

# Raman Spectroscopy to Investigate Oak Powdery Mildew-Oak Leaf Interactions

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## Background and Aims:

Oak powdery mildew is a foliar fungal disease affecting oak trees across the UK, threatening young trees and forest regeneration.

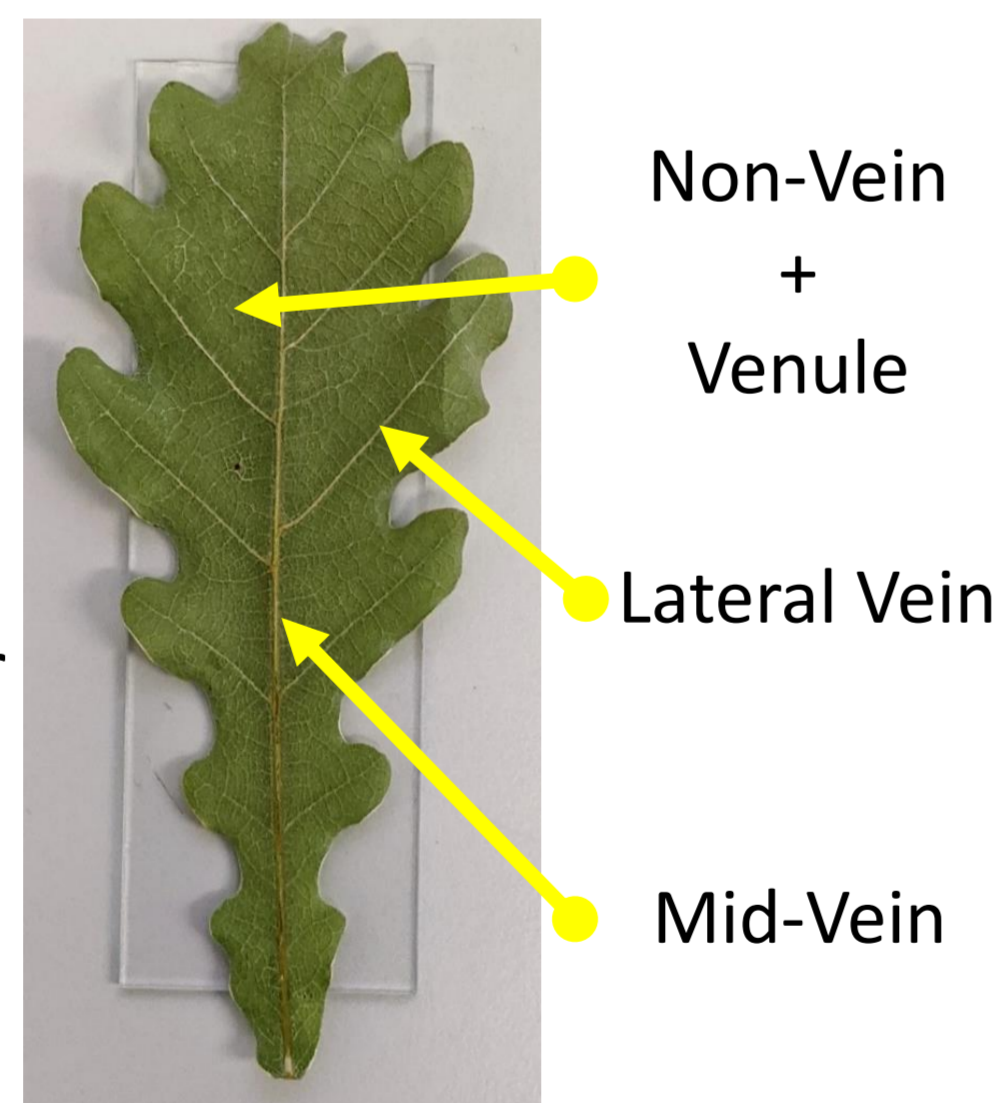
Raman spectroscopy is a non-destructive analytical technique which can provide insights into pathogen-host interactions.

