

# Mycovirus induced hypervirulence of *Leptosphaeria biglobosa* enhances systemic acquired resistance to *Leptosphaeria maculans* in *Brassica napus*



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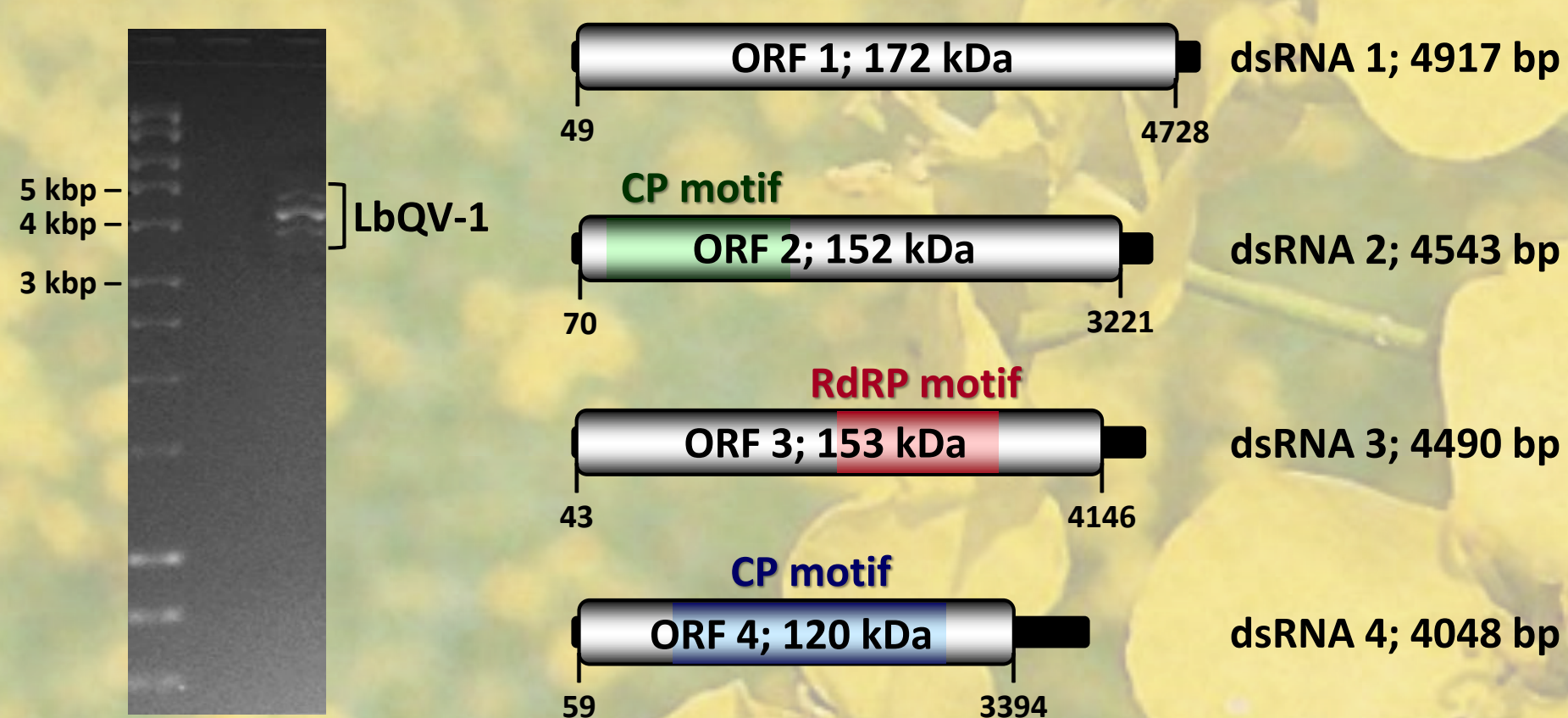
## Introduction

Systemic acquired resistance (SAR) in plants is caused by a hypersensitive response triggered by plant pathogens. Phoma stem canker is one of the most important diseases of *Brassica napus* (winter oilseed rape) world-wide and is caused by a complex that comprises at least two species: *Leptosphaeria maculans* and *Leptosphaeria biglobosa*. Mycoviruses (fungal viruses) may cause hypovirulence or hypervirulence to their hosts and affect fungus-plant interactions; therefore they have largely unexplored potential as biological control agents of plant pathogenic fungi.

