RECOMMENDATIONS OF THE TECHNICAL WORKING GROUP

for the

LIGHT BROWN APPLE MOTH PROGRAM

January 25, 2007

These recommendations were developed during a meeting of the Technical Working Group (TWG) in San Diego, California, December 13-14, 2007

Overriding recommendation: The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) and the California Department of Food and Agriculture (CDFA) should maintain the long-term goal of eradicating light brown apple moth (LBAM), *Epiphyas postvittana* (Walker), from California.

Overall strategy: The TWG recommends the following strategy in achieving the long-term goal of LBAM eradication in California:

- Maintain a comprehensive regulatory program, with proven regulatory treatments to minimize human-assisted transport of LBAM from the currently infested area into uninfested areas.
- Continue ongoing detection trapping efforts throughout California. Expand and standardize LBAM survey efforts on a national scale.
- Proceed with eradication by integrating tactics and methods that have proven effective.
- Rapidly implement a technical component of the LBAM program, which would include program and population assessment, and research and development of methods needed for best achieving program goals. The most urgent technical need at this time is testing to identify the most efficacious formulations and methods for conducting area-wide mating disruption.

Progress to date: The TWG commends the program for the substantial progress it has made to date.

- The LBAM population in California has been delimited. This required rapid implementation and operation of an extensive trapping system.
- The regulatory framework implemented by the program appears to have been effective in limiting human-mediated movement of the pest.
- "Outlier" populations were delimited and successfully eliminated.
- Work toward incorporating trapping data into an electronic geo-referenced database (ISIS) has been initiated.

Specific Recommendations:

- *Eradication strategy*

Eradication of the LBAM population will not be a simple endeavor, and will likely take several years to accomplish. In addition to mating disruption, the program should consider using a "multi-pronged" integrated approach (insecticide, attract-and-kill, biological control, and SIT). Overall, the TWG suggests approaching eradication in a step-wise fashion rather than attempting to eradicate throughout the entire infested area simultaneously. Containment measures must be in place and rigorously enforced in areas not initially targeted for eradicative activities. This should help ensure eventual success as it will allow the program to focus its eradication resources within a manageable area while containing and conducting suppression activities elsewhere in anticipation of eventual initiation of eradicative treatments. The TWG also suggests (as has been done) starting the eradication strategies at the southern end of the infestation, as this is the area from which risk of transporting LBAM to uninfested areas is greatest.

- *Mating disruption.*

At this time, aerial application of mating disruption formulations remains the tool of choice for application across broad areas. Substantial development efforts would be needed before other control methods such as sterile insects or biological controls would be ready for program use. In addition, uses of biological control for eradication may be limited. Because new and longer lasting formulations of the mating disruption products are becoming available, the TWG does not recommend any additional aerial applications of mating disruption formulations until the new formulations are tested and the most effective combination of formulation, application rate, and application methods for new formulations has been identified (see Research and Development needs). The TWG does, however, recommend that the program proceed with the purchase of neat pheromone for disruption formulations.

- G*round treatment options.*

The program should initiate a focused ground treatment component within highly infested core areas. This approach could be used both to augment mating disruption treatments (e.g., Soquel) and simply to maintain populations at reduced levels to minimize risk of spread (e.g., Golden Gate Park). "Softer" insecticides with proven track records against LBAM could be used, such as *Bt* or spinosad. In addition, the use of other potential tools such as Attract and Kill technology should be explored for ground treatments.

- *Survey*

Data management - the LBAM program should work toward maintaining trapping data in electronic geo-referenced databases. In fact, this type of trapping information would be beneficial for all detection programs. These databases should include all pertinent

information, including inspection dates, positions, number of moths captured, trap conditions, etc. of all traps. Initial (field) recording of data should be done using GPS-capable PDA's. The TWG realizes that, given the scale of these programs, moving from written records to electronic databases will not be quick or easy. In the long run, though, this will greatly simplify tasks associated with acquiring, storing, transferring, analyzing, evaluating, and assuring the quality of trapping survey data.

