Welcome to

LIGHT BROWN APPLE MOTH PROGRAM

Photo Credit: R.Anson Eaglin

Significant Events in 2009

- The sterile moth technique has advanced sufficiently to allow initial operational test releases in Napa County in November 2009. This alternative eliminated the need for aerial spraying of LBAM pheromone over urban areas.
- The LBAM infestation in Carpinteria (Santa Barbara County) was declared eradicated.
- The California Department of Food and Agriculture (CDFA) Interior Quarantine expanded into Los Angeles, Napa, San Joaquin, San Luis Obispo, Sonoma and Yolo counties.
- Twist ties were deployed in isolated LBAM infestations in Los Osos (San Luis Obispo County) and Manteca (San Joaquin County).
- The Program has developed and implemented DNA-based technology to positively identify LBAM eggs, larvae and pupae in California.
- The Program issued a draft Environmental Impact Report (EIR) for public comment, with approximately 300 comments received via oral testimony and written comments. The final EIR will be certified in early 2010.
- The Office of Environmental Health Hazard Assessment (OEHHA) issued a Human Health Risk Assessment of Isomate LBAM Plus (twist ties) in which they projected no human health problems from the use of this technology.
- Canada has imposed a 3-year LBAM-free requirement on LBAM-infested areas before it will allow the free shipment of non-exempt LBAM hosts into that country. The current USDA requirement is three life cycles, or anywhere from 7 to 10 months depending on the area.
- Chile is recommending changes to their regulations that may greatly increase the number of traps that must be deployed and the frequency with which they must be inspected to declare an area LBAM-free. If implemented, these changes will increase the cost of exporting non-exempt LBAM host material to Chile.

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INTRODUCTION

The objective of the Light Brown Apple Moth Program (Program) is to protect California agriculture and the environment through the development, implementation and communication of sound public policies to eradicate the light brown apple moth (LBAM) from the State.

The Light Brown Apple Moth Program is a federal and state cooperative program that coordinates with the county agricultural commissioners, other California state and local agencies, and industry and agricultural organizations throughout the State. The goal of the Program is to minimize the statewide impact of LBAM. The strategy is to contain, suppress and eradicate LBAM, while simultaneously developing other mitigation tools, such as sterile insect release technology and biological control organisms.

BACKGROUND

LBAM is native to Australia, but has successfully invaded New Zealand, New Caledonia, Hawaii and the British Isles. The first recorded detection of LBAM in North America was in Berkeley, California (Alameda County) in February 2007. LBAM is an exotic insect pest of quarantine significance to both CDFA and USDA, whose larvae attack more than 2,000 host plants, including nearly all types of fruit crops, ornamental plantings, vegetables and nursery stock. During severe outbreaks, damage to fruit can be as high as 85 percent of the crop. In addition to direct damage caused by LBAM, California's export markets will suffer due to the implementation of quarantines by foreign and other state governments.[1] Because LBAM is not known to occur in the continental United States, it does not have any natural enemies to keep its population in check. USDA considers it highly likely that LBAM will become permanently established in the United States if eradicative measures are not implemented.

CDFA developed two analyses[2] that predicted the potential increases in pesticide use that LBAM might cause in the urban and agricultural environments. The commercial crops evaluated were apple, pear, avocado, grape, almond, citrus, kiwi, cherry, nectarine, peach, plum, prune, cane berries, strawberry and nursery stock. The amount of increased pesticide depends on the insecticide evaluated. For the microbial insecticide *Bacillus thuringiensis* (Bt), the annual increase ranges from 600-4,800 pounds of additional active ingredient, or a 1.4 percent to 10.5 percent increase in the use of this material compared to that used on the same crops in 2006. For the insecticide spinosad, the annual increase is estimated as 1,900 to 3,800 pounds of additional active ingredient or an increase of 10 percent to 20 percent of the 2006 use. For the insecticide cryocide, the annual increase could be as large as 190,000 to 222,000 pounds of additional active ingredient, or an increase of 31 percent to 36 percent of the 2006 use. It is not anticipated that the growers will use only one insecticide to treat an LBAM infestation. The increases will be spread over a number of materials. The figures above provide a sense of the magnitude of the potential increases in pesticide use that a statewide LBAM infestation could cause in California agriculture.

Insecticide use in the production of nursery stock is estimated to at least double as compared to that used in 2006. For Bt this means an additional 2,100 pounds of active material per year, or for the insecticide chlorpryifos, an additional 5,900 pounds of active material. LBAM has already caused increases in the use of both Bt and chlorpyrifos in the production of nursery stock in the infested areas.

