Final Report of the International Technical Working Group For the European Grape Vine Moth (EGVM) in California

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At the request of APHIS PPQ, a technical working group was formed to address the discovery of a new population of the European grapevine moth (EGVM) in Napa Co., California in September 2009. The members of the TWG are listed above. Their CVs will be available upon request.

A conference call was held on December 18, 2009 (11:00 a.m. to 2:30 p.m. EST), which included the TWG, CDFA, and PPQ (see attachment). The purpose of the conference call was to exchange information on what was currently known about the EGVM infestation and to address specific questions posed by managers from the California Department of Agriculture (CDFA), the Animal and Plant Health Inspection Service (APHIS), and representatives of the Napa County, CA Agricultural Commission.

The meeting began with a summary by Kevin Hoffman (CDFA) about the discovery of the infestation and subsequent actions that had been taken or were ongoing. Briefly, the infestation was confirmed in September of 2009, but crop damage was reported in the now known infested area in 2008. In 2008 and, again in 2009, vineyards were treated for an unknown pest. Larval collections, which were made in 2008, could not be accurately identified at that time. In 2009, additional larval collections were made and, by then, molecular identification techniques had been developed and EGVM was identified. Upon learning that it was EGVM infestation, APHIS, CDFA and Napa County officials responded by deploying traps in a "spoke and wheel" pattern (see attachment) in Napa County in an effort to delimit it. Additional traps were placed on the border with Sonoma County.

To date, adults have been collected from 5 different sites. At 30 additional sites, either larvae or pupae have been collected. There appears to be 2 distinct pockets of infestation: One is on the eastern side of the city of Napa, and the other is between Oakville and Rutherford and St. Helena. Currently, only positive survey data are available. The TWG requested that all negative survey data (trap and visual survey) be included in the next summary.

The infested area is characterized as densely planted in grape vineyards with additional commercial production of olives, cane berries, and tree fruits. There are several reports of significant damage in grapes and growers reacting to this damage. The following are some of some of the growers concerns and actions that were described on the conference call. In 2009, some properties had significant damage and at least 1 grower destroyed the crop by disking it into the soil in the middle of the rows. Several growers sprayed insecticides in attempts to control the pests. Organic growers were concerned about what insecticides they could use to control the pests.

Some other observations that were mentioned follow. Growers began using Intrepid because they found *Bt* applications were not effective. This may be an application timing issue. Bob Steinhauer added that some wineries found larvae (presumably EGVM) when they were sorting harvested fruit. In this area of Napa County, the only pesticides commonly used are materials (sulfur-based compounds) for diseases (Dave Whitmer). Also, there are several organic growers throughout the area.

Listed below are the questions which were provided in advance of the conference call and the consensus response from the TWG.

<u>Overall Strategy:</u>

1. *Should eradication be pursued?*

   The TWG wants to emphasize the seriousness of introducing EGVM into the grape industry of North America. The TWG believes that, if EGVM populations are left to establish and spread, it will very likely become a major pest as in other parts of the world, and probably a key pest in grape production in some areas. As in Europe, although a pest management program can be developed, the annual costs of production and the use of pesticides will increase. Additional impacts will be felt both domestically and internationally as trade restrictions will be imposed. As was mentioned in the conference call and noted earlier, pesticide use for insect problems in Napa County presently is nearly non-existent. Introduction of EGVM has the potential to upset the current IPM program and jeopardize organic production.

