Factsheet 04/10
Hardy Nursery Stock

Horticulture Development Company

Stoneleigh Park
Kenilworth
Warwickshire CV8 2TL
T: 0247 669 2051
E: hdc@hdc.ahdb.org.uk

Bacterial shot-hole of cherry laurel

Steve Roberts, Plant Health Solutions Ltd

Bacterial shot-hole of cherry laurel is caused by the bacterial pathogen *Pseudomonas syringae* pv *syringae*. The disease can lead to product downgrading and losses in the case of cherry laurel and other susceptible ornamental plant species. This factsheet describes the symptoms and biology of the disease and summarises the available control measures.

Action points

- Quarantine bought-in plant material for at least a week and check for the appearance of symptoms.
- Get the identity of the pathogen checked in new outbreaks, especially on imported plant material.
- Keep batches of plants from different sources separate if practical.
- Focus on ensuring the health status of stock plants.
- Dispose of visibly infected plants and plant debris.
- Clean and disinfect production beds between crops.
- Grow cherry laurels under protection.
- Optimise the growing medium used in terms of drainage, conductivity and pH.
- Use sub or drip-irrigation or minimise overhead watering.
- Use as wide a plant spacing as economically possible.
- Create barriers of non-hosts plant species between batches of plants.
- Minimise the movement of machinery and people within and between batches of laurels, especially when plants are wet.
- Wash hands when moving between susceptible crops.
- Clean and disinfect pruning and cutting tools frequently.

1 Bacterial leaf spot symptoms on a young leaf of *Prunus laurocerasus* 'Rotundifolia'

Background

Cherry laurel (*Prunus laurocerasus*) is one of the single most important hardy nursery stock species; large numbers are produced for and widely used in landscaping and in amenity plantings. Plant propagation is via cuttings and production may occur in containers or in the open ground.

In an HDC-funded survey conducted in 1996-97, leaf spot and shot-hole of cherry laurel was the most prevalent bacterial disease noted on nurseries (HDC project HNS 71). It is one of the major causes of losses in cherry laurels on commercial nurseries and can result in up to 30% of stock becoming unmarketable. Losses have led some growers to reduce or stop production resulting in increases in the level of imported plant material.

The disease has been reported in the UK, Europe and N. America since the early 1980s. It is particularly troublesome on ground cover laurel varieties such as 'Otto Luyken' and 'Zabeliana', but the disease affects all varieties and the related Portuguese laurel (*P. lusitanica*).

A 3-year MAFF-funded project on the disease was completed by the author in 1998. There has also been some limited work undertaken in other countries including France and Canada. This factsheet summarises the currently available information.

Disease recognition and biology

Causal organism

In the UK, bacterial leaf spot and shot-hole of cherry laurel and related plant species is caused by the bacterium *Pseudomonas syringae* pv. *syringae*.

Another bacterium *Xanthomonas arboricola* pv. *pruni* (synonymous with *X. campestris* pv. *pruni*) is also known to infect cherry laurel (and other *Prunus* species), and is often considered as the primary cause of shot-hole in N. America. This is a quarantine pathogen within the EU. There have been localised reports on stone fruit subjects in France and Switzerland, and it has recently been reported on cherry laurel on nurseries in the Netherlands (2008) and Italy (2005).

During the HDC-funded survey of HNS and the MAFF funded project only *P. syringae* pv. *syringae* was isolated from cherry laurel, but given the recent reports of *X. arboricola* pv. *pruni* from other parts of Europe, it is recommended that the causal organism is confirmed by laboratory identification.

Host range

The species *P. syringae* is divided into pathovars (pv.) on the basis of plant host range, for example *P. syringae* pv. *berberidis* infects only *Berberis* species whilst *P. syringae* pv. *philadelphi* infects only *Philadelphus* species. *P. syringae* pv. *syringae* is considered to have a broad host range that includes lilac, all *Prunus* species, *Phaseolus* beans and many other plant species. However, the precise host range is unclear and the scientific literature is confusing. This is probably due to the frequent but incorrect assignment of unknown strains of *P. syringae* to pv. *syringae*.

