Pierce's Disease Control Program
2009 Annual Report to the Legislature

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Pierce's Disease Control Program

California Department of Food and Agriculture

Annual Report to the Legislature

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A.G. Kawamura, *CDFA Secretary*

Published by the California Department of Food and Agriculture
Sacramento, CA 95814

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Statement of the Secretary

There was a time about a decade ago when grape growers, vintners, researchers and regulators alike were, at the very least, unsure how severely Pierce's disease and the glassy-winged sharpshooter would impact our state's number-one crop.

Since August 1999, we've enjoyed many successful harvests, even in places like Temecula, where almost no one was willing to bet on the future of that region.

I hope and trust that you will view this annual report as more than just a summary of one year's experience in the Pierce's Disease Control Program. It is one installment in a progression that has already included improvements in pest control methods, advances in integrated pest management techniques, streamlined nursery inspection programs, and of course, research that promises to provide field-ready remedies for growers.

How has all of this been accomplished? Through a successful and cooperative partnership between federal, state and local agricultural departments, university researchers, industry, tremendous investments by growers, and dedication of the larger agricultural community.

The Pierce's Disease Control Program is exemplary, innovative, and continues to provide much needed protection to our valuable wine and grape industry and the economic activity it generates. I have every confidence that this ongoing effort deserves our collective commitment to sustain and build upon our successes until the job is done.

A.G. Kawamura, Secretary
California Department of Food and Agriculture

Executive Summary

The Pierce's Disease Control Program (PDCP) celebrated a decade of success in 2009. Ten years ago, winegrapes were devastated in Temecula when Pierce's disease, vectored by the glassy-winged sharpshooter, destroyed much of the area's vineyards. Today, vineyards have been replanted and Temecula has returned to a thriving winegrape production area and a vibrant tourist attraction.

Two-thirds of California's ornamental nurseries are located in the glassy-winged sharpshooter (GWSS) infested regions of southern California. Strictly enforced regulations have allowed nursery stock commerce to continue without the risk of spreading GWSS. After years of research, approved treatments to nursery stock add greater assurances of moving clean nursery stock to areas of California uninfested by GWSS.

Biological control agents that attack GWSS are in production at two separate PDCP facilities. These agents, once released in the wild, are establishing new colonies that will continue to bring down GWSS populations now and in the future.

GWSS has been successfully eradicated from 13 isolated areas in California, providing further protection to California's vineyards from this deadly vector. Meanwhile, researchers are closing in on solutions to Pierce's disease through several different approaches.

Building one success upon the next, the PDCP, with its partnerships with the USDA, Agricultural Commissioners, University of California, nurserymen, citrus growers, winegrape growers, and vintners, has become a model program for invasive pest management.

Background

The Threat

Pierce's disease has been present in California for more than 100 years. The disease has caused sizable losses in California viticulture in the past, but the damage occurred primarily in traditional "hotspot" areas. Until recently, it was not severe enough to completely prevent grape production in areas where the pathogen was present. This situation changed dramatically with the arrival of the glassy-winged sharpshooter. Viticulture in traditionally safe growing regions is now at risk from the disease. Considering only grapes, the disease now threatens a crop production value of $3.1 billion and associated economic activity within California in excess of $62 billion. Other crop and ornamental plant resources such as almonds ($2.1 billion) and susceptible species of citrus ($518 million), stone fruits ($674 million), and shade trees are also at risk, either from the Pierce's disease strain of the bacterium or from related strains found elsewhere in the world. To counter this threat, the Pierce's Disease Control Program was established within the California Department of Food and Agriculture (CDFA) to minimize the statewide impact of Pierce's disease and the glassy-winged sharpshooter.

Pierce's Disease

Pierce's disease (PD) in grapevines was first noted in California near Anaheim around 1884. The disease is caused by a strain of the bacterium *Xylella fastidiosa*. It kills grapevines by clogging their water-conducting vessels (xylem) and triggering cell death in the plant. Several strains of this bacterium exist, attacking and causing damage to different host plants including grapes, citrus, stone fruits, almonds, oleander, and certain shade trees such as oaks, elms, maples, and sycamores. Since its discovery, Pierce's disease has been reported in 28 of California's counties. The University of California (UC) reported that the disease destroyed over 1,000 acres of grapevines in northern California between 1994 and 2000, causing $30 million in damages.[1] There is currently no known cure for Pierce's disease.

Vines showing symptoms of Pierce's disease.

[1] Report of the Pierce's Disease Research and Emergency Response Task Force. April 2000.

The Glassy-winged Sharpshooter

The glassy-winged sharpshooter (GWSS) was first reported in California in 1994 but probably arrived in the state in the late 1980s. It is native to the southeastern United States and northeastern Mexico. It feeds on the xylem fluid of a large number of plants. This sharpshooter builds up large populations on a diverse array of host plants and is an aggressive flyer, traveling greater distances than native sharpshooters.

California's first indication of the severe threat posed by this new disease and vector combination occurred in Temecula, Riverside County in August of 1999, when over 300 acres of grapevines infested with the glassy-winged sharpshooter were destroyed by Pierce's disease. Losses continued to mount in Temecula and other infested areas in following years, eventually exceeding 1,100 acres statewide by 2002.

Scientists believe that the glassy-winged sharpshooter has the potential to increase both the incidence and severity of Pierce's disease in California. As observed in the Temecula infestation, the sharpshooter:

- Builds to high populations that substantially increase the number of insects vectoring the destructive *Xylella fastidiosa* bacteria to crops;
- Travels longer distances in a shorter time than other sharpshooters;
- Makes use of more breeding habitats and plant hosts than native vectors; and
- Transmits the bacteria from vine to vine, resulting in an exponential increase in disease incidence in vineyards.

The combination of Pierce's disease and the glassy-winged sharpshooter constitutes an unprecedented threat to California's multi-billion dollar grape and wine industry, as well as to almonds, oleander, and other crop and ornamental plants.

An egg mass, nymph and adult life stage of the glassy-winged sharpshooter.

Program Description

The Pierce's Disease Control Program works to minimize the statewide impact of Pierce's disease and the glassy-winged sharpshooter. The strategy is to slow or stop the spread of the glassy-winged sharpshooter while short- and long-term solutions to Pierce's disease are developed. This strategy relies upon the following five elements:

1. **Contain the Spread**

   Prevent the spread of the GWSS to new areas of the state by regulating shipments of host plants and other host material.

2. **Statewide Survey and Detection**

   Find and monitor GWSS infestations and populations through trapping and visual survey.

