CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

OFFICIAL NOTICE
FOR THE CITY OF JURUPA VALLEY
PLEASE READ IMMEDIATELY

NOTICE OF TREATMENT FOR THE ORIENTAL FRUIT FLY

Between April 4 and 8, 2016, two male oriental fruit flies (OFFs), *Bactrocera dorsalis* (Hendel) group, were trapped in the city of Jurupa Valley, Riverside County. Based on the survey data, pest biology, information from the California Department of Food and Agriculture (CDFA) *Bactrocera* Science Advisory Panel (BacSAP), recommendations provided by the CDFA Primary State Entomologist, and the CDFA "Action Plan for Methyl Eugenol Attracted Fruit Flies including Oriental Fruit Fly *Bactrocera dorsalis* (Hendel)," the CDFA concludes that an infestation of OFF exists in the area.

A Program Environmental Impact Report (PEIR) has been certified which analyzes the OFF treatment program in accordance with Public Resources Code, Sections 21000 et seq. The PEIR is available at http://www.cdfa.ca.gov/plant/peir/. The treatment activities described below are consistent with the PEIR.

In accordance with integrated pest management principles, the CDFA has evaluated possible eradication methods and determined that there are no cultural or biological methods available to eradicate OFF. The CDFA will employ chemical control as the primary tool, and will additionally use physical control via host fruit removal when there is evidence that a breeding population exists on a property.

The treatment plan for the OFF infestation will be implemented as follows:

- The male attractant treatment (MAT) will be applied within 1.5 miles of each detection site. MAT uses small amounts of the attractant methyl eugenol and the pesticide naled (Dibrom® Concentrate) mixed into a clay matrix (Min-U-Gel® 400) to lure the male flies to bait stations. A second MAT product is undergoing logistical testing as a replacement for the current mixture. This product is STATIC™ Spinosad ME, a pre-mixed solution of methyl eugenol, spinosad, and SPLAT®, and may be used in place of the naled product in some instances. The male flies are killed before they can mate with the females. This disrupts the breeding cycle and the population is eliminated. Spot applications of approximately five milliliters will be applied to utility poles, street trees, and other unpainted surfaces using pressurized tree marking guns within a nine-square mile area (1.5-mile radius) around each OFF detection site. The bait stations are placed six to eight feet above the ground and out of the reach of the public and pets. Applications are repeated every two weeks for one life cycle if no quarantine is triggered (typically two to three months), and for two life cycles if a quarantine is triggered (typically four to six months). Life cycle durations are dependent on temperature.

- If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected), foliar bait treatments may be used within 200 meters of each detection site in order to mitigate the spread of OFF by

eliminating those adult life stages not directly affected by MAT (i.e., females and sexually immature males). Foliar bait ground treatments are a protein bait spray that contains an organic formulation of the pesticide spinosad (GF-120 NF Naturalyte® Fruit Fly Bait), and are repeated every seven to 14 days for one life cycle of the fly (typically two to three months, dependent on temperature). Please visit the CDFA website to learn more about the treatment process at http://www.cdfa.ca.gov/plant/videos/spinosad/.

- If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults), all host fruit from each detection site and all properties within a minimum of 100 meters of each detection site may be removed and disposed of in a landfill in accordance with regulatory protocols. Fruit removal will occur once at the beginning of the project, but may be repeated if additional flies are detected.

Public Notification:
Any resident whose property will be treated via foliar bait sprays or host fruit removal will be notified in writing at least 48 hours in advance of any treatment, in accordance with FAC Section 5779. Following the treatment, completion notices are left with the residents detailing precautions to take and post-harvest intervals applicable to any fruit on the property. For MAT applications in public areas, notification is given to the general public via mass media outlets such as newspapers or press releases, and information is posted on the CDFA website at http://www.cdfa.ca.gov/plant/PDEP/treatment/oriental_ff.html. Information concerning the OFF project will be conveyed directly to concerned local and State political representatives and authorities via letters, emails, and/or faxes. Press releases, if issued, are prepared by the CDFA information officer and the county agricultural commissioner, in close coordination with the project leader responsible for treatment. Either the county agricultural commissioner or the public information officer serves as the primary contact to the media.

For any questions related to this program, please contact the CDFA toll-free telephone number at 800-491-1899 for assistance. This telephone number is also listed on all treatment notices.

Enclosed are the findings regarding the treatment plan and a map of the treatment area.

Attachments

FINDINGS REGARDING A TREATMENT PLAN FOR THE ORIENTAL FRUIT FLY

Between April 4 and 8, 2016, two male oriental fruit flies (OFFs), *Bactrocera dorsalis* (Hendel) group, were trapped in the city of Jurupa Valley, Riverside County. Based on the survey data, pest biology, information from the California Department of Food and Agriculture (CDFA) *Bactrocera* Science Advisory Panel (BacSAP), recommendations provided to me by the CDFA Primary State Entomologist, and the CDFA "Action Plan for Methyl Eugenol Attracted Fruit Flies including Oriental Fruit Fly *Bactrocera dorsalis* (Hendel)," I have determined that an infestation of OFF exists in the area.

