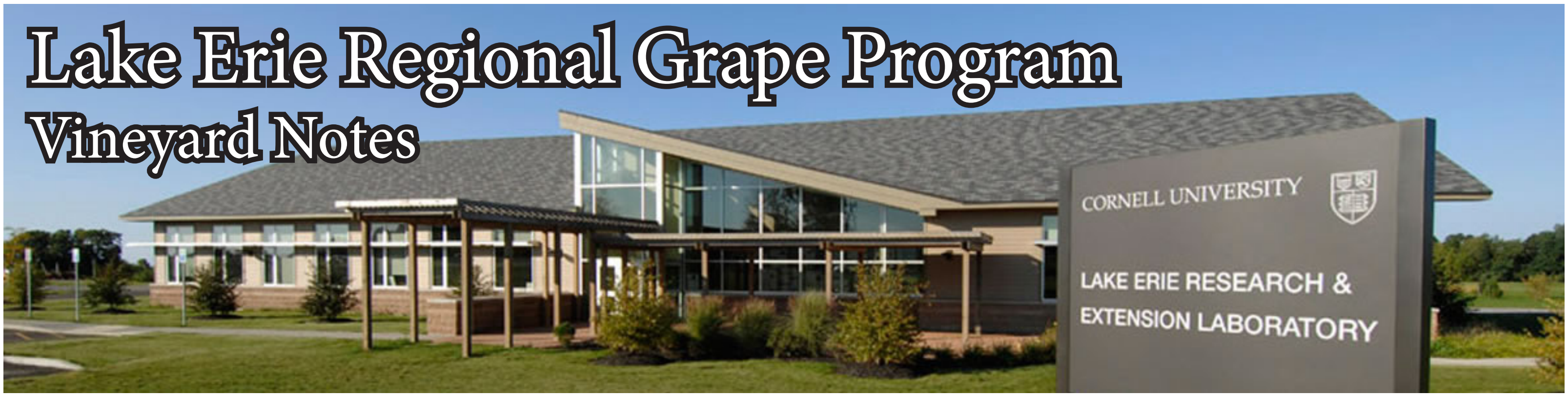
Lake Erie Regional Grape Program
Vineyard Notes



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Lake Erie Regional Grape Program

Coffee Pot meetings have begun. Check the Coffee Pot location schedule at the end of this newsletter!

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May, 2014

Grape Insect and Mite Pests- 2014 Field season
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Grape Insect and mite pests-2014 field season

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For the last 10 years I have put together a longer style newsletter article for the spring summarizing biology and management information for the key insect and mite pests affecting grapes in New York, Pennsylvania and surrounding state. This had been an annual occurrence, with the exception of last year. But I am back on track with the spring entomology update for 2014 field season. My goals for this review are to 1) highlight the main arthropod pests to keep in mind as you go through the field season, 2) provide some basic background on biology and ecology that helps in understanding alternative management tactics, 3) summarize the results of recent research, and 4) update methods of control.

The material I present here is based on the work of many people at Cornell and elsewhere. I want to thank Ted Taft Jr., Terry Bates, Kelly Link, Mike Vercant and the rest of the crew at Cornell Lake Erie Research and Extension Laboratory (CLEREL), Tim Weigle and Juliet Carroll of the NY IPM Program, Hans Walter-Peterson, Alice Wise, Dan Gilrein and Faruque Zamen from Cornell Cooperative Extension, Peter Jentsch from the Hudson Valley, Andy Muza from Penn State Cooperative Extension and Steve Hesler (my research support specialist here at Geneva). Steve, in particular, deserves thanks for his efforts in running the day-to-day operations of a busy lab and field research program. We have been working closely with Marc Fuchs and Pat Marsella-Herrick of the Department of Plant Pathology at Cornell on our mealybug/leafroll disease research, Terry Bates and Peter Cousins (formerly USDA ARS in Geneva) on grape phylloxera research, Elson Shields (Cornell Entomology) and Tim Weigle on our project investigating the use of entomopathogenic nematodes against Japanese beetle grubs and entomologists Mike Saunders, Jodi Timer (Penn State University) and Rufus Isaacs (Michigan State University) on our grape berry moth phenology research. We are very appreciative of the growers and other industry representatives for their many contributions ranging from letting us work on their farms to sharing their observations and opinions to financial support.

Update from NY and Pennsylvania Grape Guidelines and other chemical news

There are not too many changes to pesticide availability or use for grapes to report this year. The neonicotinoid insecticide thiamethoxam [the nonsystemic foliar formulation is Actara and the soil applied systemic formulation is Plantinum] includes grapes on the new labels. These are restricted use insecticides in New York and not allowed for use in Nassau/Suffolk Counties. Similar to other neonicotinoids, these products are particularly effective against sucking insects such as leafhoppers. Actara includes leafhoppers, mealybugs and Japanese beetle on the label. The Platinum label for grapes includes the same insects as Actara but adds grape phylloxera. Mustang Max [zeta-cypermethrin], a synthetic pyrethroid, has been recently labeled for use on grape in

New York and elsewhere. Unlike most of the other synthetic pyrethroids labeled for grapes, Mustang Max has a relatively short days to harvest restriction [1 day] as compared to Danitol [fenpropathrin] at 21 d and Brigade [bifenthrin] at 30 days. This becomes an issue for pests that require management near harvest such as grape berry moth and multi-colored asian lady beetle. Note that Baythroid [B-cyfluthrin] and Leverage [combination of B-cyfluthrin and imidacloprid] are also labeled for use on grapes and have shorter DTH. Like other synthetic pyrethroid insecticides, Mustang Max is broad spectrum and will kill beneficial insects and mites. Another reason to mention Mustang Max is that it is one of several insecticides that have received 2(ee) label recommendations for use against spotted wind drosophila or SWD (see below). The other insecticides that have received 2(ee) recommendations for SWD include Delegate [spinetoram with 7 DTH] and one formulation of malathion [Malathion 5EC, EPA #66330-220, 3 DTH]. Two other malathion products have Drosophila on the label [Malathion 57, EPA #67760-40-53883; Malathion 8 Aquamul, EPA #34704-474].

Review of key arthropod pests

Unlike the situation with grape diseases, where there is a clear big 4 or 5 diseases, for arthropods there is one key pest (grape berry moth) that is wide spread and causes serious damage most years and then a dozen or more pests that can create major problems but typically vary in abundance and pest potential from season to season and place to place (steely beetle, plant bugs, grape leafhoppers, potato leafhopper, grape phylloxera, grape rootworm, Japanese beetle, European red mite, and grape mealybug to name some). It's clearly a challenge to be able to recognize all of these potential pests and/or their symptoms and be familiar with different management options. Hopefully this review will be of use in this regard. I will focus on the grape pests that have a moderate to large potential to cause economic injury as we progress through the field season. More details on control measures can be found in the New York and Pennsylvania Pest Management Guidelines for Grapes: 2014. For greater focus on organic options, refer to the online organic grape guide [http://www.nysipm.cornell.edu/organic_guide/default.asp].

Before applying any chemical control measure make sure to read the label, taking into account things like potential for phytotoxicity, labeled pests, re-entry and days to harvest intervals, effects of pH, and compatibility with other pesticides. Arthropods are generally detectable in the field before they cause economic injury. Moreover, most insecticides and miticides work as eradicants as opposed to preventative agents. They can be quite expensive and some are harsh on beneficial insects and mites. Because of all these factors, it is advisable to monitor pest densities and only apply control measures when economically justified. To aid in correct identification of pests in the field, consider purchasing a handy pocket-sized guidebook put out by Michigan State University that covers many of the arthropod pests (and diseases as well) that can be problematic here in NY and Pennsylvania. Find out more at http://bookstore.msue.msu.edu/product/a-pocket-guide-for-grape-ipm-scouting-in-north-central-eastern-us-657.cfm. There are also a number of fact sheets on grape insect pests available through NYS IPM at http://nysipm.cornell.edu/factsheets/grapes/default.asp.

Let me start by providing an update on two new invasive species of insects that are now in New York and may become pests of grapes: the brown marmorated stink bug and the spotted wing drosophila.