3. **Rapid Response**

   Respond quickly to detections of GWSS in new areas by intensively surveying the area and applying treatments if necessary.

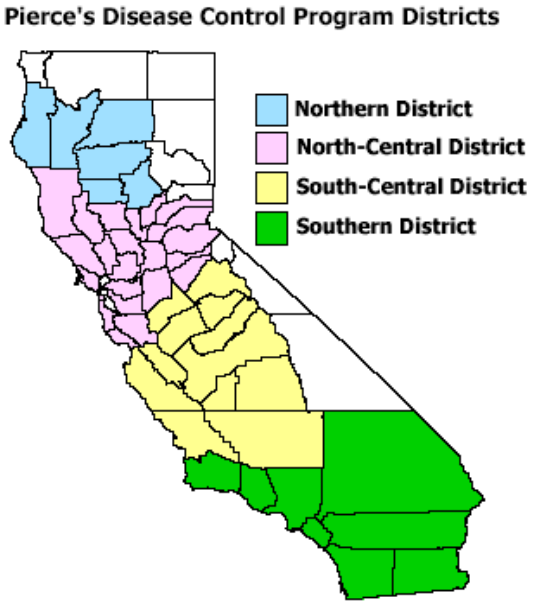
4. **Outreach**

   Raise awareness about Pierce's disease and its vectors while responding to the concerns of growers and the general public.

5. **Research**

   Develop solutions to Pierce's disease and its vectors.

Organization



The PDCP is a partnership that includes the California Department of Food and Agriculture (CDFA), county agricultural commissioners, the United States Department of Agriculture (USDA), the University of California and the California State Universities, other state and local agencies, industry, and agricultural organizations throughout the state.

A Statewide Coordinator directs the program in accordance with the policies and priorities established by the Secretary of CDFA. Program staff are located throughout the state and are responsible for coordinating and implementing the elements of the program, as well as communicating with program stakeholders. This includes working closely with the county agricultural commissioners to ensure that program activities are conducted in accordance with all statutory and regulatory requirements. Scientists at CDFA's Plant Pest Diagnostics Center provide pest identification

services. Biological control agents are produced in CDFA laboratory facilities in Riverside and Arvin. Researchers throughout the state and elsewhere are under contract with CDFA, UC, USDA, and other funding organizations. Local task forces help develop action plans, mobilize local resources, and share information with stakeholders and affected parties.

County Workplans

The agricultural commissioner of each county is responsible for conducting local PDCP activities. These activities are guided by workplans developed by the county agricultural commissioners and submitted to CDFA for approval. As stated in the law (California Food and Agricultural Code Section 6046), county workplans must include the following elements:

1. Outreach presentations and training in local communities that respond to local concerns;
2. Ongoing training of employees in the biology, survey, and treatment of Pierce's disease and its vectors;
3. Identification of a local coordinator;
4. Proposed response to the discovery of the disease and its vectors (including delimitation and treatment); and
5. A system to track and report new infestations.

Program activities are conducted year-round. County agricultural commissioners submit activity reports electronically to CDFA each month. Audits are conducted on one or more counties each year to verify the accuracy and appropriateness of charges and expenditures.

Advisory Groups

Several groups advise the PDCP. These include the following:

Pierce's Disease and Glassy-winged Sharpshooter Board

The PD/GWSS Board is composed of representatives from the winegrape industry. It provides recommendations to the Secretary on the use of funds collected under the PD/GWSS winegrape assessment, a statewide value-based assessment which has raised approximately $34 million over the last eight years. The Board is advised by subcommittees established to focus on specific areas and issues.

Pierce's Disease Advisory Task Force

The Pierce's Disease Advisory Task Force is composed of county agricultural commissioners, scientists, agricultural representatives, and other experts. The Task Force meets regularly to review program progress and develop recommendations for the Secretary. Similar to the PD/GWSS Board, the Task Force is advised by subcommittees established to focus on specific areas and issues.

Pierce's Disease / Glassy-winged Sharpshooter Science Advisory Panel

The PD/GWSS Science Advisory Panel is composed of university scientists who are experts on Pierce's disease and its vectors. The Panel provides input and expertise on scientific issues associated with the program.

Pierce's Disease Research Scientific Advisory Panel

The Pierce's Disease Research Scientific Advisory Panel is composed of university scientists with expertise in research areas directly applicable to Pierce's disease and its vectors. It provides input and expertise on the research effort.

Pierce's Disease Research Symposium Planning Group

The Pierce's Disease Research Symposium Planning Group is composed of representatives from the USDA, UC, CDFA, and industry. This group assists the PDCP with the planning of the annual research symposium by providing input on the symposium's format, content, and schedule.

California Agricultural Commissioners and Sealers Association / Glassy-winged Sharpshooter Advisory Group

The California Agricultural Commissioners and Sealers Association (CACASA) / Glassy-winged Sharpshooter Advisory Group is composed of agricultural commissioner representatives from each of the five CACASA area groups in the state. This group meets regularly to discuss issues of statewide and regional concern and to promote statewide program consistency and good communication among state and county cooperators.

Contain the Spread

The Contain the Spread element of the program is designed to prevent the spread of the glassy-winged sharpshooter to uninfested areas of the state on articles and commodities shipped from infested areas. Emergency regulations governing the movement of nursery stock and bulk grapes were first adopted in July 2000. Regulations on bulk citrus were added later, following finds of live sharpshooters in bulk citrus shipments. Permanent program regulations were adopted in July 2003.

Nursery

Nursery stock is a high-risk commodity for spreading the glassy-winged sharpshooter. Approximately 70% of California's 12,000 licensed nurseries are located in sharpshooter-infested counties. Many of these nurseries ship to the uninfested areas of the state. Activities to mitigate the risk of moving GWSS on nursery stock include:

1. Inspection of nursery stock in infested areas prior to shipping to non-infested areas;
2. Treatment of nursery stock when necessary;
3. Certification of shipments; and
4. Inspection of nursery stock at receiving nurseries prior to sale.

Inspection Results

In 2009, there were 53,700 shipments of nursery stock from infested areas to uninfested areas. Viable life stages of GWSS were discovered on only 23 of these shipments.

Over 90% of all rejections between 2001 and 2009 have been for egg masses. The table on the right presents the results of the ongoing nursery inspection and shipment certification program.

YEAR	NUMBER OF SHIPMENTS	GWSS FOUND	% FREE OF GWSS
2001	57,600	149	99.74%
2002	65,800	77	99.88%
2003	65,000	40	99.94%
2004	76,700	64	99.92%
2005	72,600	84	99.88%
2006	69,000	47	99.93%
2007	73,100	46	99.94%
2008	62,600	37	99.94%
2009	53,700	23	99.96%

Regulated nursery shipment results.

