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An unusual *Phoma* stem rot of tomato

An unusual tomato stem rot disease that appears to be caused by *Phoma labilis* and a *Phoma* species closely related to *P. destructiva* affected a few crops in southern England in 2015 and reappeared in early 2016. This factsheet provides information on tomato stem rot caused by these *Phoma* species and compares symptoms with those of *Didymella* stem canker, caused by *Didymella lycopersici* (asexual stage *Boeremia lycopersici*; previously *Phoma lycopersici*).



Figure 1. Close-up of stem symptoms of varying severity – infection begins as small black spots and can progress to girdle and kill the whole stem



Figure 2. View of an affected length of commercial crop; note lengths of affected stems separated by greener, unaffected areas

Action points

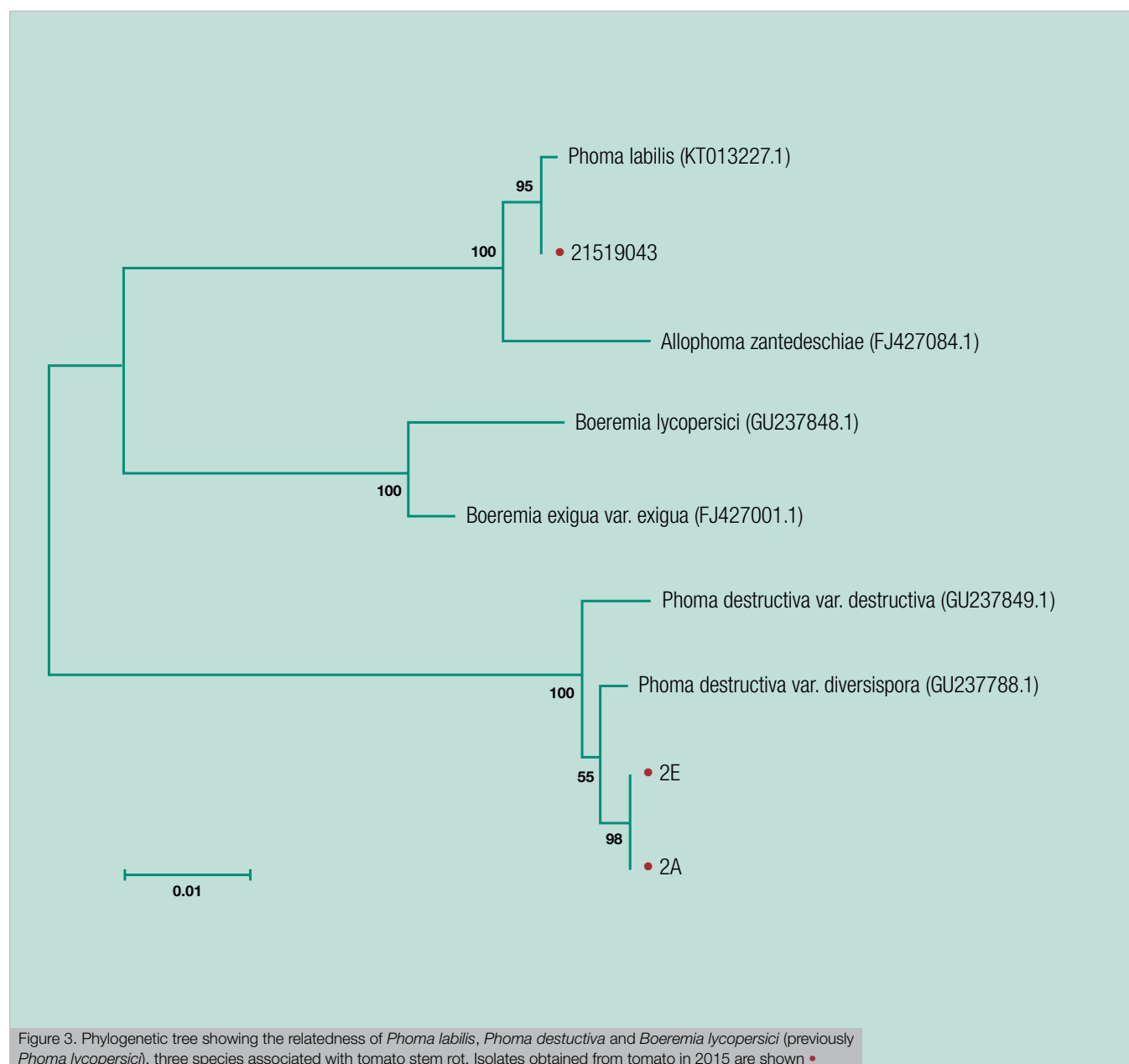
- Note that *Phoma labilis* can cause small black spots and pale brown girdling lesions on tomato stems; check the cause if you see these symptoms in a crop in case it is due to another potentially more aggressive related fungus such as *B. lycopersici* (previously known as *Phoma lycopersici*; sexual stage *Didymella lycopersici*).
- Rectify slipped glass and water leaks to minimise drips onto the crop and persistent stem wetness.
- Measures taken to minimise severity of root diseases, such as corky root rot (*Pyrenochaeta lycopersici*) will likely reduce the risk of *Phoma labilis* spots enlarging to cause girdling lesions that kill stems.

