# Grape Insect and Mite Pests-2018 Field Season

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My goals for this review are to 1) highlight the main arthropod pests to keep in mind as you go through the field season, including new invasive insects that pose a risk to grapes, 2) provide some basic background on biology and ecology that helps in understanding alternative management tactics, 3) summarize relevant results from recent research, and 4) provide an update on changes in chemical control options. I want to acknowledge and thank my Cornell colleagues and collaborators at Geneva, Portland, and Ithaca and the extension educators out in the grape growing regions of New York and Pennsylvania.

**Update from NY and Pennsylvania Grape Guidelines and other chemical news**

There have not been any major additions or losses of insecticides and miticides this past year, although updated labels have been approved for a few products. One product addition was Hero, which includes two different active pyrethroid ingredients, zeta-cypermethrin, the active ingredient in Mustang Maxx, and bifenthrin, the active ingredient in Brigade and a number of other generic products. Hero has a broad-spectrum of insecticidal activity and is labeled for us against several grape pests including grape berry moth, eastern grape leafhopper, Japanese beetle, cutworms, and multicolored asian lady beetle (MALB). Because of the bifenthrin, Hero has a 30-days to harvest restriction which limits its usefulness for late season pests such as grape berry moth and MALB. An updated label for Movento [spirotetramat] was released in 2017 that included suppression of european fruit lecanium scale for grapes. Both soft scales such as european fruit lecanium scale and grape mealybug have been on our grape pest management radar for a number of years primarily because they are known vectors of grape leafroll disease, a significant issue for *V. vinifera* grapes. We have data from the Finger Lakes showing Movento being very effective in controlling grape mealybug populations, including some evidence that this control will slow down spread of grape leafroll (see update below under mealybugs). We have not tested the efficacy of Movento against soft scales.

**Spotted Lanternfly, a new invasive insect**

Threats from invasive insects are the new normal in this age of global trade. Over the past several years the fruit industry has been dealing with brown marmorated stink bug and spotted wing drosophila and now there is spotted lanternfly. Native to parts of Asia, this phloem-feeding planthopper was first discovered in the USA in the fall of 2014 in Berks County, PA. It can build to very large numbers and can cause significant injury to ornamental plants, native perennials, fruit trees and grapes. Indeed, in Korea, where it is also an invasive, spotted lanternfly is a serious pest of grapes. You can read a nice overview of spotted lanternfly and the risks it poses for grapes and treefruit crops by Dave Biddinger, Ed Rajotte and Juile Urban, entomologists at Penn State, at the following website: https://extension.psu.edu/spotted-lanternfly-on-grapes-and-tree-fruit.

Spotted lanternfly has reached incredibly high densities in the main area of the invasion in PA, but it is spreading with recent discoveries in Delaware and a dead adult found in New York (Delaware County). Since spotted lanternfly has not yet become established in NY, I have not initiated any research on its biology and control, but PA entomologists have several ongoing research projects, including some work on control options. What is key for most grape growers is to become familiar with the signs and symptoms of spotted lanternfly and to be on the lookout for it. Detecting it early is essential. More information on spotted lanternfly will be forthcoming in extension newsletters and at grower meetings.

**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. 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. For completeness sake, I am including information on some pests that is pretty much a repeat from 2016. Pay particular attention to updated information on grape mealybug, grape cane gallmaker, grape rootworm, and fruit flies and their contribution to sour rot. More details on control measures can be found in the New York and Pennsylvania Pest Management Guidelines for Grapes: 2018. For greater focus on organic options, refer to the online organic grape guide [https://ecommons.cornell.edu/bitstream/handle/1813/42888/2016-org-grapes-NYSIPM.pdf?sequence=5&isAllowed=y].

Before applying any chemical control measure make sure to read the label, taking into account things like mode of action (IRAC code), potential for phytotoxicity, labeled pests, re-entry and days to harvest intervals, effects of pH, and compatibility with other pesticides. Also keep in mind that in NY, the pest needs to be on the registered product label to be used, unless a 2(ee) exemption has been approved and is in hand. This extra requirement is not the case in PA and most other states. 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.

