Grapes 101

Three Steps to Manage Grape Berry Moth

By Andy Muza

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As the season begins, growers should be prepared to manage a serious pest which can cause substantial economic losses. The grape berry moth (GBM) is a prevalent pest of grapes throughout Pennsylvania and the eastern United States. The larval stage feeds on berries and causes yield losses due to consumption and shelling of berries and by providing entry sites for fungi that can cause cluster rots.

I consider management of this pest to be a three phase process which includes: 1) **Pre-Treatment**, 2) **Treatment**, and 3) **Post-Treatment**.

1) **Pre-Treatment Phase**

**Sprayer maintenance.** Follow maintenance procedures outlined in your sprayer manual. Check pump, hoses, filters, nozzles, etc. to be sure that everything is in good working order before your first pesticide application. Also practice routine sprayer maintenance during the season such as lubrication of bearings and cleaning and flushing of the sprayer after each use.

**Calibration of sprayer.** Sprayers should be calibrated early in the season well before any insecticide or fungicide spraying is required. Calibration of sprayers ensures that the appropriate amount of spray material is being applied where it is needed to manage pests. The sprayer should be calibrated in the vineyard under conditions in which the sprayer will be operated. Ideally, sprayers should be calibrated 2–3 times during the season as canopy growth increases.

**Classifying a vineyard using the GBM Risk Assessment Program.** The GBM Risk Assessment Program was developed by Hoffman and Dennehy, Cornell University (Bulletin 138, Risk Assessment of Grape Berry Moth and Guidelines for Management of the Eastern Grape Leafhopper). It is a method of classifying vineyard blocks for risk (e.g., High, Low or Intermediate) of receiving damage from grape berry moth. The criteria used for assigning risk include: Value of the varieties being grown; Surrounding Vineyard Habitat; History of GBM injury; Climatic factors related to the region where grapes are being grown.
**High Risk Classification**

- **Value of the varieties being grown** – if higher value varieties such as *Vitis vinifera*, many hybrids, or table grapes are being grown then these vineyards should automatically be assigned a *High Risk Classification*. Therefore most vineyards in Pennsylvania, outside of the Lake Erie Region, should initially be classified as *High Risk*. This classification can be adjusted later if scouting history reveals that GBM injury is consistently low at your vineyard site.
- **Surrounding Vineyard Habitat** – if wooded edges or hedgerows/weedy areas are present around vineyards.
- **History of GBM injury** – if scouting reveals that damage is often above 6% cluster damage in July and/or above 15% cluster damage (2% berry damage) at harvest. These injury levels were developed with processed juice grape varieties in mind and injury levels may be lower for varieties that command a higher value/ton.
- **Climatic factors related to the region** – if a region has prolonged winter snow cover or mild winter temperatures.

![Figure 1. Grape Berry Moth adult on Concord leaf. Photo by Andy Muza.](image)

**Low Risk Classification**

- **Value of the varieties being grown** – if lower value varieties (e.g., juice grapes) are being grown.
- **Surrounding Vineyard Habitat** – if no wooded edges or hedgerows/weedy areas are present around vineyards.
- **History of GBM injury** – if vineyards seldom have problems with GBM. The history of GBM injury for each site is acquired by maintaining scouting records of vineyards over the years.
- **Climatic factors related to the region** – if permanent snow cover is rare and site is prone to severe winter temperatures.

**Intermediate Risk Classification**
• This is a catch all classification. If it isn’t High or Low risk then site is classified as Intermediate risk.

**Life cycle and description of GBM.** Knowledge about the life cycle and ability to identify the pest and injury caused is important for successful management. Moths emerge from the overwintering pupal stage in spring. Emergence in Erie County, Pa. occurs in late May but in other areas of the state this may occur 2-3 weeks earlier. These moths are small (about 6 mm), brownish with grey-blue coloration at the base of wings (Figure 1). Unless pheromone traps are used it is unlikely that moths will be observed. Adults are active around dusk and have a distinctive zig zag pattern in flight. Mated females lay eggs singly on flower clusters or berries. Eggs are very small (< 1mm), scale-like and whitish, opaque (Figure 2). Due to their size, eggs are difficult to observe without a hand lens. Early in the season larvae hatching from eggs will web together small berries to feed. However, when berries reach about 5-7 mm in size, larvae will bore directly into berries to feed. Newly hatched larvae are tiny with white bodies and black head capsules. Later stages are brownish to purple in coloration (Figure 3).