   Currently, the distribution and densities of EGVM infestations are not well defined. These parameters need to be better defined before the TWG can provide guidance on the ultimate goal of a program. The TWG, however, strongly recommends that populations that have already been identified and as new ones are discovered, all measures be taken to suppress and contain them until a comprehensive delimiting survey has been conducted. Suppression measures should include the appropriate use of pesticides, including ovicides, larvicides, mating disruption, and mechanical control measures. Also, when infested grape clusters are

found in vineyards, they should be harvested and destroyed. Experience has shown that mating disruption alone cannot be relied on to control populations. A blend of mating disruption pesticides and, possibly, sanitation and biological controls will be required to manage this pest. Also, all measures to limit the artificial movement of EGVM should be implemented as soon as possible. The TWG believes grapes, grapevines and crates and materials used for harvesting, movement or processing grapes are possible pathways for movement. The TWG recognizes that government programs often take time to be put in place and we believe that early action is critical. We recommend that growers be encouraged to move forward with a pest management program with treatment of all known infestations. Also, once a formal program is underway, the TWG believes that active grower's involvement is desirable and indeed vital in order to be successful in addressing this infestation.

The program should employ whatever mechanisms are appropriate and effective to disseminate information about EGVM to all growers and pest control advisors and to the general public. Initially, the focus of this effort should be in all grape growing areas of California but in the near future be expanded to all areas in the US where grapes are grown.

2. *If not, what management/containment strategy should be employed?*

Effective management strategies for EGVM have been developed in Europe. If this is the program direction in the future, many of these can be adapted to wherever EGVM populations may occur in the United States. As in the response to the previous questions, if these measures are used, either short or long term, they will have significant impacts on the cost of production and may have significant impacts on the current IPM management system in place for vineyards and possibly other crops. If the ultimate goal is eradication, these techniques individually, or in combination, will contribute to that effort.

Biology:

1. *What developmental values should be used to time activities in the spring?*

EGVM phenology is strongly connected to grapevine phenology. Traps should be placed before leaf bud break, as adults will fly shortly after leaves begin to expand. In the first generation, eggs may be visible of the inflorescences. Finding eggs on the inflorescence, however, is very difficult, so the decision to spray should be based on pheromone trap captures and the timing should be approximately 1 week before the beginning of flowering. Most of the EGVM larvae will exit the flower buds at flowering and begin to build a nest. During this period, they are susceptible to spray. Visual survey for EGVM nest activity during this period will help determine the efficacy of the sprays and provide information to target the second generation for spraying. Eichhorn and Lorenz (1977) describe the EGVM phenology in the Mediterranean. The first generation occurs from the flower inflorescence to fruit set, the second from pea sized grapes to the beginning of ripening, and the third from the beginning of ripening until harvest. Also, models (Gabel and Mocko (1984)) provided by Bruno, give developmental thresholds for all stages of EGVM (see attached). This developmental data should be validated under California conditions. Lucia Varela added that the thresholds are wide, so we will have to validate these in California. Also, that bud break of the earliest variety grown in the area

(Chardonnay) is around the 15th of March. Traps, therefore, should be in place no later than about 2 weeks before this or around March 1 or even around February 15. The TWG recommends work to be carried out to characterize EGVM phenology in California.

Survey:

1. *Can commercially available lures (e.g. Scentry) be used to supplement the ones supplied by the USDA?*

   There was some discussion about the quality of lures produced by commercial companies. Several commercial companies produce lures for EGVM. The TWG recommendation is that, if commercial lures are used, a quality control system should be put in place to evaluate the purity of the starting materials, the loading of the dispensers, and that appropriate substrates are used for dispensers. If non-standard substrates are used (e.g., other than septa), release rates and field performance must be demonstrated. The TWG also is contacting other technical experts that have been involved in pheromone isolation and identification for EGVM to determine if the single component lure, which is the standard lure used in Europe, can be improved. The TWG recommends that studies be undertaken to optimize the EGVM lure for detection purposes.

2. *What is the optimal trap to be used?*

   The TWG recommends that either the pagoda, INRA, or a large Delta trap be used. Additionally, wing type traps can also be used. The TWG does not recommend the Jackson trap until, and unless, it can be demonstrated that the Jackson is equivalent to the others in terms of EGVM catch. In terms of capture of EGVM males, trap color does not seem to be important. From the perspective of the conservation of non-target insects, however, red traps would be preferred. A standard trap should be adopted at the beginning of the program. Height of trap placement is important in maximizing trap efficiency. They should be placed near the top of the canopy.

