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

October 22, 2014

A subset of the Technical Working Group (TWG) for the European grape vine moth, *Lobesia botrana* (EGVM), program in California met by teleconference on October 22, 2014. TWG members attending: B. Bagnoli M. Cooper, C. Ioriatti, D. Lance (TWG Chair), A. Lucchi, V. Mastro (USDA-Emeritus), G. Simmons, R. Steinhauer, and L. Varela. The following members were not in attendance: R. Carde, L. Sazo (Appendix III). Program personnel from federal, state, and county levels provided the TWG members in attendance with a summary of activities and results from the previous season. Following that, the TWG met separately to formulate responses to a series of questions from the program and draft recommendations on guidelines for deregulating areas as the program progresses. The format did not allow for a preliminary oral report to the program during the course of the meeting.

Overview

There has been substantial program success with several previously infested areas released from quarantine and only one moth capture in 2014. The TWG believes the program goal of eradication of EGVM from California, remains 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 conditions are still applicable. At this time, all previously infested areas of California beyond Napa County have been deregulated, with the exception of portions of Sonoma County that are within 3 miles of earlier captures in Napa County. Last summer (August 2014), deregulation of the core infested area began with the Carneros and Wooden Valley areas of Napa County along with adjacent areas of Sonoma and Solano Counties. None of the chemical or behavioral (mating disruption) control tools have been lost or become ineffective. In addition, 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. Program officials at the federal, state, and county levels have continued their very good job of coordinating program activities.

Numbers of EGVM captured in the core infested area (Napa and Sonoma Counties) have been reduced each year of the program from over 100,000 moths in 2010, to 77 in 2012, 40 in 2013 and just one in 2014. In 2012, the 77 moths were captured from five separate areas. In 2013, 40 moths were captured from 14 separate areas. Most of the finds in 2012 were associated with a small private vineyard in the Olive Hill area, while a few additional finds were scattered among 4 sites in the county's wine-growing areas. In 2013, there was again a "hot spot" (Greenfield

area of St. Helena, N of Lake Hennessey), but the scattered finds were more numerous than in 2012 and occurred not only in peripheral areas but also in central portions of Napa Valley (St. Helena/Rutherford/Oakville). In addition, moths were captured in the second flight in 2013, which did not happen in 2012.

Patterns of captures in 2012 and 2013 may be explained by a decrease in acres under mating disruption (~23,000 to ~2,800 acres) and an increase of trapping density (from 25 to 100/sq. mile). This suggests that there may still be a risk of small residual pockets of EGVM infestations. As the program reduces the use of mating disruption previously "masked" infested areas may become apparent. Of particular risk are small vineyards associated with residential gardens that may not be known to the program. This concern is the basis for continuing TWG recommendations to maintain a robust detection program with as many traps as resources permit. Continued vigilance is critical. Additionally, we recommend that program partners continue efforts to identify plantings of grapes that may have previously gone unsurveyed and untreated. Wineries that have had exchanges of grapes from core infested areas and movement of farm equipment from infested vineyards also remain priorities.

Specific recommendations

Recommendations new, emphasized, or unique to this report:

Treatments: The program coordinators have done an excellent job to date of trying to achieve coverage of treatments throughout the affected areas. As additional program areas move toward deregulation and with only one capture in 2014, the TWG recognizes that maintaining focus of growers on program operations may be challenging in 2015. As the population declines toward eradication, achieving coverage of suppression treatments across all areas where treatments are recommended will continue to be important to ensure that small, localized populations of EGVM are eliminated before they grow, show up in traps, and force an extension of the program in that area and likely in surrounding areas as well. The strong effort on outreach and education along with monitoring should continue to help ensure compliance. The TWG is not recommending any changes to current treatment schedules at this time.

Quality Assurance of Monitoring Program: As the moth population declines, the importance of a single positive find increases, and it will be important to maintain high levels of scrutiny for all detection trapping. At the same time, program personnel have not seen an EGVM moth on a trap for several years which may affect the accuracy of the screening process. The TWG recommends that the program emphasize quality assurance (QA) of the trapping program.

1. Per recommendations in the CDFA Insect Trapping Guide, all traps should be inspected twice, by separate inspectors, prior to being discarded.
2. Ensure that all trapping personnel are adequately trained to recognize a suspect EGVM in a trap. This would include refreshers for veteran personnel as opportunities to see EGVM in traps have been rare recently. (This could include the use of marked EGVM available from the USDA Otis laboratory.)
3. Program supervisors should continue to accompany trappers in the field regularly to verify correct trapping procedures are being followed including effective placement of traps.
4. Consider seeding traps with marked EGVM (available from the Otis laboratory) for an additional test of trap screening effectiveness.

