Grower Summary

SF 132

Progressive die-back symptoms in blueberry: Identification and control.

Annual 2013

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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.

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Project Number:	SF 132
Project Title:	Progressive die-back symptoms in blueberry: Identification and control.
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Contractor:	FAST Ltd
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Headline

- *Phomopsis* was the most frequently isolated fungal organism on dying blueberry bushes, but it is not yet confirmed that this is the cause of blueberry dieback.

Background and expected deliverables

Dieback of shoots and crown-rot type symptoms are sometimes noted in blueberry plantations. More recently this type of problem has increased in incidence, especially in the west of England (Devon and Herefordshire) and progressive dieback type symptoms have resulted in the grubbing of a young plantation at a farm near Ross-on-Wye. Similar symptoms are apparent on other blueberry farms but not always resulting in such significant mortality.

The most common symptom observed is leaf loss and rind browning at the shoot tips which may or may not develop into more significant wilting and dieback. This dieback is often limited to one or more branches while other parts of the bush continue to grow almost normally for a while. Affected branches frequently show signs of limited recovery as the season progresses, only to fail completely the following spring. In 2010, intensive investigations of the problem on two sites (Devon and Herefordshire) were conducted by FAST using the diagnostic services of Fera. A species of *Phomopsis* was consistently identified in a majority of samples. Using DNA analysis, Fera were able to show that the pathogen was not the same as the EU quarantine organism, *Phomopsis vaccinii* but the actual identity of the species has not been confirmed.

There appear to be similarities between dieback symptoms reported by blackcurrant growers and studied as part of GSK Project no. 223 (SF12) and those observed in blueberries. SF12 has identified that *Diaporthe strumella* syn. *Phomopsis ribicola* has been consistently associated with the blackcurrant problem referred to above. However there is no current evidence that the causal agent is the same in blueberry.

It is possible that the *Phomopsis* identified so far (Figure 1) is a secondary pathogen and not the primary cause of the problem.

Figure 1. Images of bushes from which *Phomopsis* was isolated (FAST Ltd)

The purpose of this project is to (1) Identify the cause of the aggressive type of dieback and crown rot symptom responsible for rapid decline or death in blueberry bushes; (2) Discover how the problem is spread within and between sites and (3) To develop methods to manage and control the problem.

Summary of the project and main conclusions

By 12th December 2012, more than 60 plant tissue samples, collected by EMR and FAST, had been submitted to Fera for diagnostic work. Sub-samples from some sites were also retained by EMR for separate testing. Samples ranged from whole plants, delivered directly to Fera in York, through twigs, roots, fruits and leaves. The majority of samples were of plants displaying obvious dieback symptoms. The reason for submitting fruit, leaf or root samples was because of the evidence of symptoms on those organs appearing to bear some relation to the dieback infection or expression process.

Ann Barnes and colleagues at Fera followed established protocols for identifying fungi present on the samples by visual diagnosis following dissection and, where appropriate setting up cultures to study them in more detail. A very large number of fungi were identified. Samples were allocated a code in the field and at Fera. A very large number of photographs

were taken. The best of these will be collated and related to the laboratory findings. Fera also used DNA sequencing to confirm the presence of *Phomopsis* and to investigate the type of *Phomopsis* found.

Farms were visited in the South East, Herefordshire, Devon, Dorset, Northamptonshire and Scotland. No single, dominant cause of dieback was found. Table 1 (below) provides an impression of the frequency by genus.

In 2012, 32% of blueberry samples submitted for the project, yielded a clearly identified *Phomopsis* or *Diaporthe*. A further 11% yielded a pathogen that could have been either *Phomopsis* or *Phoma.*

Following damaging weather conditions during flowering in 2012, a great deal of 'blossom blight' (Figure 3 – below) was observed at the two Herefordshire sites. *Phomopsis* was clearly identified as being associated with these symptoms. This symptom was most obvious on the variety 'Darrow'.

On two sites visited in Scotland, frost damage to flowers was a common problem with visible Botrytis sporing on the dead blossoms and associated shoot dieback. *Phomopsis* was not found.