The OFF is an exotic insect originating in Asia, and has been accidentally introduced into a number of Pacific Islands, including Hawaii. It is a member of a closely related group of species, known as the OFF group, which are difficult to distinguish based on individual specimens. Several of the group species are major fruit and vegetable pests, and collectively members of the OFF group are known to attack over 230 types of fruits and vegetables. Important California crops at risk include pome and stone fruits, citrus, dates, avocados, and many vegetables, particularly tomatoes and peppers. Damage occurs when the female lays eggs in the fruit. These eggs hatch into larvae, which tunnel through the flesh of the fruit, making it unfit for consumption. This pest presents a major threat to a wide variety of California produce, with the combined 2012 gross value of these commodities of over $15.2 billion. The permanent establishment and spread of this pest would result in increased production and postharvest costs to safeguard commercial fruit from infestation, increased pesticide applications on both production agriculture and residential properties to mitigate damage, and lost economic activity and jobs from trade restrictions imposed by the United States Department of Agriculture (USDA) and foreign trade partners.

This decision to proceed with treatment is based upon a realistic evaluation that it will be possible to eliminate OFF from this area and prevent its spread using currently available technology in a manner that is based on an action plan developed in consultation with the Pest Prevention Committee of the California Agricultural Commissioners and Sealers Association, the USDA, and scientists on the BacSAP. Due to the size of the infested area and the number of flies detected, historical data indicates that eradication is possible. The first California OFF detections occurred in Orange and Santa Barbara counties in 1960, and since that time, multiple re-introductions have been delimited and successfully eradicated. In making this decision, the CDFA has evaluated possible treatment methods. In accordance with integrated pest management principles, the following is the list of options that I have considered for the treatment of this OFF infestation: 1) physical controls; 2) cultural controls; 3) biological controls; and 4) chemical controls.

Based upon input from my professional staff and outside experts familiar with OFF, I have concluded that there are no cultural or biological control methods that are effective to treat the OFF that allow the CDFA to meet its statutory obligations. To eradicate OFF, I am ordering that male attractant treatments, consisting of methyl eugenol, a pesticide (naled), and a thickener be applied to utility poles and street trees to eliminate this infestation. Additionally, in the event of evidence of a breeding population on a property, foliar bait spray treatments will be applied to host trees using ground-based equipment and host fruit removal will occur. Descriptions of these options are below. The options selected are a chemical-control measure that involves the use of insecticides targeting the adult stage and a physical-control measure targeting the eggs and larvae. These options were selected based upon biological effectiveness, minimal public intrusiveness, cost, and minimal impacts to the environment.

A Program Environmental Impact Report (PEIR) has been prepared which analyzes the OFF treatment program in accordance with Public Resources Code (PRC), Sections 21000 et seq. The PEIR was certified in December 2014, and is available at http://www.cdfa.ca.gov/plant/peir/. The PEIR addresses the treatment of the OFF at the program level and provides guidance on future actions against the OFF. It identifies feasible alternatives and possible mitigation measures to be implemented for individual OFF treatment activities. The OFF program has incorporated the mitigation measures and integrated pest management techniques as described in the PEIR. In accordance with PRC Section 21105, this PEIR has been filed with the appropriate local planning agency of all affected cities and counties. No local conditions have been detected which would justify or necessitate preparation of a site specific plan.

Sensitive Areas

The treatment area has been reviewed by consulting the California Department of Fish and Wildlife's California Natural Diversity Database for threatened or endangered species. The CDFA also consults with the United States Fish and Wildlife Service, the National Marine Fisheries Service and the California Department of Fish and Wildlife when rare and endangered species are located within the treatment area. Mitigation measures will be implemented as needed. The CDFA will not apply pesticides to bodies of water or undeveloped areas of native vegetation. All treatment will be applied to residential properties, common areas within residential development, non-agricultural commercial properties, and right-of-ways.

Work Plan

The treatment program area encompasses those portions of Riverside County which fall within 1.5 miles around each property on which an OFF has been detected and any subsequent detection sites within the program boundaries. A map of the project boundaries is attached. The work plan consists of the following elements:

1. Delimitation. Traps will be placed throughout the project area to delimit the infestation and to monitor post-treatment OFF populations. The cardboard Jackson sticky trap is baited with the attractant methyl eugenol mixed with the pesticide naled (Dibrom® 8 Emulsive), and the McPhail trap is an invaginated glass flask baited with Torula yeast and borax in water. The Jackson trap is strongly attractive to sexually maturing males, while the McPhail trap is attractive to both sexes of the fly. Jackson traps and McPhail traps will each be placed at a density of 25 per square mile within a 0.5-mile radius of each detection site, and Jackson traps will be placed at a density of five per square mile in the remaining delimitation area going out to 4.5 miles from each detection site. Additional traps may be added to further delimit the infestation and to monitor the efficacy of treatments. These traps will be serviced on a regular schedule for a period equal to three OFF generations beyond the date of the last OFF detected. In addition, host fruit may be sampled for the presence of eggs and larvae in a 200-meter radius around each detection property.

2. Treatment. Any OFF detections within the original and/or expanded eradication area(s) will be treated according to the following protocol.

