

Feeling the weather: changes in phoma stem canker and light leaf spot pathogen spore release

Yongju Huang, James Fortune, Asna Javid, Laura Sapelli, Evren Bingol, Aiming Qi, Chinthani S. Karandeni Dewage, Bruce D.L. Fitt



**University of
Hertfordshire, UK**

y.huang8@herts.ac.uk

University of
Hertfordshire **UH**

Oilseed rape



- The 3rd most important UK arable crop
- The important break crop in rotation
- Cooking oil & animal feed
- Renewable energy - biodiesel



Disease problem: phoma stem canker and light leaf spot

On leaves

On stems

On pods

Phoma stem canker



Light leaf spot

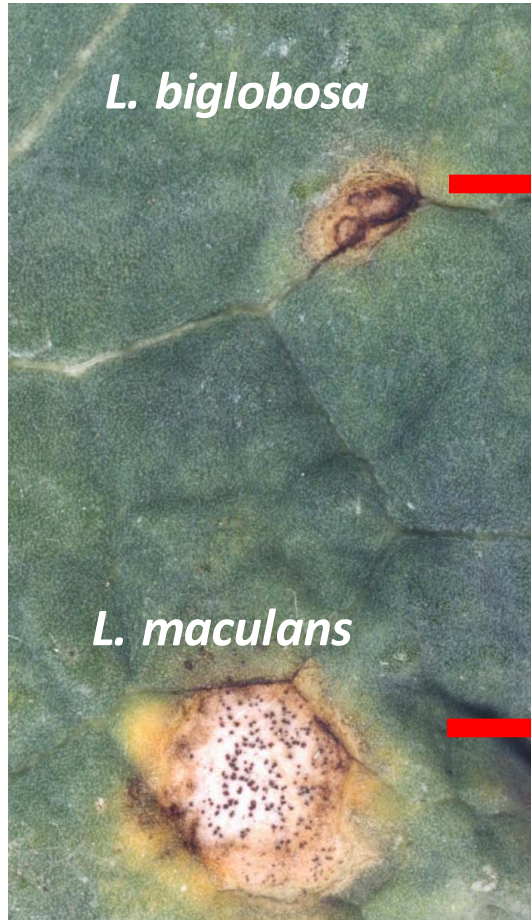


**Annual yield losses from these two diseases
> £100 M in the UK (WWW.CropMonitor)**

1. Phoma stem canker

Caused by *Leptosphaeria maculans* (Lm) and *L. biglobosa* (Lb)

