

Mildew Mania Results 2017

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Introduction

Hello! Thank you so much for all of your help with Mildew Mania this year. In 2017, we had over 2600 students registered to grow barley and help us to investigate barley powdery mildew (*Blumeria graminis* f. *hordei*; *Bgh*) infections across the state. As usual, they did a fabulous job and we'd like to share some of the results that our Mildew Maniac classes contributed to!

This package will provide you with some of this year's results to share, discuss and analyse with your class including;

- **Data From Schools** –Excel spreadsheet containing raw data about which varieties of barley/wheat were infected and a summary of the data. A summary of the demographics of participants is also included here.
- **Laboratory Analysis** (available in alternative formats for High Schools and Primary Schools) –Excel spreadsheet giving an overview of what our scientists found when they took the samples of powdery mildew, cultivated them and tested how well they would infect other types of barley with various resistance genes.
- **Maps showing distribution of infected barley crop** – Included below with interactive versions available on the web
- **Suggested questions to get you started** – The opportunities for data processing and critical thinking are endless but we've provided some questions to get you started. They are included on page 4.

If you're looking for more information on barley and resistance genes have a look at the Department of Agriculture and Food, Barley Sowing Guide for Western Australia, <https://www.agric.wa.gov.au/sites/gateway/files/Barley%20variety%20sowing%20guide%20for%20Western%20Australia%202017%20web%20version.pdf>

Maps

The below maps were constructed from the data summarised in "Data From Schools". They show the location of experiments where:

-  No mildew infection occurred,
-  Infection occurred on Barley only,
-  Infection occurred on Wheat only,
-  Mildew infection occurred on some varieties of barley and wheat
-  Mildew infection occurred on all barley and wheat varieties.

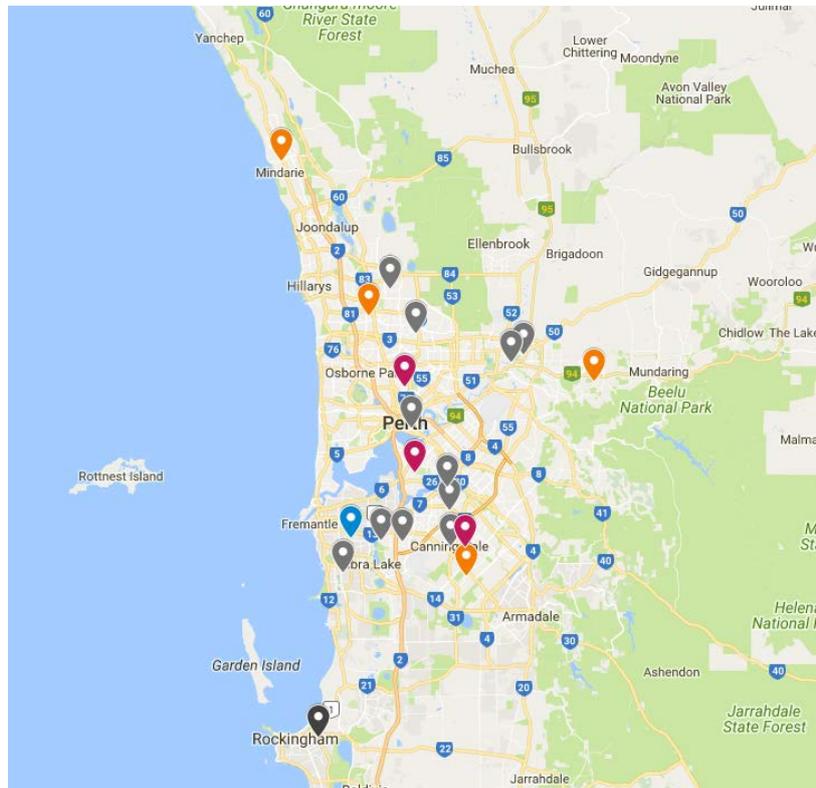
The interactive map can be accessed at:

https://drive.google.com/open?id=1b-eGOs5cd6HSR1vI3h_ddo4FfAsO7n64&usp=sharing

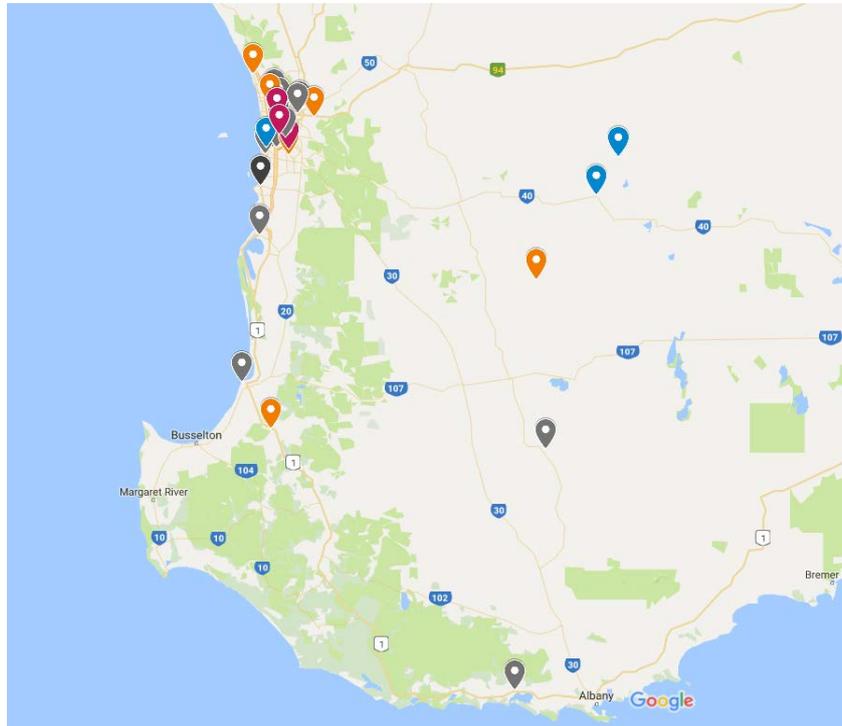
A map of all of the locations of Mildew Mania experiments since the program began in 2011 can be found here:

<https://drive.google.com/open?id=1Pmllzp6zzjh5CUamiAs5IDxbMFx6Je2W&usp=sharing>

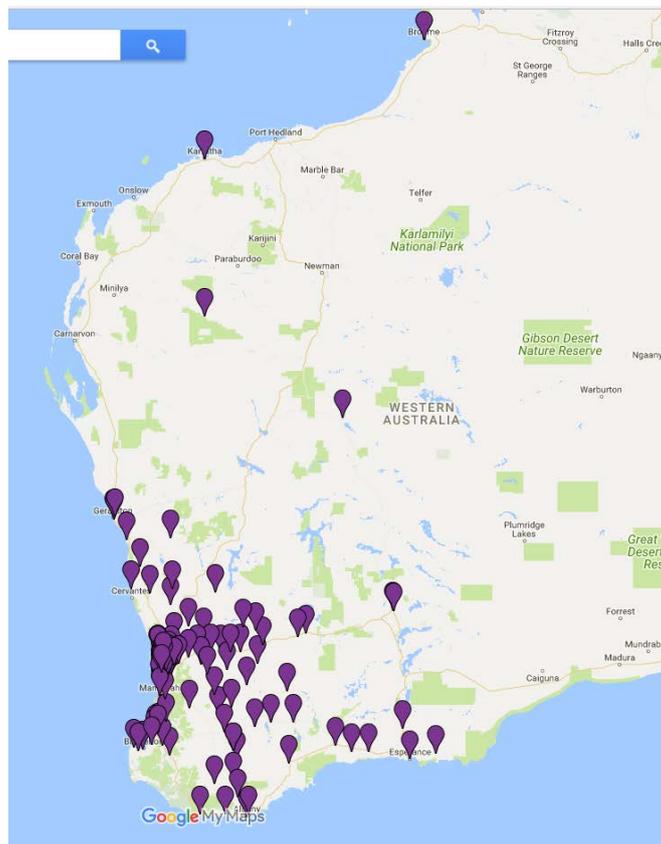
Metro Locations



Regional Locations



Locations of Mildew Mania Experiments 2011-2017



Samples tested

This year we received 53 samples from school, of which 6 were viable for analysis, much lower than usual. Once the viable samples are received by the scientists the spores are propagated many times. Some genes within the barley/wheat are more resistant to different mildew strains than others. The mildew spores were used to infect new seeds of the different varieties with different genes of resistance. The resistance is scored between 0-4 and these are the results you find in the Laboratory Analysis excel spreadsheet.

