Challenges of disease management on oilseed rape – phoma stem canker and light leaf spot

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OREGIN stakeholder Forum, JIC

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defra
Department for Environment Food and Rural Affairs

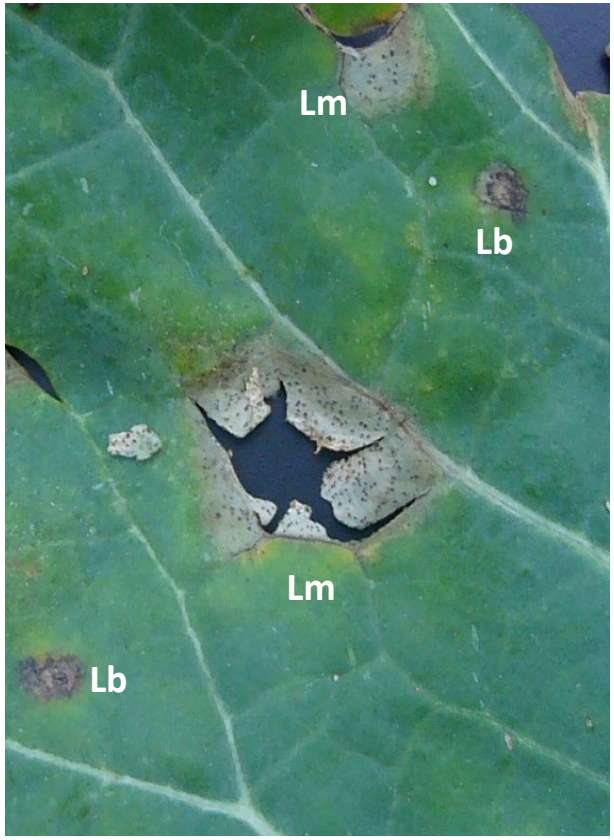
Two major diseases: phoma stem canker and light leaf spot

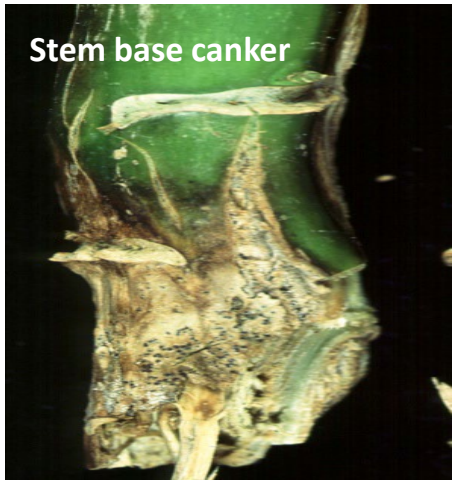
	On leaves	On stems	On pods
Phoma stem canker			
Light leaf spot			

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)



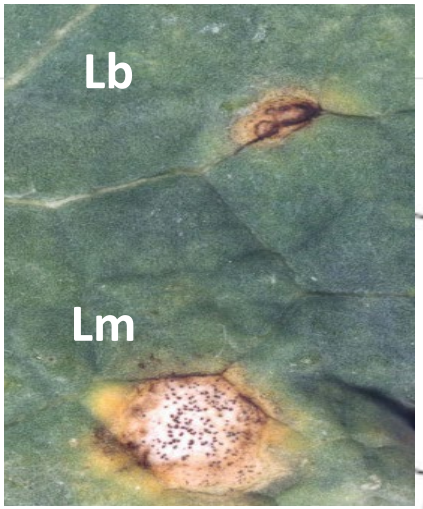


Both Lm and Lb can cause upper stem lesions and stem base cankers

Jacques et al., 2021, Plant Pathology; Huang et al., 2024, PMS

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

Phoma stem canker is a monocyclic disease



Current control by using host resistance and fungicides

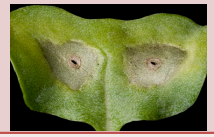
Lm: use of *R* gene resistance

- **Complete resistance**
- **Easy to assess at seedling stage**
- **Race-specific**
- **Easily rendered ineffective**

