Texas Cooperative Extension
TEXAS PD NOTES

SEPTEMBER 30, 2006 VOLUME 2, ISSUE 5

Research and Extension Personnel Propose Work for the Texas PD Program's Fifth Year.

In preparation for the PD program's new fiscal year next April, administrators from the Texas Agriculture Experiment Station have issued a call for proposals for next year's work. In conjunction with the Texas PD Advisory Board, the following research and outreach priorities have been established:

✦Area-Wide Management Practices
*Implementation of real-time, vineyard monitoring *Xylella fastidiosa (X f*)and its vectors
*Vineyard site selection
*Development of predictive mathematical models to predict the occurrence, distribution and intensity/density of *Xf* and its vectors.
*Development of geographic information system (GIS) for spatial analysis of distribution of Pierce's disease and sharpshooters in relation to environmental factors

✦Biological Control
*Biological control of *Xf*
*Biological control of *Xf* vectors

✦Biology and Interactions of Host, Pathogen, and Vector
*Determine the genetic, biochemical, and physiologic basis of *(X*f) virulence, pathogenicity, transmission, survival, and expression
*Determine genetic, biochemical, and physiologic basis of vector herbivory and disease vectoring
*Determine the genetic, biochemical, physiologic, and behavioral basis for host plant factors that influence attractions, repulsion, survival, or inhibition of vectors of *Xf*
*Improved methods for pathogen and disease detection
*Sources of pathogen, vectors, and beneficial agents occurring in commercially-grown grape vineyards

✦Cultural and Chemical Control
*Evaluation of novel chemistries for *Xf* and vector control
*Application strategies to improve chemical control efficacy
*Movement of *Xf* via root grafting or other non-vector sources

✦ Economic Feasibility
*Economic assessment of proposed/ potential management strategies

✦ Educational Program
*Publication of scientific bibliography of Pierce's Disease research (including pioneering work of T.V. Munson)
*Periodic reporting of research results
*PD Management Guide for Texas

✦ Host Plant Resistance to Pathogen and Vector
*Mechanisms of tolerance / resistance to *Xf*
*Characterization and selection of resistant root stocks
*Effects of plant stress on pathogen/vector resistance

✦Vegetation Management
*Investigate cropping system practices on impact of vector populations
*Investigate use of trap crops in a pest management program
*Effects of vineyard management practices (ex. groundcovers and other agronomic practices) on *Xf* and its vectors.

All proposals submitted will be evaluated independently by the PD Research Executive Committee, TAES/TCE Administration, APHIS, and the Pierce's Disease Grower's Advisory Board. Criteria for evaluation of proposals will include justification of proposed research, consideration of established research priorities, appropriateness of the proposed research objectives and budget to meet the project priorities, and evaluation of the scientific merit of the proposal, experimental design, and adequacy of the personnel and facilities to insure the successful completion of the objectives of the proposal. Funding decisions will be made by a joint meeting of representatives from the Pierce's Disease Grower's Advisory Board, APHIS, and TAES/TCE Administration. Notices of acceptance or refusal will be sent by January, 2007.

TEXAS PD NOTES IS PRODUCED AND EDITED BY

- Mark Black, Extension Plant Pathologist, Uvalde TX
- Ed Hellman, Extension Viticulturist, Lubbock, TX
- Jim Kamas, Extension Fruit Specialist, Fredericksburg, TX

Additional Articles Contributed by Members of the Texas Pierce's Disease Task Force

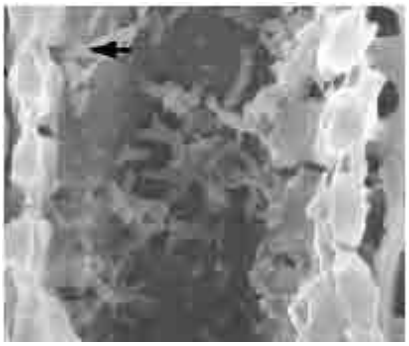
INSIDE THIS ISSUE:

Texas Cooperative Extension
Texas PD Notes
VOLUME 2, ISSUE 5

How Does *Xylella* Injure Susceptible Grapevines?- *Reviewing the Work of Josh Stevenson & Tom Rost*

In response to grower requests, this article seeks to expand on information published in the July edition of *Texas PD Notes*. The issue at hand is: What is it about the presence of *Xylella fastidiosa* in the xylem of susceptible grape cultivars that causes damage? There appear to be several factors that result in vascular clogging, but researchers still do not have all of the answers.

