

GROUND VEGETATION SURVEYS TO DETERMINE RESERVOIR HOSTS OF *XYLELLA FASTIDIOSA* IN NORTH CAROLINA

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Reporting Period: The results reported here are from work conducted May 2007 to October 2007. The project is not complete; field surveys and laboratory analyses will be conducted in October and November 2007.

ABSTRACT

Ground vegetation surveys were conducted in three North Carolina vineyards to determine plant composition of the vineyard floor and to test for the presence or absence of *Xylella fastidiosa* (*Xf*) in these plants using ELISA and SYBR-Green based quantitative real-time (QRT) PCR methods. Ten out of 27 total plant species surveyed in the spring of 2007 tested positive for *Xf* using ELISA techniques. Analyses using QRT-PCR have not been completed. The fall survey has been completed in two of three vineyards. The results of this project are significant because previous control methods have focused on removing vegetation surrounding NC vineyards. This is the first research in NC to provide evidence that *Xf* is present on reservoir hosts within the vineyard. This work will establish the first official plant host list for *Xf* in North Carolina.

INTRODUCTION

Xf is found commonly among vegetation in the southeastern US, where the bacterium is native (Hopkins 1989). However, no official reservoir host list for *Xf* has been developed for North Carolina, where the wine industry has more than doubled from 2002 to 2007 (North Carolina Winegrowers Association 2005). It is common for NC vineyard managers to allow native vegetation to proliferate on the vineyard floor, or to plant grasses as groundcover. In the past, control recommendations regarding reservoir hosts have focused on removing vegetation surrounding the vineyards. The focus of this project is directed towards identifying potential reservoir hosts of *Xf* within the vineyard, as these plants may be more easily managed to reduce inoculum. It is important to identify plant species that consistently test positive for *Xf* so that control recommendations can include selecting groundcovers that are not among them.

OBJECTIVES

1. Determine the diversity and occurrence of plant species present on the vineyard floor in North Carolina vineyards.
2. Determine the presence or absence of *Xf* in plants collected from the vineyard floor using ELISA techniques and determine *Xf* concentrations found in positive samples using QRT-PCR techniques.

RESULTS

Objective 1

A transect was established near the center of each vineyard by laying a 50m measuring tape at approximately a 45° angle along the vineyard floor. Ten sites 1m in length were selected randomly along the 50 meter transect. At each of these 10 sites, a wooden 1m² frame was placed on the ground and the percentage of each plant species within the frame was estimated and samples of each species were taken. Subsamples were put aside for identification and the samples were ground and tested for *Xf* with ELISA. Subsamples of the ground plant material are in cold storage for later analysis with QRT-PCR. In the spring, two surveys were conducted at each location, with the measuring tape arranged so that the two lines formed an "X" transect along the vineyard floor. For fall surveys, a third transect was added by sampling a straight line approximately 1m from the edge of one outer row of the vineyard. Fall surveys and analyses are still underway. The results reported here are for spring surveys only. Preliminary results from fall sampling, not shown, indicate that vineyard floor composition is significantly different in spring and fall. Vineyard floor composition for each of the three vineyards surveyed is shown below in Figure 1. Species that comprised less than 2% of the vineyard floor are grouped into the category "other."

Objective 2

Samples from each species found were ground and tested for *Xf* with ELISA. Plant species were sampled in proportion to the number of times which they were encountered. For example, for each 1m² block, one sample was taken of each species, therefore many species were recurrent and hence were sampled repeatedly. Ten out of 27 species surveyed in spring tested positive for *Xf* with ELISA. Table 1 shows which species tested positive, the location(s) from which the plants were sampled, the number of positives out of the total number of samples tested, and the percentage of the vineyard floor that is comprised of that particular species.

CONCLUSIONS

The results of this project show that NC growers who allow weeds to develop in the vineyard floor may be supporting *Xf* inoculum within their vineyard. As a result, weed control may become part of a management plan for PD in NC. We have begun preliminary studies to identify a suitable groundcover that is not a reservoir host of *Xf*.

REFERENCES

Hopkins, D.L. 1989. *Xylella fastidiosa*: xylem limited bacterial pathogen of plants. Ann. Rev. Phytopathol. 27:271-90.
North Carolina Winegrowers Association. 2005. The source for information about North Carolina grapes and wine: fast facts. (<http://www.ncwine.org/fastFacts.html>).

