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Viability and efficacy of Pierce's disease resistant *Vitis vinifera* vines in Georgia

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Objective: Establish multiple Pierce's disease (PD) resistant *V. vinifera* (Vf) grapevine test blocks throughout Georgia at multiple elevations and monitor for resistance to PD and other parameters.

Justification and Potential Benefits:
Georgia's wine grape industry is relatively young. Though Vf vineyards have been in production in Georgia for approximately 35 years, the industry has only shown significant growth in the last 10-15 years. Though Georgia wine grape acreage pales in comparison to that of North Carolina and Virginia, wine grapes and wineries contributed $83 million to the Georgia economy in 2014. Vf vineyards are concentrated in the Valley and Ridge and Blue Ridge geographical regions of North Georgia – areas with limited economic output. The growth of the vineyard industry has had a profound economic impact on the local mountain communities due to both job development and increased local tourism.

Other vineyards, containing muscadine or PD-resistant hybrids, are located throughout the state. These vineyards and wineries have also had an impact on local economies, but there is a desire to further include Vf (traditional European) grapes in these areas, though this is not possible at this time. Further expansion of the wine grape industry in Georgia and the Southeast as a whole is inhibited by PD, caused by the bacterium *Xylella fastidiosa* (Xf), which is geographically limited to areas with mild winters, such as the piedmont and coastal plain regions. Pierce's disease is the principal limiting factor in the production of *V. vinifera*, French-American hybrids and *V. labrusca* in the Southeast. The bacterium, transmitted by insect vectors such as sharpshooters (family Cicadellidae, subfamily Cicadellinae), can kill infected vines in one to two years. Ingested Xf attaches

to the sharpshooter's mouthparts, where it multiplies. Transmission to healthy plants occurs when the infected vector feeds and egests the bacterium into the plant's xylem. Plant symptoms, if any, appear weeks to months later, but ultimately the vine will be killed by constriction of water flow to the vine.

One of the biggest challenges for grape producers is management of PD, even in the areas where Vf production is currently successful. Research has shown that Vf vines experimentally infected with *X. fastidiosa* will become pathogen-free if the vines are subjected to cold temperatures; planting at higher elevations in order to take advantage of colder winter temperatures is one cultural management tool. However, vector management with insecticides is the primary means of controlling the disease at this time. Despite the lower temperatures and use of insecticides, PD continues to plague production in the mountain regions, especially following warmer than average winters. Losses can be significant, with average losses of 2-3 % per year. Since PD also precludes production of Vf grapes to other areas of the state, better methods of management are highly desired.

Figure 1. Leaf symptoms of Pierce's disease of grape in the fall. Pierce's disease of grape, caused by the bacterium *Xylella fastidiosa*, is a major disease of *Vitis vinifera*, French-American hybrids and some other grape species. It limits production of *V. vinifera* grapes to higher elevations in Georgia and the Southeast as a whole, since the bacterium and vectors are reduced in colder climates.

Recently, Dr. Andy Walker (University of California – Davis) has focused his efforts on breeding of grapevines with resistance to PD. Resistance to PD from native grapes has been bred into Vf material. These new PD-resistant breeding selections have a high percentage of Vf parentage, allowing for wine with characteristics of those provided by the European grape. PD-resistant vines could drastically change the vineyard industry in Georgia, as more Vf vines could be planted throughout the state, to include lower elevations, and losses would be reduced in current areas of production as well. The research that Dr. Walker is conducting offers exciting possibilities for Georgia's wine industry, as well as for the entire Southeastern United States. For this reason, it is our goal to establish the first PD resistant Vf vines in Georgia in the spring of 2017. The plans for this project are as follows:

Methods:

1. *Collaboration with Dr. Andy Walker at UC Davis to evaluate Pierce's disease resistant V. vinifera grapevines in Georgia.* Dr. Walker will donate approximately 300 buds from his current stock of 94% PD resistant vines and will help coordinate with a local nursery in California to graft and grow the plants. In addition, we will collaborate with Alabama vineyards to obtain 88% Vf cuttings, which will be bench grafted to select rootstocks ('Dog Ridge', 'Salt Creek', '11-03-P', '101-14', '3309', and/or 'SO4' are potential selections). Vines will be grafted in January/February of 2016 and maintained until shipment in February of 2017.

2. *Establish PD resistant vines at three locations throughout the state, in North, Middle and South Georgia, at privately owned vineyards.* Elevations are approximately 1700, 500 and 100 feet, respectively, for these selected locations. Treatments will consist of two PD-resistant scion selections grafted to each of two rootstocks. Each treatment plot will consist of 10 plants, and four replicates per treatment will be applied to a randomized complete block design. Vineyards will be established in February/March of 2017. Traditional Vf (nonresistant) vines will be interplanted with the PD-resistant vines to both increase disease pressure and as indicator plants for epidemic development. Producers will maintain vines with the same standard production practices utilized for Vf production throughout the Southeast.

3. *Monitor the viability of the vines over the next several years for both resistance to PD at the different locations (elevations and general scion X rootstock performance.* This project will be a long term observational study to evaluate the vines, as we do not plan to inoculate the vines with *Xylella fastidiosa* (PD). Vines will be tested each year for PD, and an overall visual assessment of the health of the plant and fruit crop will be made. Producers will be allowed to make wine from the test blocks, but no measurement of wine quality parameters is currently planned.

Results: We do have three sites available for planting of PD-resistant vines, but due to bureaucratic issues, we have yet to obtain vines from California. We will make a concerted effort to obtain these vines in 2017 and accomplish the objectives of this grant.