

## Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: Origin and descriptive information for barley germplasm used in this study.

File Name: Supplementary Data 2

Description: Composite interval mapping of resistance to *P. striiformis* f. sp. *tritici* in doubled-haploid and recombinant inbred line mapping populations.

File Name: Supplementary Data 3

Description: Composite interval mapping of resistance to *P. striiformis* f. sp. *tritici* in four F2 mapping populations.

File Name: Supplementary Data 4

Description: Marker-trait association at the *Rps6*, *Rps7*, and *Rps8* loci in diverse barley F2 and BC1 populations inoculated with *P. striiformis* f. sp. *tritici*.

File Name: Supplementary Data 5

Description: Structured populations and near isogenic lines inoculated with *P. striiformis* f. sp. *tritici*.

File Name: Supplementary Data 6

Description: Phenotypic evaluation of barley carrying *Mla1*, *Mla6*, *Mla7*, and *Mla8* transgenes with diverse *B. graminis* f. sp. *hordei* isolates.

File Name: Supplementary Data 7

Description: *Mla* haplotypes associated with *Rps7*-mediated resistance.

File Name: Supplementary Data 8

Description: CAPS and SSLP markers used for genetic map construction, linkage analysis of *Rps6*, *Rps7*, and *Rps8*, and recombination screens and fine-mapping *Rps7*.

File Name: Supplementary Data 9

Description: KASP markers used for genetic map construction, linkage analysis of *Rps6*, *Rps7*, and *Rps8*, and fine-mapping *Rps7*.

File Name: Supplementary Data 10

Description: Sequenom markers used for genetic map construction.

File Name: Supplementary Data 11

Description: Primer and synthesized sequences used for Gibson cloning of T-DNA constructs carrying *Mla* alleles driven by the *Mla6* promoter.