Limited host-range studies were done as part of the MAFF-funded project. Pathogenic isolates from cherry laurel were able to infect lilac and forsythia. Isolates from lilac and *Prunus avium* were able to infect cherry laurel. *P. syringae* pv. *morsprunorum*, which causes bacterial canker and shot-hole on sweet cherry and plums, did not infect cherry laurel (but has been reported to do so in Spain).

Symptoms

The bacterium infects via natural openings and wounds, and infections tend to be localised with little or no evidence of systemic spread through the vascular system of the plant. Precise conditions for infection and disease development have not been established, however in artificial inoculation experiments, symptoms first became apparent about six days after infection at temperatures in the range of 15-22°C.

Disease symptoms can be quite variable. Typically the disease is seen as brown necrotic leaf spots around 2 to 10 mm in diameter. In the very early stages, spots may have a water-soaked margin, most easily seen by holding an infected leaf up to the light. On younger leaves, spots develop a reddish border and a yellow chlorotic halo (Figure 1). Abscission layers develop around the spots which then eventually drop out to give the characteristic ragged, shot-hole appearance (Figure 2). Stems can also be infected to give cankers and shoot die back especially in combination with frost (Figure 3).

The shot-hole symptoms can be easily mistaken for insect damage. On the other hand, not all shot-hole symptoms are necessarily caused by bacteria and they are also reported to be caused by a number of different fungi (for example the leaf spot fungi *Stigmina carpophila*). Probably the most common alternative cause of shot-holes in cherry laurels (especially on hedges) is infection by powdery mildew (*Podosphaera tridactyla* and *P. pannosa*).

Another cause of confusion is marginal leaf necrosis symptoms. This is a physiological problem associated with poor growing conditions (for example drought stress, water-logging or high growing media conductivity levels). Typically these brown areas at the edges of leaves drop off, giving the leaf margins a notched appearance (Figures 4 and 5).

The presence of certain bacteria can also lead to increased levels of frost damage in crops, as the bacteria can act as ice nuclei. An ice nucleus is a particle which acts as a point for the formation of an ice crystal. Many strains of *P. syringae* (including all *P. syringae* pv. *syringae* isolates pathogenic on cherry laurel) can act as ice nuclei and promote the development of ice crystals within plants, increasing levels of frost damage.

2 Leaf spots eventually drop out to give leaves a ragged appearance

3 Shoot dieback caused by a combination of frost and *Pseudomonas syringae* pv. *syringae*

4 Shot-hole symptoms on *P. laurocerasus* 'Rotundifolia' caused by powdery mildew

5 Marginal leaf necrosis can be a physiological problem

Disease sources and spread

Pathogen presence on commercial nurseries

As part of the MAFF-funded project, studies were undertaken at two commercial nurseries. The nurseries were located in different parts of the country (South coast and North West) and followed different production practices. Samples of apparently healthy leaves were collected at each stage of production (from stock plants, through to rooted cuttings, liners and marketable plants) at each nursery and tested for the presence of *P. syringae* pv. *syringae.*

Pathogenic isolates of *P. syringae* were detected on apparently healthy leaves at all stages of production on both nurseries. Contamination varied with production stage, site and sampling date. In general, the site with the most severe disease problems also had the highest levels of contamination. Plants in protected environments (cuttings and liners) had lower levels of contamination compared with plants in the open (stock plants and marketable plants).

