THE UNIVERSITY OF ARIZONA
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Pierce's Disease of Grape

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Introduction

Vinifera grapes have become economically important crop in Arizona, as wine tourism contributed $56.2 million to the state economy in 2017. The acreage of vinifera grapes in Arizona grew from 950 to more than 1,300 acres between 2013 and 2016. In 2019, Arizona grape acreage has grown to approximately 2,000. Pierce's disease (PD) is endemic to the Southern U.S. and is a threat to vine production in Arizona, especially in regions where winters are warm. In the early 1990's, the presence of large numbers of blue-green sharpshooters led to an outbreak of Pierce's disease, which destroyed several vineyards in Sonoita and Elgin. Since then, PD has not caused any major disease outbreak that resulted in significant yield losses in Arizona vineyards. Since 2017, the Extension Plant Pathology Laboratory at the University of Arizona has found high incidence of PD and significant yield reduction in several vineyards located in Cochise county. Due to the wide distribution of sharpshooters and spittlebugs and abundant range of host plants for the bacterium, PD may become one of the most important factors limiting the development of the wine industry in Arizona.

Disease and Pathogen

PD is a systemic bacterial disease that affects all grape varieties. PD is caused by the bacterium *Xylella fastidiosa* (Xf) that has a broad host range (more than 359 species from 75 plant families). The bacteria reside in the water-conducting vascular vessels of the plants (the xylem) and thus restricting flow of water and nutrients that induce water stress related symptoms. *X. fastidiosa* is highly sensitive to low temperatures. Seven distinctive Xylella strains have been discovered on various plant hosts worldwide, coupled with host specificity. The fastidiosa strain can infect grape, almond, alfalfa, and weeds, but does not infect oleander, citrus, peach, pecan or oak trees.

Symptoms and Disease Diagnosis

Symptom expression may depend on combination of varieties and climatic conditions. These are typical symptoms for our arid climate conditions: 1) marginal leaf burn or scorching first on older leaves in mid- to late summer: an irregular, necrotic margin on the edge of the leaf, usually with a reddish brown line demarcating the area of necrosis, 2) "matchsticks": remained petiole without leaf blade, 3) green "islands": irregular maturation of the periderm on canes, 4) "raisins": dried and shriveled berry bunches, and 5) cane dieback or death of grapevines. An observation of multiple typical symptoms is often adequate for the preliminary diagnosis of PD. A definitive diagnosis of PD often requires laboratory testing. Enzyme Linked Immunosorbent Assay (ELISA) is often used to detect bacterial cells in vines with advanced symptom development. Polymerase chain reaction (PCR) based detection methods are more sensitive and capable of detecting the pathogen before the symptom appearance. Due to uneven distribution of pathogen throughout the vines, proper sample collection is critical for a successful testing of PD. Symptomatic young twig and leaf petioles are the best sampling tissues. All plant samples should be wrapped in a dry paper towel, placed in a plastic bag, and shipped overnight to the University of Arizona's extension plant pathology laboratory in Tucson. All submissions should be accompanied by completed Plant Disease Diagnostic Form. To facilitate interpretation of testing results, it is important to include the forms and complete them as thoroughly as possible.

Spread in the vineyard

The pathogen can be introduced to a new orchard or established vineyard in two ways: contaminated nursery stock, insect vectors feeding on Xf-infected vegetation near or in a vineyard. Spread from adjacent native vegetation that harbor Xf often results in first infecting plants at the borders

SYMPTOMS

Leaf scorching (marginal leaf necrosis)

Green “islands"

“Matchsticks”: retained petioles with leaf blade abscission

of vineyard (edge effect, primary transmission). Vine-to-vine spread (secondary transmission) by insect vectors can occur subsequently under favorable conditions.

Insect Vectors

The bacterium is spread primarily by xylem-feeding insects such as sharpshooters and spittlebugs. Transmission efficiency varies greatly among insect species with glassy-winged sharpshooter being the highest. Leafhoppers and smoke-tree sharpshooters are found in great numbers in Arizona. The unexpected finding of glassy-winged sharpshooter in nurseries in Sierra Vista in 2005 caused great concern and subsequent eradication efforts prevented them from getting established in Arizona. It is not clear whether other sharpshooters, including glassy-winged sharpshooters or green sharpshooters play roles in PD spread in Arizona. Other xylem-sucking insects including spittlebugs and froghoppers are considered to be potential vectors. Reports of spittlebug colonization of grapevines are common in Yavapai and Cochise counties. We have found Xf cells in spittlebugs present in vineyards. However, the identity of the species found on vinifera grapes, their seasonal abundance and habitats, in particular spittlebugs, are not well known.

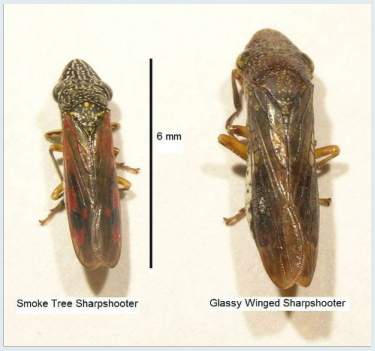
Diseases with Similar Symptoms

Phymatotrichopsis root rot, salt burn, and winter kills. A laboratory testing is required for differentiation.

Management

There is no cure for PD. However, an integrated management program (IPM) is most effective and consists of: 1) plant certified, disease-free plants; 2) use tolerant or

Grapevines with advanced stage of infection by Xf (note “raisins”)



Vector image source: T. Conklin

Blue green sharpshooter

Spittlebug

Chlorosis and leaf scorching on different varieties

“Raisin” and “matchstick” in August

“Raisin” and leaf scorching (note: leaf scorching and raisin on the left cordon, No symptoms on the right cordon)

resistant varieties and rootstocks; 3) monitor and manage vectors in and around a vineyard via insecticides and trap crops; 4) remove infected vines or rouge infected grapevines; 5) manage weeds in vineyard and adjacent vegetation; 6) maintain good vine health; and 7) disinfect pruning tools with a 10% bleach solution (1 part household bleach, 9 parts water) between cuts.

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