



2016

ANNUAL REPORT TO THE LEGISLATURE

Pierce's Disease Control Program



CALIFORNIA DEPARTMENT OF
FOOD & AGRICULTURE

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STATEMENT OF THE SECRETARY

The Pierce’s Disease Control Program is a durable and proven program, and we should all be proud of our roles in it.

This past year, California grape growers celebrated the eradication of a pest. No, it wasn’t the glassy-winged sharpshooter (GWSS) – but it was a significant threat to vineyards: the European grapevine moth (EGVM). As I stood at a podium and looked out at the Napa Valley to commemorate that success, I couldn’t help but reflect on the simple fact that almost every person gathered at that celebration has also played a role in our Pierce’s Disease Control Program (PDCP) over the past 16 years.

The cooperative partnership we’ve created through this spans the growers and wineries on the PD/GWSS Board, vineyard managers, dedicated folks at CDFA and USDA, county agricultural commissioners and staff, our university systems and researchers, and so many of our colleagues in the nursery and citrus industries. It’s a durable and proven program, and we should all be proud of our roles in it.

Some pests, like EGVM, can be eradicated when you detect them early enough, employ a scientifically sound response, and maintain a united, cooperative approach. But California agriculture’s recent history is proof that other pests – particularly those that spread disease, like GWSS and the Asian citrus psyllid – are considerably more complex and are going to remain on our radar for the foreseeable future. I look ahead with confidence, in much the same way I looked out over the partners gathered to celebrate the eradication of the EGVM last fall. I take heart in the relationships we’ve built, the mutual respect we’ve earned, and the knowledge of our shared success.

*Karen Ross, Secretary
California Department of Food and Agriculture*

EXECUTIVE SUMMARY

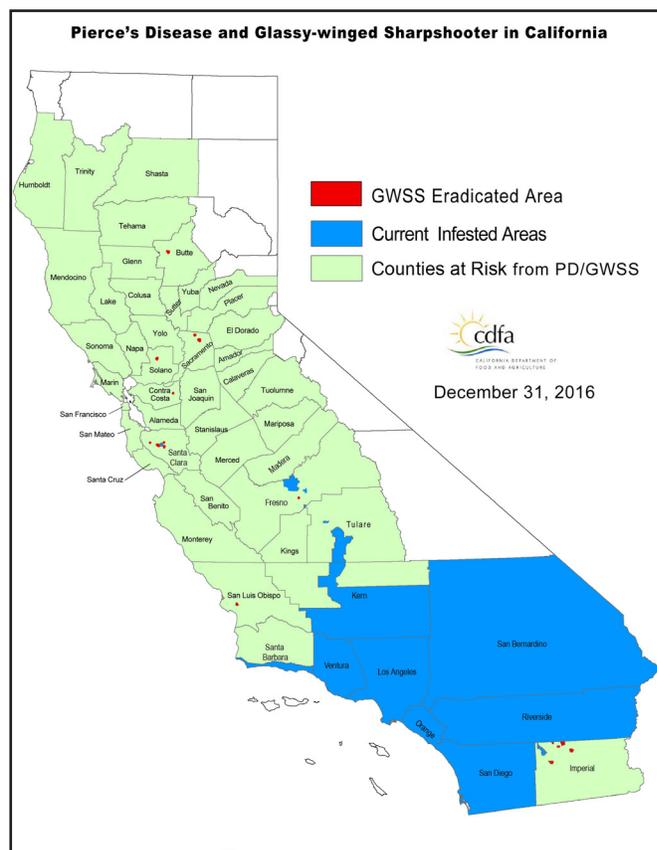
The five major components of the program (contain the spread, statewide survey and detection, rapid response, outreach, and research) have been very effective and has made the Pierce’s Disease Control Program a model for subsequent pest prevention and response programs.

When the glassy-winged sharpshooter (GWSS) arrived in California it had few natural enemies; left unchecked, its populations built up rapidly. Unfortunately, this insect was found to be an aggressive vector of Pierce’s disease (PD). Before much was understood about the GWSS, acres of grapevines began dying in southern California due to the combination of PD and its new vector.

With the future of the wine and grape industry in the balance, and with the essential cooperation of that industry, the California Department of Food and Agriculture (CDFA) responded in the year 2000 to the threat of PD and GWSS with the creation of the Pierce’s Disease Control Program (PDCP). The five major components of the program (contain the spread, statewide survey and detection, rapid response, outreach, and research) have been very effective and has made the PDCP a model for subsequent pest prevention and response programs. The PDCP also developed a biological control program that rears and releases tens of thousands of natural enemies each year that help reduce glassy-winged sharpshooter populations.

Area-wide treatment programs in vast agricultural sectors of the Southern San Joaquin Valley work to keep GWSS populations in check. These area wide campaigns are conducted with the County Agricultural Commissioners’ alongside the assistance of treatment coordinators.

California has experienced greater incidence of PD and increased populations of the GWSS in some areas during the past year. Researchers are investigating several causal theories including



climate change, insecticide resistance, and new vectors. Warmer winters have led to an increase in the number of GWSS generations in Southern California and the San Joaquin Valley. In Northern California the warmer winters may also be the reason for increased PD infections

The PDCP relies upon federal assistance and wine grape assessments that fund operations and research. The Pierce’s Disease and Glassy-winged Sharpshooter Board advises on the use of assessment funds and has been instrumental in funding scientific research to develop lasting solutions to PD and its vectors. The PDCP also relies upon the network of state, federal, and county agencies along with private entities and stakeholders that together have built a viable and successful program.

BACKGROUND

Pierce’s disease threatens a grape crop production value of \$5.24 billion and associated economic activity within California of approximately \$57.6 billion.