The aim of the project is to investigate the biology of a novel mycovirus from *L. biglobosa*.

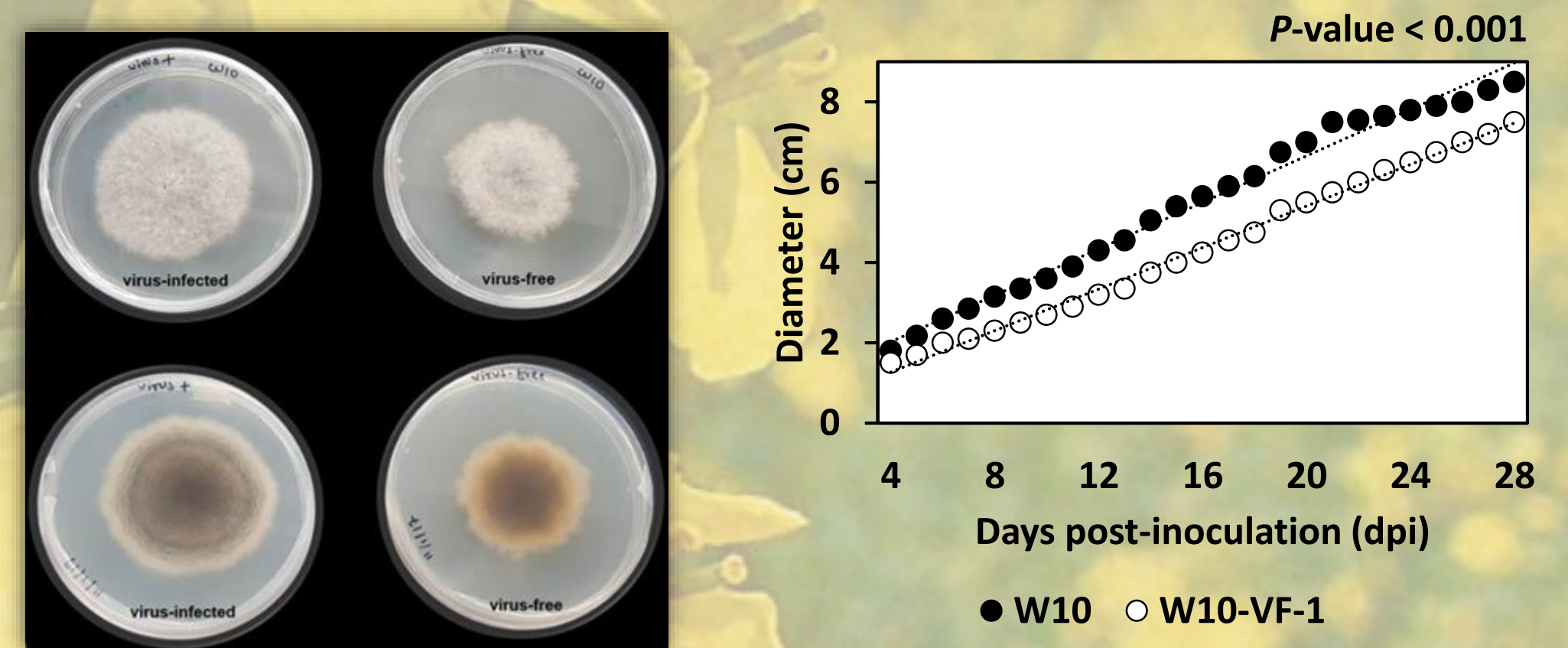
## Results

### Leptosphaeria biglobosa quadrivirus-1



