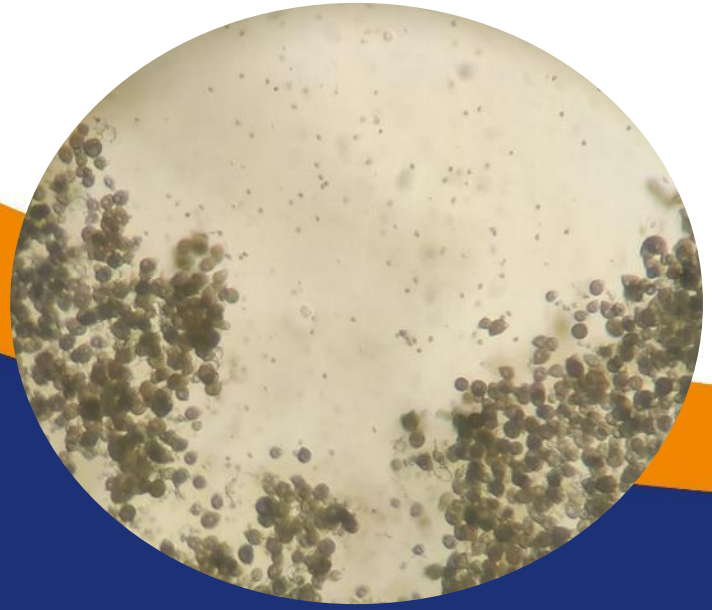


Incidence, pathogenicity and management of UK raspberry *Phytophthora*

Eithne Browne – CTP PhD Student, NIAB East Malling

Supervisors:
HAU: Prof Simon Edwards
NIAB: Dr. Charlotte Nellist

BCPC diseases review

19th October 2022

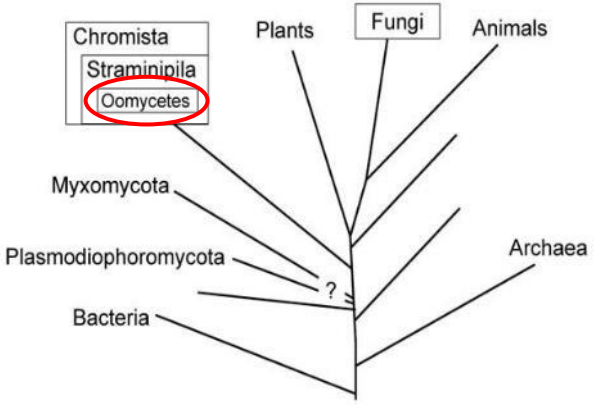
Raspberry Root Rot – more than *Phytophthora?*

Phytophthora ≠ fungi

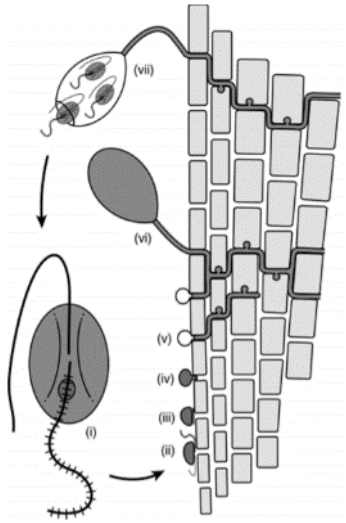
Specialised zoospores which travel through free water

P. rubi and *P. idaei* reported to be most prevalent in UK, global distribution is changing

Further insight into disease, species present and alternative *Phytophthora* control methods on UK farms is needed to ensure optimum productivity for the growers