    - The male attractant technique (MAT) will be used to eradicate all sexually-mature male OFFs. The MAT makes use of small amounts of the attractant methyl eugenol mixed with the pesticide naled (Dibrom® Concentrate), and incorporated into a clay matrix

(Min-U-Gel® 400) to lure the male flies to bait stations. A second MAT product is undergoing logistical testing as a replacement for the current mixture. This product is STATIC™ Spinosad ME, a pre-mixed solution of methyl eugenol, spinosad, and SPLAT®, and may be used in place of the naled product in some instances. The flies are killed when they feed at the stations. In each square mile within the eradication boundary, a targeted density of 600 evenly spaced five-milliliter bait stations are applied to utility poles, street trees, and other unpainted surfaces using pressurized tree marking guns mounted on specially modified trucks. The bait stations are placed six to eight feet above the ground. The size of the eradication area is defined as that area within 1.5 miles of each detection site, squared off to create a nine-square mile block, and adjusted to use existing features as boundaries, such as roads. Applications are repeated every two weeks for one life cycle if no quarantine is triggered (typically two to three months), and for two life cycles if a quarantine is triggered (typically four to six months). Life cycle durations are dependent on temperature.

- If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected), foliar bait treatments will be used within 200 meters of each detection site in order to mitigate the spread of OFF by eliminating those adult life stages not directly affected by MAT (i.e., females and sexually-immature males). The foliage of host trees and shrubs within 200 meters of each detection site will be treated with an organic formulation of spinosad bait spray (GF-120 NF Naturalyte® Fruit Fly Bait) using hand spray or hydraulic spray equipment. Treatments are repeated every seven to 14 days for one life cycle of the fly (typically two to three months, dependent on temperature).

- If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected), all host fruit from each detection site and all properties within a minimum of 100 meters of each detection site will be removed and disposed of in a landfill in accordance with regulatory protocols. Fruit removal will occur once at the beginning of the project, but may be repeated if additional flies are detected.

Public Information

Residents of affected properties will be invited to a public meeting where officials from the CDFA, the California Department of Pesticide Regulation, the Office of Environmental Health Hazard Assessment, and the county agricultural commissioner's office will be present to address residents' questions and concerns. Residents are notified in writing at least 48 hours in advance of any treatment in accordance with the Food and Agricultural Code (FAC), Section 5779. Following the treatment, completion notices are left with the residents detailing precautions to take and post-harvest intervals applicable to any fruit on the property. Information concerning the OFF program will be conveyed directly to local and State political representatives and authorities via letters, emails, and/or faxes. Treatment and other information is posted at http://www.cdfa.ca.gov/plant/pdep/treatment/oriental_ff.html. Press releases, if issued, are prepared by the CDFA information officer and the county agricultural commissioner, in close coordination with the program leader responsible for treatment. Either the county agricultural commissioner or the public information officer serves as the primary contact to the media.

For any questions related to this program, please contact the CDFA toll-free telephone number at 800-491-1899 for assistance. This telephone number is also listed on all treatment notices.

Duty to Act

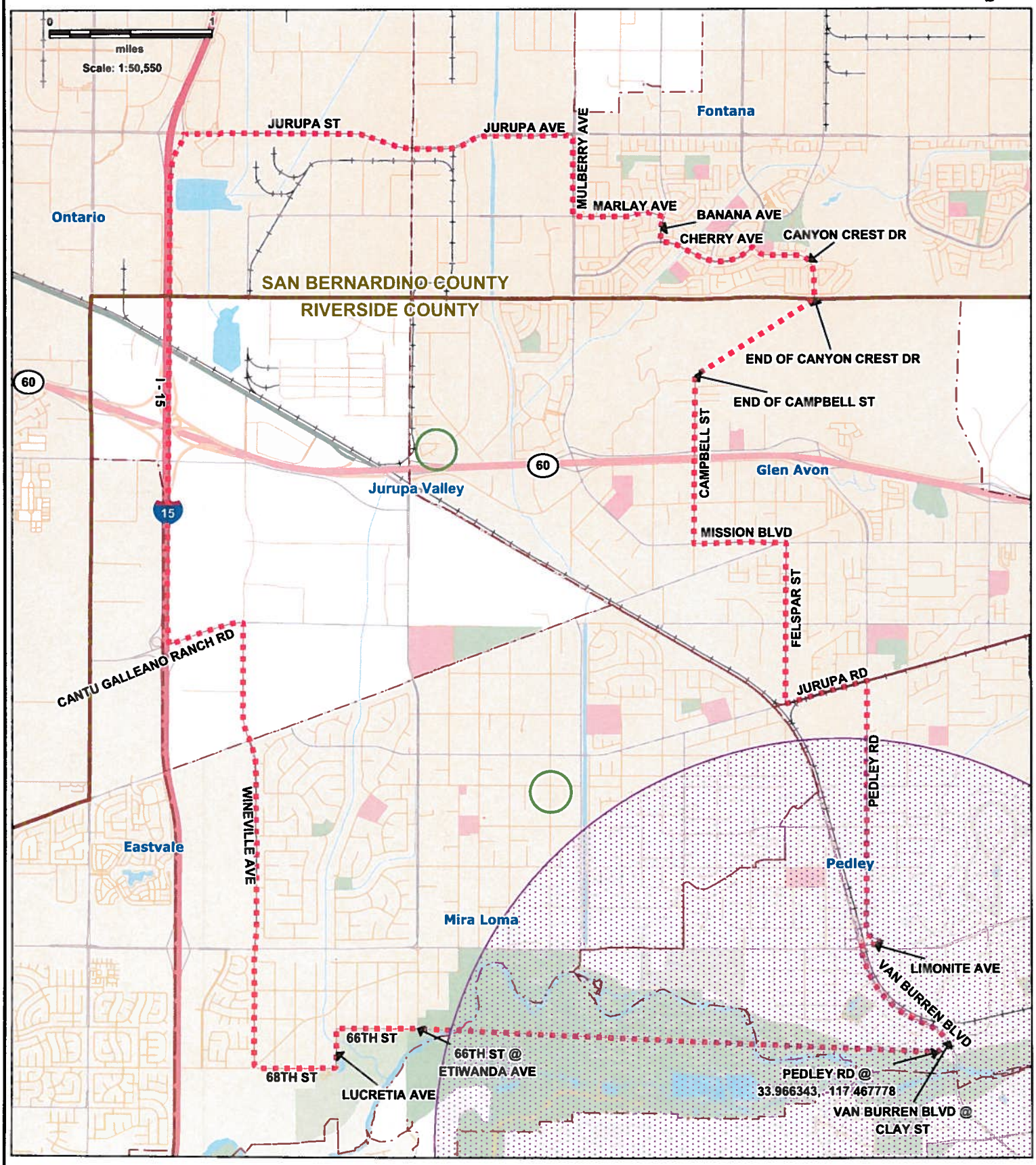
Under my statutory authority, as Secretary of the California Department of Food and Agriculture, I have decided, based upon the likely environmental and economic damage that would be inflicted by an established infestation of the OFF in this area, that it is incumbent upon me to attempt to address this threat.