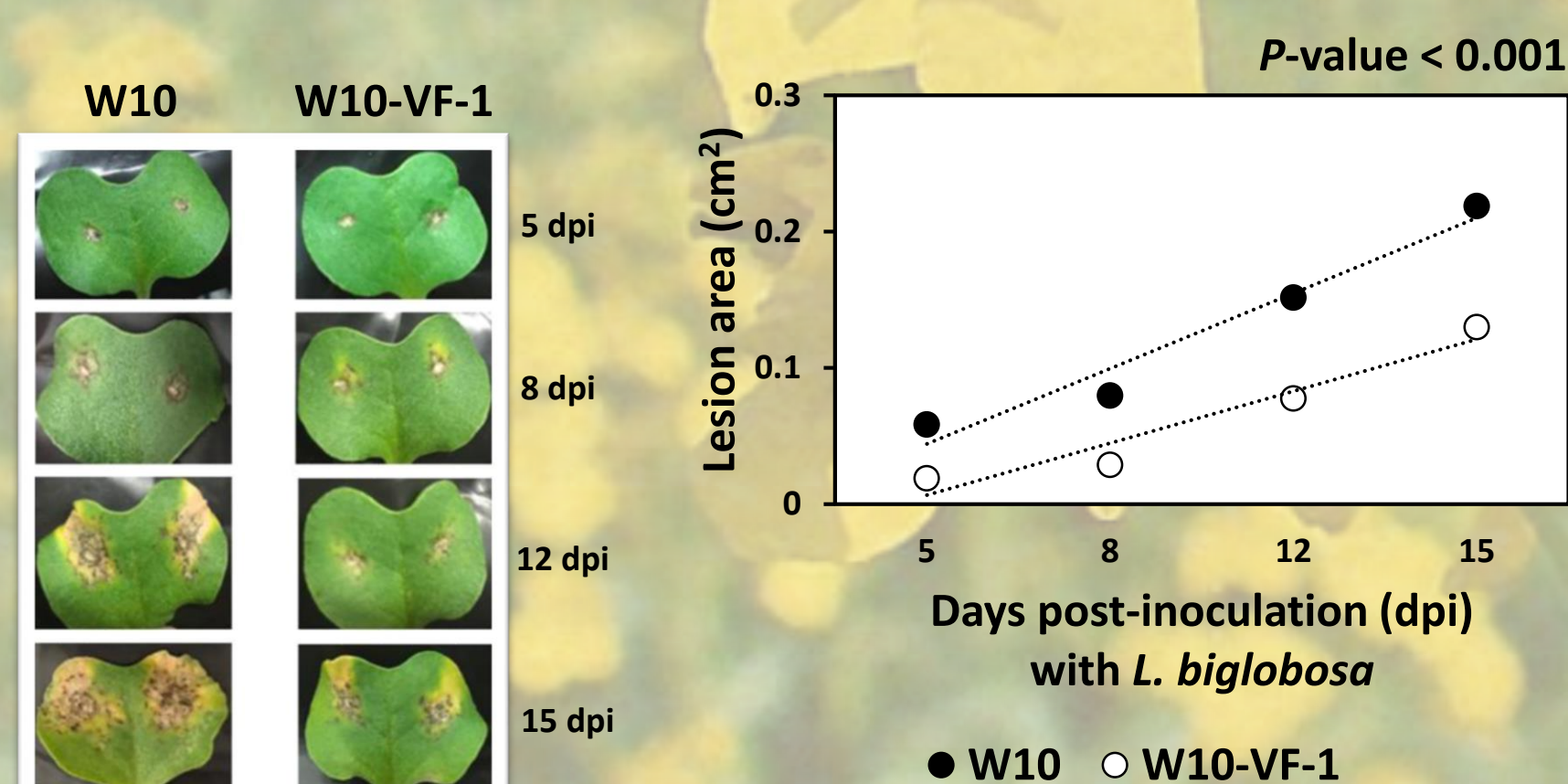
Agarose gel electrophoresis (left) and schematic representation of the double-stranded (ds) RNA genome of *Leptosphaeria biglobosa* quadrivirus.