3. *Can a fruit fly "Jackson trap" be used?* See #2.

4. *When would trapping begin and end on a seasonal basis in the various regions of California?*

   As was stated above, the traps should be in place 2 weeks before the expected bud break of the earliest grape variety. In Napa County, this is approximately March 1. Trapping can be terminated after harvest in November. Trap capture should be closely monitored in the fall to determine when male flight stops.

5. *What trap density should be used for detection?*

   There was a lot of discussion about trapping densities for EGVM and suggestions ranged from 1 trap/ha to 1 trap/20 ha. A consensus opinion, though, was that to detect low populations, a relatively high trap density is needed because of the limited adult flight distance and "drawing power" of the trap. One trap approximately per every 10 ha (25 ac) of grapes would provide 25 traps/mi.^{2} or an inter trap spacing of 322 m (1056 ft.) should be the

minimum. Females normally only disperse a maximum of 80 meters and it is thought that traps only attract males from approximately 50 meters.

Trapping should meet the requirements for the intended use of the information. If it is for treatment purposes, relatively low trap densities may be employed to determine if and when a field will be treated. If it is for quarantine purposes, the trap detection density provided above would be dense enough. As a program develops and additional population information becomes available, specific trapping densities can be developed for each goal and the quarantine buffer zone distance may also be adjusted.

The TWG believes the quarantine boundary should be set initially very liberally because of the uncertainty surrounding the size and distribution of the infestation. The exact boundaries should be determined by consulting with local officials and factoring in such variables as topography, political boundaries, host distribution and roads. Treatment or trapping regimes do not have to correspond to this boundary (See below for additional comments).

6. *How far should delimitation trapping extend from each detection property?*

   See above. If the goal is to determine the size of the quarantine area, then a trapping density of 1 trap/10 ha should be the minimal used to delimit a newly found infestation. Results of this survey would then be used to set the size of the quarantine area, which would include the addition of a buffer.

   Trapping should be conducted in all areas that can possibly support EGVM populations. In other words trapping should extend beyond the vineyards into "wild "or agricultural areas that potentially harbor hosts for EGVM. Studies should be initiated as soon as possible to determine which plant species found in the area will be utilized as a host.

7. *What trap density should be used for delimitation?*

   See above.

8. *How long should delimitation last?*

   Until the program goal is met. If this is to only establish a quarantine boundary, then once the boundary is established, then intensive trapping can be relaxed in the known infested (core) and concentrated along the quarantine boundary and beyond. If trapping data is used to evaluate treatment(s) efficacy, then relatively heavy trapping should be maintained throughout the known infested area. If, ultimately, eradication is the goal, an evaluation/delimitation density should be maintained until there is a minimum of 3 negative generations of surveys.

9. *& 10. Should visual survey for pupae occur over the winter?*

   Visual pupal survey and the associated bark stripping is very time consuming and expensive. It is useful for delimiting the extent of populations, but has an added benefit in that it denies EGVM protected pupation sites for 3 or 4 years after the initial survey or until the bark

regrows. If labor is available in the winter, it should be considered, but not at the expense of higher priority items.

Treatment:

1. *How far should a treatment program extend from each detection property?*

   The answer to this depends on several factors: 1) the degree of delimitation, 2) EGVM population characteristics, and 3) the treatment. Obviously, if treatment of a poorly defined population is attempted, then treatment boundaries would need to be larger than when treating a well defined population. If the population adjoins an area with many wild hosts, the treatment needs to be considered for those refuges. Also, to be effective, mating disruption treatments need to cover a larger area than the classical pesticide application.

2. *What commodities should be treated?*

   All grapes, grape plant parts and their means of conveyance. Other crops should be monitored closely for the presence of EGVM and, if EGVM is found, the fruit crop(s) should be regulated.