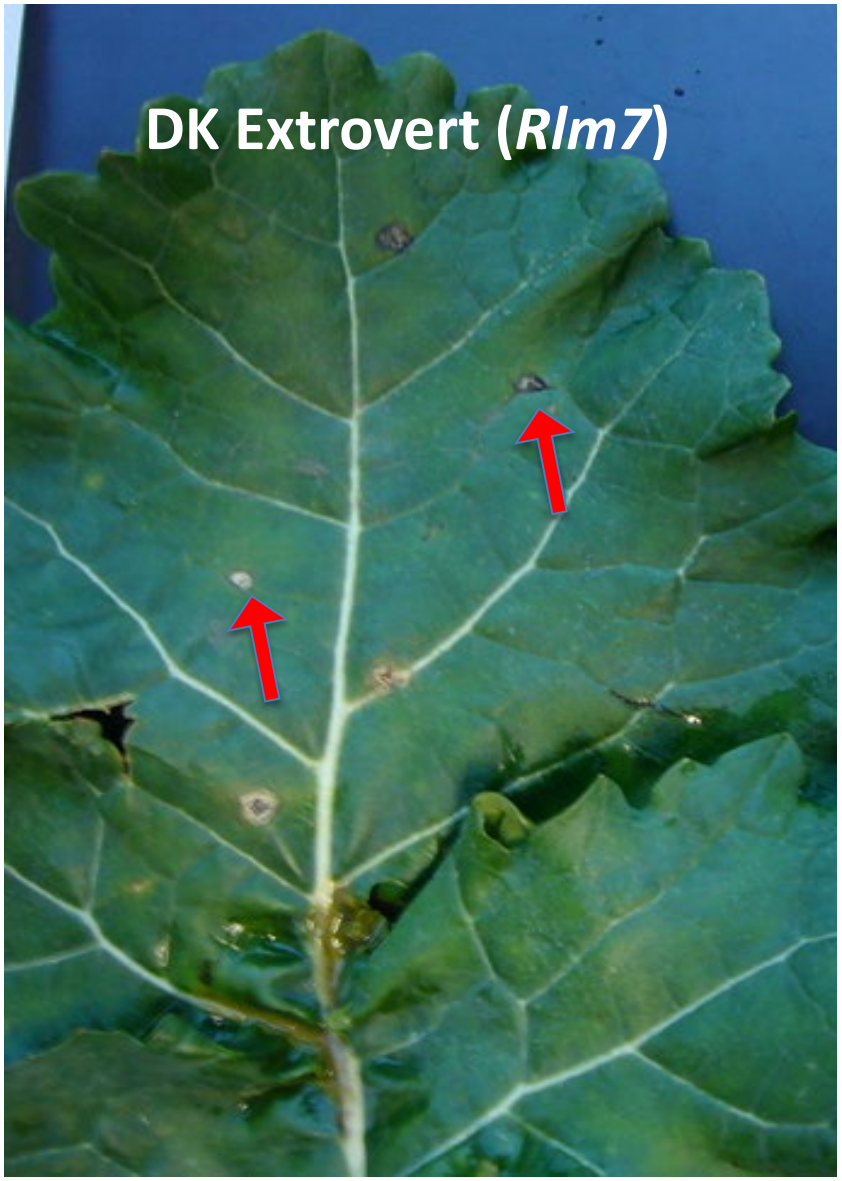
Major resistance gene (*Rlm)* confers complete resistance to isolates with the corresponding avirulent allele *(AvrLm*)

Efficacy of *Rlm* genes depends on frequencies of *AvrLm* alleles in local populations