### In vitro growth of *L. biglobosa*



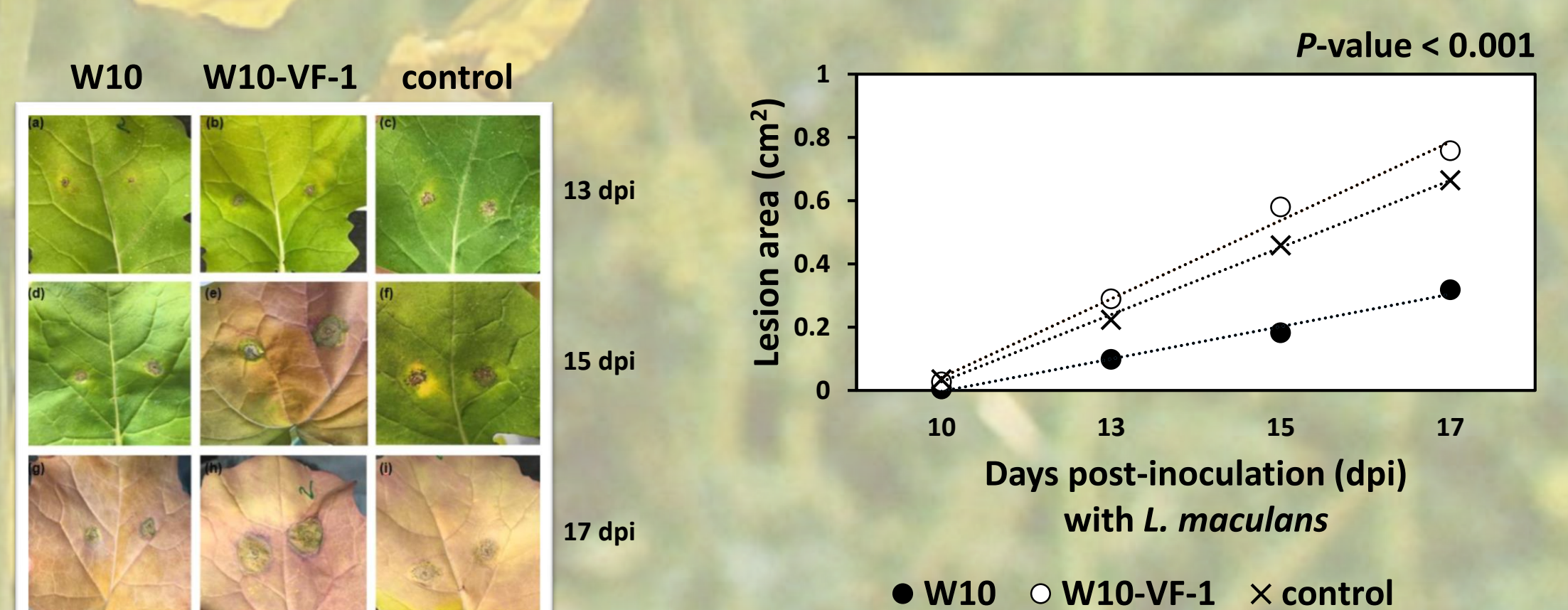
Comparison of phenotypes and radial growth of *L. biglobosa* isogenic lines W10 and W10-VF-1, respectively virus-infected and virus-free, on PDA.

