

REPORT OF THE TECHNICAL WORKING GROUP  
FOR THE  
EUROPEAN GRAPEVINE MOTH PROGRAM

Sacramento, California  
13-15 December, 2011

A subset of the Technical Working Group (TWG) for the European grape vine moth (EGVM) program in California met in Sacramento, CA, on December 13-15, 2011. TWG members attending: D. Lance (Acting Chair), R. Cardé, M. Cooper, A. Lucchi, L. Sazo, G. Simmons, R. Steinhaur, and L. Varela. The following members were not in attendance: V. Mastro (Chair), B. Bagnoli, G. Barrios, C. Ioriatti, R. Sforza, and G. Wegner-Kiss. On December 13, program personnel from federal, state, and county levels provided the TWG members in attendance with a summary of activities and results from the previous seasons. The TWG then met separately on December 14 to formulate responses to a series of questions from the program and draft initial recommendations on guidelines for deregulating areas as the program progresses. A preliminary report to the program was delivered verbally on the morning of December 15.

### **Overview**

At this point, the TWG believes that a wide variety of program goals, including eventual eradication of EGVM from California, remain technically feasible. Following its April 2010 meeting, the TWG provided three conditions for the continued feasibility of eradication. To reiterate:

1. The population is not (and does not become) substantially more widespread than it is known to be at present,
2. The grape industry remains behind the effort, and
3. Control methods that are available at the present time remain available for use by the program.

All three are still applicable. Numbers of European grapevine moth, *Lobesia botrana* (EGVM), were severely reduced in 2010 and again in 2011 within the core of the infestation (Napa area), and EGVM populations are beginning to disappear in outlier counties. Also, none of the chemical or behavioral (mating disruption) control tools have been lost or become ineffective. Finally, the grape industries have remained solidly behind, and involved with, the program. The TWG commends their efforts and recognizes that they have collectively borne the brunt of treatment costs and, along with growers of other affected crops, the burden of regulatory measures. In addition, program officials at the federal, state, and county levels have done a very good job of coordinating and ensuring compliance with program activities.

Eradication, as well as a number of other potential goals (e.g., containment and suppression), will continue to require a well-designed and well-coordinated area-wide program. As the program progresses, potential snags may develop. For example, residential and natural areas may prove problematic, as they have in Chile. Compared with cropland, these areas are more difficult to survey, and options for control treatments are more limited. In addition, while not a technical issue, TWG members expressed concern among themselves that grower enthusiasm for the program may begin to flag as moth populations decline but treatment costs continue. In both cases, adequate funding would be important to support adequate program staff and to help defray treatment costs to growers.

### **Responses to specific questions and issues**

#### *Quarantine buffer:*

The TWG previously recommended that the regulated area should encompass a 5-mile buffer around the sites of any EGVM finds, whether they are trap catches or visual finds. The TWG now agrees with a program suggestion to reduce this distance to three miles around all sites where EGVM were collected at any time during 2010 or 2011. The original buffer was set recognizing that there was a good deal of

uncertainty in the distribution of the insect, and that the effective range of the pheromone-baited traps was limited due to the insect's limited flight range. As a result, the TWG felt that finding EGVM in one spot could indicate risk in the surrounding area, and results of subsequent surveys supported their worries. The distribution of EGVM in California is now much better understood, and the 3-mile buffer is more appropriate.

*Survey recommendations:*

The TWG's recommendations for survey have changed little from those developed during the November 2010 meeting:

1. Trapping levels.

- a. Grape production areas: trap at a density of 25 traps per square mile throughout California, whether or not the area is under regulation for EGVM.
- b. Delimitation: 100 traps per square mile. This should be conducted within a 1-mile radius of new finds for 1 *full* generation (or, more correctly, one full flight). In Napa, for example, a full generation would include the first or second flight of the year but not the third, as a proportion of the population may enter diapause after 2 generations and thus would not be sampled by trapping the 3<sup>rd</sup> flight.
- c. Residential and natural areas (regulated): 25 traps per square mile. These areas provide potential refuges for EGVM populations and must be sampled intensively if eradication is to be successful.
- d. At-risk residential areas (unregulated): 5 traps per square mile. These are primarily areas where backyard grapes occur or areas near commercial grape production. "Near" would be a minimum of 500 m but could increase to 1 to 3 miles with risk factors such as a high proportion of back yards with vines or a history of EGVM infestation in the neighboring production vineyard. If possible, these surveys can be "piggy-backed" onto other surveys such as fruit fly or glassy-winged sharpshooter.
- e. Deregulation: 100 traps per square mile within 500 m of EGVM finds from 2010 or 2011 (see additional information in *Deregulation*, below).