***L. maculans* genotype**

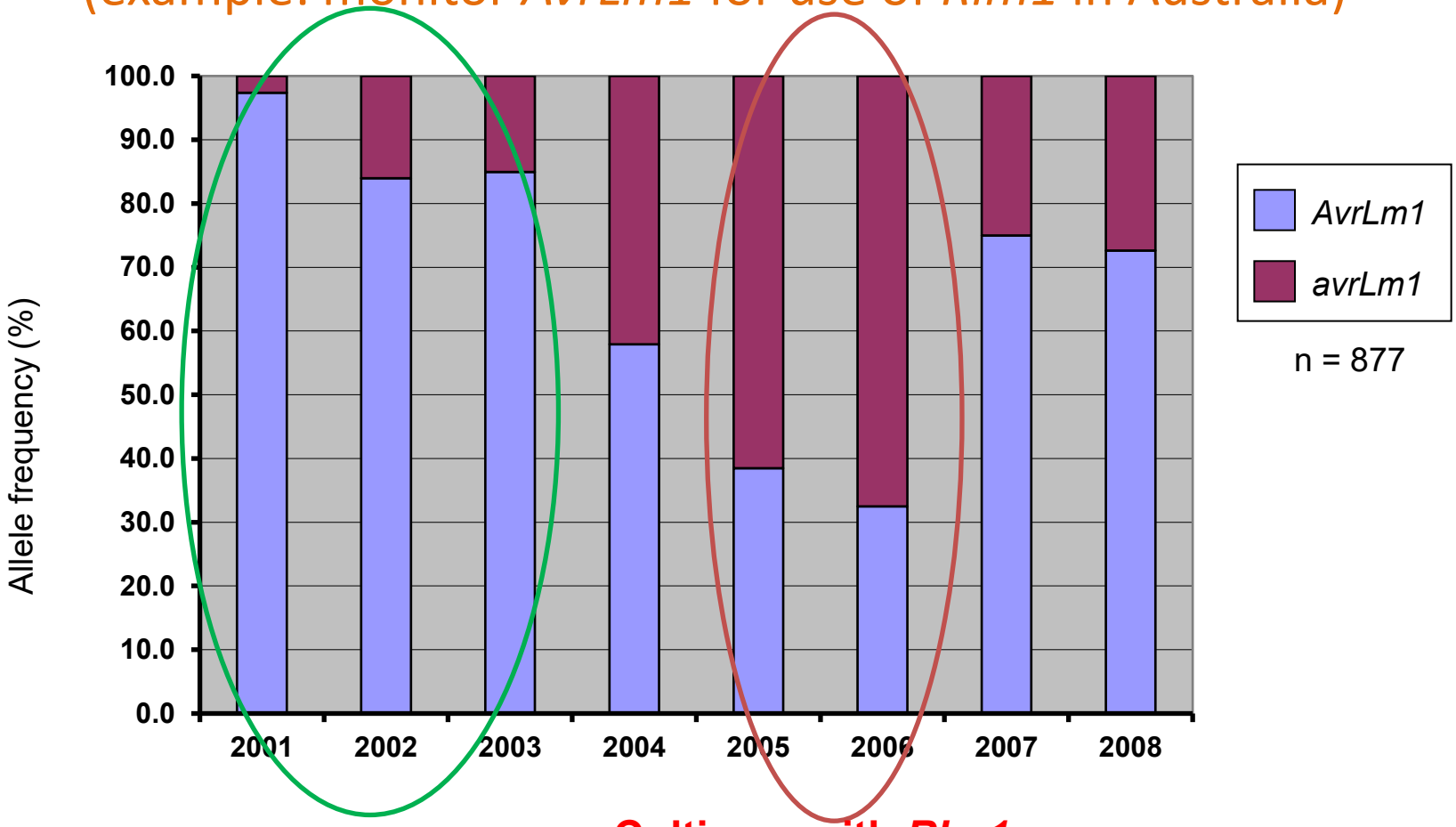
***B. napus* genotype**	*AvrLm1*	*avrlm1*
Rlm1	Resistant 	Susceptible 
rlm1	Susceptible 	Susceptible 

R gene resistance prevents the growth of Lm in the leaf and from the leaf to the stem



