Interactions between pathogens causing phoma stem canker and light leaf spot on winter oilseed rape

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Oilseed Rape Genetic Improvement Network – phase 5
Stakeholder meeting 24 Nov 2020

Phoma stem canker

Leptosphaeria maculans

L. biglobosa

Light leaf spot

Pyrenopeziza brassicae

OREGIN pathogen collection -UH

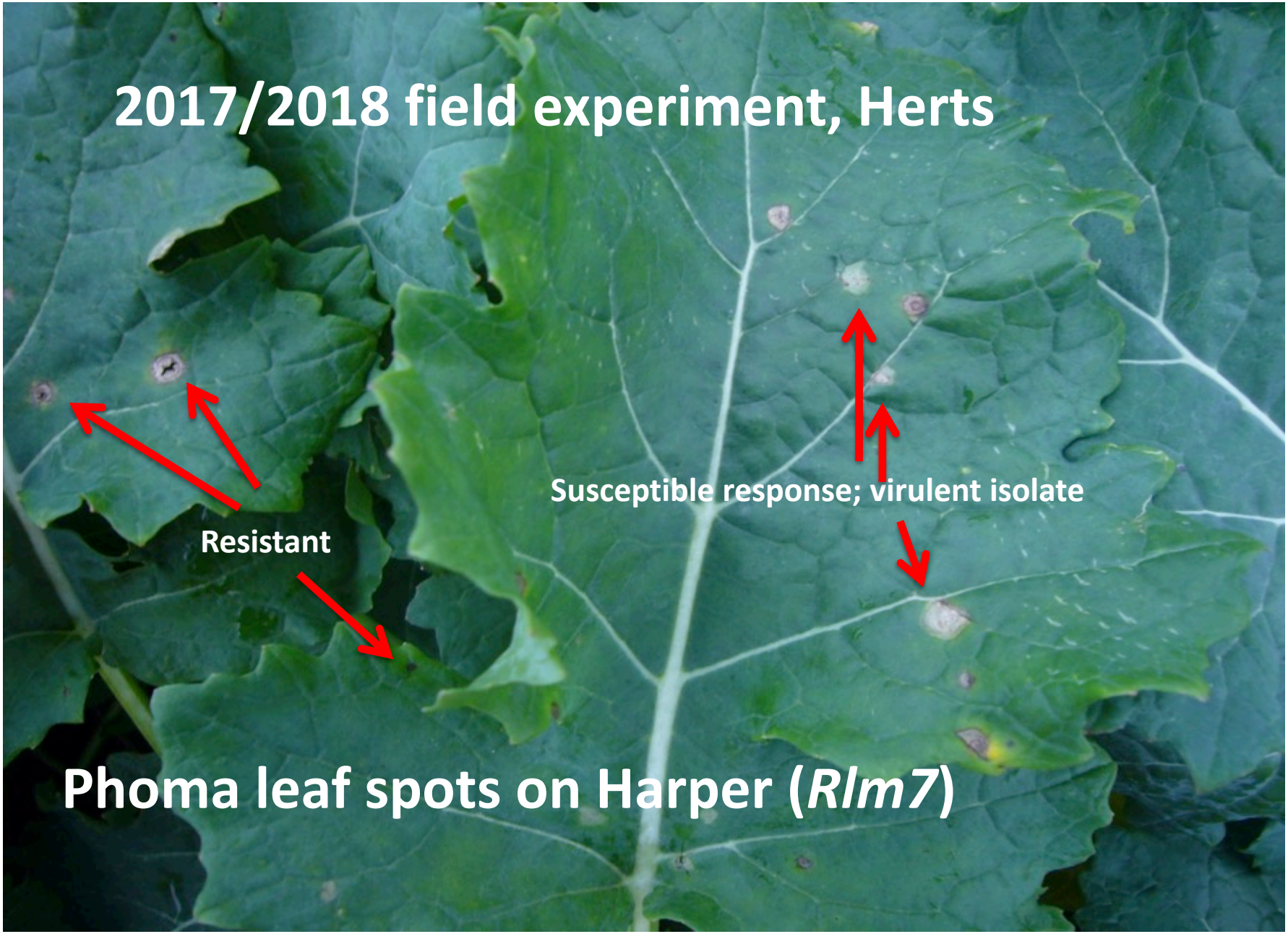
Phoma stem canker pathogens

Existing *L. maculans* Isolates

- 24 international isolates
- 80 UK isolates

New *L. maculans* Isolates

- 8 virulent against *Rlm7*
- 2 virulent against *Rlm3* and *Rlm7*


2017/2018 field experiment, Herts
Susceptible response; virulent isolate
Resistant
Phoma leaf spots on Harper (*Rlm7*)