My duty to act, and this decision, is based upon authority set forth in Sections 24.5, 401.5, 403, 407, 408, 5401-5405, and 5761-5764 of the FAC, authorizing and mandating the Secretary to: thoroughly investigate the existence of the pest; determine the probability of the pest spreading to other areas; adopt regulations (Title 3 of the California Code of Regulations, Section 3591.2) as are reasonably necessary to carry out the provisions of this code; abate a pest from the established treatment area; and, to prevent further economic damage. The project work plan above describes the CDFA's actions that are necessary to mitigate the effects of this pest.

Karen Ross
Karen Ross, Secretary

4-13-16
Date

ORIENTAL FRUIT FLY ERADICATION PROJECT
JURUPA VALLEY, RIVERSIDE COUNTY
2016



cdfa

MAXIMUM PROGRAM BOUNDARY

PROPOSED 200M TREATMENT BOUNDARY

SENSITIVE ENVIRONMENTAL AREA / TREATMENT MITIGATIONS IN PLACE

ERADICATION PROJECT WORK PLAN FOR METHYL EUGENOL RESPONDING EXOTIC FRUIT FLIES (Includes *Bactrocera correcta*, *Bactrocera dorsalis* group, and *Bactrocera zonata*)

DETECTION

1. Detection Trapping

The California Department of Food and Agriculture (CDFA) maintains a cooperative State/County trapping program for the various fruit flies to provide early detection of any infestation in the State. Traps are serviced by either County or State personnel and funded by the Department. The program uses two types of traps: the cardboard Jackson sticky trap baited with the attractant methyl eugenol mixed with the pesticide naled (Dibrom® 8 Emulsive), and the McPhail trap, an invaginated glass flask baited with Torula yeast and borax in water. The Jackson trap is strongly attractive to sexually maturing males, while the McPhail trap is attractive to both sexes of the fly. Traps are hung from branches of host trees at specified densities in susceptible areas of California. County or State employees inspect these traps weekly or bi-weekly throughout the year in southern California and from April or May through October or November in northern California.

2. Intensive Trapping

Intensive trapping is triggered after a single fly is caught. Following confirmation of the specimen, trap densities will be increased over an 81-square mile area centered on the detection. Within the next 24 hours, 25 Jackson and McPhail traps are placed in the square mile core around each find. Five Jackson traps are placed in each mile of the remaining delimitation area. Traps in the core will be checked daily during the first week. Traps in the first buffer zone will be serviced every two days; those in the remainder of the delimitation area are checked at least once during the first week. All traps in the delimitation zone will be checked weekly following a week of negative trap catches. Intensive trapping ends after the third complete life cycle following the last fly find. This time period is determined by a temperature-dependent developmental model run by the Pest Detection/Emergency Projects Branch in Sacramento.

3. Post-Treatment Monitoring

The success of the eradication program is monitored by intensive trapping levels for three life cycles of the fly after the last fly has been detected. If no flies are caught during that time, trap densities return to detection levels.

4. Larval Survey

Fruit on a property where a fly has been trapped may be inspected for possible larval infestation. Small circular oviposition scars are occasionally visible indicating an infested fruit. Fruit on properties adjacent to a trap catch may also be inspected. If two or more flies are trapped close to each other, fruit cutting may be extended to all properties within a 200-meter radius of the finds, concentrating on preferred hosts.

