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Mechanical and insect transmission of *Xylella fastidiosa* to *Vitis vinifera*

By: R. Krell, E. Boyd, J. Nay, Y. Park, and T. Perring

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• The bacterium *Xylella fastidiosa* induces Pierce's disease (PD) in grapevines. In the late 1990's, there was an outbreak of PD in Southern California that was associated with the vector of the disease, the glassy-winged sharpshooter (*Homalodisca coagulate*). But soon, PD was detected in areas where this specific sharpshooter had not been previously detected. So the authors wonder, are there other potential xylem-feeding insect vectors?

• These authors were convinced that, to develop an adequate PD-management program, it is critical to understand the sources of transmission. So they evaluated the importance of 4 potential mechanisms of transmission in PD epidemiology: 1) graft transmission by naturally occurring root grafts, 2) mechanical transmission by pruning shears, 3) transmission through the insect vector "smoke tree sharpshooter" (*Homalodisca liturata*), and 4) transmission through the insect vector "apache cicada" (*Diceroprocta apache*). These two insects are common in the Coachella Valley and have been observed in PD-infected vineyards.

• The source of *X. fastidiosa* for the transmission experiments was Thompson Seedless cuttings from an infected vineyard which were rooted in a greenhouse. The source for healthy material was non-infected Redglobe and Thompson Seedless rooted cuttings, grown in a different greenhouse. When the authors needed to find out whether individual *plants* were infected (at the beginning, to confirm their healthiness, and at the end of the experiments), they used antigens against *X. fastidiosa* (the technique is called ELISA, or enzyme-linked immunosorbent assay). And when they wanted to find out if individual *insects* were carriers, they did so by extracting DNA from the insects' heads and searching for a piece that actually belonged to *X. fastidiosa* (using a PCR, or polymerase chain reaction, assay).

• 1) **Transmission by root self-grafting.** When infected and un-infected plants were planted next to each other (and roots of both plants were deliberately intertwined to maximize the chance of naturally-occurring root grafting), no natural grafts were able to form. So transmission through self-grafting is not likely.

• 2) **Transmission by pruning shears.** When the authors made 30 pruning cuts along the cane of an infected plant (to acquire the pathogen) right before making one cut to the healthy plant, they obtained one successful transmission of *X. fastidiosa* out of 21 attempts, or about 5% efficiency. As the authors point out, in vineyards, pruning is normally performed when vines are dormant -not on green shoots as was done in this instance-. Because field observations of adjacent infected vines within a row show a pattern very consistent with transmission through pruning equipment, the authors feel that the point of whether mechanical transmission actually happens in the field merits further investigation.

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• 3) **Transmission by smoke tree sharpshooter**. Using cages, the authors exposed individual sharpshooters to infected plant material to acquire the pathogen (*acquisition access period*). They then moved the infected sharpshooter to a cage containing a healthy plant to allow for transmission (*inoculation access period*). The authors conducted a series of experiments to test the effectiveness of *nymphs* versus

adults, as well as the effectiveness of *short acquisition/inoculations periods* (80 minutes) versus *long* ones (2 days). When nymphs were used, 3 out of 24 attempts resulted in successful transmission (12%). When adults were used that had been allowed a short acquisition period, there was no transmission (0%). However, when adults that had been allowed a long acquisition period were used, 3 out of 14 attempts were successful, which was the highest rate in the experiment (21%).

• 4) **Transmission by apache cicada.** The authors did the same as above just for apache cicada *adults.* The result was that 1 of 12 attempts was able to transmit the disease (8%).

Summarizing the insect transmission trials, only the smoke tree sharpshooter adults that had the shortest exposure time to the bacteria failed to transmit *X. fastidiosa* to healthy vines. This is the first report of *X. fastidiosa* transmission for both smoke tree sharpshooter and for apache cicada in California. This means that all *pruning shears, smoke tree sharpshooters*, and *apache cicadas* have potential to transmit the disease. In Central and Southern California, PD management has focused on a single insect vector, but as this study shows, there are other vectors that need to be considered.

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