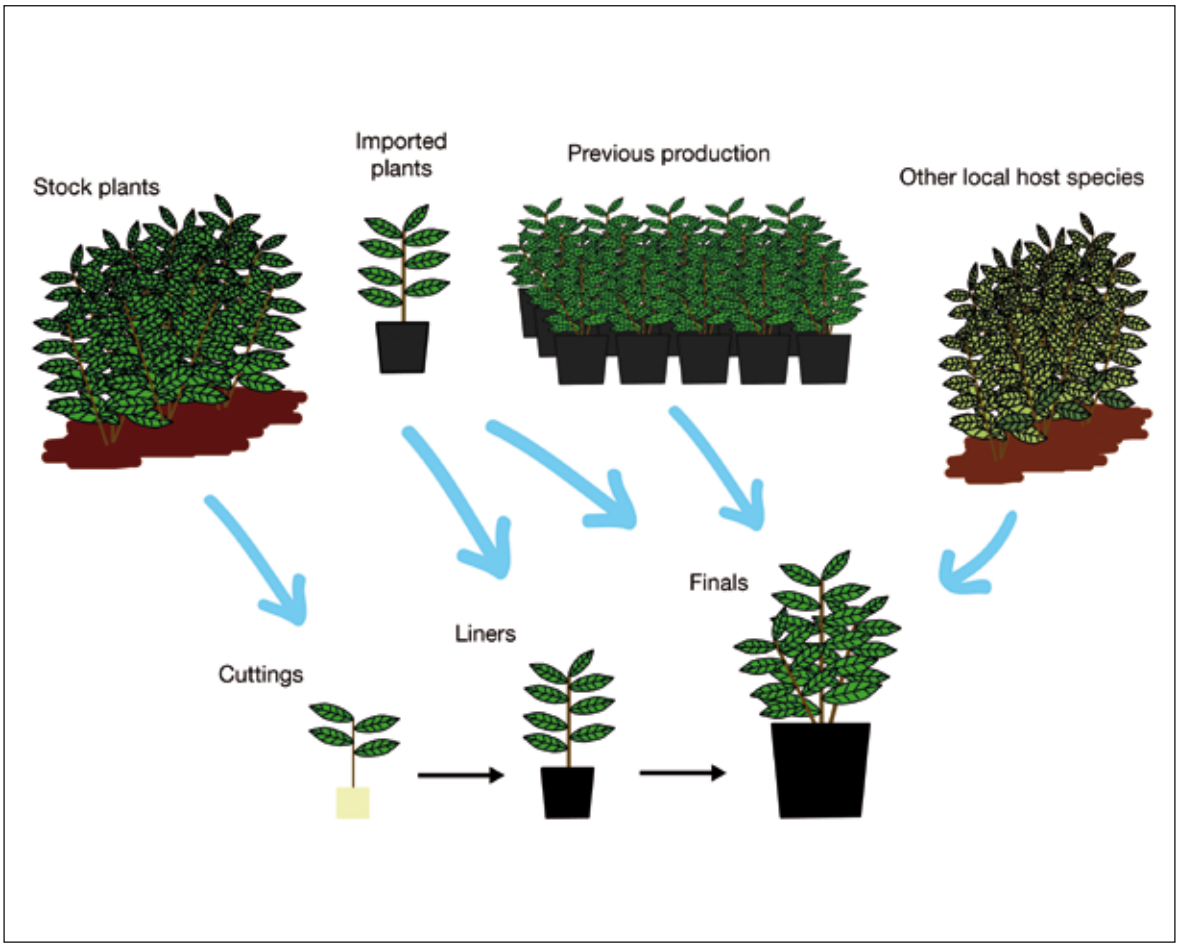
Inoculum sources

Stock plants, imported plants, previous years' production and alternate host species may all serve as sources of inoculum. Detection of the pathogen on apparently healthy leaves means that the absence of symptoms does not guarantee that the material is free from the pathogen (Figure 6).

P. syringae is generally considered to survive poorly in soil and growing media and so these are unlikely to be significant sources of inoculum. Crop debris and residues from previously infected batches may provide an inoculum source over the short-term, especially from crop to crop within a growing season, and particularly if the rate of debris breakdown is limited by dry or cold conditions.

Spread

In common with many other bacterial diseases, spread from plant to plant occurs by water-splash (rain or irrigation), wind driven rain and via the movement of people, animals, insects and machinery within crops.



6 The potential sources of inoculum within cherry laurel production.

Control strategy

Due to the potential for cross-infection with other susceptible species it is important that management of this disease is approached on a whole nursery basis. There is little value in putting effort into eliminating the disease in cherry laurels if there is regular re-infection from other species.

Cultural methods of control

Bought-in plants and stock plants

The symptomless contamination of stock plants with the pathogen suggests that a strategy based on the production and maintenance of pathogen-free stock plants should be an important part of any management strategy for this disease. Bought-in plants should be quarantined in a separate area from susceptible varieties until the health status of the plant material can be ascertained (by laboratory examination if required). If practical, keep batches of plants from different sources separate.