Heffer Link, V., M.L. Powelson, and K.B. Johnson. 2002



Harham *et al*., 2001

Above ground symptoms

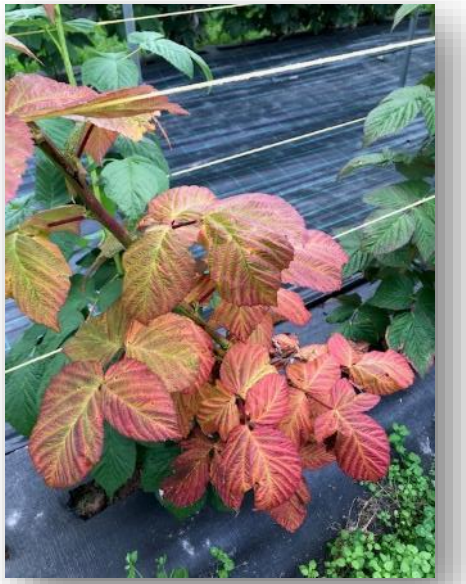
Below ground symptoms

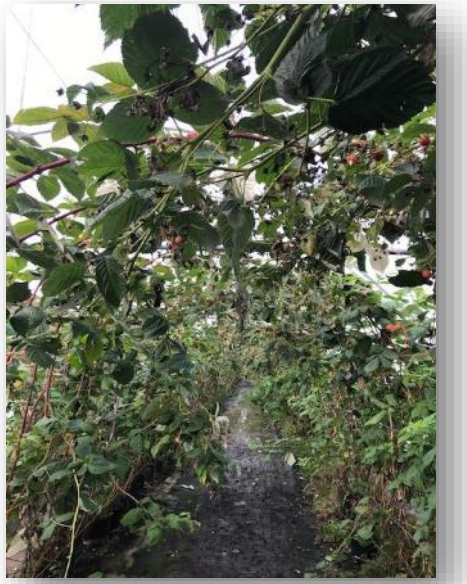
Project Objectives

1. Identify the pathogen spp. present in diseased plants on U.K farms through grower site sampling, isolation and molecular identification
2. Determine the pathogenicity of species obtained from sampling through disease trials
3. Assess the risk of these new species to UK production, how management practices can mitigate this

WP1 - Field sampling and Grower Surveys

- Symptomatic and asymptomatic samples from grower sites in England and Scotland taken and pathogens isolated from canes and roots
- Samples taken in Autumn 2020 and 2021 with help of BSPP Covid-19 PhD Student Fund

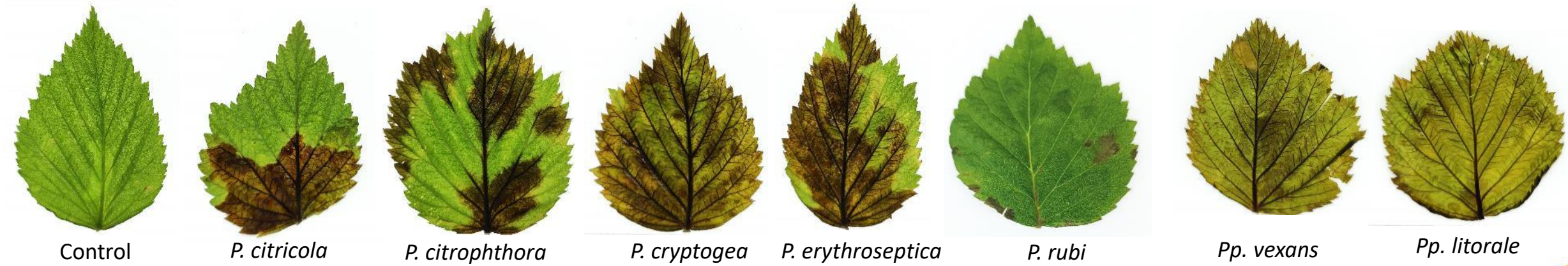





Pathogenicity Testing - Detached leaf trials

- Sterile raspberry leaves were floated on nonsterile soil extract infested with Peronosporales species. After 7 days, leaf area, lesion area and percentage disease were recorded via APS Assess 2.0 software.
- Quick, inexpensive test of host susceptibility and pathogenicity

Results on my poster



Further info on my poster, Thankyou

Thank you to the following for their help and guidance:

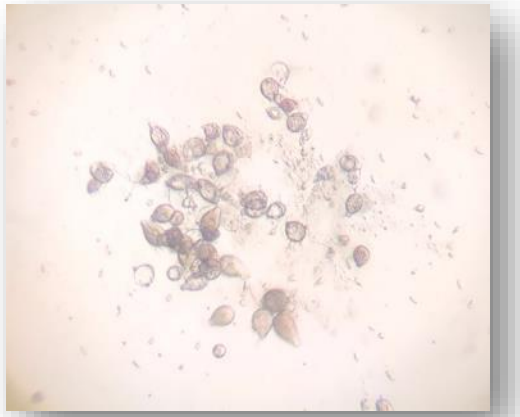
My supervisors and advisors Dr Charlotte Nellist, Prof. Simon Edwards, Felicidad Fernández, Dr Suzanne Litthaeur

NIAB EMR Pathology department (Prof. Xiangming Xu, Dr Tom Passey, Joyce Robinson, Jennifer Kingsnorth)