Enforcement Actions

Enforcement actions are taken against nurseries and shipments that are in violation of the regulations. Actions can be taken at origin or destination.

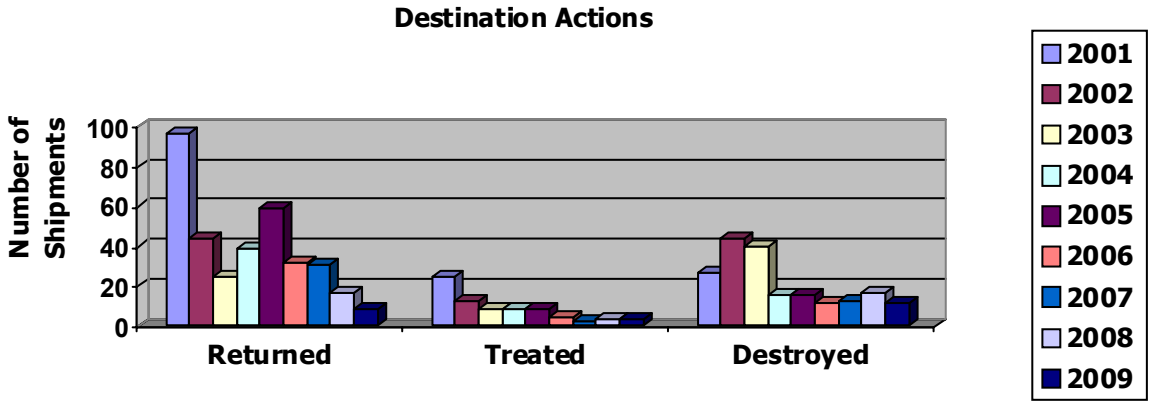
Actions that can be taken at origin consist of the following:

- ***Restriction:*** The nursery is restricted from shipping certain species of host material out of the infested area for a period of time.
- ***Suspension:*** The nursery is suspended from shipping all host material out of the infested area until the pest risk is mitigated.
- ***Revocation:*** The nursery's compliance agreement is revoked and it cannot ship any host material out of the infested area for an established period of time.

Actions that can be taken at the final destination of nursery shipments include the following:

- ***Treatment:*** The nursery shipment must be treated with an effective material.
- ***Return:*** The shipment must be returned to origin.
- ***Destruction:*** The shipment must be destroyed.

Shippers and receivers who violate nursery stock regulations are subject to fines. In 2009, administrative penalties were levied against seven companies, totaling $13,000.



Nursery Stock Approved Treatment Program

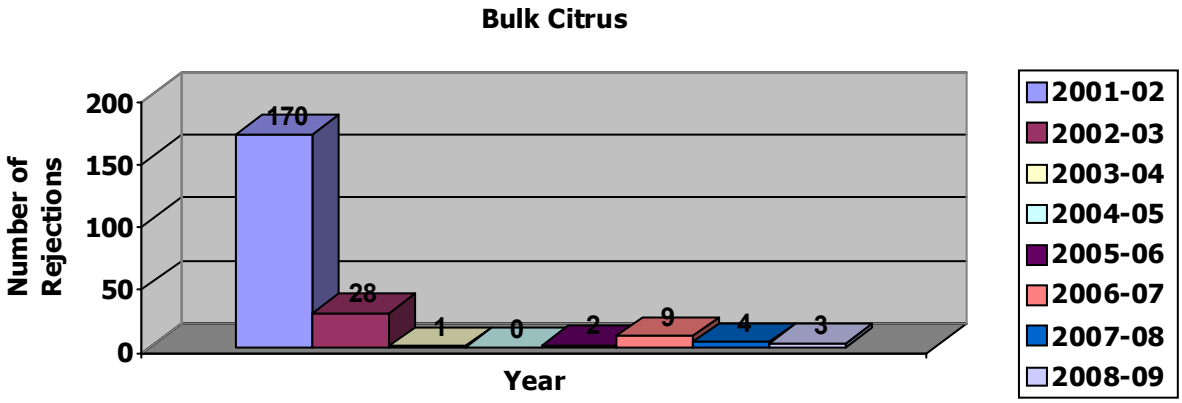
The Nursery Stock Approved Treatment Program (ATP) began in June 2008. This program was implemented following the successful three-year Nursery Treatment Pilot Program. With the ATP, qualified nurseries are allowed to ship nursery stock, treated with selected materials, to non-infested areas without an origin inspection.

Bulk Citrus

Citrus trees are primary hosts for the glassy-winged sharpshooter throughout the year. When the weather is warm, the insects are active and will flee the disturbances associated with harvest. However, once the weather turns cold, the sharpshooters are relatively inactive, and

can end up in picking bags with harvested fruit, ultimately turning up at processing facilities in other parts of the state.

During the most recent citrus-shipping season (October 2008 through September 2009), live glassy-winged sharpshooters were found in only three out of approximately 25,500 certified shipments of bulk citrus. This shipping season achieved a success rate of 99.99%. This success is attributed to the cooperative efforts of bulk citrus program participants.



The number of infested shipments has been reduced significantly over the past eight years.

Citrus harvest and inspections.

Statewide Survey and Detection

The Statewide Survey and Detection element of the program is designed to locate new glassy-winged sharpshooter infestations quickly and verify that uninfested areas remain free of infestation.

The activities of this element focus on systematically surveying and trapping commercial and residential areas and nurseries to determine if GWSS is present. The program maintains an internet map server to quickly map and display discoveries of GWSS.