Autumn/winter



Lb mainly associated



Lm mainly associated



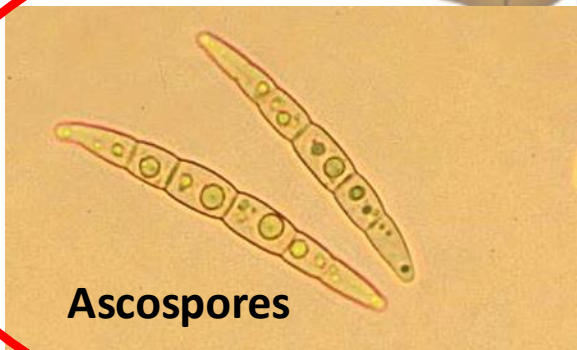
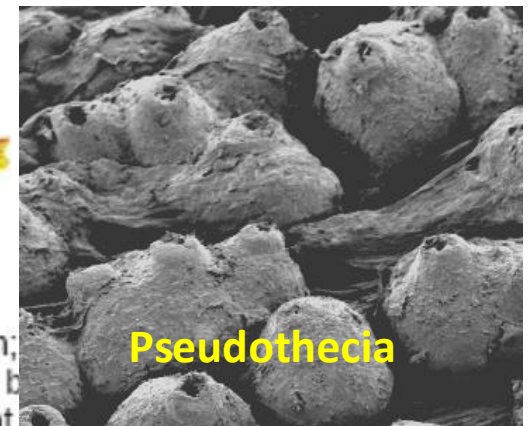
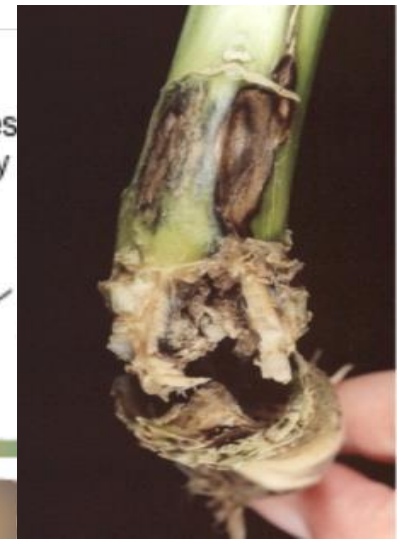
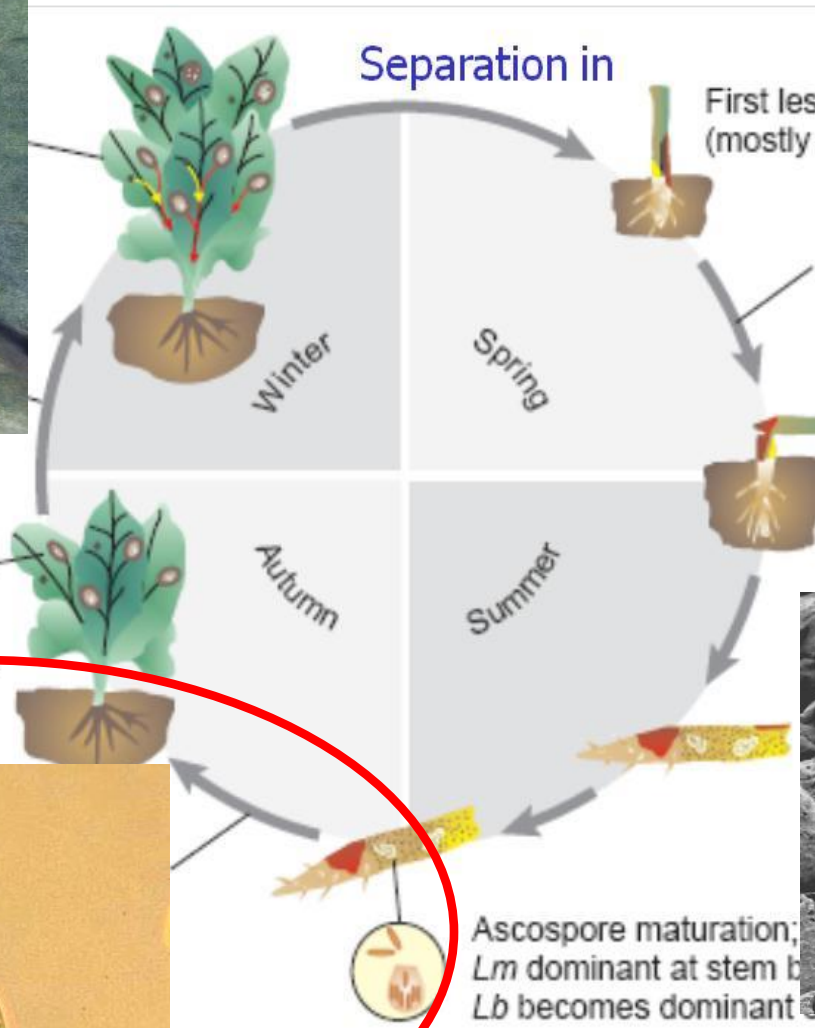
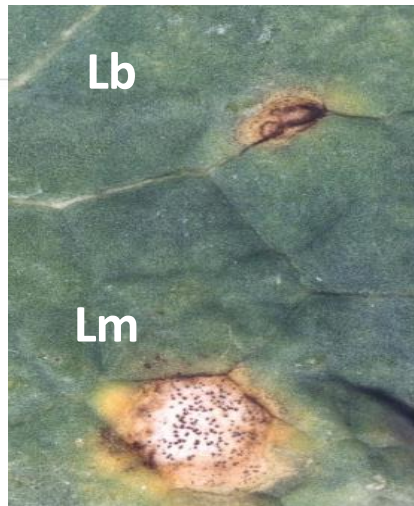
Summer



Lm is considered more damaging than Lb

Life cycle of *L. maculans* (Lm) and *L. biglobosa* (Lb)