NIAB EMR Farm and Glasshouse Staff

Driscoll's Pathology team (Dr Jenny Broome, Dr Kelly Ivors)

Berry Gardens Growers Ltd.; Richard Harnden, BG Agronomy team



E-mail: eithne.browne@niab.com

CTP FRUIT CROP RESEARCH

Harper Adams University

AHDB

British Society for Plant Pathology BSPP

NIAB world-class experience, skills and resources

Understanding the genetic basis of Ramularia disease resistance in barley

8th Annual BCPC DISEASES Review

19/10/2022

Laura Roehrig

Supervisors:

Francois Dussart, Joanne Russell, Kelly Houston, James Brosnan, Steven Spoel, & Neil Havis

Introduction to Ramularia collo-cygni

- Causative agent of Ramularia leaf spot (RLS) of barley
- Ascomycete fungus of the family *Mycosphaerellaceae* in the class Dothideomycetes
- Considered a threat to barley production since 1980's
- Outbreaks in all temperate regions worldwide
- Affects grain quality and can cause yield losses ranging between 20% to 70%

Walters et al. (2008)

How do we control RLS in Barley?

- Control mostly via foliar fungicide applications (QoI, SDHI, DMI)
- Resistance against QoI fungicides has quickly evolved in *R. collo-cygni* populations
- SDHI and DMI resistance reported in the UK and Germany
- Ban of the multisite active chlorothalonil in Europe
- No known source of plant genetic resistance to RLS

Characterising genetic regions against resistance to RLS:

Genome Wide Association Study

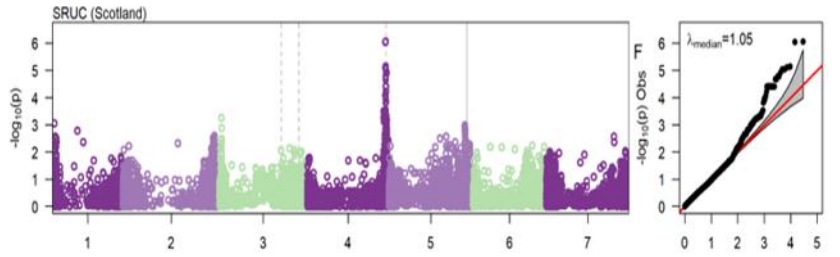
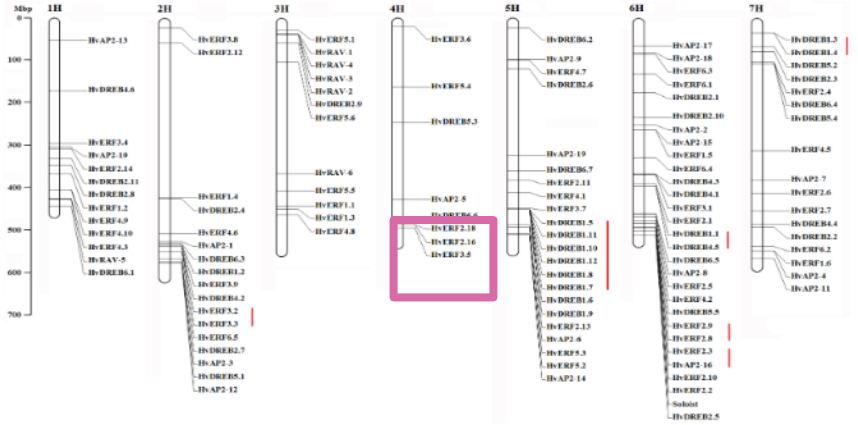


Fig. 1: Manhattan and Q-Q Plot of GWAS Study of 238 spring barley varieties.

The Identification of ethylene-responsive genes (ERFs) in barley:



Guo, B., Wei, Y., Xu, R., Lin, S., Luan, H., Lv, C., ... & Xu, R. (2016). Genome-wide analysis of APETALA2/ethylene-responsive factor (AP2/ERF) gene family in barley (Hordeum vulgare L.). PLoS One, 11(9), e0161322.