### In planta virulence of *L. biglobosa* on *B. napus*



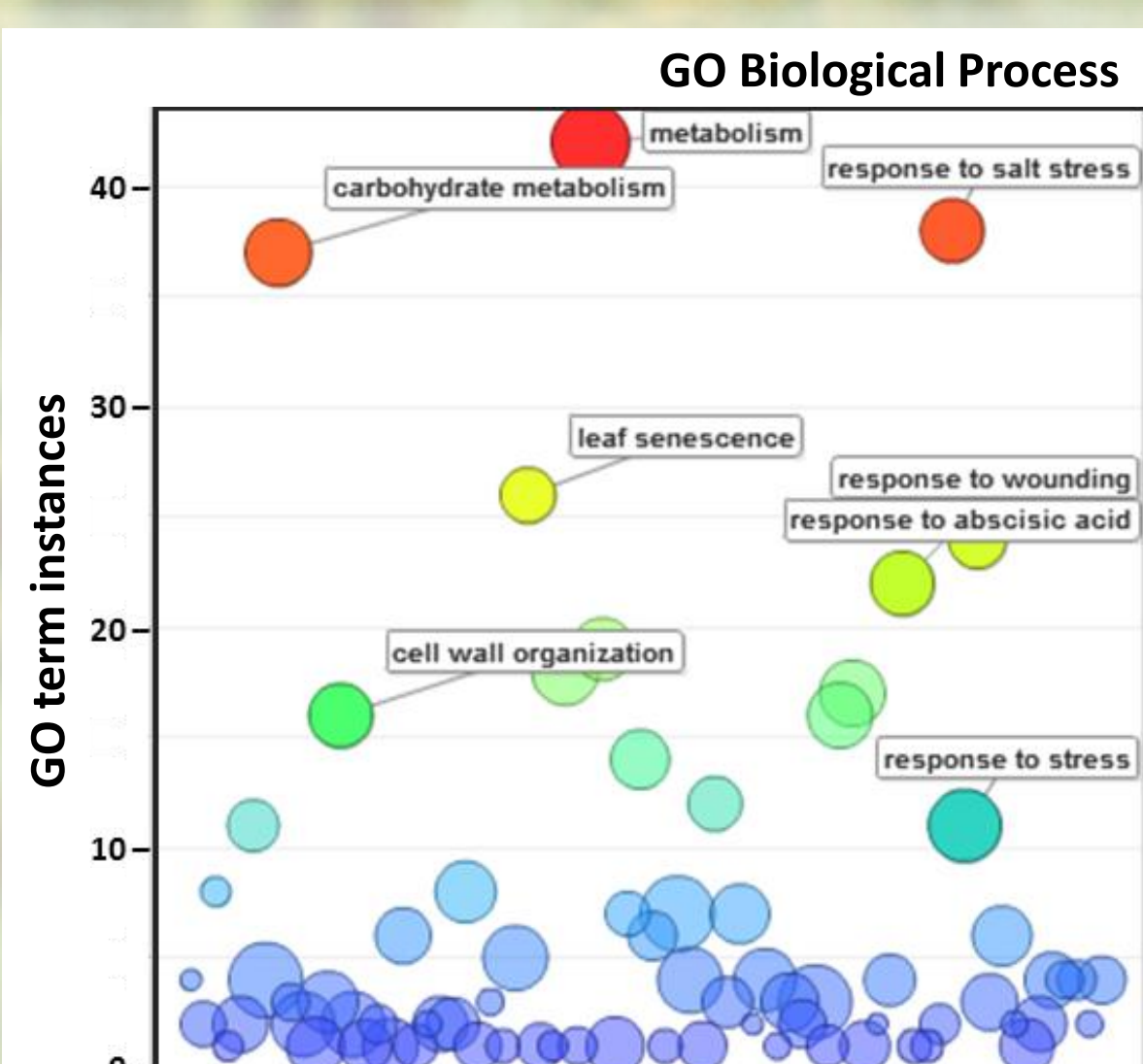
Time course of development of phoma leaf spots on *B. napus* cultivar Excel cotyledons following inoculation with, respectively, virus-infected W10 and virus-free W10-VF-1 *L. biglobosa*.