## 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 https://ecommons.cornell.edu/bitstream/handle/1813/43101/grape-flea-beetle-FS-NYSIPM.pdf?sequence=1&isAllowed=y. 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. By the time you read this you likely will have advanced past the period of vulnerability to steely beetle. Climbing cutworm (fact sheet at https://ecommons.cornell.edu/bitstream/handle/1813/43085/climbing-cutworms-FS-NYSIPM.pdf?sequence=1&isAllowed=y) 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 the 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 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, Baythroid, Leverage and Danitol. Sevin, Danitol, Baythroid, Brigade, Mustang Maxx, Hero, Leverage, and Brigadier are labeled for use against cutworms along with several more selective materials such as Altacor, Belt, Delegate and Dipel.

**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 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 viruses that cause grape leafroll diseas. This is a serious disease of *V. vinifera* grapevines (a fact sheet on leafroll is available at https://ecommons.cornell.edu/bitstream/handle/1813/43103/grape-leafroll-FS-NYSIPM.pdf?sequence=1&isAllowed=y). Soft scales and mealybugs are able to vector grape leafroll disease even at low densities. Indeed, the more we look, the more vineyard sites we find that have either soft scales or grape mealybug or both types at low densities. 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. They have limited ability to move at this stage. As the spring progresses they complete development, mate and begin laying eggs (mid-May to early-June), often many hundreds to over a thousand per female. The eggs hatch into mobile crawlers that disperse out on to the foliage to feed. The significant species of soft scales in our area that are found on grapes have just one generation per year. As they mature during the season they move back to the canes to overwinter.

Grape mealybug overwinters on canes or trunks as crawlers (first immature stage after hatching from eggs), moving out from trunk wood to first or second year wood in spring (at budswell, see Fig 1). 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 (around mid-June). The first instar crawlers (summer generation) are observed around the beginning of July. 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 (mid-August), which mostly hatch and then spend the winter as first instar crawlers.

**Fig. 1, photo S. Hesler**

Working with Dr. Marc Fuchs, virologist at NYSAES, we have documented that grape leafroll disease has increased within a vineyard over time in several different vineyard blocks in the Finger Lakes indicating that insect vectors are likely responsible. Note that the virus is not passed on to the eggs from the female. The newly hatched crawler must acquire the virus when it feeds to be able to transmit to virus. Once acquired from an infected plant, if the insect moves on to an uninfected vine before it molts, it can spread the disease. Since crawlers are the most active stage of both mealybugs and soft scale, they are the most likely stage to spread the disease. Our research has shown that overwintering crawlers in November were generally not infected with grape leafroll associated viruses (GLRaV) even though they were on infected vines. However, we discovered that in April/early May the now overwintered crawlers were infected at high levels (>70%) suggesting they had fed on the vine and acquired the virus sometime between late fall and late April prior to budbreak. We hypothesize that the crawlers may be particularly important in spreading the virus within a vineyard during the spring since there is little or no foliage to impede movement from vine to vine.

Can insecticide be used to slow the spread of leafroll disease within a vineyard? Experiments conducted over the past several years suggest that using an effective insecticide against grape mealybug, such as Movento [spirotetramat], can slow, but not stop, the spread to some degree. The results were not overwhelming, however, and disappeared the year after we stopped applying Movento. It is possible that combining effective chemical control of the vector with rogueing out of infected vines may suppress or stop the spread of the disease. We are testing this idea at a vineyard in the Finger Lakes that has a low level of disease and a moderate population of mealybugs. We have four treatments (with replication): rogue out leafroll infected vines and the two neighbor vines on either side within a row (the recommended approach when disease incidence is below 25%), treat vines with insecticide (Lorsban Advanced at budbreak and Movento during the season), rogue and treat with insecticide, or do nothing (control). We are entering into the third year of this experiment. So far, we have documented excellent control of mealybugs in plots treated with insecticide (Fig 2). It still premature, however, to determine if any of the treatments has slowed or stopped the spread of the disease. Stay tuned.