Risk of breakdown of resistance gene *Rlm7* in UK

- Resistance gene *Rlm7* currently effective
- Eight new *L. maculans* isolates virulent against *Rlm7* detected in 2019
- Two *L. maculans* isolates virulent against both *Rlm3* and *Rlm7* detected in UK
- Need to continue monitoring development of virulent races of *L. maculans* in UK

OREGIN pathogen collection-UH

Phoma stem canker pathogens

Existing *L. biglobosa* Isolates

- 6 international isolates
- 11 UK isolates

New *L. biglobosa* Isolates

- 5 isolates from Canada
- 10 UK isolates

- **Work to investigate differences in pathogenicity between UK and international *L. biglobosa* isolates**

OREGIN pathogen collection-UH

Light leaf spot pathogen

Pyrenopeziza brassicae

Existing

- 124 international isolates
- 140 UK isolates

New

- 10 isolates from different *Brassica* hosts

New isolates; long-term storage in OREGIN pathogen collection

Pathogenicity of new isolates tested on different cultivars

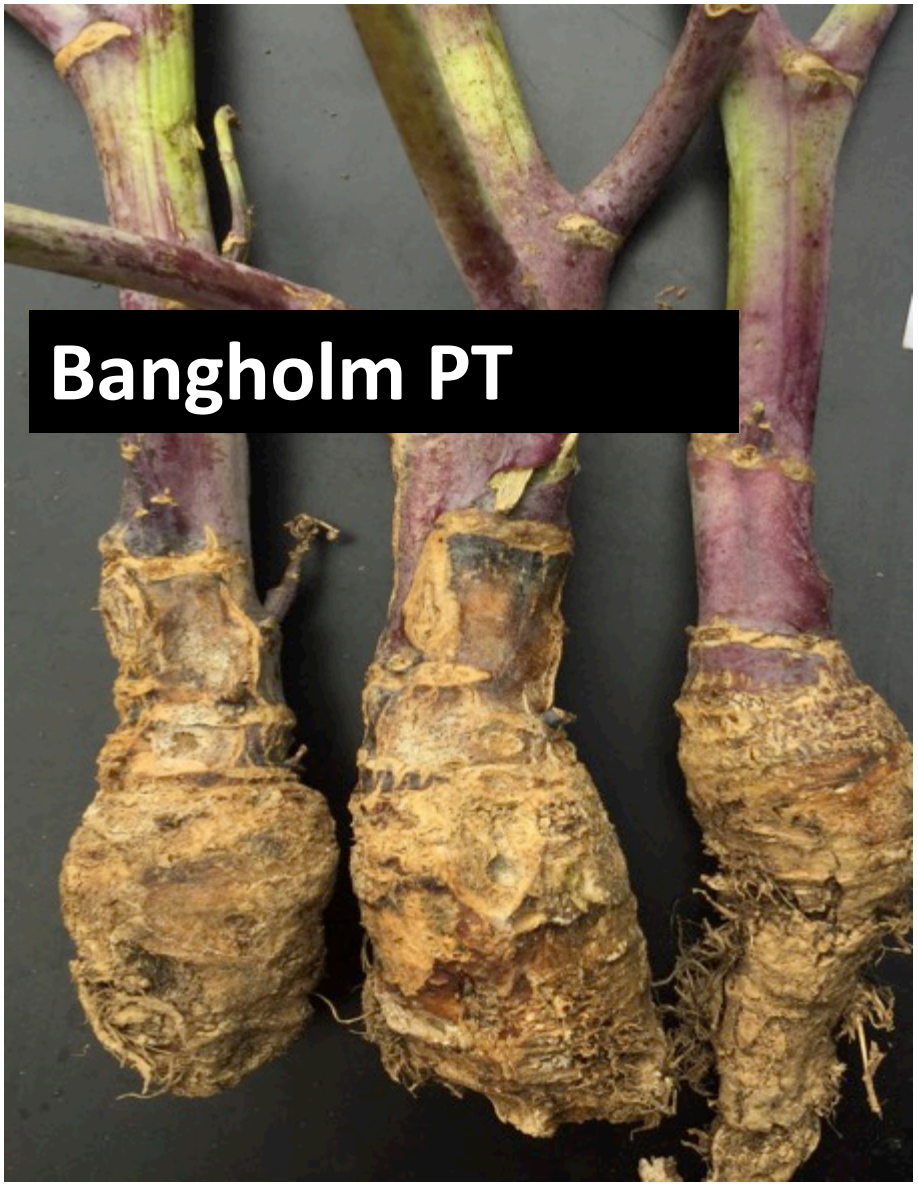
OREGIN expt, Withern, Lincs, phoma stem canker & light leaf spot assessed on 1 July 2020 with social distancing