Upon completing development larvae exit berries and either drop to the ground to pupate in leaf litter or some will pupate in the canopy in a semicircular leaf flap. Pupae which are encased in leaf sections are light brown to greenish in coloration (5 mm). Leaves with pupae will remain underneath the trellis if there is poor weed
control or will be moved by the wind and collect along wood edges, or in brushy areas. Adults will emerge from pupae to begin the next generation. There are usually 3 – 4 generations of GBM per year in Pennsylvania, depending on temperatures during the growing season.

**Scouting.** Regular scouting throughout the season (at least weekly) is critical in determining if and where applications should be applied for GBM. A scouting protocol for GBM is described in [Bulletin 138](#).

![Figure 4. Webbing in cluster from GBM larva. Photo by Andy Muza.](#)

This protocol recommends selecting four different areas in your vineyard to be sampled during each scouting event. Two different areas should be checked in the interior of the vineyard and two different areas along the exterior (border) portions of the vineyard. At each of the four sampling sites, randomly select 5 vines and examine 10 clusters/vine for GBM injury. Determine separate injury levels (# injured clusters/100 clusters = % injured clusters) for the interior and exterior portions of the vineyard. It is important to keep separate injury levels for the interior and exterior areas because border areas near woodlines/hedgerows will usually have higher levels of injury. Therefore, border areas may need an insecticide application while interior areas may not.

When scouting early in the season look for webbing in the clusters (Figure 4). Until berries are large enough to enter, larvae will web together multiple berries and feed from inside webbing sites. Some varieties (e.g., Concord) may exhibit a distinct reddening of portions of the berry if injury occurs before veraison (Figure 5) while other varieties do not (Figure 6). Later in the season look for holes, splits, webbing or dark tunneling underneath berry skin (Figure 7). If injured berries are broken open then larvae may be found.
Map vineyards and keep scouting records. Develop detailed maps of your vineyards and surrounding topography. Keep records of GBM injury levels for each scouting date and vineyard sections checked. These records will provide a GBM history per site.

Pheromone traps. GBM flight periods can be monitored using commercially available pheromone traps (Figure 8). Traps and pheromone caps can be purchased from a number of sources such as at Great Lakes IPM, Inc. and Scentry Biologicals, Inc. Monitoring traps are baited with small rubber lures impregnated with GBM female sex pheromone for attracting male moths. Pheromone traps may provide an idea of population levels at your vineyard site and can be used as a scouting tool to indicate flight periods. However, trap data are not used for timing of spray applications due to ambiguity concerning correlation of capture numbers and berry injury levels.

Cultural practices. Cultural practices are integral for any integrated pest management program. Therefore, maintain good weed control under the trellis. Poor weed management resulting in excessive vegetation under the vines can harbor GBM pupae.

Viticultural practices that promote a more open, less dense canopy resulting in better exposure of clusters to sunlight (e.g., shoot thinning, leaf removal, judicious
use of nitrogen) will not only improve quality of fruit but will enable better spray coverage.

Vineyard area maintenance such as preventing overgrown, weedy areas around the vineyard will reduce overwintering sites for GBM pupae. If possible, removal of wild grapevines near the vineyard will decrease potential reservoir sites.