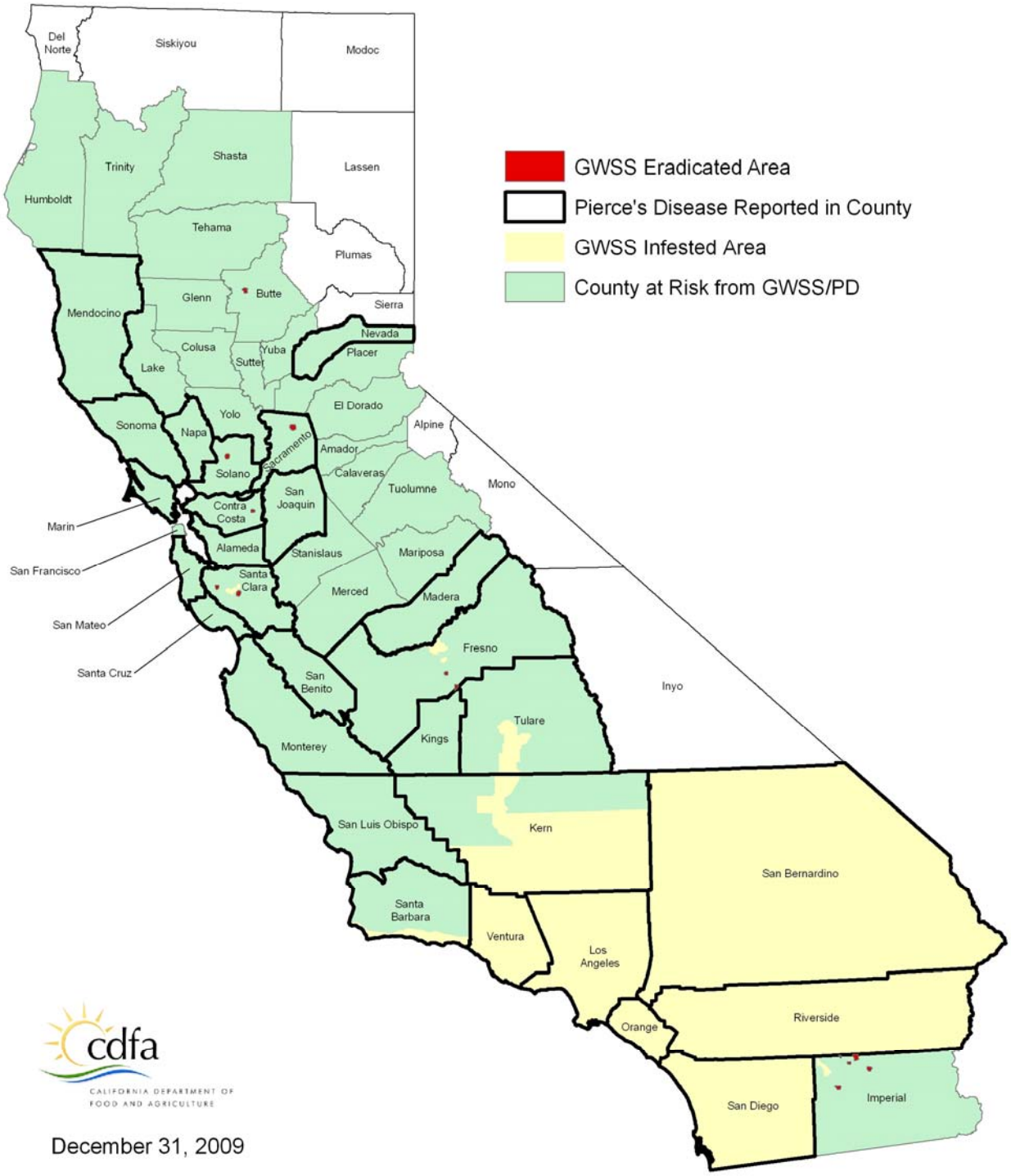
To survey for GWSS, yellow panel traps are deployed in 43 counties that are not infested or are partially infested with GWSS. The GWSS are attracted to the trap's bright yellow color and will stick to the adhesive surface. County and state personnel service traps on a regular basis during the trapping season (March through October).

Each trap is checked bi-weekly and moved to a new location every six weeks. New traps are used as needed. Survey protocols were updated and distributed to each county participant in the spring of 2009.

During 2009, program biologists provided survey and detection training to 249 employees from 43 counties. PDCP biologists assisted county personnel with field surveys and also conducted quality control (QC) inspections. These QC inspections are done to ensure that target insect recognition, trap placement, host selection, servicing schedules and record keeping are being performed at the desired levels.

A yellow panel trap in oleander.

Pierce's Disease and Glassy-winged Sharpshooter Distribution



Rapid Response

The Rapid Response element of the program involves responding quickly to new glassy-winged sharpshooter detections in partial or non-infested counties. When one or more GWSS lifestages are found in a new area, a delimitation survey is conducted by the county and state's biologists to determine if an infestation is present and, if so, to identify the boundaries. Treatments in urban and residential areas are applied under the supervision of the county agricultural commissioner and funded by the PDCP. In agricultural settings, treatments are the responsibility of the grower and must be conducted in a manner approved and supervised by the commissioner.

There were two infestations eradicated in 2009. The first one was in the Foothill Farms area of Sacramento County. After having GWSS first detected there in August 2002, this area was declared eradicated December 7, 2009. Also, this marks the first time since July 2000 that Sacramento County has been free of GWSS. The second eradicated infestation was the Blossom Hill area of San Jose, Santa Clara County. This was the first area in Santa Clara County where GWSS was detected back in 2001. This area was declared eradicated on December 21, 2009.

In 2009, GWSS were found on approximately 2,340 residential properties in the partially-infested counties of Fresno, Santa Clara, and Tulare. Approximately 4,450 properties (infested plus adjacent properties) were treated during rapid response activities.

Conducting visual surveys is part of rapid response activities following GWSS detection.

Pre-Treatment Communication with Stakeholders

Specific steps are taken before an infested area is treated to ensure residents are properly advised and environmental concerns are addressed. A public meeting with community members precedes treatment in urban and residential areas. This provides residents the opportunity to learn and discuss the treatment process with program and environmental health specialists. Door-to-door contacts, direct mail, and/or local media sources are used to inform residents of public meetings. Occupants of all properties scheduled for treatment are provided individual, advanced notification of the treatment date and time, the label of the pesticide to be used, and a phone number to call for more information. A database of threatened and endangered species is consulted to determine if any listed species are present in the treatment area. The U.S. Fish and Wildlife Service, the California Department of Fish and Game, the California Department of Pesticide Regulation, the California Department of Health Services, and other agencies are notified prior to treatment.

Treatment

Public safety is the Department's number one concern whenever pesticide treatments are applied. Program staff and cooperators ensure that only registered materials are applied, in strict compliance with label and other restrictions.

Imidacloprid has proven very effective against GWSS. It is used in treatment programs in urban and residential settings and can be used in both foliar and soil injection applications. Cyfluthrin is another material that has been used. The insecticide carbaryl has been used in residential settings and recent data shows that it is very effective against adults and nymphs emerging from an egg mass on a broad variety of ornamental plants and fruit trees.

The Environmental Monitoring Branch of the California Department of Pesticide Regulation has monitored pesticide treatments to determine resulting residue levels. This information is used by the PDCP to assess application rates and coverage. Sampling results and related monitoring reports are available on the Department of Pesticide Regulation's web site at http://www.cdpr.ca.gov/docs/emon/epests/gwss/.