Introduction

Several *Phoma* species have been described on tomato worldwide, the most frequent being *Boeremia lycopersici*, commonly known as *Didymella* stem canker and fruit rot. Historically in the UK, outbreaks of *Didymella* stem canker have been severe with significant stem death and sometimes damaged fruits as well. Consequently, it is important to identify outbreaks of *Didymella* as soon as possible in order to implement appropriate disease management practices. In recent years, infection by *D. lycopersici* has been sporadic with symptoms commencing at the very base of stems, often within the rockwool propagation cube. Provided these are spotted early and affected plants removed, the disease has not progressed.

Other species of *Phoma* recorded occasionally on tomato are *P. destructiva*, *P. exigua* and *P. glomerata*. None of these have been reported on tomato crops in the UK in recent years. It is difficult to clearly differentiate species of *Phoma* based on appearance of the fungus in culture or from morphological features when examined microscopically.

In September 2015, a *Phoma* species was consistently isolated from several tomato crops in southern England that showed small black spots on stems and occasionally girdling lesions that resulted in stem rot and plant death. Neither the symptoms in the crops nor the appearance of the fungus in culture were consistent with *Phoma lycopersici* (*D. lycopersici*). Partial genome sequencing of three isolates of the fungus indicated one isolate was closely related to *Phoma labilis*; the other two isolates were closely related to *Phoma destructiva* var. *diversispora* (figure 3). The morphology of the two isolates identified as *P. destructiva* also conformed to *P. destructiva*. All three isolates were distinct from *Boeremia lycopersici* (*Didymella lycopersici*) and *Boeremia exigua* var. *exigua* (*Phoma exigua*). *P. labilis* has been recorded on tomato stems once previously, associated with spotting on tomato stems in the Netherlands, in 1993. *Phoma destructiva* is responsible for leaf spots and fruit rots on tomato in many countries and has been recorded occasionally on tomato in the UK.



Symptoms of *Phoma* stem rot and *Didymella* stem canker

Phoma stem rot and spot (figures 4–5)

Symptoms appeared initially as small (1–3mm) grey-black spots on stems, which developed into longitudinal oval lesions penetrating c.1mm into and sometimes girdling the stem. Merged lesions resulted in 15–45cm lengths of grey-brown stem superficially similar to late blight (*Phytophthora infestans*). No symptoms were observed on leaves or fruit. Development of small spots into girdling lesions and subsequent stem death appeared to be associated with co-infection by corky root rot (*Pyrenochaeta lycopersici*) in soil grown crops.

The problem affected 2–3m lengths of layered stem bundles in rows throughout the glasshouses; it appeared to be associated with areas of plant wetness caused by water drips from poorly fitting glass.

Description of *Phoma destructiva* symptoms on tomato leaves and fruit is common, but only one observation of stem symptoms was located from a 2013 crop in Malaysia. Leaf lesions were described as initially small (1–2mm) and black, enlarging to 1–2cm in diameter and irregular to round in shape, slightly sunken and zonate; stem lesions were described as longer but similar in appearance.



Figure 4. Close-up of dark spots of varying size, the first obvious sign of infection



Figure 5. Close-up of a stem lesion that may progress to girdle and kill the stem

***Didymella* stem canker and fruit rot (figures 6–8)**

D. lycopersici is best known for the damage it causes on the stems and, to a lesser extent, the fruits of tomatoes. Slightly sunken lesions appear, usually on the lower stem at soil/cube surface level, or higher up at leafing and sideshoot wounds. These are moist and dark brown, the epidermis and cortex gradually decompose and xylem tissues turn brown. These cankers spread and gradually girdle the stem and/or petioles, thus disrupting the sap flow. Ultimately, when a canker has surrounded the stem base, the whole plant may die.

Symptoms also develop on the fruits, often at the peduncular scars. The lesions are wet, black, and develop quickly, ultimately showing as large spots with concentric rings covering the fruit. These may gradually mummify or fall.

Symptoms on fruits may also appear post-harvest, during storage and marketing.

On the leaflets, brown and wet spots appear, mainly localised at the margins of the leaf, sometimes covering large areas. These spots, often with chlorosis at the edges, eventually become necrotic and dry up. Decomposed tissues may fall out leaving a 'shot hole' appearance.

Tiny black, shiny spore cases (pycnidia) may be visible within the damaged tissue, especially on fruits. They are more easily visible with a hand lens and when tissue is examined with a microscope.

Didymella stem canker can spread very rapidly through a crop with normal cultivation practices. It also has a tendency to persist in glasshouses between crops.



