

# Exploration of bacteriophage as biocontrol against acute oak decline

Emily Grace<sup>1</sup> (erg116@student.bham.ac.uk), Mojgan Rabiey<sup>1</sup>, Michael Brockhurst<sup>2</sup>, and Robert Jackson<sup>1</sup>

<sup>1</sup>School of Biosciences, University of Birmingham, B15 2TT <sup>2</sup>University of Manchester, M13 9WJ

## Background

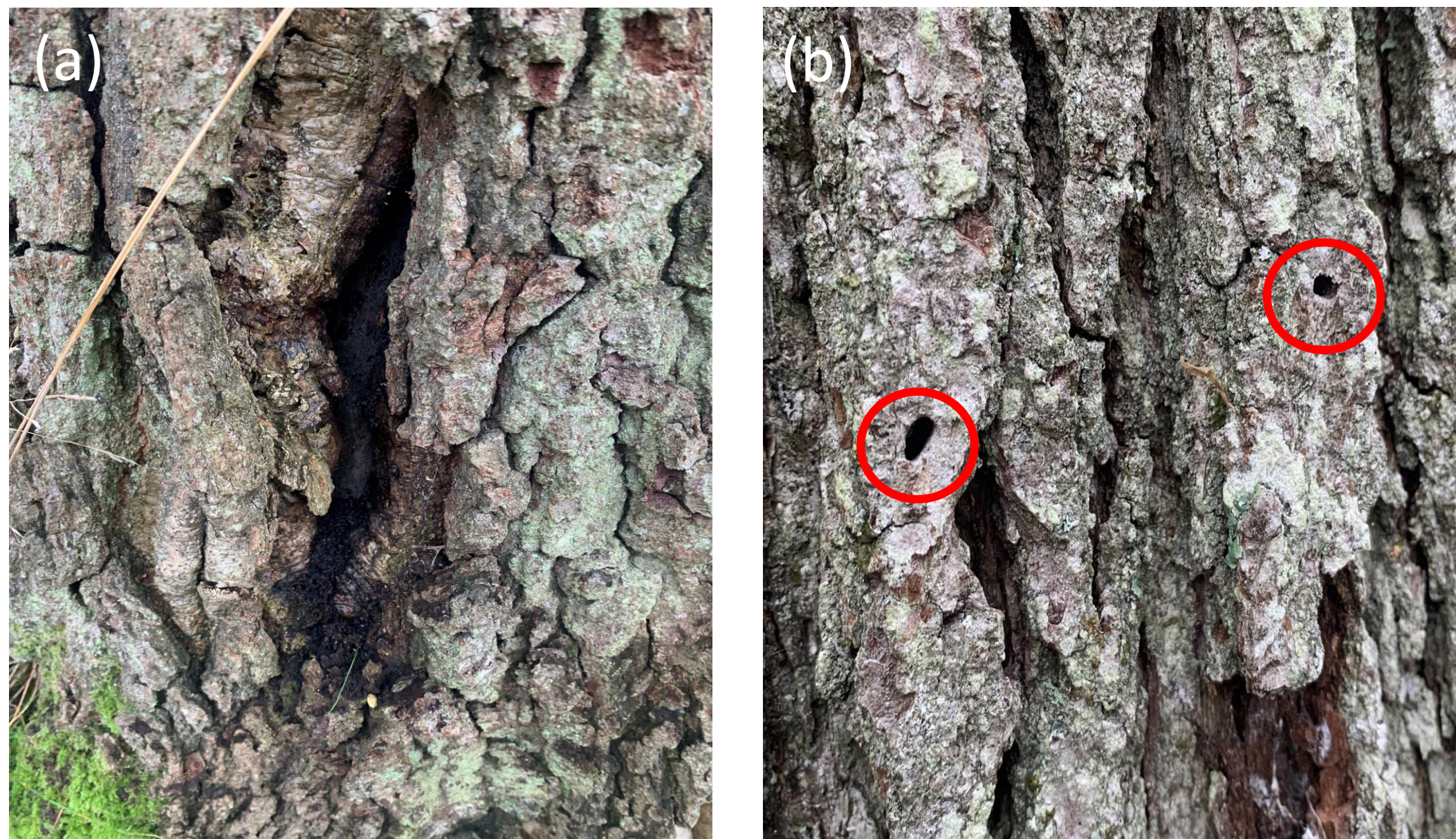
**Acute oak decline (AOD)** is a disease of native oak species across the south and midland regions of the UK.