National survey - an effective national survey is needed to ensure that the eradication program is not being undertaken in one area while other infestations are present at other locations in the U.S. The TWG understands that such surveys have occurred in a number of states in 2007 and recommends expanding the survey to all states where LBAM could potentially become established.

Phenology traps - phenology traps were placed and maintained per previous TWG recommendations but the 2007 data indicate that the system needs to be expanded upon and enhanced to provide timely data analysis.

Research and Development Needs

The TWG has identified the following research and development necessary to the success of the eradication program, including the appointment of a dedicated coordinator in support of the program:

- ***Mating Disruption***

  As new formulations become available, rapidly identify a combination of formulation and application rate, and application method that effectively reduces mating enough to suppress LBAM population levels typical of those encountered in California. The testing should include the following:

  - Ideally, open-field tests of candidate formulations should be undertaken using "wild" LBAM populations. To get such testing done in short order, these would have to be run in the southern Hemisphere – most likely in New Zealand.
  - Benchmarks for the efficacy of mating disruption need to be established by the TWG over the next few months.
  - Shin Etsu twist-ties can be used as a "positive control" standard.
  - Aerial application based on methods used in the CA program would be ideal.
  - Other types of tests, such as field-cage mating trials within smaller treated areas can be used as an augmentative or perhaps even an alternative method of evaluating formulations.

- Field studies should be backed up with lab evaluations of release rates from different formulations, resistance to wash-off, etc.
- Testing should be run simultaneously to relate mating success to trap catch at different lure-loading rates.
- In less time-critical testing, ground application of flake and sprayable formulations should be evaluated as an alternative to hand-applied disruption formulations (e.g., twist-ties) for treatment of small- to medium-sized areas.
- Evaluate and quantify the effect of levels of the *Z* isomer of 11-14:Ac (inhibits response to the pheromone) and *E*9,*E11*-14:Ac (the minor component of the pheromone) on mating disruption.
- Determine how vertical distribution of the mating disruption formulation affects efficacy.

- ***Sterile Insect Technique (SIT)***

  The program should pursue development of SIT as an alternative and/or augmentative method of suppressing/eradication of LBAM populations.

  - Develop mass rearing methodology for SIT as well as potential production of biological control agents (parasites, pathogens).
  - Develop rearing capacity (perhaps in Hawaii, or within the generally infested area of California). Explore the possibility of producing the diet at the pink bollworm rearing facility in Phoenix, AZ.
  - Complete dose-sterility testing for both conventional (complete) and inherited (F1) sterility.
  - Assess competitiveness of sterile LBAM (irradiated generation) and F1-sterile larvae and moths.
  - Assess efficacy of males-only vs. both sex releases of LBAM.
  - Identify and evaluate appropriate methods for distributing and releasing sterile LBAM adults.

  Additional research and development recommendations (unprioritized)

  - Continue ongoing efforts to evaluate candidate insecticides as regulatory treatments for nursery stock and other commodities.
  - Evaluate effectiveness of insecticides for control of LBAM populations, with focus on more biorational insecticides such as *Bt* and spinosyns. Where possible, screen these insecticides against LBAM from California populations.
  - Develop information on population dynamics and ecology of LBAM in North America.
  - Evaluate and develop biological control methods for LBAM: augmentative releases (e.g., Trichogramma), classical biological control, and insect pathogens (e.g., nucleopolyhedrosis virus). Develop information on parasitism and

predation of LBAM by natural enemies that are native to, or were previously introduced into, California.

- Evaluate effectiveness of mobile mating disruption of LBAM.
- Develop population and phenology models for LBAM in North America. Test (validate) available phenology and population model(s) using New Zealand, Australian, and United States trapping data. Climex and Dymex models are available but need validation. Determine the degree of synchrony of generations within U.S. LBAM populations.
- Optimize traps, lures, release rates, and methods of deployment (e.g., trap placement parameters such as height).
- Determine sensitivity of survey traps (distance/capture curves) for LBAM (including food-bait as well as pheromone traps).
- Determine LBAM dispersal distances under California conditions (females, males, larvae).