This study aims to develop a Raman spectroscopy procedure to probe healthy and infected oak leaves to further understand these interactions. Once this is known, it will provide tools to allow more effective management of oak powdery mildew in nurseries and forests.

## Method:

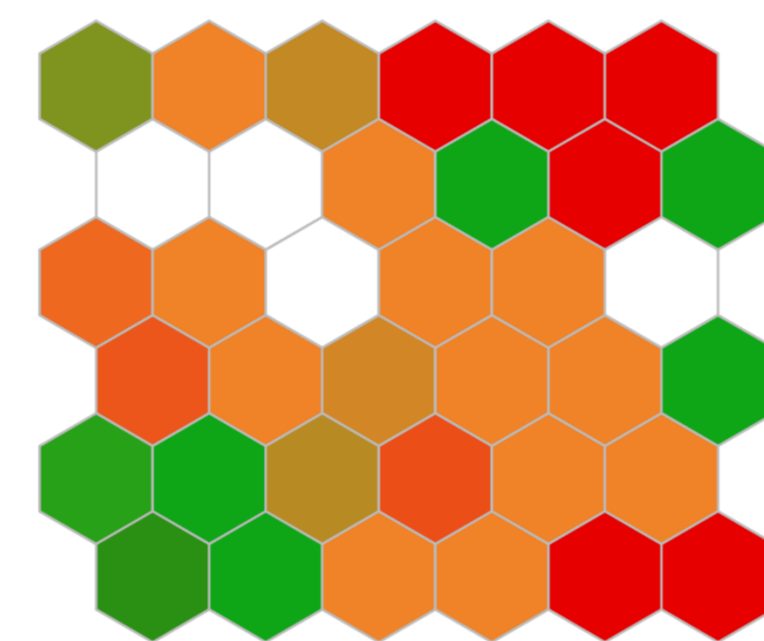
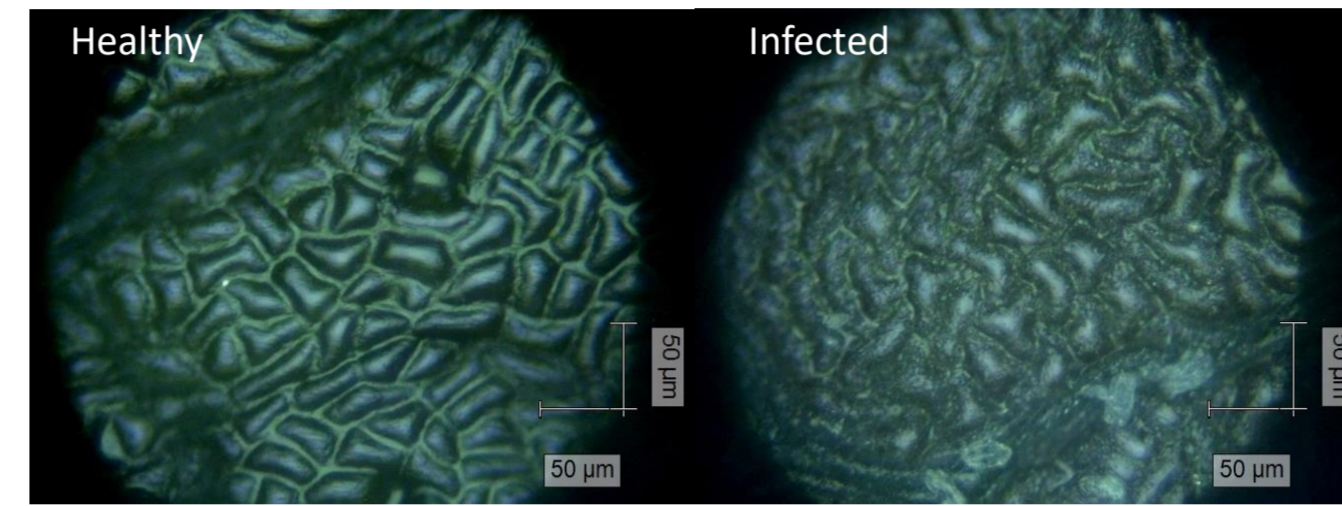
Leaves were mounted onto glass slides and placed into the Raman microscope.