TREATMENT

1. Male Attractant Technique

The male attractant technique (MAT) makes use of small amounts of the attractant methyl eugenol mixed with the pesticide naled (Dibrom® Concentrate), and incorporated into a clay matrix (Min-U-Gel® 400) to lure the male flies to bait stations. Flies are killed by the pesticide when they feed at the stations. A second MAT product is undergoing logistical testing as a replacement for the current mixture. This product is STATIC™ Spinosad ME, a pre-mixed solution of methyl eugenol, spinosad, and SPLAT®, and may be used in place of the naled product in some instances. MAT is applied as five milliliters dollops to utility poles, street trees, and other unpainted surfaces using pressurized tree marking guns. The bait stations are placed six to eight feet above the ground and out of the reach of the public. The project boundaries will be nine-square miles around each site where flies were detected. Application is made to a targeted density of 600 evenly distributed sites in each square mile. Applications are repeated every two weeks for one life cycle if no quarantine is triggered (typically two to three months), and for two life cycles if a quarantine is triggered (typically four to six months). Life cycle durations are dependent on temperature.

2. Foliar Sprays

If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected), the foliage of host trees and shrubs within 200 meters of each detection site will be treated with an organic formulation of spinosad bait spray (GF-120 NF Naturalyte® Fruit Fly Bait) using hand spray or hydraulic spray equipment. Following treatment, completion notices are left with the homeowners detailing precautions to take and post-harvest intervals applicable to any fruit on the property. Treatments are repeated at seven to 14 day intervals for one life cycle of the fly (typically two to three months, dependent on temperature).

3. Host Fruit Removal

If evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected), host removal (fruit stripping) may be used in conjunction with the other treatment options. All host fruit will be removed from all properties within a minimum of a 100-meter radius around the detection sites. The fruit is taken to a landfill for burial using regulatory compliance protocols. Fruit removal will occur once at the beginning of the project, but may be repeated if additional flies are detected.

SENSITIVE AREAS

The treatment area has been reviewed through consultation with the California Department of Fish and Wildlife's California Natural Diversity Database for threatened or endangered species. The CDFA also consults with the California Department of Fish and Wildlife, the U.S. Fish and Wildlife Service and the National Marine Fisheries Services when rare and endangered species are located within the treatment area. Mitigation measures will be implemented as needed. The CDFA will not apply pesticides to bodies of water or undeveloped areas of native vegetation. All treatment will be applied to residential properties, common areas within residential development, non-agricultural commercial properties, and right-of-ways.

PUBLIC NOTIFICATION

Any resident whose property will be treated via foliar bait sprays or host fruit removal will be notified in writing at least 48 hours in advance of any treatment, in accordance with Food and Agricultural Code Sections 5779 and 5401-5404. Following the treatment, completion notices are left with homeowners detailing precautions to take and post-harvest intervals applicable to any fruit on the property. For MAT applications in public areas, notification is given to the general public via mass media outlets such as newspapers or press releases, and information is posted on the CDFA website at http://www.cdfa.ca.gov/plant/pdep/treatment/. Information concerning the project will be conveyed directly to concerned local and State political representatives and authorities via letters, emails, and/or faxes. Press releases, if issued, are prepared by the CDFA information officer and the county agricultural commissioner, in close coordination with the project leader responsible for treatment. Either the county agricultural commissioner or the public information officer serves as the primary contact to the media.

INTEGRATED PEST MANAGEMENT ANALYSIS OF ALTERNATIVE TREATMENT METHODS TO ERADICATE METHYL EUGENOL RESPONDING EXOTIC FRUIT FLIES
January 2015

The treatment program used by the California Department of Food and Agriculture (CDFA) for control of methyl eugenol responding exotic fruit flies (MEREFFs) employs an area-wide chemical treatment called male attractant technique, complemented with a targeted foliar bait spray treatment using an organic pesticide and with fruit removal, as needed.

Below is an evaluation of alternatives treatment methods for MEREFFs which have been considered for eradication programs in California. These flies include, but are not limited to, the oriental fruit fly (*Bactrocera dorsalis*) (OFF) and its sibling species (collectively referred to as *Bactrocera dorsalis* group) (OFF group), guava fruit fly (*Bactrocera correcta*) (GFF), and peach fruit fly (*Bactrocera zonata*) (PFF).

A. PHYSICAL CONTROL

Mass Trapping. This method involves placing a high density of traps in an area in an attempt to physically remove the adults before they can reproduce. For MEREFFs, trapping is considerably enhanced when an insecticide is added to the lure to help capture adults. Mass trapping with lure only and without an insecticide, would capture some adult OFF, but would not eradicate an infestation.

Active Fly Removal. Adult flies are mobile daytime fliers, and adults could theoretically be netted or collected off of foliage. However, due to their ability to fly when disturbed, and the laborious and time prohibitive task of collecting flying insects from several properties by hand, it would be highly improbable that all of the adults could be captured and removed. Larvae live inside the fruit, so all potentially infested fruit in the entirety of the eradication area would have to be removed and disposed of in order to eliminate the larvae from the environment. For these reasons, active fly removal is not considered to be an effective alternative.