Brown Marmorated Stink Bug. The brown marmorated stink bug (BMSB) originates from Asia (Fig. 1). It was accidently introduced into Pennsylvania about 15 years ago and has been spreading through the USA ever since, reaching NY a few years ago. This insect is a plant feeder (both immature stages and adults), using its soda straw like mouthparts to suck out plant juices. BMSB is particularly fond of feeding on fruits and seeds. Adult BMSB are good-sized insects, about ½ inch in length. It can be distinguished from other stink bugs by the banded antennae and light and dark bands along the margin of the abdomen. BMSB is known to feed on a wide range of plant species, including a number of fruit, vegetable, and field crops where it can cause serious damage. Pome fruit seem to be particularly vulnerable but they do feed on grapes. At high densities, BMSB can cause grape berries to shrivel and drop off (Fig 2). To date, though, these high densities have not been observed in the major grape growing regions of NY and western PA. As its name indicates, BMSB does produce an odor when threatened or disturbed and there has been some concern in the grape industry that the odor would taint juice and wine. Adults congregate in vineyards in the fall and can get accidently harvested with grapes. In the process they release their alarm odors, which can result in unpleasant aromas in juice. Observations by Dr. Gavin Sacks (Cornell University) and Joe Fiola (University of Maryland) indicate that the stink bug odor is offensive in the juice, but diminishes after fermentation. Even if unfermented, the odor tends to dissipate over time.


Fig 1. Photo: S. Hesler


Fig 2

BMSB has caused serious economic damage to fruit, vegetable, and field crops in the Mid-Atlantic States, including grapes. As noted above, however, we have not observed significant numbers in vineyards in the Northeast. There does appear to be an increase in reports of BMSB in homes and buildings, where they like to spend the winter. So this is a pest to keep an eye out for in the future. NY has several insecticides labeled for use against BMSB through 2(ee) label expansion (Danitol [fenpropathrin], Bathroid XL, Leverage 360, and Lorsban Advanced [chlorpyrifos]).

Spotted Wing Drosophila. Spotted Wing Drosophila (SWD) (also known as *Drosphila suzukii,* Fig 3) is a new invasive fruit fly that looks superficially like your every day vinegar fly *Drosophila melanogaster* of genetics fame. The name comes from the spots at the end of the wings in the male. Note the female SWD lacks these spots. Female vinegar flies typically lay eggs in damaged and/or overripe fruit. On the other hand, female SWD have very robust ovipositors (the rear end portion of the fly used for egg laying) and will lay their eggs in ripe, marketable fruit leading to damage and contamination with maggots.

Photo: M. Hauser

Fig 3, adult male SWD

SWD first showed up in California in about 2005 and has spread north into Oregon, Washington, and western Canada, south into Florida and in 2010 showed up in significant numbers in North Carolina and Michigan. SWD was first detected in the Northeast in 2011, and caused wide spread damage to vulnerable fruit crops like blueberries and raspberries in 2012 and 2013. Research by several of us in the eastern US indicates that SWD females will lay eggs in some cultivars of grape but this does not seem to be a common event in undamaged berries. We have reared relatively more SWD from damaged berries and even more of other species of fruit flies, particularly *D. melanogaster*.

Although the risk of direct damage by SWD to grapes seems relatively minor, we do have concerns about its potential, along with other fruit flies, in spreading rot diseases such as sour rot. Collaborative research between my lab and plant pathologist Wayne Wilcox's lab is under way to evaluate the role fruit flies have in spreading sour rot and whether targeting fruit flies with insecticides near harvest can be beneficial. Stay tuned. For more information on SWD visit http://www.fruit.cornell.edu/spottedwing/. Adult SWD are susceptible to a number of different insecticides including organophosphates (e.g. malathion), pyrethroids (e.g. Mustang Max) and spinosad type insecticides (e.g. Delegate or an organic alternative, Entrust). Since fruit flies are only a threat near harvest, those insecticides with relatively short DTH restrictions are the most helpful (see chemical news above).

Budswell to Bloom

Steely Beetle (grape flea beetle) and Climbing Cutworm. The steely beetle (small, shiny black or dark blue in color) overwinters as adults and become active as temperatures increase in the spring. A fact sheet on steely beetle can be found at http://nysipm.cornell.edu/factsheets/grapes/pests/gfb/gfb.asp.   They feed on swollen buds prior to budbreak with the potential of causing considerable damage under the right conditions; specifically when we get a prolonged swollen bud stage. Look for damage from steely beetle along the edges of the vineyard. Climbing cutworm (fact sheet at http://nysipm.cornell.edu/factsheets/grapes/pests/cc/cc.asp) refers to larvae of several species of Noctuid moths that cause a similar type of damage as steely beetle. Larvae hide during the day in the leaf litter or grass below the vine and then climb up into vine to feed on buds and very young shoots on warm evenings. Grass under the vine may increase problems from cutworms. Use about 2% bud damage from either species as a threshold for treatment. Some hybrids with fruitful secondary buds and that tend to overcrop can probably handle higher damage levels. Later in the season steely beetles lay eggs that hatch into larvae that do feed on grape leaves but this damage is not economically important. There are several effective, broad-spectrum, insecticides labeled for steely beetle and in grapes including Sevin, Imidan, Baythroid, Leverage and Danitol. Sevin, Danitol, Baythroid, Brigade, Leverage, and Brigadier are labeled for use against cutworms along with several more selective materials such as Altacor, Belt, and Delegate.

Soft scales and Mealybugs. Soft scales and mealybugs are sucking insects that spend part of their life-cycle on the canes or the trunk and part out on leaves or fruit. At high densities they can reduce vine vigor or contaminate grape clusters with their sugary excrement, which supports the development of sooty mold. However, the major concern with soft scales and mealybugs in our area relates to their potential to vector leafroll viruses, a serious disease of grapevines (a fact sheet on leafroll virus is available at http://nysipm.cornell.edu/factsheets/grapes/diseases/grape_leafroll.pdf). Soft scales in our area overwinter on canes as large immatures or young adults. At this stage they vary in shape and color but are typically brown or gray and look like bumps or large scales on the canes (Fig. 4). They have limited ability to move at this stage. As the spring progresses they complete development and begin laying eggs (mid-May to early-June or 260 to 360 GDD from January 1 in °F, based on our observations from 2009), often many hundreds to over a thousand per female. The eggs hatch into mobile crawlers that disperse out on to the foliage to feed. Most of the scale insects in our area have just one generation per year. As they mature during the season they move back to the canes to overwinter.

Fig. 4, photo S. Hesler

Grape mealybug overwinters on canes or trunks as a small immatures called crawlers, initially moving out from trunk wood to first or second year wood in spring (at budswell, see Fig 5). These crawlers like to hide under loose or cracked bark; look where one-year canes have been bent over trellis wire. As they become adults they move back to the trunk region to lay eggs. In 2009 this occurred on 11 June, at about 480 GDD, and the first instar crawlers (summer generation) were first observed on about 1 July or 800 GDD. These crawlers go on to mature, being found on various tissue including clusters. As they become adults they migrate back to the trunk regions to lay eggs, which mostly hatch and then spend the winter as first instar crawlers. Grape mealybug is oval-shaped with a white waxy covering that extends beyond the body all around as filaments. They also have a pair of extra long filaments that extend at the rear. Mealybugs and soft scales, but particularly mealybugs, are often tended by ants.

Fig. 5, photo S. Hesler

Mealybugs are able to move around the vine more than soft scales, although they are slow movers.