Development of a Post Eradication Plan: The TWG received multiple questions this year regarding post-eradication strategies. This is a feature of other successful eradication programs and serves as a kind of insurance to maintain hard fought gains. The TWG recommends that a comprehensive post eradication plan be developed as soon as possible in order to provide guidance to EGVM program managers as a large regulated area in Napa County appears to be on track for removal from regulation after the second flight in 2015, with the remainder to be removed after the second flight of 2016. A small group composed of a subset of TWG members along with treatment coordinators, UC scientists and key program personnel will work to develop a post eradication surveillance and response plan. The recent plan for Pink Bollworm Post-Eradication (National Cotton Council, PBW Action Committee (http://www.aphis.usda.gov/plant_health/plant_pest_info/cotton_pests/downloads/PBW-post-eradication-minimum-standards.pdf) may serve as a model for development of a plan.

This plan should develop strategy and recommended minimum detection trapping to be initiated in core areas of the original infestation and in other areas where pathway and pest risk analysis indicates that may be at high risk of reinvasion or where a low level undetected population may reside.

The plan should also include a response plan for treatment based on detection of a reproducing population that defines what treatments should be used, delimitation trapping and other survey activities, and for how long control operations should continue. These guidelines are already available regarding responses and action triggers and these can be adapted to implement into the plan. The plan should define the minimum level of resources needed to ensure that post eradication responses can be effectively implemented. Lastly, outreach and education (e.g., to discourage "accidental" introduction of exotic pests) could also be included in the plan.

Lure loading: Based on results of testing in Portugal and Italy, the TWG is recommending loading trap lures for EGVM at 10 mg for areas where mating disruption is used. For areas without mating disruption (all program areas at the start of 2015), either a 1-mg or 10-mg loading may be used. The TWG is not recommending a change in the composition of the attractant at this time.

Mating disruption (MD) treatments: As there were no captures within the regulated area in 2014, no MD treatments should be applied at the start of the 2015 season. The TWG believes that deploying MD treatments would be warranted during 2015 only in response to captures or larval finds that occur prior to the start of the second flight of moths, per previous recommendations (see *Treatment recommendations/*Mating disruption, below). In addition, the program may consider not deploying MD around sites of single, isolated captures. An alternative would be to enhance trapping in the vicinity (up to, e.g., a trap per hectare) to gain an improved understanding of the local population. Note that the TWG is not suggesting that this trap density is sufficient to act as a control (mass-trapping) treatment.

Deregulation of portions of Napa County: Based on previous recommendations, specific portions of the regulated area could become eligible for deregulation after the second flight of the 2015 season if no moths were captured in 2013, 2014 and no additional EGVM are captured in those areas. These primarily include southern areas of Napa County and Pope Valley that are

not within 3 miles of 2013 finds. The program should set the boundaries for these deregulations based on criteria defined in the *Deregulation* section below, as well as other considerations such as physical or political features or AVA boundaries.

Trapping outside of the regulated area: The TWG is reiterating an earlier recommendation that grape production areas in California should be trapped at a minimum of 25 traps per square mile, at least until all of Napa County is deregulated. All grape production areas in California should be trapped, though maintaining the relatively high density (25 per square mile) is especially critical for Sonoma and Solano Counties given the levels of agricultural materials and equipment that move back and forth from Napa and histories of finds in those areas. As part of this, traps should be placed in the immediate vicinity of wineries or other facilities that receive materials or equipment from within regulated areas.

For areas removed from quarantine in the previously infested contiguous core area of Napa and Sonoma counties (all infested areas before the deregulation action on 8/27/2014), we recommend a minimum of 25 traps per square mile be deployed in all areas including urban areas. Appendix IV

Sonoma find in 2014. The response to the capture of a single EGVM in Sonoma County was appropriate per guidelines below; i.e., it did not in itself trigger a quarantine but did trigger delimitation trapping. Guidelines below specify one generation of delimitation, but given the current status of the program and the relatively small area of grape production around the find, the TWG believes it would be prudent to continue delimitation-level monitoring through the 2015 season.

General recommendations (with minor modifications from earlier TWG reports)

Quarantine buffer:

The TWG continues to recommend that the regulated area is encompassed in a 3-mile buffer around the sites of any new EGVM finds and finds in the previous three years (2012 to present) whether they are trap catches or visual finds.

Quarantine triggers:

The TWG is not recommending specific changes for quarantine triggers in areas that are not regulated for EGVM or have been released from EGVM quarantine.

The TWG is recommending a programmatic trigger of 1 life-stage (an adult in trap or an immature) within the regulated zone in the Napa County area. That is, finding a single insect will kick off a program response in terms of trapping levels and control activities, and will reset the deregulation "clock" for areas within 3 miles of the find. The rationale is that populations have been driven low enough that transport of single moths to points outside of infested areas will be rare, so a moth find is likely an indication of local breeding population.