Foliar spray of a bush in an infested area by a pest control operator.

Outreach

The goal of the outreach effort is to raise awareness about Pierce's disease, the glassy-winged sharpshooter, and the threat they pose to agriculture and the environment of California. Public awareness leads to public involvement, which in turn leads to earlier detection of infestations and reduced damage from this serious pest and disease complex.

PD/GWSS Board Outreach

In 2004, the PD/GWSS Board initiated a communication effort to keep winegrape growers informed about activities that are funded with the winegrape grower assessment. These efforts continued through 2009.

As part of this campaign, a new brochure entitled *Pierce's Disease – A Decade of Progress* was developed to highlight the progress that has been made since Pierce's disease devastated the Temecula wine region in 1999. Copies of the brochure were sent to every winegrape grower in California, posted on web sites and handed out at industry events. Presentations that expanded on the brochure were given to wine industry groups throughout California. A tabletop display for trade shows was also updated to complement the brochure.

The monthly e-newsletter, with current information about PD and GWSS, continues to be sent out to a long list of interested parties. Information from the e-newsletter is often reprinted in many of the wine trade publications, and it has proven useful for getting program information out in a timely manner to all stakeholders. In addition to the monthly e-newsletter, a quarterly newsletter is produced and mailed directly to California's 7,000+ winegrape growers. The program also actively maintains a presence at key industry events with a tabletop display and a brochure featuring research and control program progress.

The following materials were prepared or updated in 2009:

- Newsletters (1 each quarter)
- Web site message board
- Tabletop display/exhibit
- *Pierce's Disease – A Decade of Progress* Brochure
- Monthly e-newsletter
- Speaking points
- Presentation kit containing fact sheets, frequently asked questions, background information, list of resources and informational sheets

Local County Outreach

This year, local county agricultural staff and industry members played key roles in maintaining program visibility and stakeholder awareness. County public outreach and education efforts included the distribution of PD and GWSS informational material to local retail, production and shipping nurseries, landscape companies, and members of the community. Industry trade publications, cooperative extension newsletters and media interviews also proved to be successful methods of outreach. Many counties participated in continuing education seminars and conducted training for landscapers, pest control operators, nursery employees, and nursery association members.

Research Symposium

The annual Pierce's Disease Research Symposium provided a venue for researchers and growers to interact and share information.

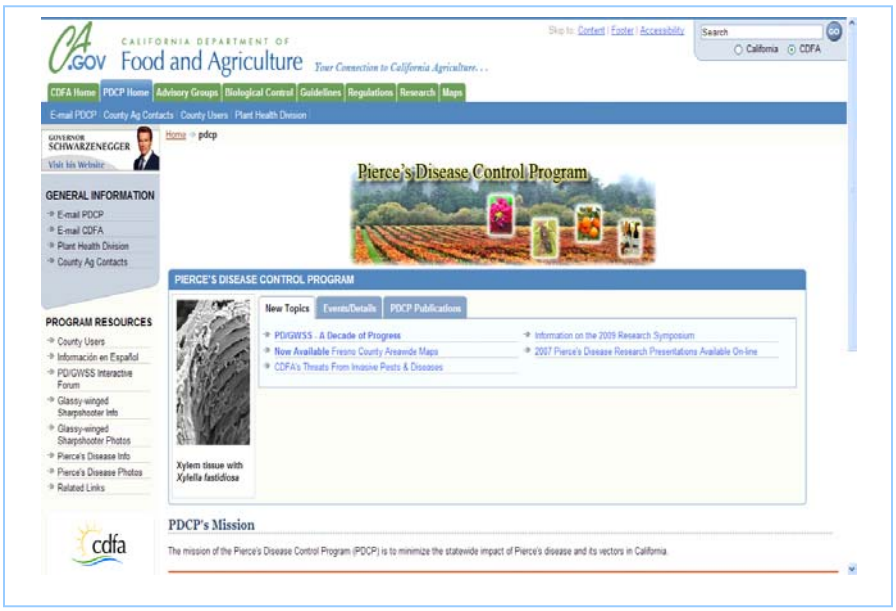
Researchers and others viewing scientific posters at the 2009 Pierce's Disease Research Symposium.

Media Coverage

In 2009, articles and reports about Pierce's disease and the glassy-winged sharpshooter continued to appear in publications, on television, radio shows, and Internet web sites. The coverage has included many statements and information generated by the PD/GWSS Board Outreach and Education Program.

Web Site

The CDFA has a highly successful web site focused on Pierce's disease and the glassy-winged sharpshooter. The web site, which was activated in March 2000, includes program activities, survey guidelines, regulatory guidelines, announcements of upcoming meetings and events, the GWSS host list, and other information. In addition, the web site provides an interactive interface that allows direct activity reporting by local entities. This web site is located on the Internet at: www.cdfa.ca.gov/pdcp.



A snapshot from the Pierce's Disease Control Program's web site.

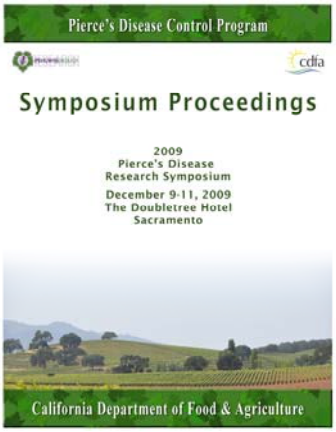
Research

Research continues to be an integral part of the Pierce's Disease Control Program. In 2009, the flurry of research activity that began at the start of the program continued with approximately 45 projects being worked on by some of the nation's top plant health researchers. Projects ranged from lab-based investigations at the molecular and genomic levels to area-wide projects in major agricultural areas. The information generated provided valuable insight into the biology, ecology, and behavior of Pierce's disease and its vectors.

The extensive and sustained research effort on Pierce's disease has yielded discoveries and approaches that show good potential for leading to solutions to this serious disease problem. These include using conventional plant-breeding methods to develop disease-resistant grapevines; using nonvirulent strains of *Xylella fastidiosa* to displace and outcompete pathogenic strains; identifying the mechanisms and processes leading to bacterial infection and spread; and elucidating the biochemical pathways which result in disease symptoms and death. Scientists have developed plant metabolites that block damage-causing pathways and processes, and are experimenting with ways to introduce them into the plants via specially-developed rootstocks, topical applications, and other means. Field testing of these new technologies is anticipated in 2010. Looking back, it is clear that solutions are getting very close relative to where we were 10 years ago.

