DOES SPOTTED LANTERNFLY PHLOEM-FEEDING HAVE DOWNSTREAM EFFECTS ON WINE VOLATILES? PRELIMINARY INSIGHTS INTO COMPOSITIONAL SHIFTS

Authors: Andrew HARNER[1*], Suraj KAR[1,2], Zeke WARREN[1], Misha KWASNIEWSKI[1], Michela CENTINARI[1]

[1]Penn State University, University Park, PA 16802, USA
Current Address: [2]Oregon State University, Corvallis, Oregon, USA
*Corresponding author: adh5238@psu.edu

Abstract:

Context and purpose of the study – The Spotted lanternfly (SLF), first detected in the U.S. in 2014, is an invasive phloem-feeding planthopper that poses a growing threat to grape and wine production in the U.S. In Pennsylvania, where it was first detected, reductions in grapevine production and fruit quality have been reported by commercial growers. Recent advances have begun to elucidate how SLF affects grapevine physiology and resource allocation, but no research has identified how SLF affects wine chemical composition and quality. Documented reductions in fruit sugar allocation due to heavy SLF phloem-feeding may have downstream effects on wine fermentation dynamics. Additionally, secondary metabolic responses stimulated by SLF may also influence berry chemical composition. The present study investigated SLF-mediated effects on wine composition through analysis of the volatile composition of wines produced from white- and red-fruited varieties of different *Vitis* parentage (e.g., *Vitis vinifera* vs. interspecific hybrids) following prolonged exposure to adult SLF phloem-feeding.

Material and methods – In 2020 and 2021, mature grapevines grown in a vineyard in Coopersburg (PA, USA) were exposed to different population densities of adult SLF ranging from 0-15 insects/shoot for about 30 days during the fruit ripening period. In 2020, we used 16 Riesling (*Vitis vinifera*) vines, while in 2021, 10 Cabernet Franc (*Vitis vinifera*) and 10 Noiret (*Vitis* hybrid) vines were used. All clusters per vine were harvested and fermented in triplicate as microvinifications in 50 mL centrifuge tubes. Wine volatile composition was analyzed using HS-SPME-GC-MS and XCMS Online was used to identify metabolite features (e.g., m/z at definite retention times corresponding to potential compounds). Compounds were identified using spectral data and the NIST spectral database and confirmed by authentic standards.

Results – Using an untargeted metabolomics approach, we identified 289, 231, and 73 features in Riesling, Cabernet Franc, and Noiret wines, respectively, that were significantly correlated to SLF infestation density. These features were used to identify 14 compounds in Cabernet Franc wines, 12 in Riesling wines, and 5 compounds in Noiret wines that were affected by prolonged SLF phloem-feeding. Most of the compounds identified thus far are fermentation-derived volatile esters and alcohols, suggesting that SLF phloem-feeding may be predominantly affecting wine volatile composition by altering primary fermentation dynamics. This may be a consequence of reduced fruit sugar accumulation, as juice total soluble sugars tended to decrease with increasing SLF infestation density for all 3 varieties. Additionally, quantification of the concentrations of selected grape-derived volatiles important for Riesling varietal character (e.g., linalool) indicated no relationship with SLF infestation density. While preliminary, these results suggest that SLF-mediated effects on wine volatile chemistry may primarily be a consequence of lowered fruit resource allocation and altered fermentation dynamics, at least within this study.

Keywords: invasive pest, untargeted metabolomics, wine volatile composition