Areas of non-vein, venule, lateral vein and mid-vein tissue were identified under x20 magnification on the adaxial side of the leaves and measured with an 830nm laser.

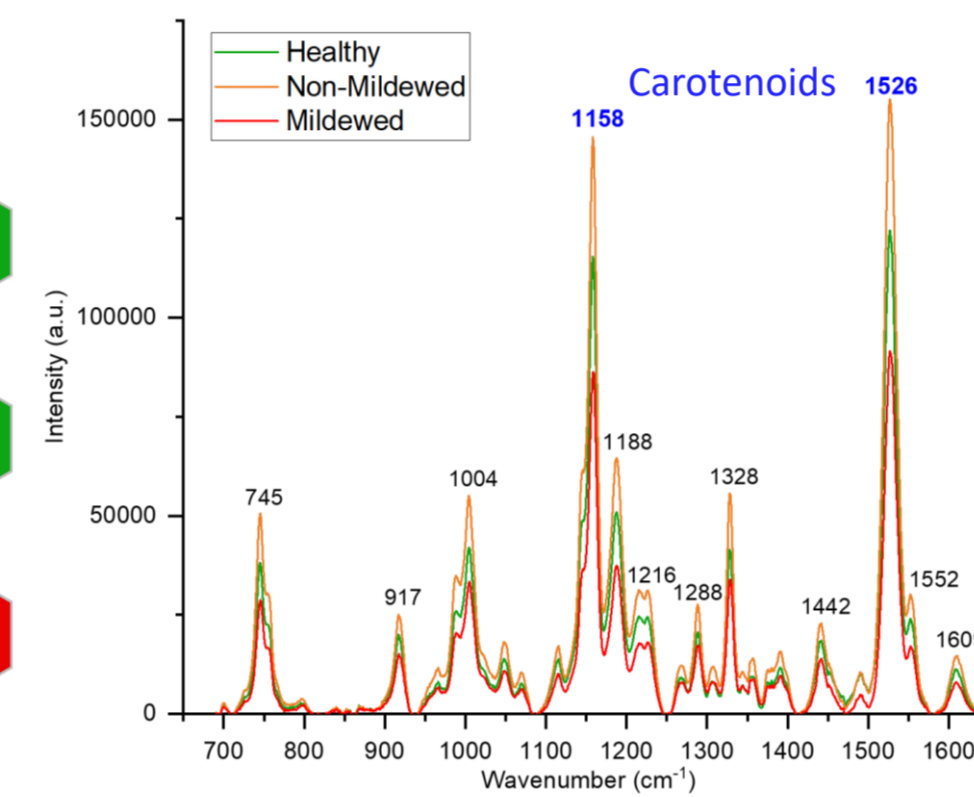


## Results

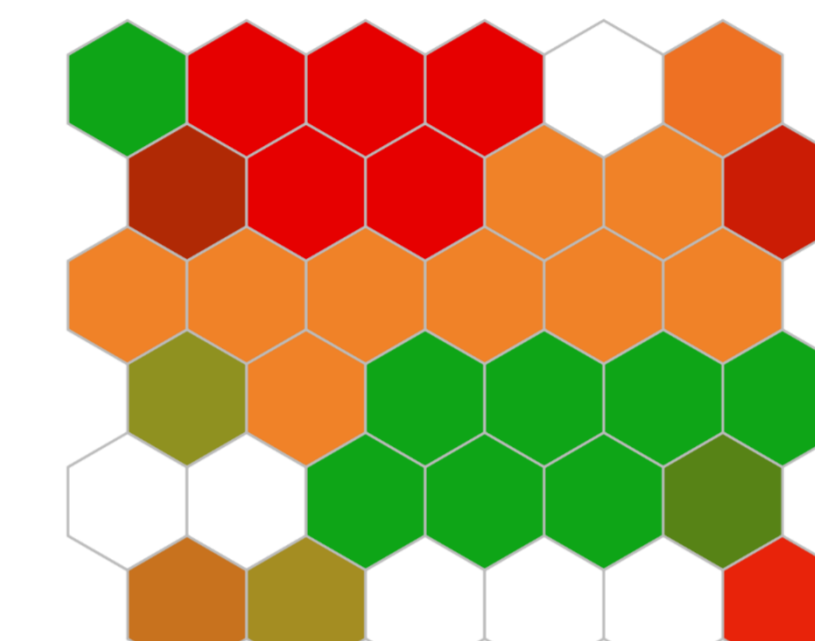
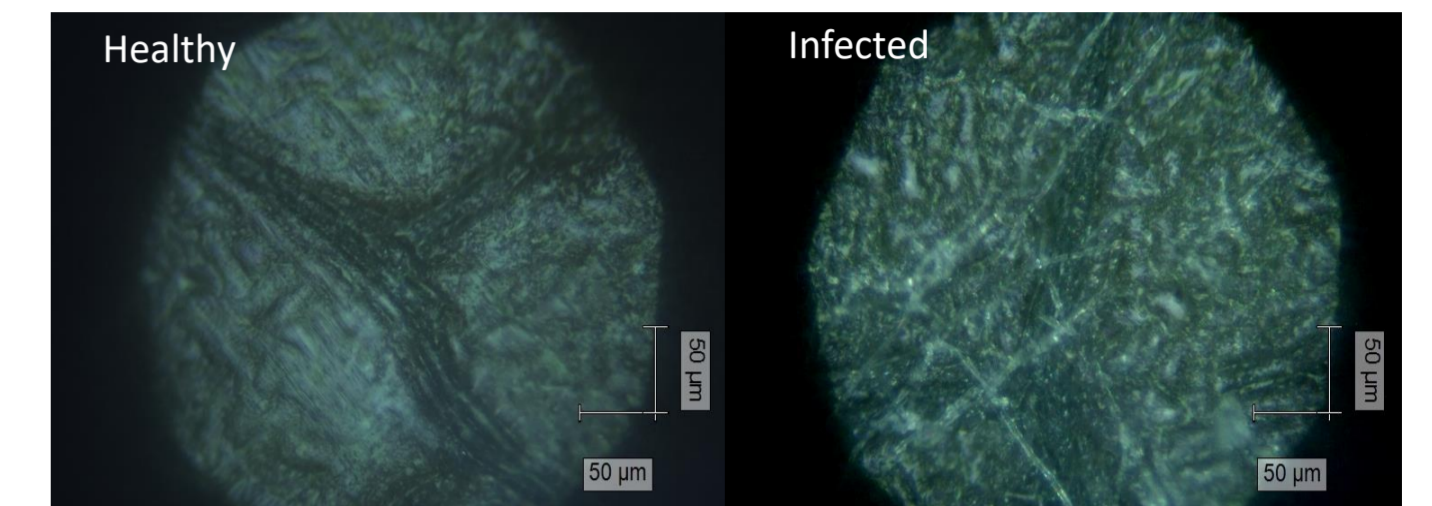
### Non-Vein



