NYWGF RESEARCH - FINAL REPORT TEMPLATE

Please fill in by typing over the red directions in each section and change font to black.

Funding for fiscal year: 2023-24

SECTION 1:

Project title: Understanding late-season damage from grape berry moth

Principal Investigator with contact info: Greg Loeb, gme1@cornell.edu, 315-945-4230

Co-PI Collaborators with contact info: Jennifer Phillips Russo, jjr268@cornell.edu, 716-792-2800

New Research ☒ **Continued Research** ☐ New in 2023 funding cycle, but we requested continued funding in 2024

Amount Funded **$** 13,060

SECTION 2: (This section should be in depth and akin to an academic report)

Project Summary Impact Statement: ENTER HERE

Grape growers continue to experience problems with grape berry moth (GBM), especially late in the season. Insecticide resistance and changes in flight phenology are two possible explanations. Using grapes at CLEREL, we evaluated the efficacy of different pyrethroid insecticides commonly used by NY grape growers, plus several labeled alternatives, to determine if resistance is playing a role in ineffective control of GBM. We found clear evidence that the GBM population near CLEREL is quite resistant to the pyrethroid Danitol 2.4 EC, but was susceptible to other, more commonly used pyrethroids and also to the insect growth regulator Intrepid, the diamide insecticide Altacor, and the spinosyn insecticide Delegate. Given that Danitol is not routinely used for GBM control in NY, we conclude that insecticide resistance is not the primary driver for excessive late-season GBM damage. In 2023 we also monitored female GBM activity in relation to degree day accumulation at CLEREL using adult traps and surveying clusters for GBM eggs. Unfortunately, the adult traps were not effective and we only caught a few female GBM over the season, which was insufficient to assess phenology. Similarly, we did not find sufficient number of GBM eggs to draw a definitive conclusion whether predictions of timing of egg laying from the NEWA temperature-driven GBM phenology model match up with GBM phenology in the field. Hence, we need additional data to answer this second potential explanation for significant late-season GBM damage.

Objectives: ENTER HERE

1. Test the field efficacy of common pyrethroid insecticides and alternative modes of action targeting GBM.

2. Compare predictions by the NEWA GBM phenology model with actual GBM flight and

egg-laying activity in vineyards.

Materials & Methods: ENTER HERE

Objective 1. Test the field efficacy of common pyrethroid insecticides and alternative modes of action targeting GBM.

The efficacy of different pyrethroid insecticides and other insecticides based on different modes of action in controlling damage from grape berry moth was tested using a mature concord vineyard located at CLEREL in Portland, NY with a history of high GBM populations. We tested the following pyrethroid-based insecticides (all IRAC Group 3A): Danitol [fenpropathrin], Brigade [bifenthrin], Baythroid XL [B-cyfluthrin], and Mustang Maxx [zeta-cypermethrin]. We also included in the trial the following three insecticides labeled on grapes for GBM with different modes of action than pyrethroids: Delegate [spinetoram, spinosyn, Group 5], Intrepid [methoxyfenozide, insect growth regulator, Group 18], and Altacor [chlorantraniliprole, diamide, Group 28]. There was also a water control. The experimental unit or replicate will be defined as 12 vines, = 3 panels. There were 5 reps of each treatment in the trial (five blocks, using a complete randomized block experimental design with one rep per treatment per block). Treatments were applied based on vine phenology and degree day accumulations to target eggs/young larvae of second, third and fourth flights of GBM with second flight = approximately 810 DD (base 47.2 _F) after bloom of wild *Vitis riparia* (11 July), third flight = approximately 1620 DD after bloom of wild *V. riparia* (14 August), and fourth flight = 14 days after spray for third flight (29 August). GBM infestations of clusters were assessed after the second flight, after the third flight, and near harvest by estimating the proportion of clusters infested. For the last assessment, we also estimated the number of infested clusters per berry.

Objective 2. Compare predictions by the NEWA GBM phenology model with actual GBM flight and egg-laying activity in vineyards.

