Phoma on vegetable Brassicas

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Phoma diseases (Leptosphaeria maculans and Leptosphaeria biglobosa; asexual stage Phoma lingam), also known as blackleg, are important worldwide in Brassica crops including the leafy and flowerhead types, turnip, Chinese cabbage and pak choi, oilseed rape and swedes and mustard. In the UK, Phoma stem canker of oilseed rape is the most economically important disease in southern, eastern and central England. Severe losses can occur in cauliflower and swede, but it is mainly a leaf blemish on other vegetable Brassicas. Once leaf spots appear, the fungus can grow in the plant without causing any symptoms before causing severe stem symptoms.

Action points

- Use healthy seed.
- Monitor crops regularly and use fungicides at the propagation stage when Phoma leaf spots are first found.
- Bury crop residues and use non-Brassica crops in the rotation where Phoma problems are identified.
- Do not grow leafy salad Brassicas close to oilseed rape.

Symptoms

Leaf symptoms can occur from the cotyledon stage onwards. Very young seedlings can be killed very rapidly. Typical leaf spots are variable in shape and pale brown or white with numerous dark brown dots within the lesion, these are the fruiting bodies called pycnidia which produce the spores (Figure 1). This contrasts with ringspot symptoms which have more numerous tiny black fruiting bodies (psuedothecia) within the lesions. The Phoma pycnidia produce a deep pink spore exudate that is diagnostic for Phoma lingam. The lesions are usually greenish on the underside of the leaf and this enables them to be distinguished from downy mildew lesions that are often yellow or pale brown on the underside. As leaf spots enlarge (1-2 cm diameter) they may develop a darker margin and show yellowing around the lesion. There is darkening of the leaf veins within the leaf spots and around the lesions, indicative of Phoma spreading through the leaf towards the stem.

The leaf symptoms caused by Leptosphaeria biglobosa are smaller and darker than those caused by L. maculans and also contain fewer pycnidia. Vegetable Brassicas with more delicate leaves such as pak choi and Chinese cabbage are very susceptible to leaf spotting. On mature leafy Brassicas there may be few signs of leaf spotting and only low levels are usually found on buttons of Brussels sprouts. There may be some difficulties distinguishing between ringspot and Phoma...
lesions however one difference is that fruiting bodies within lesions of ringspot tend to form in concentric circles.

The spread of Phoma through the leaf and petiole is largely symptomless. It invades the stem via the vascular system of the infected leaf and after a period of several weeks stem cankers form. These cankers are sunken areas on the lower stem and roots and have a distinct black margin. Sectioning the root shows internal blackening of the woody tissues and a dry rot that can weaken the stem or kill the plant (Figure 2).

Problems in cauliflower may only become apparent when plants start to wilt and die close to maturity. In swede roots, the disease causes a dry rot in the neck and shoulders of the root which progresses through the root even when temperatures are low (Figures 3 & 4).

In seed crops and oilseed rape, Phoma affects the leaves, stem base (canker lesions), the upper stem and branches, flower buds and pods.

**Epidemiology**

There are different types of epidemics because the initial source of disease may be infected seeds or air-borne spores. Air-borne ascospores are dispersed after periods of rainfall or high humidity and can germinate after as little as 4 hours of leaf surface wetness. The proportion of spores producing lesions increases as the duration of surface wetness increases to 24-48 hours. Symptoms appear in 5-6 days when temperatures are near the optimum of 20°C. Secondary spread by pycnidiospores is also favoured by long periods of leaf wetness and warm temperatures. It is also able to invade the plant where there is physical damage or pest injury.
Growth through the leaf to the stem is thought to occur at a rate of several millimetres/day under optimum temperature conditions. Thus stem infection and hence survival on woody crop residues does not occur in short term Brassica crops because the fungus does not reach the stem. In oilseed rape, for example, stem canker lesions develop in spring, about 6 months after leaf infection in the autumn. Stem symptoms appear more rapidly in spring-sown crops because temperatures are more favourable for fungal growth.

Where there is seed-borne infection, Phoma can spread in seed-beds and in module production under glass. When bare root transplants were used, spread was facilitated by washing plants particularly as plants also had damaged roots.

Life Cycle

Epidemics can be initiated by air-borne spores (ascospores) produced on crop residues and dispersed by wind. Ascospores are produced mainly on stubble in minute structures called pseudothecia. Ascospores form on infected woody stems and roots after cropping. Survival of the pathogen and spore production can continue for several years until the woody remains decay.

Winter oilseed rape stubbles are an important source of inoculum when located near to areas of Brassica production. The main period of ascospore production is during the autumn and winter so crops planted in the spring and summer are only lightly infected or escape. The leaf spots produce pycnidiospores that are splash-dispersed within the crop. The significance of this secondary phase in vegetable Brassicas is not well understood.

Phoma can be seed-borne and this can result in problems in individual varieties if there is a high level of seed-borne infection and/or spread during plant propagation. Ascospores can enter propagation glasshouses through the open vents and also introduce the disease onto seedlings.

Control

Cultural control to dispose of crop residues, unharvested crops and volunteers are important to reduce the carry-over of inoculum, particularly where crops are planted in quick succession. Chopping and burial of stems and roots will encourage more rapid breakdown of crop residues that might otherwise persist for several years. Use a rotation with non-Brassica crops for at least two years where severe Phoma problems have occurred to allow crop residues to decay.

Avoid planting vegetable Brassicas close to oilseed rape.

Use healthy seed. Where seed is known to have a low level of Phoma infection, use a fungicide seed treatment or hot water treatment.

Monitor seedlings regularly during propagation and be prepared to apply fungicide treatment if Phoma leaf spots are found. Foliar fungicides may be beneficial during the growing season when used as Phoma leaf spots start to appear. Note fungicides used against other foliar diseases may have some effect on Phoma development.

Variatel resistance

Little is known about varietal differences in the susceptibility of many Brassicas to Phoma diseases. The *Brassica rapa* group that includes Chinese cabbage, pak choi and turnip appear to be more susceptible to leaf spotting, whilst cauliflower and Brussels sprouts than nearby oilseed rape, there appears to be useful ‘resistance’ in some vegetable Brassicas.

*Phoma biglobosa* often occurs along with *P. maculans* on leaves, but is considered less damaging and causes more superficial stem lesions and some blackening of the pith within the stem.

Products

See separate insert ‘Chemical control of Brassica diseases’.

Agronomy issues

The disease is only occasionally economically important on cauliflower, Brussels sprouts, and cabbage and prevention relies heavily on using healthy seed and transplants. Local knowledge of recent problems is important to guide decisions about using fungicides on swedes as treatment timings have not been investigated. Be aware that most foliar fungicides have broad-spectrum activity and may give some control of Phoma diseases.
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