Survey recommendations (unregulated areas):

The TWG's recommendations for survey in unregulated areas have changed little from those developed during the November 2010 meeting. Trapping recommendations for the Napa area are discussed separately in *Deregulation* and *Post-deregulation*, below.

1. Survey levels

a. California grape production areas should have no fewer than 25 traps per square mile for the entire trapping season (Feb-Oct 1).
b. Priority should be given to trapping the areas within 300 m of grape processing facilities (e.g., wineries), and especially those that have received grapes from regulated areas. In addition, any vineyards within that area, no matter how small, should have at least one trap. The TWG recognizes that factors such as budget shortfalls can potentially make it impossible for the program to meet recommended or protocol trapping levels in some areas. The history of EGVM in California indicates that most finds of the moth in remote counties has occurred in the vicinity of wineries, which is why these areas are priorities for survey. However, there have been additional EGVM finds in vineyards that were remote from wineries so all grape production areas should be trapped if possible.
c. Delimitation surveys: 100 traps per square mile within 1 mile of new finds for a full generation.
d. At-risk urban areas in California (outside of the previously infested core areas of Napa and Sonoma Counties) should be surveyed at a minimum of 5 traps per square mile. These include areas near grape production areas or areas with backyard grapes. "Near" would be a minimum of 500 m but could increase to 1 to 3 miles with risk factors such as high proportions of yards with vines or proximity to current or previous EGVM infestations. This trapping can be combined with other trapping programs where applicable.
e. For areas removed from quarantine in the previously infested contiguous core area of Napa and Sonoma counties (all infested areas before the deregulation action on 8/27/2014), we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas
f. The TWG strongly supports current APHIS efforts to survey nationwide for EGVM.

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, with January 1 as the starting point for accumulating DD). 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. Trap placement.

   Traps that are placed at a specified density (i.e., a prescribed number of traps per square mile) should be spaced as uniformly as possible throughout the area being trapped. For example, if 25 traps per square mile are arrayed on a "perfect" square grid, traps will be 322 m apart, and maximum distance between an insect and the nearest trap within that area (mid-point on the diagonal between traps) will be 228 m. To keep the maximum insect-to-trap distance reasonably close to 228 m, traps need to be placed within and not just at the perimeter of any vineyards that exceed ≈325 m across in the shorter dimension (length or

width). See Appendix I of the 2012 TWG Report for details and the rationale for this recommendation.

Within vineyards, place traps at canopy height.

4. Visual inspections.

   The TWG recommends the use of 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.

5. Other considerations:

   a. Trap-check frequency. The TWG continues to recommend a 2-wk trap-servicing interval. Degradation of captured moths could occur during longer intervals, leading to misidentification or non-identification.

   b. 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.

   c. The TWG was asked if, in outlying areas, stopping trapping after the second flight could potentially be used as a cost-saving strategy. This is not recommended but is preferable to reducing trap density.

Treatment recommendations:

Options for control treatments remain similar to those in previous recommendations.

1. Chemical treatments.

   a. Treat to a 500-m radius around finds (trap or larval) collected at any time during 2013 2014 or any new finds in 2015.

   b. Treat first and second yearly generations while the area is under regulation. The TWG does not recommend attempting to treat the third-generation larvae or overwintering EGVM.

   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 sites of any 2015 finds in the Napa area, if (and only if) those finds occur during the first flight (trap) or first generation (larvae). Also, if EGVM captures indicate the presence of a population at a remote location beyond the Napa infestation, use of mating disruption is at the discretion of the program based on a variety of factors, including the apparent size of the population and the efficacy of the other control measures being used.

   b. Do not apply to areas surrounding 2010, 2011, 2012 or 2013 finds, unless those areas are also within 500 m of a 2015 find.

   c. Efficacy of mating disruption may decrease at the edges of treated areas, and this effect is most pronounced along windward edges. Applying dispensers to vegetation surrounding vineyards, where feasible, can help alleviate this effect.

   d. When mating disruption is used in residential areas, cover the area surrounding the find(s) as uniformly as possible out to 500 m.

3. Residential, urban, and natural areas. Continue to use host removal or Bt, in combination with mating disruption, when practical.

Alternate and secondary hosts

The TWG does not have recommendations in this area at this time, other than to continue treating flowering olives as potential hosts. Applicable recommendations on EGVM host plants can be found in previous TWG reports and in several communications that came out following the 2011 TWG meeting.

Regulatory Requirements.