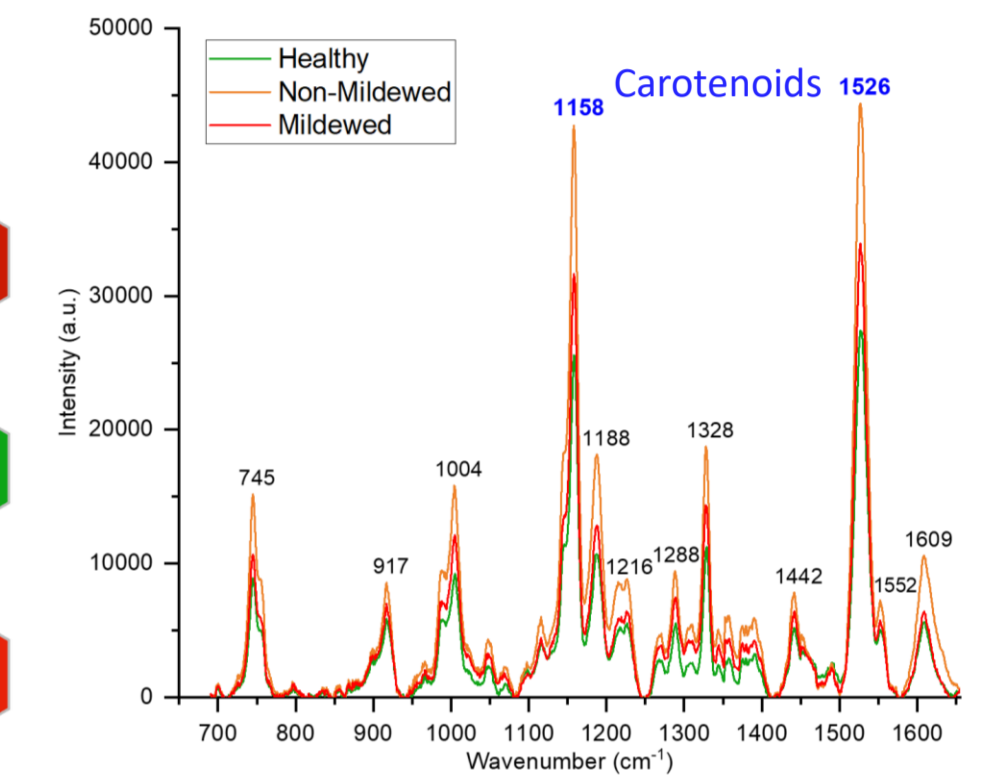
Classification Accuracy = 86.1%



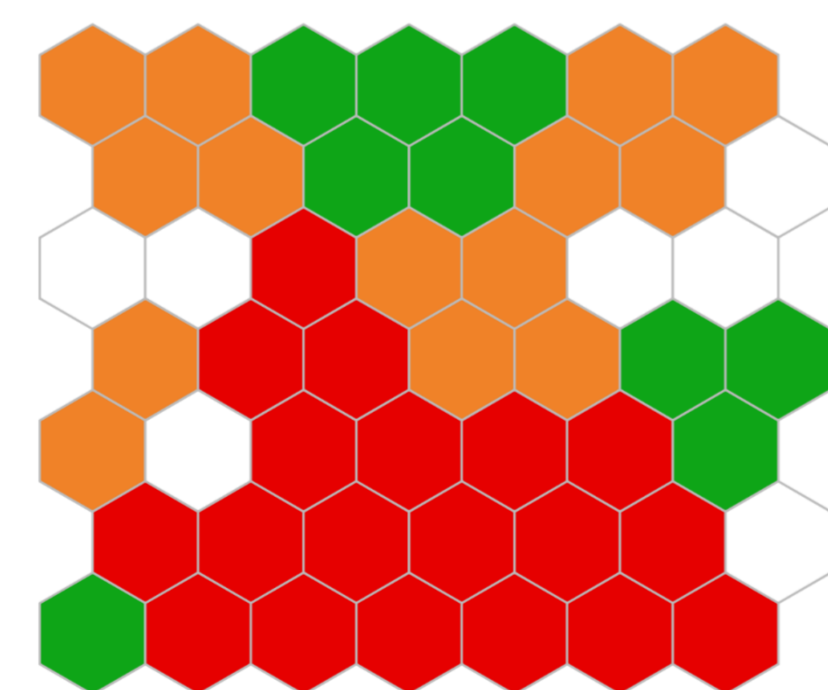
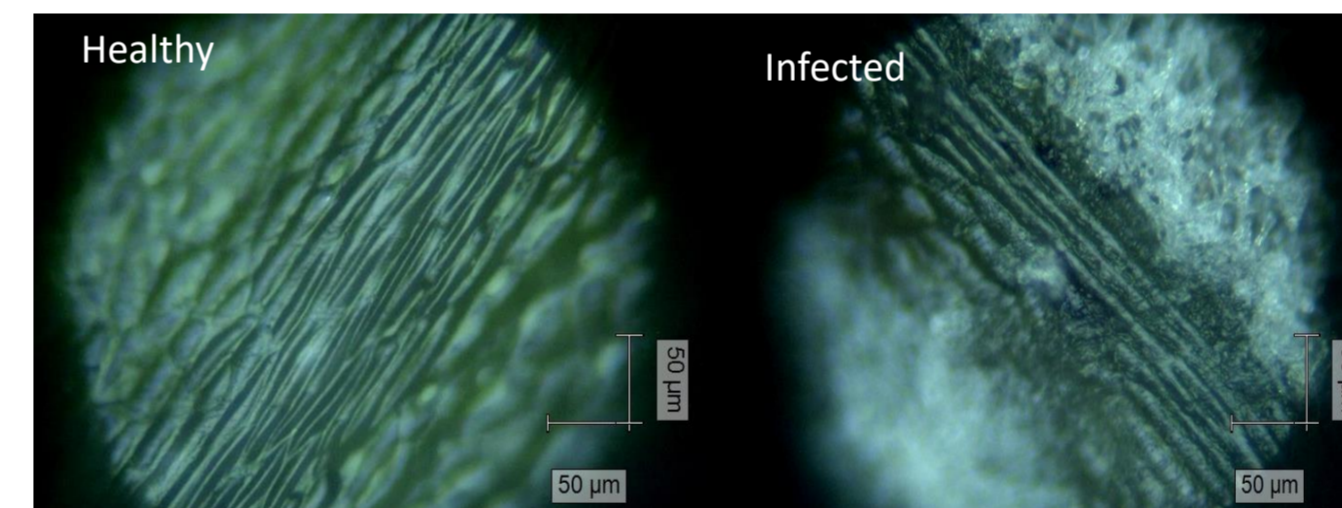
### Venule



