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Viticulture Notes

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I. Current situation

Virginia was on the southern edge of the recent incursion of a polar vortex that brought record lows to some areas of the Midwest and Northeast. By virtue of our more southerly latitude, low temperatures on the mornings of 31 January and 1-2 February generally stayed above critical temperatures for most of the commonly grown varieties. We did see and hear of temperatures of around -2°F in Loudoun County and Dulles Airport, and we got to around 1°F here at the AREC. Areas south of us were somewhat warmer, and were in double-digits in the Richmond area. While this bodes well for most of our varieties, I would encourage you to check buds and cane tissues for evidence of cold injury before you complete pruning. We had ample cold weather before the late-January episode to promote mid-winter cold hardiness, but Merlot, Tannat, Nebbiolo, Vermentino and any other variety that we would consider to be particularly cold-tender might have sustained some level of bud kill or vascular damage. Extra buds can be retained at pruning to compensate for those killed by winter injury. Assessment and compensation methods are found in our Wine Grape Production Guide, but there are also lots of web-based resources, including this eXtension site: https://articles.extension.org/pages/63372/cold-injury-in-grapevines

One Frederick County grower mentioned that he had seen some cordon splitting in Cabernet franc over the past week or so. We would generally consider Cab franc to be among our more cold-hardy vinifera varieties, so the combination of that variety and the temperatures in this area only dipping to around 0°F makes it surprising that he's seeing cracking, which often occurs as dead or dying wood begins to dry. I don't doubt that the cordons are cracking, but it might be that the injurious event with these vines occurred much earlier, possibly last winter. In any event, a recipe for cordon and possibly trunk retraining.

II. Pest management news:

The 2019 **Pest Management Guide for Commercial Vineyards** can now be found on-line. It can be accessed and downloaded directly at:
https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/456/456-017/ENTO-290C.pdf
The "PMG" is a comprehensive listing of chemical pest management strategies for commercial vineyards, covering insects, mites, diseases and weeds. Both the PMG and Dr. Mizuho Nita's Disease review (http://grapepathology.blogspot.com/) are well worth reviewing. Each year is different in terms of pest pressure, new materials that are registered, and some older ones that may be voluntarily cancelled or fall from favor for one or more reasons.

The **2019-2020 WineGrape Spray Guides** from VineSmith are hot off the press! This set of unique at-a-glance posters contains all the information you need to quickly and easily select the best fungicides, insecticides and herbicides for your vineyard. These posters will save you countless hours of time planning and tracking your spray program. To purchase your set of Spray Guides or get more information, please visit www.vinesmith.com/spray-guides

Here's what's new in the 2019-2020 edition:

- 10 new fungicides
- 4 new insecticides
- 1 new herbicide
- 1 new pest: Spotted Lanternfly
- spray adjuvant requirements for each product
- formulation for each product to aid in planning tank-mixes
- regional restrictions for each product

III. North American Grapevine Yellows: new leads on an old disease

We recently published a research article on a leafhopper vector that has the capability of transmitting a pathogen that causes North American Grapevine Yellows (NAGY) into an artificial assay to test vector capacity. This is not quite the same as demonstrating the capacity to transmit NAGY pathogens under field situations, but it points in that direction. The paper was published online in January in the Journal of Insect Science. As an open-access journal, you can read the article here: https://academic.oup.com/jinsectscience/article/19/1/1/5271163

North American Grapevine Yellows (NAGY) is one of many "Grapevine Yellows" diseases that occur worldwide. Other versions of this disease include *Flavescence dorée* and *bois noir* in Europe and Australian Grapevine Yellows. We recognized NAGY in Virginia vineyards in the late-eighties and, with VA Wine Board and other funding, conducted multi-state surveys and insect transmission studies from 2000 – 2006. Following a surge of NAGY in 2011-2012, a renewed effort was made to identify NAGY vectors in Virginia Vineyards. We summarized our knowledge (and lack thereof) of

this lethal disease in a 2013 publication (https://tinyurl.com/ybmhv5nk). At that point, we knew much about the variety susceptibility to NAGY; Chardonnay, for example is particularly susceptible, while hybrid varieties rarely show symptoms. We knew that vineyards that were situated in close proximity to upland, deciduous, mixed vegetation forest were particularly at risk; the presence of wild grapevines and certain *Prunus* species were implicated as potential alternative hosts for the NAGY pathogens. Working with colleagues at the USDA/ARS, we also learned more about the taxonomy of the pathogens that cause NAGY. And while we found circumstantial evidence for certain insect vectors, we were not able to demonstrate repeatable transmission of the NAGY pathogens by any one insect species. The uncertainty of vector(s) made it difficult to recommend an environmentally-sensitive management program for NAGY.