At this time, the TWG believes that the current regulatory requirements are sufficient (if enforced) and is not recommending any changes in regulation involving, for example, handling of winery waste, movement of grapes or grape plants, systems approaches to fresh grape certification, or handling of other grape products such as must. Some regulatory measures such as the requirement for slack-loading were relaxed in 2013 (following consultation with scientific support staff) based on reduced EGVM populations in the Napa area. The TWG remains concerned about the risk of EGVM being imported on farm equipment from EGVM infested countries, and suggests that the program work with the wine and table grape industries to ensure that such risk is mitigated to the degree possible.

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.

As noted previously, the TWG is recommending more stringent protocols prior to release from regulation for the Napa area than were used for the outlying counties, all of which have now been deregulated with the exception of portions of Sonoma that were within 3 miles of a Napa find in 2013. To reiterate, these conditions are:

1. Areas within three miles of previous EGVM finds in Napa County should be regulated (no change) at this time, with the exception of areas deregulated in the summer of 2014. This continues to include a portion of Sonoma County.
2. General detection trapping within the entire regulated area should be increased to 100 traps per square mile for grape production areas and a *minimum* of 25 traps per square mile in urban areas.

   The TWG notes that a southern section of Napa County (which includes the City of Napa) could potentially be eligible for deregulation following the first two flights of 2015. The experience in Chile indicates that eradication can be problematic if backyard grapes in residential areas harbor small reservoirs of EGVM. The fragmentation of the moths' habitat could also affect the sensitivity of detection trapping, which is already at a lower recommended density than in production areas.

   Extra care is warranted for urban and suburban areas in the last season prior to deregulation to ensure that isolation populations aren't escaping detection. This could include intensified efforts to locate, treat, and monitor small grape plantings as well as increased trap density in areas known to have grapes or otherwise at high risk.
3. When a life stage of EGVM is detected, production areas within 500 m of the find should be:
   a. Treated with program-recommended insecticides during the first and second generation of each year until the area is deregulated.
   b. Treated with mating disruption for two full flights following the detection. As noted above, in the Napa area, the third flight of the year typically includes only a portion of the population and cannot be counted toward mating disruption treatments or as a flight for confirmatory trapping prior to deregulation.
      i. If moths are trapped in an area during the first flight of a season, mating disruption treatments should be applied to the surrounding area. If they are trapped in the second flight, mating disruption should be applied the following spring.
      ii. If only a single moth is trapped, the program may, at its discretion, continue trapping at a high level (or preferably enhance trapping in the area) rather than deploying mating disruption.

iii. Trapping levels may be reduced to 25 traps per square mile for areas under active mating disruption treatment.

c. Survey visually for EGVM larvae in vineyards treated with mating disruption per protocol above under *Survey recommendations*/*Visual inspections*.

4. In the second year after the detection (the year following mating disruption), increase trapping within 500 m of previous finds to either 250 or 100 traps per square mile in production areas depending on the duration of trapping (see below), 100 traps per square mile in urban and residential areas, and 25 traps per square mile in any riparian or wild areas that may be harboring wild or feral grapes.

5. If there are no additional finds in the area after four full flights of high-density trapping (and at least six full flights after the initial find), the area becomes eligible for deregulation if 100 traps per square mile were deployed in vineyards within 500 m of earlier finds. An alternative strategy (the TWG's initial 2012 recommendation for Napa) would be to deploy 250 traps per square mile in those core production areas and reduce the required high-density trapping period to three full flights (and at least five full flights after the initial find). Active mating disruption dispensers cannot be present in areas where high-density trapping is being used to confirm eradication.

   As discussed above, traps should be spaced as uniformly as possible throughout the area being trapped in order to keep the maximum insect-to-trap distance as small as possible. More specifically, at 100 traps per square mile, traps should be arrayed so that no point in the vineyard is more than ≈120 m from the nearest trap; at 250 traps per square mile, all points should be no more than ≈75 m from the nearest trap. This will require placing traps within, and not just at the perimeters of, larger vineyards. Guidelines and rationale for this recommendation are given in Appendix I of the 2012 TWG Report.

   During the 2012 meeting, the TWG had internal discussions as to whether it would be better to suspend insecticide treatments prior to the last one or two full flights. The thought was that this would allow any residual population to grow, which would improve our odds of detecting it. The counter-argument was that any population that was small enough to require growth to ensure detection would probably be eliminated by the additional treatments. Because the latter option potentially hastens deregulation and simplifies/shortens the program, we chose it.

6. Since the beginning of the program, the TWG has maintained that when Napa County is deregulated, it should be done in fairly large contiguous blocks and preferably from the outside in, as opposed to, say, deregulating individual vineyards or individual square-mile areas in a patchwork fashion. Patterns of future finds are impossible to predict at this point, but the TWG is willing to provide recommendations in this area if and when they are needed to supplement Napa's deregulation protocols. The other consideration here, and one that the TWG has only limited knowledge to address, is how the movement of grapes within the Napa area might influence optimal spatial patterns for deregulation.

