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Fused Genes Tackle Deadly Pierce's Disease in Grapevines

A gene fusion research project led by a University of California, Davis, plant scientist delivers a one-two punch to Pierce's disease, a deadly threat to California's world-renowned wine industry.

The study was published in the early edition of the Proceedings of the National Academy of Sciences.

"Many disease-causing microbes can evade one defensive action by a host plant, but we believe that most microbes

would have difficulty overcoming a combination of two immune-system defenses," said UC Davis plant sciences professor Abhaya Dandekar, the lead researcher.

He and his colleagues tested this hypothesis on *Xylella fastidiosa*, the bacteria responsible for Pierce's disease in grapevines. Strains of the bacteria also attack and damage other host plants, including citrus, stone fruits, almonds, oleander, and certain shade trees, such as oaks, elms, maples and sycamores.

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Additional Web News

University of California
Agriculture and Natural Resources

San Joaquin Valley Viticulture Blog

Making a Difference
for California

Table Grape Vineyard Canker Disease Survey

Several unrelated groups of Ascomycete fungi cause trunk diseases in grapevines. These include: species in the Diatrypaceae family including *Eutypa lata* the causal agent of **Eutypa dieback**; species in the Botryosphaeriaceae including *Botryosphaeria dothidea* and others. Species of Botryosphaeriaceae have been reported to cause different grapevine diseases including **Bot canker**, **black dead arm**, and **Macro-**

phoma rot. Species in the Togniniaceae including *Togninia minima*, *Phaeacremonium angustius* and many species of *Phaeacremonium* are the causal agents of **esca** or **black measles** and **Petri disease**. This list of fungi is certainly not exhaustive as additional species are continually being associated with wood cankers and branch dieback worldwide.

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Canker Disease Survey

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Grapevine Infections

Infection of grapevines by fungal pathogens primarily occurs through pruning wounds. Fungal spores (sexual and asexual) become airborne during and following rain and come in contact and colonize exposed wood vessels. Grapevines have the highest risk of infection during the pruning period, from late fall to early spring, due to the high number of wounds made on a single grapevine, and the number of rain events that occur during that period of time.

Grapevine wounds remain susceptible to infection by these fungi for several weeks. Plugging of the xylem and phloem elements and decay of the wood follows infection, impairing movement of water and nutrients, and leading to the decline of the grapevine. Each grapevine can become infected multiple times with one or more pathogens and it is common to isolate several pathogens from old cankers. Therefore, trunk diseases should be regarded as a complex of pathogens. For these reasons, it is sometimes difficult to associate one type of symptom with a single pathogen. Symptom expression also varies from year to year and among grape varieties partly because of variability in susceptibility making it even more problematic to identify characteristic disease symptoms.

Economic Impact

Grapevine trunk diseases are a significant problem in California's table grape vineyards. Once canker disease symptoms are observed, the affected grapevines usually continue a steady decline over time until death occurs. Infected table grape vineyards display decreased yields and fruit quality. In addition, the labor involved in removing infected wood, retraining dead/dying vines and replanting adds to the overall production costs. When the affected vineyards are no longer economically sustainable to maintain, growers have no alternative but to replant. It is difficult to accurately measure the economic impact of trunk diseases on table grape production because of the slow movement and the long incubating time of some of these fungi. However, in 1999 losses were estimated at \$260 million per annum in California wine grape production. No data are available for table grape production. Therefore, we are asking table grape growers to fill out an online survey that will take approximately 10 minutes.

SURVEY LINK: http://ucanr.org/grapevine_cankers_survey

The survey aims to help us prioritize grapevine canker disease research focused on table grape production.

Wine Flavor 101C: Quality Control for the Winery Laboratory

Thursday, April 26, 2012

8:30 a.m.-4:00 p.m.

Freeborn Hall, UC Davis

More information:

Kay Bogart

(530) 754-9876

To register:

<http://ucce.ucdavis.edu/survey/survey.cfm?surveynumber=8182>



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Pierce's Disease

(Continued from page 1)

The findings further strengthen UC Davis' standing as a world leader in the science of plant improvement through advances in genetics, genomics, plant breeding and biodiversity.