Need to monitor pathogen population for effective use of *R* genes

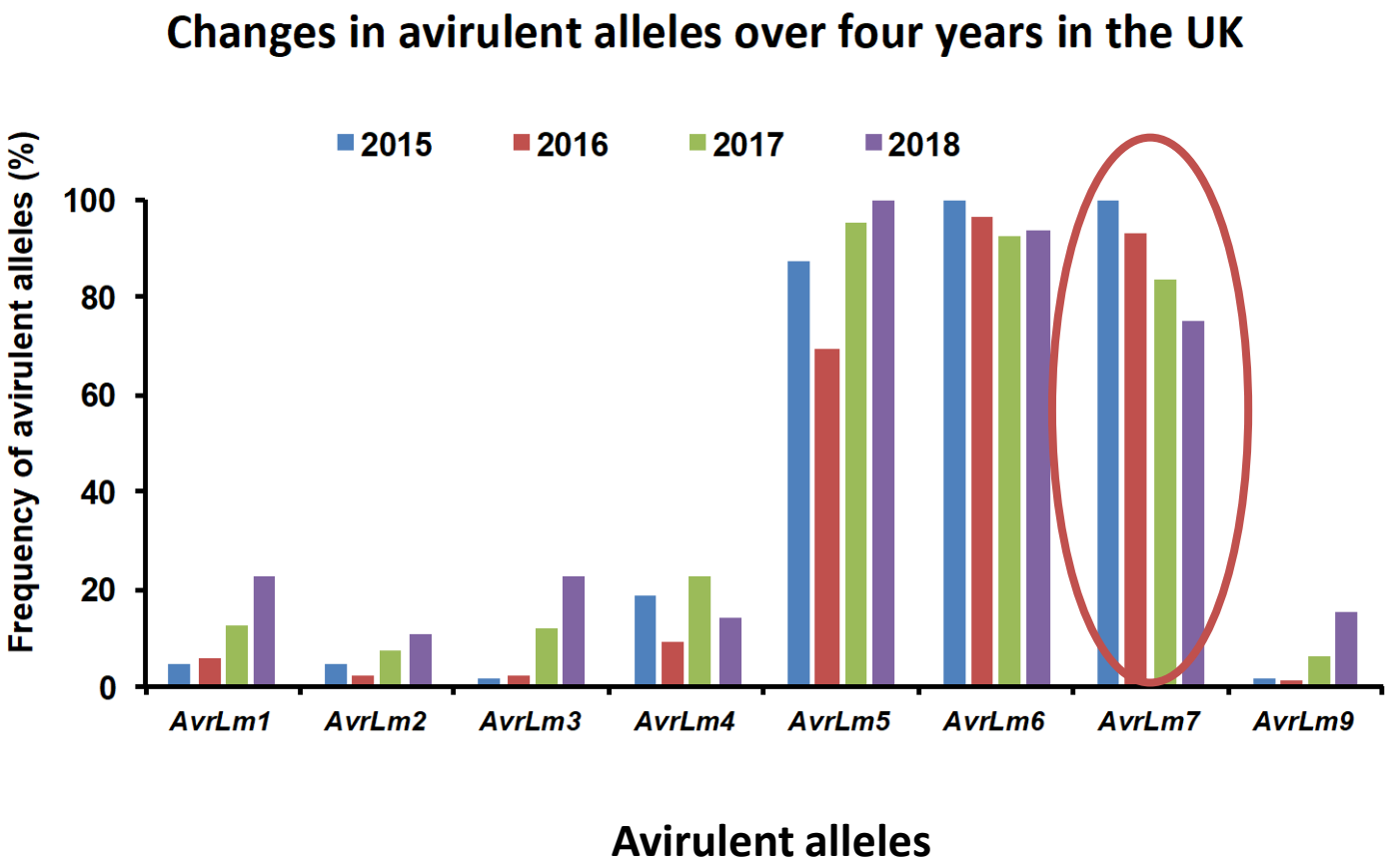
(example: monitor *AvrLm1* for use of *Rlm1* in Australia)