Research Symposium

Every year the PDCP organizes a research symposium focused on Pierce's disease and its vectors. Approximately 125 people attend these meetings to share information and learn more about the progress being made against Pierce's disease. The 2009 symposium was held in mid-December in Sacramento.



A compendium of research progress reports is prepared each year and distributed at the symposium. This document, known as the Proceedings, can be accessed electronically on the program's web site (http://www.cdfa.ca.gov/pdcp/Research.html).

Research Proposal Solicitation and Review

In 2009, the PDCP coordinated its research proposal solicitation and review process with the University of California's Pierce's Disease Grant Program. A total of 27 proposals were reviewed, with CDFA managing ad hoc reviews and the University of California managing panel reviews. Based on the feedback received during this extensive vetting process, two research projects totaling $806,570 were selected for funding by CDFA using winegrape assessment funds. In addition, eight ongoing projects were approved to receive continued funding in the coming fiscal year.

Area-wide Management Programs

The area-wide management programs coordinate insecticidal treatments in commercial citrus blocks around grapes and other agricultural commodities.

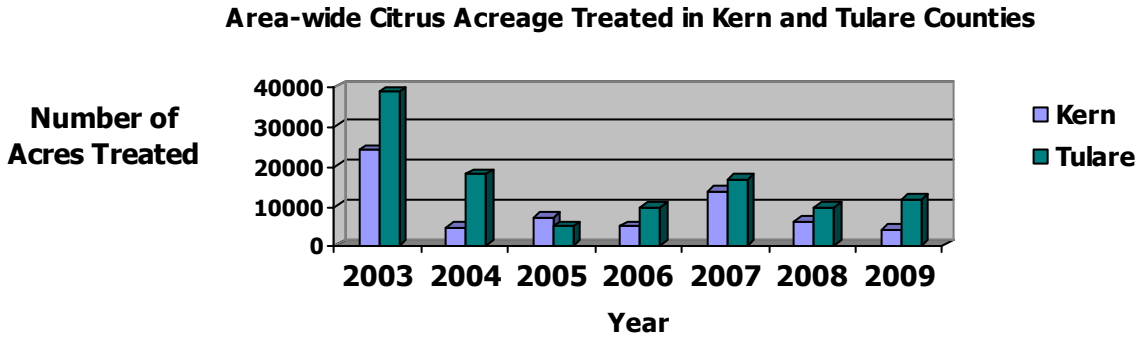
Kern County

The Kern County Area-wide Management Program has proven to be successful at dramatically reducing GWSS populations and was therefore utilized as the model for area-wide programs in Fresno, Riverside, and Tulare counties. Monitoring for GWSS and PD is occurring throughout most of these project areas.

In 2009, the boundaries of the Kern County infested area remained the same as in 2008. The infested area includes agricultural lands as well as the city of Bakersfield and several smaller Kern County communities. There were 4,182 acres of citrus treated in 2009. This is less than the 7,772 acres of citrus treated in 2008. The decrease is due to a change in strategy by changing treatment cycles. Treatments traditionally done in the fall will be applied in the spring of 2010. The change was made to increase grower coordination.

Tulare County

The infested area in Tulare County has not expanded since 2004. In 2009, the number of GWSS detected were slightly higher than in the prior year. Consequently, there were 11,528 acres of citrus treated in 2009, compared to 9,532 acres treated in 2008.



Fresno County

In the summer of 2003, Fresno County implemented area-wide trapping for GWSS in citrus groves. This year there was one GWSS find on an area-wide trap. The find was outside the urban infested areas of the county. In response, CDFA worked closely with USDA and the Fresno County Agricultural Commissioner's office to have treatments conducted around this find. About 275 acres of citrus were authorized for treatment.

Riverside County - Coachella Valley

In 2009, the GWSS management boundaries remained the same as the previous year. Traps continued to be monitored on a 1/4 mile grid system. Due to low GWSS populations, only 600 acres of citrus out of approximately 12,000 acres needed to be treated with imidacloprid (Admire Pro) to manage the GWSS.

Riverside County - Temecula Valley

High GWSS populations in Temecula during the summer and fall of 2008 required that all citrus acreage in the area be treated in 2009. A total of 921 acres of citrus were treated with imidacloprid (Admire Pro) and 72 organically grown citrus acres were treated with PyGanic and Omni Oil. Due to the low residual activity of the organic insecticides, the organic citrus was

treated three times during the season. An application of Omni Oil was applied in June, followed by PyGanic treatments in July and September.

Epidemiology Projects

Three epidemiological studies designed to control PD are in progress in California. The first is a control project for Temecula and southern California, which is entering a new phase. The second is an early-stage project (in its second year) for controlling PD in Sonoma County and the northern coastal viticulture areas. Finally, the third is a project to utilize a bio-protective strain of *Xylella fastidiosa* (*Xf*) to prevent PD.

PD Management in Southern California

Cooperative epidemiological research conducted following the severe Temecula PD epidemic of the late 1990s has led to the development of an effective PD control protocol. This protocol involves the following three steps: (1) Applying a systemic neonicotinoid insecticide such as imidacloprid in mid-May; (2) Monitoring the vineyard for diseased vines and removing them; and (3) Maintaining an area-wide GWSS management program to prevent large GWSS population outbreaks. The success of this program has led to significant new investments in vineyards, wineries and resorts, along with an increase in tourism activity in the Temecula area over the last seven years.

This year marked the beginning of a new project to quantify the benefits of the management program. These new efforts should lead to a better understanding of the costs and benefits of good PD/GWSS management, and enable growers to make more informed management decisions.

PD Management in Northern California

There is a fundamental difference between the epidemiology of PD in northern California versus southern California. Both areas have a window of vulnerability during part of the growing season. Transmissions and new infections acquired during this vulnerable window will progress to disease and eventual death of the vine. The other, non-vulnerable portions of the season are safe. The following two factors make the non-vulnerable parts of the season safe: new infections transmitted during that time are cured during the subsequent dormant winter season (the *Xf* bacteria die out), or new infections do not occur at that part of the season. The window of vulnerability in southern California is June through August, whereas the vulnerable window in northern California is the first six to 10 weeks after bud break. Systemic insecticides are the most effective management protocol in southern California since it protects the vineyards against disease transmission during that vulnerable window of time.