The potential annual increase in homeowner insecticide use that LBAM might cause in the nine currently-infested northern California counties – San Francisco, Marin, Santa Clara, Monterey, Santa Cruz, Alameda, Contra Costa, San Mateo and Solano - ranges from 281 pounds of additional insecticide (represented by permethrin) per year to 2,353 pounds of additional insecticide per year. Extending the analysis to an additional seven coastal counties – Los Angeles, Orange, San Diego, Santa Barbara, San Luis Obispo, Sonoma and Ventura - increases the estimate from 20,364 to 74,305 pounds of additional insecticide per year added to the environment in 16 counties for the foreseeable future. The analysis does not include potential increased pesticide use by owners of business properties, or those maintaining plants in parks, along streets or in natural areas.

The Light Brown Apple Moth Program has formed the following advisory groups:

LBAM Technical Working Group (TWG)

The LBAM TWG is comprised of representatives from the scientific and academic community and individuals with extensive experience regarding LBAM and eradication of invasive species. This group provides recommendations to CDFA and USDA Secretaries regarding feasibility and tools to achieve eradication of the LBAM.

Environmental Advisory Task Force (EATF)

The EATF, chaired by CDFA Secretary A.G. Kawamura, is comprised of representatives from numerous environmental and research-oriented organizations. The EATF informs the Secretary of environmental concerns regarding the Light Brown Apple Moth Program, possible mitigating factors, and research into new control and eradication methods.

1 Robert C. Venette, Erica E. Davis, Michelle DaCosta, Holly Heisler, and Margaret Larson, Mini Risk Assessment, Light Brown Apple Moth, University of Minnesota, Department of Entomology, September 21, 2003. Dowell, R.V., October 13, 2008. A Partial Analysis of the Potential Increase in Pesticide Use Light Brown Apple Moth Might Cause in Commercial Agriculture and Uncultivated Settings in California.

2 CDFA. Unpublished report. Dowell, R.V., April 29, 2008. Calculation of the Potential Increase in Urban Homeowner Pesticide Use Caused by a Generalized Light Brown Apple Moth Infestation in Coastal California.

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California Department of Pesticide Regulation (DPR) and Office of Environmental Health Hazards Assessment (OEHHA)

DPR provides consultation to CDFA regarding pesticide registration issues for materials used in the eradication of LBAM. The OEHHA provides consultation to CDFA regarding the potential human health effects of materials used in eradication efforts.

OEHHA has published a report entitled "*Human Health Risk Assessment of Isomate LBAM Plus*," which evaluated the potential human health risks associated with the use of twist ties to dispense LBAM pheromone in mating disruption treatments. The executive summary of the report states, "This document describes a human health risk assessment on the use of Isomate LBAM Plus conducted by the Office of Environmental Health Hazard Assessment (OEHHA), California Environmental Protection Agency. The Isomate LBAM Plus device, also known as a "twist tie," is a pheromone dispenser. It consists of an aluminum wire and a hollow plastic tube that contains moth pheromones and other additives. It is one of the tools employed by the CDFA to control and eradicate LBAM. LBAM is an invasive pest that was first detected in California in early 2007."

In the wild, female moths release a sex pheromone into the air to attract male moths. Male moths detect the pheromone "scent" with a specialized sensory organ and follow it upwind to locate and then mate with the females. The purpose of the pheromone dispenser is to disrupt this communication system and suppress mating and reproduction by preventing male moths from finding females. Pheromones do not kill or harm the moths.

LBAM Strategy Elements

OEHHA evaluated potential health risks associated with exposures to the pheromones and additives in Isomate LBAM Plus. The pheromones belong to a class of chemicals known as Straight Chain Lepidopteran Pheromones (SCLPs). The SCLPs share many chemical structure features. The United States Environmental Protection Agency (USEPA) has determined that SCLPs are sufficiently similar toxicologically to be considered as a group. Toxicology data of one member of the SCLPs can be applied to other members. This approach was also used in this evaluation.

OEHHA's evaluation indicates that inhalation is the most relevant route of exposure, and the use of Isomate LBAM Plus is not likely to pose a health hazard to humans, including children. The reasons are as follow:

- Low toxicity of SCLPs
- Low application rate of the dispenser
- Low release rate of pheromones from the dispenser
- Low expected human exposure to the pheromones

Furthermore, pheromones in Isomate LBAM Plus have chemical structures similar to the common food items and nutrients known as long-chain fatty acids, and they are expected to be metabolized in a similar fashion in the body. These chemicals are not likely to accumulate in the body or persist in the environment.