Dr Van De Wouw, Australia

Marcroft et al., 2012, Plant Pathology

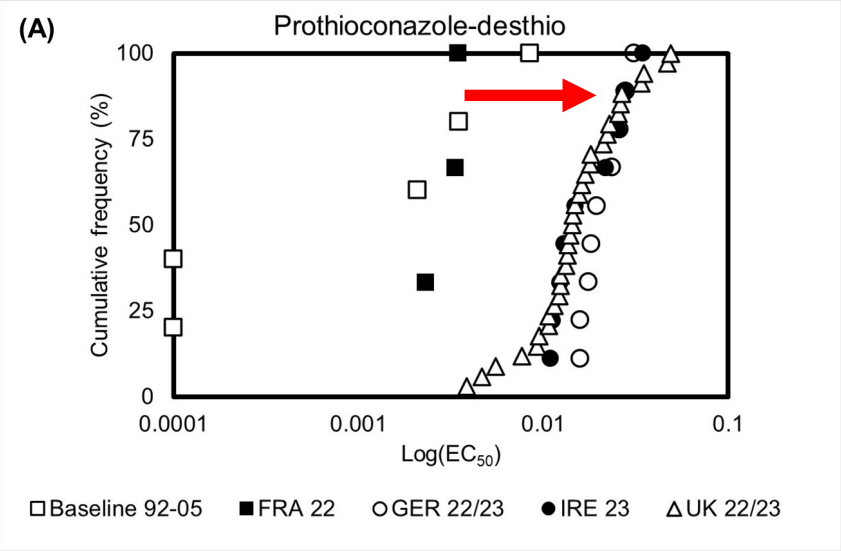
Changes in frequencies (%) of avirulent alleles in *L. maculans* populations over four years

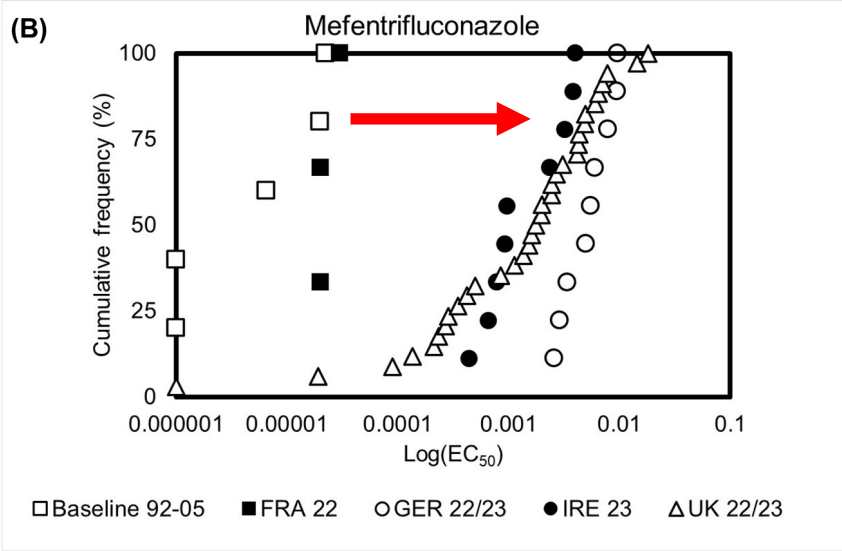


Currently, *Rlm7* is widely used to control phoma in the UK; there is a risk of breakdown of *Rlm7* resistance in the UK

Van de Wouw et al., 2024, Plant Pathology; Noel et al., 2022, Frontiers in Plant Science

Fungicides: changes in azole sensitivity in Lm





☹ Bad news: significant shift towards decreased azole (DMI) sensitivity in modern Lm populations (red arrows)

Sensitivity shifts caused by inserts in the *CYP51* promoter region (168 – 736 bp)

Inserts widespread in modern European Lm populations – 85% of isolates

King et al. (2024) *Plant Pathology*.

Severe phoma leaf spots were observed on 26 Nov 2024 despite the spray of fungicides

MAGIC2024/2025 field trials at Rothamsted and JIC

Lb: currently little information on control of Lb by host resistance or fungicides

More Lb detected in stem cankers, from 30% in 2000 to 90% in 2013

Huang et al., 2024, PMS

Lb: currently little information on control of Lb by host resistance or fungicides

- **Previously, only Lb 'brassicae' presented in the UK**
- **Recently, new Lb subclade (Lb 'canadensis', previous mainly in Canada and Australia) was first detected in the UK in 2022**
- **Lb were less sensitive to azole fungicides than Lm**

Eckert et al., 2010, PMS; Huang et al., 2011, Plant Pathology

King & West (2022) Eur J *Plant Pathology*.