Last year, a new project was begun to find ways to protect the vineyards in Sonoma County by applying modified methods that were found successful in Temecula. Modification was necessary to accommodate the early window of vulnerability in the north. The challenge is to find a way to introduce the systemic chemical into the vines during the early part of the growing season to protect them during the first 10 weeks after bud break. This project is in its second season, and will continue for at least an additional two years. The early results indicate that effective control may be possible, and even likely, in northern California, but technical hurdles still require additional effort.

One of the attractive aspects of these management efforts is the use of neonicotinoid insecticides, which have very low toxicity in people and its application process minimizes introduction to the surrounding environment. This treatment option may be highly beneficial to the industry in the next several years. Ideally a non-insecticide based control method, such as microbial bio-control or a method based on the molecular biology of the disease would be available to industry.

PD Management Using a Bio-Protective Strain of *Xylella fastidiosa*

California field trials from 2008 continue to test a promising microbial bio-control system to prevent damage from PD. Dr. Don Hopkins, a researcher at the University of Florida, discovered a benign strain of *Xf* in elderberry that can colonize grapevines without causing Pierce's disease. In Florida during field trials over the last 13 years, this strain protected grapevines from the virulent strains of *Xf*, thus preventing the development of PD.

The field trials in California are being conducted by a team comprised of Don Hopkins, UC researchers, CDFA, and industry cooperators, and are located in both Temecula and Sonoma County. The test plots are located in commercial vineyards where losses from PD are high. This year (2009) was the second year of a planned four year project. The team is still excited by the potential for success in California, and is looking forward to the results from the next two years.

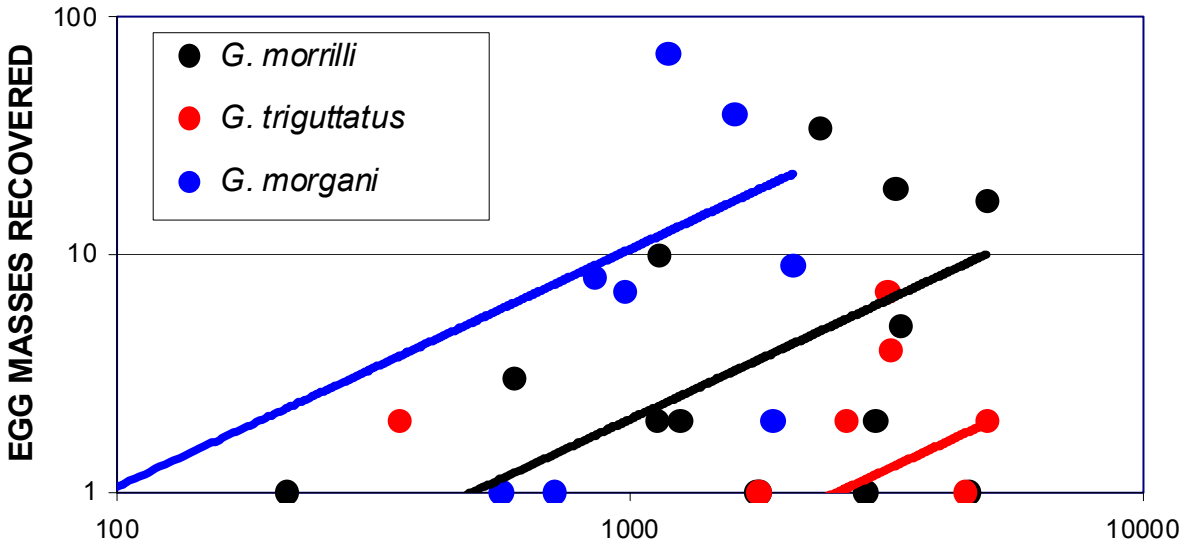
Biological Control

The GWSS biological control group has been producing, releasing, and evaluating natural enemies for the control of GWSS since 2001. The biological control agents selected are minute (1/16") wasps that parasitize eggs of the pest, thereby killing them. These wasps have three main attributes that favor them as biological control agents: (1) a short life cycle that allows for a rapid population increase compared to the pest; (2) a very narrow host range so non-target insects are unaffected; and (3) they are able to locate their hosts from a distance so that it is not necessary to release the agents at the exact location where the pest is present.

Over 1.9 million biological control agents have been released in 13 counties to control GWSS, mostly in the agricultural counties of Kern, Fresno, Tulare, Ventura, and Riverside. Currently, there are 60 active sites spread throughout southern California that are visited on a regular basis to release and evaluate agents. The efficacy of a particular species as a biological control agent is evaluated by collecting GWSS eggs at the release sites. The eggs are incubated to calculate parasitism rates and the natural enemy responsible for the parasitism.

Of the seven species of agents evaluated by CDFA, four are currently in production. Three species were discontinued due to poor recovery rates that indicated poor survivorship in California's climate. Of the remaining four species, two species (*Gonatocerus ashmeadi* and *G. morgani*) are native to California. The other two species (*G. triguttatus* and *G. morrilli)* were introduced from the southeastern United States, which is the native range of GWSS.

Gonatocerus morgani **female.**



Recovery rates for introduced biological control agents in California, 2009. Each point represents one release site.

The most recently released species, *G. morgani*, is now the most important parasitoid in production, and is responsible for 11% of all parasitism at release sites. The relative importance of parasitoids changes seasonally and spatially. The location of the release site also has an impact on the species of agent recovered; *G. morrilli* has a better chance of survival in coastal counties where the climate is cooler, as shown in the table below.