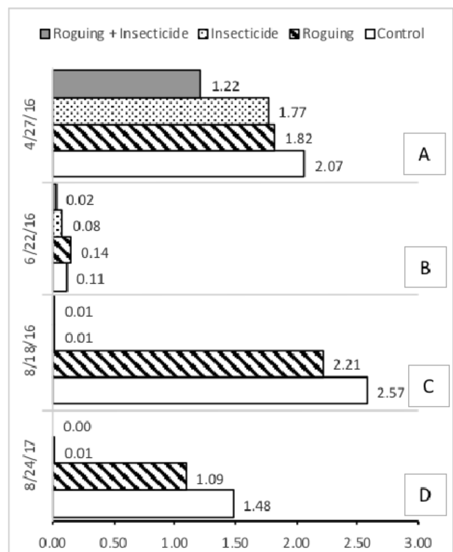


Figure 2. Mealybug(MB) survey results (mean MB/minute) from trial evaluating removal of GLRaV infected vines and management of grape mealybug as a model for commercial *V. vinifera* vineyards with a GLRaV incidence of >25%. Vines were scanned for set periods of time and presence of MB at various life stages were recorded. Insecticide treatments with Lorsban Advanced and Movento were initiated after the 27-Apr sample. 2016-2017, Finger Lakes Region, NY. Dates on Y-axis represent sampling dates. Frequency of MB incidence is expressed on the X-axis in MB/min.

There are multiple insecticides labeled for use against grape mealybug. Fewer options are labeled for soft scale. See Grape Pest Management Guidelines for a full listing. For both pests, there are two times during the season where chemical control is potentially effective: in the spring at or just prior to budbreak targeting the overwintering stage of the insect and during the growing season right after egg hatch targeting the crawler stage (first instar immature). A delayed dormant oil application has been shown to be effective in controlling soft scale in other crops and I would expect it would work in grapes, though I have not specifically tested this.

The oil smothers the soft scale, which are often out on the canes where they are exposed. Delayed dormant oil was not very effective against grape mealybug in our trials, however. We believe that is because the overwintering mealybug crawlers are protected under loose bark on the trunk. We are now testing Lorsban Advanced just prior to budbreak against overwintering crawlers.

As noted above, during the growing season the systemic insecticide Movento [spirotetramat) has been very effective in controlling grape mealybug in our trials (2 applications, 6.25 fl oz/A per application, 30 days apart). The Movento label for grapes now includes suppression of european fruit lecanium scale. The neonicotinoid insecticides Admire Pro [imidacloprid] and Platinum [thiamethoxam] (not allowed on Long Island), when applied through a drip system and therefore systemic throughout the vine, are effective against grape mealybugs. Admire Pro (when applied via drip to soil) also includes european fruit lecanium scale on the label.

Since the crawlers actively move around the vine they are more likely to get exposed to the insecticide residue and therefore the best target for insecticides that work by contact. The question is how to time egg hatch? Right now we don't have a validated degree-day model to predict this timing. A number of years ago, however, we did obtain some initial estimates and found egg hatch for grape mealybug occurred at around 800 DD (starting Jan 1, base 50 F) which that year was around July 1 while we observed the first crawlers of soft scale insects at around 650 DD (starting Jan 1, base 50 F) which that year was third week of June. If you do have soft scale insects or mealybugs in your vineyard, one thing you can do is check the status of eggs underneath soft scale (mostly on canes) or adult grape mealybug females (under loose bark on trunk wood). With a hand lens you should readily be able to see the eggs and crawlers if present.

During the growing season, carbaryl is labeled for european fruit lecanium 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 other insecticides are labeled for mealybugs but not soft scales including Movento, Admire Pro, Assail, Brigadier [bifenthin, imidacloprid and other active ingredients], Leverage 360, Portal [fenpyroximate], Baythroid [cyfluthrin] and Imidan.

**Plant bugs.** There are at least two species of plant bugs that have the potential to cause significant damage to grapes prior to bloom: banded grape bug and *Lygocoris* bug. These insects are only a threat up to bloom. Both species overwinter as eggs, presumably 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. 3). Nymphs of *Lygocoris* are pale green with thin antennae 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 by examining flower buds on approximately 100 shoots along the edge and interior of

**Fig. 3, photo J. Ogrodnick**

vineyard blocks. A video demonstrating scouting techniques for banded grape bug can be found at https://www.youtube.com/watch?v=FrEJ6IJB_is. 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. Remember, though, by the time you reach bloom, it is too late to treat. There are several insecticides labeled for use against plant bugs (Imidan [phosmet], Danitol 2.4 EC, and Assail 30 SG [acetamiprid]).

**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. 4). 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. 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, it's 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.

