

## MANAGEMENT OF GRAPE INSECT AND MITE PESTS-2006

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The 2005 growing season, with warm temperatures and dry conditions, was ideal for insects and mites. Fortunately, though, insect and mite pests were not particularly problematic for area vineyards. Why? Part of the reason may be that it takes a couple of favorable years in a row to allow populations to build up. Remember that some of our worse problems with grape berry moth occurred following several years of warm growing seasons coupled with mild winters in 2000-2002. Given this winter was fairly mild, we should be on guard for significant populations of some pests if we have a growing season like last year. The spring and early summer conditions are especially important for some of our insect pests that can produce several generations during the growing season (grape berry moth, leafhoppers). When we have wet and cool temperatures in the spring, these insects get off to a slow start and they may never quite recover, even when temperatures turn above average in August and September. Conversely, when we have above average temperatures in May and June, the potential for leafhoppers and berry moth to get an extra generation in increases which leads to higher populations.

In preparation for the 2006 growing season, in this article I review the major arthropod pests of grapes, providing a brief summary of their biology and the damage they cause, including any new information that is available, and then a discussion of control options. The material I present is based on the work of many people at Cornell and elsewhere. I would like to especially acknowledge the contributions of Rick Dunst and Ted Taft and the rest of the crew at the Vineyard Lab at Fredonia, Tim Weigle of the NY IPM Program, Tim Martinson, Alice Wise, and Dan Gilrein from Cornell Cooperative Extension, Andy Musa from Penn State Cooperative Extension and Steve Hesler (my research support specialist here at Geneva), and Jan Nyrop (entomology faculty at Geneva).

### INSECTICIDE AND MITICIDE NEWS

I noted last year that a second pyrethroid (Capture 2EC, binfenfthrin) has been labeled for use in grapes. Like the other pyrethroid, Danitol 2 EC (fenpropathrin), this is a broad-spectrum insecticide with activity against several important grape insect pests as well as spider mites. For unknown reasons, though, grape berry moth was not included on the original label. However, a new label has been approved that includes grape berry moth, eastern grape leafhopper, cutworms, Japanese beetle, and two-spotted spider mite (not European red mite which is more of a problem for our area). Rates for Capture 2 EC range from 3.2 to 6.4 fl. oz./A. Keep in mind that you may not use more than 6.4 fl. oz./A during a single season. The days to harvest for Capture 2 EC is 30 days while it is 21 days for Danitol 2 EC. For 2006 there is a third synthetic pyrethroid that has been approved for use by EPA for use on grapes, Bathroid 2 (cyfluthrin). It has not yet received approval in NY, however. Advantages of these synthetic pyrethroids include broad-spectrum activity, relatively low mammalian toxicity and low cost. The major disadvantage is that they tend to be hard on beneficial insects and mites. One concern I have about the extensive use of these broad-spectrum products is that spider mites may develop resistance. Predatory mites, that generally do a good job of keeping spider mites under control, are very sensitive to pyrethroids.

The neonicotinoid imidacloprid can be applied as a foliar application (Provado) or as a soil treatment (Admire). Admire acts systemically while Provado does not. Up until recently only the foliar material was labeled for grapes. However, two formulations of Admire (Admire 2 and Admire Pro) are now labeled for grapes, although their usefulness in our area is limited by the fact that they work best when applied through an irrigation (drip) system. The two products mainly differ in concentration (21% active versus 42%) but generally control or suppress the same spectrum of pests (leafhoppers, mealybugs, and phylloxera). The pre harvest interval (PHI) for Admire 2 and

Admire Pro is 30 days and there are limitations on the amount applied during the season (32 fl. oz. and 14 fl. oz., respectively). Note also that all the formulations of imidacloprid are now classified as restricted use in New York, which means their application is limited to persons who are certified applicators. In addition to imidacloprid there two other neonicotinoids labeled for use on grapes, Assail (acetamiprid) and Venom (dinotefuran). Assail has been labeled for use on grapes for several years now. However, the formulation of this product has changed from WSP (water soluble packet) to SG (soluble granule). Assail is not a restricted use insecticide. Venom (dinotefuran) obtained its EPA label in 2006 but has not yet received a NYS label. Assail and Venom, like imidacloprid, are particularly effective against sucking insects such as leafhoppers.

