Grower Summary

The incidence, pathogenicity, and management of UK raspberry *Phytophthora*

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Project leader:	Charlotte Nellist, NIAB
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Location of project:	NIAB, East Malling, Kent
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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Signature  Date 23rd June 2022

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GROWER SUMMARY

Headline

Phytophthora may not be the only culprit in raspberry root rot.

Background

Root rot of the European red raspberry (*Rubus idaeus*), caused by a yet-unknown consortium of *Phytophthora* species, is a recurring and destructive disease of this commodity fruit. The disease is most frequently observed during persistent periods of high rainfall and humidity and when the crop is in high productivity. This timing corresponds with the most economically important stage of raspberry growing, thus severely impacting a grower's ability to profit from this work-intensive crop. As such, root rot is a significantly limiting factor in UK raspberry production. Current control strategies rely on cultural practices due to the lack of fungicide efficacy. Infection prevention is employed through securing clean planting material, maintenance of freely draining soil and sterilising irrigation lines. Infection risks have led to ~70% of UK raspberry growers moving from field to pot-based cultivation which involves more consumables and labour, increasing the costs involved in raspberry production.

Raspberry root rot is an understudied field of research. Much is to be gained from further understanding the species involved in the disease. This project seeks to elucidate the diversity and pathogenicity of raspberry *Phytophthora* in the UK through large scale surveying of UK grower sites, direct isolation from symptomatic plants and subsequent pathogenicity studies to determine their risk to UK production. Additionally, the project will investigate whether factors such as location, treatment regimes and variety affect the diversity of *Phytophthora* in UK raspberry using state-of-the-art genetic analysis. Findings from this project will add to our knowledge of UK raspberry *Phytophthora* and highlight the importance of the inclusion of other *Phytophthora* species into raspberry breeding programme resistance screens to produce varieties which are more resilient to changes in *Phytophthora* species dominance in raspberry root rot, ensuring clean and robust genotypes for UK growers.

Summary

Surveys and Sampling

In the first year of this project, 13 UK raspberry grower sites were sampled across England and Scotland. Root and cane tissue were taken from healthy plants and plants exhibiting root rot symptoms i.e., wilting, chlorosis, cane lesions. Additionally, a questionnaire was distributed which collected agronomy details and the Raspberry root rot experiences of individual growers.

Root and cane isolations

Diseased cane and roots taken from grower sites were plated onto *Phytophthora*-specific media using a protocol adapted from Stewart et al. (2014) which consisted of cornmeal agar amended with antibiotics (rifampicin and ampicillin) and fungicides (pimaricin PCNB and hymexazol) which reduced the growth of fast-growing fungi and bacteria. Isolates were sub-cultured onto fresh agar plates and grown in the dark at 18°C for 14 days. DNA was extracted from the isolates and from diseased raspberry and a small sample of blackberry roots after which they were sequenced to determine their identity. Twelve isolates of five species of *Phytophthora* and seven isolates of two *Phytopythium* species were collected. To our knowledge this constitutes the first report of *Phytopythium vexans*, *Phytopythium litorale*, *Phytophthora hedriandra* and *Phytophthora meadii* on red raspberry and the first report of *P. meadii* in the UK. *P. rubi* and *Phytophthora bishii* were detected in symptomatic blackberry roots, a first report of both species on blackberry. Pathogenicity testing of these isolates on a range of commercially relevant cultivars is ongoing. Further tests will be conducted using these pathogens to record symptoms of their infection and disease rate.

Detached leaf inoculations

To determine the pathogenicity of the isolates recovered on UK farms, leaves of a proprietary commercial variety were sterilised and inoculated with five species of *Phytophthora* and two species of *Phytopythium* and observed over seven days. Two methods of infection were trialled to assess which is most suitable. These trials are ongoing, with preliminary results being inconclusive. The purpose of these trials is to assess the potential of a detached leaf infection as a reliable and efficient method to

test varietal susceptibility to *Phytophthora* and *Phytopythium* which could be used within breeding programmes to screen for resistance.

Financial Benefits

Over 16 thousand tonnes and 146.8 million pounds worth of raspberries were produced in the UK in 2019, a figure which is steadily growing with the popularity of the fruit (DEFRA, 2020). However, root rot can have a devastating financial impact on raspberry growers due to the cost of replacing diseased canes and lost fruit crop. This project seeks to increase our understanding of root rot in raspberry and the effects of emerging pathogens on the crop. Through extensive pathogenicity screening and sampling, we hope to reduce the financial loss associated with raspberry root rot and improve upon rapid screening processes for new robust varieties.

Action Points

At this stage of the project, recommendations to change-of-practice cannot be given.

References

DEFRA. (2020). *Latest horticulture statistics*. https://www.gov.uk/government/statistics/latest-horticulture-statistics

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