ROTHAMSTED RESEARCH

NIAB

University of Hertfordshire UH

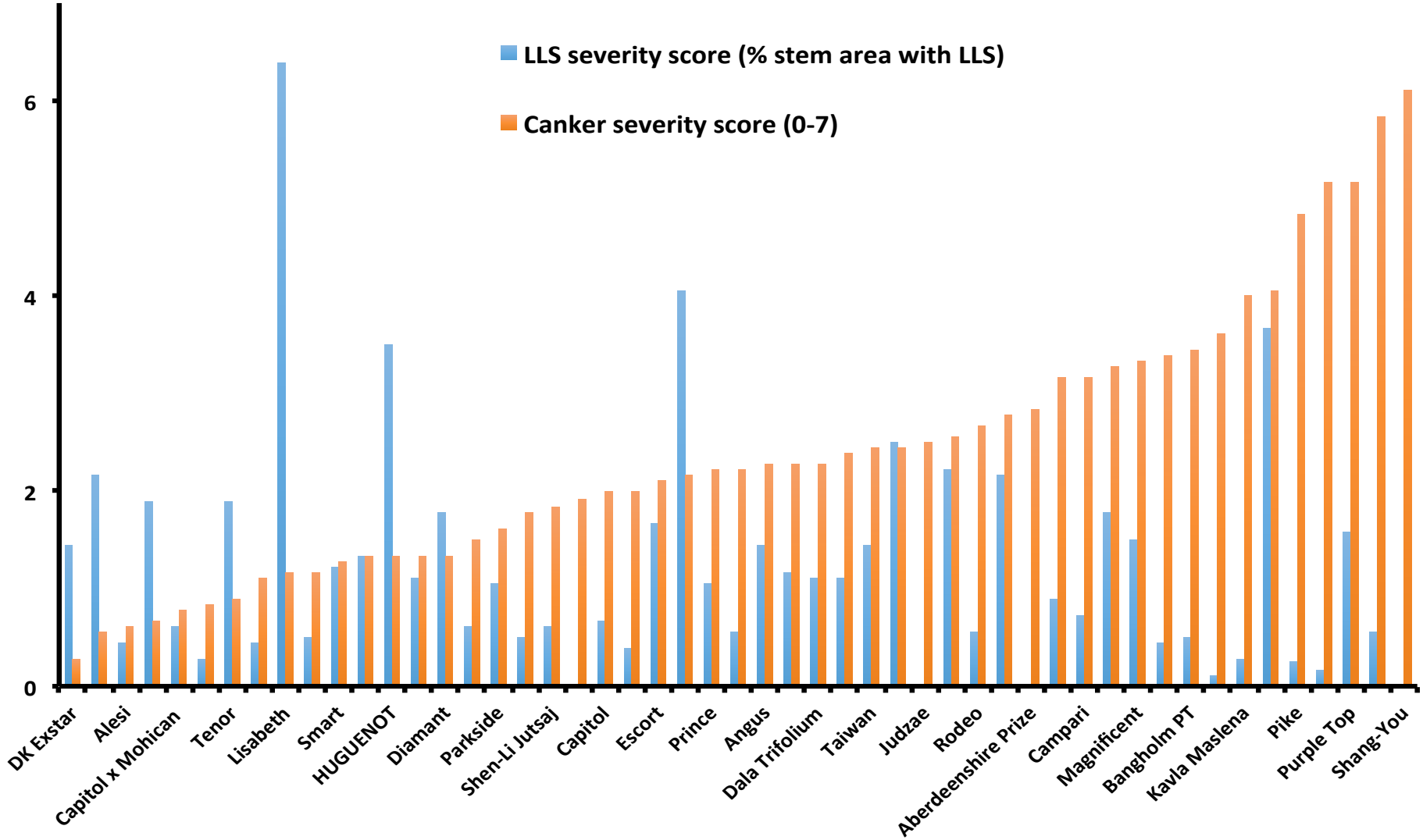
Severe phoma stem canker but no LLS



Severe phoma stem canker but no LLS

Severe LLS but no phoma stem canker

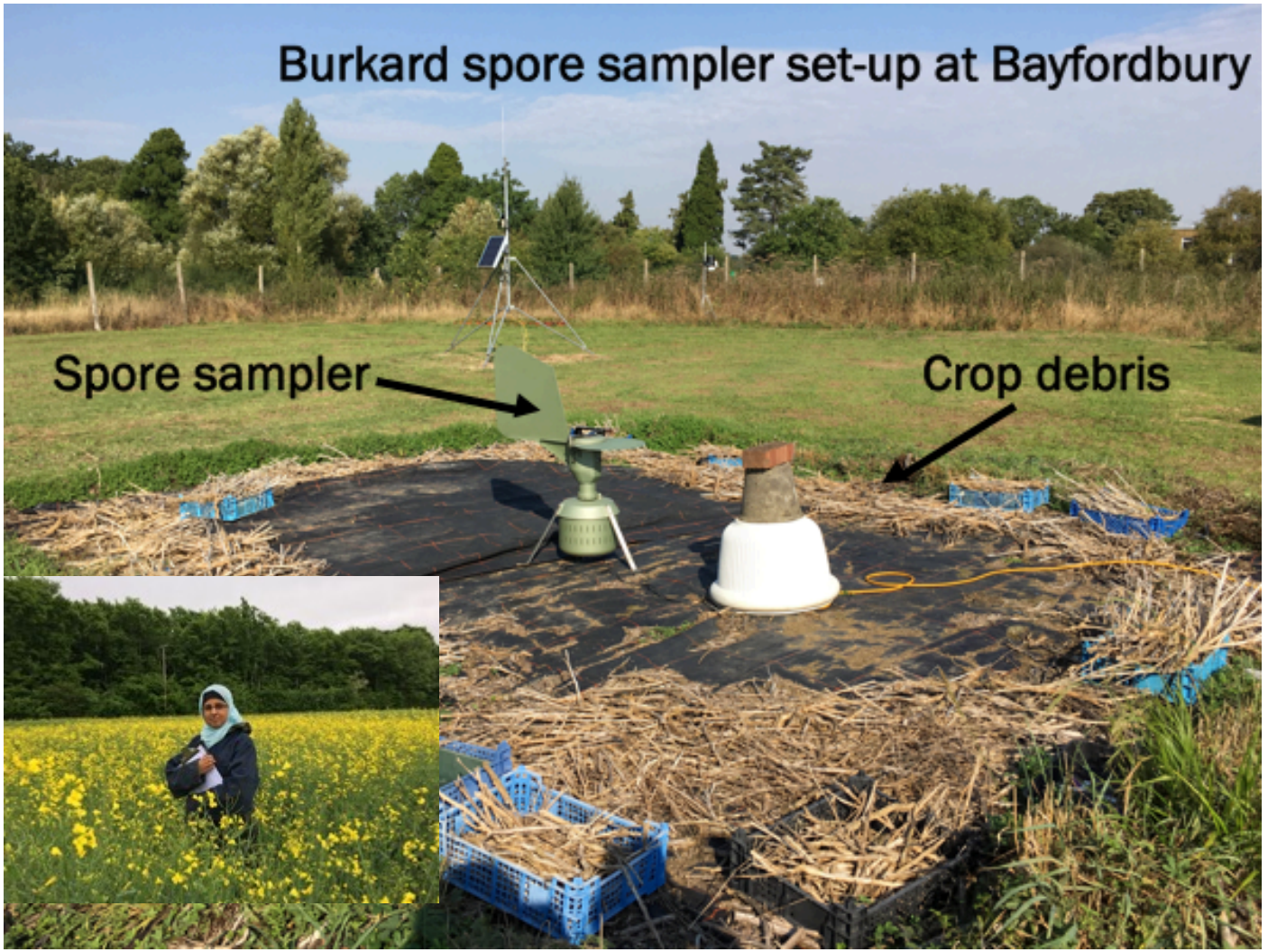
Phoma stem canker & light spot severity scores on different cultivars/lines, 1 July 2020