Challenge - control phoma stem canker

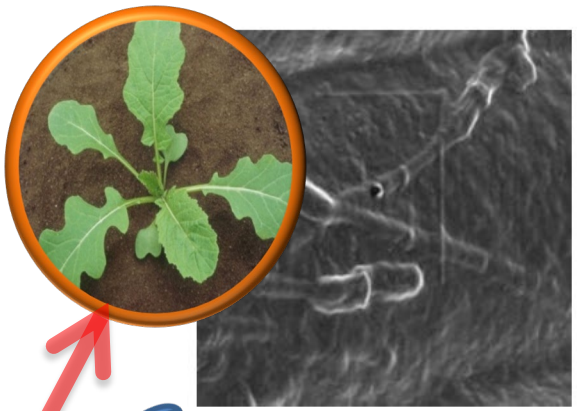
- Current effective resistance gene – *Rlm7*
- *L. maculans* isolates virulent against *Rlm7* detected
- Insensitivity to azole fungicides in Lm widely spread
- New Lb subclade was first detected in the UK
- Strategies to avoid breakdown of resistance
- Need to investigate new sources of resistance

- Effective control of phoma stem canker needs to target both Lm and Lb

2. Light leaf spot (LLS)

Caused by *Pyrenopeziza brassicae*

Light leaf spot is a polycyclic disease



Pathogen hyphae grow in sub-cuticular space

Asexual sporulation produces conidia

Ascospores germinate and directly penetrate cuticle

Ascospores

Symptomless Phase

Asexual Reproduction

Autumn Winter Spring Summer

Air-borne ascospores initiate epidemic

Sexual Reproduction

Secondary Cycles

Apothecia develop on infected debris

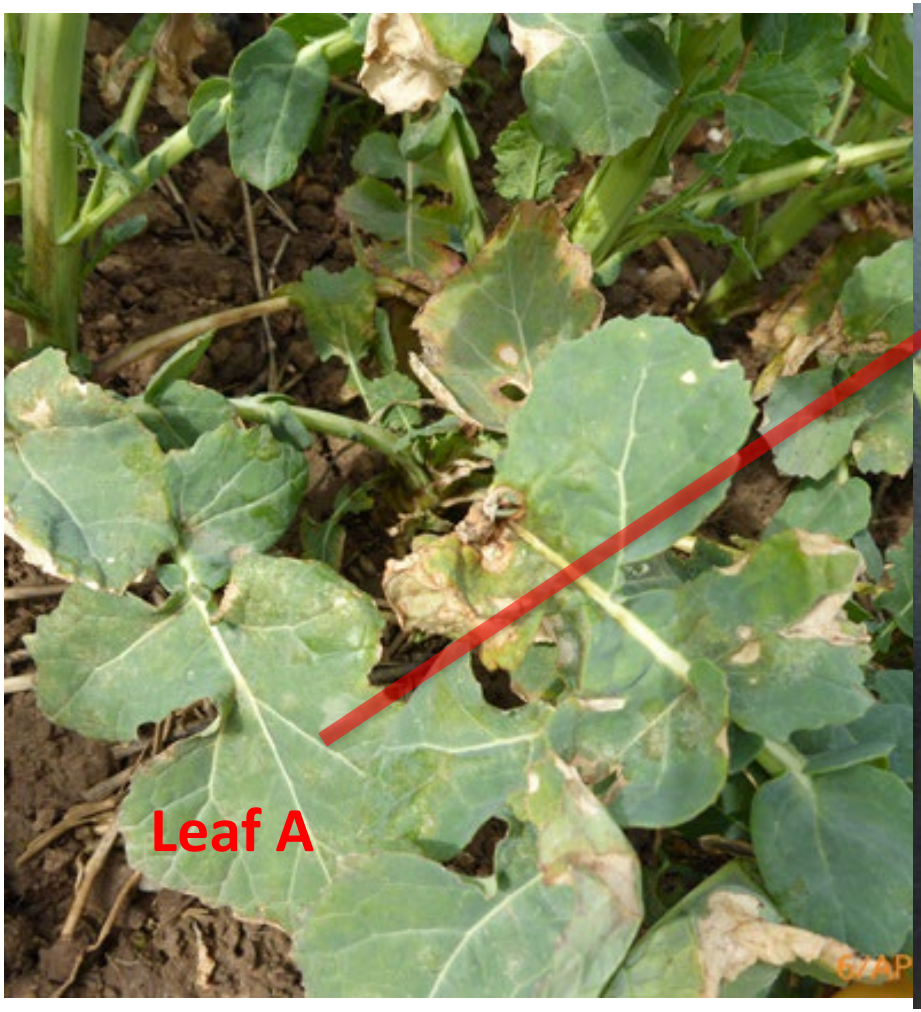
Infection of leaves, stems, meristems & pods