Figure 6. A sunken lesion on a tomato stem caused by *D. lycopersici* with visible pycnidia

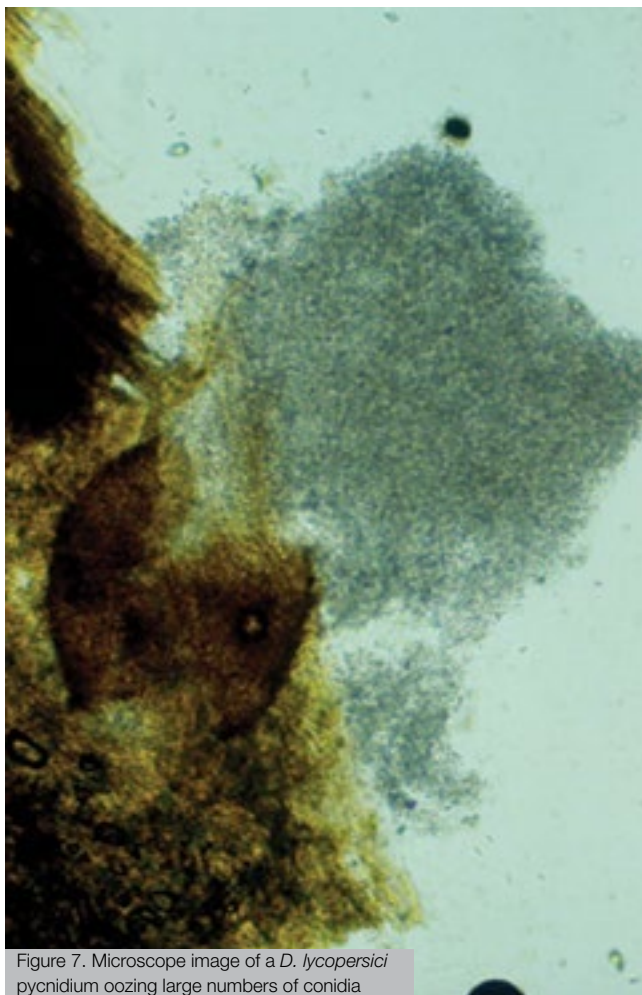


Figure 7. Microscope image of a *D. lycopersici* pycnidium oozing large numbers of conidia



Figure 8. Fruit and stem symptoms of *D. lycopersici* on tomato

Phoma labilis stem rot and spot – biology and control

Biology

Information on disease biology and epidemiology is sparse. In 2015, the disease was recorded in crops grown organically and in one crop grown on coir slabs. In the coir crop there was no evidence that stem spots progressed to cause lesions and stem death. Varieties affected were Lyterno, Angelle and Kierano.

In April 2016, stem spotting and rot developed in new crops in the same areas of the glasshouses as were affected in Autumn 2015. *Phoma* was again confirmed associated with the disease symptoms.

Stem sections with *Phoma* spot symptoms incubated in a damp chamber rapidly developed a soft, black cortical rot, whereas unaffected stem pieces remained intact with no rot. In experimental work, *P. labilis* was inoculated both as a spore suspension and as mycelial plugs on potato dextrose agar onto visibly healthy tomato stems. After one week, spot symptoms had developed on both wounded and unwounded stems following mycelial inoculation, and on wounded stems only following spray-inoculation with the spore suspension; no infection occurred on the control treatments. These results, taken with the progression of stem spots to girdling lesion on plants grown in soil that was affected by corky root rot, suggest that *P. labilis* is a relatively weak pathogen of tomato that can cause crop losses under certain conditions. No pathogenicity tests were done with the isolates identified as *P. destructiva*.

Cultural control

Variety

Specific information on susceptible and resistant varieties is unavailable.

Growing conditions

As with many fungal infections of aerial plant parts, limiting high relative humidity and encouraging ventilation around infected plants will discourage infection and spread. Rectify any slipped glass or blocked gutters that result in water dripping onto plants. If economically viable, consider increased heating in an attempt to prevent condensation in the glasshouse.

Hygiene

Check the cause of any unusual stem rot in tomato in case it is *B. lycopersici* (*Didymella lycopersici*). If *Didymella* is suspected, restrict entry to the affected area and consult a specialist adviser.

For *Phoma labilis*, when working in an affected area, crop workers should ensure they minimise spread by using different knives for pruning in affected and unaffected areas. Removing crop debris and any spore bodies will minimise infection spreading and carrying over to the next season. There is reasonable evidence to suggest that composting crop debris will effectively eliminate *Phoma* species.

Regular handwashing when entering and leaving the crop should be carried out with an appropriate disinfectant.

Plant protection products

As this disease does not occur routinely on commercial sites, there is no specific efficacy data for the pathogen. Consult a plant pathologist or specialist crop adviser regarding which fungicides and biofungicides currently permitted for use on tomato may also have activity against *P. labilis*.

Further information

Sources of further information

Factsheet 07/09: Energy management in protected cropping: Humidity control.

Factsheet 18/14: Getting the best from biopesticides.

PC 301 – Targeting of humidity control, through the use of stem temperature measurements, to reduce stem *Botrytis* and save energy in tomato production.

Acknowledgements

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