Pierce’s disease (PD) is a fatal bacterial disease of grapevines that is spread by certain types of insects, such as leafhoppers. It has been present in California for more than 100 years and in the past has caused sizable losses to viticulture in localized “hotspot” areas of the state.

Until recently, it did not pose a severe threat to the majority of areas currently under grape production. This situation changed dramatically with the arrival of the glassy-winged sharpshooter (GWSS), an aggressive insect vector of Pierce’s disease. Because of this insect, 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 \$5.24 billion and associated economic activity within California of approximately \$57.6 billion. Other crop and ornamental plant resources such as almonds (\$5.89 billion) and susceptible types of citrus (\$942 million), stone fruits (\$904 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 PDCP was established within the CDFA to minimize the statewide impact of PD.



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* that kills grapevines by 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. 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.[†] There is currently no known cure for PD.

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



The Glassy-winged Sharpshooter

The 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 a strong flyer, traveling greater distances than native sharpshooters.

The combination of PD and the GWSS 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.

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 GWSS were destroyed by PD. Losses continued to mount in Temecula and other infested areas in following years, eventually exceeding 1,100 acres statewide by 2002.

The GWSS clearly has the potential to increase both the incidence and severity of PD in California. As observed in the Temecula infestation, the sharpshooter:

- Builds to large 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 host plants than native vectors; and
- Transmits the bacterium from vine to vine, resulting in an exponential increase in disease incidence in vineyards.



Abbreviations and Acronyms

ATP	Approved Treatment Program
CACASA	California Agricultural Commissioners and Sealers Association
CDFA	California Department of Food & Agriculture
EGVM	European grapevine moth
GWSS	Glassy-winged sharpshooter
PD	Pierce’s disease
PD/GWSS Board	Pierce’s Disease and Glassy-winged Sharpshooter Board
PDCP	Pierce’s Disease Control Program
UC	University of California
USDA	United States Department of Agriculture

PROGRAM DESCRIPTION

PDCP's strategy is to slow or stop the spread of the GWSS while short- and long-term solutions to PD are developed.

ORGANIZATION

The Pierce's Disease Control Program (PDCP) works to minimize the impact of Pierce's disease (PD) in California. The PDCP is a partnership that includes the California Department of Food and Agriculture (CDFA), the County Agricultural Commissioners, the United States Department of Agriculture (USDA), the University of California (UC), 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 the CDFA. Program staff are located throughout the state and are responsible for coordinating and implementing the elements of the program. 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 the CDFA laboratory facility in Arvin. Researchers throughout the state and elsewhere conduct research geared towards finding solutions to PD.

COUNTY WORKPLANS

The County Agricultural Commissioners are responsible for conducting local Pierce's Disease Control Program 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 PD and its vectors;

PDCP STRATEGY



Contain the Spread



Statewide Survey and Detection



Rapid Response



Outreach



Research

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 the 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, including:

Pierce’s Disease and Glassy-winged Sharpshooter Board

The Pierce’s Disease and Glassy-winged Sharpshooter (PD/GWSS) Board is composed of 14 representatives from the winegrape industry, plus one member representing the public. It provides recommendations to the Secretary of CDFA on the use of funds collected under the PD/GWSS winegrape assessment, a statewide value-based assessment which has raised approximately \$53 million over the last 15 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 reviews program progress and develops 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 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 CONTROL PROGRAM DISTRICTS



Pierce’s Disease Research Symposium Planning Group

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

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

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



CONTAIN THE SPREAD

Preventing the spread of the glassy-winged sharpshooter (GWSS) 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 GWSS. Approximately 60% of California's 12,000 licensed nurseries are located in sharpshooter-infested counties. Many of these nurseries ship to the non-infested areas of the state. Activities to mitigate the risk of moving the 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;
4. Inspection of nursery stock at receiving nurseries prior to sale; and
5. Trapping in and near nurseries shipping to non-infested areas.

INSPECTION RESULTS

In 2016, there were 36,000 shipments of nursery stock from infested areas to non-infested areas. Viable life stages of GWSS were discovered in only nine of these shipments. Origin county inspectors stopped 165 egg masses, two nymphs, and eight adults from moving in nursery stock shipments.

Over 90% of all rejections between 2001 and 2016 have been for viable GWSS egg masses. Table 1 on the next page presents the results of the ongoing nursery inspection and shipment certification program.

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 the origin of nursery shipments 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 destination of nursery shipments consist of 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.

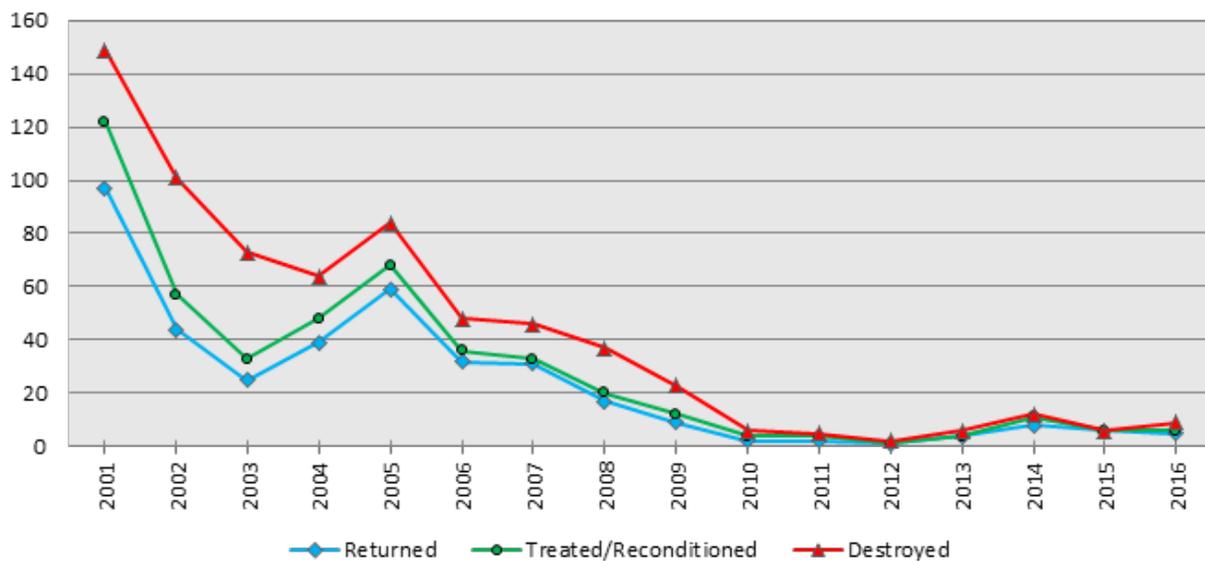
Shippers and receivers who violate nursery stock regulations are subject to fines. In 2016, no administrative penalties were levied against any companies.