University of Hertfordshire

Karandeni Dewage et al.(2018) Crop & Pasture Science.

Light leaf spot - symptomless period

Infection occurs in autumn, symptoms in crops are often not visible until spring



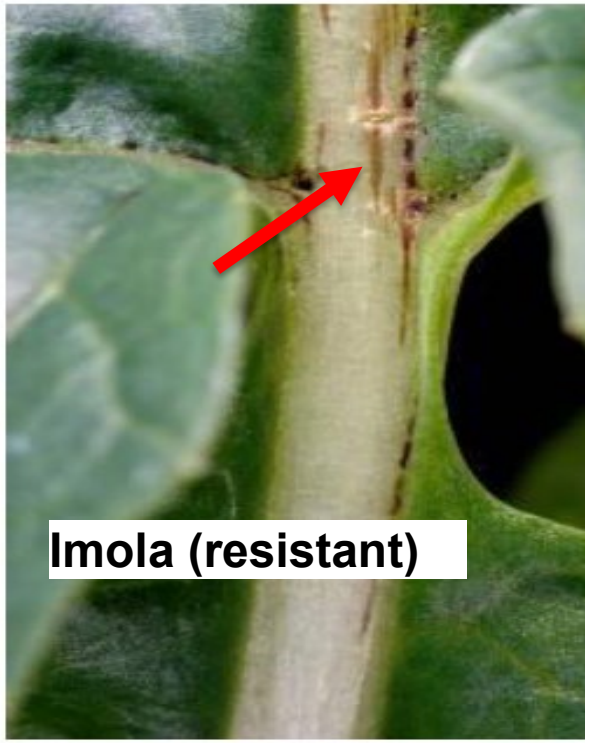
Interactions between *B. napus* and *P. brassicae* (different symptoms)

Boys et al. (2012) Plant Pathology; Karandeni Dewage et al. (2018) Crop and Pasture Science; Karandeni Dewage et al. (2021) Plant Pathology.

Host resistance is less understood

Black flecking - *R* gene resistance?