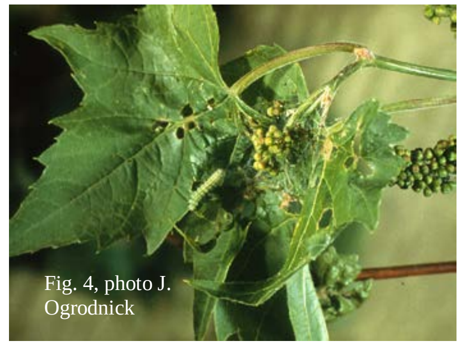
Fig. 4, photo J. Ogrodnick

## Bloom to Mid-season

**Grape Cane Gallmaker.** The grape cane gallmaker is a beetle in the weevil family. You can find a fact sheet on GCG at https://ecommons.cornell.edu/bitstream/handle/1813/43098/grape-cane-gallmaker-FS-NYSIPM.pdf?sequence=1&isAllowed=y. The adult is quite small (3 mm long) and reddish brown in color (Fig. 5). Adults overwinter in debris on the ground and become active in Spring. Egg-laying occurs in May and June when shoots are between 25 to 50 cm in length. The female weevil hollows out a small cavity along the shoot just above a node and places a single egg. She fills the cavity with frass and then goes on to create additional cavities along the shoot (up to 14). Only the first has an egg, although other adults may join in such that


Fig 5. Adult grape cane Gallmaker
Photo: J. Ogrodnick

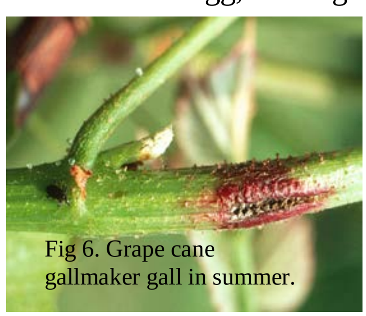
Fig 6. Grape cane gallmaker gall in summer.


Fig 7. Grape cane gallmaker gall, dormant season.

you can find more than one gall with a larva per shoot. In response to the adult weevil feeding damage, the vine forms a gall (swelling) around each of the cavities (Fig 6). The egg hatches and the larvae feeds on grape tissue that forms around the cavity, emerging as an adult later in the summer. The galls typically do not kill the shoot, but can create areas of mechanical weakness that can lead to breakage (Fig 7). And if numerous enough, galls can truncate shoot growth.

Grape cane gallmaker is considered a minor pest, generally not requiring control. However, there have been increasing reports of extensive galling on grapevines of several different cultivars in the Finger Lakes region, especially around Keuka Lake, but also Seneca Lake, to the extent that chemical control may be warranted. Insecticides should target the adult stage during May and June. In severe situations, multiple applications, starting at 2-4 inch shoot growth, may be necessary to get things under control. There are a limited number of products labeled for grape cane gallmaker including Danitol, Baythroid, and Leverage.

**Grape Berry Moth.** Grape berry moth (GBM) is familiar to most grape growers in our region. Despite this familiarity, managing this pest is still challenging, especially late in the growing season. I believe the key to successful management of GBM is having a good understanding of its phenology (timing of the different stages of its life-cycle), combined with scouting, so that management actions are properly timed. Of course, getting good spray coverage on fruit is also critical, which can be a challenge in itself, especially later in the season for cultivars like Concord.

GBM has several flights during the growing season (2-4) starting around bloom and continuing, in some years, into September. A temperature-driven phenology model has been developed for GBM, using bloom date of wild grapes as the starting point for accumulating degree days (biofix), that helps predict timing of egg-laying associated with these flights. Knowing when most eggs are laid is important for effective chemical control since insecticides mostly target the young larvae before they have a chance to enter the berry where they are pretty protected. The GBM phenology model is available to growers through the Network for Environment and Weather Applications (**NEWA**) web site (http://newa.cornell.edu/) along with management guidelines. The model is most useful for timing the second and third flights of the season, but less helpful for timing subsequent flights. The reason is that by late season, the flight period becomes less synchronous and spread out such that eggs are being laid continually. **Therefore, we are now recommending growers use the phenology model to time the second and third flights but beyond that, in warm years and for high risk sites, growers should continue spraying on a 7 to 10 day rotation until about mid-September when egg laying pretty much stops.**

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 estimated degree days required to develop from an egg to an egg-laying female moth), the program notes that this is approaching the peak of the second GBM flight 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 in NY on grapes)) where the timing should be close to 810 degree days and those that work mostly through contact (e.g. Brigade, Danitol, Baythroid, Sevin) where timing should be between 810 and 850. In 2015, we reached 810 degree days in the Geneva area on around July 8.