2. Timing of trapping.

Trapping should commence in the late winter or spring before the predicted start of the adult flight season, based on degree-day modeling (at ~150 DD Celsius, 10-30 deg base). Trapping should continue until at least October 1. No EGVM have been captured in California after October 15, so there is no need to trap after this date. Further, given the minimal captures in the first half of October, the TWG felt that the benefit from trapping during this period does not justify the effort, especially if traps interfere with harvest or vice versa. Note that diapause occurs in the pupal stage in EGVM and is controlled primarily by photoperiod. As a result, weather – aside from temperature effects on the duration of the pupal stage – will have relatively little influence on the calendar date when the flight season ends.

3. Visual inspections.

The TWG recommends an increased emphasis on visual inspections of grapes for immature EGVM, especially in areas under mating disruption treatment. These should be conducted during first generation of the year:

- Inspect 100 clusters at 25 trap sites per square mile in treated areas.
- Inspections should be made during the period from the beginning of flowering to fruit set.
- Inspections would be expected to require 15-20 minutes per 100 clusters.

#### 4. Other considerations:

- a. Use of UV light traps is not recommended. Work in Italy indicates that they are not efficient for EGVM, in part because the moths fly mostly at twilight, when there is competing skylight, rather than during darker periods. In addition, the traps are expensive, labor-intensive to operate, and catch large numbers of non-target organisms.
- b. Based on Chilean experience, alternate locations for trap deployment in residential and natural areas without wine or table grapes may include secondary hosts such as olives, *Ligustrum* (privet), and other *Vitis* spp.
- c. Trap-check frequency. The TWG continues to recommend a 2-wk trap-servicing interval to ensure captured moths are in good condition for identification.
- d. Second-generation diapause. In areas of California, including the Napa Valley, a portion of the population appears to go into diapause following the second annual generation (i.e., they overwinter as pupae rather than emerging as adults as part of the third flight). This has also been observed in other areas where EGVM occurs. Second-generation diapause can affect our ability to detect the population via trapping during the third flight. It can also affect calculations of the overall number of generations a population passes through.

#### *Treatment recommendations*

Options for control treatments are also similar to those in 2010 recommendations.

##### 1. Chemical treatments.

- a. Treat to a 500-m radius around finds (trap or larval) collected at any time during 2010 or 2011.
- b. Treat first and second yearly generations while the area is under regulation.
- c. Timing based on DD models and host phenology (first annual generation) and primarily DD models (second generation).
- d. The current list of available insecticides remains appropriate. Methoxyfenozide (“Intrepid”) and Chlorantraniliprole (“Altacor”) have been the most commonly used options and have been very effective, but growers (or program managers) should continue to select products based on situation and need. For organic production, Bt and spinosads (“Entrust”) are the available options. These insecticides have a short field residual and can require multiple applications per generation to be effective.

##### 2. Mating disruption.

- a. Treat to a 500-m radius around finds (trap or larval) collected during 2010 or 2011.
- b. Apply prior to first flight of the season, based on degree-day models.
- c. Do not apply to areas that are eligible for deregulation during or at the end of the current field season. For example, if any area is eligible for deregulation after the second flight in 2012 or at the end of 2012, no mating disruption treatments should be applied to that area in 2012.
- d. For residential areas, the TWG was asked if dispensers could be applied to front yards only or would have to be applied to back yards also. Mating disruption works best when dispensers are applied uniformly, leaving no large “holes” that could result in pockets of relatively pheromone-free space. With Shin Etsu dispensers, the recommendation is 500 per ha, which translates to one dispenser about every 4.5 m if placed on a regular grid with square cells. Given that dispenser spacing in residential areas would already be disrupted by the presence of buildings, streets, and other landscape features, it would definitely be best to distribute them to the degree possible

through the remaining areas, which would include backyards, while attempting to maintain an overall level of 500 per ha. If alternative formulations come out of studies planned for 2012 in Italy, it may be possible to “shoot” dispensers into backyard areas, depending on chemical trespass laws. Those systems would not be available until at least the 2013 season.