Post Program Monitoring

As part of a post eradication program that is being developed, the TWG will recommend that monitoring levels should be based largely on risk. Experience from other pest programs suggest that risks of detection can be higher in the wake of deregulation than if the pest had never been introduced in the first place. In the case of EGVM, deregulation is proceeding in a step-wise fashion, which, due to proximity to areas that are still considered infested, will also elevate risk for deregulated areas pending the successful completion of the entire eradication program. This indeed is the basis for the TWG recommendation that all grape-growing regions in California, and especially those in proximity to or with commercial ties to Napa, continue to have trap densities of at least 25 per square miles until sometime after the completion of eradication.

The TWG suggests the program consider: (1) maintaining delimitation-level trapping in deregulated areas for a year following deregulation, and (2) maintaining the elevated level of detection trapping (25 per square mile) throughout the core Napa/Sonoma/Solano area for a prescribed length of time (e.g., 2 years or more) after declaring overall eradication. The argument against this type of approach, aside from its cost, is potentially giving the appearance that the program was not confident that the pest was in fact eradicated. In practice, though, monitoring plans that are used for declaring eradication will always balance risk of missing a residual population against the costs of continuing elevated levels of monitoring and, moreover, regulation. Further, in many cases (including this one) that level of risk is not well understood. Elevated post-regulation monitoring will help ensure that any residual population, however small the risk that one exists, can be dealt with readily and easily.

In the longer term, the TWG recommends ongoing monitoring of California's grape production areas for a number of high-risk invasive pests including EGVM. Monitoring levels should be determined based on a balance of costs of the monitoring system against projected costs of eradication (or other appropriate post-detection costs) while considering likelihood of program success as well as a variety of logistical, environmental and social factors associated with pest programs.

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

- Determine the utility of high-load pheromone lures, light traps, food-lure traps, etc., for monitoring EGVM populations in areas under mating disruption treatments. *As discussed above, studies on high-load pheromone lures in Italy and Portugal over the past two years have resulted in a recommendation of 10X lure loading for monitoring under mating disruption. Testing of additional lure components is also underway. To date, light- and food-based lures have not been shown to be effective for program use.*

- 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 was included in an earlier TWG report.*

- Optimize trap design (includes looking at folding of flaps in delta traps). *This has not been pursued to date.*

- Determine sensitivity of the detection and delimitation systems (would have to be done abroad at this point). *There was some release-recapture done in Italy in 2012 but studies were not specifically designed to address this. More work would be needed to address this question.*

- Validate the degree-day model. *A Degree-day model has been developed and validated. It is being used along with grapevine phenology to time insecticide treatments for control of the first and second generation.*

Ecology, behavior, biology, biological control:

- Continue work to determine what alternative hosts are used by EGVM in California. *There was a re-assessment of the literature that resulted in some recommendations, but this issue appears to be less urgent now that only the Napa area is being regulated.*

- Determine factors that control entry into diapause; i.e., is it possible that a significant portion of the EGVM population in Napa goes through only two generations in a growing season?

As the EGVM population has declined to extremely low levels, it is not possible to conduct this research.

- Evaluate genetic diversity in EGVM. *Research using microsatellite DNA to identify unique markers has shown that populations of Chile and US are genetically very similar, suggesting that (1) the same population from Europe was introduced twice to the Americas, or (2) the U.S. population was introduced from Chile, or (3) the Chile population was introduced from the U.S. The nearest European populations to those from the Americas are from Spain and/or France.*

- Characterize adult behavior (flight, mating, oviposition, resting).

As the EGVM population has declined to extremely low levels, it is not possible to conduct this research.

- Evaluate possibility of using biological control agents to reduce populations. *The success of the program in moving toward eradication has reduced the potential value of pursuing this, at least in the short term.*

- Characterize population dynamics of EGVM in California, including effects of natural enemies.

As the EGVM population has declined to extremely low levels, it is not possible to conduct this research.

- Develop a spread model. *Studying population dynamics is not possible in California due to absence of the pest. A GIS spatial analysis and modelling effort will begin in 2015 to analyze program trap data and will be used to assess the role of pathways, spread patterns and, control activities on invasion and population dynamics.*

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.

A GIS spatial analysis and modelling effort will begin in 2015 to analyze program trap data and will be used to assess the role of pathways, spread patterns and, control activities on invasion and population dynamics.

