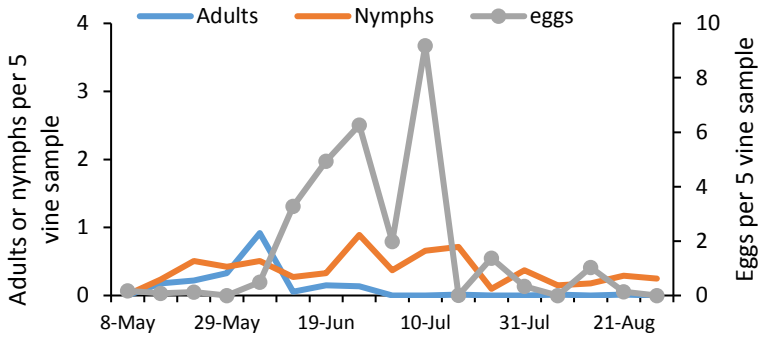

Figure 1. Grape mealybug phenology at southwest Michigan vineyards in 2017.

We detected the first crawlers, or newly hatched nymphs, on sticky tape bands that were collected at bud break on May 8. Adults, immature mealybugs (nymphs), and eggs were found during the first round of visual scouting on May 8th (Figure 1). These observations agree with previous research in other regions in which crawlers were found around bud break. The data from 2017 are very similar to our findings from 2016, and show that emergence dates were consistent from year to year. Standardizing the dates using growing degree-days may allow for better comparison between years and to help construct a better understanding of the seasonal phenology of grape mealybug in Michigan. This data analysis portion of the project will continue outside of the project period.

2) Determine which ant species are interacting with mealybug populations and how their control affects mealybug populations. We monitored ant abundance using test tube traps

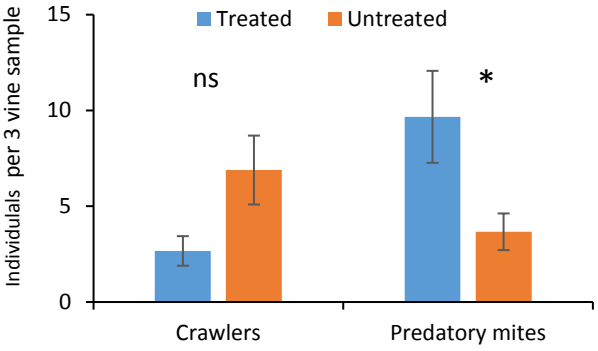

Figure 2. Fewer crawlers and more predatory mites were caught on sticky tape bands in vineyards treated with ant bait. The asterisk denotes a significant difference between treatment means ($F_{1,3}$ = 10.7; *P*=0.047), ns = not significantly different (*P*<0.05).

containing either tuna fish or a 10% sucrose solution at each of the above vineyards where mealybug assessments took place. Traps 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 contents. Ants were abundant in all vineyards we sampled, and there does not appear to be a clear relationship between all species of ants and mealybug abundance across vineyards. Samples are still being assessed, but preliminary results indicate there were eight different species of ants found in the vineyards in this study. Early correlation analyses suggest there are two species that are more common in mealybug-infested vineyards, and these species are likely of particular importance in mealybug control. Sample sorting and data analysis will continue outside of the dates of this project, and results will be shared with the grape and wine industry through MSU eNews.

To assess if ant bait can reduce mealybug abundance, a trial was set up using three wine grape vineyards in southwest Michigan. The vineyards were all mature 10+ year old plantings of Riesling, Chardonnay or Chancellor. A 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. 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. We deployed ant bait stations in early June and refilled as necessary through August. This allowed foraging ants to collect the toxic bait and carry it back to the nest where it was shared with other ants including the queen. This sharing of food containing toxin eventually kills the ant colony.

To determine if the ant bait treatment reduced ant or mealybug abundance, we assessed those insects in each vineyard with sticky tape bands, visual samples, and ant traps 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 we found that the number of mealybug crawlers captured on sticky tape bands was lower in areas that were treated with ant baits, and there were more predatory mites in these vineyards (Figure 2). However, there was not a consistent effect of the ant bait treatment on the number of mealybugs per vine. Similarly, the number of ants we captured in our test vineyards was not reduced by the use of ant baits. We suspect the buffer we used to separate treatments in vineyard sections were not spaced far enough apart. This may have allowed ants from untreated area to move into the treated vineyard section. We are still encouraged by this method and in the future would be interested in trying this on a larger scale without untreated buffers.