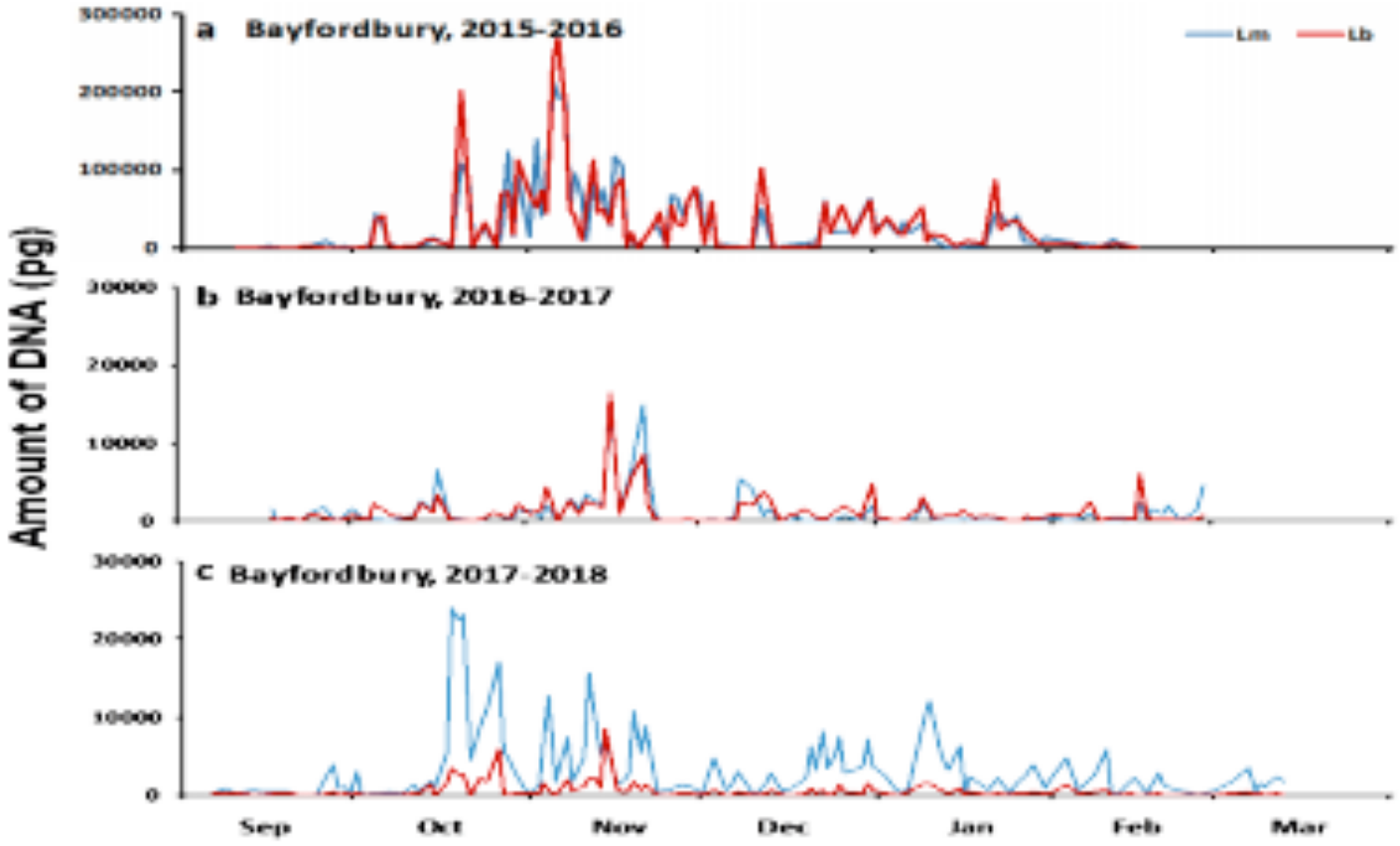
Information on differences in resistance to pathogens between genotypes in OREGIN diversity set can be used to improve breeding for resistance

- *Differences in resistance to phoma pathogens*
- *Differences in resistance to light leaf spot pathogen*