Reduces/stops secondary infection

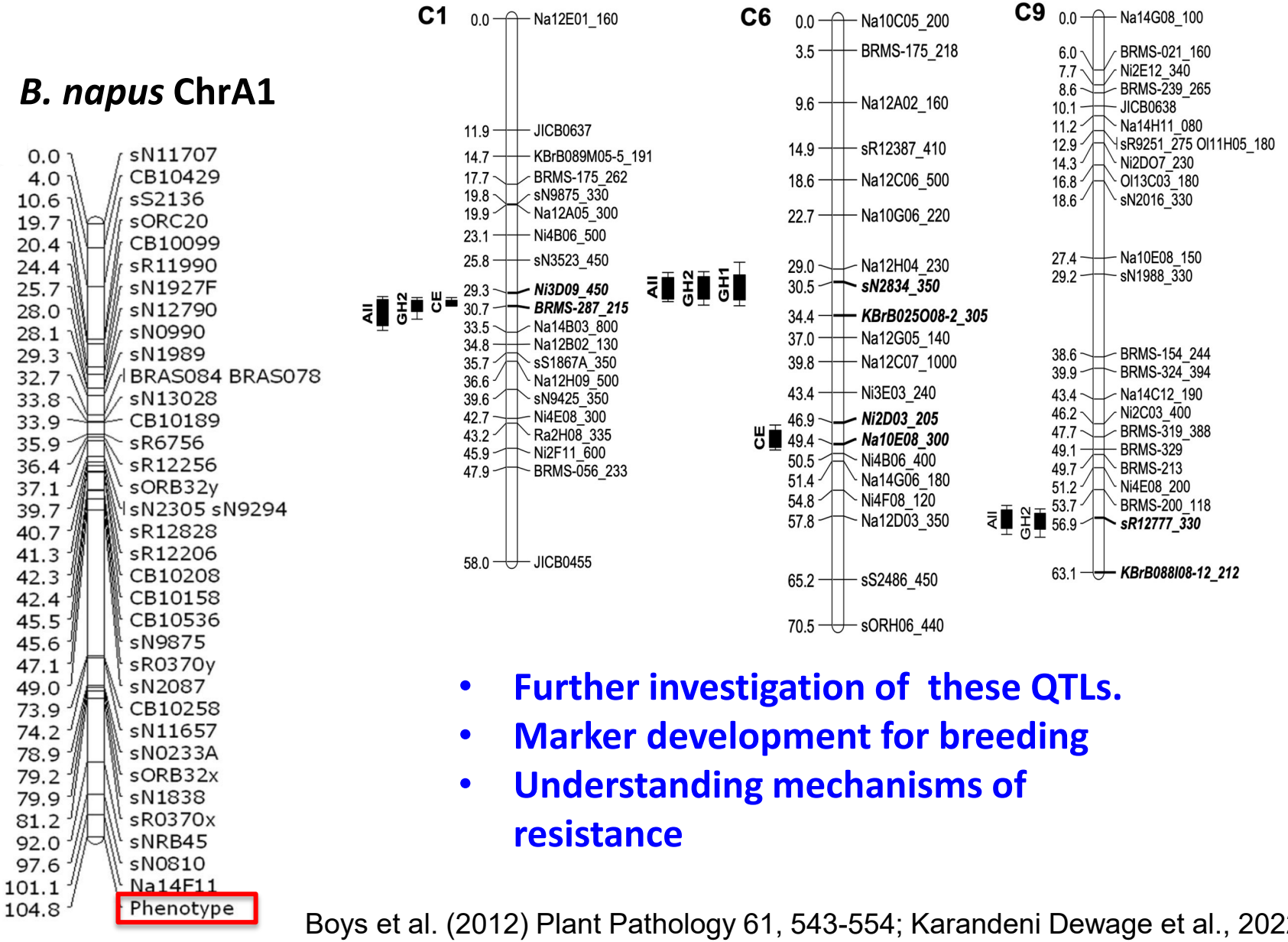


Variation in sporulation between cultivars - quantitative resistance (QR)?

Reduce secondary infection

Boys et al. (2012) Plant Pathology; Karandeni Dewage et al., 2021; Karandeni Dewage et al., 2022

Little information about host resistance



- **Further investigation of these QTLs.**
- **Marker development for breeding**
- **Understanding mechanisms of resistance**

Boys et al. (2012) Plant Pathology 61, 543-554; Karandeni Dewage et al., 2022.

13 April 2023

Severe light leaf spot symptoms

OREGIN 2022/2023 field trial at Harlaxton

Severe light leaf spot symptoms 10 April 2024

MAGIC 2023/2024 field trial at JIC

Currently no information on pathogen races

AHDB RL for 2024/2025, cultivar Dart, LLS resistance rating 7 as resistant, however it is susceptible in controlled conditions

Challenge - control light leaf spot

- LLS is a polycyclic disease
- Long symptomless period after initial infection
- Host resistance is less understood
- Lack of knowledge about variations in *P. brassicae* populations
- Development of fungicide-insensitivity was observed in *P. brassicae*
- Host resistance is ever more important

Acknowledgements

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defra Department for Environment Food and Rural Affairs

OREGIN project

MAGIC field trials

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Thank you for your attention