This article is intended to highlight some of the research that we conducted between 2013 and 2018, and illustrate where some of the missing information is coming into focus.

First, some basics. NAGY symptoms include leaf reddening in red-fruited varieties, leaf chlorosis in white-fruited varieties, downward rolling of leaf margins, dieback of shoot tips, abortion of fruit clusters throughout the season, and non-uniform maturation of shoot stem periderm. Depending on variety, NAGY-affected vines often die within two or three years of symptom onset. Although there are common symptoms of all “grapevine yellows” diseases, the specific pathogens, vectors, and alternative hosts often differ among these diseases, reflecting the different ecological conditions and geographic regions where the diseases occur. NAGY and other yellows diseases are caused by specialized bacteria called phytoplasmas. Unlike most bacteria, phytoplasmas can not be artificially cultured outside of living hosts. Studying phytoplasmas and proving their role in causing disease is therefore difficult, and requires a reliable reservoir of phytoplasmas in a host that allows the multiplication of the phytoplasmas but is not killed by the pathogen. The causal role of phytoplasmas is therefore usually inferred by the presence of specific phytoplasmas in Grapevine Yellows-affected vines. Detection of phytoplasmas today is a forensic exercise: DNA is extracted from affected grape or suspect insect tissues, or artificial transmission media, and is subjected to PCR amplification using nucleotide primers that are specific for phytoplasmas, and specific for the phytoplasmas identified in NAGY-affected vines in Virginia. Samples that produce “positive” results in the sense of DNA amplification by the NAGY-specific primers, are then subjected to nucleotide sequencing to confirm if the sample contained DNA of the NAGY phytoplasma.

Grapevine yellows diseases require certain conditions, including susceptible hosts, one or more causal pathogens, effective vectors, and possibly alternative host plants to maintain a reservoir of the pathogens. *Flavescence dorée*, for example, is believed to have rapidly spread among French vineyards as a result of the importation of an effective insect vector, *Scaphoideus titanus*, from North America. Although what we now call NAGY was observed in Virginia as early as the 1980s, the ecology and epidemiology of NAGY is still an incomplete story.

So, we hired an entomologist, Dr. LeAnn Beanland, in 2000 to focus on potential insect vectors of NAGY. Leafhoppers and planthoppers were a logical starting point of investigation due to their

known role in other yellows diseases. Part of LeAnn's work involved surveys of NAGY-affected vineyards in Virginia, Pennsylvania and New York, while another aspect of the work involved attempted transmission studies with commonly found leafhoppers. LeAnn found a diverse range of leafhoppers and planthoppers. Three leafhopper species, *Scaphoideus titanus*, *Osbornellus auronitens*, and *Jikradia olitorius* (currently, *J. olitoria*), exhibited seasonal movement into vineyards from nearby wooded areas that could explain the clustering of infected vines near the vineyard edge that we often observed. In addition, *Graminella nigrifrons*, *Macrosteles quadrilineatus* and *Deltocephalus flavicosta*, which are recognized phytoplasma vectors in other non-Vitis yellows diseases, were also abundantly collected. Testing of leafhoppers found in and immediately outside NAGY-affected vineyards in Virginia occasionally produced positive PCR results for phytoplasmas detected in cultivated vines; however, actual transmission attempts were inconclusive.

We were able to employee LeAnn for about 4 years and published her work in 2006 (Beanland et al. 2006). We discontinued the NAGY work after that until 2011, when a surge in NAGY-affected vines was observed in Virginia. Again with Wine Board funding, we hired Dr. Teresa Steopler in March 2012 to take another look at potential NAGY vectors, again focusing on leafhoppers and some planthoppers. Teresa conducted extensive vineyard surveys and over 2000 individual insect transmission assays from 2012 through 2014. These assays consisted of allowing insects to feed on a small quantity of sucrose solution, and then testing the sucrose solution for the presence of NAGY phytoplasmas. The premise with this assay is that if the leafhoppers harbored phytoplasmas in their salivary glands, some phytoplasmas would be secreted into the solution – much like into a grapevine leaf – in their feeding. It's not quite the same as using a test plant, but it's a rapid screening tool that has been used with other phytoplasma-caused diseases. Both Drs. Stoepler and later Paolo Lenzi, who continued the work from 2014 through 2016, made progress on understanding more about the ecology of NAGY and revealed that one leafhopper in particular, *Jikradia olitoria* (Figure 1) was capable of transmitting NAGY phytoplasmas into the artificial feeding solutions.