Future Work:

Characterising the gene expression of three identified ethylene-responsive genes in a subset of spring barley varieties

Impact of ACC on *Rcc*-growth and development:

Disease symptoms

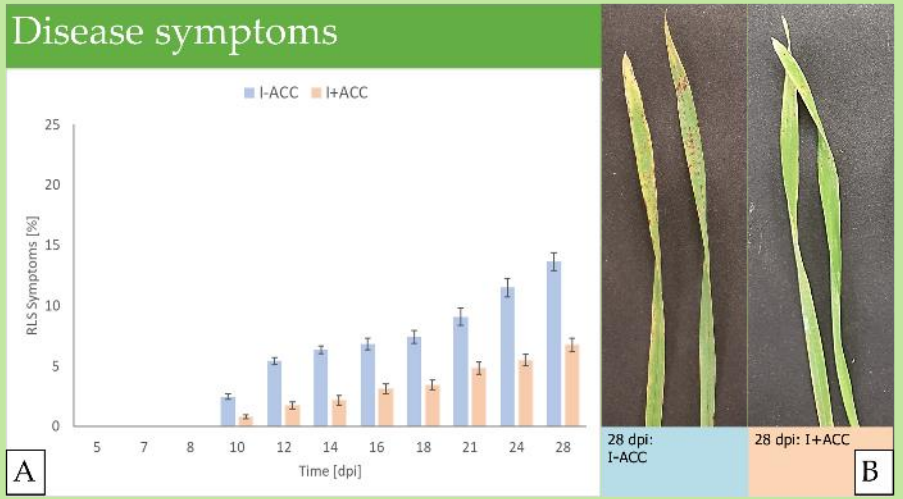


Fig. 2: Ramularia Leaf Spot Symptoms (RLS) post treatment with 10 mM ACC/H_20. I-ACC: Rcc-Inoculated plants treated with H20 as a control; I+ACC: Rcc-Inoculated plants treated with 10 mM 1-aminocyclopropane-1-carboxylic acid (ACC). A: Bar chart showing average RLS disease symptoms in percent per prophyll leaf area of 12 leaves and standard error.
B: Pictures showing disease symptoms 28-days post inoculation.


SRUC
Dr Neil Havis
Prof Ian Bingham
Dr Francois Dussart
Dr Joanne Russel
Dr Kelly Houston
The James Hutton Institute
Dr Klaus Oldach
KWS
THE Scotch Whisky RESEARCH INSTITUTE
Prof James Brosnan
Dr Frances Jack
THE UNIVERSITY OF EDINBURGH
Prof Steven Spoel
Dr Annis Richardson
Cov-19 PhD Impact Fund
British Society for Plant Pathology BSPP
Hons Students:
Izzy Hall
Francesca Piatti
PhD Students:
Emilio Balducci
Diana Garzon
Questions? Come and see my poster!

ANASTASIA'S PRESENTATION WILL BE ADDED SHORTLY

Early Detection and Spread of Tomato Powdery Mildew (TPM) in Commercial Glasshouses

19th October 2022

Anastasia Sokolidi

Rothamsted Research

The Epidemiology and Management of *Cladosporium* on Raspberry

Lauren Farwell

Supervisors:

Prof. Xiangming Xu (NIAB @ East Malling)

Prof. Naresh Magan (Cranfield University)

The Problem:

Cladosporium is an opportunistic pathogen of raspberries forming skin lesions when conditions are right making fruit unmarketable.

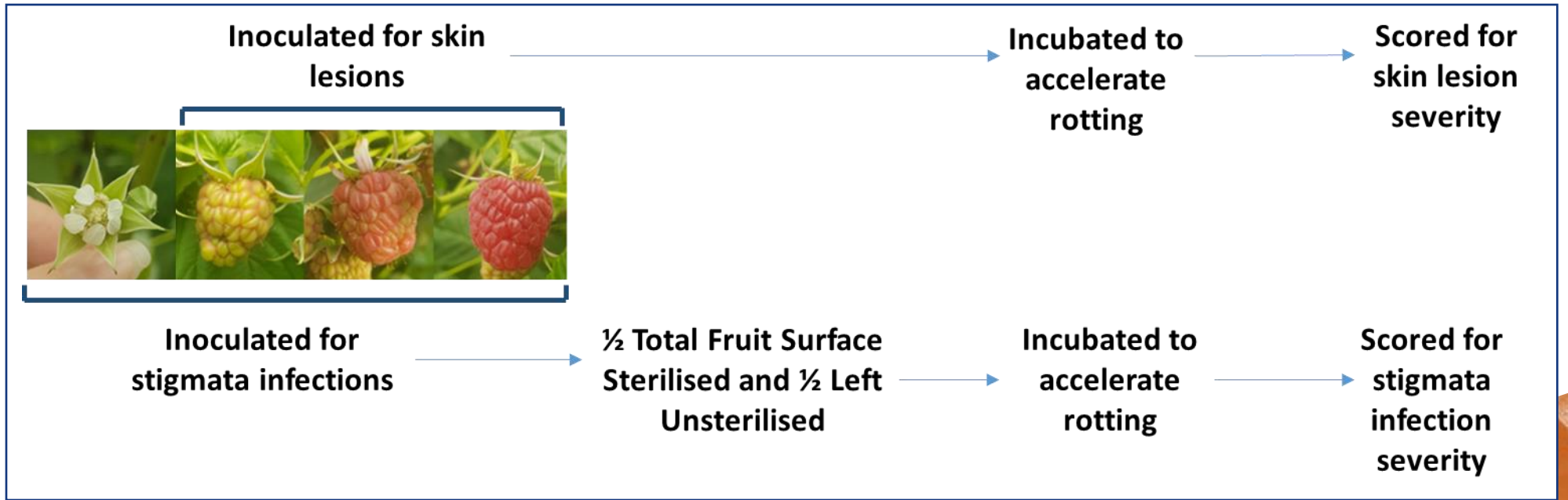
- *Cladosporium* infection and symptoms often appear close to harvest and can result in product rejections by suppliers.
- *Cladosporium* was present on over **50%** of fruit at one farm in Kent[1].
- Currently only one other study has focused on *Cladosporium* on raspberries, and this was performed in the USA.