3. Residential, urban, and natural areas. Continue to use host removal or Bt, in combination with mating disruption, when possible. The use of mating disruption continues to be strongly favored by TWG members, except in areas targeted for deregulation, as described previously.

#### *Alternate and secondary hosts*

The available literature lists a wide variety of host plants for EGVM. This contrasts with the field experience of many who work with this insect, which suggests that there may be relatively few plants that the insect utilizes to the point where the plant becomes a regulatory risk. In addition, the ongoing suppression of EGVM populations in program areas reduces risk associated with secondary hosts. The TWG recommends a critical re-evaluation of the available literature to assess which plants on current host list do indeed pose a risk that warrants regulation. This effort should be conducted rapidly (e.g., by March 2012) and should initially focus on plants in production agriculture that are affected by EGVM quarantines, such as stone fruit and cut flowers. If the re-examination of the literature does not provide sufficient information for key plants on the host list, biological testing would be warranted.

Given the information available to the TWG at this meeting:

- a. Evidence in literature regarding *Rubus* spp. (canberries such as blackberries or raspberries) as EGVM hosts is scant, anecdotal, and, moreover, contradictory. Taken in total, this information does not support regulation of *Rubus*, and we recommend removing the genus from the host list.
- b. Flowering olives should continue to be treated as potential hosts.

#### *Regulation of waste products*

The TWG was asked to answer a number of questions around regulation of green waste and winery waste. We believe these questions can be answered by the following:

1. Unfermented pomace or other material pressed at 2 bars or greater does not need to be regulated.
2. Unfermented pomace pressed at <2 bars should be treated as green waste using existing protocols.
3. The process of de-stemming and/or crushing typically does not mitigate risk. An exception would be where grape berries or whole clusters are pressed at 2 bars or greater.
4. For red wine production, must is not considered a risk because the liquid “drowns” immature stages of EGVM. Similarly, pomace from red wine production (which has been through fermentation) does not require regulation.
5. The TWG does not have sufficient information at this point to comment on specific protocols for shredding/chipping or solarization, or on potential use of such methods as “stack and pack” or ozone to mitigate risk associated with winery and green waste. Additional studies would be needed to determine the potential effectiveness of these methods either as stand-alone treatments or as part of a systems approach to handling waste.
6. The TWG was asked which life-stages pose the greatest risk in green waste. In general, pupae and mature larvae will pose a greater risk than younger larvae or eggs (which require a continued source of acceptable food) or adults (which may tend to fly off prior to transport). Mature larvae, in particular, can leave grapes or green waste after transport to uninfested areas. They do not require food but instead seek suitable, protected sites for pupation.
7. The TWG notes that risk of EGVM life stages such as larvae and pupae on vineyard and winery equipment should be taken into account.

8. Compost conditions in existing, signed Compliance Agreements should stay in place even if somewhat more stringent than necessary given the above recommendations.

#### *Systems Approach (fresh grapes)*

The TWG recognizes that a “systems approach” to quarantine security was put into place to allow shipments of fresh grapes from regulated areas to unregulated areas. This approach requires treatment (e.g., fumigation) of grapes from within areas adjacent to EGVM finds but allows grapes from surrounding (but still regulated) areas to be shipped without a post-harvest treatment if proscribed monitoring and inspection procedures are followed (and no EGVM are found). Table grapes shipped under this approach should pose little risk: (1) EGVM populations in regulated table-grape production areas are currently very low or potentially non-existent, (2) poor quality grapes (rotting, diseased, etc.) are culled out to a large degree, (3) grapes are refrigerated in transit, and (4) grapes are sold in small quantities in the retail market (e.g., single clusters), and (5) final disposition of these grapes is presumably not in the vicinity of host material in most cases. Fresh grapes for wine production pose a somewhat greater risk: (1) grape quality may not always be scrutinized to the degree typical with table grapes, (2) grapes are sold to individual customers in larger quantities (thus potentially carrying numerous EGVM to a single site, which increases chances of establishment), and (3) end customers may include wineries, which often have production and/or demonstration vineyards on the premises. The TWG recommends extra care and caution if a systems approach is to be used to allow shipments of fresh wine grapes from regulated areas. This is especially true for grapes grown in the Napa area, because the relatively higher EGVM populations in that area increase the risk that EGVM may be in the shipments.

