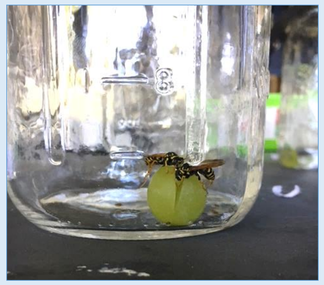
Paper Wasps (*P. Dominulus)* Facilitate Microbial Dispersal and Plant Disease

Sean Boyden ‘17
Mentor: Dr. Philip Starks

Abstract

Sour rot, a microbial disease in grapes, is an insect-transmitted disease with significant impacts on vineyard health and wine quality. Many insect species feed on grape berries, but most studies of the disease have focused on the role of fruit flies in facilitating symptoms and vectoring sour rot pathogen microorganisms. As a result, we are likely failing to recognize additional insects involved in this disease. The European paper wasp *P. dominulus* reaches high abundances in vineyards, but has only been thought to disperse brewing yeast and other helpful microbes. We extended sour rot studies by characterizing the relationship of the paper wasp *P. dominulus* with grape sour rot.



Methods

48 *P. dominulus* wasps were collected from 2 field sites in Lincoln, MA. White table grapes (*V. vinifera*) were purchased (Whole Foods Market, Medford, MA), washed, and placed in 48 sterilized mason jars, one grape per jar. In half of the jars, 2 wasps were placed with the grapes, with the remaining half containing grapes in isolation to serve as matched controls. The jars were maintained for a 13-day period; every 4 days, a portion of the jars were broken down. Grapes were photographed and assessed for disease severity, pH level, and acetic acid content. All wasp and grape samples were stored at -20°C. These data were used to track the development of sour rot over time in both grapes exposed to wasp foraging and grapes in isolation.

Research Question

How does wasp foraging behavior affect the microbial communities of foraged-on grapes over time?

Hypothesis

Interactions between the microbial communities of wasps and grapes due to wasp foraging behavior will lead to the development of sour rot in foraged-on grapes.

Results

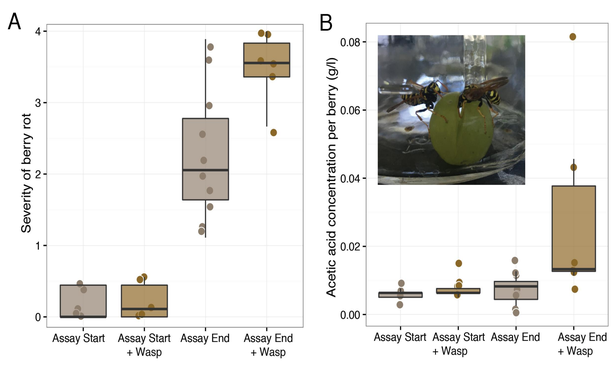


Figure 1. Effect of wasps with native microbial communities on grape berry disease. A.) Wasp foraging increased the severity of disease in injured grapes (Mann-Whitney U, W =9, p-value=0.03, controls: n=10, wasp treatment: n=6). B. Wasp foraging increased the concentration of acetic acid in berries (Mann-Whitney U, W=2.5, p-value<0.01, controls: n=10, wasp treatment: n=6).

Figure 2. Photographs of grapes taken at time of enclosure breakdown. Photographs were rated for disease severity by independent observers.

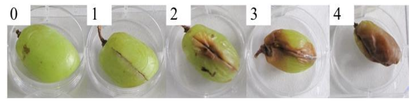


Figure 3. Scale used to rate disease severity of grapes.

- Grapes that were foraged on by wasps had statistically significant higher disease severity scores and acetic acid content than grapes in isolation
- Acetic acid content and disease severity scores increased over time in grapes exposed to wasp foraging behavior

Discussion

The results of this study showed that grapes exposed to wasps developed significantly more severe symptoms of sour rot (visual changes in grapes, increase in acetic acid content in grapes) compared with grapes that were not exposed to wasps. Additionally, disease symptom severity increased over time in wasp-exposed grapes. These results support the hypothesis that *P. dominulus* is capable of facilitating sour rot in grapes through vectoring sour rot pathogens. Genetic sequencing of the microbial species present on the grape and wasp samples may be conducted in future analyses in order to ascertain the mechanism by which these microbial communities interact with one another.

Acknowledgements

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References

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