- Develop/assess new mating disruption formulations for EGVM, including machine-applied. *Field trials were conducted in Europe (Italy, Portugal) in 2012-2014; results were presented during the TWG meetings. It is proposed to continue testing 5 component lure and new female attractant in 2015.*

- Determine field life of mating disruption dispensers and how that affects the efficiency of pheromone-based trapping systems over time. *This was a new item for the 2012 report; there is some concern that if dispensers are left in vineyards, they could affect detection sensitivity the following year. Various types of mating disruption dispensers from the 2012 study in Italy were analyzed for attractant residue across time; results are being published.*

- 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 and has resulted in identification of a suitable diet as well as substantially improved holding and handling methodology.*

- Radiation biology – identify dose and methods for producing fully sterile and F1-sterile male EGVM. *This work has been ongoing at the Otis lab initial characterization is complete, and age/dose schedules have been developed for pupal irradiation. Work on radiation as a phytosanitary treatment for EGVM is also underway.*

- Develop release technology. *We are not yet at the point where this is feasible.*

- Evaluate field competitiveness of sterile moths. *Initial laboratory testing of male competitiveness have been conducted at the Otis laboratory. Tests of response of sterilized males to pheromone could potentially be conducted in Europe in 2015.*

Regulatory:

- Develop and/or confirm regulatory treatments for grapes (table, wine, and raisin). *This work has been completed.*

- Develop regulatory treatments for grape nursery stock; confirm efficacy of hot-water dip. *As the EGVM population has declined to extremely low levels this work has become less urgent.* -
Investigate pathways that could move EGMV to new areas. Also, how did it get to Napa?

This goal will be part of planned GIS spatial analysis and will be used to assess the role of pathways on invasion dynamics.

- 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. *As the EGVM population has declined to extremely low levels this work has become less urgent.*

- 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.). *Research has been published on wine making and determined phytosanitary risk of wine making identified importance of winery sanitation and resulted in deregulation of red wine must. Work on mechanical treatments and composting methods was put on hold as pest populations declined. If the Program determines that more work in this area is needed options for work includes working inside quarantine, working overseas, or using another similar tortricid species as a proxy for EGVM.*

- 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. *This is no longer a priority as EGVM was eradicated from raisin production area in Central Valley*.

Appendix II, Questions from EGVM Program with responses from the TWG

Questions from CDFA

1. On 6-25-2014 in the County of Sonoma, Cazadero area (PDR#490P06176784), an EGVM adult male was trapped. The area of the detection is near a remote vineyard location, with the surrounding natural area described as coastal grassy woodlands. Given that this find is an outlier and the closest detections were from 2013 and 20 miles away; how does the technical working group view this detection in a regulatory context to the current quarantine area?

   Per the guidelines above, the single moth find would not trigger a regulatory response but would trigger delimitation-level trapping around the find. Given where we are at this point in the overall program in California and the small area of grape production in the vicinity of the find, leaving the delimitation-level trapping in place through 2015 would seem prudent.

2. In 2014 we proposed to deregulate Solano county and areas of Sonoma and Napa counties using the University of California Cooperative Extension's (UCCE) five lifecycle model and the technical working group agreed. Portions of Napa and Sonoma remain inside of the quarantine for the remainder of 2014 and during 2015. The last detection in the contiguous quarantine area of Napa and Sonoma counties was on 7-2-13 (PDR#280P06193456). If there are no more detections within the contiguous quarantine area would the technical working group treat the remaining quarantine areas in Napa and Sonoma similarly to the deregulation protocol for 2014 using the UCCE's five lifecycle model?

   The TWG recommendations for deregulating the remaining portions of Napa and Sonoma are outlined above (see "Deregulation" p. 7). The deregulation of 2014 was based on the TWG recommendations of 2012, (see 2012 Report, page 5) which states: "deploy 100 traps

per square mile in those core production areas and extend the trapping period to four full flights (and at least six full flights after the initial find, ,)". Under those guidelines, additional portions of Napa County would become eligible for deregulation in the late summer of 2015 assuming that no moths were caught in 2013, 2014 and no additional moths are captured in the first 2 generations of 2015, and the appropriate trapping protocols are followed.

3. In a cool area like Cazadero is it possible that EGVM could only have one life cycle per year and have a population that persists indefinitely solely on olive?

   The TWG has no evidence that EGVM can reproduce on olives beyond the flowering stage. While Cazadero is cooler than interior areas there are sufficient degree days for at least two full generations of EGVM per year.

4. What level of trapping will be needed next year in non-quarantined counties (i.e., which areas and at what density)? For example, this year we spent considerable resources trapping large areas of table grapes for which there was no apparent pathway from the quarantined area – is this still needed?

   The TWG continues to recommend trapping at 25 traps per square mile in all grape production areas in California. If available resources do not permit this, first reduce trap density (but do not eliminate trapping) in lower-risk areas.

