



Asian Citrus Psyllid Program - Treatment Around Commercial Citrus Groves in Southern California
Redlands and Mentone, San Bernardino County
Proclamation of an Emergency Program Map (2022-02)

-  Treatment Area
-  Environmentally Sensitive Area: Treatment Mitigation in Place



I. Detection and Survey Activities for Asian Citrus Psyllid

A. Urban and Rural Residential Detection Trapping and Visual Survey

Trapping for Asian citrus psyllid (ACP) is a cooperative state/county trapping program to provide early detection of an infestation in a county. Traps are serviced by either state or county agricultural inspectors. The trap used for ACP detection is the yellow panel trap, which is a cardboard panel coated with an adhesive on each side. ACP becomes entangled on the sticky surface and cannot move off the trap. Yellow panel traps have proven successful at detecting infestations of ACP. At all locations where traps are placed, the host plant is visually inspected for ACP. If ACP is detected, the host is visually surveyed for additional ACP and symptoms of huanglongbing (HLB).

- Trap Density: Five to 16 traps/square mile.
- Trap Servicing Interval: Monthly.
- Trap Relocation and Replacement: Traps are relocated and replaced every four to eight weeks to another host with a minimum relocation distance of 500 feet.
- Visual surveys and/or tap sampling are conducted once at each trapping site when the trap is placed.

B. Commercial Grove Trapping

In counties with substantial commercial citrus production, and which are not generally infested with ACP, traps are placed within the groves at the density of one trap per 40 acres. Traps are replaced every two weeks and submitted for screening. In areas that are generally infested with ACP, agricultural inspectors visually survey commercial groves for plant tissue displaying symptoms of HLB and collect ACP which are tested for *Candidatus Liberibacter asiaticus* (CLAs), the bacteria that causes HLB.

Delimitation Trapping and Visual Survey Outside of the Generally Infested Area

The protocols below are the actions in response to the detection of ACP in counties north of Santa Barbara County and the Tehachapi Mountains.

1. Response to the Detection of One or More ACP

a. Trapping

ACP traps are placed at a density of 50 traps per square mile in a four-square mile delimitation area centered on the detection site. Traps are serviced weekly for one month. If no additional ACP are detected, the traps are serviced monthly for one year past the date the ACP was initially identified. Subsequent detections may increase the size of the delimitation survey area and restarts the one-year duration on the trap servicing requirement.

b. Visual Survey

All find sites and adjacent properties are visually surveyed for ACP and HLB. Additional sites may be surveyed as part of the risk-based survey.

II. Detection and Survey Activities for HLB

HLB Delimitation Survey

Upon confirmation of an HLB infected citrus tree (or host plant), a mandatory delimitation survey is initiated in the 250-meter radius area surrounding the detection. All host plants are visually

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surveyed for symptoms of HLB and presence of ACP. Plant and insect samples are collected from every host plant in the 250-meter area and subsequently analyzed for CLAs.

III. Treatment Activities

Treatment

The Citrus Pest and Disease Prevention Division (CPDPD) treatment activities for ACP vary throughout the state and depend on multiple factors.

Factors CPDPD considers prior to treatment include:

- Determination if suppression of ACP is feasible;
- The proximity of the ACP infestation to commercial citrus;
- Whether growers are conducting coordinated treatment activities;
- The level of HLB risk; and
- Consistency with the overall goal of protecting the state's commercial citrus production.

Scenarios Throughout the State in which Treatment Occurs:

- ACP detections in areas with commercial citrus production near previous HLB detections that are generally infested with ACP, and where all growers are treating on a coordinated schedule, CPDPD may conduct residential buffer treatments to suppress ACP populations around the commercial groves in an effort to prevent establishment of HLB.
- In areas where HLB is detected, CPDPD conducts residential treatments to suppress ACP populations.
- In areas where ACP has not been previously detected, or where ACP has been detected at low densities, CPDPD conducts residential treatments in response to ACP detections to prevent ACP establishment or suppress populations.
- In areas where ACP has been detected along the California-Mexico border, CPDPD conducts residential treatments in response to ACP detections to suppress ACP populations due to proximity of HLB detections in Mexico.

CPDPD's current policy is to not conduct treatments in areas that are generally infested if there is limited or no commercial citrus production in the area.

1. Treatment Protocols

In accordance with the integrated pest management principles, CPDPD has evaluated possible treatment methods and determined that there are no physical, cultural, or biological controls available to eliminate ACP from an area.