- *Novel sources of resistance for breeders*
- *May be interactions between pathogens*

Interactions between *Leptosphaeria maculans* & *L. biglobosa;* seasonal/regional differences in ascospore release in air (Asna Javaid, PhD)



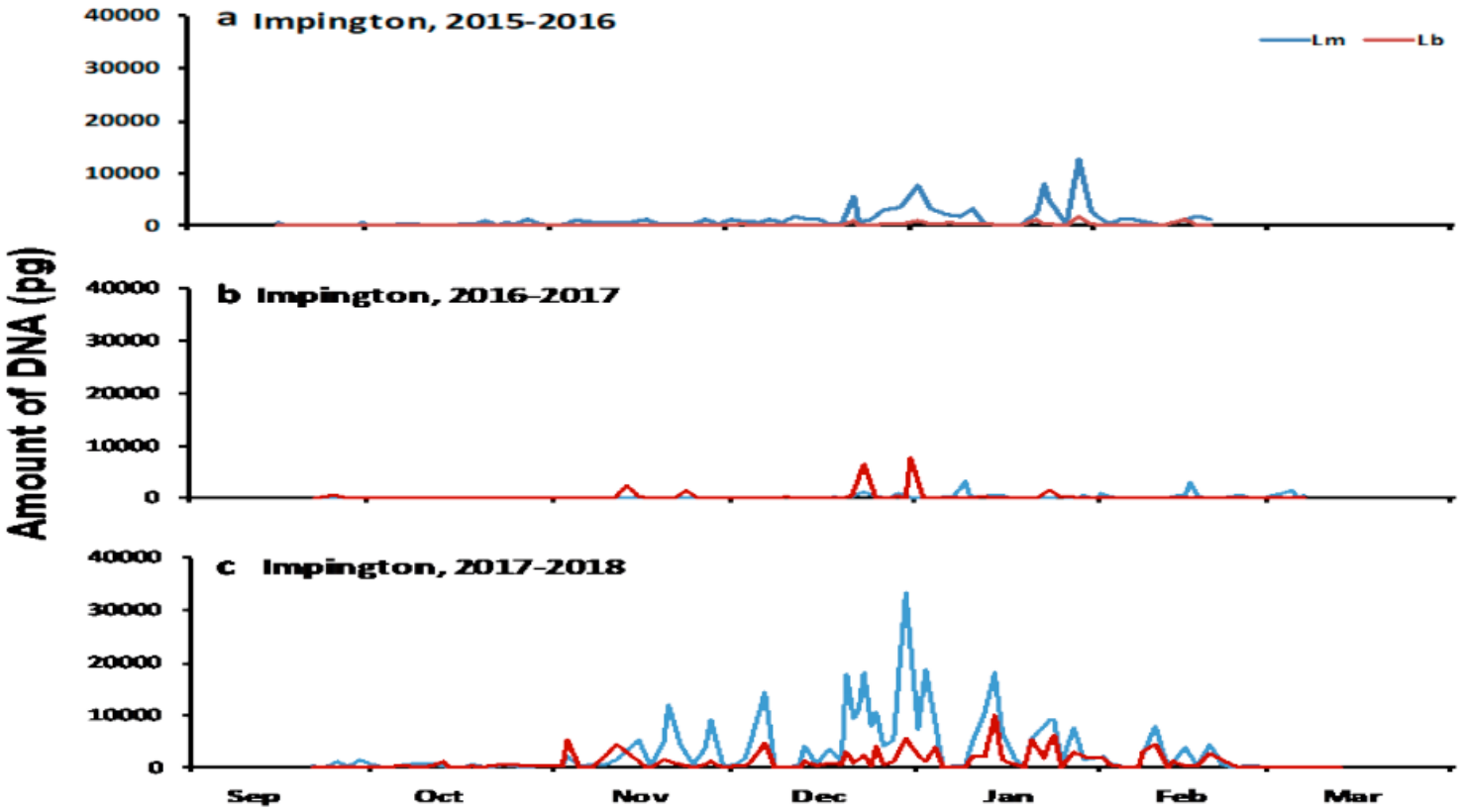
Bayfordbury, Hertfordshire, 2015/16, 2016/17, 2017/18