3. *What treatment options are available?*

   Lucia has compiled the attached list of insecticides that have shown some effectiveness and which are registered in California. Other pesticides used in Europe, but not registered in the U.S., are also listed. Also, mating disruption is widely used for EGVM control in both Europe and Chile. Timing of pesticide applications is very critical, particularly for the products with short field life.

4. *What is the optimal time to apply each option?*

   Pesticides can be applied in any generation. In Chile, where there is an intensive management program, insecticides are used as early as the first generation to suppress the populations all season long. Mating disruption can be applied prior to the first spring flight. In Europe, for crop protection, insecticides are usually applied to the second generation. The goals of a program in California, however, will be different. Suppression measures should be applied to every generation if containment and/or eradication are the goals.

   As the program develops, an integral part should be an evaluation component. This evaluation component will be used to be used to determine when treatments should continue or be terminated, which treatment are the most effective, etc.

5. *How long should treatment continue?*

   See above

Quarantine:

1. *How far should a quarantine area extend from each detection property?*

With the present state of knowledge about the distribution and density of population, the quarantine boundary should be very liberal and extend out a reasonable distance from any known infestation. The actual quarantine boundary should take into consideration distribution of hosts, topography and natural and manmade boundaries. Also, consideration should be given to any known movement of possibly infested vines or grapes from areas where growers have reported damage in the last 2 years or where EGVM have been confirmed. The technical working group believes that the boundary be set very liberally until the program has been able to adequately delimit the infestation. We are recommending a 5 mile buffer once a thorough delimitation program has been conducted. As we gain experience with EGVM in California, quarantine areas should be decreased or increased based on this experience.

Follow-up question in response to the interim TWG report

Question CDFA requested that the USDA approve a 3-mile radius quarantine boundary around all European grapevine moth (EGVM) find sites versus the 5 to 10 mile boundary suggested by the TWG.

Recommendation: The TWG believes that there is a high level of uncertainty about the size and geographical location of EGVM infestation(s) in California at this time. The uncertainty is caused by the following factors: 1) Pheromone trapping was undertaken late in the season probably shortly before insects were entering into diapause, therefore probably missing the peak opportunity for trapping 2) The trapping array used (spoke and wheel and some others placed in Sonoma Co. Etc) intended purpose was to determine how far the heavy infestations may extend. As the spokes diverge away from the origin, the trapping density and hence the sensitivity of detection becomes less and less. Although this was an effective approach given the time and circumstances the results will not provide the detailed information of a systematic survey. 3) Although some larval survey was conducted at sites where it had reported that LBAM may have occurred, this effort was again not a systematic method to determine the distribution of Lobesia. 4) Given the limited information that is available to date it appears that there are at least 2 centers of infestation. Two possible explanations are that either there were 2 separate introduction sites or there has been at least 1 instance of artificial spread. Some anecdotal/observational information indicates that larvae were detected in grape processing houses. This would indicate that populations have been artificially moved. Also, the very high densities of Lobesia found in a least 1 area are comparable to those densities found in Chile when Lobesia was first discovered there. The area that is now known to be infested in Chile is very large and demonstrates this species ability to move and establish in new areas very rapidly. Given all of the uncertainties cited above the TWG believe that it is prudent to survey and regulate beyond 3 miles and ideally to 10 miles. Trapping densities will of course depend on resources available but should be placed in as high as densities as possible up to and including 25 / square mile. The TWG does not recommend trapping at densities lower than 16 /square mile. As the program progresses and the distribution and behavior of EGVM in California is revealed then reducing the "buffer" for quarantine may be possible and desirable. For detection of possible other outlier populations of EGVM, the TWG recommends that systematic intensive trapping program be carried out in the remainder of Napa County and the surrounding counties. Also, a comprehensive survey should cover all grape growing areas in the state and in the US.