1. The TWG was asked if the current 7-day interval between inspection and shipment can be increased to 14 days. The TWG recognizes that this increases the time interval, prior to shipment, when previously uninfested grapes could potentially become infested. Nonetheless, the TWG members agreed to this change where it is being used for table grapes. The program may also consider this change for fresh wine grapes if it feels risk can be kept at acceptable levels.
2. The TWG was asked about the biological rationale for excluding detection and delimitation traps from Fresh Grapes Systems Approach. This appears to be a programmatic/logistical decision.
3. As a point of clarification – for the systems approach, the 300-cluster sample is specified as a statistical sample that provides a set level of assurance that the grapes in the field have a minimal level of infestation (specifically, 95% assurance that <1% of clusters are infested).

#### *Deregulation*

The TWG recognizes that, as the EGVM program progresses; it is desirable to keep all infested areas under regulation, but to lift regulations as quickly as possible from areas where the insect has been eradicated. There are two associated “error states” – specifically, (1) lifting regulations from an area where the pest still exists and (2) keeping an area under regulation after the pest has been eradicated. While neither of these error states is desirable, the former would be much less so, as finding a population in an area that has been declared pest-free – especially if there are multiple incidents – will tend to erode confidence of the public, the industry, and our trading partners. Declarations that areas are pest-free are based primarily on sampling, which for EGVM is done with pheromone-baited traps and in some cases by visual examination of vines. Such sampling can never provide 100% assurance that a population of the pest isn’t present, but the ability to detect a population, and especially a small population, increases with the intensity (e.g., traps per square mile) and the duration (moth generations) of the sampling effort. Determining the success of eradication efforts is further complicated with EGVM because we do not have a good understanding of the efficiency or effective sampling range of the traps. With these factors in mind, the TWG has developed strategies for deregulation that we believe will minimize the risk of type (1) errors without placing an undue burden on affected industries.

1. Requirements for de-regulation (counties beyond the contiguous core):
  - a. Five consecutive generations without a find at
  - b. 25 traps per square mile in grape production and other at-risk areas (residential, natural), as well as
  - c. Intensive monitoring for at least two *full* generations immediately prior deregulation (or two full generations followed by a partial third, where a portion of the insects from the second are expected to enter diapause). This includes, in addition to the 25 traps per square mile above:
    - 100 traps per square mile in place within 500 m of sites of earlier finds, and
    - No mating disruption treatments in the area. If the two (or two+) generations occur in the same field season, mating disruption should not be used that year.
  - d. Continue insecticide treatments for the first two annual generations throughout the regulated period. The TWG realizes that continuing to treat in the face of negative trapping data imposes a cost burden, but we would also point out that failure to eliminate a small infestation will eventually re-set the clock on deregulation. With that said, while insecticide treatment of the first and second annual generation is recommended throughout the period that an area is under regulation, the decision to deregulate is based primarily on survey results.
  - e. After deregulation, the TWG is recommending leaving pre-deregulation trapping levels in place for two additional generations. The TWG recognizing that leaving higher-than-baseline levels of survey in place after deregulation is not the usual practice, but it also is not unprecedented (e.g., Asian longhorned beetle). We believe this allows for an extra measure of assurance and keeps risk of exporting EGVM at a minimum while allowing areas to be freed from regulations at the earliest acceptable time.
2. Counties eligible for deregulation. The TWG believes that the following counties could be deregulated prior to the 2012 field season: Fresno, Mendocino, Merced and San Joaquin. While the guidelines outlined above were not strictly met in all cases, we believe that the combination of survey, treatments, geographic location, size of EGVM population, and, in some cases, degree-day accumulation supports deregulation.
3. Counties eligible for deregulation after 2012. If the guidelines above are followed and there are no additional finds, the following counties should be eligible for deregulation after 2012: Santa Clara, Santa Cruz, Nevada. TWG members did express some concerns about Nevada County in that the nature of agriculture and the landscape could tend to make both survey and treatment less effective than in other areas. Nevada County may choose to augment treatment with mating disruption again in 2012, but this would push their time schedule back if the TWG guidelines are followed.
4. Solano County. Solano County did not have any EGVM finds in 2011, but the TWG is recommending that program areas are not released from regulation at this time, with the exception, potentially, of areas affected by the change from a 5- to 3- mile buffer. There are several reasons for this: first, the regulated area in Solano is contiguous with the core regulated area (Napa), which increases risk of infestation; second, trapping levels around finds were 25 rather than 100 traps per square mile in 2011; and third, captures in the second flight of 2010 means that there have only been 4 find-free generations (and 2 full generations without a find) at this point. If trapping levels are brought to pre-release-from-regulation levels for the first two generations of 2012 with no additional finds, then the TWG would agree with releasing Solano from regulation at that point, which would likely occur in August 2012. The exception would be portions of Solano that are within 3 miles of any find site that occurred in Napa County, which should remain regulated at this point (treated as part of Napa County). The TWG recommends continuing treatments around find sites (500 m) in