Regulated Nursery Shipment Results

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%
2010	50,600	6	99.99%
2011	44,500	4	99.99%
2012	44,600	2	99.99%
2013	45,800	6	99.99%
2014	44,000	12	99.97%
2015	38,000	6	99.98%
2016	36,000	9	99.97%

Table 1

Nursery Shipment Destination Actions



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 specified materials, to non-infested areas without an origin inspection. These materials are 100% efficacious at killing emerging GWSS nymphs.

In 2016 there were eight participating nurseries that shipped approximately 2.87 million plants in 10,755 shipments. There was a total of 26 yards associated with these eight nurseries. Forty-five counties received plant material from ATP nurseries throughout the year, with one nymphal emergence from a sleeved egg mass under observation in a receiving county.

Trapping is conducted in ATP nurseries to ensure pest free standards are met. Yard traps are maintained at two traps per acre in all ATP nurseries. If a trap exceeds the threshold of 10 GWSS within a two-week period, then all host plants within a 100-foot radius is placed on hold and must be treated within five days.

If a hold treatment is not conducted within five days, plants within the 100-foot radius will be held for a minimum of two weeks from the time the treatment is made.

All trapping is conducted by county or PDCP staff. Following are the results from the 2016 trapping effort:

- 26 nursery yards
- 1,370 nursery acres
- 2,937 traps deployed
- 890 traps with more than 10 GWSS

Nursery stock being shipped under this program must be treated with carbaryl or fenprothrin. All treatments are witnessed by licensed county inspectors. Additional monitoring of treatments includes quality control checks by PDCP staff using water-sensitive paper. Yellow sheets of water-sensitive paper are placed within the nursery stock shipment at various heights and locations. After treatment, the sheets are checked to see if they were hit by the pesticide.

When the pesticide droplets make contact with the paper, it turns from yellow to blue. In 2016, PDCP staff placed water-sensitive paper at each participating nursery a minimum of once a month. Out of 287 water-sensitive papers inspected only nine indicated the need for retreatment of the shipment.

Under the ATP program, county inspectors may choose to monitor GWSS egg masses found at destination on treated shipments of nursery stock. In 2016, a total of 51 egg masses from five ATP yards were monitored in insect rearing sleeves by destination counties. There was one viable emergence resulting in a regulatory action against the shipping nursery.