Fruit Bagging. Fruit bagging involves individually enclosing each developing fruit in a bag which prevents fruit flies from laying eggs. In order to be effective, frequent monitoring of the bagged fruit is needed to identify and repair damage to the bags before female flies can enter and lay eggs. Fruit bagging is considered an economically inefficient option for area-wide treatment because it is so labor intensive. It is also intrusive to residents, who may oppose having their home grown produce confined inside bags. Additionally, this method may possibly promote the dispersal of female flies in search of egg laying sites, thus spreading the infestation if other treatments are not used outside the fruit bagging area. For these reasons, fruit bagging is not considered to be an effective alternative.

Host Fruit Removal. Removal of host fruits involves the physical removal of all suitable fruit from both the host plant and from the surrounding ground, in order to eliminate developing eggs and larvae. The fruit is collected and double-bagged before being buried in a landfill. California's MEREFF program performs host fruit removal within a 100-meter radius of detection sites which are indicative of an active breeding area, such as those with immature stages, a mated female, or multiple adults, as an added measure to reduce populations within that area and to prevent spread of adult life stages which are not targeted under the preferred area-wide treatment of male attractant technique, such as sexually immature males and females. Fruit removal is not considered an economically inefficient option for area-wide treatment because it is so labor intensive. It is also intrusive to residents, who may oppose losing their home grown

produce. Additionally, this method may possibly promote the dispersal of female flies in search of egg laying sites, thus spreading the infestation if other treatments are not used outside the fruit removal area. For these reasons, fruit removal is most useful as a complimentary treatment to one or more other treatments.

Host Plant Removal. Removal of host plants involves the large scale destruction of plants by either physical removal or phytotoxic herbicides. Host plant removal is not considered an economically inefficient option for area-wide treatment because it is so labor intensive. It is intrusive to residents, who may oppose losing their plants. Additionally, this method may possibly promote the dispersal of female flies in search of egg laying sites, thus spreading the infestation if other treatments are not used outside the host plant removal area. And finally, because only the fruit becomes infested, there is no need to remove the entire plant during a temporary eradication project as long as the fruit can be removed.

B. CULTURAL CONTROL

Cultural Control. Cultural controls involve the manipulation of cultivation practices to reduce the prevalence of pest populations. These include crop rotation, early harvest (i.e., harvesting green fruit before it is suitable for oviposition), using pest-resistant varieties, and intercropping with pest-repellent plants. None of these options are applicable for MEREFF eradications in an urban environment with multiple hosts, and may only serve to drive the flies outside the treatment area, thus spreading the infestation.

C. BIOLOGICAL CONTROL

Microorganisms. No single-celled microorganisms, such as bacteria, have been shown to be effective at controlling MEREFFs.

Nematodes. No nematodes have been shown to be effective at controlling MEREFFs.

Parasites and Predators. Parasites and predators are not considered an effective stand alone eradication method because their success is density dependent; they are more effective against dense prey populations than against light populations, so their effectiveness decreases as the prey populations decline. Although several organisms, such as parasitic wasps, have been investigated as potential biological control agents against exotic fruit fly species, they have only been used in suppression programs and not in eradication programs. Since there is insufficient research documenting their efficacy in an eradication program, using these organisms could lead to the ineffectiveness of the program.

Sterile Insect Technique (SIT). SIT is currently used to suppress OFF and GFF populations in mango orchards in Thailand, and research is ongoing for use against OFF in Hawaii and against a member of the OFF complex, *Bactrocera philippinensis*, in the Philippines. However, there are no production-level colonies of these species outside of Thailand, and these facilities and research colonies are too small and too far away to support an active eradication effort in California. In addition, for introduced populations of the OFF complex, there is uncertainty as to which species has actually invaded, and therefore SIT using the wrong species could lead to ineffectiveness of the program.

D. CHEMICAL CONTROL

Male Attractant Technique. The use of male attractant technique (MAT) (formerly male annihilation technique) in California can be traced back to the 1960's. The current formulation was developed in the 1970's and has been successfully employed over the years in California and Florida to eradicate introduced populations of MEREFFs. MAT makes use of small amounts of the attractant methyl eugenol mixed with the pesticide naled (Dibrom® Concentrate), and incorporated into a clay matrix (Min-U-Gel® 400) to lure the male flies to bait stations. A second MAT product is undergoing logistical testing as a replacement for the current mixture. This product is STATIC™ Spinosad ME, a pre-mixed solution of methyl eugenol, spinosad, and SPLAT®, and may be used in place of the naled product in some instances. Sexually maturing males are strongly attracted to methyl eugenol because it is needed for proper production of their sex pheromone. The male flies responding to the methyl eugenol die from the pesticide when they feed at the stations. In each square mile within the eradication boundary, a targeted density of 600 evenly spaced five milliliter bait stations are applied to utility poles, street trees, and other unpainted surfaces using pressurized tree marking guns mounted on specially modified trucks. The bait stations are placed six to eight feet above the ground. The size of the eradication area is defined as that area within 1.5 miles of each detection site, and squared off to create a nine square mile block, and adjusted to use existing features as boundaries, such as roads. Applications are repeated every two weeks for one life cycle if no quarantine is triggered (typically two to three months), and for two life cycles if a quarantine is triggered (typically four to six months). Life cycle durations are dependent on temperature.