2) Treatment Phase

![Late season GBM injury on Concord berries. Photo by Andy Muza.](image)

**Spray timing.** To accurately time insecticide applications it is recommended that the *Grape Berry Moth Degree-Day Model* be used. The GBM DD Model is a temperature-driven developmental model developed by Tobin and Saunders at Penn State. This model is incorporated into Cornell's Network for Environmental and Weather Applications (NEWA). Collaborative research at Penn State, Cornell and Michigan State Universities has shown that use of this developmental model can improve GBM management. For a comprehensive explanation concerning the development and use of this forecasting model consult *Focus on Females Provides New Insights for Grape Berry Moth Management.*

**Use of the GBM DD Model:**

![Pheromone trap for monitoring GBM flight periods. Photo by Andy Muza.](image)

- **CHECK** the NEWA weather station closest to your vineyard. There are a number of NEWA weather stations located throughout Pennsylvania. However, the majority of vineyards outside Erie County, PA will probably not be close enough (i.e., within a few miles) to a NEWA station
for this option to be useful. But you can still use the GBM DD Model by recording daily maximum and minimum temperature data on your own. Options include either purchasing a max/min thermometer or weather station for your site. The RainWise AgroMET & IP-100 Package [http://www.rainwise.com/](http://www.rainwise.com/) is the authorized choice for participation into the NEWA network.

- **MONITOR** and **RECORD** the date of wild grape bloom (i.e., when approximately 50% of flowers open) for each vineyard site. Research has shown that egg laying by females that emerge in the spring (first generation) is closely associated with bloom of wild grapevines. Therefore, the majority of eggs from this generation are laid on wild grape clusters and not in cultivated vineyards. **Note:** If using a NEWA site then enter the date of wild grape bloom into the model. If you do not record a wild grape bloom date for your site then the model does provide an estimated date for the weather station that is used.

- **TRACK** GBM degree days using a NEWA station closest to your vineyard site or keep a running total throughout the season of GBM degree days [(Daily MAX + MIN Temperatures)/2] – 47.14 F] starting on the recorded date of wild grape bloom.

- **SCOUT** to determine injury levels.

- **SPRAY** (if needed) as close to the designated degree day timings as possible.

The model recommends an insecticide treatment in high and possibly intermediate risk sites when: 810 GBM degree days are accumulated for the second generation; 1620 GBM degree days for the third generation; and 2430 GBM degree days (if harvest has not yet occurred) in years that a fourth generation occurs. Insecticides such as Intrepid, Altacor, and Delegate are suggested for these timings.

If using broad spectrum contact insecticides (e.g., pyrethroids) then applications should be delayed about 100 GBM degree days for each generation (i.e., 910, 1720, 2530 GBM degree days).

**Insecticides.** There are numerous insecticides effective for GBM which are registered for use in Pennsylvania. Consult the [2017 New York and Pennsylvania Pest Management Guidelines for Grapes](http://www.rainwise.com/).

Rotate insecticides with different modes of action into your GBM spray program to prevent/delay insecticide resistance. Read the label to determine if a spray adjuvant and/or pH adjustment to spray water is required. Also, incorporate more selective insecticides (e.g., Intrepid, Altacor, Delegate) into your spray program which will aid in conserving natural enemies.
Good spray coverage on clusters is critical. Therefore, spray every row and use appropriate gallonage, speed, pressure, and nozzles for good cluster coverage as the size of the canopy increases throughout the season.

3) Post-Treatment Phase

**Evaluate efficacy of applications.** Don’t assume that because an insecticide was applied that GBM was controlled. After an insecticide application check areas that were sprayed to determine the effectiveness of the application. *High Risk* sites in Erie County, PA have benefited from back to back applications (about 10 days apart) per generation due to extremely high population levels at these sites.

**Continue to scout.** Monitoring your vineyard(s) not only for GBM but also for other insects, diseases and weeds should continue through harvest.

**Keep accurate records.** Accurate records should be kept each season for: scouting (e.g., dates, pests observed, vineyard location where observed, injury levels), pesticide applications (e.g., pesticides used, rates/acre, gallons/acre applied, etc.), and weather data.

**Re-examine management practices.** At the end of the season, especially if GBM was not adequately controlled, re-examine management practices by reviewing your records. A few factors to consider that contribute to poor control include: inadequate spray coverage, inaccurate spray timing, too few applications, and choice of insecticides.

**Fine tune management practices.** The results of re-examining your practices may reveal flaws in your management strategy. If flaws are identified then be prepared to make the necessary changes in the future. Fine tuning your pest management strategy is an ongoing process which should evolve as long as you continue to farm.

**References:**

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