Some regulatory changes for use of Imidan (phosmet) are currently in the works. Imidan is an organophosphate insecticide and one the more effective materials for controlling grape berry moth as well as a number of other grape pests. As an organophosphate, it has been under review by EPA as part of the Food Quality Protection Act, assessing both benefits and risks of current use practices. As a result of this review, EPA is changing the re-entry interval (REI) from 24 hours to 14 days for Imidan, starting with product being sold in July. This is quite a long REI and likely to affect use of this material in grapes. Interestingly, REI for Imidan use on some other crops (e.g. blueberries) is not going to change principally because blueberry growers were quite vocal about its benefits. Gowan and the EPA have plans to meet sometime this fall to discuss the implications of this label change for grapes, perhaps opening the door for a re-evaluation depending on whether EPA learns of serious concerns from grape growers.

We have had several new miticides labeled for use on grapes over the past couple of years including Agri-mek and ABBA (abamectin), Acarmite (bifenazate), and Nextar (pyridaben). This past year another miticide received an EPA label for grapes (Zeal, etoxazole) as well as a supplemental label for use in NY. Note, that Zeal Miticide currently only has two-spotted spider mite on the label (same is true for abamectin), although Valent is pursuing a 2 ee exemption for use against European red mite in NY (stay tuned). To make things a bit more confusing, Valent is changing the formulation of Zeal (granular) to wettable powder (it is called Zeal Miticide1). There should be a supplemental label for Zeal Miticide1 for use on grapes and we are currently checking to make sure this will be the case for New York. In other miticide news, Dupont is in the process of getting their miticide Savey DF (hexythiazox) labeled for use on grapes. Savey is specific to the egg and small instar mite stages

Finally, Dupont Company will likely obtain a federal label for use of the insecticide Avaunt [indoxcarb] on grapes this year. Avaunt is in a new chemical class of insecticide and shows fairly broad-spectrum activity against sucking insects and lepidoptera. It is fairly easy on beneficials, however. In our trials Avaunt has provided good control of grape leafhopper and grape berry moth. Use of Avaunt in New York for grapes will depend on the outcome of a review by the DEC, but this is not expected for the 2006 growing season.

## **REVIEW OF KEY ARTHROPOD PESTS**

There are over 20 insect and mite pests that attack grapes in New York, although many of these are rarely abundant enough to be of economic concern. In this review I will focus on the key grape pests that have a moderate to large pest potential. I will briefly go over basic biology and symptoms of damage and then discuss some of the control options available. More details can be found in the New York and Pennsylvania Pest Management Guidelines for Grapes: 2006 now available in print from your Regional Grape Program or on line [<http://ipmguidelines.org/grapes/>]. I will present these pests in the order they tend to show up in the vineyard during the season (budbreak, pre bloom, post bloom, and mid-season). As a caveat before proceeding, note that an important distinction exists between control of diseases and arthropods. Because of the small size of plant pathogens and their capacity to increase rapidly under suitable growing conditions, you often need to make chemical control decisions well before obvious symptoms are visible. Related to this, most of the fungicides act to protect foliage or fruit before infection rather than eradicate the disease. Arthropods, on the other hand, are generally detectable in the field before they cause economic injury and insecticides and miticides mostly work as

eradicants. Hence, for arthropods its possible, and generally advisable, to monitor pest densities and only apply control measures when economically justified.

## **Budswell to Bloom**

*Grape Cane Borer.* In the fall the adults of this beetle bore tunnels into live 1 and 2 year old canes to create a place to spend the winter. Although this damage doesn't generally kill canes, they may be weakened and break during the growing season. In addition, initial experimental results indicate tunnels may reduce yield on a cane. In many cases damaged canes can be removed at pruning, although this adds time to the process. The larva of grape cane borer (GCB) develops in dead wood and does not cause economic damage. However, since larvae grow into adults it makes sense to try and limit reproduction. Because of the severe winters the last few years there may be a fair amount of dead wood in the grape canopy, on the vineyard floor, or in burn piles. These are all good food sources for GCB larvae. My sense is that destroying as much of this dead wood as possible before larvae have a chance to mature (end of July) would help reduce GCB adult populations in the fall, although we do not have a lot of data yet to back this up. Adults become active in the spring as temperatures warm up, especially evening temperatures, and sap begins to flow (probably as early as budswell). Egg laying gets started about budbreak and continues well into June. Our current approach to controlling GCB is to target an insecticide (Imidan 70W is the only material labeled right now) against the spring adults in order to reduce reproduction and overall population levels. In a trial conducted two years ago in the Finger Lakes we found that three applications of Imidan 70W, starting at around budbreak and repeated about every 10 days, significantly reduced damage from adults in the fall. However, in 2005 three applications of Imidan were not very effective. We also tried a fall application of Imidan, targeted against the overwintering adults, but this also had little impact on damage in the late fall/winter. Hence, we are still searching for an effective chemical control option. We have also examined the influence of removing and destroying dead wood from the canopy and vineyard floor during the spring on damage in the fall and found some evidence that this helps. However, the process was fairly labor intensive and therefore, expensive. This season we plan to assess whether thorough chopping of pruning material, raked into the row middles, will reduce damage.

