

FATE OF *XYLELLA FASTIDIOSA* IN ALTERNATE HOSTS

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INTRODUCTION

This project investigated the fate of the Pierce's disease bacterium *Xylella fastidiosa* (*Xf*) in alternate hosts from which sharpshooters might acquire *Xf* by feeding. We identified additional bacterial hosts among vineyard weeds, cover crops, field crops and adjacent vegetation common to vineyards in California's San Joaquin Valley. Field studies conducted at the Kern County Agricultural Center in Bakersfield tested the survival of *Xf* in field conditions for five weed and cover crop species known to be systemic hosts of *Xf*.

The rapid and striking emergence of Pierce's disease of grape in the General Beale Road project area in Bakersfield during summer 2001 showed the damage that can be done by the glassy-winged sharpshooter (GWSS). Identification and eradication of plants that are bacterial hosts is important where the insect vector has large populations and feeds on many different plants. *Xf* survives and multiplies in an unusually large number of plants (Freitag 1951; Hopkins 1988), and sharpshooters collected distant from agricultural habitats can be infectious with *Xf* (Freitag and Frazier 1954). Previous studies of *Xf* in four plant species established that *Xf* multiplies in plants at the inoculation site but moves systemically within the plant in only some plant species (Hill and Purcell 1995b). Lab and field studies of *Xf* in 33 species of riparian plants commonly found in Napa Valley revealed that most plants were propagative but non-systemic hosts of the bacterium and suggested that *Xylella* eventually disappears from non-systemic hosts (Purcell and Saunders 1999).

Research during 2000 and 2001 (funded by Kern-Tulare Glassy-winged Sharpshooter-Pierce's Disease Task Force), identified 7 species of weeds as systemic high- and mid-population hosts of *Xf* and that 12 other weed species were infrequently infected, supported low *Xf* populations, or had limited bacterial movement beyond the site of insect feeding. We tested 13 additional plant species as hosts of *Xf* this year. Recent studies of the effects of temperature on *Xf* growth in culture or in grapevines indicated that *Xf* slowly dies instead of multiplying at temperatures below 10°C or above 34°C (Feil and Purcell 2001). To determine how well field plants support the growth of *Xf* during winter and summer, we followed the population changes of *Xf* in systemic weed or cover crop hosts of *Xf* grown in Kern County in a protective cage (to exclude vector transmission) in two cool season and two warm season trials.

OBJECTIVES

Evaluate the fate of *Xylella fastidiosa* in Central Valley weeds.

RESULTS AND CONCLUSIONS

We continued investigations into the fate of *Xf* in 13 previously untested species of weeds, field and cover crops, and vegetation commonly found adjacent to San Joaquin valley vineyards. We inoculated plants with blue-green sharpshooters (BGSS) or mechanically, and tested for the presence of *Xf* at 1, 3 and 9 weeks after inoculation. Culture on semi-selective medium (PWG) estimated bacterial populations ($\log_{10}$ colony-forming-units [cfu] per gram) and systemic movement of the bacteria throughout the plant beyond the inoculation site.

Recent tests showed that 'Ace' tomato, 'Violeta lunga' eggplant, black nightshade and red gum (mechanical inoculation only) consistently developed *Xf* infections with populations over $\log_{10}6$ /cfu/g. Quinoa, field bindweed, yellow nutsedge, and blue gum had high *Xf* populations (between $\log_{10}5$ and $\log_{10}7$) in plant tissue at the inoculation site but rarely developed systemic infections in the greenhouse. Plants with fewer than 10% of their sites infected, or that supported populations at or below $\log_{10}3$ cfu/g were: johnsongrass, jojoba, prostrate pigweed, annual sowthistle, southwestern cupgrass, whitestem filaree, and watergrass. These plants also had systemic infections at less than 10% of their inoculation sites. Three species of recently tested weeds: cheeseweed, sacred datura, and red gum, frequently developed infections when mechanically inoculated but not when inoculated by insects. Jojoba developed infections after exposure to BGSS but not after needle inoculation. Systemic populations of *Xf* over $\log_5$ and especially over $\log_6$ are most likely to be significant sources of *Xf* for sharpshooters that feed on them, but this needs to be tested for representative weed species.

Bacterial survival in field conditions was tested with five species of common vineyard weeds that previously had been identified as systemic hosts of *Xf*. Cocklebur, wild sunflower, and prickly lettuce were tested from July to November 2002. Prickly lettuce, poison hemlock, and 'Aquadulce' fava bean (used in cover crops) were grown from November 2001 to

March 2002. After inoculation in the greenhouse, half the plants remained in the greenhouse, and half were planted in a vector-proof cage outside at the Kern County Cooperative Extension office. We sampled plants by culturing 1, 3, and 9 weeks after inoculation to estimate bacterial populations and systemic movement.

We recovered *Xf* less frequently and in lower populations from field-grown plants when compared to greenhouse-grown plants during the first three weeks. In all four trials comparing *Xf* infections in the field and greenhouse, fewer infections became established in field-grown plants, bacterial populations were lower, and fewer infections moved systemically beyond the inoculation site to colonize the entire plant. For tests done in cool weather from November 2001 to March 2002, *Xf* was recovered from 26% of field-grown plants (31 of 134) and 46% of greenhouse-grown plants (50 of 109 inoculation sites). For tests with summer weeds from July to November 2002, we recovered *Xf* from 35% of greenhouse-grown weeds (56 of 158 sites) and 21% (27 of 127) of field-grown weeds. Field-grown plants also had fewer systemic infections and lower bacterial populations. We conclude that *Xf* multiplies and survives more poorly under field conditions than in ideal growth temperatures (26-29 °C) maintained in greenhouse studies. This confirms our initial assumption that lab tests were more suitable for initial screens of plants' abilities to support the multiplication of *Xf*, and is consistent with our predictions that *Xf* would grow more slowly under fluctuating field temperatures that exceed or fall below permissive growth temperatures.

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