Renewal Progress Report for CDFA Agreement Number 18-0306-000-SA

**Project Title**
Geographic distribution of isolate virulence in *Xylella fastidiosa* collected from grape in California and its effect on host resistance

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**Time period covered by the report**
7/01/2018 to 2/22/2019

**Introduction**

Plant pathogens with broad host ranges, like *Xf* if considered at the species level, often rely on multiple virulence and growth factors to colonize their diverse hosts. Though *Xf* was the first plant pathogenic bacterium to have its full genome sequenced, (7,14,15) only a small number of studies have looked at virulence variation (3,4,5,9,12,13). One small study in alfalfa, found significant correlation between genetic relatedness and virulence among 15 strains of *Xf* subsp. *fastidiosa* (3). In grape, virulence studies are lacking, but preliminary data suggest that virulence differences exist in CA. Further evaluation of virulence differences in *Xf* strains from CA is needed to understand the relationship between genetics and virulence.

Virulence comparisons among *Xf* strains are useful to understand the biology of this pathogen. In *Nicotiana tabacum* (tobacco), different subspecies of *Xf* are capable of colonizing and causing leaf scorch symptoms (1,10), and show differences in host colonization and symptomatology (6, 13). The co-PI De La Fuente used tobacco as a model system to understand changes in host mineral and nutrient composition caused by *Xf* infection (13), bacterial gene function (2,11), and impact of new DNA acquired from natural competence and recombination (8). The tobacco system will be used to determine the relative virulence of diverse strains and differential host response. Using tobacco to test multiple strains saves considerable greenhouse space and time, since a typical tobacco virulence experiment from planting to symptoms development takes ~ 3-4 months, half the time required for grapes.

PD resistance has been identified in multiple *Vitis* species. How these sources differ in durability (sustainability of resistance when exposed to multiple strains) of resistance is unclear. A single source of resistance *PDR1* from *V. arizonica*, a wild southwestern grape, has been used to develop high quality wine grapes with PD resistance (breeding efforts by Andy Walker, UC Davis). Table grape efforts also use this same source. Plants with *PDR1* have no disease symptoms and low bacterial populations when inoculated with *Xf*. *PDR1* has maintained efficacy in field trials in Texas and northern California, but its durability to multiple isolates is unclear.

**List of objectives**

**Objective 1:** Evaluate the virulence diversity of *Xylella fastidiosa* strains from California  
   Sub-objective a: Evaluate *Xf* isolate diversity in tobacco  
   Sub-objective b: Evaluate *Xf* isolate diversity in grape

**Objective 2:** Evaluate known grape sources of PD resistance against diverse strains of *X. fastidiosa.*
**Description of activities**

Objective 1: Evaluate the virulence diversity of Xylella fastidiosa strains from California

Sub-objective a: Evaluate Xf isolate diversity in tobacco

- A graduate student has been hired to perform tobacco greenhouse evaluations.

Sub-objective b: Evaluate Xf isolate diversity in grape

- Permit acquired from CDFA to evaluate Xylella-infected plants in the field at the San Joaquin Valley Agricultural Sciences Center, institutional approval has been submitted.
- 900 Cabernet Sauvignon plants have been received from Duarte nursery for field planting and evaluations. Vines are currently being maintained in pots.

![Fig. 1. Cabernet Sauvignon 47 Uber vines received from Duarte Nursery and awaiting planting.](image)

- A field site has been selected, irrigation supplies and stakes ordered (not with CDFA funds), and irrigation is being replaced prior to planting.

Objective 2: Evaluate known grape sources of PD resistance against diverse strains of X. fastidiosa.
- Dormant cuttings have been collected and are being propagated for known sources of PD resistance incl. 8909-08, Tampa, IAC 572, Bo25G, T56, B43-17, and BD5-117 in a growth chamber.

Fig 2. Dormant cuttings planted in a growth chamber

Publications produced
- Presented research updates to the CDFA PD/GWSS board at the December 2018 meeting (oral and poster), and wrote the accompanying proceedings paper

Relevance statement
This project will provide the first look at the durability of host resistance to Xylella fastidiosa in the state of California, aiding breeders in developing resistant cultivars. In addition, this work will expand upon previous work looking at the genetic diversity of Xf to determine if there are differences in the amount of disease that isolates from different areas can cause and its effect on management.

Layperson summary
Plant material has been collected and will be planted this spring for testing.

Status of funds
Funds will be charged, but have not gone through, for the USDA ARS on technical support to collect and propagate cuttings for disease evaluations. Monies for Auburn University are still being processed by the federal government. Extreme delays have occurred due to the agreement not being finalized until the end of the Federal fiscal year (9/18-11/18) and the Federal government shutdown (12/18-1/19). We anticipate money being transferred to Auburn University within another week.

Summary and status of intellectual property
No intellectual property will be generated by this proposal.
Literature cited