Figure 1. Jikradia olitoria (credit, Maryland Biodiversity Project).

With the help of our laboratory research specialist at the AHS Jr AREC, Dr. Diana McHenry, we've been able to continue some of the transmission studies in 2017 and 2018, even though we were not operating a funded research project. The most recent years' results have reinforced what we saw in earlier years.

Jikradia olitoria (AKA, *Coelidia olitoria*) has been in Virginia for a long time – certainly longer than we've been growing *V. vinifera* vines here. It was first described in 1830 and was abundantly found in a comprehensive survey of leafhoppers published in 1927.

To summarize our efforts since 2012, with over 2,000 individual insect transmission attempts, and the testing of 49 different leafhopper species, *J. olitoria* was the only species tested that was capable of transmitting the NAGY phytoplasma pathogen through feeding. We also gained circumstantial evidence through survey work (see the Journal of Insect Science paper) that the incidence of *J. olitoria* in vineyards had a positive relationship with the incidence of NAGY vines in those the surveyed vineyards. *Jikradia* presumably overwinters as eggs in vegetation predominantly outside the vineyard. LeAnn Beanland reported a seasonal movement of *J. olitoria* into the vineyard starting in mid-summer (July) and extending into October (Beanland et al., 2006). We saw a similar, seasonal movement into the vineyard in our more recent survey work of 2015 – 2018. Some growers, particularly in northern Virginia and the northern Shenandoah Valley have attempted to use insecticides more frequently in order to target leafhopper vectors of NAGY. While we can't at this point confidently state that *J. olitoria* is the only potential vector of NAGY phytoplasmas, it might be tempting to focus insecticides more towards the mid- to late-summer period of the season if NAGY is a serious issue in your vineyard. We are currently updating the Cooperative Extension bulletin on North American Grapevine Yellows to include several strategies for potentially reducing NAGY incidence in vineyards.

I would be happy to assist growers who might want to deploy yellow sticky trap cards this summer and start to survey their vineyards for *J. olitoria* activity. The adult insects are about 10 mm long, fairly "robust" looking, and fairly easy to identify with their two transverse, opaque bands across the wings (Figure 1). You can find lots of images online (see additional images here: https://www.marylandbiodiversity.com/viewSpecies.php?species=11694). While it's a fairly common leafhopper from mid-summer on, it's much easier to find in wild grapevines and other vegetation outside the vineyard than inside the vineyard.

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Beanland, L., Noble, R. and Wolf, T K. 2006. Spatial and temporal distribution of North American Grapevine Yellows disease and of potential vectors of the causal phytoplasmas in Virginia. Environ. Entomol. 35:332-344.

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Upcoming Vineyard Meetings:

21-23 February 2019	Winter Technical Meeting- Virginia Vineyards Association
	https://virginiavineyardsassociation.org/?
Friday, March 01, 2019	Dormant Pruning Workshop
	Hamlet Vineyards, Bassett VA
	Free, registration required: https://www.eventbrite.com/e/dormant-pruning-workshop-for-vineyard-growers-tickets-55660249304
19-21 March 2019	Eastern Winery Exposition
	Syracuse NY
	https://easternwineryexposition.com/
Save the date	
Monday, March 18, 2019	Vineyard IPM Meeting
	Horton Vineyards

Review of upcoming VVA meeting (22-23 February 2019)

The annual Virginia Vineyards Association's winter technical meeting (22-23 February) is fast approaching and we hope to see you there. The program includes a pre-conference pruning workshop as well as a grape disease workshop conducted by Dr. Mizuho Nita. Registration and lodging (Omni Hotel, Charlottesville) information is available on-line at the Virginia Vineyards Association website (https://virginiavineyardsassociation.org/?). Major themes this year include:

- a review of the 2018 season (painful but necessary catharsis in anticipation of better seasons ahead)
- Climate forecasts for Virginia's agriculture (this will set the stage for a panel discussion on winter injury avoidance and compensation tactics
- Lots of local research updates (mealybugs, fruit exposure to enhance grape-derived aromas, ripe rot, GeoVine GIS tool upgrades, nitrogen fertilizer trials, and more)
- A diverse "regulatory compliance" panel session
- Winemaker's Research Exchange (WRE) discussions, tastings, and more discussions
- Interaction with vendors and fellow winegrowers