Solano County for at least the first generation of 2012 and possibly the second, depending on where the timing of treatment would fall relative to the timing of the second flight.

5. Sonoma County. Nine EGVM were captured in Sonoma County in 2011, all of which were caught in the first flight. Eight of those captures occurred in a single area that abuts an infested portion of Napa County. If trapping levels are increased per guidelines above in 2012 with no further captures (and mating disruption is not used), the TWG would support removing Sonoma County from the regulated area after 2012, with the exception of those areas of the county that are within 3 miles of Napa County find sites. In addition, if there are one or two isolated locations in Sonoma where moths are found in 2012, we believe that those could be treated as isolated infestations (falling back to the 3-mile rule) rather than continuing to regulate the broader area that is currently under regulation. If larger numbers of apparently isolated EGVM populations are found in Sonoma, it would be prudent to continue regulating the larger area. Insecticide treatments are again recommended during the first two generations of 2012 for sites within 500 m of EGVM collected during 2010 and 2011.
6. Napa County. While the numbers of EGVM captured in Napa County declined 1000-fold from 2010 to 2011, the TWG believes that the remaining population is large enough to warrant another full season of coordinated, area-wide suppression activities before moving toward deregulation. There are a couple of additional factors playing into this recommendation. First, with the widespread use of mating disruption in the county, EGVM populations are almost certainly somewhat higher than trap catch data alone might suggest. Secondly, the TWG is concerned about possible EGVM populations in hosts in backyard and natural areas, which may not have been surveyed or treated as systematically production areas. These areas provide potential refuges from eradication treatments and require a focused effort to ensure that they won't scuttle the program. Backyard grapes, in particular, have been very problematic for the program in Chile.

With that said, if the 2012 data indicate continued success of the EGVM suppression activities, the TWG would recommend proceeding toward deregulation of Napa County in a step-wise fashion starting in 2013. We have proposed the following scenario, keeping in mind that this will be a complicated effort and will require work among regulators, the industry, and technical experts to develop a final plan. For example, the TWG does not fully understand how grapes move within Napa County, yet this could affect the feasibility of different deregulation scenarios.

The proposed plan follows existing recommendations, such as the 3-mile rule and programmatic trapping levels. Specifically, areas of Napa County could be considered for deregulation after the second flight of the 2013 field season if the following criteria are met:

- The area is at least 3 miles from any 2012 finds.
- No mating disruption is applied in 2013.
- Protocol trapping levels are met (25 traps per square mile in production and applicable residential and natural areas, with 100 traps per square mile within 500 m of earlier finds).
- Insecticide treatments continue in the first and second generations of 2013 in areas within 500m of location where EGVM were collected at any time during 2010 or 2011.
- The program should consider using visual inspections (see item 3 under *Survey recommendations*) to augment trapping survey in areas of Napa targeted for deregulation during or at the end of the current field season.

This process would be repeated in subsequent years until all areas de-regulated. For example, areas that were at least 3 miles from any 2013 finds could become eligible for deregulation after two generations in 2014. One restriction would be that deregulation should proceed in large blocks rather than on a vineyard-by-vineyard basis, and should ideally proceed from outside in.