In general, when treatment has been deemed appropriate, CPDPD applies insecticides to host trees in the residential (urban) areas in a 50 to 800-meter radius around each detection site. Only ACP host plants are treated.

a. International Border Treatments

CPDPD treats citrus host plants in the residential area within two miles of the California-Mexico border. This treatment is conducted within a 400-meter buffer surrounding ACP detections that are within two miles of the California-Mexico border.

- A Proclamation of an Emergency Program (PEP) is issued.
- Prior to undertaking any treatment activity for a property with ACP and/or hosts infected with HLB, CPDPD will contact the affected residents directly or schedule

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a public meeting or series of public meetings to inform residents, growers, and other interested parties of CPDPD's intent to take action, and to provide technical information about products used, dates of treatment(s), etc.

b. Within a Generally Infested Area with Commercial Citrus Production

For ACP detections, CPDPD treats citrus host plants within a 250-meter buffer surrounding commercial citrus groves if the growers are conducting coordinated treatments in the designated Psyllid Management Area (PMA) and at least 90 percent of the growers have completed two out of three of the coordinated treatments. The exception is Imperial County, which has fewer residential properties, and therefore ACP detections trigger treatment of residential citrus host plants within 800 meters of commercial citrus.

- A PEP is issued.
- Prior to undertaking any treatment activity for a property with ACP and/or hosts infected with HLB, CPDPD will contact the affected residents directly or schedule a public meeting or series of public meetings to inform residents, growers, and other interested parties of CPDPD's intent to take action, and to provide technical information about products used, dates of treatment(s), etc.

c. Outside of the Generally Infested Area

The actions below are in response to the detection of one or more ACP, whether collected live or in a trap, in counties north of Santa Barbara County and the Tehachapi Mountains.

- Detection of one ACP at one site - All properties with a host within a 50-meter radius of the detection site are treated. A subsequent detection of one or more ACP within 400-meters will result in all properties with hosts within 400-meters of the detection site(s) being treated.
- Detection of two or more ACP at one site - All properties with a host within a 400-meter radius of the detection site are treated.
- A PEP is issued.
- Prior to undertaking any treatment activity for a property with ACP and/or hosts infected with HLB, CPDPD will contact the affected residents directly or schedule a public meeting or series of public meetings to inform residents, growers, and other interested parties of CPDPD's intent to take action, and to provide technical information about products used, dates of treatment(s), etc.

d. In response to an HLB Detection

- All properties with a host within a 250-meter radius of the detection site are treated.
- All host plants found to be infected with HLB are destroyed and removed by mechanical means.
- A PEP is issued.
- Prior to undertaking any treatment activity for a property with ACP and/or hosts infected with HLB, CPDPD will contact the affected residents directly or schedule

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a public meeting or series of public meetings to inform residents, growers, and other interested parties of CPDPD's intent to take action, and to provide technical information about products used, dates of treatment(s), etc.

2. Treatment Methodology

The treatment protocol consists of both a foliar and a systemic insecticide. The foliar insecticide is used for immediate reduction of the adult ACP population to prevent the adults from dispersing. The systemic insecticide is a soil treatment used to kill the sedentary nymphs and provide long term protection against reinfestation. Treatment frequency is dependent on the insecticide applied and severity of the infestation.

CPDPD uses registered pesticides and follows the label directions. The treatment protocol may be adjusted to use only the foliar or the systemic insecticide to allow for mitigations in special situations

a. Foliar Treatment

Tempo® SC Ultra (cyfluthrin) is a pyrethroid contact insecticide. Treatment initially occurs once, and subsequent applications may occur for up to three times annually if additional psyllids are detected. This material is applied to the foliage of all host plants using hydraulic spray or hand spray equipment.

b. Soil Treatment

A systemic soil application is made using either Merit® 2F or CoreTect™.

- Merit® 2F (imidacloprid), is a neonicotinoid systemic insecticide. Treatment initially occurs once, and a subsequent application may occur once on an annual basis if additional psyllids are detected. This material is applied to the soil within the root zone of host plants.
- CoreTect™ (imidacloprid) is a neonicotinoid systemic insecticide. It is used in place of Merit® 2F in situations where there are environmental concerns about soil surface runoff of the liquid Merit® 2F formulation, such as host plants growing next to ponds and other environmentally sensitive areas. This material is a pelletized tablet and is inserted into the soil and watered in within the root zone of host plants.

