Grower Summary

FV 390

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

Annual 2012

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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 the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

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Project Title:	Outdoor herbs: epidemiology and control of downy mildew in outdoor sage, parsley, mint and in basil under protection
Project Leader:	Kirsty Wright
Contractor:	Stockbridge Technology Centre
Industry Representative:	Tom Davies, Malvern View Herbs
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Headline

- Long periods of leaf wetness appear to be required for downy mildew infection; extreme temperatures may hamper development and sporulation of the disease even if leaf wetness period is ideal.

Background and expected deliverables

Downy mildew has become an increasing problem over the last 3-4 years on a range of outdoor grown herbs, but particularly on sage, mint and parsley. Downy mildew has also more recently become a problem on protected basil in the UK. 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.

The first record of *Peronospora lamii* (downy mildew) on sage and rosemary in the UK was made in May 2004. The same species of downy mildew also affects mint. Parsley crops are susceptible to a different host-specific downy mildew pathogen – *Plasmopara umbelliferarum* (syn. *P. petroselini*), whilst the latest research on basil downy mildew has identified the pathogen as *Peronospora belbahrii*.

The cool, wet conditions experienced in each season from 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 in soil and crop debris, and long-term systemic infections in herb crops grown perennially e.g. mint and sage.

Downy mildew can infect herbs in propagation, those grown under protection (tunnels) as well as field grown perennials or seed-raised crops, given conducive environmental conditions. Whilst it has not necessarily been demonstrated in the case of these specific pathogens, some downy mildews are seed-borne and a seed-borne route cannot be discounted.

Fungicide actives 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 been detected 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 biological 'biopesticide' products with activity against oomycetes. Fungicide

applications need to be targeted when environmental conditions are likely to lead to a high risk of disease development on unprotected crops. The use of fungicides, bio-control products and other possible novel control mechanisms will be investigated for the control of the relevant downy mildew species. The potential efficacy of UV lights, burning-off of crop debris and over-wintering fungicide applications to eradicate spores (sporangia and oospores) and latent mycelium of the pathogen will be explored as a possible disinfection methodology for soil and affected plant material.

Summary of the project and main conclusions

Downy mildew literature review

A review of the recent literature on downy mildew pathogens in general and those which infect herb crops in particular was carried out. Background information on the main genera of the downy mildews which cause economic losses to horticulture and agriculture were discussed. Details of the possible sources of inoculum, environmental conditions conducive for disease spread and development and also the range of existing and potential methodologies for disease control and eradication have also been gathered. The full review is available in the Science Section of this report.

Parsley, mint and sage downy mildew – Monitoring environmental conditions and disease development in field crops

Downy mildew and environmental conditions were monitored in field crops of parsley (*Petroselinum hortense*) and sage (*Salvia officinalis*) in Norfolk from 13 April to 28 October 2011 (ADAS) and in sage and mint (*Mentha* spp.) in North Yorkshire from 17 May to 7 November (STC) to gain information on how weather affects the occurrence of these diseases. The environmental parameters recorded at each site were temperature, rainfall, relative humidity and leaf wetness. Disease monitoring was carried out in crops managed under commercial conditions with standard products applied for pests, disease and weeds as necessary.

Parsley (Norfolk): Downy mildew (*Plasmopara umbelliferarum)* was first seen in the parsley crop in Norfolk on 30 September, but there was no evidence in the experimental plots until 13 October when 0.2% leaf area affected was observed in four plots. By the final assessment on the 20 October, the disease had increased to affect 0.5% of total leaf area in the majority of plots.

Criteria on how temperature and leaf wetness duration influence disease were used to examine whether they explained disease development in the parsley field crops in 2011. The

criteria used were taken from work elsewhere on basil downy mildew and from growth cabinet work in this project on parsley. Previous work by other groups has suggested that the period of leaf wetness required for infection is >12 hours, while the optimum temperature range for disease development, based on the growth cabinet work, was taken as 5-15°C. The onset of infection on parsley correlated with a period during September when there were frequently long periods (30-40hrs) of leaf wetness and the temperatures were cool (5-15°C). Subsequent spread occurred during the cooler average temperatures of October (7.7°C).

Sage (Norfolk): In the sage crop monitored in Norfolk, downy mildew (*Peronospora lamii)* was present in each plot from 13 April to 28 October except after harvest cuts when there were no leaves present for assessment. Downy mildew symptoms increased with time on new growth and after each cut but then declined towards the end of the season.
Sage and Mint (North Yorkshire): No downy mildew developed in either of the crops monitored in North Yorkshire during the 2011 season.

Effect of temperature, leaf wetness and relative humidity on incidence and severity of downy mildew on parsley and sage

The effects of environmental conditions on the incidence and severity of parsley and sage downy mildews was investigated in three experiments in controlled environments. Two experiments tested the effects of four temperatures and four leaf wetness durations on parsley and sage inoculated with *Plasmopara umbelliferarum* and *Peronospora lamii* respectively. A third experiment tested the effects of four temperatures and six combinations of leaf wetness duration and relative humidity on parsley seedlings inoculated with *Plasmopara umbelliferarum.*

Disease levels were low in all experiments. Downy mildew on parsley appeared most prevalent at 5-10°C, especially where there was 24hr leaf wetness followed by 24hr high humidity. Sage downy mildew occurred mainly at 15°C.

Effect of overwinter fungicide drenches to soil and crop debris on downy mildew in sage

The objectives of this work were (1) to test the effectiveness of fungicide drenches against sage downy mildew when applied as overwinter and early spring disinfestation treatments to a dormant crop and to debris between rows and (2) to establish that products are safe to use on sage crops when applied as drenches.

Five fungicides (SL567A, Previcur Energy, Invader, Signum and a tank mix of SL567A and Invader) were applied in winter and/or early spring. 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 covered, simulating a drench spray. The fungicides used are currently authorised for use on sage under the Extension of Authorisations for Minor Uses system (formerly SOLA).

A replicated plot experiment was established with the five fungicides each applied at three timings: winter only, spring only, and winter and spring. The trial will be assessed for disease and phytotoxicity during 2012 and results available at the end of the 2012 growing season.

Financial benefits

- Information regarding the epidemiology of the key downy mildew pathogens, along with investigation into their survival, dissemination and control will help herb growers to understand the pathogen and therefore be better equipped to manage outbreaks in crops in the future.
- Project results will contribute to better understanding and management of a new downy mildew disease on basil (*Peronospora belbahrii*), first reported during 2010.
- Additional knowledge regarding the potential use of biological control products, cultural control and risk-based pesticide strategies to disease control may help herb growers reduce the risk of detectable fungicide residues on cut herb crops.

Action points for growers

- There are indications that winter 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 irrigation should be completed early in the day, wherever possible, so that the crop dries and does not remain wet overnight. Data indicate that long periods of leaf wetness and cool temperatures favour parsley downy mildew infection and spread.

Open planting and increased spacing within the crop aids air flow around plants and is likely to increase drying of the crop after surface wetness periods. This may help reduce infection periods.