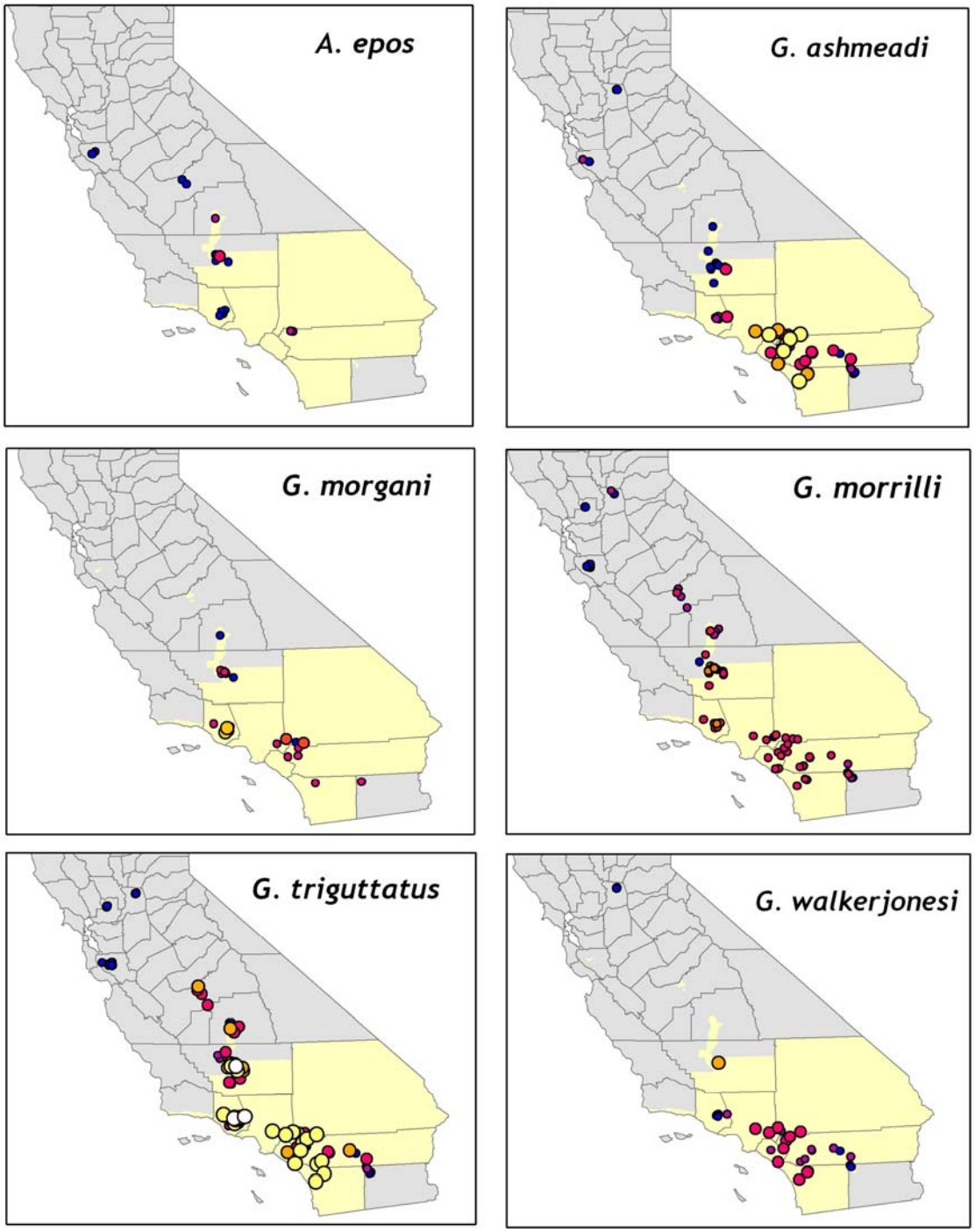
	Active Sites	Number of Sites with Recoveries			Number of Parasitoids Released		
		G. morrilli	*G. triguttatus*	*G. morgani*	*G. morrilli*	*G. triguttatus*	*G. morgani*
Los Angeles	2	0	1	0	17,922	20,083	3,228
San Bernardino	5	0	0	1	3,037	436	1,564
San Diego	4	1	1	0	2,690	94	225
Fresno	8	0	0	0	5,848	7,362	410
Imperial	6	1	0	0	1,149	100	441
Kern	11	4	2	2	17,922	20,083	3,228
Orange	3	0	0	2	1,426	349	0
Riverside	12	1	1	1	9,929	683	831
Tulare	7	0	0	0	5,233	7,344	478
Ventura	7	6	4	5	19,037	23,829	7,371
Total	**65**	**13**	**9**	**11**	**84,193**	**80,363**	**17,776**

Counties in California where recoveries of agents have occurred and number of agents released into each county.

Many species of parasitoid that attack GWSS are considered native to California and play an important role in suppressing GWSS populations throughout its current range. Native agents include *G. ashmeadi*, *G. walkerjonesi*, and *G. incomptus* and they are responsible for 77% of egg mortality at monitored field sites. Because of their importance, the biological control group produces and releases *G. ashmeadi*. A total of 14,000 have been produced and released in 2009.

Accomplishments for 2009 include increased production of biological control agents compared to the previous year and the highest number of recoveries of agents since the start of the program. *G. morgani* has now been recovered in sites where no releases have been made, indicating not only that this species can successfully establish itself in California, but that it can also effectively disperse under its own power. In 2009, research was initiated in conjunction with UC Riverside and the Citrus Research Board to streamline parasitoid identification. Currently, field collected eggs have to be incubated for up to one month before parasitoids emerge and can be identified. A multiplex molecular technique is being developed to identify parasitoid DNA in the sharpshooter egg, negating the need for incubation.

Biological Control Release Sites



Total # agents released for biological control of GWSS in California 2001-2009

A = Anagrus ***G = Gonatocerus***

Environmental Compliance

In 2009, the California Department of Food and Agriculture continued its efforts to ensure that the Pierce's Disease Control Program is conducted in an environmentally responsible manner. These efforts include adhering to a special notification and consultation process with federal and state environmental stewardship agencies prior to treatment, ensuring that pesticide applications are performed by licensed pest control professionals in strict accordance with pesticide laws and regulations, and conducting environmental monitoring during selected pesticide treatments.

A statewide programmatic environmental impact report (EIR) was released for the PDCP in mid-2003. A legal challenge was filed against the EIR shortly thereafter. Although a trial court found the EIR to be adequate, the State Appeals Court later reversed the trial court's ruling. In 2009, the CDFA solicited bids from environmental consulting firms for preparing the environmental analyses, documents, and risk assessments called for by the Appeals Court. Efforts on this project will continue in 2010.

Financial Statement

FISCAL YEAR	2008-09	2009-10
REVENUE		
State (Budget Act)	$ 4,088,825	$ 3,904,055
Federal (USDA)	$ 15,030,000	$ 14,300,000
Total Revenue	$ 19,118,825	$ 18,204,055
EXPENDITURES		
Personal Services	$ 3,675,573	$ 3,300,250
Operating Expenses	$ 2,569,314	$ 1,073,805
County Payments	$ 12,873,938	$ 13,830,000
Total Expenditures	$ 19,118,825	$ 18,204,055

Abbreviations and Acronyms

CACASA	California Agricultural Commissioners and Sealers Association
CDFA	California Department of Food & Agriculture
EIR	Environmental Impact Report
GWSS	Glassy-winged sharpshooter
PD	Pierce's disease
PD/GWSS Board	Pierce's Disease & Glassy-winged Sharpshooter Board
PDCP	Pierce's Disease Control Program
UC	University of California
USDA	United States Department of Agriculture
Xf	*Xylella fastidiosa*