Pheromones in Isomate LBAM Plus have been shown to be slight skin irritants in rabbits. While no eye irritation tests have been performed on the pheromones, some SCLPs have been shown to be slight eye irritants as well, when the chemicals are placed directly into the eye. Therefore, as a precautionary measure, it is advisable to minimize the chance of eye or skin contact with the pheromones.

Under federal law, the identity and the composition by weight of the additives in a pesticide product such as Isomate LBAM Plus are considered trade secrets. However, scientists from OEHHA had legal access to this information and used it in the assessment. They are prohibited from releasing this information to the public.

OEHHA's evaluation indicates the additives in Isomate LBAM Plus are not likely to pose a health hazard to adults and children. Nevertheless, the additives are potential eye and skin irritants, and as a precautionary measure, it is advisable to minimize the chance of eye or skin contact with the additives.

STATEWIDE DETECTION

CDFA, in cooperation with the USDA and the California county agricultural commissioners (CACs), has an intensive and extensive trapping array throughout the State to determine the extent of the infestation. The Program is designed to locate new LBAM infestations quickly and verify that uninfested areas remain free from LBAM. This trapping effort has revealed LBAM infestations in Alameda, Contra Costa, Los Angeles, Marin, Monterey, Napa, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma and Yolo counties (Figure 1). The rest of the State remains LBAM-free.

QUARANTINE AND CONTAINMENT

A federal domestic quarantine order and state interior quarantine restrict the movement of LBAM hosts from the infested portions of regulated counties. Currently, over 3,900 square miles are under quarantine (Figure 1).

The quarantines restrict the movement of hosts in and out of the quarantine areas. Regulated host articles such as nursery stock, assorted fruits and vegetables, cut flowers and greenery,

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Christmas trees, hay, and green waste must also comply with the movement restriction(s). The quarantine includes provisions requiring regulated host articles to be inspected and found LBAM-free, originate from a premise that has been trapped and found LBAM-free grown under an integrated pest management system, or moved under specific conditions to a specific location and processed in an approved manner. Infested hosts or premises must be treated or reconditioned and re-inspected and found LBAM-free prior to movement.

Persons or businesses in the quarantine that wish to move regulated host articles in and out of the quarantine area may sign a compliance agreement with their local regulatory official (i.e., the county agricultural commissioner or the Cooperative Light Brown Apple Moth Program) in order to self-certify their hosts for movement. The local regulatory officials conduct periodic inspections and oversight visits of all entities operating under compliance agreements in order to verify compliance.

The current international quarantines will remain in place and other countries may impose their own quarantines on products from the infested portions of California. Canada and Mexico imposed regulations on the movement of agricultural products from the LBAM-infested portions of California in 2007 and these regulations are still in place. Chile did so in 2008. South Korea and China have made inquiries about the Light Brown Apple Moth Program in California. China has regulations in place pertaining to the movement of LBAM host material from Australia and New Zealand. They require that any regulated items be LBAM-free. Growers may treat with pesticide sprays, use cultural practices, inspections, etc., to achieve this requirement.

The Southern Plant Board comprised of state departments of agriculture, petitioned USDA to strengthen the regulations governing the movement of non-exempt LBAM host material from the regulated areas of California. Canada has imposed a 3-year, LBAM-free requirement on the lifting of their quarantine regulations from an area from which LBAM has been eradicated. The current USDA requirement is three life cycles, which is less than a year. Chile is recommending changes to their regulations that may greatly increase the number of traps that must be deployed and the frequency with which they must be inspected to declare an area LBAM-free. If implemented, these changes will increase the cost of exporting non-exempt LBAM host material to Chile.