I wanted to briefly mention scouting for GBM damage. It's important for both intermediate and high risk vineyards for the second and third generations to scout for damage. The timing of scouting should be just prior to predicted peak flight and initiation of egg-laying (810 degree-days after biofix and 1620 degree-days after biofix). If it were easy to see GBM eggs, then the scouting could be helpful for timing insecticide treatments. However, it is very difficult to scout for eggs. Therefore, the purpose of the scouting is to get a handle on potential damage levels and whether you are exceeding economic thresholds. For Concord grapes, if the percent of clusters that show some GBM damage to berries is <6% at second flight and <15% at third flight, then a treatment is not recommended. These levels can be used as a guide for wine grapes. However, for high value vinifera cultivars, especially cultivars with tight clusters prone to fruit rots, the thresholds probably should be lower.

There are several options available for chemical control of GBM. See the guidelines for a full listing. The most commonly used products are the pyrethroids (Danitol, Brigade (including several generic products with same active ingredient), Baythroid, Mustang Maxx, Hero). Pyrethroids are broad-spectrum and will kill a number of other insect pests, as well as, beneficial insects. Leverage and Brigadier both include a pyrethroid that provides control of GBM and a neonicotinoid that provides 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 label for Imidan has a 14 day REI, which makes its use problematic. Another broad-spectrum insecticide, Sevin (carbaryl), is labeled for GBM and in the past, was commonly used. However, there has been some evidence of control failures with Sevin in the Lake Erie area due to resistance.

There are some additional, more narrow-spectrum, materials registered for use against GBM. Dipel and Biobit are organic options that have 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 (but not allowed on Long Island) 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.

**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 8). Hence, moderate densities can reduce photosynthesis, ripening and yields. Severity of damage is increased in dry years, assuming irrigation is not available.

Fig. 8, photo J.

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 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 Danitol you will also control leafhoppers. The next sampling period for leafhoppers is mid July and focuses on abundance of first generation nymphs. 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 insecticides for leafhopper (or broad-spectrum insecticide for 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.

Dr. 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 many effective alternatives to Sevin (see guidelines).


**Fig. 9, photo D. Gadoury**

**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. Generally, though, we begin seeing signs of damage in early part of June. Potato leafhopper tends to arrive on Long Island before the Finger Lakes or Lake Erie regions. 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. 9). 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.

Potato leafhopper is a sporadic pest, although it can be serious in some places and some years. 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, Admire Pro, Actara (not for use on Long Island), and Applaud (not for use on Long Island). *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.

**Grape Phylloxera.** Grape phylloxera is an aphid-like insect with a complex life-cycle that causes 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. 10). 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.

*Fig 10. 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.*

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, we have conducted research on growing vinifera vines on their own roots. Root-form phylloxera throws a potential monkey wrench to this strategy. We have been asking, 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. vinifera* and Concord 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 effects of root form phylloxera. We now have several years' worth of data. Own-rooted vines when treated with insecticide had at least as much live periderm at the end of the five-year study as grafted vines while untreated own-rooted vines had significantly less periderm. 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, however, that 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.

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 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 (cannot use on Long Island) 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 shoot 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, mature Concord vines 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. 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 was a key pest of grapes in NY and surrounding areas in the early 1900s. Since the sixties, broad-spectrum insecticides targeting grape berry moth greatly reduced the impact of grape rootworm. 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, but also in the Finger Lakes. Grape rootworm is a beetle in the Family Chrysomelidae (flea beetle family). You can find a fact sheet of grape rootworm at

**Fig. 11**

**Fig 12. Leaf feeding damage by adult grape rootworm.**

https://ecommons.cornell.edu/bitstream/handle/1813/43105/grape-rootworm-FS-NYSIPM.pdf?sequence=1&isAllowed=y. The adult (Fig 11) feeds on leaf material, creating characteristic chain like feeding damage (Fig 12). This damage is not economically significant. The adults emerge over the middle 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. Feeding damage by larger larvae cause reduced vine growth and vigor, increased vulnerability to stress, and reduced yields.