Water sensitive paper



Insect rearing sleeves

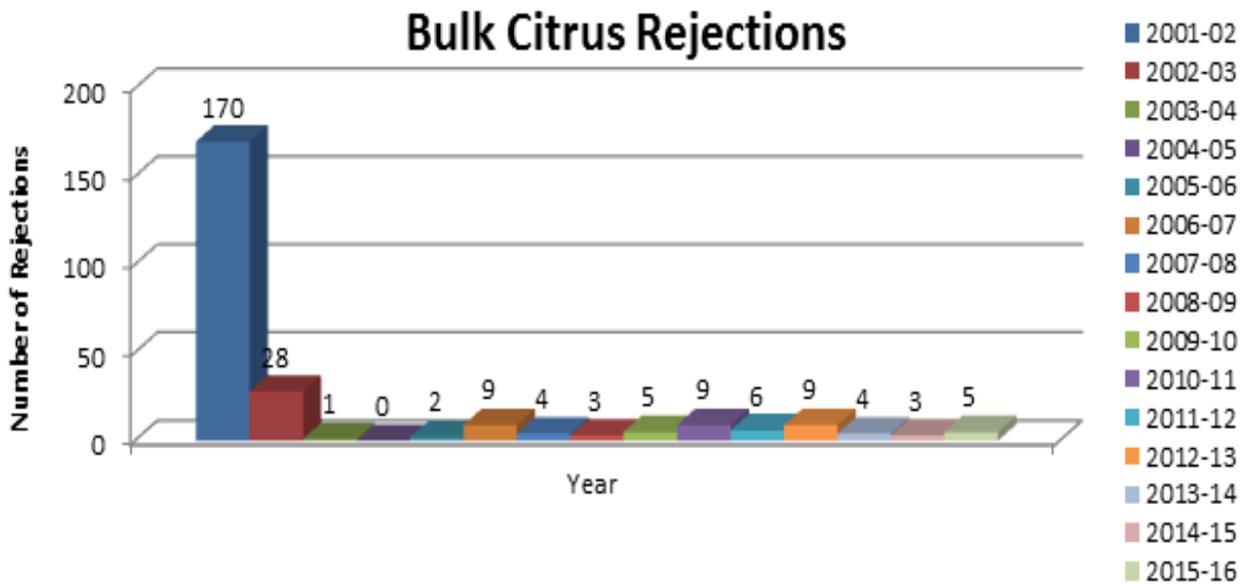


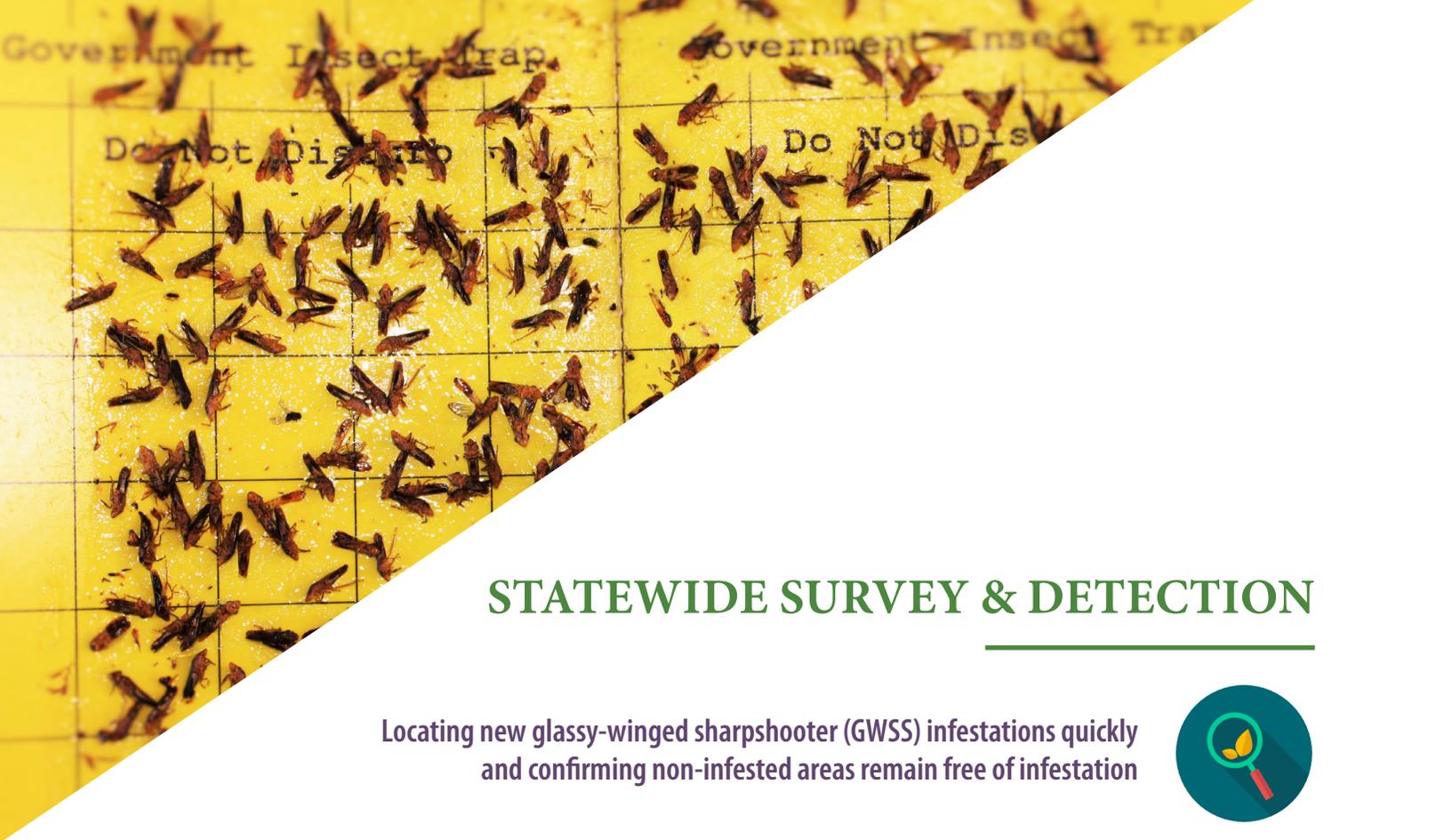
Nymphs perishing on emergence

BULK CITRUS

Citrus trees are primary hosts for the GWSS 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 2015 through September 2016), live GWSS were found in only five out of approximately 38,904 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.





STATEWIDE SURVEY & DETECTION

Locating new glassy-winged sharpshooter (GWSS) infestations quickly and confirming non-infested areas remain free of infestation



Survey and detection activities focus on systematically trapping urban and residential areas and nurseries to determine if GWSS are present. The program maintains an internet map server to quickly map and display discoveries of GWSS.

GWSS are detected by using yellow panel traps that are deployed in 43 counties that are not infested or are only partially infested with GWSS. The GWSS are attracted to the trap's bright yellow color and become stuck on the adhesive surface. County and state personnel service traps on a regular basis during the trapping season.

Each trap is checked every second or third week 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 2016.

During 2016, Program staff provided detection training to 586 employees from 45 counties, CDFA, ATP participating nurseries, and citrus packing houses. PDCP staff assisted county personnel with field surveys and also conducted quality control inspections of County trapping programs. These 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.



Survey/detection and nursery training for County personnel



RAPID RESPONSE

Responding quickly to new glassy-winged sharpshooter (GWSS) detections in partially-infested or non-infested counties



When one or more GWSS are found in a new area, a delimitation survey is conducted by County biologists, on occasion with Pierce's Disease Control Program (PDCP) assistance, 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, using winegrape assessment funds. In agricultural settings, treatments are the responsibility of the grower and must be conducted in a manner approved by the County Agricultural Commissioner.