FUNDING AGENCIES

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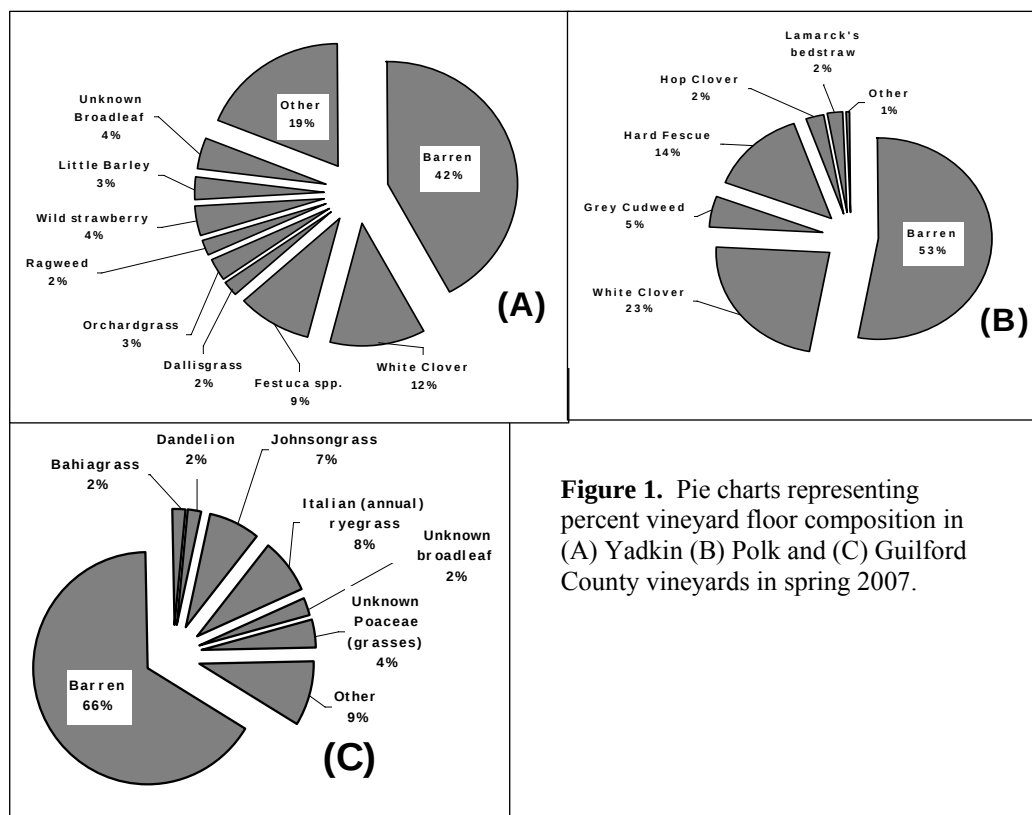


Figure 1. Pie charts representing percent vineyard floor composition in (A) Yadkin (B) Polk and (C) Guilford County vineyards in spring 2007.

Table 1. List of host plants tested for *Xf* from three NC vineyards in Guilford, Yadkin and Polk counties in spring 2007. Red font indicates plants that tested positive for *Xf* with ELISA.

Common Name	Scientific Name	Family	No. Positive/Total Sampled			Percent of Vineyard Floor		
			Guilford	Yadkin	Polk	Guilford	Yadkin	Polk
Bahiagrass	<i>Paspalum notatum</i>	Poaceae	0/4			2%		
Bermudagrass	<i>Cynodon dactylon</i>	Poaceae	1/1	1/1		1%	1%	
unidentifiable broadleaf	--			1/5			4%	
Dallisgrass	<i>Paspalum dilatatum</i>	Poaceae		0/3			2%	
Dandelion	<i>Taraxacum officinale</i>	Asteraceae	0/9			2%		
Fescue	<i>Festuca sp.</i>	Poaceae		1/7			9%	
Rabbitfoot clover	<i>Trifolium arvense</i>	Fabaceae		0/2			1%	
Poverty rush	<i>Juncus tenuis</i>	Juncaceae		0/1			1%	
Greenbriar	<i>Smilax rotundifolia</i>	Smilacaceae		0/3			1%	
Grey Cudweed	<i>Gamochaeta claviceps</i>	Asteraceae			5/11			5%
Hard Fescue	<i>Festuca spp.</i>	Poaceae			2/8			14%
Hop Clover	<i>Trifolium spp.</i>	Fabaceae			2/7			2.30%
Horse nettle	<i>Solanum carolinense</i>	Solanaceae		0/1			0%	
Italian (annual) ryegrass	<i>Lolium multiflorum</i>	Poaceae	0/9			8%		
Johnsongrass	<i>Sorghum halepense</i>	Poaceae	0/10	0/1		7%	1%	
Lamarck's Bedstraw	<i>Galium divaricatum</i>	Rubiaceae			4/4			2.30%
Little Barley	<i>Hordeum pusillum</i>	Poaceae	1/1	0/7		1%	3%	
Orchardgrass	<i>Dactylis glomerata</i>	Poaceae		0/6			3%	
Oxalis, yellow woodsorrel	<i>Oxalis stricta</i>	Oxalidaceae		0/1			0%	
Prairie fleabane	<i>Erigeron strigosus</i>	Asteraceae	0/1	0/1		0%	1%	
Prostrate spurge	<i>Chamaesyce maculata</i>	Euphorbiaceae		0/2			1%	
Ragweed	<i>Ambrosia artemisiifolia</i>	Asteraceae		0/2			2%	
Red Clover	<i>Trifolium pratense</i>	Fabaceae		0/2			1%	
Rough bluegrass	<i>Poa trivialis</i>	Poaceae	1/1			1%		
Smooth hawksbeard	<i>Crepis capillaris</i>	Asteraceae	0/2			1%		
White Clover	<i>Trifolium repens</i>	Fabaceae		1/14	5/18		12%	23%
Wild Garlic	<i>Allium vineale</i>	Alliaceae		0/4			1%	
Wild Strawberry, Indian Strawberry	<i>Duchesnea indica</i>	Rosaceae		0/3			4%	