Huang, Javaid & Fitt, 2019. AHDB Project Report N0.615

Impington, Cambridgeshire, 2015/16, 2016/17, 2017/18

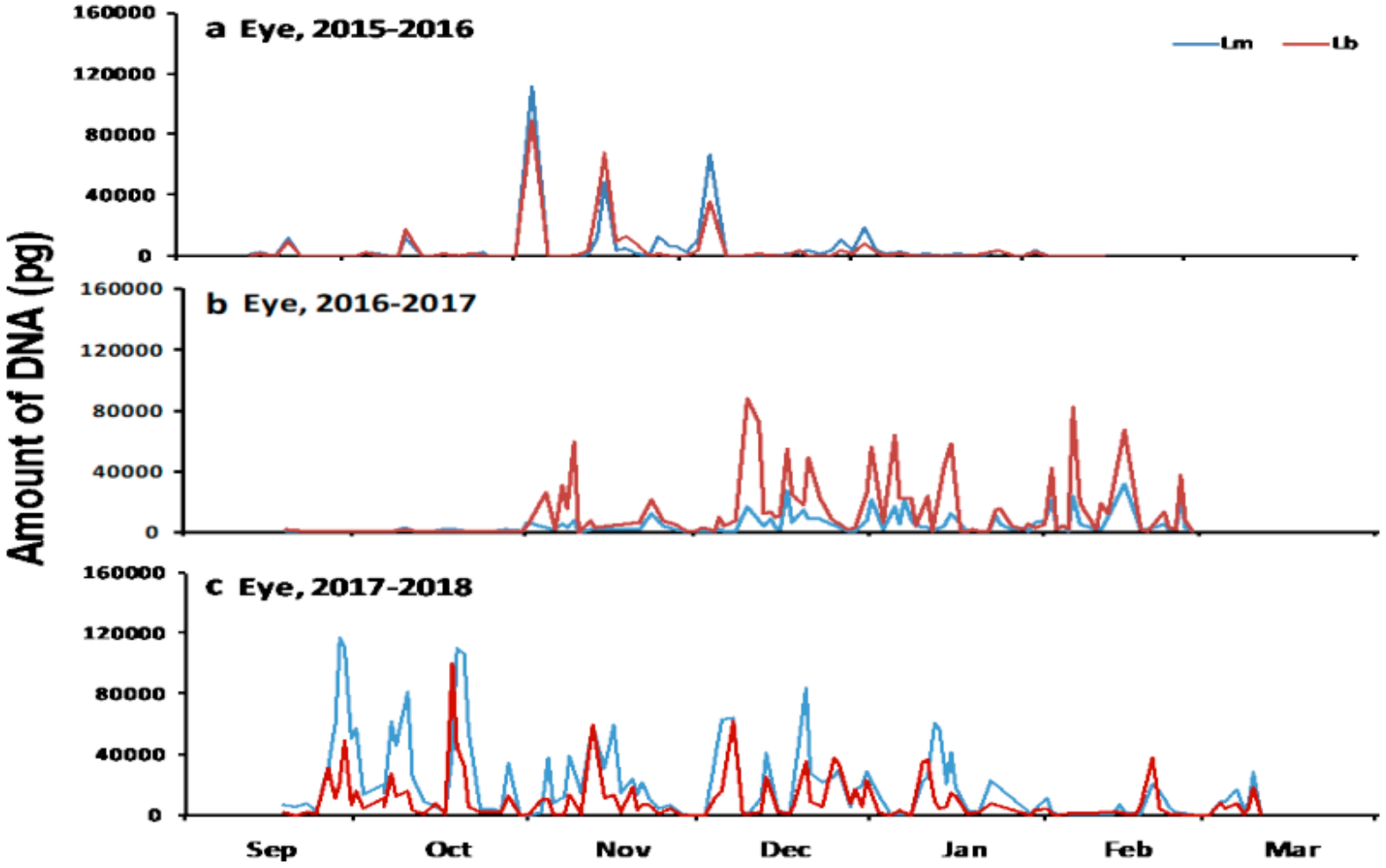
(Burkard operated by Craig Padley, LSPB)