*Steely Beetle (grape flea beetle).* These shiny black beetles overwinter as adults and become active as temperatures increase in the spring. 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. Michigan grape growers have reported a fair amount of damage from steely beetle in 2006. Look for damage from steely beetle along the edges of the vineyard. Use about 2% bud damage as a threshold for treatment. Some hybrids with fruitfull secondary buds and that tend to overcrop can probably handle higher damage levels. Note that after budbreak, the adults do not cause additional injury. Later in the season the 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 in grapes including Sevin, Imidan, and Danitol.

*Banded Grape Bug and Lygocoris Bug.* As growers have reduced insecticides over the past 15 years we have observed more of these plant bugs in vineyards. Both species overwinter as eggs in 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. Nymphs of *Lygocoris* are pale green with thin antennae and about half the size of BGB. Nymphs of both species can cause 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. 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. But if present at sufficient 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 broad-spectrum insecticides labeled for use against plant bugs (Sevin, Imidan, Danitol).

*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. 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, 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. Sevin, Danitol, and Dipel (*Bacillus thuringiensis* or Bt) are labeled for use against grape plume moth.

### **Bloom to Mid-season**

*Grape Berry Moth.* Grape berry moth is familiar to most grape growers in New York. It is considered our most important arthropod pest in Lake Erie and the Finger Lakes and much of our current IPM strategy centers around its control. Grape Berry Moth is typically not abundant on Long Island, although it can still be a serious problem especially for cultivars prone to bunch rots (see below). 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 broad-spectrum 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 (vineyards with at least one side bordered by woods, prone to heavy snow accumulation, history of GBM problems) should be treated with insecticides shortly after bloom (first generation larvae) and in late July (second generation). They should be scouted for GBM damage in late August to see if a third insecticide application is required. Note that much of the problems with GBM from 1999-2002 were from late-season egg-laying. Too often growers put their sprayers away after early August and do not check for GBM. Pay attention to email crop updates for alerts on GBM (and other pests). For Low Risk vineyard blocks (lack of woods, low amounts of snow, little history of GBM problems) you can probably safely ignore GBM for the first generation but remember to scout in late July and it may even make sense to scout in late August as well. For vineyard blocks that fall in between high and low risk (Intermediate Risk) we recommend an insecticide treatment for first generation (immediate post bloom) and scout for GBM at the end of July and end of August. The current thresholds are 6% cluster damage for late-July and 15% at the end of August. These thresholds have been developed for native grapes bound to processing plants. Thresholds for vinifera are probably less due to the additional risk of bunch rots associated with GBM feeding injury and their higher value.

There are several options available for chemical control of GBM. The most commonly used product is Sevin,

although Danitol and Imidan are also effective broad-spectrum materials. Note, though, that Imidan is not quite as effective against leafhoppers as the other two. 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 is usually a good idea. More and more growers are turning to pyrethroids (e.g. Danitol, Capture, now Baythroid outside of NY) for control of several different arthropod pests, including berry moth. These pyrethroids are effective materials but as noted above, 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 one option that has been around for a number of years. The toxin produced by the *Bacillus thuringiensis* (Bt) bacteria is specific to Lepidoptera. In our trials it has been less effective than the broad-spectrum insecticides but has the advantage that it conserves predators and parasitoids in the system. We have found that 2 applications of Dipel per GBM generation (immediate post bloom and mid-July), 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. 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 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 is now the main method for releasing pheromone. The older version of the Isomate GBM twist tie releaser is no longer being sold. However, there is a new product called Isomate-GBM Plus, which lasts the entire growing season. The older product was thought to run out of pheromone by the end of the season in some years thereby leaving the vineyard unprotected. We have just started large-scale field trials to test the efficacy of Isomate GBM plus in collaboration with researchers in Pennsylvania and Michigan. Finally the insect growth regulator Intrepid from Dow Corporation has an EPA label for use on grapes and is available in Pennsylvania and most other states. It has not received DEC approval for New York and we don't expect it to happen this field season. Intrepid is a selective material active against the larvae and eggs of many species of Lepidoptera including GBM. We are still learning how to best use this new material but it seems it needs to be applied a bit earlier than other insecticides (bloom instead of immediate post bloom, for example).

*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 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. 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, probably due to cold winters and cool temperatures during spring and early summer.