## **Research needs, unprioritized, from 2010 report (*annotated with updates in italics*)**

### *Monitoring:*

- Determine the utility of high-load pheromone lures, light traps, food-lure traps, etc., for monitoring EGVM populations in areas under mating disruption treatments. *Populations of EGVM in California were not sufficient to obtain meaningful data in this area. Studies on in this area, but not including light traps, are planned for 2012 in Italy. Additional work on female attractants is ongoing in New Zealand.*
- Develop/validate sampling systems for assessing populations of immature EGVM in fields (for use in monitoring to assess risk of moving grapes out of quarantine zone for crush and for assessing mating disruption effectiveness). *Research has not been done specifically in this area, but a recommendation based on European sampling plans is included here.*
- Optimize trap design (includes looking at folding of flaps in delta traps). *This has not been pursued, but some trapping work will be done in Europe next year.*
- Determine sensitivity of the detection and delimitation systems (would have to be done abroad at this point).
- Validate the degree-day model. *This work is ongoing in California.*

### *Ecology, behavior, biology, biological control:*

- Continue work to determine what alternative hosts are used by EGVM in California. *The TWG is recommending this be considered a priority, starting with a critical re-assessment of the literature.*
- Determine factors that control entry into diapause; i.e., is it possible that many EGVM in Napa go through only two generations in a growing season?
- Evaluate genetic diversity in EGVM. *This work is ongoing in California.*
- Characterize adult behavior (flight, mating, oviposition, resting).
- Evaluate possibility of using biological control agents to reduce populations.
- Characterize population dynamics of EGVM in California, including effects of natural enemies.
- Develop a spread model.

### *Control and management:*

- Develop enhanced systems for monitoring and evaluating an area-wide EGVM management program.
  - a. *Use GIS/GPS to track monitoring, treatment, and related relevant programmatic data (ongoing, APHIS-PPQ)*
  - b. *Enhance tracking and evaluation of insecticide treatment data for Napa and Sonoma program areas (ongoing, UC Extension).*
  - c. *Develop enhanced geospatial tracking and analysis of EGVM spread, control, and program activities in California (proposed).*
- Develop/assess new mating disruption formulations for EGVM, including machine-applied. *Work is planned for Italy in 2012.*
- Continue to assess insecticides and develop lists of “best” insecticides for use in conventionally managed vineyards, organic vineyards, and sensitive areas (e.g., riparian, urban and suburban areas). Encourage registration of promising compounds and products for use against EGVM. Determine



optimal timing and use patterns for products with short field life such as Bt. *Ongoing work, closely integrated with the program.*

*Develop Sterile Insect Technique methodology for EGVM:*

- Improved rearing technology. *This work is ongoing primarily in support of commodity treatment evaluations.*
- Radiation biology – identify dose and methods for producing fully sterile and F1-sterile male EGVM. *This work was initiated at the Otis lab but has not received funding.*
- Develop release technology. *We are not yet at the point where this or field evaluation is feasible.*
- Evaluate field competitiveness of sterile moths.

*Regulatory:*

- Develop and/or confirm regulatory treatments for grapes (table, wine, raisin). *This work is well underway but additional replicates are needed.*
- Develop regulatory treatments for grape nursery stock; confirm efficacy of hot-water dip.
- Investigate pathways that could move EGVM to new areas. Also, how did it get to Napa?
- Evaluate/develop improved methods of transporting grapes within California to reduce incidence of new EGVM finds in the vicinity of wineries that are outside of regulated areas.
- Confirm efficacy of/develop improved methods for handling, composting, or otherwise treating winery waste to minimize risk. In particular, look at mechanical treatments for green waste (shredding, grinding, etc.). *Mechanical treatments and composting methods require additional evaluation. Methods involving mixing of green waste with wet fermented pomace wastes may also be assessed.*
- Determine if EGVM life stages can survive the crush process and survive in unfermented pomace. *Work in this area has led to recommendations to treat at 2 bars or higher to minimize risk.*
- Confirm that processing grapes into raisins will kill all EGVM life stages.

*Economic assessment of EGVM in California and North America.*

- Completed and posted in November 2010.