5. What trapping density will be needed next year in Solano and the non-quarantined portion of Sonoma County?

   The TWG recommends that the program continue with trapping at a minimum of 25 traps per sq. mile until after eradication for California is declared. We also suggest increased vigilance may be warranted and, at the discretion of program managers in Napa and Sonoma, traps may be deployed at above 25 traps per square mile in previously quarantined or sensitive areas, for example around wineries, near vineyards where farm equipment is moved between Napa and Sonoma, or in areas of patchy vineyard-urban interfaces where there may be residual populations.

Questions for the TWG – Napa County

Our main concerns or questions relate to:

1. Does the TWG support continued 100 traps per square mile in all wine grape/olive producing areas of Napa County, including the areas removed from quarantine?

   The TWG recommends continued trapping at a minimum of 100 traps per square mile in the core infested area within the quarantine see above: "Recommendation for Survey". For areas removed from quarantine in the previously infested core areas of Napa and Sonoma, we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas. The recommendation for uniform trapping across the landscape of the core infested areas is based on finds in previous years in 2012 and 2013 where undetected populations were uncovered in areas of mixed residential and small vineyards.

2. Does the TWG support these trap levels for a period of time after the quarantine is completely removed for Napa County?

   The TWG is working to develop recommendations for a post eradication plan to submit to the EGVM program that will address recommended surveillance in previously core infested areas. See section in main report "Post Eradication Plan"

3. Should trapping levels in urban/residential areas of Napa County remain at the current 25 traps per square mile level versus increasing the number or use of some alternate risk based approach that would address sub-detectable populations that may be present in these areas, but difficult to trap given host and trap densities?

   The TWG recommends continued trapping at 25 traps per square mile in urban areas of Napa County. We do consider that the AG commissioner's office and CDFA should use whatever means are available to assess the risk of undetected populations. After eradication is declared, the TWG will address post eradication monitoring with the development of recommendations for a post eradication plan.

Questions for the TWG from Sonoma County 2014

1. Considering the risk of re-infestation given the amount of fruit and equipment that is moved from Napa County to Sonoma County, what level of quarantine enforcement is warranted in Sonoma County post deregulation, compared to other counties?

   The TWG will be developing recommendations for a post eradication plan for EGVM program consideration. The plan will recommend post eradication monitoring strategies for the core infested or other sensitive areas removed from quarantine. For areas removed from quarantine in the previously infested core areas of Napa and Sonoma, we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas. We agree that extra vigilance may be required to monitor sensitive areas and while we do not propose increased or continued regulatory enforcement, we do encourage that the grape industry and local program officials consider flexible approaches to assess risk and monitoring of sensitive areas.

2. Given the number of finds in Sonoma County in the past and the amount of material and equipment moving between the two counties, should the trapping levels in Sonoma County continue to remain higher than in other counties that were removed from quarantine? If so what are the recommended levels?

   The TWG will be work with the cooperative program to develop recommendations for a post eradication plan for EGVM. The plan will recommend post eradication monitoring strategies for areas removed from quarantine. For areas removed from quarantine in the previously infested core areas of Napa and Sonoma, we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas.

3. How high a priority is trapping at facilities that receive fruit from quarantine areas? Given the trapping level around these facilities and the rate of growth of populations, how long into the future should these facilities be trapped?

   This is the highest priority for trapping and if resources are limited, trapping in these areas should be prioritized. The TWG will be developing recommendations for a post eradication plan for EGVM program consideration. The plan will recommend post eradication monitoring strategies for sensitive areas that are removed from quarantine.

4. What should the long term detection plan look like? In terms of years, how long after an area has been removed from quarantine should trapping continue? What does this look like in relation to while there are active quarantine areas within the state, or when the quarantines have been lifted?

   The TWG will be developing recommendations for a post eradication plan for EGVM program consideration. The plan will recommend post eradication monitoring strategies for the core infested or other sensitive areas removed from quarantine. While this approach will be non-regulatory, the need for flexible approaches by local officials and industry partners, post program monitoring and additional risk assessment is encouraged.

5. What is the risk that there are small undetected populations in small vineyards in urban/rural residential areas near where there have been finds in the past? How would you suggest that these sites continue to be monitored?

   The TWG will address post eradication monitoring with the development of recommendations for a post eradication plan. We do consider that the Agricultural Commissioner's offices and CDFA should use whatever means are available to assess the risk of undetected populations. For areas removed from quarantine in the previously infested core areas of Napa and Sonoma, we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas. The recommendation for uniform trapping across the landscape of the core infested areas is based on finds in previous years in 2012 and 2013 where undetected populations were uncovered in areas of mixed residential and small vineyards.

6. Should the agricultural commissioners be given in their contracts a certain number of discretionary traps to be placed at high risk sites of their choice? What are the criteria the TWG would suggest the county take into consideration in the placement of these traps?

