GRAPES

Cornell University

Integrated Pest Management

Grapevine Red Blotch Disease

Grapevine red blotch-associated virus

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Introduction

Grapevine red blotch disease (GRBD) is a recently recognized viral disease. It was first described on *Vitis vinifera* cv. Cabernet Sauvignon at the University of California Oakville Research Field Station in 2008, but the causative agent was not characterized until 2012. The disease, GRBD, is caused by a DNA virus named *Grapevine red blotch-associated virus* (GRBaV). Infected red wine grapevines exhibit symptoms similar to those associated with leafroll disease, with red blotches forming on leaves during the later summer months. Fruit ripening issues have been reported in grapevines diagnosed with GRBD. The symptom similarity to leafroll disease and abiotic factors such as nutrient deficiencies, insect damage, or physical injuries makes visual diagnosis difficult and explains the delay in recognition and characterization of the disease.

Causal Agent

The causal agent, *Grapevine red blotch-associated virus* (GRBaV), has a single-stranded circular DNA genome. The virus, GRBaV, is a member of a proposed new genus in the family *Geminiviridae*. It is one of only two geminiviruses currently known to infect woody perennial plants. Within GRBaV, two groups of genetic variants have been identified so far and are being studied to determine their relative virulence, symptomatology and modes of transmission so as to improve risk assessment and disease management.

Symptoms and Impact

Grapevine red blotch disease was first described in California in 2008, but the original source of GRBaV has yet to be determined. Grapevine red blotch-associated virus has since been identified across the United States and in Canada. States with documented infected vines include Arizona, Arkansas, California, Georgia, Idaho, Maryland, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Texas, Virginia, and Washington. GRBaV has been found in red wine grapes, white wine grapes, table grapes, interspecific hybrids, and rootstocks.

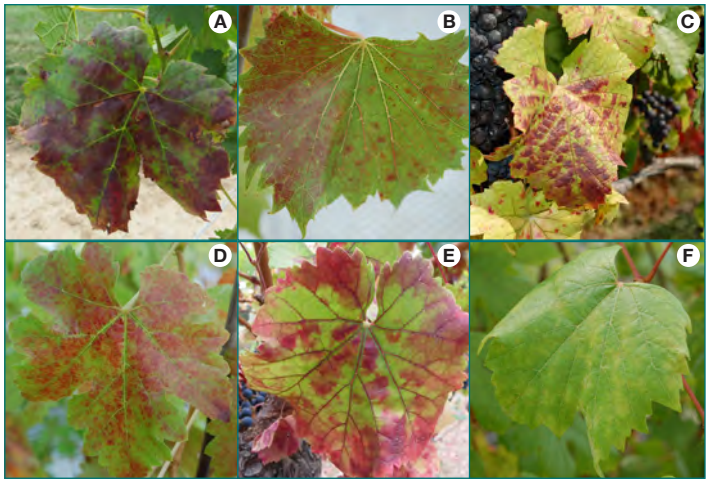

Figure 1. Foliar symptoms of red blotch on 'Cabernet franc' (A), 'Chambourcin' (B), 'Pinot noir' (C), 'Syrah' (D), 'Cabernet Sauvignon' (E) and 'Chardonnay' (F). Photos by M. Fuchs.

Figure 2. A GRBaV-infected 'Cabernet franc' vine exhibiting red blotch symptoms at the base of the canopy (left) and a healthy 'Cabernet franc' vine (right) in August-September. Photo by M. Fuchs.

As suggested by the disease name, red blotches and specks appear on leaves of infected red wine cultivars (Figure 1 A-E), sometimes accompanied by reddening of veins underneath the leaf blade or cupping. In white wine cultivars, foliar symptoms are more difficult to identify and generally involve irregular chlorotic areas sometimes accompanied by cupping (Figure 1F). Later in the season, regions of the leaf blade with severe chlorosis become necrotic. Foliar symptoms first appear on older leaves (Figure 2) at the base of the canopy in June and July and progressively move toward the top of the canopy in later months (Figure 3). Grapevine red blotch disease does not appear to substantially reduce fruit yield (Figure 4A and B, and Figure 5D and E) but does affect fruit quality by altering juice chemistry, and delaying ripening. Reductions in total soluble solids (1° to 6° Brix), and higher malic acid and titratable acidity are consistently reported in infected 'Cabernet franc', 'Chardonnay', and 'Cabernet Sauvignon' vines. In Cabernet cultivars, lower berry anthocyanin and skin tannin content have also been documented.

Transmission and Spread

Because GRBaV has been detected throughout almost all regions of the country in which wine grapes are grown, the likelihood of dissemination via propagation material is high. Although spread of GRBaV by a vector has not been confirmed, the grouping of infected vines in clusters within healthy vineyards adjacent to or near infected vineyards and the increase in number of diseased vines in healthy vineyards over time suggests that a vector is involved in disease spread. Extensive research efforts are ongoing to address spread of GRBaV.

Management

Like for other plant viral diseases, there is no cure for red blotch disease in vineyards. Selection of planting material derived from clean, virus-tested stocks is the best preventative strategy to limit the presence of GRBaV. Ongoing research developments on virus spread and transmission will likely lend insight into additional management options. So far, growers with confirmed, GRBaV-infected vines are culling them and replacing them with clean vines derived from virus-tested stocks.

Figure 3. Red blotch affected vines in a 'Cabernet Sauvignon' vineyard in October-November. Photo by M. Fuchs.

Foliar symptoms of GRBaV strongly resemble symptoms of leafroll disease, mite damage, or even magnesium or potassium deficiency. Symptom ambiguity makes visual diagnosis of infected vines difficult. Therefore, it is imperative to accurately diagnose symptomatic vines for GRBaV using a DNA-based assay to decide on the most appropriate management strategy. This is particularly true for white grape cultivars in which foliar symptoms are indistinct (Figure 1F and Figure 5 A-C) making them best candidates for DNA-based testing for the presence of GRBaV to facilitate management decisions.

Figure 4. Comparative fruit production on a (A) GRBaV-infected and (B) healthy 'Cabernet franc' vine. Photo by M. Fuchs.

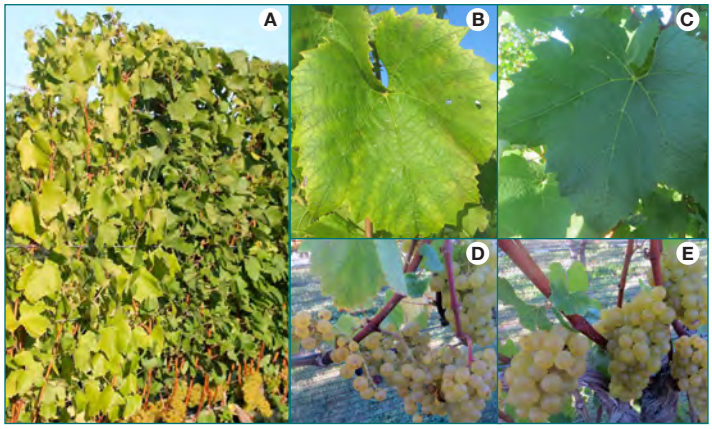

Figure 5. Red blotch disease on 'Chardonnay'. (A) Foliar symptoms on a diseased vine (left) in comparison to a healthy vine (right) (Photo by T. Martinson); close-up of a (B) diseased and a (C) healthy leaf; close-up of fruits from a (D) diseased and a (E) healthy vine. Photos by M. Fuchs.

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