Tim Weigle, NYS IPM Program, has been studying the emergence patterns and control of grape rootworm in the Lake Erie region the past three years. His research indicates that adults begin appearing around or shortly after bloom (about 600 degree days, base 50 F) and peak around third week of June (around 750 DD) (see Figure 13, 2015 data). In terms of chemical control, it appears one well-timed insecticide is sufficient to greatly reduce adult populations. In general, we recommend scouting for adult feeding damage around bloom for evidence of adult activity. Also, continue to follow email alerts from the regional grape programs.

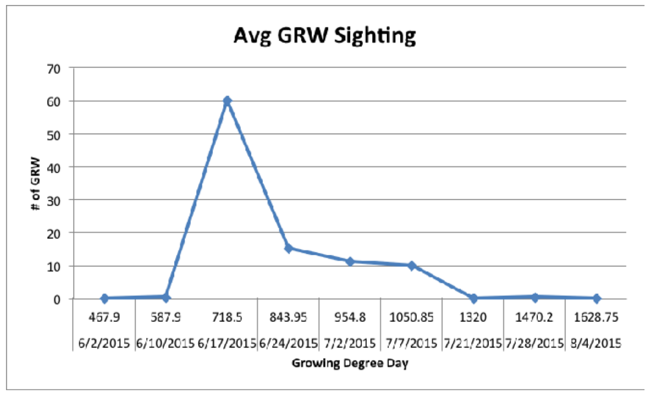


Figure 13. Counts of adult grape rootworm in Lake Erie vineyards surveyed in 2015. A similar pattern was observed in 2016 and 2017, though adults were observed much later in the season in 2017.

There are five different insecticides labeled to control grape rootworm: Sevin, Sniper (2ee), Danitol 2.4 EC (2ee), Leverage 360 (2ee), and Admire Pro (2ee). Even though the adult stage does not cause significant damage to vines, it is the target of the insecticides to prevent egg laying and larval infestation. Adult female grape rootworm require a week or two of leaf feeding (pre-oviposition period) before they start to lay eggs. Hence, knowing when adults have emerged from the ground is critical to successful chemical control.

**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. 14. Highly magnified. Photo by J. Ogrodnick.*

An important difference between the two spider mite species is that ERM overwinters on grapes 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. 14). Adult female

TSSM tend to have large black spots on the top of the abdomen but this is 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. 15. 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 15) 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.

There are 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, Portal and Nealta. 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. 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. 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. Danitol and Brigade and Hero (two-spotted only) are broad-spectrum insecticides that also have fairly good miticidal activity. Pyrethroids are hard on beneficial mites, however.

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 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. The other miticides (Vendex, Onager, Savey, Zeal, Acramite, Nealta, and Nexter) are generally pretty easy on natural enemies, although at high rates Nexter can negatively affect predatory mites. Overall, paying attention to conserving predatory mites can pay economic dividends since miticides are quite expensive.

Fig 16. Photo: Steve Hesler

**Japanese Beetle**. By and large, Japanese beetle populations have not been as bad as they were a few years ago. The adults (1/2 inch body, metallic green in color, Fig 16) 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 17) 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. We (myself, Tim Weigle, and Elson Shields) have investigated 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. Establishment of beneficial nematodes appears good but the results are not very clear in terms of reducing adult feeding damage.

*Fig. 17; 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. 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.

**Spotted Wing Drosophila**. Spotted Wing Drosophila (SWD) (also known as *Drosphila suzukii*, Fig 18) 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 and will lay their eggs in ripe, marketable fruit leading to damage and contamination with maggots.

Photo: M. Hauser

Fig 18, adult male SWD

Research by several of us in the eastern US indicates that SWD females will lay eggs in some thinner-skinned cultivars of grape but overall, SWD does not seem to be a major issue as a direct pest for most cultivars. We do have more concerns about its potential, along with other fruit flies, in causing and spreading sour rot. Sour rot is a more appropriate topic for Wayne Wilcox's spring Opus but I did want to highlight the role of Drosophila fruit flies. Based on research led by Megan Hall, a recently graduated PhD student with Wayne, we have good evidence that several species of Drosophila fruit flies, including SWD, are important in spreading and enhancing sour rot symptoms for susceptible varieties. Indeed, because SWD populations tend to explode in August and September, they very likely have exacerbated sour rot issues since their arrival in our area. Several factors are involved in determining risk of sour rot including cultivar (tight clustered cultivars seem more prone to sour rot), the year (warm and wet conditions favor disease development), fruit phenology (ripening fruit with Brix around 15 or more), fruit injury due to bird or insect damage, and presence of fruit flies. When factors align to promote sour rot, we have good data showing that applying an insecticide targeting fruit flies can significantly reduce incidence and severity.