First noted in California near Anaheim around 1884, Pierce's disease in grapevines is now known to exist in 28 California counties. From 1994 to 2000, the disease destroyed more than 1,000 acres of northern California grapevines, causing \$30 million in damages. There is currently no known cure for Pierce's disease.

In grapevines, *Xylella fastidiosa* (Fig. 1) is carried from plant to plant by half-inch-long insects known as sharpshooters. The bacteria infect and clog the plant's water-transporting tissue, or xylem. Grapevines with Pierce's disease develop yellow and brown leaves and die within a few years. To block such infections, the researchers engineered a hybrid gene by fusing together two genes that are responsible for two key functions of the plant's innate immune response: recognizing *Xylella fastidiosa* as a bacterial invader and destroying its outer membranes, causing the bacteria to die.

The researchers then inserted this hybrid gene into grapevines.

They found that sap from plants genetically engineered with the hybrid gene effectively killed *Xylella fastidiosa* in the laboratory. And grapevines engineered to carry the hybrid gene

had significantly less leaf scorching and xylem clogging, indicating resistance to Pierce's disease.

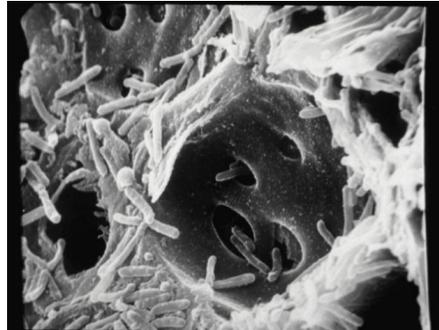


Figure 1. Electron micrographs of *Xylella fastidiosa* in xylem vessels of grapevine.

Photo: Dr. Doug Cook, UC Davis.

The Los Alamos National Laboratory, New Mexico, and the U.S. Department of Agriculture collaborated on the project. Funding came from the state Department of Food and Agriculture's Pierce's Disease Program, the U.S. Department of Energy and the U.S. Department of Agriculture.

More information on Pierce's Disease:

<http://ucipm.ucdavis.edu/PMG/r302101211.html>

For more information contact:
Abhaya Dandekar, Plant Sciences,
(530) 752-7784,
amdandekar@ucdavis.edu

Preventing Heat Illness

The first in a series of seminars to help educate farm labor contractors, growers and supervisors about heat illness prevention regulations was held on April 5, in Easton CA. Attendees learned about methods and policy to prevent heat illness that could be shared with their staff.

California employers are required to take these four steps to prevent heat illness

1. **Training:** Train all employees and supervisors about heat illness prevention.
2. **Water:** Provide enough fresh water so that each employee can drink and least 1 quart per hour and encourage them to do so.
3. **Shade:** Provide access to shade for at least five minutes of rest when an employee believes he or she needs a preventative recovery period. They should not wait until they feel sick to do so.
4. **Planning:** Develop and implement written procedures for complying with the Cal/OSHA Heat Illness Prevention Standard.

The seminars aim to reduce heat illness injuries in agriculture by training participants about the dangers of heat-related injuries and how heat injuries can be prevented.

Two additional classes will be held in Bakersfield on April 18 and Modesto on April 26. Two sessions—a Spanish session begins at 10:00 a.m. and an English session that begins at 1:00 p.m.—are scheduled.

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Glassy-Winged Sharpshooter Program: 2012 Season Begins!

Carol Hafner

Spring is here and the time has come to begin the Glassy-winged sharpshooter (GWSS) trapping, surveying, treatment and bio-control program in Fresno County. The treatment strategy will continue as a suppression effort beginning at the perimeter of known GWSS finds in 2011 and moving inward toward the core of the cities of Fresno and Clovis. The goal is to stop the expansion of this destructive pest through effective treatments and the use of bio-control measures; while reducing the size of the infested area over time. The result will minimize the impact of this pest to ornamental landscapes and as a serious threat to agriculture.

The GWSS causes severe damage by feeding on a wide variety of ornamentals and crop plants. It prefers to feed on stems rather than leaves, using their strong sucking mouthparts to remove fluid and nutrients from plants. As a result of their feeding, they can transmit various plant diseases including Pierce's Disease caused by *Xylella fastidiosa*. This disease kills grapevines and there are no effective treatments for it.

