Grower Summary

HNS 146

Hebe: aspects of the biology and control of fusarium wilt

Annual report 2007

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I declare that this work was done under my 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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GROWER SUMMARY

Headline

Fusarium oxysporum (the cause of fusarium wilt of hebe) is now causing financial losses in the UK and can persist in sand beds, once-used pots and as symptom-less infection in stock plants.

Background and expected deliverables

In 2005 *Fusarium oxysporum* was consistently isolated from stained vascular tissue of container-grown hebe plants affected by wilt and dieback. A vascular wilt disease of hebe caused by *F. oxysporum* was first described in Europe in 2000 (in Italy) and it was considered that this might be the same problem. Hebe is a very popular garden plant and the occurrence of a new wilt disease could severely damage sales. By the start of this project, the problem had been recognised on one nursery, where it had been a continuing problem for several years. In 2005 it caused losses of over 15,000 plants.

The objectives of this project are:

1. To determine whether *F. oxysporum* is a cause of hebe wilt in the UK

2. To investigate aspects of the disease biology and spread

3. To devise an effective control strategy

Summary of the project and main conclusions

Symptoms and cause of fusarium wilt in hebe

A *Fusarium* species consistently isolated from the vascular tissue of container-grown hebe plants exhibiting symptoms of a vascular wilt disease was identified as *F. oxysporum.* Identification of the species was confirmed by DNA sequencing at CSL.

Fusarium wilt of hebe caused by *Fusarium oxysporum* commonly appears as:

- wilting of one or more, but rarely all, shoot tips (Figure 1);
- loss of leaf colour;
- brown patches on leaves progressing to leaf, shoot and eventually plant death (Figure 1);
- dark brown staining of vascular tissue in the stem base and in affected shoots;
- occasionally, pale pink fungal pustules of *F. oxysporum* develop at the stem and/or on affected shoots.

Figure 1. Shoot-tip wilting (left) is an early symptom of fusarium wilt; leaf and shoot death (right) usually follow.

Occurrence of hebe fusarium wilt in the UK

Although reported to be widespread in the Netherlands, the disease was only identified on two UK nurseries in 2006. The UK Plant Health and Seeds Inspectorate (PHSI) determined that the fungus isolated (*F. oxysporum*) was a non-quarantine organism and therefore not subject to any statutory controls. ADAS horticulture consultants examined hebe plants on several other nurseries and garden centres during the year, they found no evidence of fusarium wilt.

Infection and disease development

Micropropagated hebe plug plants, cv. Pink Pixie, were inoculated with spores of an *F. oxysporum* isolate obtained from wilted hebe, applied as a root dip pre-potting.

Symptoms of fusarium wilt developed after three weeks. *F. oxysporum* was consistently recovered from affected plants in pure culture. *F. oxysporum* was therefore confirmed as a cause of fusarium wilt of hebe in the UK according to Koch's postulates.

The incidence of infected plants increased as the inoculum (spore concentration) increased. Root wounding (by cutting-off root tips) did not increase the incidence of infected plants. Other inoculation techniques were examined. Drenching potted plants around the stem base with *F. oxysporum* resulted in fusarium wilt symptoms, as did dip-inoculation of freshly cut shoot tips, but these methods of inoculation were generally less successful than the root-dip method.

Some plants that were still visibly healthy at 15 weeks after inoculation were found to have dark, stained vascular tissue at the stem base, and *F. oxysporum* was recovered from such tissue. These results indicate that the development of fusarium wilt can be relatively slow, taking more than 15 weeks.

Effect of temperature and moisture on infection

Plug plants of cv. Pascal were inoculated with *F. oxysporum* by dipping roots in a spore suspension for 15 minutes. Plants were potted in a peat-based medium and held for seven days in controlled environment cabinets maintained at 18 and 25°C with the growing medium maintained damp or wet. Plants were then placed in a warm glasshouse for 7 weeks and watered as required. Symptoms of fusarium wilt first appeared 4 weeks after inoculation.