In 2016, no new GWSS infestations were found in California. However, in areas already undergoing eradication efforts GWSS were found on approximately 650 residential properties in isolated infestations in Fresno and Tulare counties. In response, approximately 4,500 properties (infested plus adjacents) were treated.

PRE-TREATMENT COMMUNICATION WITH STAKEHOLDERS

- A public meeting or other outreach efforts for community members precedes treatment in urban and residential areas. This provides residents the opportunity to learn about 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 advance notification of the treatment date and time, information on the material 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 Wildlife, 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 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 the GWSS. It is used in treatment programs in urban and residential settings and can be used for both foliar and soil treatment applications.

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 website at <http://www.cdpr.ca.gov/docs/emon/epests/gwss/>.



Soil injection treatment of a tree in a glassy-winged sharpshooter infested area by a pest control operator

Spray treatments are applied where appropriate in residential areas but only after notification of the residents.





OUTREACH

Keeping winegrape growers and stakeholders informed about activities that are funded by the winegrape grower assessment as well as other programs funded on their behalf



The PD/GWSS Board initiated its outreach and education program in 2004 to inform winegrape growers about activities funded by the winegrape grower assessment, as well as other related activities funded by other funding sources.

COUNTY AGRICULTURAL COMMISSIONER OUTREACH ACTIVITIES

In 2016, 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. Some counties also participated in continuing education seminars and conducted training for landscapers, pest control operators, nursery employees, and nursery association members.

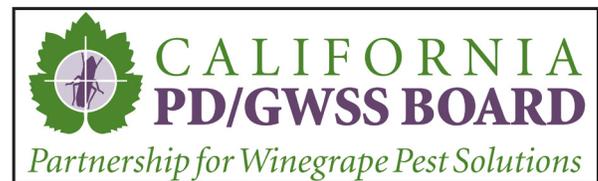
In 2016 the main objectives of the PD/GWSS Board's outreach and education program were:

- Update growers on the grapevine field trials
- Inform winegrape growers of the research milestones accomplished on their behalf
- Educate growers on newly designated pests and diseases

During the year, a monthly e-newsletter containing information about PD and GWSS as well as information about designated pest and disease threats was sent out to over 1,100 interested stakeholders, with over 600 of those being California winegrape growers. Information from the e-newsletter was often reprinted verbatim in some of the wine trade publications. In addition to the monthly e-newsletter, a quarterly newsletter was produced and mailed directly to California's 7,000+ winegrape growers, as well as other stakeholders.

The following materials were prepared or updated in 2016:

- Newsletters (quarterly)
- Website message board
- Facebook page
- LinkedIn group
- YouTube video channel
- “Solutions Are At Hand To Pierce’s Disease” brochure
- Stock photography
- Videotaped researcher interviews
- Monthly e-newsletter
- Fact sheets on newly designated pests and diseases
- Redesign of the PD/GWSS logo
- Redesign and update of the trade show display

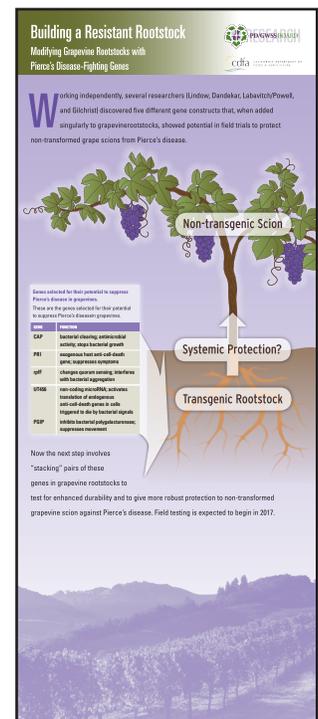


RESEARCH MILESTONES

2016 saw a number of research milestones achieved:

- The beginning of “gene stacking” using modified rootstocks to limit the spread of *Xylella fastidiosa* in winegrapes
- The release of more traditionally bred winegrapes and their rootstocks to UC Davis’ Foundation Plant Services, the first step leading to the release of the vines to winegrape growers.
- The continuation of the commercialization of two different unorthodox methods of PD prevention, one using a benign strain of *Xylella fastidiosa* and the other using a mixture of bacteriophages (viruses that attack bacteria) to control PD.

These achievements were highlighted in a new brochure titled “Solutions Are at Hand to Pierce’s Disease,” a trade show display, and videos. An infographic that explains the gene stacking approach was created and will be used in slide presentations and future articles on the subject.



OTHER DESIGNATED PESTS AND DISEASES

Besides PD and GWSS, the PD/GWSS Board has designated other pests and diseases that are a threat to California's winegrape industry. The list now includes the European grapevine moth (EGVM), which has been eradicated, brown marmorated stink bug (BMSB), all mealybugs, red blotch (GRBaV), grapevine leafroll, and fanleaf viruses. As part of the outreach and education efforts, information regarding these threats was communicated to winegrape growers around the state through brochures, a trade show display, speaking engagements, a website, and special fact sheets.

MEDIA COVERAGE

In 2016, articles and reports about PD and GWSS continued to appear in print media and on internet websites, with some television and radio coverage. The coverage mainly focused on how growers were coping with PD and the increases of PD in some regions in California.

There was also coverage on new research and the PD-resistant winegrape vines being developed and released to the Foundation Plant Services. Wide coverage of the successful eradication of the EGVM focused on the partnership between the public, industry, and government. Meanwhile the designated disease red blotch continued to receive major attention, largely because it has only recently been discovered as a threat to vineyards.

WEBSITE

In March 2000, the CDFA activated a web site focused on PD and GWSS. It has been highly successful and continues to be an effective tool for providing current and reliable information to interested parties. The website features information on program activities, survey guidelines, regulatory guidelines, announcements of upcoming meetings and events, the GWSS host list, and other information.