From the standpoint of reduced vigor, we do not believe most growers have sufficient soft scale or mealybug pressure to warrant control with insecticides. Their role as vectors of grapevine leafroll associated viruses (GLRaV) is another matter. Dr. Marc Fuchs, virologist at NYSAES, has quantified a small number of cases where grape leafroll disease has increased within a vineyard and vectors are likely responsible. Moreover, the causal viruses have been detected in both grape mealybug and soft scale collected from Finger Lakes vineyards. Note also that Marc found that the virus was not spreading in the majority of sites indicating that insect vectors are not playing a major role in most vineyard blocks with grape leafroll disease. Working with Marc, we have assessed virus in mealybugs at different times of the year in a vineyard with high incidence of GLRaV. In the fall, the overwintering crawlers do not have virus, even though the vine typically has high GLRaV titers at this time. However, by early spring prior to budbreak, we found that close to 80% of crawlers had virus, indicating some feeding on the vine must have occurred in late fall or possibly early spring. During the rest of the season we found high levels in all stages of mealybug except the eggs, indicating that the virus is not transmitted to the egg.

Can the spread of leafroll disease be slowed or prevented by controlling the vector? We completed an initial experiment in 2010 trying to test this out and basically found that moderately effective insecticides targeting the crawler stages (50% population reduction) did not reduce virus spread in a chardonnay vineyard block. It's possible a more effective insecticide would have produced better results. In 2011 we began a new study looking at the potential of Movento [spirotetramat] to control mealybugs and therefore slow disease spread. The systemic nature of Movento (it is taken up through leaves and translocated throughout the vine) delivers the insecticide to the mealybug so that it does not matter if they are hidden under bark. In our experiment we applied Movento twice at 6.25 fl oz per A rate, once prior to bloom and a second 30 days later. Movento was effective in reducing mealybug populations by about 70% in 2011 and to 0 by 2012 (Fig. 6). We observed half as many new vines infected in insecticide-treated plots compared to control plots in 2012 indicating that insecticide may play a role, along with rouging out of infected vines, as a management tool. However, this requires further experimentation.

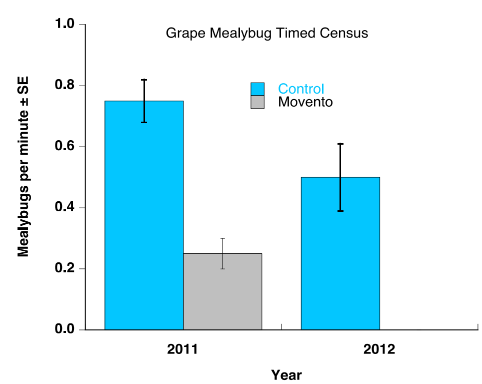

Fig 6. Movento provided good control of grape mealybug after two years in chardonnay vineyard

There are two windows of opportunity for controlling soft scale and mealybugs with non systemic insecticides (e.g. pyrethroids, foliar applied neonicotinoids). The first window is during the spring just before budbreak where the target is the overwintering stage. Dormant oil is often recommended at this time. The idea is the oil will smother the scale or mealybug. We have not tested oil against soft scale, although I suspect it would be effective since the soft scale overwinter out on the canes where they are more exposed and research done by other entomologists supports this. We obtained some data on efficacy of dormant oil just prior to budbreak for mealybug crawlers, however. Although we saw a decrease in mealybug numbers initially, overall it was not very effective, I believe because the overwintered crawlers are often well protected under bark on the trunk and canes at the time the oil is applied. Some of the other contact insecticides may be more effective at this time than oil, but we still need to conduct the trials. The second window is the crawler stage of the first generation. This occurs in mid or late June for soft scale and late June to early July for grape mealybug. The crawler stage is the most mobile stage and hence, you have the best chance of hitting them with insecticides. To make certain of timing, you can check underneath soft scales on canes in June or examine mealybug egg masses under loose bark on the trunk in later June with a hand lens and look for crawlers. In future research, we would like to examine the effectiveness of treating the crawler stage early in the season with a contact insecticide in combination with Movento during the growing season.

During the growing season carbaryl is labeled for European fruit lecanium, a species of soft scale on grapes, and an insect growth regulator called Applaud [buprofezin] is labeled for both soft scale and mealybugs. *Note that Applaud is not legal to use on Long Island*. A number of additional insecticides are labeled for mealybugs but not soft scales including Movento, Admire Pro [imidacloprid], Assail [acetamiprid], Brigadier [bifenthin, imidacloprid and other active ingredients], Leverage, Portal [fenpyroximate], Baythroid and Imidan [phosmet].


Fig. 7, photo J. Ogrodnick

Banded Grape Bug and **Lygocoris Bug**. Both species overwinter as eggs, presumable on grape canes, emerging as nymphs shortly after budbreak to 5 inch shoot growth. The banded grape bug (BGB) nymph is greenish to brown in color with black and white banded antennae (see Fig. 7). Nymphs of Lygocoris are pale green with thin antennae (Fig. 8) and about half the size of BGB. Nymphs of both species can cause serious economic damage by feeding on young clusters (buds, pedicel and rachis) prior to flowering. Adults, which appear close to bloom, do not cause economic damage and for at least one of the species (BGB), become predaceous on small arthropods. There is only one generation per season. Monitor for nymphs at about 5 inch shoot stage by examining flower buds on approximately 100 shoots along the edge and interior of vineyard blocks. These plant bugs are sporadic from year to year and from vineyard to vineyard; most vineyards will not require treatment. If present at relatively low numbers (1 nymph per 10 shoots), they can cause significant yield reductions and hence it is worth the time to check. Pay particular attention to vineyard edges. There are several


Fig 8 Lygocoris. Photo: J. Ogrodnick

insecticides labeled for use against plant bugs (Imidan, Danitol, and Assail [only BGB on label]).

Grape Plume Moth. This is another potential pest of grapes that overwinters as eggs in canes and emerges shortly after budbreak. Larvae typically web together young leaves or shoot tips and leaves to form a protective chamber from which they feed (Fig. 9). Sometimes the flower buds get caught up in the webbing and get fed on and this is where the potential for damage occurs. Research indicates 1) that damage tends to be concentrated on the vineyard edge near woods and 2) that it takes quite a few plume moth larvae to cause economic damage. **For Niagara grapes we were unable to detect a statistical effect on vines with 20% infested shoots compared to control vines where plume moth was killed with an insecticide.** Nevertheless, the trend was for reduced yield associated with high plume moth infestations (>20%). For higher value cultivars a somewhat lower threshold would be appropriate. Treatment of plume moth can be tricky for several reasons. First, the larvae develop very quickly and often have reached the pupal stage before you even recognize there is a problem. Second, larvae inside their leaf shelters are protected from insecticides. For these reasons, its important to monitor and treat for plume moth early in the season (before 10 inch shoot stage) using sufficient water to achieve good coverage. Danitol is the only insecticide labeled for use against grape plume moth in NY (2(ee) recommendation). Dipel can be used in PA as well as some other insecticides labeled for use on grapes.

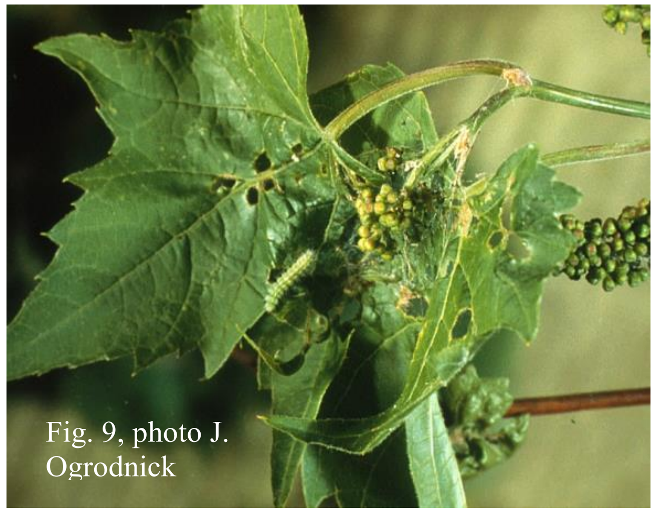
Fig. 9, photo J. Ogrodnick

Bloom to Mid-season

Grape Berry Moth. Grape berry moth is familiar to most grape growers in the eastern US. See our fact sheet on grape berry moth at http://nysipm.cornell.edu/factsheets/grapes/pests/gbm/gbm.asp. It is considered our most important arthropod pest and much of our current IPM strategy centers around its control. Grape berry moth (GBM) overwinters as a pupa in the leaf litter, emerging as adults in May and June to initiate the first generation of larvae that feed directly on young fruit clusters of wild and cultivated grapes. Depending on temperature, there can be one to three additional generations produced during the season. The larvae cause damage in three ways. First, they can reduce yield by 1) directly feeding on the flower clusters, 2) hollowing out the grape berry and 3) causing premature berry drop. Second, they contaminate the juice that can lead to rejection of entire loads at the processing plant. This is mainly a serious problem for native grapes grown for sweet juice. Third, their feeding activity on flowers/young berries (first generation) and green or ripe fruit (later generations) create good conditions for the development of bunch rots. This is particularly a serious problem for wine grapes, especially those with tight clusters.