Phoma stem canker is a monocyclic disease in the UK

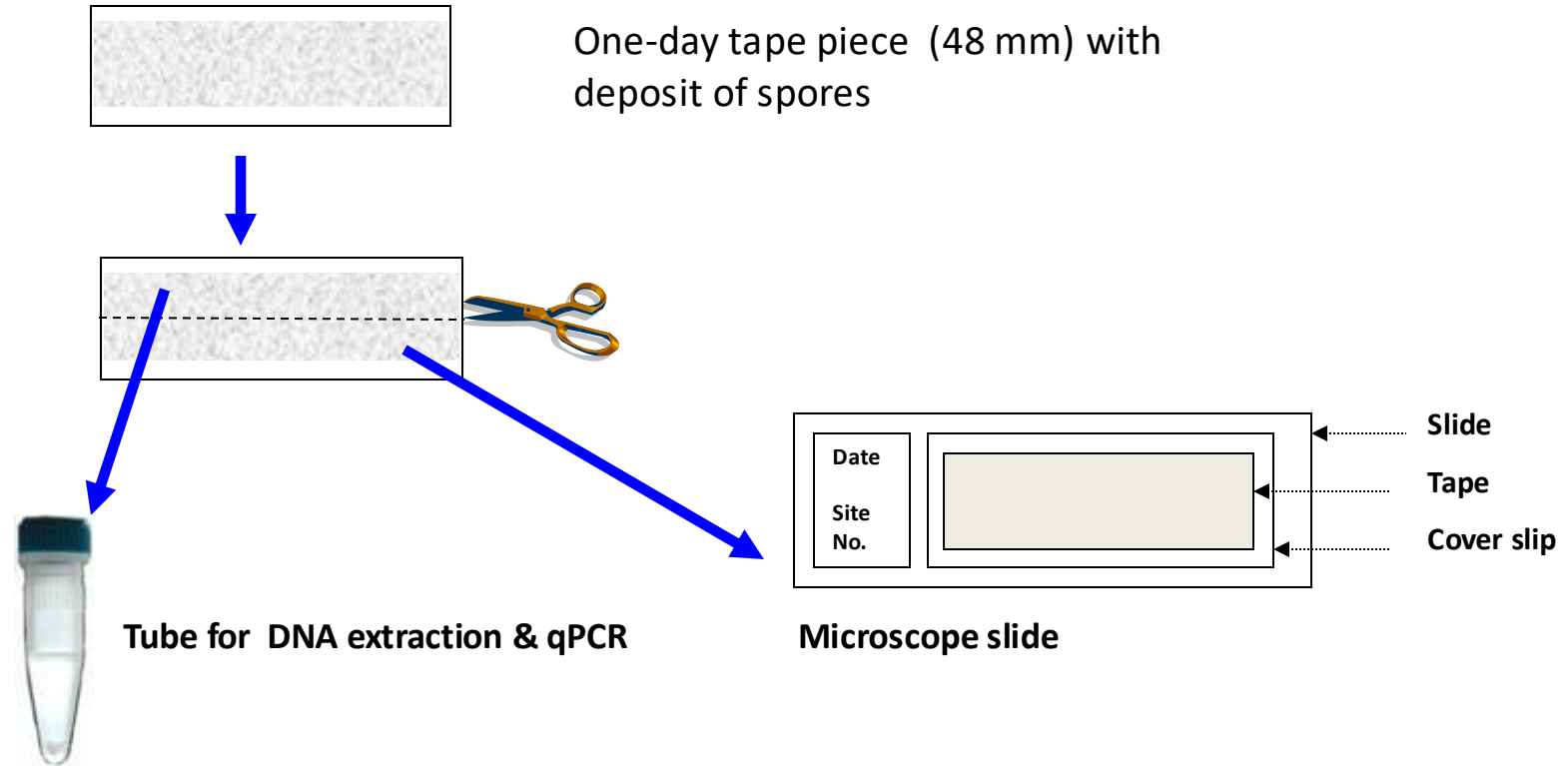


West *et al.* (2002), Fitt *et al.*, (2006)

Release of ascospores monitored using Burkard spore samplers; weather data collected using onsite weather stations

