Fusarium wilt in lettuce: diagnostics, biology and control

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Fusarium oxysporum f.sp. *lactucae* (FOL)

- Part of the *F. oxysporum* species complex comprising of multiple *formae speciales*, each uniquely adapted to a specific host.

- *F. oxysporum* f.sp. *lactucae* (FOL) causes wilt and root rotting in both field and glasshouse grown lettuce

- FOL races have evolved due to the deployment of resistant lettuce cultivars
  - **Race 1 (FOL1)** widespread and causes disease in field grown lettuce in warmer locations such as USA and southern Europe
  - **Race 4 (FOL4)** has emerged very recently in N. Europe affecting protected lettuce only
  - Races 2 and 3 less important and only found in Asia

- FOL Races are defined by differential resistance / susceptibility to a set of lettuce lines

Emergence of FOL race 4 in the UK

- **2013:** FOL4 first identified in the Netherlands
- **2016:** First lettuce wilt symptoms observed in Republic of Ireland
- **2017:** FOL4 confirmed in Ireland and Lancashire
- **2018-present :** further spread to Cambridgeshire and further sites in Ireland and Lancs
- **Varieties affected:** Little Gem and Butterhead types
- **<u>No FOL4 on outdoor lettuce</u>**

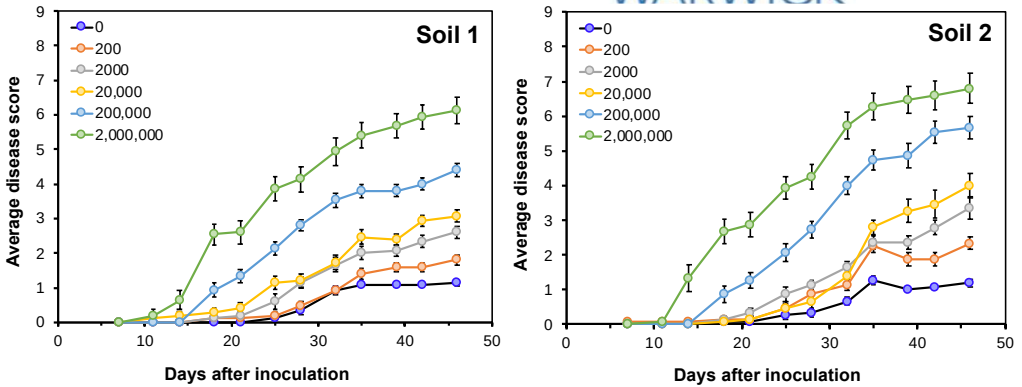
Challenges

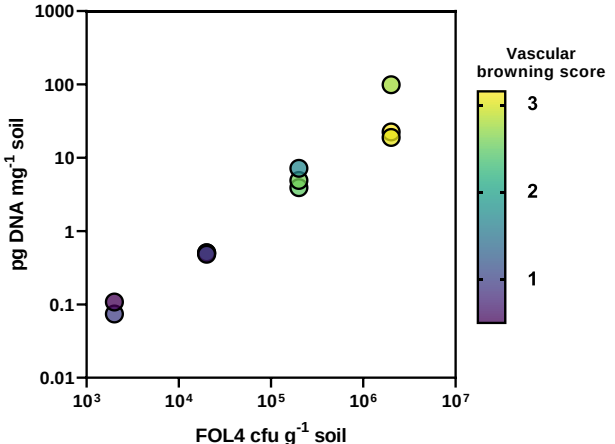
- How do we identify and quantify FOL4?
- What are the conditions for disease development?
- Does non-host cropping reduce inoculum?
- Can we develop plant resistance to FOL4?