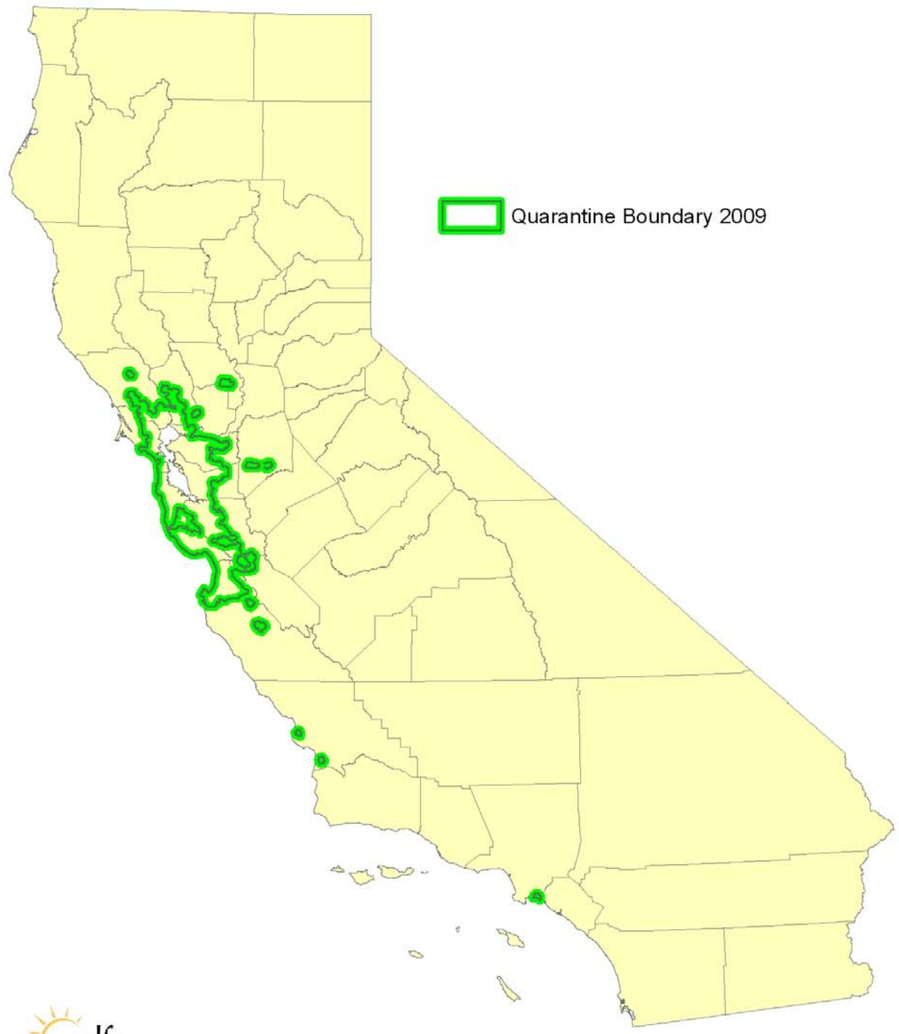

Figure 1

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RAPID RESPONSE

The primary objective of the rapid response component is to quickly and efficiently eradicate incipient infestations of LBAM. In 2009, the treatment program used pheromone mating disruption applied by ground. Eradication of LBAM will require a systems approach using multiple tools, including applications of mating disruption pheromone, use of insecticide treatments, releases of sterile moths and other technologies still under development.

To inform the state, county and local officials of the LBAM problem, CDFA presented the Light Brown Apple Moth Program and the eradication plans to each city that received any type of treatment in 2009 and to any city or county that expressed a desire to learn about the Program. Following these meetings, a press release was issued once treatment dates were determined, informing the public of the LBAM problem and the areas scheduled for treatment (Food and Agricultural Code, Section 5771 – 5780).

Prior to the first treatment in any area, residents, local officials and elected officials are invited to an informational open house. This open house provides the residents an opportunity to learn about the treatment that will be occurring in their neighborhood and to ask specific questions. Program, health and environmental specialists are present to answer questions. During 2009, two informational open houses or public meetings were held in the infested areas.

Residents in the treatment area are notified via door-to-door notification, direct mail and the media. The notice contains the date and time of the treatment, the type of pesticide to be applied, any health and safety precautions the citizens may wish to take and a telephone number for residents to call for any additional information. The Department also introduced an e-mail update notification system.

Prior to any treatment, the Department's environmental scientist reviews the California Department of Fish and Game's (DFG) Natural Diversity Database to determine if any threatened and endangered species are present within the proposed treatment boundaries. Depending on the environmental concerns for a treatment area, the Department consults with the Department of Pesticide Regulation (DPR), Department of Health Services (DHS), California and United States Environmental Protection Agencies, DFG, United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) and the Monterey Bay National Marine Sanctuary (MBNMS). Treatment programs are modified if necessary to protect any threatened and endangered species that might be in the area.

TREATMENT RESPONSES

A twist tie formulation of the LBAM pheromone was used in 2009 to treat small outlier infestations. The application of the twist tie treatment is very labor intensive; therefore, this application is reserved for small outlier infestations. As new technologies are developed and approved for use, they will be incorporated into the existing ground treatment plan.