INTEGRATED PEST MANAGEMENT ANALYSIS OF ALTERNATIVE TREATMENT METHODS FOR CONTROL OF THE ASIAN CITRUS PSYLLID AND HUANGLONGBING

May 2018

The treatment program used by the California Department of Food and Agriculture (CDFA) for control of the Asian citrus psyllid (ACP), *Diaphorina citri* (Hemiptera: Psyllidae), and the disease it transmits, namely Huanglongbing, *Candidatus* Liberibacter asiaticus, targets multiple life stages. A contact insecticide is used for an immediate control of ACP adults in order to prevent spread, and a systemic insecticide is used to control developing ACP nymphs and to give the plant long term protection from re-infestation. The contact insecticide preferentially used contains the synthetic pyrethroid cyfluthrin, while the systemic insecticide contains the synthetic neonicotinoid imidacloprid. Both products have been shown to be effective against ACP elsewhere, particularly in Florida. In addition, HLB-infected plants are removed in their entirety and destroyed, in order to remove a reservoir for the disease. The California Huanglongbing Task Force, a joint government, university, and industry group formed in 2007 to provide guidance to the CDFA on matters pertaining to ACP and HLB has endorsed the use of these chemicals in the CDFA's treatment program.

Below is an evaluation of alternative treatment methods to control ACP and HLB which have been considered for treatment programs in California.

A. PHYSICAL CONTROL

Mass Trapping. Mass trapping of adults involves placing a high density of traps in an area in an attempt to physically remove them before they can reproduce. The current available trapping system for ACP relies on short distance visual stimulus, and is not considered effective enough to use in a mass trapping program.

Active Psyllid Removal. Adult ACPs 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 minute insects from several properties by hand, it would be highly unlikely that all adults could be captured and removed. Nymphs attach themselves to developing leaves and stems via their proboscis. Therefore, physical removal of the nymphs would entail removal of the growing shoots which will stunt the tree and reduce fruit production. For these reasons, mechanical control is not considered to be an effective alternative.

Host Removal. Removal of host plants for ACP would involve the large-scale destruction of plants and their roots by either physical removal or phytotoxic herbicides. Additionally, host removal could promote dispersal of female psyllids in search of hosts outside of the treatment area, thus spreading the infestation. For these reasons, host removal is considered inefficient and too intrusive to use over the entirety of the treatment areas used for ACP. However, physical host removal of HLB-infected plants in their entirety is used for HLB control, because it is limited in scope to just the infected tree and it is effective at eliminating the disease reservoir, thereby preventing further spread of the disease by ACP.

B. CULTURAL CONTROL

Cultural Control. Cultural controls involve the manipulation of cultivation practices to reduce the prevalence of pest populations. These include crop rotation, using pest-resistant varieties, and intercropping with pest-repellent plants. None of these options are applicable for ACP control in an urban environment, and may only serve to drive the psyllids outside the treatment area, thus spreading the infestation.

C. BIOLOGICAL CONTROL

Microorganisms. No single-celled microorganisms, such as bacteria, are currently available to control ACP.

Nematodes. Entomopathogenic nematodes can be effective for control of some soil-inhabiting insects, but are not effective, nor are they used, against above ground insects such as psyllids.

Parasites and Predators. There have been two parasites released in Florida against ACP, but only one of these are considered somewhat successful there, namely *Tamarixia radiata* (Hymenoptera: Eulophidae). This insect has been released into the environment in southern California. The CDFA is working with the citrus industry to pursue options for incorporating this parasite into treatment programs statewide. In addition, a second wasp has been recently released by the University of California Riverside, *Diaphorencyrtus aligarhensis*.

Sterile Insect Technique (SIT). SIT involves the release of reproductively sterile insects which then mate with the wild population, resulting in the production of infertile eggs. SIT has neither been researched nor developed for ACP, nor has it been developed for any species of psyllids, and is therefore unavailable.

D. CHEMICAL CONTROL

Foliar Treatment. A number of contact insecticides have been researched for use against ACP elsewhere, particularly in Florida. Contact insecticides are more effective against adult ACPs than the sedentary nymphs because adults actively move around on plants, thereby coming into contact with residues, whereas nymphs have to be directly sprayed in order for them to come into contact. The following product has been identified for use by the CDFA, based on a combination of effectiveness against ACP, worker and environmental safety, and California registration status.

Tempo® SC Ultra is a formulation of cyfluthrin which is applied to the foliage of all host plants. Tempo® SC Ultra is a broad-spectrum synthetic pyrethroid insecticide which kills insects on contact. Tempo® SC Ultra has no preharvest interval, which makes it compatible with residential fruit-growing practices.