Identification and quantification of FOL4

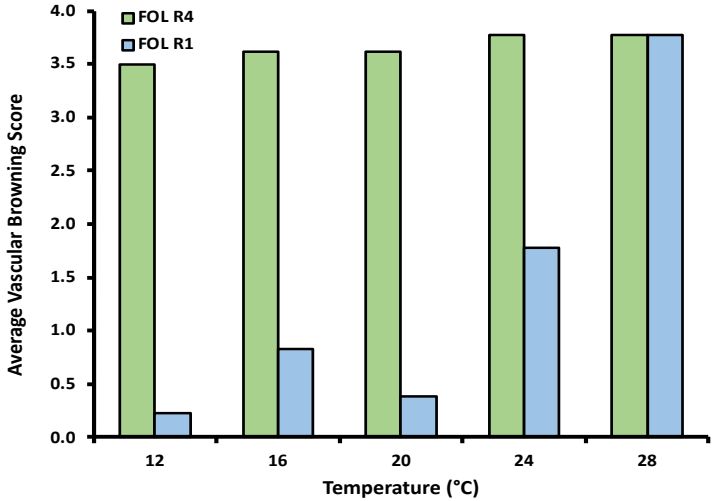
- **Symptoms can be quite clear:** wilting and characteristic vascular browning
- **Confirm:** by isolation on to agar and specific PCR tests for different races
- **Quantify by qPCR:** We have related pathogen DNA detected to inoculum level and disease development





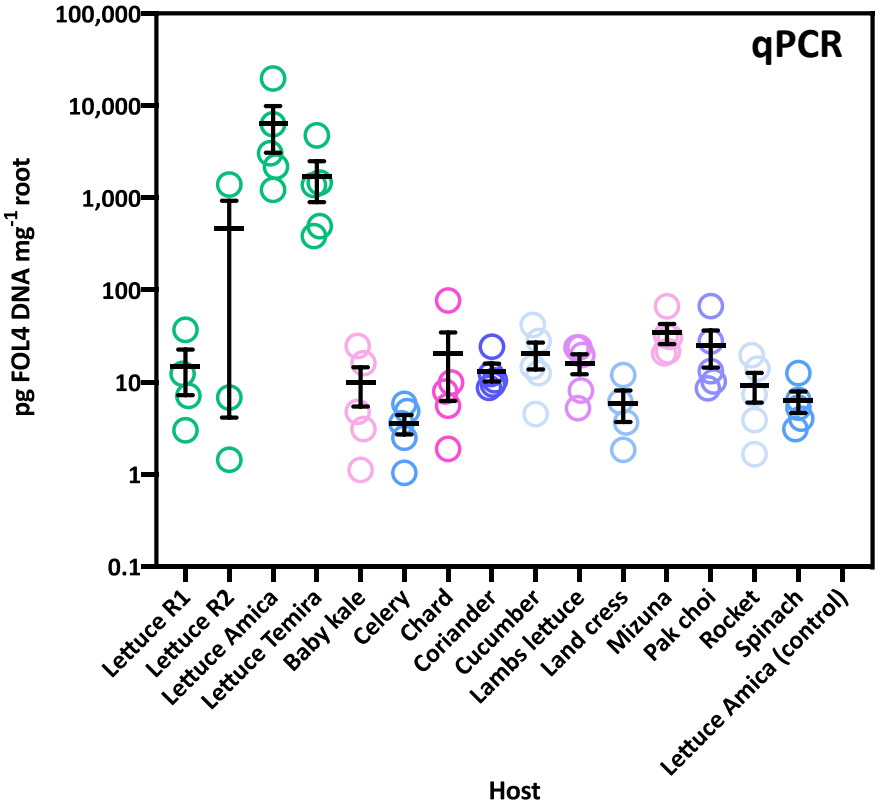
Effect of temperature on FOL1 and FOL4

- No difference in growth of FOL1 and FOL4 on agar at different temps
- FOL4 causes much more rapid wilt disease development and vascular browning at 12°C - 24°C than FOL1