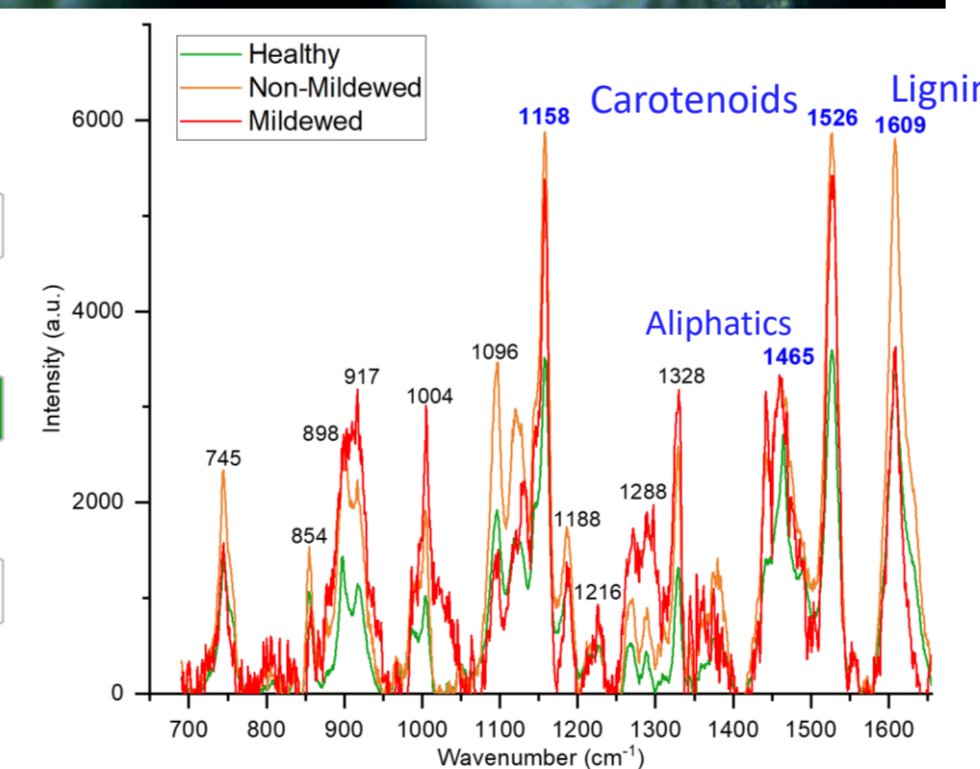
Classification Accuracy = 88.9%