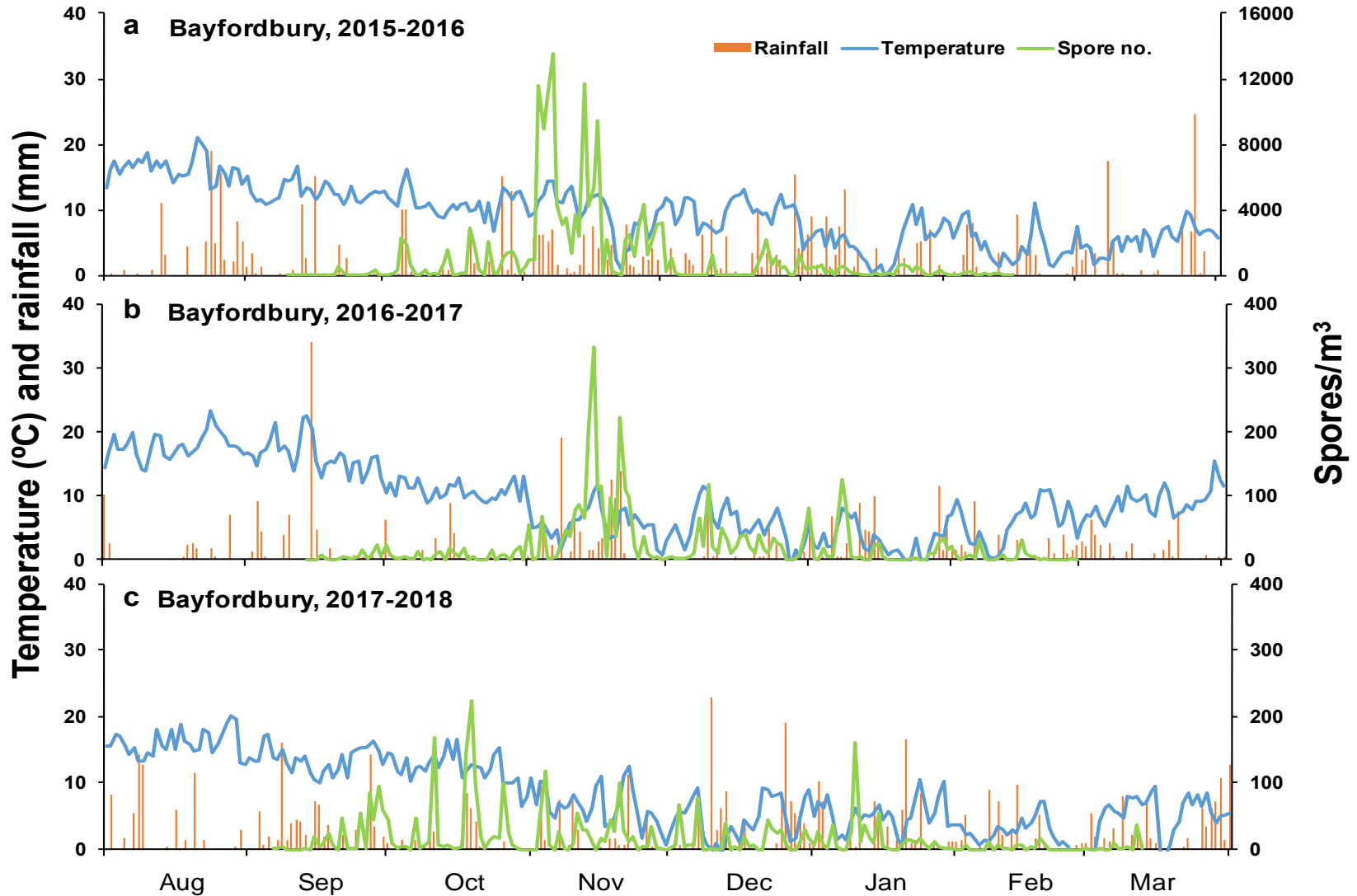


Processing air samples



- ❖ Half of the tape for ascospore counting
- ❖ The other half of the tape for DNA extraction & qPCR

Rainfall, especially frequency of rainfall affected timing of Lm & Lb ascospore release