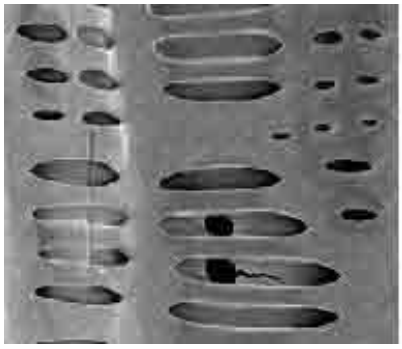
Infected susceptible grapevines die from the inability to deliver water to parts of the vine. It appears that the growth and conjugation of these bacteria directly block xylem tissue. It is believed that fimbrae, or hair-like attachments on the bacteria hook



Bacterial congregation in xylem

together and help the bacteria cling together. The bacteria also appear to trigger the production of a resin-like substance now known as fastidian gum. The gum itself can clog vascular tissue and helps the bacteria embed itself along the xylem walls.

One issue that has puzzled researchers is how the bacteria move between xylem cells within the plant. Xylem vessels are somewhat like soda straws stacked side by side in a staggered fashion just below the periderm. Xylem cells can pass water from cell to cell, but the pit membrane at the top of each

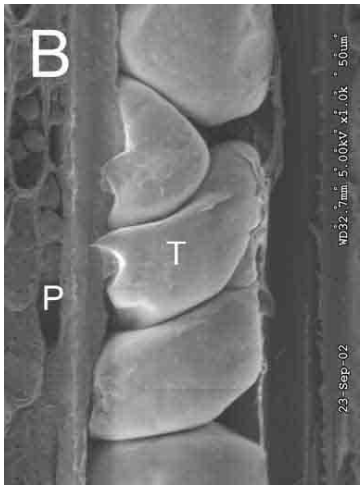


Damaged Xylem Pit Membranes

"straw" theoretically would prohibit bacterial movement from cell to cell. This photo exhibits damage to the pit membrane of a grapevine xylem cell. It is theorized that *Xylella* may secrete an enzyme capable of dissolving the cell wall enabling bacterial movement from cell to cell. It is also known that drought stress can cause xylem cell cavitation which can result in naturally occurring tears in the pit membrane. This could explain why stressed plants appear to be more susceptible to disease development following inoculation.

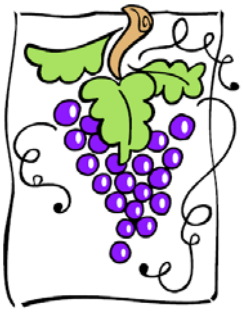
We also now know that the presence of *Xylella fastidiosa* triggers abnormal growth of naturally occurring structures within xylem tissue known as tyloses. While tyloses occur in uninfected vines, infection tends to cause more tyloses to be formed and for existing tyloses to grow to abnormal size. This increase in number and size further occludes xylem tissue.

In addition to these methods of blocking water conductive tissue, it is theorized that *Xylella* fastidiosa triggers the direct production of a toxin within



Abnormally Enlarged Tyloses Within Xylem Tissue in PD Infected Grapevine Xylem Tissue

grapevines. While not yet identified, it is believed that toxins in combination with direct clogging of xylem tissue trigger the all-too-familiar initial symptom of irregular leaf scorch.



Fastidian gum can directly clog vascular tissue and helps the bacteria embed itself along the xylem walls.

Photographs in this article are taken from Dr. Josh Stevenson's 2005 Presentation at the Texas PD Research Symposium

Investigating the Tolerance of Native Vitis Species–

Mark Black, Josh Stevenson and Jim Kamas

As a logical follow up to the article on page two of this issue, a project has been initiated to investigate the mechanisms by which native species and tolerant cultivars tolerate and survive infection by *Xylella fastidiosa*.

We know that Pierce's disease is endemic to the Gulf Coast of the United States because the numerous native *Vitis* species appear to suffer no ill effects from the bacterium. While the native grape species are believed to be an important source of the bacterium in our environment, strangely, when they are sampled, it is rare that they test positive. Grape breeders report, however that within native populations, seedlings are sometimes killed by *Xylella*.
Last year, grapevines were sampled in 24 locations along the coast from Galveston to Corpus Christi. These areas were chosen because they favor bacterial diversity and survival. Samples of xylem fluid were taken from these vines at budbreak when the vines naturally bleed from pruning wounds. This fluid was dilution plated to avoid fungal contaminants and all plates turned up negative. The question is why. Low bacterial titer? Inability to move within the vine? Something else in the xylem that inhibits bacterial growth?

Collecting xylem fluid from native grape at budbreak

An experiment is in its initial stages to examine this phenomenon. Seeds have been collected from native grapevine populations throughout the Hill Country. *Vitis monticola, V. berlandieri, V. mustangensis* and naturally occurring hybrid populations are included in this study. Seeds will be stratified to break dormancy, then grown under greenhouse conditions where natural infection is avoided. One third of the vines will be inoculated the first growing season, one third the second growing season, and the rest will remain uninfected. Greenhouse facilities in Uvalde will be used for this experiment and Mark Black's lab will provide the bacteria and skilled labor for inoculations. We will then employ the skills of Josh Stevenson to section and photograph these specimens. This study should give us visual as well as theoretical understanding of how these native grape species survive in the wild.

Seed collection from native grape species in the Hill