Soil Treatment. A number of systemic insecticides have been researched for use against ACP elsewhere, particularly in Florida. Systemic insecticides are particularly effective against psyllid nymphs because nymphs spend much of their time feeding, thereby acquiring a lethal dose. The following products have been identified for use by the CDFA, based on a combination of effectiveness against ACP, worker and environmental safety, and California registration status.

Merit® 2F is a formulation of imidacloprid which is applied to the root system of all host plants via a soil drench. Imidacloprid is a synthetic neonicotinoid insecticide which controls a number of other phloem feeding pests such as psyllids, aphids, mealybugs, etc.

CoreTect™ is a formulation of imidacloprid which is applied to the root system of all host plants via insertion of a tablet into the soil, followed by watering. It is used in place of Merit® 2F in situations where there are environmental concerns about soil surface runoff of the liquid Merit® 2F formulation, such as host plants growing next to ponds and other environmentally sensitive areas.

E. RESOURCES

Grafton-Cardwell, E. E. and M. P. Daugherty. 2013. Asian citrus psyllid and huanglongbing disease. Pest Notes Publication 74155. University of California, Division of Agriculture and Natural Resources Publication 8205. 5 pp.

<http://www.ipm.ucdavis.edu/PDF/PESTNOTES/pnasiancitruspsyllid.pdf>.

Grafton-Cardwell, E. E., J. G. Morse, N. V. O'Connell, P. A. Phillips, C. E. Kallsen, and D. R. Haviland. 2013. UC IPM Management Guidelines: Citrus. Asian Citrus Psyllid. Pest Notes Publication 74155. University of California, Division of Agriculture and Natural Resources. <http://www.ipm.ucdavis.edu/PMG/r107304411.html>.

PEST PROFILE

Common Name: Asian Citrus Psyllid

Scientific Name: *Diaphorina citri* Kuwayama

Order and Family: Hemiptera, Psyllidae

Description: The Asian citrus psyllid (ACP) is 3 to 4 millimeters long with a brown mottled body. The head is light brown. The wings are broadest in the apical half, mottled, and with a dark brown band extending around the periphery of the outer half of the wing. The insect is covered with a whitish waxy secretion, making it appear dusty. Nymphs are generally yellowish orange in color, with large filaments confined to an apical plate of the abdomen. The eggs are approximately 0.3 millimeters long, elongated, and almond-shaped. Fresh eggs are pale in color, then, turn yellow, and finally orange at the time of hatching. Eggs are placed on plant tissue with the long axis vertical to the surface of the plant.

History: Asian citrus psyllid was first found in the United States in Palm Beach County, Florida, in June 1998 in backyard plantings of orange jasmine. By 2001, it had spread to 31 counties in Florida, with much of the spread due to movement of infested nursery plants. In the spring of 2001, Asian citrus psyllid was accidentally introduced into the Rio Grande Valley, Texas on potted nursery stock from Florida. It was subsequently found in Hawaii in 2006, in Alabama, Georgia, Louisiana, Mississippi, and South Carolina in 2008. ACP was first found in California on August 27, 2008 in San Diego County. Subsequent to this initial detection in San Diego County, the ACP has been detected in Fresno, Imperial, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Luis Obispo, Santa Barbara, Tulare, Ventura, Marin, Monterey, San Francisco, and Santa Clara counties. The ACP has the potential to establish itself throughout California wherever citrus is grown.

Distribution: ACP is found in tropical and subtropical Asia, Afghanistan, Saudi Arabia, Reunion, Mauritius, parts of South and Central America, Mexico, the Caribbean, and in the U.S. (Alabama, Arizona, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, South Carolina, and Texas).

Life Cycle: Eggs are laid on tips of growing shoots; on and between unfurling leaves. Females may lay more than 800 eggs during their lives. Nymphs pass through five instars. The total life cycle requires from 15 to 47 days, depending on environmental factors such as temperature and season. The adults may live for several months. There is no diapause, but populations are low in the winter or during dry periods. There are nine to ten generations a year, with up to 16 noted under observation in field cages.

