

Level of Resistance To Necrotrophic and Biotrophic Diseases in Grapes

How does it vary? Is there a correlation between resistance to necrotrophs and biotrophs?

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Introduction:

In the study “Nature of Susceptibility to Helminthosporium Victoriae and Resistance to Puccinia Coronata In Victoria Oats”, S.C. Litzenger found a relationship between susceptibility and resistance to different fungi species in certain oat varieties (1948). However, this correlation has never been documented in grapes. For my research, I attempted to find the relationship between susceptibility and resistance to necrotrophic disease and biotrophic disease in varying grapes varieties. Specifically, how does this relationship differ based on the genetic makeup of the variety? Finding a correlation between varieties and their levels of disease resistance will help breeders make more informed choices when it comes to species selection. Infecting different varieties with various diseases in the lab helps us see how the varieties are affected based on their specific genes.

Questions:

Is there a correlation between different levels of disease resistance?

If a variety is more resistant to a necrotrophic disease, is it less resistant to a biotrophic disease, or vice versa?

If there is a correlation, how can that inform variety breeding?

References:

Litzenger, S. C. (1949). Nature of susceptibility to Helminthosporium victoriae and resistance to Puccinia coronata in Victoria oats. *Phytopathology*, 39(4), 300-318.

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Methods:

Stage 1: Isolating Disease Cultures

Wild grapes from around the Amherst area based on their amount of apparent infection from black rot, anthracnose, and phomopsis, all of which are necrotrophic diseases. These disease samples were then transferred to potato dextrose agar plates. Necrotrophic diseases survive on dead plant tissue and can be replicated in a lab setting. Biotrophic diseases, like downy mildew, only survive on living plant tissue, therefore, they can only be observed in the field. Downy mildew was scored in the Cold Spring Orchard vineyard.

