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Barley Partial (Host) and Nonhost Resistance QTL-Near-Isogenic Lines against Barley Homologous and Heterologous Rusts

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Partial (host) and nonhost resistance are possibly associated. Histological studies on partially resistant barley accessions showed that the mechanism of partial resistance to the barley leaf rust fungus (*Puccinia hordei*) is prehaustorial. This is similar to the mechanism of non-host resistance of barley to heterologous rust fungi, such as the wheat leaf rust fungus (*P. tritricina*). This suggests that the two resistance types are based on shared principles, partial resistance resembling a weak form of nonhost resistance. Moreover, QTLs for partial and nonhost resistances of barley tend to co-locate on a consensus map of barley. It is possible that the genes for partial resistance play similar roles in nonhost resistance. Near isogenic lines (NILs) for four partial resistance QTLs (*Rphq2*, *Rphq3*, *Rphq11* and *Rphq16*) and one nonhost resistance QTL (*Rnhq*; L94 allele - *Rnhq.L* and Vada allele - *Rnhq.V*) were developed in SusPtrit genetic background (Sus-QTL). SusPtrit is an experimental line susceptible to several heterologous rust fungi. NILs of *Rphq2*, *Rphq3* and *Rnhq.V* are also available in L94 genetic background (L94-QTL). L94 is somewhat susceptible to a certain number of heterologous rusts. The genome purity of the NILs was evaluated using a barley SNP array, Infinium 9K barley iSelect. Sus-*Rphq16*, L94-*Rphq2* and L94-*Rnhq.V* are clean from the donor genome away from the QTL region. The other NILs have some small introgressions from the undesirable donor genome. The NILs were challenged with different isolates of homologous and heterologous rusts. In general, it is observed that partial resistance QTLs are not only effective towards the homologous rust *P. hordei* but also confer resistance against heterologous rusts. Interestingly, nonhost resistance QTL *Rnhq.V* also confers resistance to the homologous rust *P. hordei* (to one isolate) and to three species of heterologous rusts if in SusPtrit background, but not if in L94 background. Differential QTL x isolate interactions also occurred, indicating a minor-gene-for-minor-gene interaction. For some QTLs, the resistance effect in SusPtrit background is different from their effect in L94 background. The results are consistent with the hypothesis that genes for partial resistance to *P. hordei* play also a role in nonhost resistance to heterologous rusts, and that their effectiveness is rust species specific.