Foliar Bait Treatment. Foliar bait treatments use an insecticide mixed with a food attractant in order to kill adults, particularly females. The bait makes the treatment selective for flies, and therefore biological control agents for other pests are not affected. The CDFA uses this treatment if evidence that a breeding population exists on a property (i.e., immature stages, mated female, or multiple adults are detected). The goal is to decrease the population density and to target adult life stages which are not susceptible to MAT (e.g., mated females, sexually immature males) in order to contain the population while MAT drives the population to extinction. The foliage of host trees and shrubs within 200 meters of each detection site is treated with an organic formulation of spinosad bait spray (GF-120 NF Naturalyte® Fruit Fly Bait) using hand spray or hydraulic spray equipment. This treatment is repeated at seven to 14 day intervals for one life cycle beyond the last fly detected. While effective in the area treated, this type of treatment is considered economically inefficient to apply in a biologically relevant timeframe over the entirety of the eradication area, so it is used as a complimentary treatment to MAT rather than a standalone treatment.

Foliar Cover Spray Treatment. Foliar cover spray treatments use a contact insecticide in order to kill adults. This treatment is non-selective and will affect any insects which come into contact with it, including biological control agents for other pests. In order to sufficiently cover an area, much more pesticide must be applied per area than with foliar bait sprays. For these reasons, cover sprays are not used for this program.

Soil Treatment. Contact insecticides drenched into the soil have been used against MEREFFs in the past. The goal is to directly kill larvae entering the soil to pupate, pupae in the soil, and adults emerging from pupae by drenching the soil surrounding host plants. The insecticide previously used for this purpose contains the organophosphate insecticide diazinon. However, this treatment has not been used since 2001 in California because of its environmental toxicity,

difficulty in removing all ground clutter and debris, and a potential lack of effectiveness in the varied soil types found in urban environments.

E. RESOURCES

California Department of Food and Agriculture. 1993. The Exotic Fruit Fly Eradication Program Utilizing Male Annihilation and Allied Methods. Final Programmatic Environmental Impact Report. State of California, Department of Food and Agriculture, Sacramento, California. State Clearinghouse Number 90021212, April 1993. 572 pp. http://www.countyofsb.org/agcomm/fruitfly/ExoticFFEIR.pdf

United States Department of Agriculture. 2001. Fruit Fly Cooperative Control Program. Final Environmental Impact Statement 2001. 385 pp. http://www.aphis.usda.gov/plant_health/ea/downloads/fffeis.pdf

PEST PROFILE

Common Name: Oriental Fruit Fly

Scientific Name: *Bactrocera dorsalis* (Hendel)

Order and Family: Diptera, Tephritidae

Description: The adult oriental fruit fly (OFF) is somewhat larger than a housefly, about eight millimeters in length. The top of the thorax is mostly black with yellow patches, the abdomen is yellow-orange with a dark T-shaped mark, and the face has two black spots. The wings are clear with a dark line along the front edge. The female has a pointed slender ovipositor to deposit eggs under the skin of host fruit. The egg is minute, white, cylindrical, rounded at the ends and about six times as long as wide. The larva is creamy-white, legless, and may attain a length of ten millimeters. The pupa is encased in a dark brown cylindrical puparium.

History and Economic Importance: The OFF is an exotic insect originating in Asia, and has been accidentally introduced into a number of Pacific Islands, including Hawaii. It is a member of a closely related group of species, known as the OFF complex, which are difficult to distinguish based on individual specimens. Several of the complex species are major fruit and vegetable pests, and collectively members of the OFF complex are known to attack over 230 types of fruits and vegetables. Important California crops at risk include pome and stone fruits, citrus, dates, avocados, and many vegetables, particularly tomatoes and peppers. Damage occurs when the female lays eggs in the fruit. These eggs hatch into larvae, which tunnel through the flesh of the fruit, making it unfit for consumption. The first California detections occurred in Orange and Santa Barbara counties in 1960, and since that time, numerous re-introductions have been delimited and successfully eradicated.

Distribution: OFF is widespread through much of the mainland of southern Asia and neighboring islands, including Sri Lanka and Taiwan. Distribution in the United States is restricted to the Hawaiian Islands.

Life Cycle: Females lay eggs in groups of three to 30 under the skin of host fruits, and a single female can lay more than 1,000 eggs in her lifetime. The amount of time it takes for egg development depends on the ambient temperature. Larvae tunnel through the fruit feeding on the pulp, shed their skins twice, and emerge through exit holes in approximately ten days. The larvae drop from the fruit and burrow two to three centimeters into the soil to pupate. In ten to twelve days, adults emerge from these puparia. The newly emerged adult females need eight to twelve days to mature sexually prior to egg-laying. Breeding is continuous, with several annual generations. Adults live an average of 90 days, feeding on honeydew, decaying fruit, plant nectar, bird dung, and other sources of protein. The adult is a strong flyer, recorded to travel 30 miles in search of food and egg laying sites. This ability to fly long distances allows the fly to infest new areas very quickly.