Huang, Javaid & Fitt, 2019. AHDB Project Report N0.615

Eye, Suffolk, 2015/16, 2016/17, 2017/18

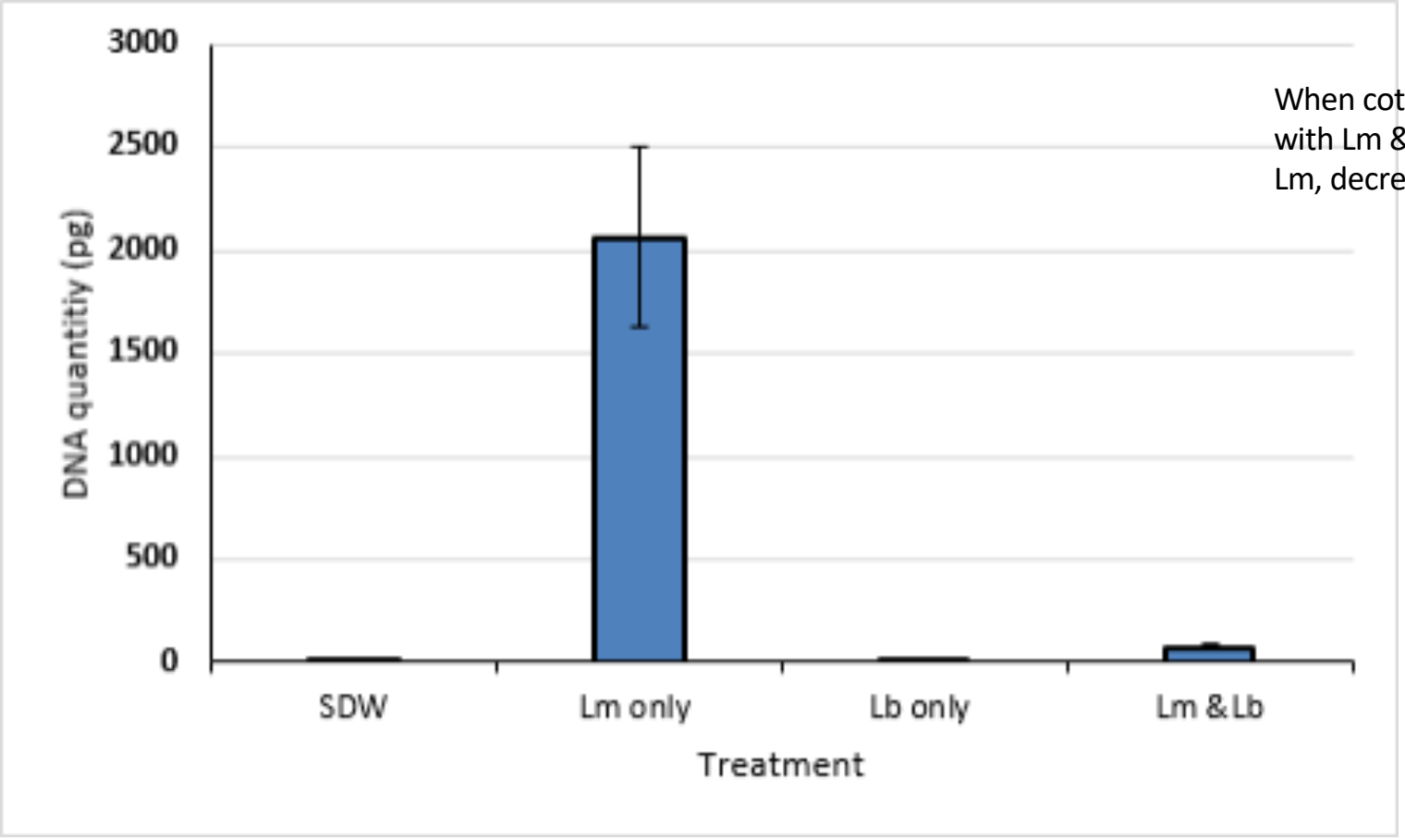
(Burkard operated by Neil Groom, Grainseed)



