

The effect of genetic variation in barley on responses to *Ramularia collo-cygni*

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Summary

The effect of *mlo* resistance to powdery mildew on the responses of barley seedlings to *Ramularia collo-cygni* was studied in relation to light intensity before inoculation. It had previously been found that *mlo* alleles were associated with reduced severity of Ramularia leaf spot (RLS) in field trials while high light intensity before inoculation increased the disease in seedlings. In a cross-over experiment, plants were grown at three light levels before inoculation then placed in each of the three light levels after inoculation. As in previous work, light intensity before inoculation increased the severity of RLS, but in contrast to previous results from field trials, the *mlo5* allele was associated with increased RLS levels, while the effect of higher pre-inoculation light intensities on enhancing RLS was stronger in *mlo5* plants than in those with the *Mlo* mildew-susceptibility allele. It is proposed that the effect of elevated light intensity on enhancing RLS in general and on doing so more strongly in *mlo5* plants may be mediated by the induction of oxidative stress.

Key words: *Ramularia collo-cygni*, Ramularia leaf spot, barley, *mlo*, oxidative stress.

Introduction

mlo resistance to powdery mildew appears to affect the response of barley plants to infection by *Ramularia collo-cygni* (*Rcc*) but existing data are inconsistent. Many of the barley cultivars which are most susceptible to Ramularia leaf spot (RLS) have *mlo* resistance while many of the most resistant cultivars have the wild-type *Mlo*⁺ allele, which confers susceptibility to mildew (Pinnschmidt *et al.*, 2007). On the other hand, the presence of *mlo* mildew resistance was associated with a 40% reduction in RLS on upper leaves in a series of field trials, in which near-isogenic lines of cvs Ingrid and Pallas carrying various *mlo* alleles were grown at sites in Scotland and Ireland in 2004 and 2005 (Makepeace *et al.*, 2007).

One hypothesis which could explain this apparent contradiction is that *mlo* causes resistance to RLS but hitch-hiking selection in barley breeding programmes has caused a fortuitous association between *mlo* and genes for RLS-susceptibility in current varieties. An alternative hypothesis, however, is that *mlo* increases resistance to RLS in some environmental conditions but increases susceptibility in others. The latter hypothesis was tested using a method of inoculating seedlings with *Rcc*. In previous experiments, RLS symptoms were maximised when plants were exposed to high intensity of light in the visible spectrum before inoculation but not afterwards (Makepeace *et al.*, 2008).