What stages of fruit development are susceptible to *Cladosporium*?

- Previous work has shown ripening and ripe fruit are susceptible to skin lesions[2], but no studies have investigated if green fruit are susceptible.

- As *Cladosporium* is a saprophyte, the dead stigmata may provide material for *Cladosporium* to colonise earlier in development.

- **Knowing when fruit are susceptible allows for better timing of control measures.**



What stages of fruit development are susceptible to *Cladosporium*?

Skin Lesion Susceptibility:

Green fruit were not susceptible to *Cladosporium* skin lesions. Ripe fruit are more susceptible to skin lesions than ripening fruit (odds ratio 2.04, S.E. 0.283).

Stigmata Infection Susceptibility:

No significant difference in stigmata infection scores across fruit developmental stages (Wald $X2(3)= 7.08$, $p = 0.069$).

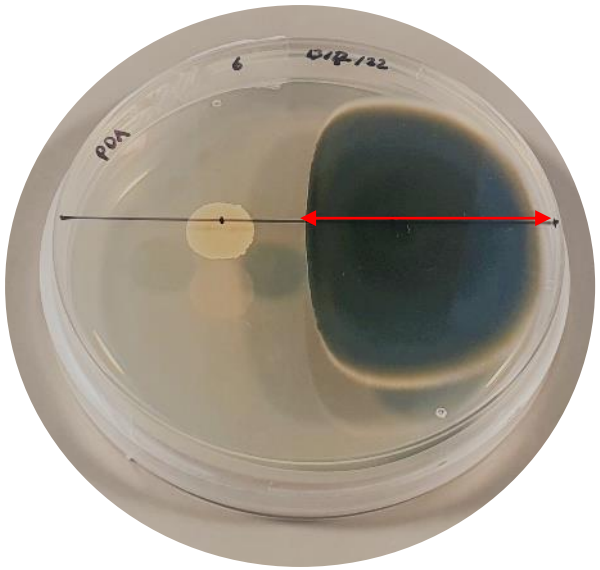
- **All stages of development are susceptible to stigmata infections.**

There was significantly higher stigmata infection scores in unsterile fruit than sterile fruit (Wald $X2(1)= 160.5$, $p<0.001$).

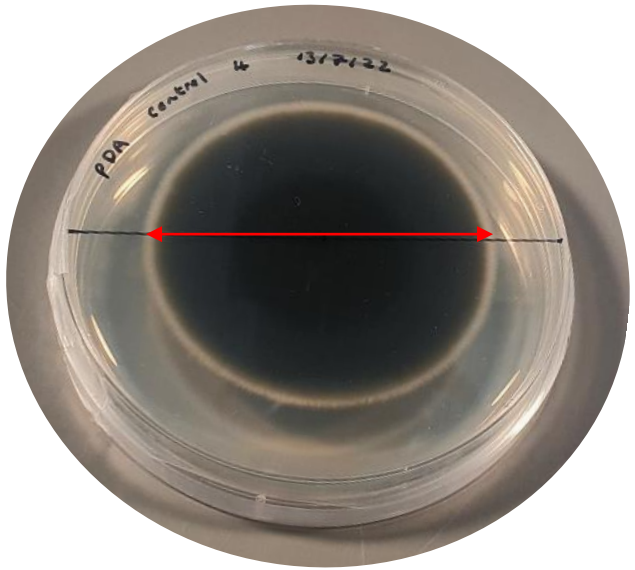
- ***Cladosporium appears to* colonise the surface of stigmata more than penetrating into the stigmata**.

