Grower Summary

PE 024a

Basil: Improving knowledge and control of downy mildew in protected and outdoor crops

Final report, March 2019

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Further information

If you would like a copy of the full report, please email the AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

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Project title:	Basil: Improving knowledge and control of downy mildew in protected and outdoor crops
Project number:	PE 024a
Project leader:	Philip Jennings, Fera Science Limited
Report:	Final report, March 2019
Previous report:	Annual and Final report for PE 024
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Date project commenced:	01 May 2018

GROWER SUMMARY

Headlines

- Transmission of *Peronospora belbahrii* from basil seed to seedlings was demonstrated for two naturally infected seed lots, with 0.4% and 1.3% seedlings showing symptoms of downy mildew.
- Metalaxyl-M resistance was found in three out of the four *Peronospora belbahrii* isolates collected from the UK.

Background

A British Herbs survey showed that approximately 30 ha of sweet basil (*Ocimum basilicum*) is grown in the UK, with about 25% under protected conditions. Most of the crop is grown outdoors in the summer. Several crops can be produced from the same area in the same season, so the total area grown will be considerably larger than this. It has been estimated that the value of the crop is 'in the order of tens of millions of UK sterling'.

Basil downy mildew, caused by the biotrophic oomycete *Peronospora belbahrii*, was first reported in sweet basil in the UK during the summer of 2010. Initially the disease was given quarantine status, with infected crops subject to statutory action; this status was lifted in 2012. The UK fresh basil industry is highly valuable, and the recurring problem of downy mildew is causing growers major issues.

Although new to the UK, the disease is endemic in many parts of Europe (including Switzerland (2001), Italy (2003), France (2005) and Hungary (2011)), North America, Africa, Asia and South America.

There has been a great deal of work published on basil downy mildew. However, knowledge gaps have been identified, particularly relating to sources of inoculum, role of alternate hosts, epidemiology and control. These gaps were primarily addressed in AHDB Project PE 024 however, on completion of the project, there were two areas where further work was required. These areas were covered in this extension project as follows:

1) Determine whether P. *belbahrii* infections can be transmitted to plants from *P. belbahrii* contaminated seed

2) Determine the level of metalaxyl-M resistance in *P. belbahrii*

Summary

<u>Transmission of *Peronospora belbahrii* from contaminated seed to plants.</u>

Eight seed samples were tested in seed transmission studies using two different protocols, a conventional grow-on test and a box test. Six samples were obtained from AHDB project PE 024 and two by NIAB during this project (one from an inoculated field trial conducted in 2018 and the other from Germany). No basil downy mildew infections were reported in the UK during 2018 so fresh seed samples could not be obtained via this route.

Four seed samples were screened using the grow-on screen with between 2500 and 6000 seed analysed per sample. No downy mildew symptoms were observed in any of the seedlings screened, despite all four seed samples testing positive for the presence of pathogen DNA, and the maintenance of suitable environmental conditions for the expression of disease symptoms.

Seven seed samples were screened using the box test protocol with between 100 and 775 plants screened per seed sample. Downy mildew symptoms were observed in seedlings from seed samples coded 17 (0.4 %) and 21 (1.3%), with a higher level of symptom expression in sample 21, which also contained the higher level of *P. belbahrii* DNA. This demonstrates that *P. belbahrii* can be transmitted from basil seed to seedlings. With transmission rates as high as 1.3% it suggests that seed-borne inoculum can play an important role in outbreaks of basil downy mildew.

Despite very high levels of *P. belbahrii* DNA being present in the two seed samples obtained during this project extension, no downy mildew symptoms were expressed. Reasons for this are unclear, however, the germination level in seed from the inoculated NIAB field trial was very low at 6%, likely due to poor pollination during the trial, but it cannot be ruled out that this was due to disease expression in a different form.

The level of metalaxyl-M resistance in *Peronospora belbahrii.*

Four samples of basil downy mildew from the UK were screened for metalaxyl-M resistance; the isolates from STC and NIAB used in PE 024 and two samples sent to Fera by the industry. The samples sent by the industry to Fera were received in August and September 2017, no samples were received during 2018.

The isolates screened from STC and NIAB were shown to be metalaxyl-M resistant and sensitive respectively. These data are consistent with the results obtained from the fungicide trials carried out in PE 024. The two industry isolates were both metalaxyl-M resistant.

This result highlights the need to use a planned fungicide resistance management strategy alternating different modes of action to reduce the chances of further resistance developing.

Financial Benefits

The UK fresh basil industry is highly valuable, and the recurring problem of downy mildew is causing growers major issues; particularly as an infection results in damaged leaves and thus unmarketable plants. The lack of any tolerance from retailers to blemishes and the rapid

spread of downy mildew under favourable conditions have led to complete loss of crops grown under glass and up to 80% losses in the field. Outputs from this PE 024 and the extension project (PE 024a) have provided information on potential routes of downy mildew infection, conditions under which infections are likely to occur and control strategies. Implementation of these strategies will significantly lower downy mildew infections and hence associated losses.

Action Points

- Check with your seed supplier as to the health status of seed batches and any treatment methods used.
- Consider using the simple box-test protocol to screen incoming seed batches for basil downy mildew (see Appendix I in Science Section). Note, a negative result does not necessarily imply that seed is free of *P. belbahrii*.
- Check crops regularly and, where practical, if foci of infected plants are found remove them immediately by carefully bagging to avoid dispersing spores to other plants.
- For protected crops ensure there is adequate air circulation around plants to minimise prolonged periods of leaf wetness by better spacing and by increasing the ventilation in the glasshouse. If possible, avoid overhead watering as this is likely to aggravate the disease. If it is necessary to water from overhead then do this early, on days when solar radiation levels will ensure the leaves have a chance to dry out quickly.
- Use a planned fungicide resistance management strategy alternating different modes of action) to reduce the chances of further fungicide resistance developing. Do not rely on metalaxyl-M alone for seed treatment or disease control in the crop.
- Remove leaf and other plant debris at the end of the season to minimise the risk of carry-over of the disease and maintain effective weed control in and around the growing areas.
- Consider growing host crops independently to each other.