

# Mildew Mania Results 2016

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## Introduction

Hello! Thank you so much for all of your help with Mildew Mania this year. In 2016, we had over 1800 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 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 untreated Baudin only,
-  Mildew infection occurred on some varieties of barley, and
-  Mildew infection occurred on all barley varieties.

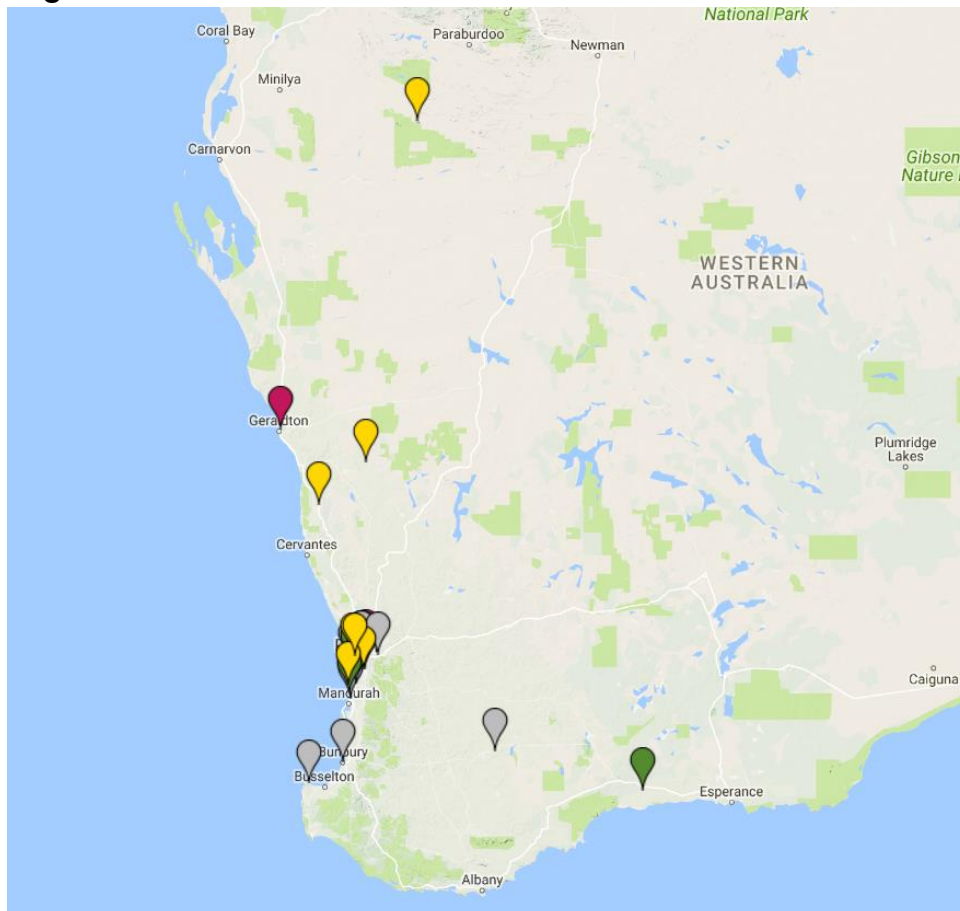
The interactive map can be accessed at:

<https://drive.google.com/open?id=1H1XpgM-tmiCUnZRGHDw3lACxr7g&usp=sharing>

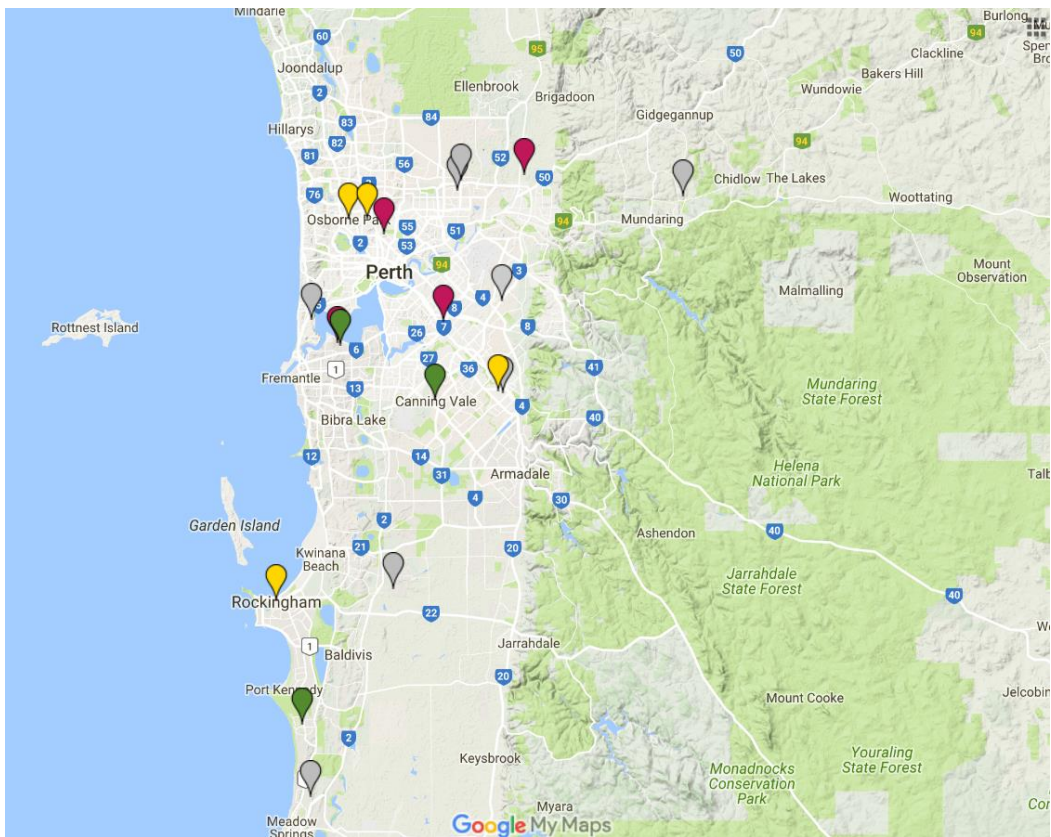
A map of all of the locations of Mildew Mania experiments since the program began in 2011 can be found here:

<https://drive.google.com/open?id=1Sh1-1Fg8Qmq16i-O-tWeT3MakbQ&usp=sharing>

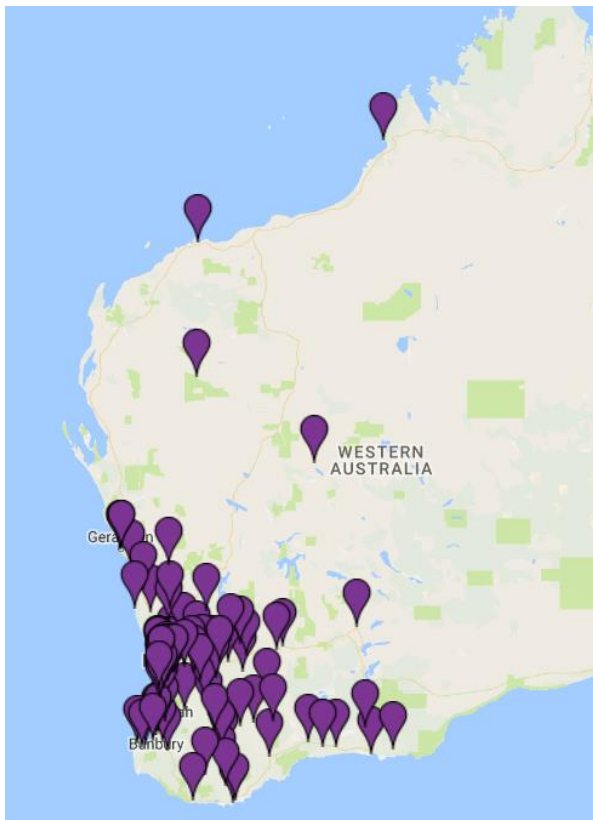
### Regional Locations 2016



## Metropolitan Locations 2016



## Locations of Mildew Mania Experiments 2011-2016



## Questions

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

### Laboratory Analysis

1. 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?

2. 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?

- 3a. According to the data from the **laboratory analysis**, which of the 4 varieties of barley that you planted (Baudin, Oxford, Hindmarsh and Flinders), was the most resistant to powdery mildew?

- 3b. How does this match up with resistance ratings given in the Barley variety sowing guide?

Extension for High school students: Differences in Mildew Mania results and variety guides might indicate that mildew pathogen is becoming more virulent (i.e. overcoming barley resistance genes). What environmental and host-pathogen interactions might contribute to spread of more virulent powdery mildew isolates?

Hint: Selection pressure favouring spread virulent pathotypes (high density of the same barley variety being cropped in WA); rapid lifecycle of powdery mildew; long distance of spore dispersal via the wind.

### Data from Schools

- b. 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?

Hint: It has something to do with the cold winter weather.

- c. 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?
- d. Did the fungicide Jockey have a very big impact? Why/ why not?

## How did you help?

We had a chat to program leader Dr Simon Ellwood to find out how your results have helped the Powdery Mildew of Barley Program. This is what he 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 crop.

**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. Entirely new virulence genes also provide an early warning of which cultivars which contain resistance genes the new virulence genes are effective against are likely to become susceptible.

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

**Easy answer:** This year's data shows that there is a huge variety 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 continues to show that many pathotypes of mildew are found far and wide across WA.

### **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:** The diverse mildew isolates collected are used to screen cultivars that have resistance to all current isolates. The objective is to find resistance genes less likely to break down.

**Thank you to everyone who helped us to investigate and combat Powdery Mildew in 2016. We hope you join the program again in 2017 and help us continue this research to help protect Australia's barley crops!**

**Register for 2017 at <https://mildewmania2017.eventbrite.com.au>**

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## 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.