Grower Summary

FV 390

Outdoor herbs: epidemiology and control of downy mildew in outdoor sage, parsley, mint and in basil under protection

Final 2014

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Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Title:	Outdoor herbs: epidemiology and control of downy mildew in outdoor sage, parsley, mint and in basil under protection
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GROWER SUMMARY

Headlines

- Sage downy mildew may persist in woody plant material between growth seasons.
- Parsley downy mildew infection occurred only in autumn, despite the occurrence of leaf wetness periods of greater than 24 hours and conditions of high relative humidity earlier in the growing season.
- Basil downy mildew, whilst no longer a notifiable disease in the UK, is a particularly aggressive pathogen requiring effective control measures.

Background and scope

Downy mildew has become an increasing problem over recent years on a range of outdoor grown herbs, particularly sage, mint, and parsley. Downy mildew has also emerged as a problem on UK protected basil. Some growers whose crops were severely affected by downy mildew on sage in 2009 reported up to 80% of the crop being lost to infection.

Downy mildew diseases are caused by a number of different oomycete fungus-like organisms that frequently have narrow host ranges. The first record of *Peronospora lamii* on sage and rosemary in the UK was in May 2004. The same downy mildew species also affects mint. Downy mildews in parsley and basil are caused by different organisms, namely *Plasmopara umbelliferarum* (syn. *Plasmopora petroselini*) and *Peronospora belbahrii*, respectively.

The cool, wet seasons experienced during 2007–2010 were highly conducive to downy mildew infections on a wide range of crops. These high-risk seasons may have given rise to increased inoculum levels in soil and crop debris, and to long-term systemic infections in perennial herb crops like mint and sage.

Given the appropriate environmental conditions, downy mildew can infect herbs in propagation and those grown under protection (tunnels) as well as field-grown perennials or seed-raised crops. Downy mildews of some crops are seed-borne, and, while seed transmission has not been demonstrated for all the herb downy mildews under discussion here, a seed-borne route cannot be discounted, and there is circumstantial evidence to suggest a seed-borne route for dispersal. For example, *Peronospora belbahrii* has been found in association with basil seed, but the significance of this with respect to infection and disease spread is unclear.

A range of fungicide active ingredients such as metalaxyl-M and dimethomorph are available for use on both outdoor and protected herbs. These should provide good activity against downy mildews and other oomycete pathogens, assuming that reduced sensitivity and/or resistance have not developed in the pathogen population. However, the industry is keenly aware of pesticide residue issues and the need to reduce the use of pesticides in line with client (retailer) requirements and this currently presents a particular challenge, especially as there are no effective biopesticide products currently available that have activity against oomycetes. Fungicide applications need to be targeted appropriately, preferably when environmental conditions are favourable for disease development on unprotected crops.

The aims of this project were to determine the environmental conditions posing the greatest risk for downy mildew development through field monitoring, controlled environment work, and literature mining (Objective 1), collate data from Objective 1 to develop a forecasting model for environmental periods of high infection risk (Objective 2), determine whether disinfestation of crop debris and soil could mitigate against infection (Objective 3), and investigate fungicide programmes (Objective 4).

The project was hampered at all stages by lack of reliable infection during the project period (2011–2014). Downy mildews are obligate pathogens, meaning that they cannot be cultured artificially for use as inoculum. Problems were experienced in obtaining suitable inoculum, and, when inoculum was sourced successfully, achieving effective artificial infection proved difficult.

Summary of the project and main conclusions

Downy mildew and environmental conditions were monitored in field crops of parsley (*Petroselinum crispum*) and sage (*Salvia officinalis*) in Norfolk and in sage and mint (*Mentha* spp.) in North Yorkshire in the 2011 and 2012 growing seasons. Environmental parameters were recorded at each site. Disease monitoring was carried out in crops managed under commercial conditions with standard products applied for pests, disease and weeds as necessary. No downy mildew developed in either crop in North Yorkshire in the 2011 season, and only a small amount of disease was seen in 2012, in sage.