Hosts and Economic Importance: ACP feeds mainly on *Citrus* spp., at least two species of *Murraya*, and at least three other genera, all in the family Rutaceae. Damage from the psyllids occurs in two ways: the first by drawing out of large amounts of sap from the plant as they feed and, secondly, the psyllids produce copious amounts of honeydew. The honeydew then coats the leaves of the tree, encouraging sooty mold to grow which blocks sunlight to the leaves. However, the most serious damage caused by ACP is due to its ability to effectively vector three phloem-inhabiting bacteria in the genus *Candidatus* Liberibacter, the most widespread being *Candidatus* Liberibacter asiaticus. These bacteria cause a disease known as huanglongbing, or citrus greening. In the past, these bacteria have been extremely difficult to detect and

characterize. In recent years, however, DNA probes, electron microscopy, and enzyme-linked immunosorbent assay tests (ELISA) have been developed that have improved detection. Symptoms of huanglongbing include yellow shoots, with mottling and chlorosis of the leaves. The juice of the infected fruit has a bitter taste. Fruit does not color properly, hence the term “greening” is sometimes used in reference to the disease. Huanglongbing is one of the most devastating diseases of citrus in the world. Once infected, there is no cure for disease and infected trees will die within ten years. The once flourishing citrus industry in India is slowly being wiped out by dieback. This dieback has multiple causes, but the major reason is due to HLB.

Host List

SCIENTIFIC NAME

Aegle marmelos
Aeglopsis chevalieri
Afraegle gabonensis
Afraegle paniculata
Amyris madrensis
Atalantia monophylla
Atalantia spp.
Balsamocitrus dawei
Bergia (=Murraya) *koenigii*
Calodendrum capense
X Citroncirus webberi
Choisya arizonica
Choisya ternate
Citropsis articulata
Citropsis gilletiana
Citropsis schweinfurthii
Citrus aurantiifolia

Citrus aurantium

Citrus hystrix
Citrus jambhiri
Citrus limon
Citrus madurensis
(=X *Citrofortunella microcarpa*)
Citrus maxima
Citrus medica
Citrus meyeri
Citrus × nobilis
Citrus × paradisi
Citrus reticulata
Citrus sinensis
Citrus spp.
Clausena anisum-olens
Clausena excavata
Clausena indica
Clausena lansium

COMMON NAMES

bael, Bengal quince, golden apple, bela, milva
Chevalier's aeglopsis
Gabon powder-flask
Nigerian powder-flask
mountain torchwood
Indian atalantia

Uganda powder-flask
curry leaf
Cape chestnut

Arizonia orange
Mexican or mock orange
Katimboro, Muboro, West African cherry orange
cherry-orange
African cherry-orange
lime, Key lime, Persian lime, lima, limón agrio, limón ceutí, lima mejicana, limero
sour orange, Seville orange, bigarde, marmalade orange, naranja agria, naranja amarga
Mauritius papeda, Kaffir lime
rough lemon, jambhiri-orange, limón rugoso, rugoso
lemon, limón, limonero
calamondin

pummelo, pomelo, shaddock, pompelmous, toronja
citron, cidra, cidro, toronja
Meyer lemon, dwarf lemon
king mandarin, tangor, Florida orange, King-of-Siam
grapefruit, pomelo, toronja
mandarin, tangerine, mandarina
sweet orange, orange, naranja, naranja dulce

anis
clausena
clausena
wampi, wampee

<i>Clymenia polyandra</i>	a-mulis
<i>Eremocitrus glauca</i>	Australian desert lime
<i>Eremocitrus</i> hybrid	
<i>Esenbeckia berlandieri</i>	Berlandier's jopoy
<i>Fortunella crassifolia</i>	Meiwa kumquat
<i>Fortunella margarita</i>	Nagami kumquat, oval kumquat
<i>Fortunella polyandra</i>	Malayan kumquat
<i>Fortunella</i> spp.	
<i>Limonia acidissima</i>	Indian wood apple
<i>Merrillia caloxylon</i>	flowering merrillia
<i>Microcitrus australasica</i>	finger-lime
<i>Microcitrus australis</i>	Australian round-lime
<i>Microcitrus papuana</i>	desert-lime
X <i>Microcitronella</i> spp.	
<i>Murraya</i> spp.	curry leaf, orange-jasmine, Chinese-box, naranjo jazmín
<i>Naringi crenulata</i>	naringi
<i>Pamburus missionis</i>	
<i>Poncirus trifoliata</i>	trifoliolate orange, naranjo trébol
<i>Severinia buxifolia</i>	Chinese box-orange
<i>Swinglea glutinosa</i>	tabog
<i>Tetradium ruticarpum</i>	evodia, wu zhu yu
<i>Toddalia asiatica</i>	orange climber
<i>Triphasia trifolia</i>	trifoliolate limeberry, triphasia
<i>Vepris (=Toddalia) lanceolata</i>	white ironwood
<i>Zanthoxylum fagara</i>	wild lime, lime prickly-ash