GBM has been effectively managed over the past 15 years, while at the same time reducing overall pesticide use, through 1) the recognition that vineyards vary in risk to GBM, 2) the use of a reliable monitoring plan, and 3) judicious use of insecticides. Note that this approach to GBM management was developed for native grapes and although it can provide a useful guideline for wine grapes, more research needs to be done for these grape varieties. Categorizing vineyard blocks according to risk is a good place to start. High Risk vineyard blocks are characterized by having at least one side bordered by woods, being prone to heavy snow accumulation, and a history of GBM problems. Also, high value grapes are considered high risk. In the past we have recommended treating these high risk sites shortly after bloom (first generation larvae) and in late July/early August (second generation) and then scouting for damage in mid to late August to see if a third insecticide application is required. **Our recent research indicates that the first postbloom spray has little impact on end of season damage by GBM and can probably be skipped for low to moderate-value varieties.** Extremely high risk sites, regardless of crop value, may still benefit from the postbloom spray.

Determining the exact timing of the later insecticide applications (July and August) has proven tricky. However, we are making good progress toward developing a temperature-based phenology model to aid in timing management decisions. Currently we are using the bloom time of wild grape *Vitis riparia* as the starting point for the model (called the biofix), but we are researching other approaches including using estimates of emergence of adults from overwintering pupa and using bloom date of cultivated grapes such as Concord. The old method recommended a second-generation spray for high risk sites at the end of July or early August. But since development of insects (and plants) is primarily driven by temperature, this calendar-based system of timing may miss the second flight by a number of days. During the 2008 growing season the temperature-driven model, using estimates of degree day requirements, recommended a treatment in early to mid-July. A similar discrepancy occurred in 2009. The difference was even larger in 2010 and 2012 where temperatures and heat accumulations were well ahead of average. In our trials, damage at the end of the season has been lower or the same in vines treated according to the model compared to the standard timing even though vines were only treated twice compared to three times for timings based on risk assessment protocols.

We have sufficient confidence in the phenology model to make it available to growers via a web-based system (Network for Environment and Weather Applications) system. The forecast model can be found at the following web site as part of NEWA (http://newa.cornell.edu/ and look under pest forecasts). To use the model, you need to provide a starting point to begin accumulating degree days. We have found bloom date of the wild grape *V. riparia* is a pretty good indicator or biofix. The program asks that you provide a date for 50% bloom time of *V. riparia*. If this is hard to come by, the program will estimate it based on historical records. Using this date, the model accumulates degree days using the nearest NEWA weather station (you choose the weather station on the web site; several new weather stations in New York and surrounding states have been added to the system since 2012). At any given date, the model will provide the degree day accumulations from the biofix, a forecast of accumulation over the next several days, and pest management advice based on current accumulations. For example, as accumulation gets close to 810 degree days, the program notes that this is approaching the peak of the second GBM generation eggs and you are advised to apply an insecticide at near 810 for a high risk site and to scout for damage for low or intermediate risk sites. The NEWA forecast makes a distinction between insecticides that need to be consumed (e.g. Altacor [chlorantraniliprole], Belt [flubendiamide], Intrepid [methoxyfenozide, not allowed NY on grapes) and those that work mostly through contact (e.g. Brigade, Danitol, Baythroid, Sevin). Note that this model is still being worked on and should be used as a guide for making pest management decisions. However, it's an improvement over the calendar-based practice. If you try using the model this season, please forward feedback (good and bad) to me (gme1@cornell.edu), Juliet Carroll (jec3@cornell.edu), or Tim Weigle (thw4@cornell.edu) to help us improve future versions.

There are several options available for chemical control of GBM. See the guidelines for a full listing. The most commonly used products are the pyrethroid Danitol and the carbamate Sevin. Other broad-spectrum pyrethroids (e.g. Brigade, Baythroid and Mustang Max) are also effective. Leverage and Brigadier include both a pyrethroid that would provide control of GBM and a neonicotinoid that would provide good control of sucking insects like leafhoppers (see below). Imidan is also an effective broad-spectrum material but it is not quite as effective against leafhoppers as the pyrethroids. Moreover, the new label for Imidan has a 14 REI, which makes its use problematic. There has been some evidence of control failures with Sevin in the Lake Erie area due to resistance. Although such problems have not been documented in the Finger Lakes or Long Island, it is something to pay attention to and rotation among pesticides with different modes of action is a good idea when possible. The pyrethoids are effective materials as noted above, but I have concerns about their overuse leading to spider mite problems.

There are some additional, more narrow-spectrum, materials registered for use against GBM. Dipel is an organic option that has been around for a number of years. The toxin produced by the *Bacillis thuringiensis* (Bt) bacteria is specific to Lepidoptera. We have found that 2 applications of Bt per GBM generation, improves efficacy. Use sufficient water to achieve good coverage of fruit since the larvae must consume the Bt as they enter the berry for it to be effective. Good coverage is an issue for all the GBM materials. Another selective material from Dow AgroSciences, Delegate, has been effective in our trials. The insect growth regulator Intrepid, also from Dow, has an EPA label for use on grapes and is available in Pennsylvania and most other states and has proven quite effective in trials in NY, Michigan and Pennsylvania. Intrepid is a selective material active against the larvae and eggs of many species of Lepidoptera including GBM. Intrepid has fairly long residual activity and is an excellent choice for the second generation treatment in July as it may provide some control of the overlapping third generation as well. Intrepid is not allowed for use on grapes in NY. Finally several new anthranilic diamide insecticides have been labeled for use on grapes in the last several years (Belt SC, Altacor WG , Voliam Flexi WG [chlorantraniliprole + thiamethoxam], Tourismo SC [flubendiamide + buporfezin]). These materials are pretty selective for Lepidoptera such as grape berry moth and are reported to have pretty good residual activity. Altacor is also labeled for use against Japanese beetle. Similar to Intrepid, Delegate, and Bt, they work best when ingested by the first instar (recently hatched) larvae as they try to move into the fruit. Note that the diamides are not allowed on Long Island.

Mating disruption, using large releases of the GBM sex pheromone, is another control option to consider. The idea is to prevent mating by artificially releasing so much sex pheromone that males have difficulty locating the real female moths. This technique has been around for a number of years and is being used by a small percentage of growers. It is probably most effective for intermediate and low risk vineyards or in years where berry moth densities are low. However, these are the areas that often times do not require an insecticide application for GBM every year. Plastic twist ties impregnated with sex pheromone (Isomate GBM Plus) is the main method for releasing pheromone, but the product is hard to find. Dr. Rufus Isaacs at Michigan State University has been working with a new method of application of a sex pheromone called SPLAT GBM™. Basically the pheromone is mixed into a wax material that is sprayed on the foliage as small droplets. Each droplet acts like a small twist tie, releasing sex pheromone over an extended time period. Dr. Isaacs has had some success with this technique and there is a product labeled by EPA. It is not yet labeled in New York.