The LBAM infestation discovered in Carpinteria (Santa Barbara County) was eradicated using pheromone disruption treatments delivered by the use of twist ties. Two additional isolated LBAM infestations are currently being treated with twist ties in Manteca (San Joaquin County) and Los Osos (San Luis Obispo County).

ENVIRONMENTAL MONITORING

Prior to the start of any treatments, the CDFA consults with the DPR to determine the need and scope of any environmental monitoring. No additional environmental monitoring was needed for the use of twist ties in 2009.

ENVIRONMENTAL IMPACT REPORT (EIR)

CDFA contracted with a consulting firm to produce an EIR covering the Program activities. A series of public hearings were held to gather public input on the content and scope of the EIR in Monterey, Santa Cruz, San Francisco and Oakland. The EIR was later expanded to cover the entire state of California and to include the use of sterile LBAM. A second series of public meetings about the expanded EIR was held in Los Angeles, San Jose and Sacramento. The draft EIR was available for public comment 2009. The CDFA received some 300 public comments on the draft EIR. As this report goes to press, CDFA is currently reviewing the public comments and preparing responses to them. The final EIR is expected in early 2010.

RESEARCH

Research is an integral part of the Light Brown Apple Moth Program because no single eradication technique currently exists that can be practically, safely and effectively implemented over the entire LBAM-infested area. Therefore, the LBAM TWG recommends eradicating LBAM in a multi-faceted systems approach. As additional treatment methods are developed and approved for use in California, they will be implemented into the project.

Some treatments developed in Australia and New Zealand will have to be modified for California conditions. Others, such as the sterile insect technique, will require various levels of development and validation to make them functional and effective.

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The Department has developed a research plan with the following objectives:

- Expand upon and modify alternative methods to eradicate LBAM from California.
- Develop methods to control LBAM if eradication is not feasible.
- Develop data on the possible environmental impacts of any eradication or control method used by the Light Brown Apple Moth Program.
- Develop an effective DNA fingerprint and identification technology for LBAM.

Research and Demonstration Projects in Progress:

- ***Trichogramma Wasps.*** Research by Dr. William Roltsch of CDFA and Dr. Nada Carruthers of USDA Agricultural Research Services has confirmed that commercially available California native Trichogramma platerni and Trichogramma pretiosa will successfully attack and kill LBAM eggs. A colony of T. platerni has been established from which a commercial colony will be developed.
- ***Sterile Male Moth Technique.*** This technique involves mass breeding large quantities of LBAM and releasing the sterilized moths over an infested area. The sterile male LBAM mate with wild female LBAM and no offspring are produced. With each generation, the population declines until it is eradicated. An LBAM colony has been established in Moss Landing, Monterey County. The initial test releases started in November 2009 in Napa County.

Develop methods to control LBAM if eradication is not feasible:

- ***Trichogramma Wasps.*** Trichogramma wasps have been used to control moth pests. It is likely that growers could use these commercial wasps to reduce damage to their crops.
- ***Classical Biological Control.*** Department scientists are working with University of California researchers and with LBAM scientists in Australia and New Zealand to import LBAM parasites to evaluate their ability to attack LBAM and their preference for LBAM compared to native or naturalized leaf roller moth larvae. Several exotic LBAM parasites are currently in colony under quarantine and they have undergone host range testing. A permit to release these two parasites will soon be submitted to the USDA Animal and Plant Health Inspection Service for review.
- ***Evaluate Existing Natural Enemies in California.*** CDFA, USDA and University of California scientists are evaluating the presence and possible impact of existing LBAM natural enemies, especially parasites, in California. To date they have found several larval parasites and at least two egg parasites; one of which is not native to California. These natural enemies are attacking a substantial portion of the LBAM population in the latter part of each year, but, to date, they have not slowed the LBAM population from increasing each year since at least 2007.
- ***Develop an effective DNA fingerprint and identification technology for LBAM.*** The technology to identify all the LBAM life stages has been developed and is in use. It is possible to positively identify LBAM eggs, larvae and pupae using DNA technology.
- ***Develop efficacy data for alternatives to organophosphate pesticide treatments for LBAM-infested nursery stock.*** The Program in cooperation with USDA and Australian researchers are conducting pesticide trials in order to evaluate the efficacy of non-organophosphate pesticides against LBAM. Several materials have proven effective and they are being integrated into the LBAM regulatory program.