**Importance:** death of infected mature trees can occur within 5-10 years of initial infection<sup>[1]</sup>.

**Symptoms:** bleeding lesions on trunks, and presence of larval galleries close to the lesions (Fig. 1).

**Cause:** a polymicrobial consortium of *Brenneria goodwinii*, *Gibbsiella quercinecans* and *Rahnella victoriana*.

**Management:** none so far. One potential biocontrol is bacteriophage (phage), viruses that infect and kill bacteria.



**Figure 1.** Common symptoms of AOD: **(a)** dark vertical lesions on bark; **(b)** D-shaped larval galleries caused by the insect *Agrilus biguttatus*.

## Aims

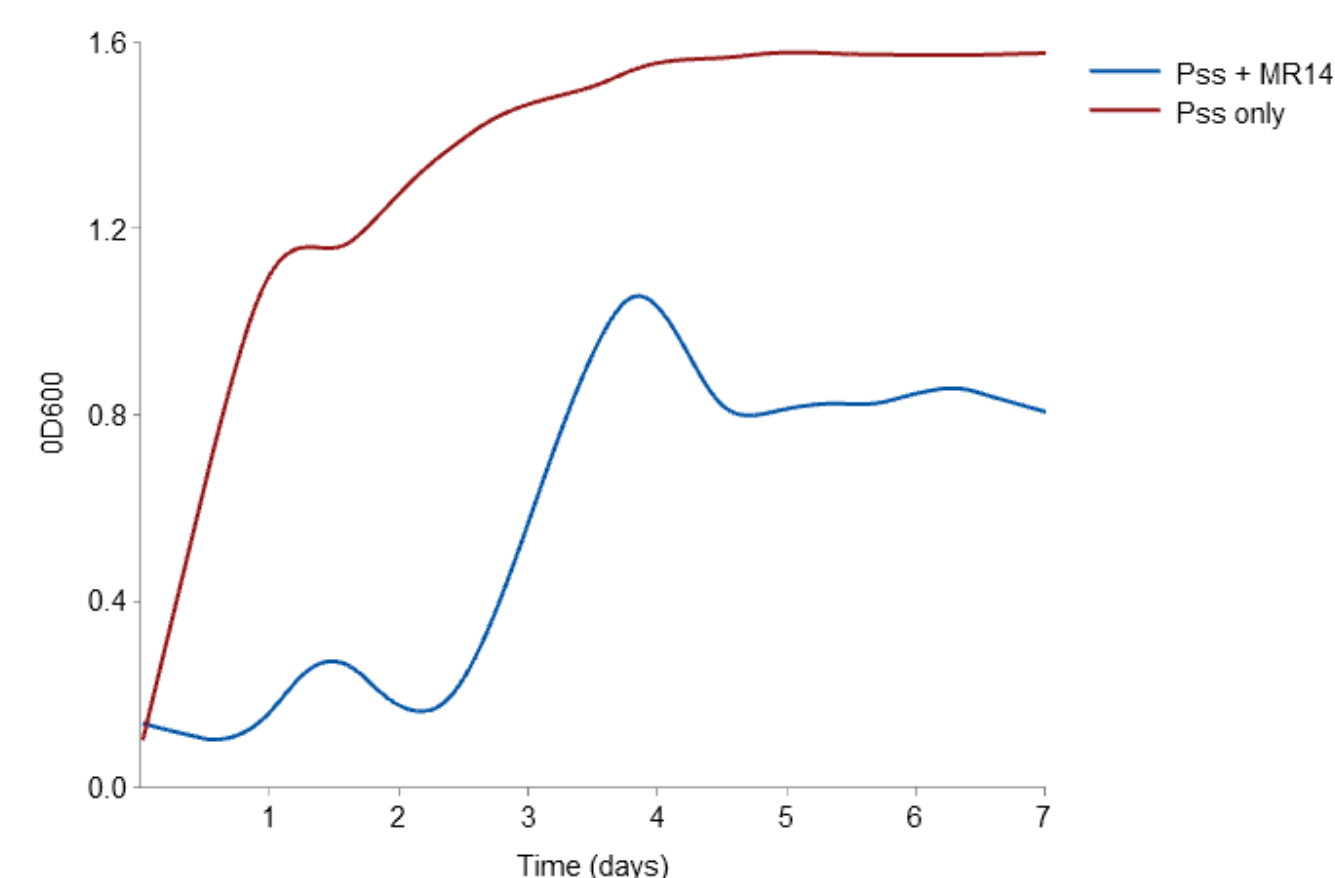
To isolate and characterise phages that infect AOD-associated bacteria, and to examine:

1. Their potential as biocontrol agents.
2. Their *in vitro* and *in planta* coevolutionary dynamics with their hosts.

## Current work:

### 1) phage-bacteria coevolutionary dynamic

Previously characterised MR phages that infect the cherry canker pathogen *Pseudomonas syringae* pv. *syringae* (*Pss*)<sup>[2]</sup> are being coevolved over a 7-day period to observe any arms race/fluctuation selection dynamics *in vitro* (Fig. 2) and *in planta*.



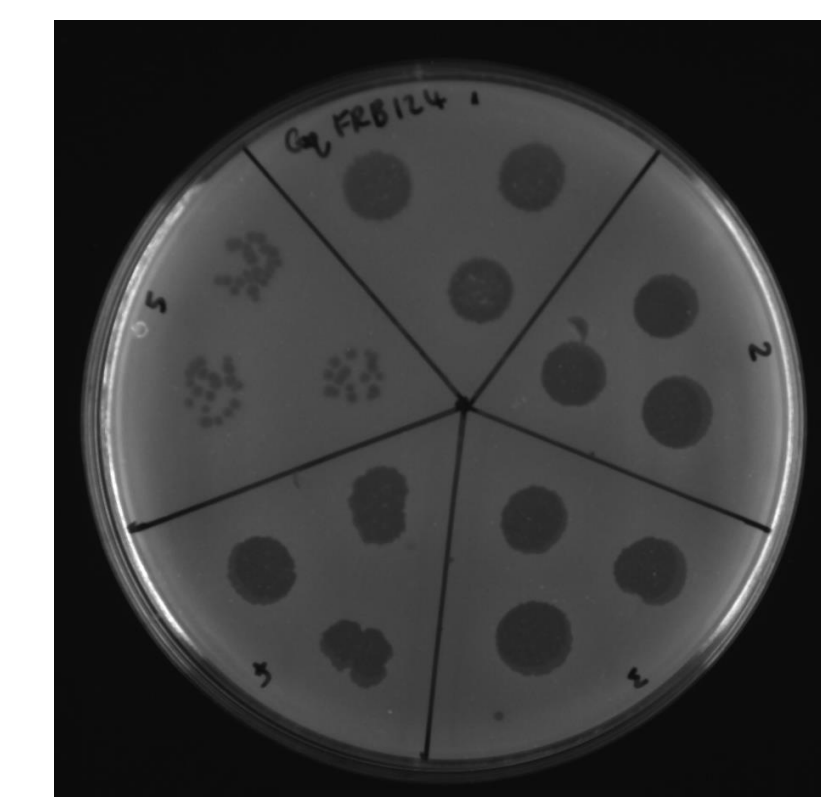
**Figure 2.** *In vitro* killing curve showing the impact of phage MR14 on *Pss* populations over 7 days.

## Methodology

- **Phage isolation** from 3 sites in the UK.
- **Phage characterisation**, via:
  - Host range assays
  - Electron microscopy
  - DNA extraction and sequencing
  - Temperature and UV sensitivity assays
- **Phage-bacteria coevolution dynamics assays** *in vitro* and *in planta*.

### 2) Phage isolation and characterisation

5 phages that lyse *G. quercinecans* have been isolated from diseased oak tissues. Their lytic abilities against their host (Fig. 3) and host ranges are being tested to determine their specificity and safety.



**Figure 3.** Spot assay of 5 isolated phages on their host *G. quercinecans* FRB124.

#### References

- [1] Denman et al. (2018). *The ISME Journal*, 12, 386-399.  
[2] Rabiey et al. (2020). *Microbial biotechnology*, 13(5), 1428-1445.