

# Angular Leaf Spot of Strawberry

## Introduction

Angular leaf spot of strawberry is caused by the bacterium *Xanthomonas fragariae*. The bacteria initially causes small, angular, interveinal, water-soaked spots on lower leaf surfaces which enlarge, becoming reddish-brown and necrotic with time. As spots coalesce into larger necrotic areas a blighted appearance can be observed on both upper and lower leaf surfaces.

Leaf spot symptoms are most likely to appear in late summer and early autumn where relatively cool days and cooler nights with high humidity favour the spread of infection. This is a serious disease of strawberry and it is important to avoid introduction on imported, infected planting material.

## Key Facts

- Symptoms appear as small, angular, interveinal, water-soaked spots on lower leaf surfaces.
- Advanced symptoms present where numerous, close spots coalesce to give plants a blighted appearance.
- Severe infections can lead to decreased vigour, collapse and death of the plant.
- Although not established in the UK, presence in several European countries e .g. Spain and Italy pose a threat to introduction on imported, infected planting material.
- Infected planting material may not show symptoms on arrival, but could be detected by laboratory screening.
- *Xanthomonas fragariae* can overwinter in infected dead leaves once present and is easily transmitted by water splash, wind-driven rain, overhead irrigation and mechanical means.
- Fruit yield losses have been reported as high as 75% where established infections have spread through the use of overhead irrigation systems.
- There are no effective chemical treatments available placing importance and emphasis on preventative measures.
- *Xanthomonas fragariae* is an EPPO A2 listed organism due to recognition of its potential economic importance and limited distribution within Europe.



Small, angular, water-soaked spots



Translucent against light

## Symptoms

Initial symptoms are small (1-4 mm) angular, interveinal, leafspots on the lower leaf surface. These spots appear translucent when viewed against light. Spots are frequently concentrated along the main leaf vein and pale coloured exudates can appear under high relative humidity. Spots increase in size with time before coalescing into larger necrotic patches. As this occurs symptoms become apparent on upper leaf surfaces, often appearing as reddish-brown irregular spots.

Leaves can become ragged in appearance as dead tissues tear away. In severe cases systemic infections of the crown may occur, but can only be observed as water-soaked zones when cut. Spots may develop on the calyx, runners and crowns. Fruits are not directly affected, but the calyx may become dry and dark making unmarketable.



*Coalescing spots on underside of leaf*



*Larger reddish-brown spots on upper leaf surface*

## Biology

Survival of the bacterium in old, infected, decaying leaf litter or crown infections in planting material allow survival from one crop to the next. Infection spreads to young leaves at the beginning of the growing season as they emerge. Cold storage will not eliminate infections in crowns which may not present symptoms.

Spread occurs where bacteria exude from primary lesions and are transported as aerosols from rain, overhead irrigation systems and wind. Spread can also occur mechanically, facilitated by workers hands and tools, especially in humid conditions via stomata or through wounds.

Spread and infection is favoured by a combination of high humidity, moderate to cool daytime temperatures (around 20°C) and low night-time temperatures. These conditions generally occur in autumn or late in wet summers.

Damp nursery conditions can also exacerbate bacterial exudation and spread of systemic infections leading to epidemics and high losses (as high as 75% fruit losses reported in the US).

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## Diagnosis

Diagnosis of *Xanthomonas fragariae* infections can be carried out on symptomatic material and detected on latent (non-symptomatic) plants. Isolation of the pathogen in the laboratory can be difficult and unreliable due to very slow bacterial growth and competition from saprophytic organisms.

Current diagnostic methodology includes rapid screening by immunofluorescence microscopy followed by TaqMan real-time PCR for confirmation of presence

For symptomatic plants, water-soaked spots are taken for testing or crowns and petioles where plants show vascular symptoms.

For asymptomatic samples, bulked crown or petiole samples representative of the stock can be processed by soaking and concentration, prior to screening for infection as above.

## Control

There are no effective chemical controls or treatments available for *Xanthomonas fragariae*. Therefore, preventing entry to the UK and establishment in commercial strawberry crops is the most appropriate and cost effective course of action.

Control is achieved by obtaining planting material from reputable sources with assurances that they are free of the pathogen. Testing prior to dispatch and pre-planting is recommended, along with visual inspections for symptoms.

High standards of sanitation must be in place at all times with particular attention paid to movement of soil, tools, plant debris between areas/crops which could increase the risk of spreading contamination. Continued inspections for symptoms throughout the season are also important.

Outbreaks or interceptions of *Xanthomonas fragariae* must be reported to the APHA Plant Health and Seeds Inspectorate (PHSI) due to the quarantine nature of the disease (EPPO A2 listed).