Grape Leafhoppers. There is actually a suite of leafhoppers that feed on grapes. The Eastern grape leafhopper *Erythroneura comes* (pale white in summer) mainly feeds on native cultivars like Concord (see fact sheet at http://nysipm.cornell.edu/factsheets/grapes/pests/glh/glh.asp) while several additional species feed on *V. vinifera* and hybrids including *E. bistrata/vitifex*, *E. vitis*, *E. vulnerata*, and *E. tricinta*. All these Erythroneura leafhoppers have similar life-cycles. They overwinter as adults and become active as temperatures warm up in the spring. They move on to grapes after budbreak, mate and begin laying eggs around bloom. There is one full generation during the summer and a partial second. In warm years there is a potential for a nearly full second generation of nymphs and adults. Both nymphs and adults cause similar damage; removal of leaf cell contents using sucking mouthparts causing white stippling (Fig. 10). Hence, moderate densities can reduce photosynthesis, ripening and yields. Severity of damage is increased in dry years, assuming irrigation is not available. The last few years have been low grape leafhopper years, although I am not certain why.

Sampling for leafhoppers corresponds to sampling for grape berry moth. At the immediate post bloom period sucker shoots should be examined for evidence of stippling (white dots on leaves caused by leafhopper feeding). If you see stippling throughout the vineyard


Fig. 10, photo J. Ogrodnick

block an insecticide treatment is recommended. Note that for vineyards at high risk of GBM damage, you may already be applying an insecticide at this time (10 day postbloom). If you use a broad-spectrum material such as Sevin or Danitol you will also control leafhoppers. The next sampling period for leafhoppers is mid July and focuses on abundance of first generation nymphs. At this time check leaves at the basal part of shoots (leaves 3 through 7) for leafhopper nymphs or damage, on multiple shoots and multiple vines located in the exterior and interior of the vineyard. Use a threshold of 5 nymphs per leaf. The third time for sampling for leafhoppers should occur in late August. This focuses on nymphs of the second generation. Follow a similar sampling protocol as used at the end of July, using a threshold of 10 nymphs per leaf. Note if you have made previous applications of broad-spectrum insecticides for leafhopper or GBM it is very unlikely that it will be necessary to treat for leafhoppers in late August. If you do not observe much stippling it is not necessary to more carefully sample for leafhopper nymphs.

Tim Martinson developed a modified approach to monitoring grape leafhopper based on the presence or absence of a certain amount of stippling of leaves (as depicted in a photograph on the scouting form) as the key to determining whether a leaf was "damaged" by leafhopper. His work showed that if you did the scouting in July while scouting for GBM you would head off any problems. At least in Concord we have not seen where it has been a problem late in the season if it was not above threshold in July. The link to the scouting form is http://nysipm.cornell.edu/publications/grapeman/files/hpprform.pdf. This could be used for those growers who do not want to count nymphs.

There are several choices of pesticides to use against leafhoppers. Sevin, or other carbaryl products, has been a standard for many years and is still effective except in isolated pockets of Concord and other native grapes around the Finger Lakes where we have observed control failures suggesting emergence of resistance. There are several effective alternatives to Sevin including Danitol, Brigade, Baythroid, Mustang Max (eastern grape leafhopper only) and the neonicotinoids Admire Pro, Alias 4F (generic version) and Assail. The carbamates (Sevin) and pyrethroids are hard on predatory mites.

Potato Leafhopper. The potato leafhopper is quite distinct from grape leafhoppers discussed above. One big difference is that potato leafhopper originates each year from the southeastern US (it can not successfully overwinter in upstate NY or PA) while grape leafhoppers are year round residents to our area. The overwintered, winged adults ride north on warm fronts and usually arrive in our area sometime after bloom. When and where they arrive is not very predictable and some years are worse than others. However, they tend to arrive on Long Island before the Finger Lakes or Lake Erie region. Vineyards adjacent to alfalfa sometimes get an infestation of potato leafhopper right after the alfalfa is mowed. The adult potato leafhopper is iridescent green and wedge-shaped while the nymph is usually green and moves sideways in a unique crab-like manner when disturbed. Instead of feeding on cell contents of leaves like grape leafhoppers, potato leafhopper adults and nymphs use their sucking mouthparts to tap into the phloem vessels (the tubes used by plants to transport products of photosynthesis) of a number of different species of plants including grapes. In the process of feeding, they introduce saliva into the plant that causes, to varying degrees, distorted leaf and shoot development (Fig. 11). Some cultivars of vinifera grapes seem particularly sensitive as does the French-American hybrid Cayuga White, but Labrusca cultivars also show symptoms. Feeding symptoms in grapes include leaves with yellow margins (more reddish for red Vinifera grapes) that cup downward. Often these symptoms are noticed before the leafhoppers themselves.

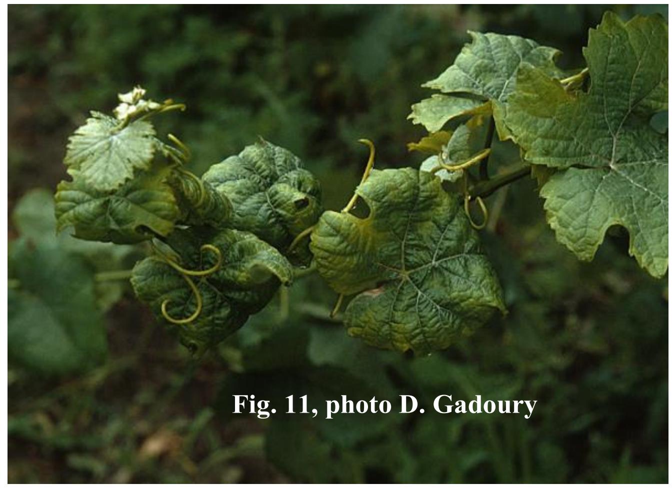

Fig. 11, photo D. Gadoury

Potato leafhopper is a sporadic pest, although it can be serious in some places and some years. Long Island seems particularly hard hit. We currently do not have good estimates for an economic threshold. We do know that shoots will recover from feeding damage once the leafhoppers are removed. Several insecticides are registered for its control in grapes including Sevin, Danitol, Leverage, Assail and Admire Pro. *Note that products containing imidacloprid are considered restricted use pesticides in NY (not PA)*. Potato leafhopper is fairly mobile and it may require several treatments over the season as new infestations occur.

Fig 12. A single grape phylloxera leaf gall, with the side of the gall opened to show adult female and many yellowish eggs. Photo by J. Ogrodnick.

Grape Phylloxera. Grape phylloxera is an aphid-like insect with a complex life-cycle that causes feeding galls on either roots or leaves. Leaf galls are in the shape of pouches or invaginations and can contain several adults and hundreds of eggs or immature stages (Fig. 12). Root galls are swellings on the root, sometimes showing a hook shape where the phylloxera feed at the elbow of the hook. At high densities, leaf galls can cause reduced photosynthesis. Root galls likely reduce root growth, the uptake of nutrients and water, and can create sites for invasion of pathogenic fungi. There is a wide range in susceptibility of grape varieties to both gall types. Labrusca-type grapes and vinifera grapes tend not to get leaf galls. Some hybrid grapes, such as Baco Noir, Seyval, and Aurora, can become heavily infested with leaf galls. Labrusca grapes will get root galls but these tend to be on smaller diameter, non-woody roots that may reduce vine vigor in some cases, but are not lethal. The roots of vinifera grapes are very susceptible to the root-form of phylloxera, including galls on larger, woody roots that can cause significant injury and even vine death. Indeed, most vinifera grapes grown in the eastern US are grown on phylloxera-resistant rootstock and this is the primary method for managing the root-form of phylloxera.