- At 8 weeks after inoculation there was a significantly greater incidence of infected plants following an initial incubation period at 25°C, compared with at 18°C.

Distribution of F. oxysporum within plants

In order to provide information on the extent of systemic infection within plants, isolation of *F. oxysporum* was made from different parts of apparently healthy

cuttings and pot-grown plants. The plants tested were obtained from a nursery with a history of the disease. *F. oxysporum* was recovered at a low incidence from the stem base of rooted cuttings cv. Purple Pixie (3/20) and Rosie (1/20). It was also recovered from the stem base of 9 cm potted plants (3/30 plants), and from the roots of some plants (1/30 plants). When older plants in 3 L pots were tested, *Fusarium* sp. was recovered from 3/6 shoots on one branch and from none of 19 shoots on eight other branches.

- These results indicate that cuttings taken from apparently healthy container-grown plants, used as stock plants, may be infected with *F. oxysporum*.

- The disease could therefore be maintained on a nursery through the propagation cycle.

Varietal susceptibility

Fusarium wilt was observed in the UK in 2006 on cvs. Autumn Glory, Blue Star, Caledonia, Pascal, Pink Paradise, Pink Pixie, Purple Pixie, Purple Shamrock, Rosie, Sapphire, Silver Dollar and Sutherlandii.

- Pink Pixie and Purple Pixie were more commonly affected than other varieties.

- An inoculation experiment comparing the relative susceptibility of six varieties (Caledonia, Pascal, Pink Paradise, Pink Pixie, Purple Pixie and Rosie) is in progress.

Sources of F. oxysporum on a nursery

In July 2006, samples of sand were collected from three sand beds where batches of affected hebe plants had stood. The samples were examined in the laboratory for *Fusarium* sp. by plating onto agar. Isolates of *Fusarium* sp. were recovered from all the samples tested.

In October 2006, samples of sand from three sand beds and once-used hebe pots were collected from a nursery with a history of fusarium wilt and tested for contamination with *F. oxysporum* by a growing-on test. The sand was mixed with a peat-based growing medium and used to fill new plastic plant pots; the once-used pots were filled with new growing medium. Both sets of pots were potted with plants of cv. Pink Pixie.

- The first symptoms of fusarium wilt in any of the media amended with nursery sand were observed after six weeks; all of the inoculated control plants were showing symptoms at this time.

- After 18 weeks, 25% of plants grown in medium amended with sand from one of the nursery beds, and 15% of plants in the once-used pots, had developed symptoms of fusarium wilt.

- None of the uninoculated control plants, or the plants in two of the sand-amended media, developed symptoms.

- At the end of the experiment, examination of apparently healthy plants revealed additional, symptom-less infection in plants grown in medium mixed with sand from one of the sand beds on the nursery.

Financial benefits

Losses due to fusarium wilt of hebe on one nursery were at least £30,000 in 2005 and further substantial losses occurred in 2006. As the project progresses it is anticipated that an increased understanding of the disease will allow a reliable control strategy to be devised.

This disease is new to the UK and appears at present to be restricted in occurrence. If it can be controlled in the near future, the potential financial benefit is huge because widespread fusarium wilt in garden centres or home gardens could severely damage the image of hebe and subsequent sales.

Action points for growers

- Growers should familiarise themselves with the symptoms of hebe fusarium wilt.

- Note that hebe fusarium wilt could initially be confused with downy mildew. If in doubt, contact a plant pathologist or submit a sample to a Plant Clinic.

- If hebe fusarium wilt is known or suspected on your nursery, disinfect sand beds, other standing areas, pots and containers before re-using them for hebe (see HDC Factsheet 15/05).

- Consider checking the health of stock plants before taking cuttings; symptomless, systemic infection by *F. oxysporum* can occur within plants.

- Where feasible, maintain growing temperatures below 20°C; there is evidence that fusarium wilt is favoured by temperatures around 25°C.