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

We compared the efficacy of Movento 2F when applied early or late in the season to determine how treating at these timings affects control of grape mealybug. We set up sixteen 6 vine plots in an infested Chancellor vineyard near Baroda, MI. Plots received Movento 6 oz/acre + 0.5% stylet oil either: two weeks after bloom (20 June); at berry touch (July 19); both after bloom and at berry touch; or they were left untreated as a control. We applied all treatments with a backpack sprayer at 50 psi, at a rate of 50 gallons of water per acre. Four weeks after each application we assessed mealybug abundance by sampling one vine in each plot as described above in Objective 1. We compared mealybug abundance between treatments on the last sample date, with one-way ANOVA.

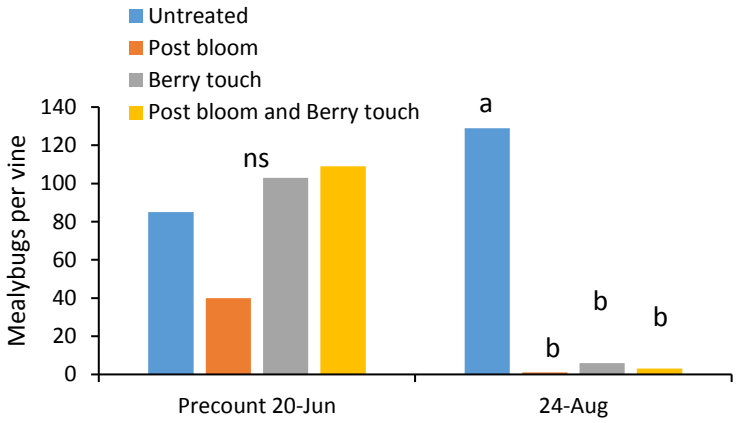

Figure 3. Mealybug abundance in plots using different timings for application of Movento 6 oz/acre. Data are the sum of mealybug adults, nymphs and eggs. Letters indicate significantly different treatment means. ($F_{3,9}$ = 8.0; *P*=0.007), ns = not significantly different (*P*<0.05).

No significant differences were detected in mealybug abundance at the precount. All application timings of Movento reduced mealybug abundance compared to the untreated control at the last sample date. There were no differences between Movento treatment timings in the number of mealybugs per vine, and one application was as effective as two in reducing the abundance of this pest. Our results support the manufacturer's recommended application timing, and we recommend using Movento two to four weeks after bloom to limit the amount of feeding by nymphs and help slow the transmission and spread of grapevine leafroll virus.

4) Communicate the results of this work to industry partners through MSU Extension meetings, workshops, newsletters and the grapes.msu.edu website. Mealybug and grapevine leafroll virus were discussion topics at grower meetings that were held during 2017. Recent reports of increased incidence of grapevine leafroll symptoms (early coloring or yellowing and curling of leaves before harvest) in northwest Michigan vineyards make it imperative for growers to know if they have infected vines and how to slow the spread. We plan to produce an article about grapevine leafroll and mealybug control that is geared for northwest growers, and it will be shared through the 2018 MSU eNews Grape Scouting Report. We will continue to present results from this project at 2018 MSU Extension meetings organized by MSU Extesnion, 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 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 focused 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 2017, we were able to detect first instar nymphs (crawlers) and adults were detected at the same time as nymphs. The periods when different life stages were detected was similar between the two years of sampling, and mealybugs were detected throughout each season. Ants were very abundant in all vineyards, and of the eight species of ants we identified, two species appear to be very closely tied to mealybug abundance. An experiment using a toxic ant bait showed a reduction of mealybug crawlers early in the season in vineyards treated with the bait. A concurrent increase in the number of beneficial predatory mites was also recorded in these plots. Unfortunately we did not see a reduction in the number of ants or mealybugs in bait-treated vineyards later in the season. The use of Movento 2F at 6oz/acre with 0.5% Stylet oil 1-2 weeks after bloom was very effective at reducing the number of mealybugs in treated plots. Movento is the best chemical option for mealybug control. We have also observed that vineyards where trunks and cordons are periodically renewed typically very have few mealybugs, and we encourage growers and vineyard managers to renew old trunks to help reduce mealybug popukations and slow the spread of leaf roll virus.

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 vineyard owners and their staff at Lemon Creek, Ed Oxley Farms, Karma Vista, Tabor Hill, 12 Corners and SWMREC for their cooperation with this study, and for providing access to their vineyards. We also thank Chris Worst, Zach Yarost, Nolan Jahn and Jeremiah Eaton for their work scouting vineyards, checking traps and sorting samples for this project. Bayer CropScience provided Movento for use in the insecticide trial.

EXTERNAL GRANTS

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