Motivated by the difficulties associated with needing to hill up around grafted vines each winter to protect some buds of the scion in the case of a severe winter, there has been some recent interest in growing vinifera vines on their own roots. Root-form phylloxera throws a potential monkey wrench to this strategy. We have been asking the question, therefore, whether we can manage root-form phylloxera well enough with insecticides to allow the use of own rooted vinifera vines in some circumstances. We have been looking at this issue in two ways. One is conducting insecticide efficacy trials. To date we have found that both Movento applied to foliage and the insecticide Admire Pro applied through a drip system or as a drench have been fairly effective in reducing galling on the roots of *V. vinfera* vines. Our second approach has been to study the potential of growing own-rooted vinifera (hence, not necessary to hill up) by using insecticides (Admire Pro) to mitigate negative affects of root form phylloxera. In 2008 we established a planting of Riesling vines at CLEREL that have either been grafted (Riparia Gloire) or on their own roots and are either treated with an insecticide to manage root phylloxera or left untreated. We now have several year's worth of data on growth and in 2011 and 2012, we obtained data on yield. Own-rooted vines when treated with insecticide had at least as much live periderm at the end of the 2012 field season as grafted vines while untreated own-rooted vines had significantly less periderm (Fig 13). Yield was slightly larger for vines treated with Admire Pro regardless of whether they were grafted or not. Lowest yields were found on control vines. Our results should be interpreted with caution. It does appear at least some of the negative effects associated with growing own-rooted vines can be mitigated over the short-term through the use of Admire Pro insecticide, at least at one site in New York. Although we did not test it in this study, I expect we would get similar results using Movento instead of Admire Pro. There are a number of good reasons to use rootstock with vinifera and some hybrid grapes, resistance to grape phylloxera being one of them. And the rootstocks we have been using in New York have worked very well and maintained resistance to grape phylloxera.

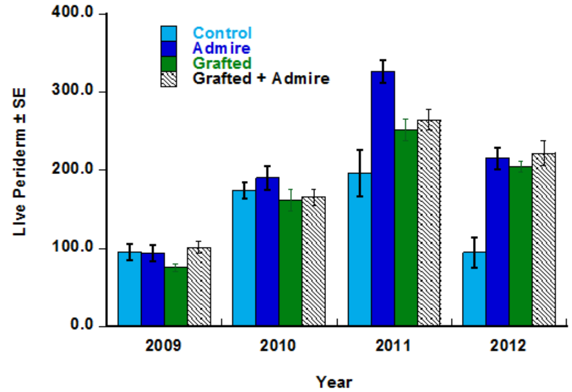

Fig. 13. Number of live periderm in the fall of 2009-2012 on grafted and own-rooted vines with or without Admire insecticide.

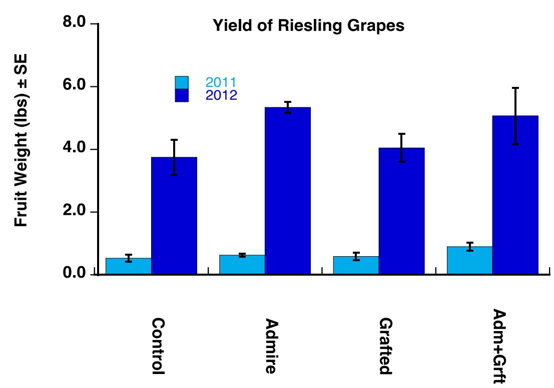

Fig. 14. Weight of clusters (yield) in 2011-2012 on grafted and own-rooted vines with or without Admire insecticide.

There are a couple of insecticides labeled for the control of leaf-form phylloxera, although we do not have a well-defined treatment threshold at this time. The neonicotinoid Assail (acetamiprid) and the pyrethroid Danitol (fenpropathrin) are also labeled for the leaf-form of grape phylloxera as is the systemic insecticide Movento. Soil applied Admire Pro is also systemic to the foliage and therefore will provide control of leaf-form phylloxera as well as some other sucking insects such as leafhoppers. Similarly, the neonicotinoid Platinum is also labeled against grape phylloxera. Leaf-galls first appear at low densities on the third or fourth leaf, probably originating from overwintered eggs on canes. The crawlers from these first generation galls disperse out to shoots tips and initiate more galls around the end of June or beginning of July. These second generation galls tend to be more noticeable to growers.

As noted above, imidacloprid applied through the soil (e.g. Admire Pro) is labeled for the grape phylloxera as is Platinum and can provide some control, especially when applied through a drip system. Movento, applied as a foliar spray, has also shown some reasonably good efficacy on root-form phylloxera in our trials both with *V. vinifera* vines, but also with Concord. Recall that Concord and other native grapes are moderately susceptible to root galling phylloxera. In a study conducted at CLEREL over the past several years, mature Concord vines at CLEREL were either treated twice with Movento (plus the adjuvant LI 700) or only with LI 700. In each of the years we found more phylloxera galls on control vines than vines treated with Movento. We also found a significant 18% increase in yield in the third year for vines treated with Movento. The difference was less in 2011 (12%), but the trend was in the same direction. We assume that the growth and yield increases are due to the reduced number of phylloxera galls on roots, but other factors could be involved. For example, Movento is also known to negatively affect nematodes. Overall, our data indicate some benefit to using Movento on native grapes. There are a number of questions remaining. How often does Movento need to be applied to maintain benefits? Can rates or number of applications be reduced while maintaining benefits? Will young vines benefit more or less from Movento compared to mature vines? What are the economics involved? To what extent will some of our hybrid grapes grown on their own roots benefit from Movento?

Grape Rootworm. Grape rootworm is a beetle in the Family Chrysomelidae (flea beetle family). Grape rootworm is actually a complex of several species, although the species most common in NY and PA is *Fidia viticida* (see fact sheet at http://www.nysipm.cornell.edu/factsheets/grapes/pests/grw/grw.asp). The adult (Fig 15) feeds on leaf material, creating characteristic chain like feeding damage. This damage is not economically significant. The adults emerge over the mid part of the season, starting around bloom time. After an initial bout of leaf feeding, they mate and the females lay clusters of eggs on older canes, often under loose bark. The eggs hatch and the larvae drop to the ground where they work their way into the soil to find fine grape roots to feed on.


Fig. 15

Feeding damage by larger larvae (Fig 16) cause reduced vine growth and vigor, increased vulnerability to stress, and reduced yields. At the turn of the 20th century, grape rootworm was considered one of the most important insect pests of grape in the Lake Erie Region.

Since the sixties, broad-spectrum insecticides targeting grape berry moth greatly reduced the impact of reduced grape rootworm populations. However, with the use of more selective materials and less use of insecticide overall in recent years, growers are observing more evidence of this pest, especially in the Lake Erie Region. Currently, only one insecticide is labeled against grape rootworm, carbaryl, targeting the adult stage prior to commencement of egg-laying. Females require a week or two pre-oviposition period, and hence, knowing when adults have emerged from the ground is critical to successful chemical control. Tim Weigle and I have initiated a new project to document the extent of the grape rootworm problem in the Lake Erie Region, to better understand the phenology of emergence of adult grape rootworm, and to test the efficacy of alternative control methods, including the use of entomopathogenic nematodes.

Spider Mites. There are two species of spider mites that attack grapes in the Eastern US, two-spotted spider mite (TSSM) and European red mite (ERM), but ERM typically is the more common. It is important to know the difference between the two species since some miticides are more effective against one than the other. Problems with spider mites tend to be more serious in hot and dry years.

Fig. 17. Highly magnified. Photo by J. Ogrodnick.

An important difference between the two spider mite species is that ERM overwinters on grape as eggs in bark crevices of older wood while TSSM overwinters as adult females, probably in ground cover. As the name indicates, ERM is reddish in color and lays red eggs (Fig. 17). Adult female TSSM tend to have large black spots on the top of the abdomen but this is a pretty variable. TSSM eggs are clear to opaque. TSSM tends to stay on the bottom side of leaves and produces obvious webbing while ERM can be found on either side of the leaf and does not produce much webbing. Both species have the capacity to go through a number of generations during the season. However, we typically do not see significant populations and damage until mid to late summer. This is especially true of TSSM since they do not start off on the vine.

Fig. 18. Riesling leaves with and without ERM feeding damage.

Because of their small size, it is often difficult to know if you have mites. Foliar symptoms (bronzing of leaves, see Fig 18) are one clue, although if you have wide spread, obvious symptoms then economic damage may already be occurring. The working threshold for spider mites (TSSM and ERM combined) in our area is 7 to 10 mites per leaf, although this will vary depending on health of the vineyard, crop load, value of the grape, etc. In summer, I suggest sampling at least 50 mid-shoot leaves from both the edge and the interior (25 leaves each) of a vineyard block, examining both sides of the leaf. A hand lens will be necessary to see the mites for most people. Even with a hand lens, it is challenging to count the mites. Thus, we recommend estimating the proportion of leaves infested with mites and use something like 50% infested as a treatment threshold. A leaf is considered infested if it has one or more spider mites. Remember to keep rough track of which species is most common.