Weather data used for predicting date of ascospore release

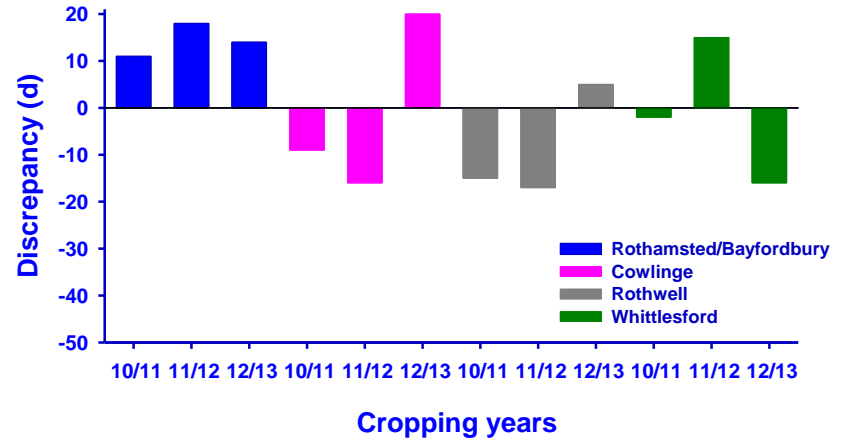
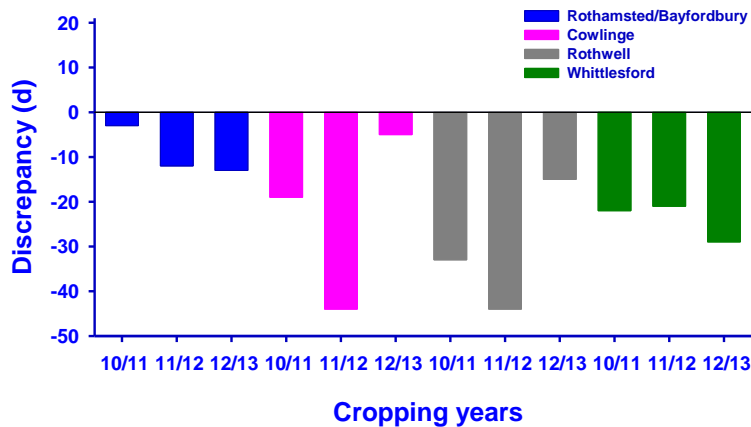
$$P_{30} = \sum_{i=1}^n \left[\frac{1}{11.6 + 69.3(0.89)^{T_i}} \right] R_{bi}$$

$$P_{50} = \sum_{i=1}^n \left[\frac{1}{10.5 + 72.09(0.92)^{T_i}} \right] R_{bi}$$

SporacleEzy model: Accumulating favourable days from 1 Aug (when $6^{\circ}\text{C} < T_{\text{ave}} < 22^{\circ}\text{C}$ and rainfall ≥ 1 mm) to 18 days in the UK

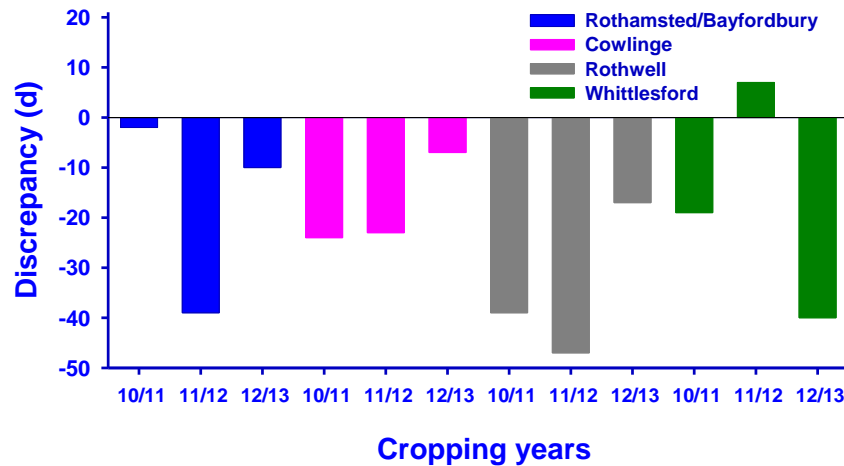
Huang *et al.* (2007), Salam *et al.* (2007)