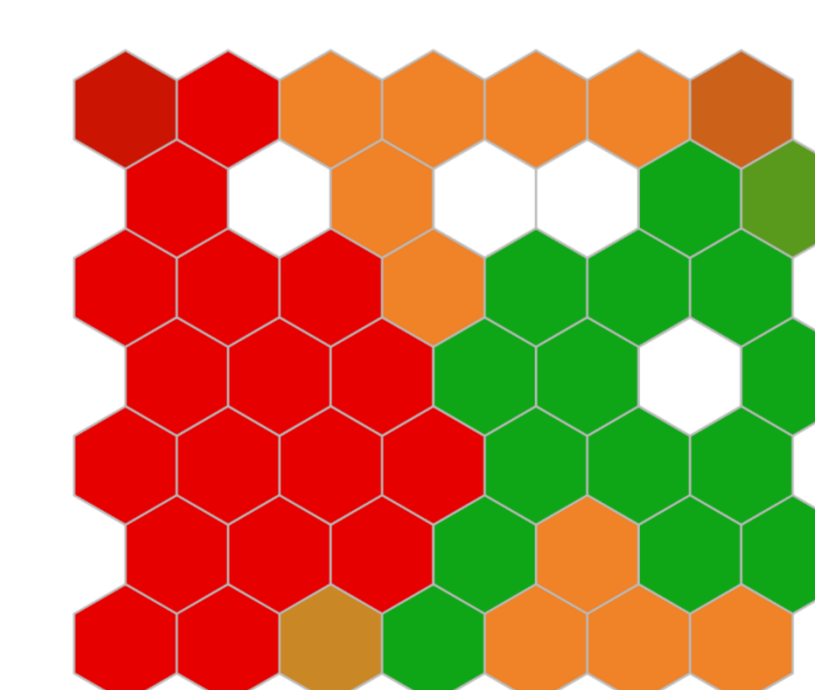
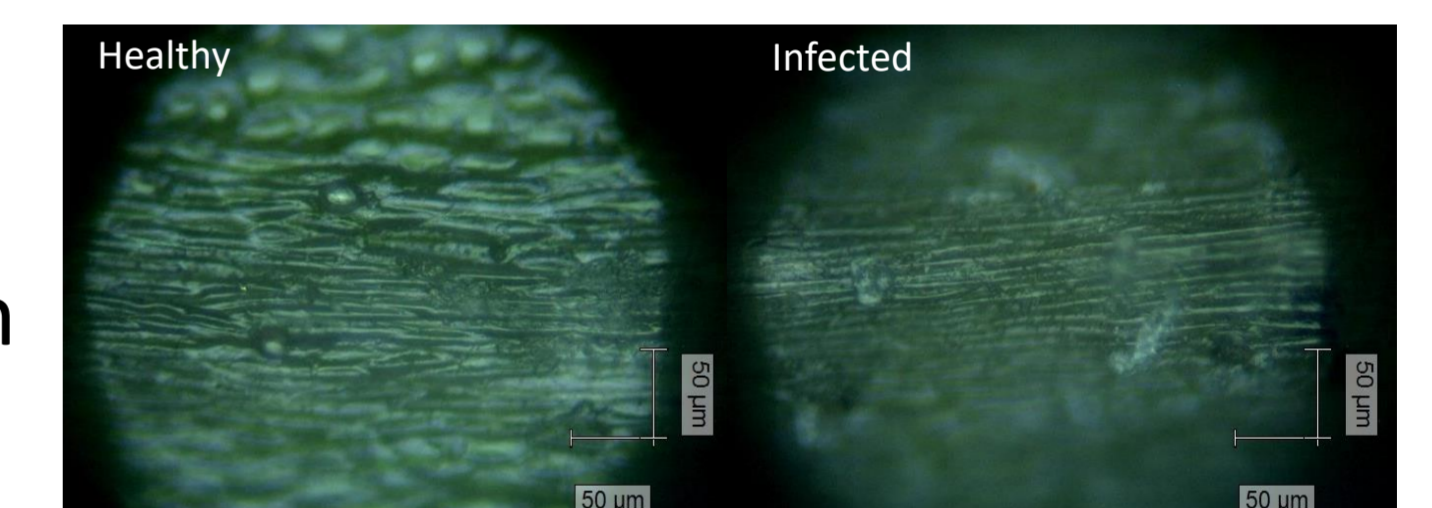
### Lateral Vein