Questions

Below are some suggested questions to discuss and investigate...

Laboratory Analysis

- a. Only 6 out of 53 samples were viable for testing, what might be some reasons why not all samples were tested?
- b. Which resistance gene is the most effective at stopping Powdery Mildew? (recommended for High School students)

Hint: Which resistance gene has the most 0-1 ratings for all of the different mildew strains?

- c. Which strain of Mildew is the most virulent (is the best at damaging all variations of barley)? (recommended for High Schools students)

Hint: Which mildew strain has the most 3-4 ratings for all of the different resistance genes?

Data from Schools

1. This year, almost half of the classes did not get any mildew growing on any of their barley plants, even those that had reported mildew growing on their plants in previous years. Why do you think there was less mildew growing this year?
2. Hint: It has something to do with the cold winter weather.
3. According to the data from **schools**, which of the 4 varieties of barley that you planted (Baudin, Oxford, Hindmarsh and Flinders), was the most resistant to powdery mildew? Does this differ from the data from the laboratory analysis?
4. Which of the barley was more resistant than the wheat?

How did you help?

We had a chat to Scientist Dr Nola D'Souza to find out how your results have helped the Powdery Mildew of Barley Program. This is what she had to say...

What types of mildew strains are the most useful to receive?

Easy answer: Very virulent mildew strains are the most useful because they provide an insight into how mildew is adapting to the resistance genes that are currently being used in Barley crops. Mildew strains from the resistant barley cultivars you grow are also very useful because they can be the early warning we need that indicates a resistant cultivar is breaking down.

Looking for a bit more science: Mildew isolates with new combinations of existing virulence genes are the most useful as these indicate how the pathogen is adapting to currently grown barley cultivars. Mildew isolates with entirely new virulence genes, which have arisen through mutation and selection pressure also provide an early warning of which barley resistance genes are breaking down because the new powdery mildew virulence genes are effective against them.

What are some of the interesting results that have come from data collected by Mildew Mania Schools this year?

Easy answer: A very low number of samples were returned to us from across the participating schools this year. This was an indication of how the environment and weather patterns can effect pathogen populations. This was a mild year for powdery mildew. Despite this there was still variability in pathotypes, in the mildew seen across WA.

Looking for a bit more science: The mildew isolates collected from schools are important because they are from all over WA and contribute to profiling the powdery mildew population. This includes changes in the distribution of different pathotypes and which pathotypes are becoming more common. The data this year was limited but still variable, indicating the potential for virulence mutation that can overcome resistance genes and be a problem in future years, when environmental variables may be favourable to powdery mildew.

More questions on the next page:

How will the data be used to help improve resistance to powdery mildew?

Easy Answer: The range of mildew samples collected help us find resistance genes that are likely to be more effective at resisting Powdery Mildew in the long run.

Looking for a bit more science: Each year we keep any powdery mildew pathotypes that exhibit variation in virulence to previous years. These cultures represent the current diversity within the powdery mildew populations in WA. These can then be used to screen cultivars to ensure they have resistance to all current isolates. The objective is to find combinations of barley resistance genes that are less likely to break down, remaining durable for longer.

Thank you to everyone who helped us to investigate and combat Powdery Mildew in 2017. We hope you join the program again in 2018 and help us continue this research to help protect Australia's barley and wheat crops!

Register for 2018 at <https://www.eventbrite.com.au/e/expression-of-interest-for-mildew-mania-2018-mapping-powdery-mildew-across-australia-tickets-36920987668>

If you have any questions or feedback please do not hesitate to contact The Mildew Mania team at scienceoutreach@curtin.edu.au

Glossary

Cultivar- a plant variety that has been produced by selective breeding.

Cultivate- grow up, to grow more of.

Mildew isolates- a culture of Bgh isolated for study.

Pathogen- A disease producing agent or microorganism.

Pathotypes- A classification used to group organisms of the same species depending on their ability to cause a disease.

Resistance Gene-Genes bred into a particular crop strain to give it resistance to pests or disease.

Virulence genes – Genes that make a pathogen virulent.

Virulent- The relative ability of a pathogen to cause disease. The more virulent a strand of Bgh the more dangerous and damaging it is.