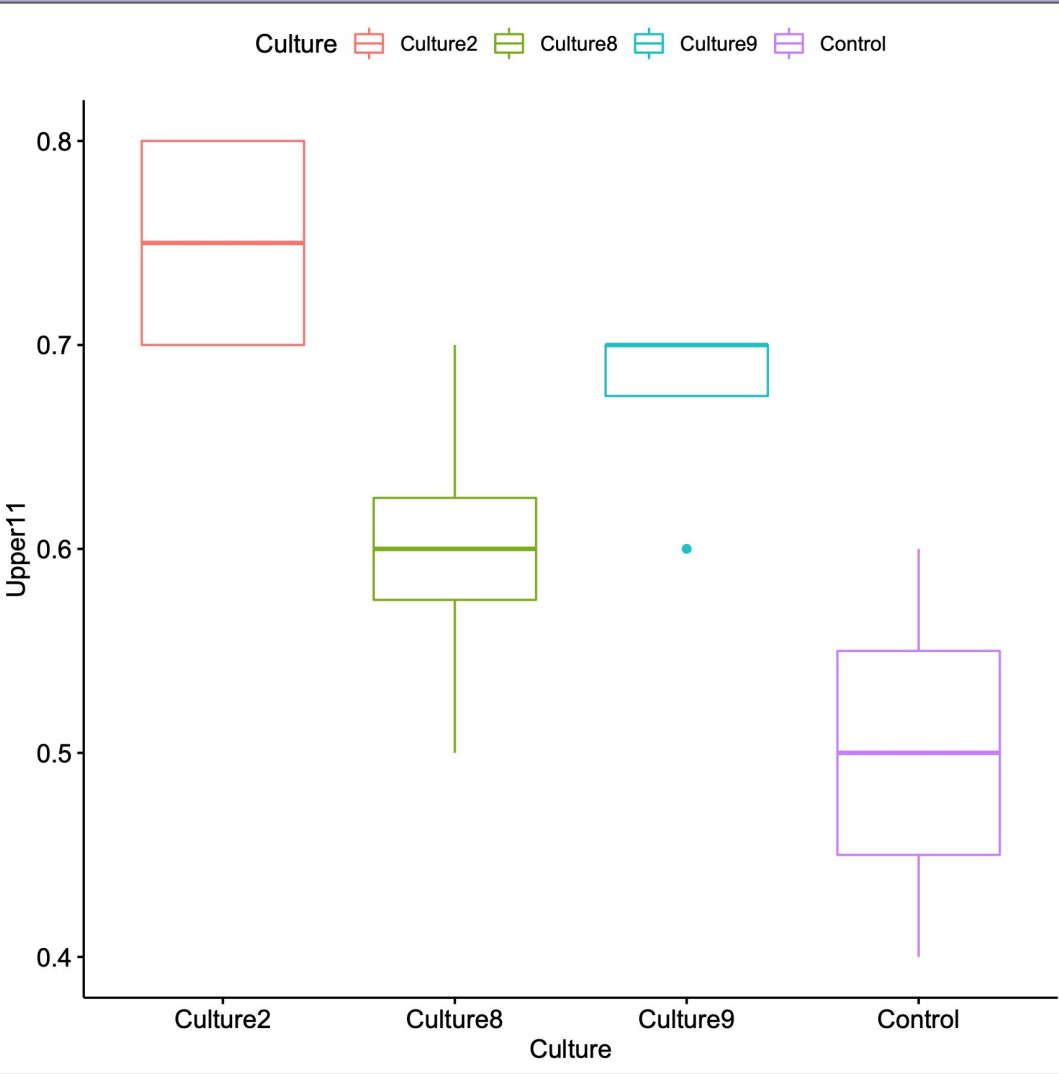
Stage 2: Inoculating Undiseased Leaves

The varieties used to conduct this experiment were decided based on the percent vinifera, riparian, and labrusca of their genetic makeup. The varieties chosen were Riesling, Vidal, Frontenac, Noiret, wild Labrusca, and wild Riparia. Undiseased leaves of each of those varieties were picked and cleaned thoroughly. Once the diseased plates had grown a significant amount, the diseases were inoculated on the clean leaves. These leaves were placed in damp plastic bags to imitate a humid environment for the fungi to grow. These bags were examined every 3-4 days for 14 days and the lesions were measured across the largest area.

Results:

After 14 days, I found that the Vidal variety was the most susceptible to Black rot, the Frontenac variety was most susceptible to anthracnose, and the Noiret variety was most susceptible to phomopsis. Downy mildew was scored using a system of number grade based on what amount of the surface of the leaves were infected and how many leaves out of 100 appear to be infected. Downy mildew is most present in late August and early September due to humidity and dampness. Most of the scoring took place in the fall of 2021. As for the correlation between necrotrophic and biotrophic diseases, we will continue to look into whether there is a relationship. Additionally, we will be continuing our study of the three necrotrophs and how different varieties respond to each based on their genetic makeup.

Most Susceptible to Black Rot

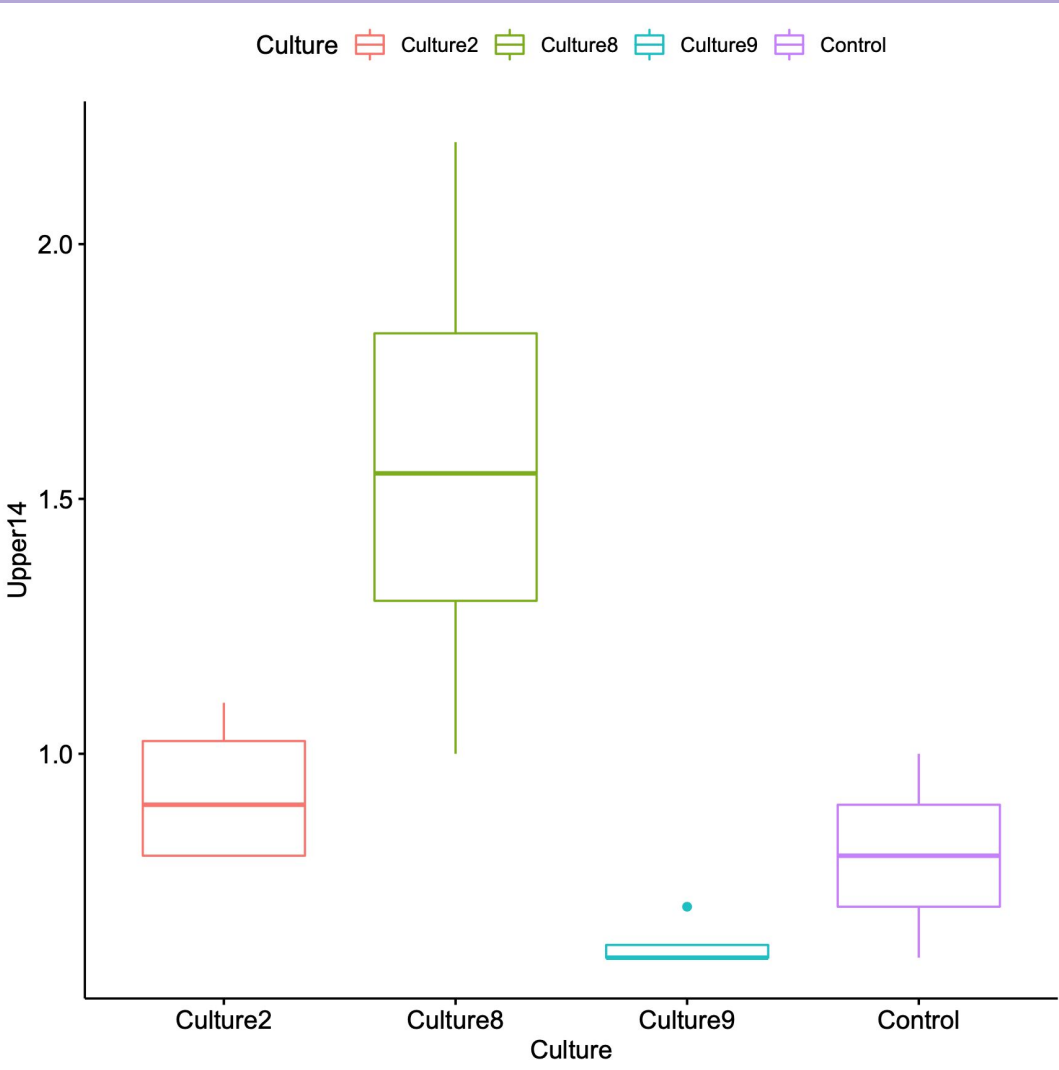


Vidal Variety

Figure 1: Susceptibility of Vidal variety to Black rot, anthracnose, and phomopsis.