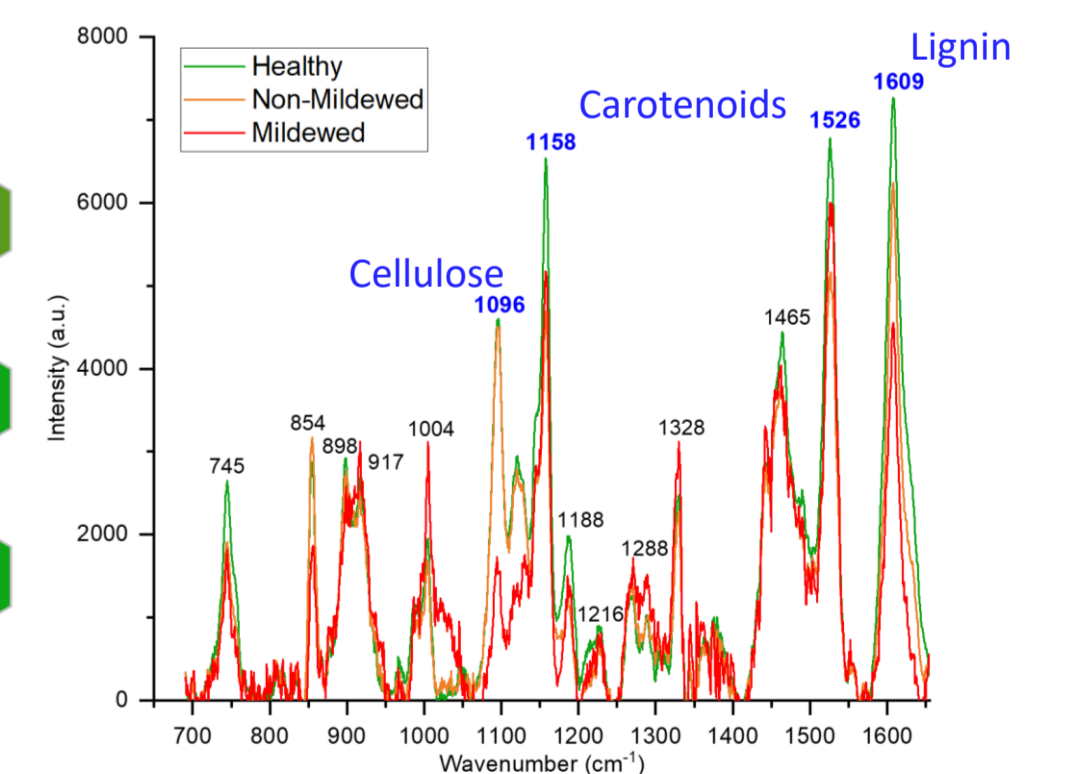
Classification Accuracy = 83.3%



### Mid-Vein



Classification Accuracy = 88.9%



## Conclusions:

- Non-Mildewed areas of tissue appear to be locally healthy across all tissue types
- Loss of chlorophyll in non-vein and venule tissue types but no diagnostic value
- Diagnostic value in lateral vein and mid-vein tissue types with 898/917  $\text{cm}^{-1}$  and 1267/1288  $\text{cm}^{-1}$  peaks
- Loss of chlorophyll, cellulose and pectin and increase of lignin and hemicelluloses and increased metabolite activity in lateral vein and mid-vein tissue types

## Future Work:

- Investigations to further understand effects of leaf age on interaction model
- Disease progression study to understand the asymptomatic disease case
- Similar investigations into ash dieback on ash leaves and ash wood
- Elevated carbon dioxide study to identify any changes to interaction model
- Development of a portable Raman spectroscopy device to measure changes in the field