We have several chemical options available for mite control in New York and Pennsylvania: Vendex [fenbutatin-oxide], Agri-Mek and several generics [abamectin], Nexter [pyridaben] (not on Long Island), Acramite [bifenazate], JMS Stylet Oil [aliphatic petroleum distillate], Zeal Miticide1 [etoxazole], Onager or Savey [hexythiazox], Danitol and Brigade. A new miticide, Portal, has also recently been labeled for spider mites on grapes. Read labels carefully. JMS Stylet Oil is not compatible with a number of other products including Captan, Vendex, and sulfur. Also, although Stylet Oil can help with mite problems, it is not likely to provide complete control in problem vineyards. Nexter is very effective against ERM but higher rates should be used for TSSM. Nexter is pretty soft on predatory mites except at high rates. It also provides some partial control of leafhoppers. Agri-Mek currently has TSSM on the label but not ERM, although in apples both species are on the label. Acramite includes both TSSM and ERM, although it calls for higher rates for ERM. Acramite and Agri-Mek are relatively soft on beneficial arthropods. The new label for Zeal miticide 1 includes both ERM and TSSM in NY whereas the old label only had TSSM. You need a 2(ee) recommendation, which is readily available, for use against ERM with older material. Since Zeal miticide 1 affects eggs and immatures, it is advised to apply before populations reach damaging levels to give the material time to work. Similar advice can be applied to Onager, Savey and Portal. Zeal miticide 1, Onager, Savey, and Portal are relatively safe for beneficial arthropods. Danitol and Brigade (two-spotted only) are broad-spectrum insecticides that also have fairly good miticidal activity.

Spider mites are often thought of as a secondary pest. In other words, something must happen in the vineyard that disrupts their natural control by predators, particularly predatory mites, before their populations can increase to damaging levels. Several broad-spectrum insecticides used in grapes, including Danitol, Brigade, Brigadier, Leverage, Baythroid and possibly Sevin can also suppress predatory mites. Since Danitol and Brigade have miticidal activity they would not be expected to flare spider mites in the short term. However, in the past, spider mites have been quick to develop resistance to frequent use of pyrethoids. This may or may not happen but it is worth keeping in mind. One of the first things to watch out for is initial good suppression of mites followed by a resurgence indicating the spider mites recovered more quickly than the predatory mites. Overall, paying attention to conserving predatory mites can pay economic dividends since miticides are quite expensive.

Japanese Beetle. By and large, Japanese beetle populations have not been as bad as they were a few years ago. I don't really have an explanation. The adults (1/2 inch body, metallic green in color, Fig 19) seem to have a fondness for grape foliage, but also feed on a number of other plant species. Although the adults have broad diets, the larvae (Fig 20) feed principally on the roots of grasses. Hence, we often find the most significant problems with adult Japanese beetles in areas surrounded by an abundance of turf. The fact that most vineyards have sod row middles may exacerbate problems with adults. Indeed, we (myself, Tim Weigle, and Elson Shields) have been investigating the use of entomopathogenic nematodes (soil inhabiting, insect feeding) against Japanese beetle larvae in sod row middles as a way to reduce adult Japanese beetle populations and damage. Results are still be collected, but establishment of beneficial nematodes appears good and we are seeing a trend toward reduced numbers of adult Japanese Beetles in vineyard blocks where nematodes were released compared to control blocks.

Fig 19. Photo: Steve Hesler

Fig. 20; Mature Japanese beetle larva (grub). Photo: S. Hesler.

The adults emerge from the soil in mid-summer and begin feeding and then mating and egg-laying. The feeding damage caused by adults can be quite extensive, perhaps exceeding 10 or 20% of the foliage. Fortunately, grapes are fairly tolerant of this type of feeding at this time of the season. Research in Kentucky and also in Michigan examining the impact of foliar damage by Japanese beetle on grape productivity, fruit quality and yield indicate that both natives and vinifera grapes can tolerate some leaf damage. The exact amount is hard to nail down but it seems that up to 15 or 20% leaf damage has little impact. Note, though, that the actual impact of leaf feeding will depend on a number of factors including health and size of the vine and the cultivar. Moreover, if it is a high value cultivar then the economic injury level will be lower compared to a lower value cultivar. Young vines may be particularly vulnerable in that they have fewer reserves to draw upon to recover from damage. You should make a special effort to regularly monitor vines inside growth tubes for Japanese beetles and apply insecticides directly into the tubes if treatment is warranted. Grape cultivars do seem to vary in resistance to Japanese beetle. Thick leaved native cultivars are the most resistant followed by hybrids and then *V. vinifera*.

There are several insecticides labeled for use against Japanese beetles on grapevines. These all are roughly similar in efficacy but they do vary in impact of beneficial arthropods like predatory mites. I mention this because multiple applications of something like Sevin could depress predatory mite populations and promote spider mite outbreaks. Also keep in mind that the adults are very mobile and can re-colonize a vineyard block after being treated with an insecticide. Regular monitoring of the situation is recommended.

Multicolored Asian Lady Beetle (MALB). MALB was introduced into the US from Asia to help control aphid pests. It has spread to many areas in the southern and eastern US and into Ontario Canada and has generally been an effective biological control agent. However, it has the habit of moving into vineyards in the fall near harvest time. When disturbed, the adult MALB releases a defensive chemical out of its joints (methoxypyrazines) that helps it ward off enemies. Unfortunately, the defensive chemical has a nasty taste and offensive odor for people at very low detection levels that gets carried into the juice and wine. Relatively low densities of MALB (10 per grape lug) can cause off-flavors in juice and wine. MALB is sporadic both in where it shows up during a given year and from year to year. Vineyards in the Niagara Peninsula in Canada appear particularly vulnerable. Also, vineyards adjacent to soybeans in a year when soybean aphid is abundant may be more vulnerable. I recommend that you scout your vineyards before harvest to see if MALB is present. The economic injury level for Concord grapes has been established at about 6 beetles per 10 pounds of fruit by National Grape Cooperative. For wine grapes, something in the range of 5 beetles per 25 clusters could result in off-flavors. There could be several different species of ladybugs in your vineyard but probably only MALB would be at high densities on the clusters. You can recognize MALB by the black markings directly behind the head that look like an M or W depending on which direction you look from (Fig. 21). The color or number of spots is variable. I would also pay attention to the crop updates of the regional grape extension programs to see if and when MALB is turning up in vineyards. Late harvested varieties are usually the most vulnerable. The abundance of MALB appears to be closely tied to the abundance of soybean aphid, which tends to alternate between high and low years.


Figure 21. Photo by Scott Bauer, USDA

There are a few chemical approaches to managing MALB in New York: Danitol [fenropathrin], Mustang Max, Aza-Direct and Evergreen [natural pyrethrins]. To use Danitol in New York for this purpose, you need to have the 2(ee) label. However, a 21 days to harvest restriction limits its usefulness. Mustang Max, another pyrethroid, includes MALB on the grape label and only has a 1 DTH restrictioin. Aza-Direct, which is based on the active ingredient azadirachtin from the neem tree, appears to have a repellent effect on MALB, again based on trials by Roger. Based on a trial a few years ago by Tim Weigle, Evergreen appears to have both toxic and repellent effects on MALB. Aza-Direct and Evergreen have no days to harvest restrictions. For Aza-Direct, pH in spray water should be 7 or less (optimum is 5.5 to 6.5). The neonicotinoid insecticide Venom [dinotefuran] has shown good efficacy against MALB (both toxic and repellent) in trials conducted by Rufus Isaacs at Michigan State University. It only has a 1 day to harvest restriction. Venom is labeled for use in PA but not NY. Recenlty a 2(ee) label expansion for Admire Pro has also been approved. Admire Pro has a zero day to harvest interval when applied to foliage. Imidacloprid has both toxic and repellent effects on MALB similar to Venom.