2. *What treatment options are available to allow regulated commodities to move within and out of the regulated area?*

   Presently, fumigation with methyl bromide. The effectiveness of this treatment needs to be verified. Also, system approaches can be developed to move harvested grapes to processing plants in a safe manner. The TWG strongly recommends regulation of grapes and their means of conveyance.

3. *How long should the quarantine last?*

   The quarantine should be continued as long as an EGVM population is present, and the movement and/or spread of that population into non-infested areas, through either natural or human-mediated means, is considered an actionable risk.

Eradication:

1. *When can eradication be declared?*

   If eradication is the long-term goal, then a declaration of eradication needs to be based on the monitoring program in place. Typically, when an effective delimitation-level monitoring program is in place, then 3 generations, with negative survey following and suppression treatments are usually acceptable.

   The TWG strongly recommends that a research effort be initiated to characterize effectiveness of various trapping densities and percentages of a population that is captured at various trap densities.

Napa County:

1. *When would overwintering Lobesia botrana within Napa County begin to emerge in 2010 and how far in advance of projected emergence should detection traps be deployed? (e.g. Is there a specific degree day model we might use in conjunction with weather data being acquired at the Oakville Experimental Field Station to inform our pest detection efforts?)*

   See above.

2. *What is the recommended number of detection traps or trap (and spatial) density that should be utilized to accurately identify the distribution of Lobesia botrana within Napa County? In a statewide survey?*

   See above.

3. *What are the proven and recommended treatment options utilized in areas of the world? Where Lobesia botrana is found--are these and/or other tools available for wine grape growers to prevent damage and spread of Lobesia botrana?*

   See above.

4. *Based on good science and known behavior of Lobesia botrana, what distances should be used for determining quarantine/regulatory boundaries?*

   See above.

5. *What beneficial organisms are present within Napa County/California/USA that prey on Lobesia botrana? Are there beneficial organisms in other regions that might play a significant role in the long term control of Lobesia botrana?*

   This is unknown at this point. A number of native parasites may utilize EGVM as a host. How significantly they are in terms of impact on populations of EGVM will be determined over time. In Europe, where the biocontrol organisms have coevolved with EGVM, they frequently do not maintain populations below the economic damage level on their own. We know, however, that economic damage occurs when populations of EGVM are low.

California SPHD:

It is unknown if the twist-ties for the European grapevine moth (EGVM) and the light brown apple moth can be hung on the same hanger, but it is unlikely that their performance would negatively be effected. It would be prudent to place the dispensers 5 meters apart until this is actually demonstrated. In field studies, when pheromone dispensers for EGVM are placed in traps baited for the light brown apple moth (*Epiphyas postvittano*), demonstrate that there is no significant impact on LBAM moth captures. The inverse, however, has not been demonstrated (Mastro et al.). The TWG recommends that research be undertaken to address both issues. The TWG also recommends additional research activities be directed at developing alternative mating disruption techniques and formulations.

PPQ Emergency Management:

1. *In the UC IPM* EGVM *article, it mentioned red delta traps for EGVM monitoring. Is this the most effective trap for EGVM? Are there other types of traps for EGVM like the Phercon trap or another type of trap? What is the most effective trap for* EGVM *monitoring?*

   See the discussion above where the most effective trap designs are noted. These include the pagoda, INRA, large delta and the wing type trap. Color does not seem to have any impact

on captures of EGVM, however, trap position does. It is recommended that the best position is at the top of the grapevine canopy. The composition and purity of the pheromone, as well as the release rate will all have an impact of trap efficiency. Presently, the recommendation is to use high purity E, Z-7, 9-12AC loaded on to rubber septa at a 0.5 mg rate.

Following are some added comments by the TWG

The TWG also believes that every effort is made to determine how Lobesia botrana was introduced and subsequently moved artificially within in the infested area. If the pathways can be described, the information can be used to stop or slow further introductions from offshore sources and further spread into California and to other portions of the United States.

The TWG also strongly recommends that a research support component to the program be established immediately to address some of the issues identified above and other issues not identified in this report.