We surveyed for grape berry moth adults using delta traps with either UV LED lights, host plant volatiles, or both as attractants for both males and females, along with control traps without lures. A total of 30 delta traps were placed on the edge rows at the northwest end of the railroad block of concords at CLEREL in mid-June and monitored weekly for adult moths until August. To directly assess egg-laying, we scanned 100 clusters along the edge of vineyard for presence of either hatched or unhatched GBM eggs, approximately every other week from late June to late August. Number of female moths and number of eggs were plotted against date and degree day accumulations reported from the nearest NEWA weather station.

Results/Outcomes/Next Steps:

Objective 1. Test the field efficacy of common pyrethroid insecticides and alternative modes of action targeting GBM.

There was low to high GBM pressure at CLEREL as the seasoned progressed. An average of 3.6% of clusters were infested for unsprayed plots on 1 August (below economic threshold for Concord juice grapes of 6%), 7.2% on 24 August (below threshold of 12%), and 43.6% (well above threshold of 12%) on 12 September. At the first assessment date there were no significant differences among treatments with respect to proportion of clusters with at least one stung berry. At the second assessment date there was one significant difference among treatments with respect to number of clusters out of 100 with some GBM damage ($F_{10,44} = 4.4$, $P < 0.001$, Generalized Linear Mixed Model with Poisson distribution). Only the Delegate treatment was statistically different from untreated control using a Tukey HSD all pairwise comparisons test (see Table 1 for LSmean values). Closer to harvest, overall levels of damage as measured by proportion of infested clusters were much higher and some additional differences among treatments emerged ($F_{10,44} = 19.0$, $P < 0.0001$). Indeed, all treatments other than the pyrethroid Danitol were statistically lower than control with Delegate having the lowest number of stung berries at 6 percent of clusters. The other treatments fell in between the control and Delegate. Similar results were obtained for number of stung berries per cluster ($F_{10,44} = 38.8$, $P < 0.0001$), although the differences among treatments were more exaggerated. Once again, Danitol was not different from unsprayed control treatment. Delegate had the lowest total number of stung berries out of 50 clusters at 5.3, significantly lower than all other tested insecticides.

Overall, other than Danitol, the other labeled products reduced infestations relative to untreated control, although with the exception of Delegate, the damage exceeded threshold by the end of the season. For the third season in a row Danitol was not statistically different than the unsprayed control treatment indicating GBM in this area has developed resistance. Other, newer pyrethroids, provided better control. Moreover, these results indicate that there is not wide-spread resistance to pyrethroids (the most commonly used class of insecticide on grapes for berry moth control) nor other insecticide classes (diamides, spinosyns). Hence, insecticide resistance is not likely to be the major driver of late-season GBM infestations.

Objective 2. Compare predictions by the NEWA GBM phenology model with actual GBM flight and egg-laying activity in vineyards.

Unfortunately, over roughly 2 month period we did not capture many adult GBM in the delta traps with LED lights and/or plant volatile lures. Indeed, we only captured half dozen moths, and only two females. Although we did observe both hatched and a few unhatched eggs on clusters on some sampling dates, the number of eggs was not to compare to predictions from NEWA based degree days.

There were a couple of factors contributing to not being able to test our hypothesis that the NEWA model is no longer accurately predicting peak flight and egg-laying activity. First, the delta traps we used, although they work fairly well capturing male GBM using synthetic sex pheromone as a lure, have not been as successful at capturing female moths when baited with host plant lures. We were hoping adding the UV LED lights would entice females to enter the trap, but that does not appear to be the case. In the past we successfully used UV lights to capture male and female GBM, although the traps we used included a fan that created suction into the trap. In terms of not finding very many eggs, we believe the main reason was that we did not sample intensively enough. We estimate that rather than looking at 100 clusters, we probably need to look at closer to 1000.

Our next step in addressing the question of how well the NEWA model is predicting peak female flight and egg laying is to sample much more intensively at the CLEREL concord site involving using the older style UV light traps that include suction fans and checking many more clusters for eggs more frequently (at least once per week). This CLEREL research planting is a good location for this intense sampling because it can be efficiently and frequently accessed by trained personnel, there is historically good GBM pressure in this block of concords, and we are able to refrain from applying any insecticides that might disrupt GBM flight activity.

