

## P12 – A virus-resistant *Vitis* germplasm

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### Abstract

More than 80 viruses infect grapevines and spread among vineyards and nurseries, singly or collectively. The most prevalent are grapevine leaf roll-associated viruses (GLRaV). Grape breeders and researchers are seeking virus-resistant *Vitis* species and cultivars, a holy grail for them. Although 734 *Vitis* accessions were assessed for resistance against Grapevine fanleaf virus, GLRaV-1 and GLRaV-3 in the 1990s, no virus-resistant germplasms were found. After multiple years of evaluation, we found that a North American grapevine, *Vitis aestivalis* 'Norton', is resistant to Grapevine vein clearing virus (GVCoV), a DNA virus spreading in cultivated and native grapevines in the Midwest of the USA. In another project, we infected 'Norton' by graft-transmission with seven grapevine viruses, Grapevine fleck virus (GFkV), GLRaV-1, -2, and -3, Grapevine virus A (GVA), Grapevine Pinot gris virus (GPGV), Grapevine rupestris stem pitting-associated virus (GRSPaV), all of which were infecting 'Kishmish Vatkana' (*Vitis vinifera*) grapevine. Five months later, we applied RNA-seq to compare viral small RNA (vsRNA) composition and genome coverage of the seven viruses in 'Norton' and 'Kishmish Vatkana'. Total vsRNAs of GLRaV-1, GLRaV-2, GLRaV-3, GVA, and GPGV were significantly less abundant in 'Norton' than in 'Kishmish Vatkana', but total vsRNAs of GFkV were more abundant in Norton than in 'Kishmish Vatkana'. vsRNAs of GLRaV-1, GLRaV-2, GLRaV-3, and GVA vsRNAs did not cover their specific viral genome in 'Norton' as fully as in 'Kishmish Vatkana'. vsRNAs of the seven viruses were composed of mainly 21- and 22-nt classes. Quantitative PCR assays showed that GLRaV-1 was not detected in 'Norton'; GLRaV-2, GLRaV-3, and GVA were less abundant in 'Norton'; and GFkV was more abundant in 'Norton' than in 'Kishmish Vatkana'. These results demonstrated that Norton grapevine resists GLRaV-1 and suppresses GLRaV-2, GLRaV-3, and GVA, but supports GFkV in comparison with 'Kishmish Vatkana'. This study revealed complex molecular interactions between grapevines and multiple viruses. We are currently conducting genetic analysis of a selfed 'Norton' population to discover genetic elements conferring resistance to viruses. Norton's broad-spectrum resistance to biotrophic and necrotrophic fungi as well as to multiple viruses merits its use as valuable germplasm in breeding and inspires further study on genetic and molecular mechanisms underlying grapevine virus resistance.

**Keywords:** resistance, virus, grapevine, *Vitis*