The GWSS adult, a large insect is approximately ½-inch long and is dark brown to black, with lighter underside (Fig. 1). The wings are partly transparent with reddish veins. When the adults and nymphs are newly emerged, they are grayish to light brown in appearance. The nymphs do not have fully developed wings (Fig. 2).

Beginning February 23rd, homeowners have been asked permission to treat properties, as well as the soil beneath "backyard citrus" (a known prime overwintering host), for the GWSS. Treatment will begin on March 1, 2012 with the application of a systemic insecticide in one or more of the following ways:

- 1.) to the soil directly beneath host plants;
- 2.) sprayed onto the foliage of the plants on properties where the GWSS had been found last season; and/or
- 3.) at the edge of determined quarantine boundaries.

Trapping with yellow sticky panels will commence on May 1, 2012. As done in previous years, traps will be placed in nurseries,

commercial citrus orchards and in towns throughout Fresno County. In addition, traps will now be placed in Fresno around the perimeter of the city, the eastern edge of Clovis and surrounding the Sunnyside area at a density of 15 traps per square mile.

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Figure 2. GWSS nymphs are gray in color and have no wings.



Figure 1. Adult GWSS is approximately 0.5 inches long.

Spring Fever

Matthew Fidelibus and Stephen Vasquez

Preventing Heat Illness

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For more information, or to register, contact Fresno County Farm Bureau at (559) 237-0263 or info@fcb.org.



Informational handouts on the heat stress prevention regulations are available online at: <http://www.dir.ca.gov/dosh/HeatIllnessInfo.html>.

Current weather forecasts predict the San Joaquin Valley may experience alternating periods of cool and warm temperatures in the next few weeks. Such conditions may lead to the development of weather-related disorder known as “spring fever”. On vines with spring fever, basal leaves will become chlorotic, with green leaf-color fading first from the leaf margins, and then progressing inwards, towards primary and secondary veins (Figure 1). Also, leaf margins will curl upward, and they may become necrotic. Severely affected leaves may fall from the vine. As the weather becomes warmer and less variable—typically before bloom—the vines will grow out of this condition, normally without any lasting effects on productivity.

The symptoms of spring fever resemble those of potassium deficiency, so this disorder is sometimes referred to as “false potassium deficiency”. The reason why spring fever and true potassium deficiency induce similar leaf symptoms may be that both can lead to an excessive accumulation of the amino acid putrescine in leaves. However, symptoms of spring fever and true potassium deficiency differ in the time of the season when they are noted, and on the leaves in which they affect. As noted earlier, spring fever symptoms affect basal leaves, and symptoms will usually disappear by bloom, whereas symptoms of potassium defi-

ciency usually begin on leaves from the middle of shoots, no earlier than bloom, and extend to younger leaves. Moreover, vines afflicted with spring fever are not potassium deficient, so mineral nutrient analyses of petiole samples can be used to distinguish between spring fever and potassium deficiency, if there is any doubt.

The critical values for bloom samples are 1.0% K or less (deficient) and >1.5% K (adequate).

Matthew Fidelibus is the UC Davis, Viticulture Specialist based at the Kearney Ag Center, Parlier CA. Stephen Vasquez is the Viticulture Farm Advisor in Fresno County.



Figure 1. Thompson Seedless spring fever symptoms.

Agriculture Trade Mission to China and Korea

The California Agricultural Trade Mission to China and Korea will include customized one-on-one meetings with foreign buyers (Shanghai and Seoul), market briefings by U.S. Embassy staff, as well as retail market visits to assist California small businesses with export sales and foreign market expansion. The trip is scheduled for June 10-16, 2012 with a variety of meetings being organized that will benefit small agriculture businesses.



This trade mission is designed to assist California small businesses with entering and expanding export sales to China and Korea. Program staff will work with participating companies to schedule one-on-one business meetings with appropriate foreign buyers. Companies will also receive in-depth market briefings from U.S. Department of Agriculture officials and visit a variety of retail market outlets to better understand the sales and distribution channels in the market. In addition, companies will have the opportunity to showcase their products to importer/distribution representatives.

Participation Fee: \$500.00 (*Participation is limited*) and fill out the [registration form](#).