Technology Transfer Plan:

The PI (GL) and cooperator (JPR) work directly with grape growers in NY and both of us have formal extension responsibilities in grape pest management and viticulture. We will communicate results from this study directly with stakeholders through presentations at winter meetings and during the field season at coffee pot meetings. GL will also include results from this project in his annual spring entomology update made made available online as well as for inclusion in regional newsletters such as *Vineyard Notes.* In addition, GL will update information on chemical control for grape berry moth in the New York and Pennsylvania Pest Management Guidelines.

Attachments: relevant charts and graphs, photos etc.

Table 1. GBM insecticide efficacy trial conducted at CLEREL Railroad Concord Block during the 2023 growiong season. LSMean ± SEM for number of infested clusters out of 100 for the first two assessment dates and out of 50 clusters for third assessment date and LSmean ± SEM for total number of GBM stung berries out of 50 clusters at the third assessment date.

Treatment	**# Inf Cls out of 100 Cls** **8/1**	**# Inf Cls out of 100 Cls** **8/22**	**# Inf Cls out of 50 Cls** **9/12**	**Mean total stung berries** **per 50 Clusters** **9/12**
Control	3.4 ± 1.0	7.0 ± 1.5	43.2 ± 4.1	57.6 ± 7.3
Brigade	2.6 ± 0.9	2.7 ± 0.8	23.0 ± 2.6	32.6 ± 4.5
Danitol 2.4EC	3.7 ± 1.1	5.1 ± 1.2	36.9 ± 3.7	64.8 ± 8.1
Baythroid 2E	1.9 ± 0.7	2.5 ± 0.8	27.8 ± 3.0	33.6 ± 4.6
Mustang Maxx	2.1 ± 0.7	6.4 ± 1.4	23.8 ± 2.7	33.4 ± 4.6
Altacore Evo	2.2 ± 0.8	4.7 ± 1.1	19.8 ± 2.4	23.2 ± 3.4
Intrepid 2F	2.1 ± 0.7	3.3 ± 0.9	20.2 ± 2.4	24.8 ± 3.6
Delegate W	1.5 ± 0.6	1.4 ± 0.5	6.0 ± 1.2	5.3 ± 1.2

SECTION 3: (The goal of this research is to benefit growers and producers across New York State. Result summaries will be shared on the NYWGF website and via email newsletters. To that end, this section should be brief and written in terms understandable for the average grower and producer, as well as consumers and trade interested in our industry.)

Project summary and objectives:
(5 Sentence Max)

Growers continue to experience problems with grape berry moth (GBM), especially late in the season. Insecticide resistance and changes in flight phenology are two possible explanations. Using grapes at CLEREL, we assessed the efficacy of different pyrethroid insecticides commonly used by NY grape growers, plus several labeled alternatives. We also monitored female GBM activity in relation to degree day accumulation and predictions of the

NEWA GBM phenology model.

Importance of research to the NY wine industry:
In recent years, grape growers in NY have experienced significant damage by grape berry moth, especially late in the season and especially in the Lake Erie Grape Belt, leading to reduced crop loads, potential crop rejection at processing plants, and increased cluster rots. We tested two hypotheses to explain late season GBM damage; wide-spread resistance to pyrethroid insecticides rand changes in GBM flight phenology such that the NEW GBM phenology model is no longer accurately predicting spray timing. Pyrethroid insecticides are the most commonly use class for controlling GBM and if GBM populations have developed resistance to these products this would strongly suggest the need to shift spray practices to other classes. The NEWA GBM phenology model was developed over 20 years ago and due to various factors, we need to examine whether it remains useful and effective in determining the best timing for applying insecticides to control GBM.

Project Results/next steps: ENTER HERE

Although we found compelling evidence that GBM is resistant to the pyrethroid insecticide Danitol 2.4EC, at least the population at CLEREL, other pyrethoids remain relatively effective as well as other classes such as diamides (e.g. Altacore) and spinosyns (e.g. Delegate). Therefore, we do not believe wide-spread insecticide resistance is the main driver of late season GBM damage. Unfortunately, we did not capture a sufficient number of female GBM nor find a sufficient number of GBM eggs to test the reliability of the NEWA GBM phenology model in predicting spray timing at peak activity. Our next step, therefore, is to implement a much more intensive monitoring program in 2024, using a better trap for adult GBM and sampling many more clusters for GBM eggs.

Supporting attachments: (Choose a maximum of 1 supporting figure or table to demonstrate results if desired)