In addition, the website provides an interactive interface that allows direct activity reporting by local entities.

Visit the website at: www.cdfa.ca.gov/pdcp.





RESEARCH

Providing valuable insight into the biology, ecology, and behavior of Pierce's disease (PD) and its vectors



Research continues to be an integral part of the Pierce's Disease Control Program (PDCP). In 2016 the flurry of research activity that began at the start of the program continued, with approximately 35 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 field trials in major agricultural areas. Additionally, seven projects on other pests and diseases of winegrapes were in progress in 2016, increasing the knowledge base available for developing management solutions to these pests and diseases.

This extensive and sustained research effort on PD has yielded discoveries and approaches that show good potential for leading to solutions. For Pierce's disease, these include using conventional plant-breeding methods to develop disease-resistant grapevines, using non-virulent 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. Several grapevine scions and rootstocks bred for resistance to Pierce's disease using traditional methods have been field tested and provided to Foundation Plant Services at UC Davis for possible commercialization. Small lots of wine have been produced from some of these and have tested well in wine tastings. Field testing of grapevine plant material developed using transgenic approaches began in 2010 and continued through 2016.

In 2013 a Technology Facilitator was brought in to advise on developing and commercializing these promising discoveries, and in 2014 the services of a Viticulture Consultant were obtained to ensure the field trial test vineyards were properly managed. Looking back, it is clear that solutions to Pierce's disease are getting very close relative to where we were 17 years ago.

RESEARCH SYMPOSIUM

In 2016, as in most years beginning in 2001, the PDCP organized a Pierce's Disease Research Symposium to foster communication and information sharing among scientists and stakeholders on the latest research progress and findings on Pierce's disease. The 2016 Symposium was held in mid-December in San Diego. Approximately 80 people from California, other states, and other countries attended this important event to learn more about this serious disease.

For the first time, the Symposium also included presentations and posters for research projects on other winegrape pests and diseases besides Pierce's disease and its vectors. The other pests and diseases reported on were red blotch virus disease, other grapevine virus diseases, and vine mealybug, all of which have been designated as serious threats to California winegrapes by the CDFA PD/GWSS Board.

A compendium of research progress reports, known as the Proceedings, was prepared and distributed at the Symposium and can be viewed at <https://www.cdfa.ca.gov/pdcp/Research.html>. Research progress reports and other research-related information are also available at <http://www.piercesdisease.org/>.

Research Proposal Solicitation and Review

In 2016, the PDCP partnered with the Unified Grant Management for Viticulture and Enology Program at UC Davis to conduct its research proposal solicitation and review process. In addition to calling for research proposals on Pierce's disease and its vectors, the request for proposals also called for research proposals on the following other pests and diseases of winegrapes: brown marmorated stink bug, mealybug pests of grapevines, and three grapevine virus diseases.

A total of 25 proposals were received and reviewed, with 15 research projects totaling \$2.6 million selected for funding by the CDFA using winegrape assessment funds. In addition, 11 ongoing projects were approved to continue for another fiscal year.

AREA-WIDE MANAGEMENT PROGRAMS

The area-wide management programs coordinate GWSS management efforts in large, agriculturally diverse grape production areas.

Fresno County

Fresno County implemented area-wide trapping for GWSS in citrus groves in 2003. In 2011 traps were added to grapes near the existing infested area and the San Joaquin River. In 2016, there were 132 GWSS finds in citrus and grapes, compared to 107 trap finds in 2015. About 1,050 acres of citrus were treated in 2016, compared to 1,400 acres in 2015.

Kern County

In 2016, the boundaries of the Kern County infested area remained the same as in 2015. The infested area includes agricultural lands as well as the city of Bakersfield and several smaller Kern County communities. The 2016 cooperative area-wide program in Kern County incorporated an extra treatment compared to prior years. Consequently in 2016, there were about 52,800 GWSS found in area-wide traps which was significantly below the 201,060 GWSS that were found in 2015. About 31,600 acres of citrus were treated in 2016 compared to about 15,550 acres treated in 2015.

Madera County

In 2016 there were three GWSS finds, the same number found in 2015. About 950 acres of citrus were treated in 2016, compared to 80 acres in 2015.

Riverside County

In 2013, due to budgetary constraints, the area-wide management programs in Riverside County were reduced to monitoring-only activities. In 2016 no GWSS were found in the Coachella Valley. In Temecula the overall GWSS catch in 2016 was the highest observed since 2009, but was still far below the densities seen at the outset of the area-wide program.

Tulare County

The infested area in Tulare County has not expanded since 2004. In 2016, there were 11,960 GWSS found in area-wide traps, compared to 5,251 in 2015. There were about 7,000 acres of citrus treated in 2016 compared to about 6,000 in 2015.



BIOLOGICAL CONTROL

Since 2001, the Pierce's Disease Control Program (PDCP) has been implementing biological control tactics as an important component of an Integrated Pest Management (IPM) approach to controlling the glassy-winged sharpshooter (GWSS)

Biological control is a method of controlling target pests using other living organisms, such as predators, parasitoids, and pathogens. The biological control agents of GWSS used in PDCP are stingless, minute (1/16") parasitic wasps that specifically attack GWSS eggs (egg parasitoid). Female adult wasps deposit their eggs inside GWSS eggs and immature wasps develop inside the host eggs, with adult wasps eventually emerging from GWSS eggs. After mating, newly-emerged wasps search for GWSS eggs to lay their eggs. Through this repeated life-cycle, the parasitic wasps kill GWSS eggs and contribute to suppression of GWSS populations.

