Natural infection of Run1-positive vines by naïve genotypes of Erysiphe necator

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Background. The Run1 (Resistance to Uncinula necator 1) gene is a highly effective control for grape powdery mildew. Discovered in muscadine grapes (Vitis rotundifolia) of the southeastern United States, the gene causes localized cell death at the site of fungal invasion, pre-empting the establishment of an infection. Through breeding, the gene has been incorporated into diverse grape varieties, including cold hardy breeding lines adapted to New York growing conditions. To determine if the resistance provided by the Run1 gene would be stable in commercial vineyards, the breeding lines were tested in Geneva, N.Y, in the center of diversity for the powdery mildew pathogen, Erysiphe necator.

Experimental design. Seeds from a cross including a Run1 gene were obtained from Pál Kozma in Hungary. Seedlings were grown without fungicide control to evaluate resistance to powdery mildew, and the best-performing seedlings were crossed to breeding lines adapted to New York State growing conditions. Over 1000 seedlings were grown and evaluated for disease resistance; 306 resistant lines were then planted to a vineyard for further
evaluation and comparison to susceptible control vines. Vines were rated for disease (percentage of leaf area infected with powdery or downy mildew) for three seasons, in October 2008-2010, and the leaves of infected individuals were collected in October 2010 and incubated in the lab to allow fungal infections to progress. The development of the fungus was observed with a microscope. DNA was isolated from 150 vines to test for the presence of the Run1 gene.

Results and conclusions:

- Powdery mildew infection was lower on Run1 vines (12%) than control vines (100%).
- The average disease severity was also lower on Run1 vines (2.5) than control vines (4.0-4.8).
- Evidence of powdery mildew infection was visible on leaves, petioles and canes (Figure 2).
- Prior to the planting of the test vines in Geneva in 2001, local powdery mildew populations were “naïve”—they had not encountered Run1 resistance—because the gene is only found in muscadine grapes whose range is at least 800 km away. Despite this, within a decade, isolates capable of overcoming the resistance had emerged.
- Even though disease was present on individual leaves, the Run1 vines had full foliage in October, when control vines were defoliated, even without the use of fungicides (Figure 1).

The bottom line. Run1 has significant commercial value in decreasing the need for fungicides in vineyards, but the grape community will need to work together to protect it for future use through breeding strategies, such as the incorporation of additional resistance genes along with Run1, and careful management of disease on Run1 vines.