April 23, 2004

Kern/Tulare

GWSS Update

A project of the Glassy-winged Sharpshooter Task Force of Kern and Tulare Counties. Participants: Agricultural Commissioner's Offices of Kern and Tulare Counties, California Department of Food and Agriculture, University of California-Cooperative Extension, U.S. Department of Agriculture (APHIS and ARS Divisions).

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Researchers look for *Xylella* in common weeds

"It takes two to tango."

This old phrase has some scientific truth in the epidemiology of Pierce's Disease (PD) and almond leaf scorch (ALS). The glassy-winged sharpshooter (GWSS) would not have reached its current notoriety if not for its association with the bacterial pathogen, *Xylella fastidiosa* (*Xf*). Separately, these pests are not much of a concern, but together and near susceptible crops they form a dangerous pair. University and USDA scientists are investigating insect and pathogen interactions to determine what brings GWSS and *Xf* together in order to predict, monitor and control PD and ALS.

Native sharpshooters, like the redheaded sharpshooter, have a more limited host range than GWSS. These native sharpshooters are more attracted to weedy hosts, and they enter vineyards and almonds as only temporary visitors. For this reason, one cultural control for native sharpshooters is to remove nearby vegetation, such as Bermuda grass or blackberries, that hosts either the insect vector and/or the bacterial pathogen.

This concept may not be so easily employed for ALS and PD in the San Joaquin Valley due to the large number of hosts of GWSS and *Xf*. Instead, successful control programs have targeted GWSS and *Xf* separately. Outside the vineyard, primarily in citrus orchards, the area-wide projects have used insecticides to kill GWSS. Inside the vineyard, PD-infected vines are rouged-out to remove *Xf*.

Still, GWSS and *Xf* can be found together, often very near vineyards and almonds, presenting conditions for their potentially dangerous tango. The unsuspecting rendezvous point is often right under our feet — weeds.

What hosts plants are important in the San Joaquin Valley? Researchers have previously developed lists of GWSS and *Xf* host plants, on-line at www.cnr.berkeley.edu/xylella/.

Our goal was to add information to this list by investigating three important aspects of PD and ALS epidemiology: the incidence, seasonal distribution and population density of GWSS and *Xf* on common weeds found in and around Central Valley vineyards and almonds. Here we report some of our initial findings.

Screening studies: *Xylella* incidence and seasonality. We sampled common weed species in and around PD-infected vineyards or ALS-infected orchards in Kern, Stanislaus, Butte and Glenn Counties. The selected weed species were known host plants for both GWSS and *Xf*. *Xf* DNA was extracted from collected material by immunocapture PCR. While we found *Xf* in the usual insect suspects, such as the green sharpshooter, the number of insects testing positive for *Xf* presence was quite low.

Results from plant samples are the most interesting, and those plant hosts testing positive for *Xf* include chickweed, red filaree, English ivy, Shepherd's purse, bluegrass, clover and stinging nettle (Table 1). Negative samples included miner's lettuce, hare barley, dandelion, nutsedge, alfalfa, field bindweed, ranunculus, malva, lupine, wild oat and prickly lettuce, although many of these plants are known hosts of *Xf*.

One example of an overlooked insect-pathogen-host triangle is stinging nettle (*Urtica urens*), a common weed throughout the Central Valley. We found stinging nettle was a common host for GWSS in the spring, and in Kern County this weed was also a common host to *Xf*.

In one sample-set, collected in December, DNA extraction showed 60 percent of stinging nettle in a Kern County PD-infected vineyard had *Xf*. Does this prove that stinging nettle will be an important springtime reservoir for *Xf*? Not necessarily so; seasonality, population density and *Xf* strain can all influence PD epidemiology.

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— Kent Daane, et al., UC Berkeley

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***Xylella* overwintering and population density.** *Xf* infections must survive the winter inside grapes and almonds for PD and ALS to develop. *Xf survival* depends on winter temperature, the degree of plant dormancy and the *Xf* strain. In our surveys, samples of stinging nettles from the same vineyard that tested positive in January have since tested negative.

We will conduct field studies of select weed species in winter 2004-05 to follow *Xf* overwintering in common weeds. Multi-year studies are needed to clarify differences in the overwintering potential of *Xf* strains and determine how this might impact PD and ALS epidemiology. For GWSS to acquire and transmit *Xf*, there must be more than 10,000 bacteria per gram of plant tissue. For this reason, our survey of common weeds will record both GWSS and *Xf* presence and *Xf* population density inside the plant.

***Xylella* strain differences.** Finally, we are categorizing *Xf* by its common strains. Genetic studies show that *Xf* has distinct strains, often associated with different host plants. This can be important for the epidemiology of PD and ALS because not all *Xf* strains will cause PD and/or ALS.

For example, *Xf* isolated from almonds can be separated into three distinct strains, one that is genetically more similar to grape strains than the two other ALS strains. However, in greenhouse tests, the grape strains caused ALS, but the almond strains did not cause PD. Therefore, our initial screening of *Xf* from Kern County weeds includes a simple analysis of *Xf* strains — grape or almond. The results may not make much difference in regional epidemiology as we found both grape and almond strains in separate samples of bluegrass, Shepherd's purse, common groundsel, chickweed, cheeseweed and filaree.

We will work with Dr. Chen and Dr. Groves (USDA-ARS, Parlier, Calif.), who will better separate closely related *Xf* strains using more advanced genetic techniques.

Project contribution to PD control. How can this information be used? By identifying those less obvious but common plant species that can host both sharpshooters and *Xf*, we will develop better information on PD and ALS epidemiology. For example, control programs might target some plant species for weed control or determine critical overwintering and spring periods in the movement of *Xf* between weeds and crops. Because most of the host plants that we will study are found throughout California, our results can be applied to other regions.

— Kent Daane, Elaine Shapland, Tarcisio Ruiz, Alexander Purcell and Tina Wistrom – UC Berkeley; Marshall Johnson – UC Riverside; Joe Connell – UCCE Butte County; Roger Duncan – UCCE Stanislaus County; Mario Viveros, Jennifer Hashim and Murray Pryor – UCCE Kern County

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Table 1. Plant samples testing positive for the presence of *Xylella*

Region	Ground vegetation	Samples testing positive for *Xylella*
Stanislaus County	Chickweed	1 of 6
	Red filaree	1 of 8
	Malva	1 of 4
	Ivy	1 of 1
Glenn & Butte Counties	Red filaree	5 of 8
	Shepherd's purse	1 of 3
	Clover	1 of 1
Kern County	Bluegrass	1 of 9
	Chickweed	2 of 8
	Shepherd's purse	1 of 2
	Stinging nettle	11 of 21