The graph to the left shows how the Vidal variety reacted to the three aforementioned diseases. Of all varieties tested, Vidal was the most affected by black rot. Culture 2 represents black rot. Culture 8 represents anthracnose. Culture 9 represents phomopsis.

Most Susceptible to Anthracnose

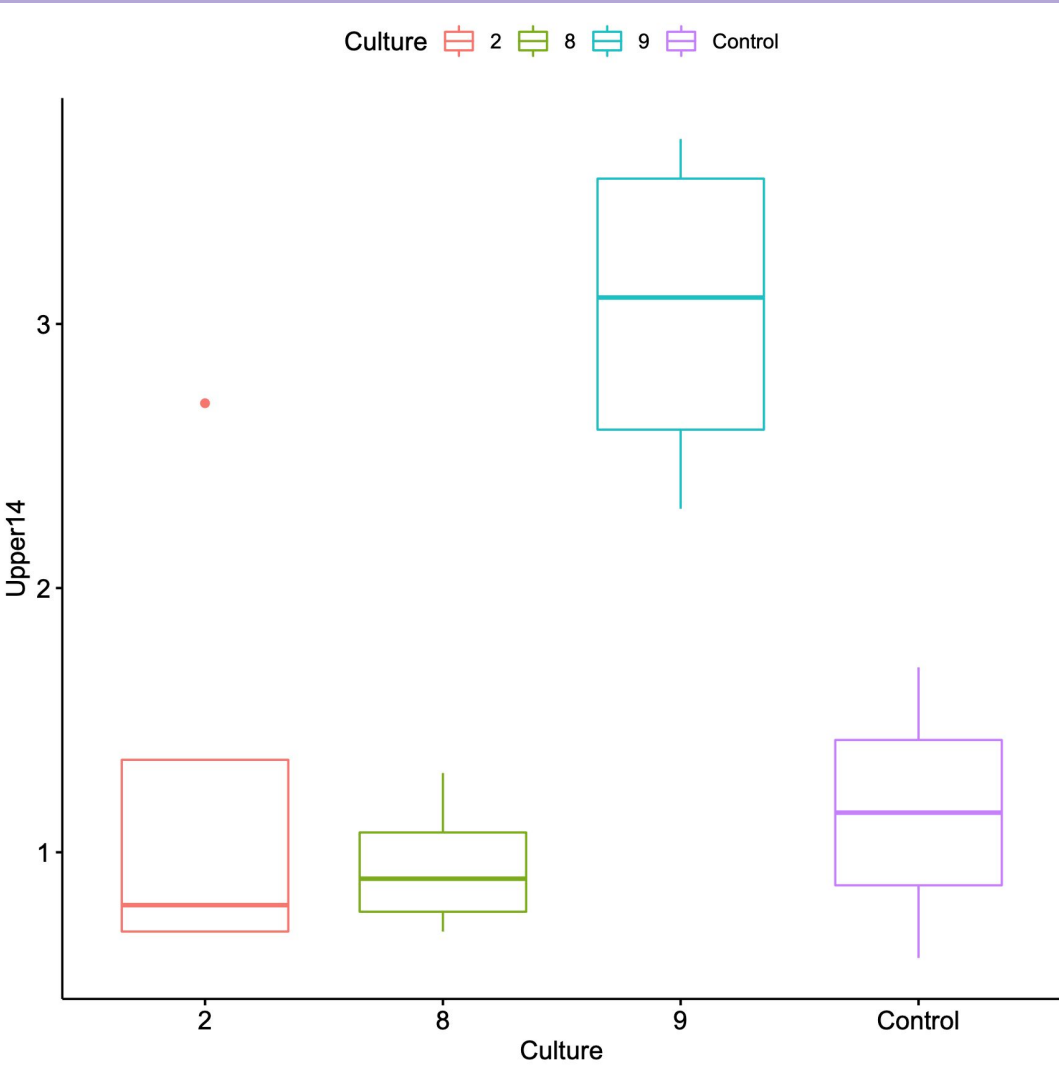


Frontenac Variety

Figure 2: Susceptibility of Frontenac variety to Black rot, anthracnose, and phomopsis.

The graph to the left shows how the Frontenac variety reacted to the three aforementioned diseases. Of all varieties tested, Frontenac was the most affected by anthracnose. Culture 2 represents black rot. Culture 8 represents anthracnose. Culture 9 represents phomopsis.

Most Susceptible to Phomopsis



Noiret Variety

Figure 3: Susceptibility of Noiret variety to Black rot, anthracnose, and phomopsis.

The graph to the left shows how the Noiret variety reacted to the three aforementioned diseases. Of all varieties tested, Noiret was the most affected by phomopsis. Culture 2 represents black rot. Culture 8 represents anthracnose. Culture 9 represents phomopsis.