Can Biological Control Agents be a Viable Management Strategy for *Cladosporium* on Raspberries?

As *Cladosporium* appears to mainly be colonising the surface of raspberries, BCAs may be a good option for control.



BCA Plate



Control Plate

- Two fungal BCAs on a Raspberry Agar-based Medium
- Three bacterial BCAs on LB agar/PDA Media
- Diameter of *Cladosporium* is recorded at 3 time points (days 2, 4 and 9 post BCA application).
- Minimum 9 plate replicates per BCA, N= 65).

Can Biological Control Agents be a Viable Management Strategy for *Cladosporium* on Raspberries?

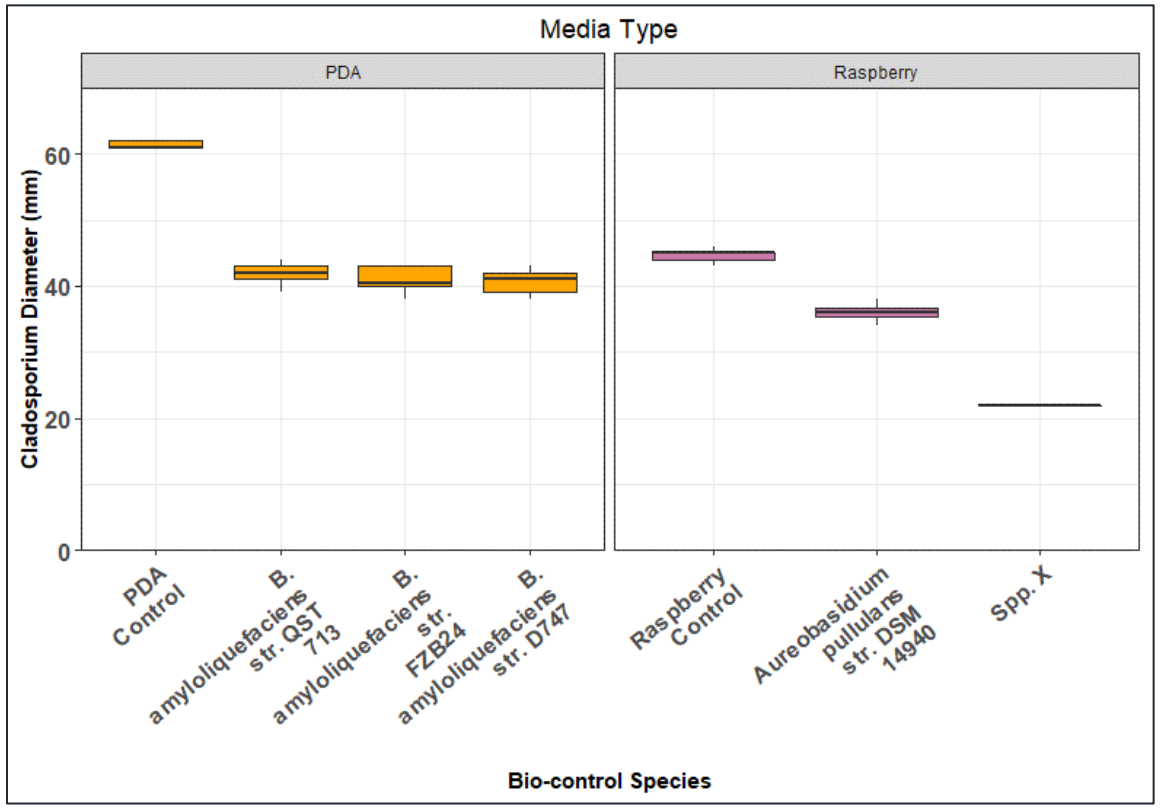


Fig. 1. The diameter of *Cladosporium* colonies on PDA/Raspberry Media 9 days post inoculation with a BCA.

- **All BCAs caused a reduction in the growth of *Cladosporium* on media.**
- The results are yet to be statistically analysed.
- This is a sterile environment. In reality, BCAs need to contend with a dynamic ecosystem to control disease.

Acknowledgements:

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E-mail: Lauren.Farwell@NIAB.com