Production system

The most effective way to manage bacterial shot-hole is to grow cherry laurels under protection with sub or drip-irrigation to prevent the spread of the pathogen from plant to plant by water splash. Plants should be grown at as wide a spacing as economically possible. If the nursery production system permits, create barriers of non-host plant species between batches of plants. A suitable growing medium should be used to grow the plants in, the medium should be well drained, have a low conductivity and a pH of around 6.5.

Nursery hygiene and use of disinfectants

Dispose of infected plants and sweep up beds between crops to minimise the amount of crop debris remaining between batches of plants. Production areas and pruning tools should be disinfected to minimise pathogen spread. *P. syringae* pv. *syringae* is sensitive to most general purpose disinfectants, in HDC project HNS 91, both Jet 5 (peroxyacetic acid) and Menno Florades (benzoic acid) were effective at reducing the pathogen to undetectable levels in laboratory tests.

Wash hands when moving between susceptible crops and try to avoid the movement of machinery and staff within susceptible batches of plants especially when the plants are wet.

Foliar treatments

Currently the only approved fungicides with known activity against bacterial plant pathogens are those based on copper compounds or the bio-pesticide Serenade ASO.

The copper based products Cuprokylt and Cuprokylt FL (copper oxychloride) have activity against bacterial diseases. Neither of these products has a label recommendation for use in hardy ornamental plant production or a Specific Off-Label Approval (SOLA). Use is therefore currently via the Long Term Arrangements for Extension Use (LTAEU), until a SOLA can be obtained.

The bio-pesticide Serenade ASO (active ingredient *Bacillus subtilis*) has a Specific Off-Label Approval (SOLA 0246/2009) for use on ornamentals, and is known to have activity against bacteria, but its efficacy as a foliar spray for control of bacterial leafspot and shot-hole of cherry laurel has not been examined.

Recommendations from other parts of the world are often vague and generally indicate the use of copper compounds or the antibiotic Streptomycin (not approved in the UK). However there have been no definitive studies and results reported for copper compounds are variable. In an HDC-funded trial on bacterial diseases of hardy nursery stock (HDC Project HNS 91) none of the compounds examined (including Bordeaux mixture, fosetyl-aluminium and peroxyacetic acid) gave satisfactory control despite being applied on 26 occasions over a period of 37 weeks.

In areas where copper and/or Streptomycin have been used extensively on ornamentals, *P. syringae* has developed resistance. Nevertheless, copper resistance was never detected in isolates obtained during the MAFF study on plant material obtained in the UK.

If the decision is made to apply sprays to control the disease, it is important that consideration is also given to treating stock plants, young plants and other potential hosts on the nursery. Both copper based fungicides and Serenade ASO work as protectants; therefore applications made after symptoms are widespread are likely to have little impact.

Disease diagnosis

Shot-hole symptoms present a problem for successful diagnosis as the infected tissues are often missing. It is therefore important to send samples for laboratory diagnosis at the earliest stages of infection and certainly before lesions have dropped out. Samples with a range of symptoms (packed in absorbent paper in plastic bags within a box for protection) should be sent to a laboratory specialising in the diagnosis of bacterial diseases; for example Fera, Plant Clinic, Sand Hutton, York YO41 1LZ (www.fera.defra.gov.uk) or Plant Health Solutions Ltd, Ryton Gardens, Wolston Lane, Coventry CV8 3LG (www.planthealth.co.uk).

Further information

A summary of the MAFF-funded project (HH1731SHN 'Aetiology and control of bacterial leaf spot of cherry laurel') can be found at www.planthealth.co.uk/publications/. Reports on the HDC funded projects referred to (HNS 71 'Ornamental nursery stock: Examination of the distribution and importance of bacterial diseases' and HNS 91 'Bacterial diseases of HNS: Chemical control') are available from the HDC by either phoning 0247 669 2051 or visiting www.hdc.org.uk. A further HDC funded project HNS 179 'Management of bacterial canker in *Prunus* species' has recently commenced.

Acknowledgements

All images are copyright of Plant Health Solutions.

October 2011