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 or intermediate risk of GBM damage, you would probably already be applying an insecticide at this time. If you use a broad-spectrum material such as Sevin or Danitol you will also control leafhoppers. Thus, sampling for leafhoppers at immediate post bloom is only necessary for low risk vineyards. The next sampling period for leafhoppers is mid to late July and focuses on abundance of first generation nymphs. Monitoring for leafhoppers is only necessary for low and intermediate risk vineyards, assuming a broad-spectrum material is used to control GBM in high risk vineyards. 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 or 10% of leaves with at least moderate stippling to determine need for treatment. 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 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.

There are several choices of pesticides to use against leafhoppers. The carbamate Sevin 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, Capture, Lannate [methomyl], and the two neonicotinoids Provado and Assail. Lannate is in the same chemical class as Sevin so there is potential for cross-resistance. The carbamates (Sevin and Lannate) and pyrethroids are hard on predatory mites. The neonicotinoids are mainly effective against sucking insects like leafhoppers and not as hard on natural enemies as the broad-spectrum insecticides. Note that a half label rate of Provado (0.5 oz.) was as effective as the full rate in controlling leafhoppers in our trials.

*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) while grape leafhoppers are indigenous 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 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. 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. 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, Lannate, Assail and Provado. Note that Provado is now a restricted use pesticide. Potato leafhopper is fairly mobile and it may require several treatments over the season as new infestations occur.

*European Red Mite.* There are actually two species of spider mites that attack grapes in the Eastern US, two-spotted spider mite and European red mite (ERM), but ERM presents the more serious threat. Problems with ERM on grapes in New York have historically been concentrated on Long Island where the longer season and dryer climate are more conducive to population growth. However, vineyards in the Finger Lakes can also experience mite problems. ERM overwinters as eggs on one-year and older wood. Around budbreak eggs hatch and larval mites move to young leaves. The immature and adult mites feed on cell contents causing stippling of leaves and when abundant, leaf bronzing. The eggs of ERM are red to brown red in color, the immatures and adults are pale brown to red. ERM are very small in size (a fraction of an inch) and best observed with a 10 to 15X hand lens. Under the right conditions (hot and dry, lack of natural enemies), they can reach high populations and cause serious injury to grapes. Cultivars of *V. vinifera* and French-American hybrids appear most susceptible but native

varieties can also develop large populations. With rare exception, ERM typically does not become a problem until mid to late summer when conditions are most favorable for population growth and shoot growth has slowed down. Look for immature and adult mites on the top and bottom of leaves in the middle of shoots. The current economic threshold is about 7-10 mites per leaf, or 50% of the leaves infested.

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. Pesticides, that differentially harm predators but not spider mites, are the most typical cause of disruption and this seems to be the case for grapes in New York. We and other researchers have been looking at this issue for several years now. Some tentative conclusions can be made. The use of certain fungicides, particularly mancozeb products, suppresses predatory mites. Repeated use of a mancozeb product may promote outbreaks of ERM. In some situations, however, predatory mite populations are sufficient and/or conditions for ERM population growth are insufficient, such that outbreaks do not occur even with repeated use of a mancozeb product. Jan Nyrop and Wayne Wilcox have recently shown that one early-season application of Dithane had little effect on a well-established population of predatory mites. Several insecticides used in grapes, including Lannate, Danitol, and Capture can also suppress predatory mites. Danitol and Capture are also miticides so at present their use does not create an ERM problem. However, in the past, spider mites have been quick to develop resistance to frequent use of pyrethroids like Danitol and Capture. This may or may not happen with 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.

We now have several chemical options available for mite control in New York: Kelthane [dicofol], Vendex [fenbutatin-oxide], Agri-Mek, Nexter (previously called and sold as Pyramite), Acramite, JMS Stylet Oil [aliphatic petroleum distillate], Zeal, Danitol and Capture. Note that Nexter is not allowed on Long Island. Kelthane and Vendex are the old standards that have been relied upon for a number of years. Kelthane is fairly hard on predatory mites while Vendex is not. My experience with Vendex is that it takes a bit longer to have an impact than Kelthane. Trials conducted by Tim Martinson demonstrated that 3 early-season applications of JMS Stylet Oil, being used primarily for control of grape powdery mildew, also reduced ERM populations by about 50%. JMS Stylet Oil is relatively benign to predatory mites. Read the label carefully since JMS Stylet Oil is not compatible with a number of other products including Captan, Vendex, and sulfur. Also, although Stylet Oil can help with ERM problems, it is not likely to provide complete control in problem vineyards. Nexter has been registered for use on grapes in New York (but not on Long Island) for a couple of years. It is very effective against ERM but higher rates may be necessary for two-spotted spider mites. Nexter is pretty soft on predatory mites except at high rates. It also provides some partial control of leafhoppers. Agri-mek currently has two-spotted spider mite on the label but not ERM. The Agri-Mek label recommends the use of a nonionic surfactant to improve wetting. Acramite, as indicated earlier, has recently received DEC approval for use in New York, including Long Island. The new label for Acramite includes both two-spotted mite and ERM. Acramite and Agri-Mek are relatively soft on beneficial arthropods. Note the different miticides vary in their re-entry interval and days to harvest requirements. It is good news that we now have several miticides to choose from for control of ERM in grapes. It's a good idea to rotate materials to help reduce pressure for resistance.