Since the start of the Biological Control Program, more than 2.56 million biological control agents have been released in agricultural, riparian, and urban environments in California. In 2016, three species of GWSS biological control agents (*Gonatocerus ashmeadi*, *G. morgani*, and *G. morrilli*) were reared at the CDFA Arvin Biological Control Facility in Kern County (total production of 50,458 biological control agents in 2016). Out of the three species, *G. ashmeadi* and *G. morgani* are native to California, and *G. morrilli* was introduced from the southeastern United States and Mexico, the native range of GWSS.

In 2016 a total of 38,932 GWSS biological control agents were released at 68 sites in five counties (Fresno, Kern, Madera, Tulare and Ventura). The number of field-released agents per species was 5,002 of *G. ashmeadi*, 15,036 of *G. morgani*, and 18,894 of *G. morrilli*. The field release of the biological control agents was conducted mostly over spring through fall, synchronizing with the seasonal occurrence of GWSS eggs in the field.

Biological control workers visited each field site approximately every two weeks to release biological control agents and conduct post-release surveys in order to evaluate performance of the biological control agents. Post-release surveys included sampling of GWSS eggs at field sites, incubation of GWSS eggs under laboratory conditions, and identifying of parasitic wasp species that emerged from GWSS eggs. Specimens of insects that emerge from GWSS eggs were collected and submitted to Rubidoux Biological Control Center, Riverside, CA for further investigation.

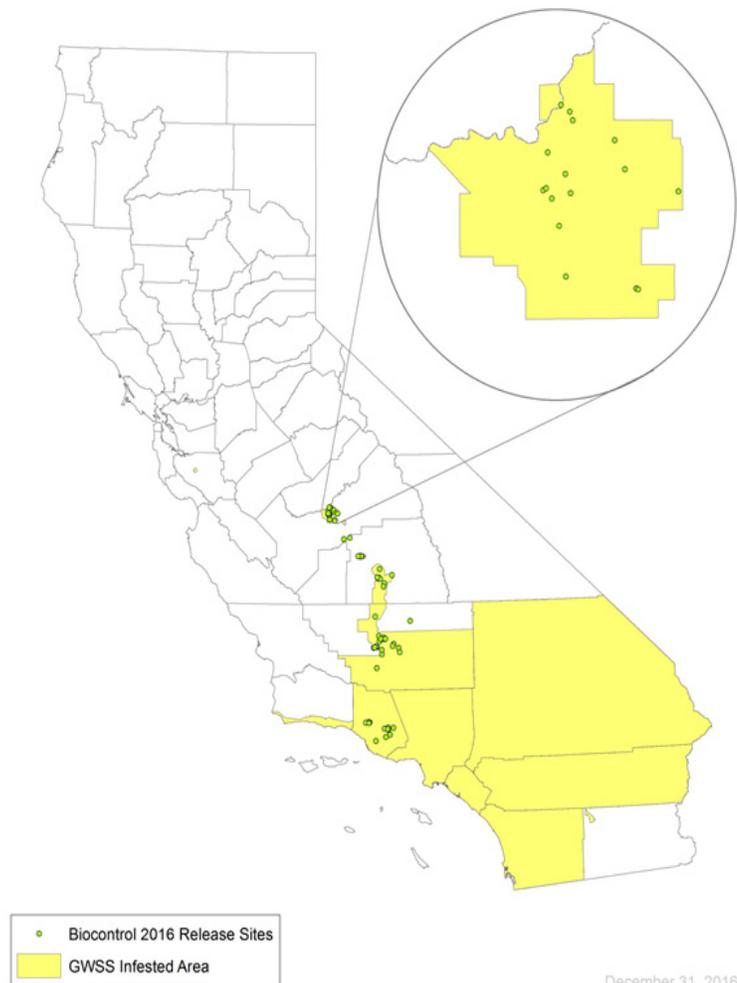
In 2016, GWSS eggs were sampled from field sites in Fresno, Kern, Tulare and Ventura counties. In December, GWSS eggs from Ventura County only resulted in emergence of parasitic wasps or GWSS

nymphs, indicating the prolonged reproductive period of GWSS adults likely due to mild winter weather in Ventura County. Both *G. ashmeadi* and *G. morgani* were recovered from all four counties, and *G. morrilli* was recovered from Fresno, Kern, and Ventura counties. As in previous years, *G. ashmeadi* was the predominant species. The number of insects emerging from GWSS eggs indicated that there were two peaks of GWSS reproductive activity (spring and summer), resulting from reproduction by different GWSS generations.

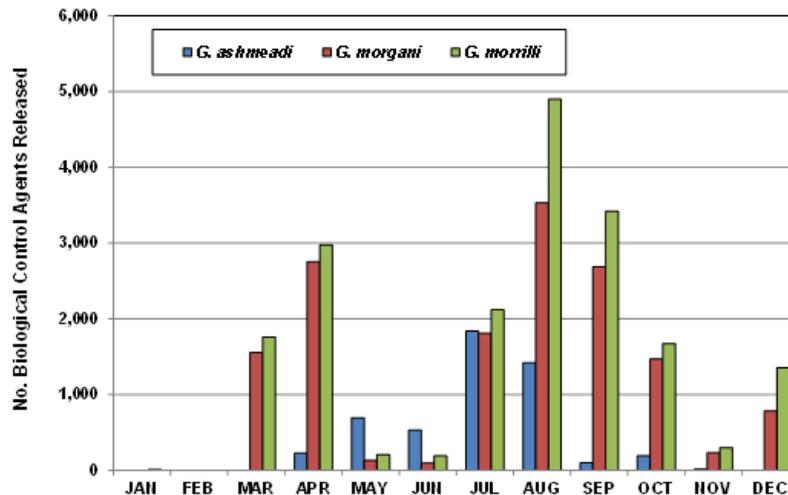
In 2016, approximately 65% of GWSS eggs were parasitized. In general, the parasitism rate was low in spring but stayed above 50% during the rest of the season.