   While this is a request for the cooperative EGVM program to decide and is primarily not a technical question, we do consider that the grape industry and cooperators in the Agricultural Commissioner's offices and CDFA should use whatever means are available to assess the risk of undetected populations in the core infested areas. Detections in 2012 and 2013 were primarily uncovered in areas of mixed residential and small vineyards and because of the difficulty of survey for these areas, the use of local knowledge and risk assessments by the cooperative program will be beneficial. The TWG will address issues of monitoring after eradication from core areas in a post eradication plan.

7. Does the single moth find outside the quarantine area give any indication of the level of exclusion or detection activities needed going forward?

   Although this find has not triggered a quarantine, the TWG believes that continued delimitation trapping should continue in this area for three flights after the initial find. For Napa and Sonoma and parts of other counties that were in the core infested area, we recommend a minimum of 25 traps per sq. mile be deployed in all areas including urban areas.

8. What criteria should be used by field detection staff to determine when a sample should be sent to the lab for verification?

   The CDFA Insect Trapping Guide (http://www.cdfa.ca.gov/plant/PDEP/Insect_Trapping_Guide/docs/itg_submitting-specimens.pdf) recommends submitting all suspect samples to CDFA. Any similar looking moths of the same size, color and shape should be submitted including moths that may be buried in glue and are difficult to discern their color or shape. Compared to the first years of the program, when populations were much higher, a single moth find has much more significance and errors made on the side of submitting more rather than fewer suspect positives is encouraged.

9. Given the fact that EGVM populations are at such low levels is it prudent for staff to have a second look at traps prior to disposal?

   The TWG recommends that the program have in place a quality assurance program (see above: Quality Assurance of Monitoring Program: where traps are inspected twice by separate inspectors to verify as is practiced in other pest surveillance programs and as recommended in the CDFA Insect Trapping Guide. As the EGVM population is now at very low levels, or nearly eradicated in California, it will be important to maintain high levels of scrutiny for all detection trapping. Since field staff may have not recently seen any EGVM in traps, the program should consider additional pre-season training for trappers as well as placing marked EGVM on some traps during the season for quality assurance.

10. What is the importance of exclusion activities (enforcement of: maintaining slack-fill, equipment cleanliness requirements, green waste handling and disposal requirements, etc.) as we move to lower populations?

    Until production areas have been declared free of EGVM and released from quarantine, exclusion activities should be continued. This should include any counties that receive grapes from quarantined production areas.

11. Is the reduction in populations from 100,000+ to 1 in 4 years consistent with what has been seen in infestations in other parts of the world? What has been done in California differently

that has facilitated this rapid decline? What are the chances of low level incipient populations?

While there were some examples of early success in the eradication program in Chile, populations have increased in some areas and residual populations remain in urban areas. California appears to be the first grape production region worldwide where a successful area-wide control program leading to a sharp reduction in populations has been achieved. This success is likely because EGVM was detected relatively early, the industry, UC extension, affected counties along with State and Federal cooperators were proactive and formed a strong and cohesive area-wide control program, and because there was the availability of effective pest control and monitoring tools and these were used in an area-wide program. The appointment of treatment coordinators was an important aspect of the program that helped implement a uniform response. Research and rapid communication of findings and status with University of California leadership was another important aspect of the program. The risk of low level undetected populations remains high, particularly in urban areas and in urban-rural interface areas with small vineyards. An effective post eradication monitoring and emergency response program should be put in place.

Questions for the TWG – APHIS/PPQ (Scott Pfister, Director, Pest Management)

What would a post eradication strategy look like – trapping densities statewide, trapping densities in the previously regulated areas (satellite infestations vs. Napa core area), monitoring and other activities?

The TWG recommends that a comprehensive post eradication plan be developed in order to address these and other program response issues. We envision a small group composed of a subset of TWG members along with treatment coordinators, UC scientists and key Cooperative Program personnel will work to develop a post eradication surveillance and emergency response plan.

This plan should develop strategy and recommended minimum detection trapping levels over time to be initiated in core areas of the original infestation and in other areas where pathway and pest risk analysis indicates that may be at high risk of detecting EGVM.

The plan should also include a response plan for treatment based on detection of a reproducing population that defines what treatments should be used, delimitation trapping and other survey activities, and for how long control operations should continue. Last, the plan should define the minimum level of resources needed to ensure that a post-deregulation response can be effectively mounted.

Appendix III, Participating Members of the Animal & Plant Health Inspection Service (APHIS) European Grapevine Moth (EGVM) Technical Working Group (TWG)

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Appendix IV: Map – Recommendation for trapping European grapevine moth at 25 traps/mi^2 in core area of Napa & Sonoma Counties, California