We, and others, have been very interested in trying to understand if and how SWD overwinters in northern locations like NY. Without going into the details here, it appears that there is very high mortality of adult SWD during the winter in our area, although some adults probably do survive in protected areas. Probably more survive in mild winters and this may explain why SWD seems to show up earlier and be more of a problem after mild winters. One question we still don't know the answer to is where they overwinter. It has been suggested that large compost piles and possibly pomace piles might provide a sheltered environment for SWD. There is some data showing that SWD is present in and around compost piles and pomace piles in the late fall. What we don't know, however, is whether they are able to survive our cold winters in these habitats. This spring we put out monitoring traps near compost and pomace piles, as well as other habitats in the Finger Lakes. We hypothesized that if SWD is surviving better in compost than in the middle of vineyards or in the woods, we would catch them first near compost. So far, we have not captured any SWD, regardless of habitat.

Drosophila fruit flies are susceptible to a number of different insecticides including organophosphates (e.g. malathion), pyrethroids (e.g. Mustang Max [zeta-cypermethrin]) and spinosad type insecticides (e.g. Delegate [spinetoram] or an organic alternative, Entrust [spinosad]). Since fruit flies are only a threat near harvest, insecticides with relatively short DTH restrictions, such as Mustang Maxx with a one DTH, are the most helpful. In our initial studies we applied insecticide starting about when grapes reached 15 brix and continued weekly applications thereafter leading up to harvest. However, more research is necessary to better determine optimal timing and frequency of insecticides. Check the grape pest management guidelines for more specific details. You can also find more information about spotted wing drosophila at http://www.fruit.cornell.edu/spottedwing/.

**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 adjacent to soybeans in a year when soybean aphid is abundant may be more vulnerable. **Pay attention to the crop updates of the regional grape extension programs as we get into harvest to see if and when MALB is turning up in vineyards. Then scout your vineyards before harvest. Late harvested varieties are usually the most vulnerable.** 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. The color or number of spots is variable. The abundance of MALB appears to be closely tied to the abundance of soybean aphid, which tends to alternate between high and low years.

There are a few chemical approaches to managing MALB in New York: Mustang Maxx, Aza-Direct and Evergreen [natural pyrethrins]. Mustang Max has a 1 DTH restriction. 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 Williams at Ohio State. 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. A 2(ee) label expansion for Admire Pro has also been approved for use in NY. 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 plant bugs, there are relatively few insect pests between budbreak to bloom period that can cause significant harm. For those sites where **grape cane gallmaker** has become problematic, this is the time period where control should be applied. Also, sites with sandy soils may experience damaging populations of **rose chafer** at 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, but also some in the Finger Lakes. Chemical control targets the adult stage.

Mid-summer to harvest 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 and third-generation larvae in mid-summer and late summer and in warm years, late summer/early fall damage from a combination of third and fourth generation larvae. Timing of insecticides is important. Insecticides target the egg and young larva before it penetrates the berry. **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 for the second and third flights. It has not been as useful for timing late season GBM. **In warm years and in high-risk sites, growers need to continue chemical control on a 10 to 14 day interval from mid-August to mid-September. Good coverage of the fruiting zone is essential.**

Two other pests are worth mentioning for the mid-summer period. One is conspicuous and you probably will be tempted 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 lookout for yellowing or bronzing leaves and generally low thrift during the hot days of late July and August.

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 in 2015 we did see some significant infestations, especially in areas where soybeans are also being grown. **For late maturing cultivars it is essential that you monitor clusters for MALB close to harvest and take appropriate action if they are present.** Keep an eye out for email alerts from your regional grape extension programs. The other late-season insect pests we have concerns about are **fruit flies**, both the invasive SWD and regular vinegar flies. Our concern centers on their role in spreading sour rot bacteria. In a year where weather conditions favor sour rot, our results indicate that an insecticide near harvest targeting fruit flies can help reduce incidence and severity of sour rot.

**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 (see IRAC codes on labels) to reduce development of resistance. Be aware of consequences of your choice of pesticides on natural enemies. 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, contact your regional extension office or you can also contact me at my office (315-787-2345) in Geneva or through email at gme1@cornell.edu.

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