Downy mildew was first observed in the Norfolk parsley crop in late September in both 2011 and 2012. In 2011, this subsequently spread rapidly, affecting 80% of assessed plots by the middle of October. The similar emergence date in both years suggests that cooler autumn temperatures are likely to be particularly conducive to disease development and spread. This is supported by the controlled environment work (2011). Artificial infection levels were minimal under controlled environment conditions; nevertheless, parsley downy mildew infection appeared to occur more readily at lower temperatures (5–15°C) than other downy

mildews, and infection occurred with leaf wetness periods as short as 1 hour. Summer 2012 was particularly wet, yet parsley downy mildew still did not develop in commercial crops until early autumn. This suggests that temperature may be of more importance than high relative humidity for disease development, though this may also be indicative of waning plant strength and persistence/effectiveness of chemical control as the crop moved into autumn. By contrast, parsley downy mildew was sustained throughout periods of higher temperatures (early to late spring, 2014) in a small number of test plants at STC when high-humidity was maintained through fleecing. In summary, both lower temperatures and prolonged periods of high humidity were conducive to disease development, but early autumn appears to be a period of particularly high risk.

Downy mildew was present at the majority of assessments in the sage crop (Norfolk) in both 2011 and 2012. In 2011, downy mildew symptoms increased with time on new growth and after each cut but then declined towards the end of the season. No clear correlation between disease development and environmental conditions was apparent, but disease severity increased in early autumn 2012 coinciding with high rainfall levels. Controlled environment work indicated that the optimal conditions for infection were 10–20°C with leaf wetness periods of 6–24 h. However, pesticide treatment of sage plants and crop debris between the 2011 and 2012 seasons had only minimal effect (in spring) and no effect over the whole 2012 season, suggesting that infection in sage may derive from pathogen persistence in woody plant material, despite pesticide application, or that infection arrives each year as airborne spores (sporangia). The products used were SL567A, Previcur Energy, Invader, Signum, and a tank mix of SL567A and Invader, and these were applied in winter 2011 and/or early spring 2012. Sprays were applied over the top of plants to the point of run-off (1000 l/ha) so that the plants and soil were well treated, simulating a drench spray. At the time the work was conducted, the fungicides used were authorised for use on sage under the Extension of Authorisations for Minor Use (EAMU) system (formerly SOLA). Some efficacy was seen with Invader and Signum at the spring assessment (prior to the second spray), but disease severity at later assessments did not differ between treatments. This suggests that disinfestation may be of some value when clearing ground for new crops, but is not likely to minimize disease development in an existing crop.

Financial benefits

- This project has provided additional information regarding the development and persistence of herb downy mildews, particularly in parsley and sage, and the conditions under which the diseases are most problematic. Unfortunately, due to low disease levels in commercial crops during the project, less progress was made than hoped and further work is necessary towards effective control of the pathogen

Action points for growers

- Winter weather severity and spring/summer rainfall are factors that might be used to assess seasonal risk and hence the prospects for early downy mildew infections. Parsley downy mildew is more likely to occur during cooler autumn periods.
- Herb irrigation should be completed early in the day, wherever possible, so that the crop dries and does not remain wet overnight. Long periods of leaf wetness and cool temperatures will favour downy mildew infection and spread, and are best avoided where possible.
- Open planting and increased spacing within the crop aids airflow around plants and is likely to increase drying of the crop after surface wetness periods. Where possible, reducing leaf wetness periods to less than 24 hours may also help reduce infection periods.
- Downy mildew infection in sage may persist in woody material between seasons or may arrive seasonally as airborne spores. Pesticide treatment of sage material between seasons had minimal effect on disease development. However, growers may wish to consider this type of disinfestation when replacing plants or starting a new crop.
- When this project commenced, basil downy mildew was under statutory control and this made it extremely difficult to source isolates of *P. belbahrii* for study. Statutory control has now been lifted, allowing easier access to isolates for research purposes. The HDC has put out a call for further work on Basil Downy Mildew. Growers will be kept updated on progress.
- Growers should source seed from reputable suppliers. Where possible, seed should be from a disease-free crop that has been treated for downy-mildew.
- This project demonstrated that downy mildew is difficult to control once established and fungicides applied at this point have limited efficacy. Treatment for downy mildew should therefore be applied at or before the first sign of disease.