Non-host colonisation by FOL4

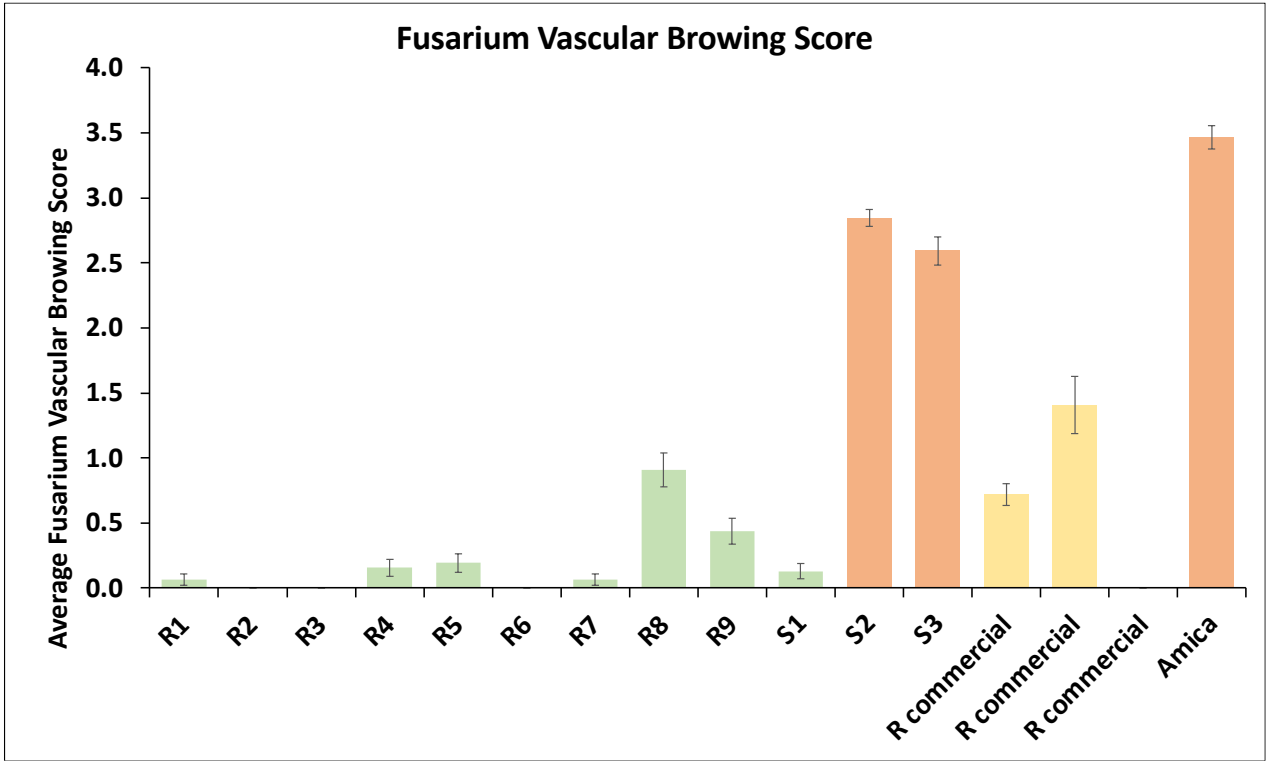
- Roots of multiple hosts are colonised by FOL4
- Roots of (partially) resistant lettuce lines are also colonised by FOL4
- Susceptible lettuce lines more highly colonised

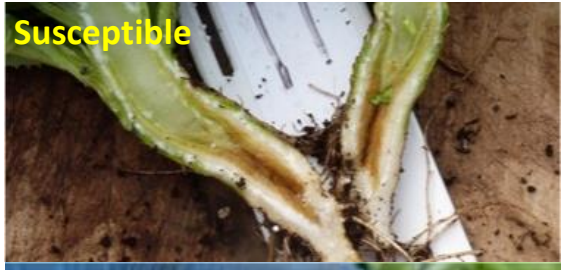


FOL Resistance

- Identified lettuce accessions resistant to FOL1 and FOL4 (VeGIN)
- Collaboration with Enza Zaden is developing resistant lettuce cvs. with support from BBSRC PhD (funding partner AHDB)
- Collaboration with EU lettuce breeders standardising lettuce accessions used to identify FOL races and levels of resistance

FOL4 Resistance - polytunnel





Summary

- Diagnostics are important to identify FOL (races) and may help predict disease risk.
- FOL4 causes disease in lettuce at lower temperatures than FOL1.
- Non-host crops and resistant lettuce varieties may allow persistence of FOL4.
- Development of better FOL resistant lettuce lines is still required.

Current work

- AHDB CP204: Putting Fusarium diagnostics into practice across multiple crops (focus on onion)
- AHDB CP204: Identifying treatments for preventing build up of FOL inoculum in successive lettuce crops
- Sceptre+ identifying biological control for control of Fusarium wilt in lettuce (Stakeholder meeting 15th March 2022)
- Developing resistance to Fusarium in lettuce and examining plant-pathogen interactions (PhD)

With thanks to…..

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