Huang, Javaid & Fitt, 2019. AHDB Project Report N0.615

Controlled environment experiments investigating interactions:
James Fortune (HKEP PhD; RSK ADAS/UH)

Simultaneous co-inoculation of *L. maculans* & *L. biglobosa* effects on amount *Lm* DNA



When cotyledons inoculated with Lm & Lb, Lb suppresses Lm, decreasing amount DNA

Relevance to farmers

- Guidance; time application of fungicide (azole) for when 10-20% plants in crop have phoma leaf spots (*L. maculans*).
- If *L. maculans* & *L. biglobosa* ascospores released at same time, phoma leaf spot lesions may appear later or be smaller, resulting in later application of fungicide.
- As most fungicides used effective against Lm, Lb and Pb, if fungicide application is delayed, crops exposed to Pb ascospores for longer without protection.

OREGIN website at UH

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About OREGIN

Welcome to OREGIN

Providing a pre-breeding pipeline, to integrate sustainability traits into Oilseed Rape cultivars.

The Oilseed Rape Genetic Improvement Network (OREGIN) has been successful in achieving initial objectives of providing a focus for the UK Oilseed Rape genetic improvement R&D and stakeholder communities, and a mechanism for prioritising research requirements.

The principal activities of the OREGIN project are the generation, gathering, collation and dissemination of information and genetic resources for the benefit of the stakeholders. Ongoing discussions amongst the R&D and breeder communities have identified the highest priority requirements in the context of Defra strategic objectives. It is recognised that other trait areas such as pest resistance may be of increasing commercial priority and affect the long-term sustainability of the crop.

The components of the OREGIN pre-breeding platform will also provide a foundation for and contribute significantly to other projects of relevance to the overall objectives of achieving improvements in sustainability through crop genetic improvement.

Contact OREGIN

Get in touch with us and find out the latest developments

The website is maintained and regularly updated at UH

OREGIN website at UH

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Contact OREGIN

Get in touch with the OREGIN project team

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Contact page has been recently updated: Please contact Jamie Stone to keep the website updated and accurate

OREGIN website at UH

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Pathogen Collection

Rationale

To enable the reliable genetic analysis of complex disease resistance traits in *B. napus*, a core collection of isolates of the two major fungal pathogens causing economic losses in oilseed rape (OSR) crops, *Pyrenopeziza brassicae* and *Leptosphaeria maculans*, was established. The genetic diversity within the pathogen collection was analysed to ensure that the assembled collection represented the majority of the pathogen diversity. This was necessary in order to enable future reliable genetic analysis of specific pathogen-host interactions in combination with the host crop DFFS. Framework standard operating procedures were established so that they can be applied to other oilseed rape pathogens in future projects associated with OREGIN.

Establishment of a worldwide OSR fungal pathogen resource collection

In 2003/04, isolates of *Leptosphaeria maculans* and isolates of *Pyrenopeziza brassicae* were assembled at Rothamsted Research from sources representative of the worldwide distribution of stem canker and light leaf spot epiphytotics in OSR. Information on these isolates and their properties was maintained in spreadsheets and a prototype database of the culture collection was tested and then made available on the OREGIN website. In 2004/05, additional collections were made from sources in western Australia, France, Portugal, Sweden, Germany and Scotland and the culture collection of pathogen isolates was enlarged with isolates of *Leptosphaeria maculans* and isolates of *Pyrenopeziza brassicae*. Information on the isolates and their properties was maintained in MS Excel spread sheets. Isolates were sourced and annotated. By April 2006, the culture collection comprised of

Requests for pathogen isolates received from Canada, Argentina, Netherlands and UK researchers

Provision of trait data

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Trait data

Trait Data from OREGIN5 projects

Data Area	Specifics	Lines / Populations	Project	Contact	Data Available	Data Curated	Priority
Rooting field trials	9 Traits (e.g. Rooting, Yield, Height etc.)	BnASSYST	OREGIN5	Kate Storer (ADAS)	yes (click here)		
Disease Data	Phoma stem canker and light leaf spot	28 BnASSYST lines	OREGIN5	Yongju Huang (UH)	yes (Click here)		
Pathology field trials	32 traits (Establishment, Vigor, Seed loss, moisture, Oil content etc.)	50 BnASSYST Lines	OREGIN5	Tom Wood	yes (Click here)		

Trait Data from earlier OREGIN projects

Data Area	Specifics	Lines / Populations	Project	Contact	Data Available	Data Curated	Priority

Please send trait data Jamie Stone (j.stone2@Herts.ac.uk)

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Tom Wood, Alex Hadleigh, Simon McAdam (NIAB)