### Virulence of *L. maculans* after treatment with *L. biglobosa*



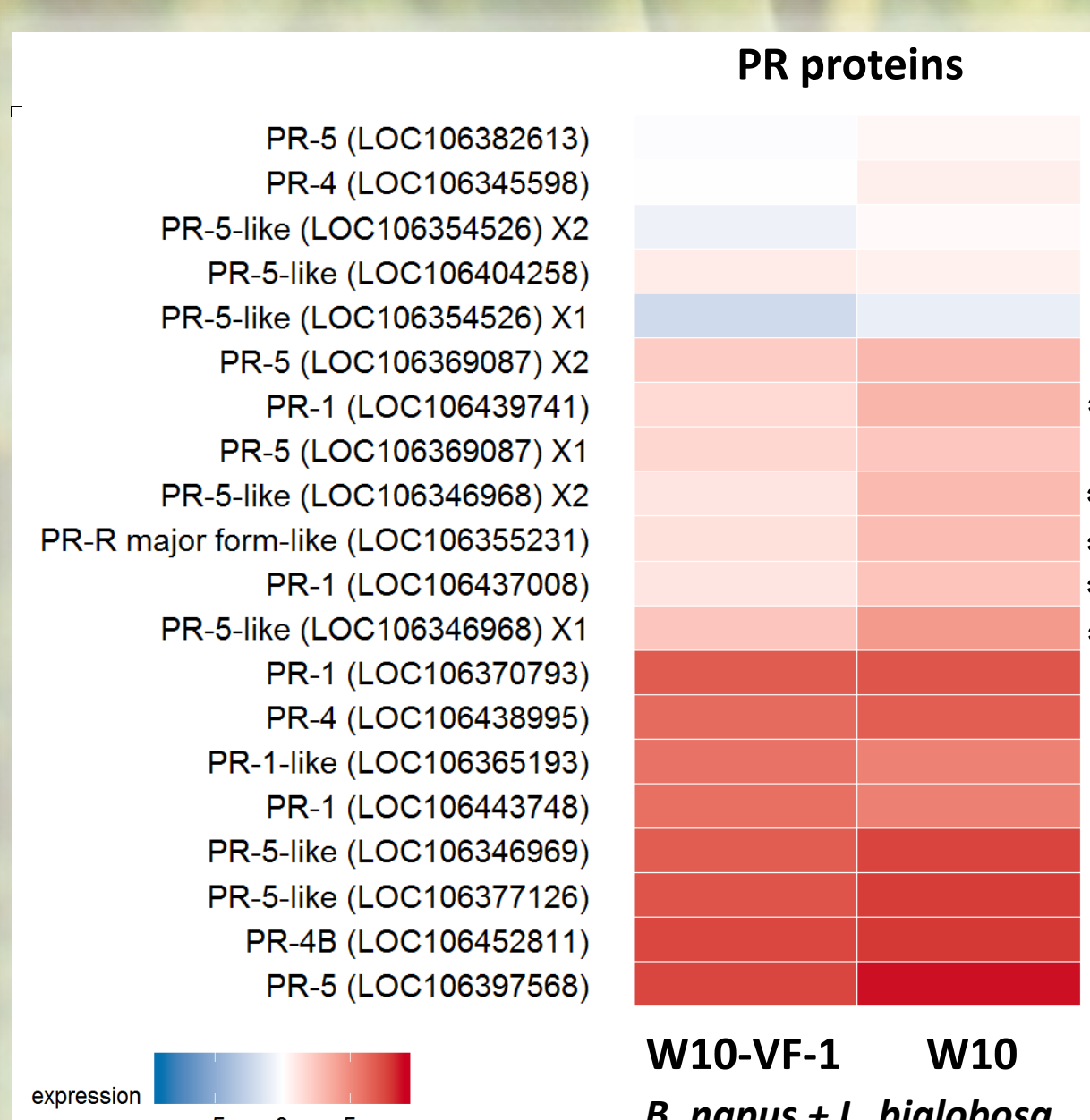
Effect of pre-inoculation of *B. napus* first leaves with virus-infected W10 or virus-free W10-VF-1 *L. biglobosa* on development of phoma leaf spot lesions on second true leaves following challenge inoculation with *L. maculans* spores.

### Transcriptional profile of *B. napus* infected by *L. biglobosa*



Visualisation of GO terms associated with transcripts differentially expressed in *B. napus* after inoculation with W10-VF-1 compared to W10 *L. biglobosa*. The ordinate indicates the number of appearances of each GO term in the data set and the bubble size indicates the frequency of the GO term in the underlying *A. thaliana* database (bubbles of more general terms are larger).

Heat map of normalized differential expression of transcripts involved in *B. napus* defence response after inoculation with virus-infected W10 or virus-free W10-VF-1 *L. biglobosa*.



## Conclusions

- ✓ 11/16 of *L. biglobosa* isolates from the UK and China, but not *L. maculans*, harbour a dsRNA mycovirus.
- ✓ LbQV-1 consists of isometric particles 40 nm in diameter, has four genomic segments and belongs to the family *Quadriviridae*.
- ✓ LbQV-1 increases the growth and virulence of its host *L. biglobosa*.
- ✓ Pre treatment of *B. napus* with LbQV-1-infected *L. biglobosa* resulted in induced systemic resistance towards *L. maculans*.
- ✓ Transcripts involved in carbohydrate and amino acid metabolism, PR proteins, chitinases and WRKY transcription factors are differentially expressed in virus-infected W10 and virus-free W10-VF-1 *L. biglobosa*.
- ✓ Deliberate inoculation of *B. napus* with hypervirulent *L. biglobosa* may decrease the severity of phoma stem canker.

## References

- 1.Shah et al. (2018) *Viruses* 11(1):9.
- 2.Shah et al. (2020) *MPMI* 33(1):98-107.