Bushes at the Herefordshire sites showed a remarkably high incidence of tip dieback. Most of the sites visited by EMR also showed a high incidence of the tip dieback, which resembles antlers (Figure 2).

Figure 2. 'Antler' symptom

Whereas this type of symptom is common in blueberry plantations, it is not universal. The authors have visited many plantations in the UK and overseas, where bushes show few or no 'antler' type symptoms.

Botryosphaeria was not identified in samples from the severely diseased Herefordshire and Devonshire sites.

Table 1. Types of fungi isolated from the collected samples

Fungi isolated:	**% of all blueberry samples**	**% of samples when leaf spot, fruit and root samples excluded**
Phomopsis/Diaporthe	32	30
Phoma	14	12
Phomopsis/Phoma	11	11
Botrytis	16	14
Fusarium	14	12
Cytospora	9	9
Botryosphaeria	7	7
Phytophthora	9	7
Coniothyrium	5	5
Cylindrocarpon	2	2
Ceratocystis	2	2
Ascochyta	2	2
None	4	2

With *Phomopsis* showing in so many samples and in the knowledge that this pathogen had already been implicated in the loss of plants in the Herefordshire and Devon, Fera scientists have worked to grow pure cultures from a selection of the samples. Molecular DNA analysis is on-going in an attempt to resolve the taxonomy beyond the genus of the isolates. At the time of writing this work appears to indicate that more than one distinct species of *Phomopsis* is present in the population of pathogens found.

With many fields showing significant shoot die-back (Figure 4 – below) but a smaller number suffering from the more serious loss of complete branches or even bush death, it is necessary to establish whether there is a link between aerial symptoms and infections that result in decay at the base of branches or within crowns. To that end, separate samples were distinguished according to whether necrotic symptoms appeared to be the result of basal, tip or side infections. An attempt is being made to distinguish 'die-back' from 'die-up' symptoms

by looking for necrotic staining within the affected branches within otherwise healthy wood, below or above the area showing clear external symptoms. Work on this is on-going.

Figure 3. Blossom blight, May 2012

Figure 4. Die-back, December 2012

FAST looked at several scientific papers reporting the results of research into blueberry dieback in other countries. Research findings about the epidemiology of *Phomopsis* in the eastern states of USA appeared to be particularly relevant as did a paper reporting the diversity of fungal species to be found on blueberries in northern Europe.

Descriptions of *Phomopsis* symptoms and disease development that have been described by researchers in both Michigan State University and North Carolina State University, fit much of what we are seeing in badly diseased British plantations (Figure 5). Whether any of the

Phomopsis species present in our samples are sufficiently pathogenic to infect and cause severe dieback symptoms on their own, cannot be assumed without work to satisfy Koch's Postulates, which will be started in 2013.

Figure 5 Image from Szmagara, 2009

Financial benefits

The establishment cost for a new blueberry plantation is particularly high. Fields are planted with at least 3,000 plants per hectare and often more when soil-less systems are used. Where sulphur and other soil amendments are used or when bushes are to be maintained in pots, the loss of plants to die-back disease can have a substantial impact on profitability. This is made worse if the cause and source of infections are uncertain because replanting risks infection of the replacements.

Action points for growers

The fungus responsible for blueberry dieback and death has not be clearly identified so it is not possible to provide clear advice on disease control at this stage of the project. However, some guidance can be given to growers based on the results of the investigations to date:

- During the dormant season, prune out twigs showing the 'antler' type dieback symptom, as it is possible these are a source of inoculum for infection in spring. Remove the prunings from the plantation, as if left on the ground they may still provide inoculum for re-infection.

- Where there is a significant incidence of 'antler' type symptoms, where possible select broad spectrum plant protection products for Botrytis control that may also be active against *Phomopsis*. It should be noted that, in the USA, the period between bud break and petal fall is regarded as the highest risk for infection by *Phomopsis* species.

- Avoid basal injuries to young plants or exposure of the same to high risk situations that may provide access points for *Phomopsis*. Potential causes of basal injury include vine weevil larvae, wind-rock, removal of ‘twiggy’ shoots after planting, fertiliser scorch and freeze injury. High risk situations include permanently moist compost in contact with wounds, humidity (growing and storage) and harsh weather between bud break and flowering.