Bottom line comments

The bottom line message for insect and mite pests is to regularly monitor your grapes. There is no guarantee that a particular pest will show up in a particular year or at a particular site. Moreover, you typically have time to react using an eradicant if a pest does reach sufficient densities to cause economic damage. Knowledge of what is present will lead to better management decisions.

During the period after budbreak to bloom **plant bugs (banded grape bug and *Lygocoris inconspicuous*)** represent the greatest insect risk for yield loss. Most vineyard blocks escape serious damage from plant bugs most years but every year I find sites with significant numbers that managers don't know about. Monitor for the nymphs at about 10-inch stage, keying in on the flower buds. If you find more than one nymph per 10 clusters, consider an insecticide treatment such as Sevin or Danitol or Assail. Remember that only the nymph stage causes significant damage. Treatments close to bloom are probably too late to do much good since most nymphs have completed development and become adults. Other than these plant bugs, there are few insect pests between budbreak to bloom period that can cause significant harm. A caveat to this is for sites, often with sandy soils, that are prone to **rose chafer,** which emerge around bloom time. The light-brown adult beetles feed on flowers and young clusters and can reduce yields. **Grape rootworm** also comes out around bloom or a little after. Adult beetles cause characteristic chain like feeding damage on lower leaves. It's the larval stage that causes the significant injury, feeding on roots. We have been observing more evidence that this pest is becoming an issue for grape growers, especially in the Lake Erie Region. Chemical control targets the adult stage.

Mid-summer is the time where insects and mites often create the most concern. On the top of the list is **grape berry moth**. Traditionally for high-risk sites we have recommended an insecticide during the postbloom period to kill first generation larvae. But except for super high-risk sites or high value varieties, our research indicates this postbloom spray is not useful. Focus should be on the second-generation larvae in mid-summer and late summer damage from a combination of second and third generation larvae. Timing of insecticides is important for many of our new insecticides since they need to be ingested as the young larva penetrates the berry. The practice of using calendar date to determine timing of scouting and insecticide control for second and third generations is problematic. **Rather, temperature is the primary determinant of insect and vine phenology. Check out the temperature-based phenology forecast model available online at http://newa.cornell.edu/ (look under pest forecast models for grape berry moth).** This model can help you better time the occurrence of grape berry moth flight activity. It also provides useful pest management sign posts and guidelines. The model uses bloom date of wild riverbank grape *V. riparia* as a biofix (starting point for accumulating degree days to be used to predict timing). This generally occurs about a week before Concord bloom. If you don't know the bloom date of wild grape, the model will estimate it based on historical data. Also remember to follow pest updates emailed out from your regional grape extension program. Use a long residual material (Intrepid is a good option for PA) for the second generation if available since we have observed a large overlap between the second and third generations later in the summer. Also good coverage of the fruiting zone is essential. Continue to monitor damage and be particularly vigilant in years with above average temperatures during the first half of the season. Above average temperatures in the first half of the season increases the chances of a third or even partial fourth generation of moths (this is what occurred in 2010 and 2012). You may need to add an additional insecticide in late summer. Insecticides with shorter days to harvest restrictions may need to be used at this time.

Two additional comments on grape berry moth. First, damage from berry moth is often concentrated on the edge of the vineyard. When rows run parallel to the wood edge, insecticides can easily be applied to only the first six rows thereby saving time and money. Second, for wine grapes, feeding by berry moth can exacerbate problems with bunch rots. Hence, the tolerance (threshold) for grape berry moth damage for varieties prone to rots should be lower than varieties less prone to rots.

Two other pests are worth mentioning for the mid-summer period. One is conspicuous and you probably will be temped to spray for it even if it does not make economic sense to do so because the damage looks bad. I am speaking of **Japanese beetle**. Granted, these guys can do a lot of feeding during July. But remember that for a healthy vineyard, especially a vigorous one, the vines can probably handle conservatively 15% foliar damage. If you do need to treat, be aware of the potential for some insecticides to flare spider mites. **Spider mite** is the second pest I wanted to mention. They are actually not very conspicuous and as a consequence growers may miss them. Be on the look out for yellowing or bronzing leaves and generally low thrift during the hot days of late July and August. Use a hand lens and scan both sides of mid-shoot leaves for European red mite or possibly two-spotted spider mites. If you are uncertain what to look for bring suspicious leaves into the nearest extension office for a second opinion. You can also contact me at my office (315-787-2345) in Geneva or my email at gme1@cornell.edu. Threshold for mites will depend on health of the vines as well as value but a useful guide is 50% of leaves infested with at least one mite. A sample of 60 leaves per block is recommended.

Toward harvest keep an eye out for **multicolored asian lady beetle (MALB)**. This normally beneficial insect can become a pest at this time of year by congregating in the clusters at harvest. Its primarily been an issue for late harvested varieties. The adult beetle releases a noxious chemical when disturbed (such as by harvesting the fruit) and this can taint wine and juice. Their populations have been fairly low in recent years although we are overdue for a big year. In the past, Lake Erie vineyards and the Niagara Peninsula have been particularly vulnerable. Also vineyards near soybeans. Keep an eye out for email alerts from your regional grape extension programs. The other late-season insect pest we have concerns about is **fruit flies**, both the invasive spotted wing drosophila and regular vinegar flies. Our concern centers on their role in spreading sour rot bacteria. There is much research to be done on this topic before we are ready to make concrete management recommendations, however.

In summary, there is a seasonality to pests and checking the electronic updates from your regional grape extension programs is an excellent way to stay on top of what you should be on the look out for during the season. Generally speaking we have good chemical control options available for most arthropod pests if necessary. But be smart about using them. Pay attention to label restrictions and review recommendations in the pest management guidelines. Rotate among materials with different modes of action to reduce development of resistance. Be aware of consequences of your choice of pesticides on natural enemies. The cheapest material to apply on a per acre basis may not always result in the lowest cost because of unintended consequences and/or the need for repeated applications. Most important, only use pesticides or other control options when it makes economic sense to do so (monitor and apply economic thresholds where available). If you have questions or concerns please let me know.

2014 LERGP Coffee Pot Locations

May 7th	10:00am	Ann & Martin Schulze 2030 Old Coomer Rd. Burt NY 14028
May 14th	10:00am	John Mason 8603 W. Lake Rd. Lake City PA 16428
May 21st	10:00am	Leo Hans 10929 W Perrysburg Rd. Perrysburg NY 14129
May 29th	10:00am	Bob & Dawn Betts 7365 E Rte 20. Westfield, NY 14787
June 4th	10:00am	Clover Hill Farms- 10401 Sidehill Rd. North East, PA 16428
	2:00pm	Brant Town Hall-Back entrance 1272 Brant North Collins Rd. Brant NY 14027
June 11th	10:00am	The Winery at Marjim Manor, 7171 East Lake Rd. Appleton NY 14008
	2:00pm	Chris Ortolano-2053 Lake Rd. Silver Creek NY 14136
June 18th	10:00am	Dan Sprague- 12435 Versailles Plank Rd. Irving NY 14081
	2:00pm	Evan Schiedel/Roy Orton -10646 W Main Rd. Ripley NY 14775
June 25th	10:00am	Tom Tower 759 Lockport Rd.Youngstown NY 14174
	2:00pm	Jim Pratz- 9210 Lake Rd. North East PA 16428
July 2rd	10:00am	Peter Loretto- 10854 Versailles Plank Rd. North Collins NY 14111
July 9th	10:00am	Kirk Hutchinson- 4720 W Main Rd. Fredonia NY 14063
July 16th	10:00am	Earl & Irene Blakely 183 Versailles Rd. Irving NY 14081
July 23th	10:00am	Fred Luke- 1755 Cemetery Rd. North East PA 16428
July 30th	10:00am	Carl Vilardo- Walker Rd. Westfield NY 14787

Lake Erie Regional Grape Program

6592 West Main Rd., Portland, NY 14769 (716) 792-2800
662 North Cemetery Road, North East, PA 16428-2902 (814) 725-4601
850 East Gore Road, Erie, PA 16509-3798 (814) 825-0900

Cooperatively yours,

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