Discrepancy of predicted from observed first date of major ascospore release



Date of P_{30} model

Date of P_{50} model

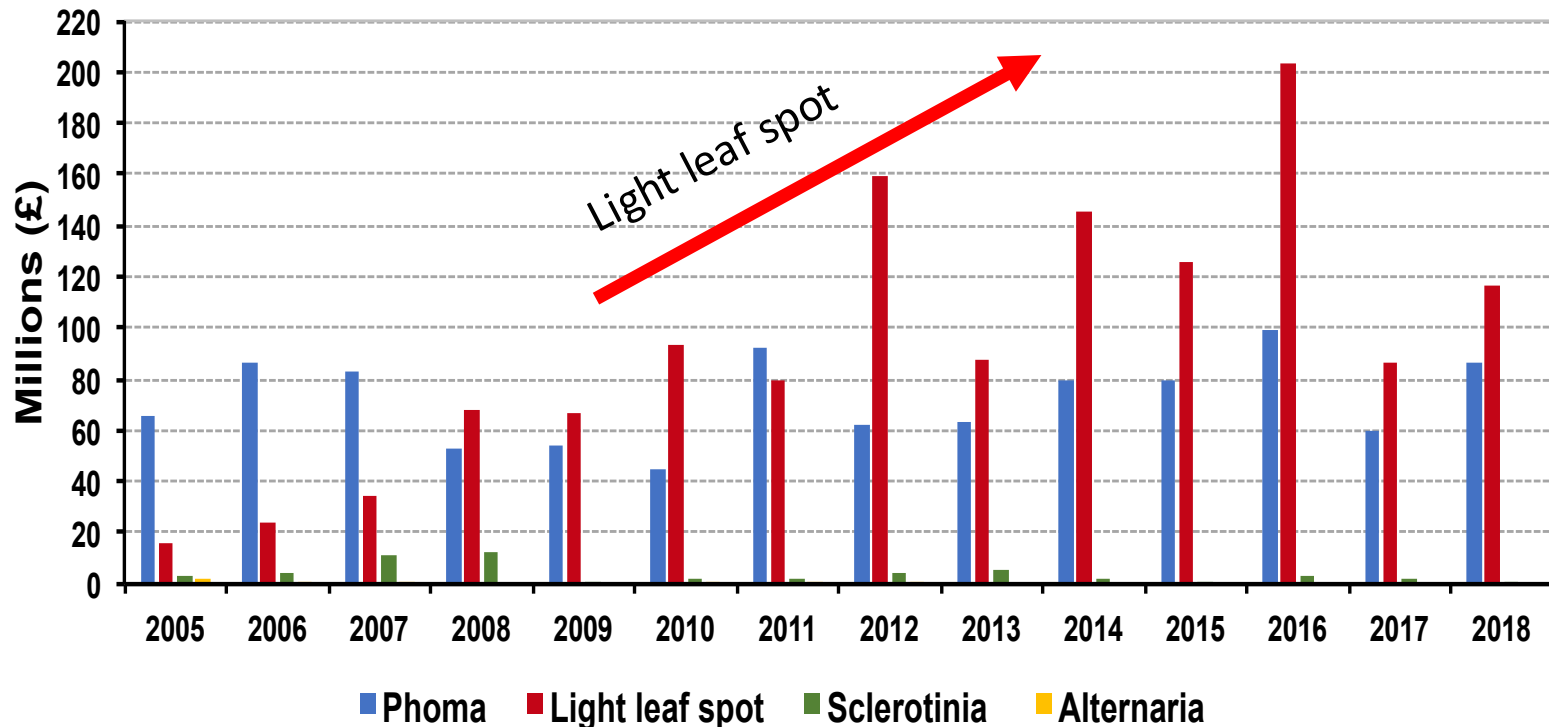


SporacleEzy model

2. Light leaf spot (*Pyrenopeziza brassicae*)

Recently, it became a major disease in England

Winter oilseed rape yield losses caused by diseases

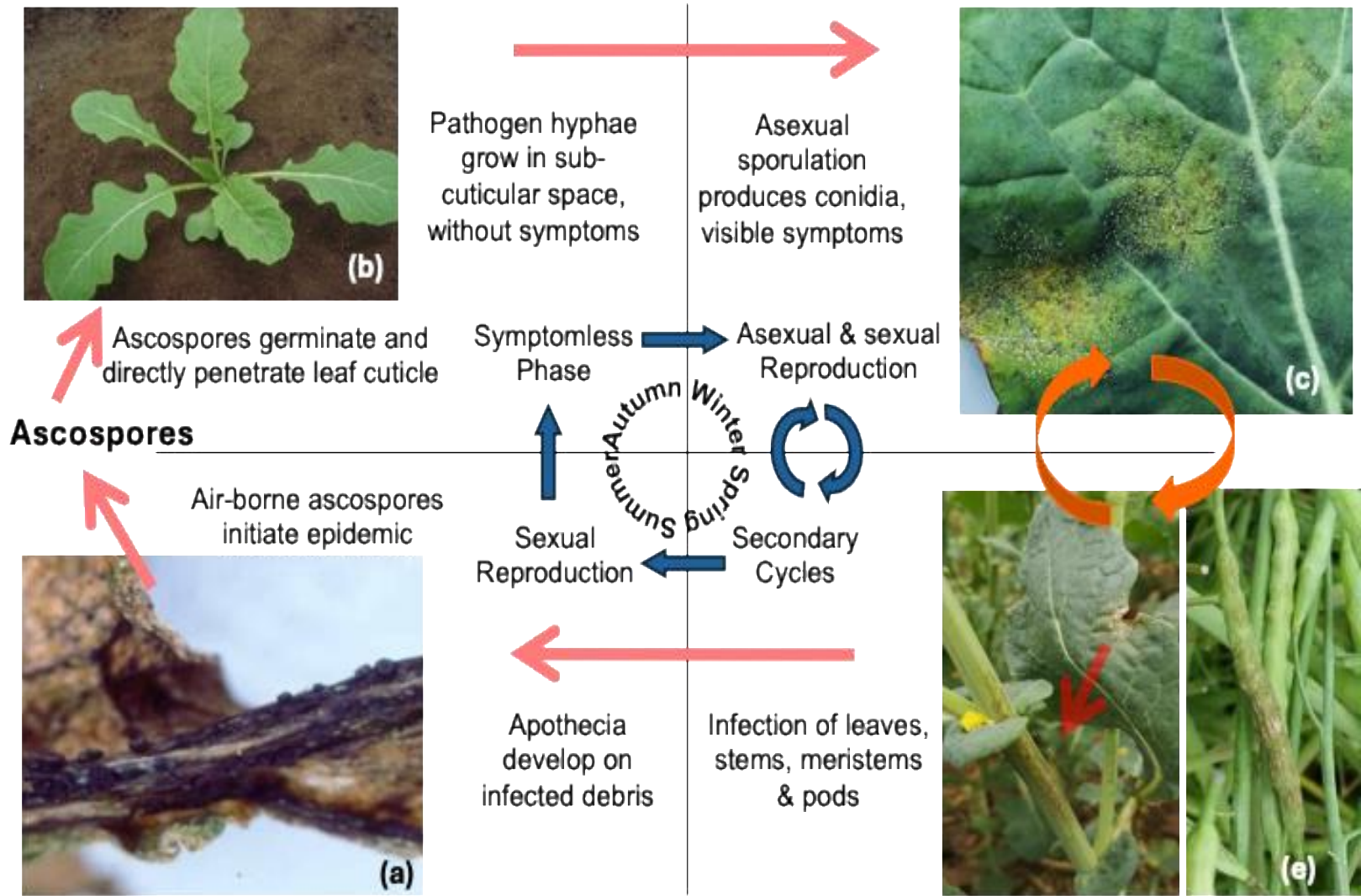


Annual yield losses from LLS increased in recent years in the UK

CropMonitor; Defra pest and disease survey on oilseed rape

Life cycle of *P. brassicae*

Light leaf spot is a polycyclic disease



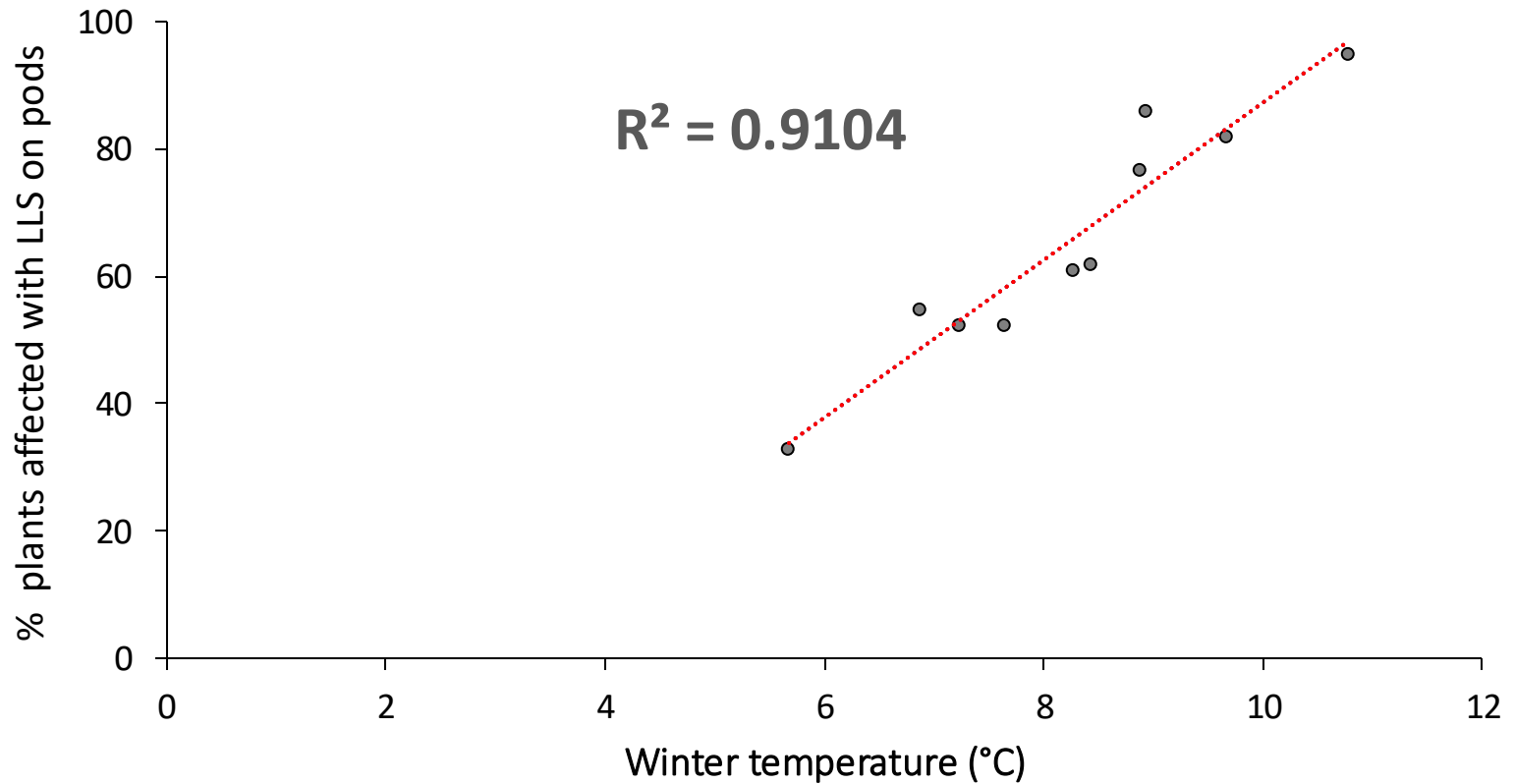
Light leaf spot is a polycyclic disease, *P. brassicae*
spores may be released the whole year

- ❖ Previously, *P. brassicae* spore release was only monitored in the autumn/winter (Sept – Jan/Feb)
- ❖ There is a need to monitor spore release in the whole year

Temperature and rainfall are the main factors affecting the Pb spore release



Warmer winter increases LLS severity



Data from 10 cropping seasons (2008/09 to 2017/18)

Fortune et al., unpublished

Summary

For phoma stem canker

- Differences between regions and seasons in Lm and Lb ascospore release
- The rainfall in Aug and Sept is main factor affecting the date of Lm/Lb ascospore release in autumn
- The model to predict 50% of ascospore release is better than the other two models, can be used to guide fungicide spray timing
- Hotter summer favours Lb ascospore production

For light leaf spot

- Pb spores release observed all year around but mainly released in summer and autumn
- Temperature and rainfall are two main factors affecting Pb spore production and release
- Warm winter favours LLS development, leading to high pod infection at harvest causing yield loss

Acknowledgements



BBSRC IPA and LINK projects



TSB, Agri-tech projects



OREGIN project



Chadacre Agricultural Trust



Hertfordshire
Local Enterprise Partnership

PERFECTLY PLACED FOR BUSINESS