California small businesses will be provided:

- Customized one-on-one appointments in Shanghai and Seoul
- Market briefings by U.S. Officials
- Hotel accommodations in Shanghai and Seoul
- Travel assistance/reimbursement of international airfare up to \$1,500 – restrictions apply.
- California [small business requirements](#) must be met to receive trade mission travel assistance.
- California entities that do not meet the small business requirements can participate in the trade mission at their own expense.

For more information, contact:

Candy Hansen-Gage
Center for International Trade Development
559-324-6401

candy.hansen-gage@scccd.edu

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GWSS Program

(Continued from page 4)

The 2012 strategy is for a higher concentration of detection traps to be placed at the edge of the quarantine boundary instead of traps being placed throughout the city. Bio-control efforts will continue through the release of a very tiny wasp that is a parasitoid of GWSS eggs. Areas identified as “good candidates” for bio-control efforts will occur through consultation with the California Department of Food and Agriculture and the Fresno County Department of Agriculture’s Entomologist.

Each Fresno County Department of Agriculture employee has been issued an identification badge and directed to wear it while on duty. Residents and growers are encouraged to ask for official identification badges carried by permanent and seasonal staff employees.

If you think that you have found GWSS or have questions about our trapping, surveying, host treatments or parasitoid release efforts, please call the Fresno County Department of Agriculture at (559) 600-7510. You may also bring a suspect insect to the Department’s Entomologist located at 1730 S. Maple Avenue in Fresno, Monday — Friday, between the hours of 8:00am — 5:00pm for identification.

Carol Hafner is the Agricultural Commissioner for Fresno County.

CALENDAR OF EVENTS

Local Meetings and Events

Viticulture Research Roadshow

June 14, 2012

1:00 p.m.—5:00 p.m.

EOC Nielsen Conference Center

3110 W. Nielsen in Fresno

Contact: Peterangelo Vallis (559) 272-1411 x803

U.C. Davis University Extension Meetings (800) 752-0881

Introduction to Sensory Evaluation of Wine

May 5-6, 2012

9:00 a.m.— 4:00 p.m.

1632 Da Vinci Ct.

Da Vinci Building

Davis, CA

Section: 114VIT200

Managing the Small Vineyard II

May 12, 2012

9:00 a.m.— 4:00 p.m.

Medical Science Building, Rm. 180

E. Health Science Drive

Davis, CA

Section: 114VIT204

Introduction to Wine Analysis

May 12, 2012

9:00 a.m.— 6:00 p.m.

1127 North, Robert Mondavi Institute
for Wine and Food, Old Davis Rd.

Davis, CA

Section: 114VIT202

Publications from the University of California



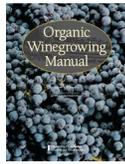
Vineyard Pest Identification and Monitoring Cards

ANR Publication 3532

Price - \$25.00 + tax and shipping

Keep your vineyard healthy by staying on top of pest activity with this pack of 50 sturdy, pocket-size laminated cards. This is the perfect quick reference to identifying and monitoring vineyard diseases and pests. Twenty-seven common insects and mites, 8 diseases, 6 beneficial insects, and a variety of other disorders, weeds, and invertebrate pests are covered in 244 photos.

These 50 information-rich cards will help growers, vineyard managers, and their teams identify and manage most common problems.



NEW! Organic Winegrowing Manual

ANR Publication 3511

Price — \$35.00 + tax and shipping

Interest in California organic wine grape production inspired this publication that provides a full-color guide with information on soil management, including soil considerations when selecting a vineyard site, developing organic soil and fertility programs and selecting cover crops. An extensive section covering weed, disease, insect, mite, and vertebrate pest management options for organic grape production is covered. The chapter on organic certification contains an overview of considerations for evaluating and selecting a certifier.

Order Form

Publication	Qty.	Price	Subtotal
Vineyard Pest Identification		\$ 25.00	
Organic Winegrowing Manual		\$ 35.00	

Shipping – USA Only		
Merchandise Total	Shipping Charge	
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\$40—49.99	\$9	Shipping Based on Merchandise Total:
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\$100+	\$15	

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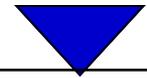


Vine Lines

Produced by UC Cooperative Extension Farm Advisor Stephen J. Vasquez. Contact me for further article information, or to be added to the mailing list.

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**Visit us online at
<http://cefresno.ucdavis.edu>**



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