The parasitism rates of GWSS eggs per county were estimated to be 82, 65, 74 and 51% in Fresno, Kern, Tulare and Ventura counties, respectively. Overall, the data show that the parasitic wasps contributed significantly to reducing GWSS populations. The low parasitism rates and the abundance of GWSS eggs in early spring suggest that it would be important to control overwintering GWSS adults before laying eggs by integrating other control measures.

In 2016 the Biological Control Program also provided technical assistance and GWSS specimens to scientists and collaborators from other agencies.



December 31, 2016



TOTAL NUMBER OF BIOLOGICAL CONTROL AGENTS RELEASED IN 2016

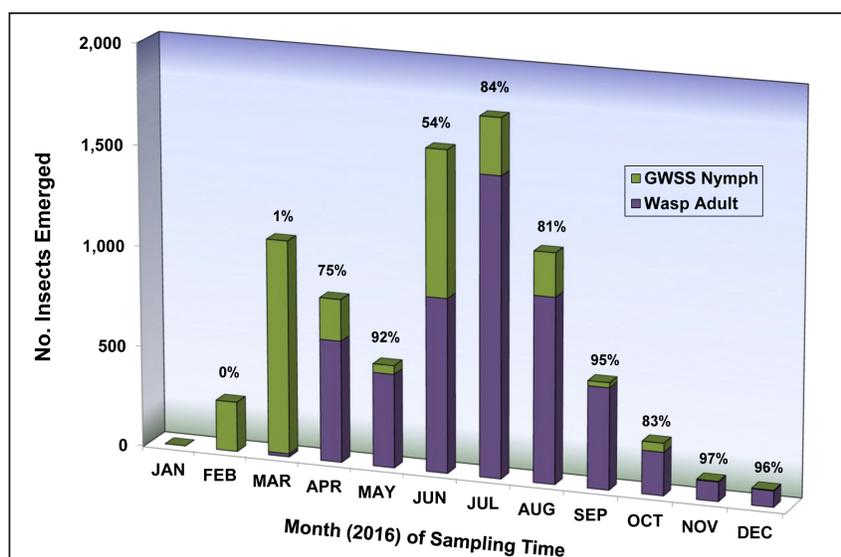
COUNTY	NO. SITES	SPECIES			TOTAL
		G. ASHMEADI	G. MORGANI	G. MORRILLI	
Fresno	16	755	2,383	3,560	6,698
Kern	20	2,111	1,639	5,226	8,976
Madera	2	3	145	267	415
Tulare	17	1,633	759	2,803	5,195
Ventura	13	500	10,110	7,038	17,648
Total (2016)	68	5,002	15,036	18,894	38,932

TOTAL NUMBER OF BIOLOGICAL CONTROL AGENTS RECOVERED IN POST-RELEASE SURVEYS IN 2016

COUNTY	NO. SITES	SPECIES			TOTAL
		G. ASHMEADI	G. MORGANI	G. MORRILLI	
Fresno	16	1,726	6	3	1,735
Kern	20	1,524	33	24	1,581
Madera	2	0	0	0	0
Tulare	17	365	17	0	382
Ventura	13	815	53	168	1,036
Total (2016)	68	4,430	109	195	4,734

NUMBER OF INSECTS THAT EMERGED FROM GWSS EGGS COLLECTED IN 2016 DURING POST-RELEASE SURVEY

Combined data - Percentage data indicate the estimated parasitism each month.





ENVIRONMENTAL COMPLIANCE

The California Department of Food and Agriculture continues to ensure the PDCP is conducted in an environmentally responsible manner

In 2016, the CDFA continued its efforts to ensure that the PDCP is conducted in an environmentally responsible manner. These efforts included adhering to a special notification and consultation process with federal and state environmental stewardship agencies prior to treatment and ensuring that pesticide applications are performed by licensed pest control professionals in strict accordance with pesticide laws and regulations. In addition, the PDCP continued posting notifications of program-related pesticide applications on a CDFA web page in compliance with a permit obtained to meet the requirements of the National Pollutant Discharge Elimination System.

A statewide programmatic environmental impact report was released for the PDCP in mid-2003. A legal challenge was filed against the

environmental impact report shortly thereafter. Although a trial court found the environmental impact report to be adequate, the State Appeals Court later reversed the trial court's ruling. In 2010, the CDFA contracted with an environmental consulting firm and began preparing the environmental analyses, documents, and risk assessments called for by the Appeals Court. In 2012 it was decided to combine the efforts of this project with a similar one being conducted for the Department's statewide plant health and pest prevention program. This work continued through 2014 and in late December the final EIR for the CDFA statewide plant pest prevention program, including the PDCP, was certified by the Secretary.

The full document can be found at <http://www.cdfa.ca.gov/plant/>

FINANCIAL STATEMENT

	FY 2015-16 (Actual)	FY 2016-17 (Budgeted)
REVENUE		
Federal (United States Department of Agriculture)	\$15,574,754	\$15,574,754
CDFA (Reserve)	\$598,554	
Industry (PD/GWSS Board winegrape assessment)	\$4,645,457	\$8,154,100
TOTAL REVENUE	\$20,818,765	\$23,728,854

	FY 2015-16 (Actual)	FY 2016-17 (Budgeted)
EXPENDITURES		
Personal Services	\$3,204,602	\$3,000,000
Operating Expenses	\$6,673,686	\$9,464,068
Total County Payments	\$10,940,477	\$11,264,786
TOTAL EXPENDITURES	\$20,818,765	\$23,728,854