

The identification of genetic synteny between *Lolium perenne* chromosome 7 and rice chromosome 6 genomic regions that have major effects on heading-date

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Introduction Comparative genetic mapping between plant species has established that there has been a conservation of genomic organisation which reflects evolutionary relationships. The genetic mapping of *L. perenne* has identified such syntenic relationships with both the Triticeae and rice. The recent publication of the complete sequence of the rice genome has allowed these relationships to be analysed more closely and has raised the possibility of using the rice genome as a template for chromosome landing-based gene identification in related non-model species. The aim of the present work was to map particular markers and genes associated with heading-date in rice in *L. perenne* in order to test this comparative genomics approach.

Materials and methods A *L. perenne* F2 mapping family of 188 individuals constructed from parental material with early and late heading dates was established and genetically mapped with a marker set that included comparative mapping RFLP probes (Armstead *et al.*, 2004). The family was evaluated for heading date and a QTL analysis performed. Using known comparative genetic relationships between rice and *L. perenne*, STS markers based upon rice gene sequences known to be associated with rice heading date QTL were developed and mapped in the *L. perenne* mapping population.

Results Interval and MQM mapping with MapQTL 4.0 (Van Ooijen *et al.*, 2002) identified a QTL for heading date which accounted for up to 64% of the variance and which was associated with *L. perenne* chromosome (C) 7. The trait appeared to be under the control of a single dominant gene, or a block of tightly linked dominant genes. Comparative mapping indicated that this region of *L. perenne* C7 showed a degree of conserved genetic synteny with rice C6, a region of the rice genome which contains both the Hd1 and Hd3 rice heading date QTL. The mapping of STSs based upon gene sequences associated with these QTL in rice indicated the major effect in the *L. perenne* genome in this mapping family seemed to be associated more closely with the Hd3 as opposed to the Hd1 equivalent regions. However, a parallel heading-date linkage disequilibrium study (Skot *et al.*, 2004) identified molecular markers which, when mapped in the same *L. perenne* mapping family, were associated with Hd1 equivalent region of *L. perenne* C7.

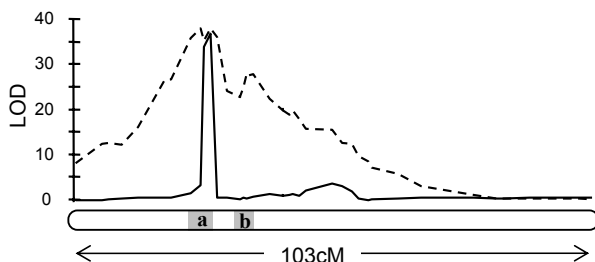


Figure 1 Position of major QTL for heading date on *L. perenne* chromosome 7; dashed line and solid line illustrate LOD profiles produced by interval and MQM mapping, respectively. **a** = positions of markers associated with the Hd3 region of rice; **b** = markers associated with the Hd1 region of rice and markers generated from the *L. perenne* linkage disequilibrium study.

Conclusions Comparative genetics indicates that *L. perenne* C7 and rice C6 share a degree of conserved synteny. Further detailed analysis indicates that this relationship extends beyond just co-linearity of molecular markers. It also implies similarities in terms of the significance of this genomic region in determining an important trait in that both the Hd3 and Hd1 chromosomal regions of rice C6 and the equivalent chromosomal regions of *L. perenne* C7 can be associated independently with heading-date determination.

References

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