*Japanese Beetle.* Most of you are familiar with Japanese beetles and their fondness for grape foliage. Actually, the adults (1/2 inch body, metallic green in color) feed on a number of different plant species but they do seem to really get excited about grapes. Japanese beetles were introduced into the eastern USA a number of years ago and have been spreading throughout the Northeast and Great Lakes regions. Although the adults have broad diets, the larvae 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 adults emerge from the soil in mid-summer and begin feeding and then mating and egg-laying. In some years Japanese beetles can be fairly destructive (last year they were quite abundant in the Finger Lakes), removing significant amounts of foliage (10%). Fortunately, grapes are fairly tolerant of this type of feeding at this time of the season. Dr. Rufus Isaacs of Michigan State has been

examining the economic impact of Japanese beetle for the last couple of years. Removal of up to 30% of leaf area on young Niagara vines at veraison did not cause significant decreases in growth or yield the next season. Note, though, that the actual impact of leaf feeding will depend on health and size of the vine. Young vines in growth tubes, for example, may be particularly vulnerable in that they have fewer reserves to draw upon to recover from damage and the beetles are protected in the tubes from insecticide sprays. 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 including Sevin, Imidan, Danitol, Capture, and Assail. These all are roughly similar in efficacy. The key fact to remember about controlling Japanese beetle is 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 that helps it ward off enemies. Unfortunately, the defensive chemical has a nasty taste and bad odor 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. 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. I would also pay attention to the crop updates to see if and when MALB is turning up in vineyards. If you do end up with a problem, there are a few chemical approaches you can try. Note that we have yet developed a good estimate of the economic threshold for MALB. There are several pesticides now labeled for MALB: Sevin [carbarly], Danitol [fenprothrin], Aza-Direct and Evergreen [natural pyrethrins]. To use Sevin and Danitol in New York for this purpose, you need to have the 2(ee) label or a copy of the 2006 NY and PA pest management guidelines. Sevin and Danitol are toxic to MALB based on field and laboratory trials conducted by Roger Williams at Ohio State University. 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 last year by Tim Weigle, Evergreen appears to have both toxic and repellent effects on MALB. Note that Danitol has a 21 days to harvest restriction, Sevin has a 7 days to harvest restriction, and 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).

#### **SOME FINAL COMMENTS**

There are a large number of potential arthropod pests of grapes and it is possible to get overwhelmed with information on biology, symptoms, control options, etc. Here are a few points to keep in mind to help simplify things.

Although there are a large number of potential pests, there are relatively few that consistently represent a major threat (grape berry moth, leafhoppers, mites, and a few others). And of those that can cause significant injury, they may not become a pest at a particular site or a particular year. Generally speaking, with arthropod pests you have time to make management decisions based on what is present in the vineyard rather than before it develops. There is a distinct time of the season when particular pests may turn up in your vineyard. In other words, you can focus your scouting on a limited number of pests at a given vine phenology. Look for steely beetles and climbing cutworm at budswell; plant bugs and plume moths when shoots are between 5 and 10 inches; grape rootworm, rose chaffer around bloom; grape berry moth, leafhoppers, leaf phylloxera, Japanese beetle, and spider mites after

bloom to late August. Don't put your sprayer away too early in the season. Watch out for late-season damage from grape berry moth. Read extension pest alerts available through the grape extension programs. If you don't have access to email, see if you can get someone who does to make copies for you. To sign up for either of the electronic newsletters, Tim Martinson's Finger Lakes Vineyard Update or The Lake Erie Regional Grape Program The Crop Update, please contact either program directly. Although the FQPA review process is starting to limit the use of some materials, for the most part, we have good chemical control options available. But be smart about using them. Pay attention to label restrictions and review recommendations in the pest management guidelines. Be aware of the potential for grape berry moth and grape leafhopper resistance to Sevin. Rotate among materials to reduce development of resistance. Be aware of consequences for natural enemies. The cheapest material to apply on a per acre basis may not always result in the lowest cost because of unintended consequences. 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.