

CAN PIERCE'S DISEASE *PdRI* RESISTANCE INTROGRESSED INTO *VITIS VINIFERA* BE TRANSLOCATED FROM A RESISTANT ROOTSTOCK TO A SUSCEPTIBLE SCION?

Principal Investigator:

Drake C. Stenger
San Joaquin Valley Agric. Sci. Center
USDA ARS
Parlier, CA 93648
drake.stenger@ars.usda.gov

Co-Principal Investigator:

David W. Ramming
San Joaquin Valley Agric. Sci. Center
USDA ARS
Parlier, CA 93648
david.ramming@ars.usda.gov

Co-Principal Investigator:

Elizabeth E. Rogers
San Joaquin Valley Agric. Sci. Center
USDA ARS
Parlier, CA 93648
elizabeth.rogers@ars.usda.gov

Reporting Period: The results reported here are from work conducted August 2011 to October 2011.

ABSTRACT

The goal of this research is to evaluate the potential of a non-transgenic, Pierce's disease (PD) resistant *Vitis vinifera* selection used as an experimental rootstock to confer systemic resistance to PD susceptible *V. vinifera* scions. Source of PD susceptible plant material will be the wine grape variety 'Chardonnay', known to support high populations of *Xylella fastidiosa* (*Xf*) and exhibit severe PD symptoms. Source of PD resistant material will be a modified backcross generation 2 (mBC2) raisin selection with PD resistance locus *PdRI* introgressed from 89-F0908 (*V. rupestris* X *V. arizonica*). Scions will be mechanically inoculated with *Xf* strain Stags Leap. PD severity will be visually assessed using a nominal 0-5 rating scale where 0 corresponds to no visual symptoms and 5 corresponds to death of the plant. Following development of PD symptoms on the positive control ('Chardonnay' as both scion and rootstock), anticipated to be ~12-16 weeks post inoculation, tissue samples (petioles) will be assayed for *Xf* titer by real-time PCR.

LAYPERSON SUMMARY

Pierce's disease (PD) resistance from a wild grapevine species has been transferred into *Vitis vinifera* via classical (non-transgenic) breeding. However, given the extensive number of wine, raisin, and table grape varieties susceptible to PD, introgression into each will be time consuming and costly. In this research, proof of concept experiments will be conducted in greenhouse trials to determine if PD resistance in a *V. vinifera* selection used as a rootstock may be translocated to susceptible *V. vinifera* scions.

INTRODUCTION

This new project describes pilot experiments designed to test the hypothesis that a Pierce's disease (PD) resistant rootstock can affect PD development in susceptible scions. It is known that rootstock selection can affect symptom expression resulting from *Xylella fastidiosa* (*Xf*) infection of peach and citrus (Gould et al., 1991; He et al., 2000), and these observations were used as a rationale by Cousins and Goolsby (2010) to initiate examination of five grape rootstocks for potential to reduce PD symptoms in susceptible scions. The *V. vinifera* selection to be used as an experimental rootstock bears the *PdRI* resistance locus introgressed from 89-F0908 (*V. rupestris* X *V. arizonica*) that is known to confer high levels of PD resistance via reduction of *Xf* population levels (Buzkan et al., 2005; Krivanek et al., 2006; Riaz et al., 2009) and xylem sap from *PdRI* plants reduce growth of *Xf* in culture (Cheng et al., 2009). As the *PdRI* resistant rootstock to be used in these experiments is a second generation backcross with a genetic composition of ~87.5% *Vitis vinifera*, difficulties encountered by Lin and Walker (2004) in establishing sound graft unions between *V. vinifera* scions and rootstocks derived from wild *Vitis* species should be eliminated. The simple experimental design to be used will determine whether or not the *PdRI* resistance factor(s) is (are) capable of systemic protection of tissues beyond the graft union to affect pathogenesis of *Xf* in susceptible scions.

OBJECTIVE

Determine effect of rootstock genetic background (+/- *PdRI*) on disease severity and *Xf* population levels in PD susceptible scions following challenge inoculation of scions with *Xf*.

RESULTS AND DISCUSSION

Data are not yet available for this newly funded project.

CONCLUSIONS

No conclusions may be drawn at this time.

REFERENCES CITED

- Buzkan, N., Kocsis, L., and Walker, M. A. 2005. Detection of *Xylella fastidiosa* from resistant and susceptible grapevine tissue by sectioning and membrane entrapment immunofluorescence. *Microbiological Research* 160:225-231.
- Cheng, D. W., Hong, L., Walker, A. M., Stenger, D. C., and Civerolo, E. L. 2009. Effects of grape xylem sap and cell wall constituents on *in vitro* growth, biofilm formation and cellular aggregation of *Xylella fastidiosa*. *European Journal of Plant Pathology* 125:213-222.

- Cousins, P. and Goolsby, J. 2010. Grape rootstock variety influence on pierce's disease symptoms in Chardonnay. Proceedings, 2010 Pierce's Disease Research Symposium. California Department of Food and Agriculture, Sacramento, CA. pp. 159-160.
- Gould, A. B., French, W. J., Aldrich, J. H., Brodbeck, B. V., Mizell III, R. F., and Andersen, P. C. 1991. Rootstock influence on occurrence of *Homalodisca coagulata*, peach xylem fluid amino acids, and concentrations of *Xylella fastidiosa*. *Plant Disease* 75:767-770.
- He, C. X., Li, W. B., Ayres, A. J., Hartung, J. S., Miranda, V. S., and Teixeira, D. C. 2000. Distribution of *Xylella fastidiosa* in citrus rootstocks and transmission of citrus variegated chlorosis between sweet orange plants through natural root grafts. *Plant Disease* 84:622-626.
- Krivanek, A. F., Riaz, S., and Walker, M. A. 2006. Identification and molecular mapping of *PdR1*, a primary resistance gene to pierce's disease in *Vitis*. *Theoretical and Applied Genetics* 112:1125-1131.
- Lin, H., and Walker, A. 2004. Characterization and identification of Pierce's disease resistance mechanisms: analysis of xylem anatomical structures and of natural products in xylem sap among *Vitis*. Proceedings, 2004 Pierce's Disease Research Symposium. California Department of Food and Agriculture, Sacramento, CA. pp. 22-24.
- Riaz, S., Tenschler, A. C., Graziani, R., Krivanek, A. F., Ramming, D. W., and Walker, M. A. 2009. Using marker-assisted selection to breed Pierce's disease-resistant grapes. *Am. J. Enol. and Vitic.* 60:199-207.

FUNDING AGENCIES

Funding for this project was provided by the CDFFA Pierce's Disease and Glassy-winged Sharpshooter Board.