Hosts and Damage: In excess of 230 fruits and vegetables have been reported as hosts of members of the OFF complex (see Partial Host List below). Fruit that has been attacked may be unfit for consumption due to the larvae tunneling through the flesh as they feed. Decay-producing organisms then enter, leaving the interior of the fruit a rotten mass.

Partial Host List

Common Name	Scientific Name
Akia	*Wikstroemia phyllyraefolia*
Alexander laurel	*Calophyllum inophyllum*
Apple	*Malus sylvestris*
Apricot	*Prunus armeniaca*
Avocado	*Persea americana*
Banana	*Musa paradisiaca* var. *sapientum* (*Musa x paradisiaca*)
Banana, dwarf	*Musa nana*
Barbados cherry	*Malpighia glabra*
Bell pepper	*Capsicum frutescens grossum*
Brazil cherry	*Eugenia dombeyi*
Breadfruit	*Artocarpus altilis*
Caimitillo	*Chrysophyllum oliviforme*
Cashew	*Anacardium occidentale*
Cactus	*Cereus coerulescens*
Cherimoya	*Anonna cherimola*
Cherry, Catalina	*Prunus ilicifolia*
Cherry, Portuguese	*Prunus lusitanica*
Cherry, sweet	*Prunus avium*
Chili	*Capsicum frutescens* var. *longum*
Coffee, Arabian	*Coffea arabica*
Country gooseberry	*Averrhoa carambola*
Cucumber	*Cucumis sativas*
Custard apple	*Annona reticulata*
Date palm	*Phoenix dactylifera*
Dragon tree	*Dracaena draco*
Eggfruit tree	*Outeria campechiana*
Elengi tree	*Mimusops elengi*
Fig	*Ficus carica*
Gourka	*Garcinia celebica*
Granadilla, sweet	*Passiflora ligularis*
Granadilla, yellow	*Passiflora lauriflora*
Grape	*Vitis* spp.
Grapefruit	*Citrus paradisi*
Guava	*Psidium guajava*
	P. littorale
	P. cattleianum
Imbu	*Spondias tuberosa*
Jackfruit	*Artocarpus heterophyllus*
Jerusalem cherry	*Solanum pseudocapsicum*
Kitembilla	*Dovyalis hebecarpa*
Kumquat	*Fortunella japonica*
Laurel	*Calophyllum inophyllum*
Lemon	*Citrus limon*
Lime	*Citrus aurantiifolia*
Longan	*Euphoria longan*
Loquat	*Eriobotrya japonica*
Lychee nut	*Lychee chinensis*
Malay apple	*Eugenia malaccensis*
Mammee apple	*Mammea americana*
Mandarin orange (tangerine)	*Citrus reticulata*

Common Name	Scientific Name
Mango	*Manifera indica*
Mangosteen	*Garcinia mangostana*
Mock orange	*Murraya exotica*
Mulberry	*Morus nigra*
Myrtle, downy rose	*Rhodomyrtus tomentosa*
Natal plum	*Carissa grandiflora*
Nectarine	*Prunus persica* var. *nectarina*
Oleander, yellow	*Thevetia peruviana*
Orange, calamondin	*Citrus mitis* and *C. japonica*
Orange, Chinese	*Citrus japonica hazara*
Orange, king	*Citrus nobilis*
Orange, sweet	*Citrus sinensis*
Orange, Unshu	*Citrus unshu*
Oriental bush red pepper	*Capsicum frutescens abbreviatum*
Otaheite apple	*Spondias dulcis*
Palm, syrup	*Jubaea spectabilis*
Papaya	*Carica papaya*
Passionflower	*Passiflora edulis*
Passionflower, softleaf	*Passiflora mollissima*
Passionfruit (yellow lilikoi)	*Passiflora edulis flavicarpa*
Peach	*Prunus persica*
Pear	*Pyrus communis*
Pepino	*Solanum muricatum*
Pepper, sweet	*Capsicum frutescens* var. *grossum*
Persimmon, Japanese	*Diospyros kaki*
Pineapple guava	*Feijoa sellowiana*
Plum	*Prunus americana*
Pomegranate	*Punica granatum*
Prickly pear	*Puntia megacantha*
Prune	*Prunus domestica*
Pummelo	*Citrus maxima*
Quince	*Cydonia oblonga*
Rose apple	*Eugenia jambos*
Sandalwood	*Santalum paniculatum*
Sandalwood, white	*Santalum album*
Santol	*Sandericum koetjape*
Sapodilla	*Manilkara zapota*
Sapodilla, chiku	*Achras zapota*
Sapota, white	*Casimiroa edulis*
Seagrape	*Coccoloba uvifera*
Sour orange	*Citrus aurantium*
Soursop	*Annona muricata*
Star apple	*Chrysophyllum cainito*
Surinam cherry	*Eugenia uniflora*
Tomato	*Lycopersicon esculentum*
Tropical almond	*Terminalia catappa*
	Terminalia chebula
Velvet apple	*Diospyros discolor*
Walnut	*Juglans hindsii*
Walnut, English	*Juglans regia*
Wampi	*Citrus lansium*
West Indian cherry	*Malpighia punicifolia*
Ylang-ylang	*Canaga odor*