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Genetic mapping of fire blight resistance QTL in two related apple progenies

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Fire blight, caused by the necrogenic gram negative bacteria *Erwinia amylovora*, is one of the most destructive diseases of apple (*Malus x domestica*) and pear (*Pyrus communis*) worldwide (Fig. 1). Using genetically resistant cultivars could be an alternative to chemical fight. The objective of this study was to identify the genetic determinism underlying resistance to fire blight in two apple progenies.



Fig. 1 : Symptom of necrosis caused by *Erwinia amylovora* on the stem of an apple shoot.

Material and Methods

Two connected F₁ progenies of resp. 144 and 188 individuals were derived from the crosses 'Prima' x 'Fiesta' (PxF), and 'Fiesta' x 'Discovery' (FxD). Parental or integrated linkage maps of both progenies had previously been constructed (Maliepaard et al 1998; Van de Weg, unpublished results). The strain CFBP 1430 of *E. amylovora* was inoculated in both progenies (10⁷ bacteria/mL). Six (PxF) or seven (FxD) replicates per genotype were used. The length of necrosis was measured on the stem of each shoot inoculated, 7 and 14 days post inoculation (dpi). QTL were detected using the rMQM (restricted multiple QTL mapping) procedure of the MapQTL software (Van Ooijen et al 1996).

Results

In the PxF progeny, two QTL were detected at both 7 and 14 dpi (Fig. 2). In the FxD progeny, four QTL were identified either at 7 or at 14 dpi, and 2 QTL were identified at both dates. A major effect QTL derived from 'Fiesta' was identified on linkage group 7 in both progenies studied at both dates of inoculation.

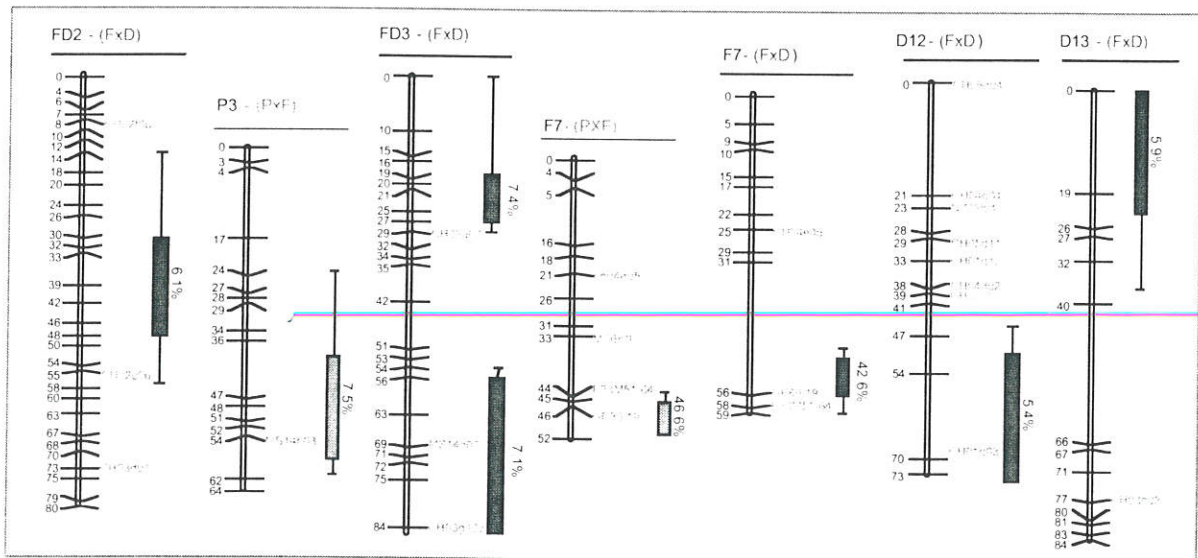


Fig. 2 : Linkage groups of parental or integrated linkage maps of the 'Prima' x 'Fiesta' and 'Fiesta' x 'Discovery' progenies carrying QTL for resistance to fire blight identified with data collected either at 7 (PxF progeny, in green) or at 14 days (FxD progeny, in blue) post inoculation (dpi). QTL are represented to the right of linkage groups. LOD-2 and LOD-1 support confidence intervals of QTL are shown. R² (percentage of phenotypic variation explained by QTL) are indicated.

Conclusion

The genetic determinism underlying resistance to fire blight in the studied progenies is polygenic. A common QTL with major effect derived from 'Fiesta' is stable in the two genetic backgrounds studied. Minor QTL need to be confirmed in larger progenies. The major QTL is highly promising for breeding purposes.

References :

Maliepaard C. et al (1998). Aligning male and female linkage maps of apple (*Malus pumila* Mill.) using multi-allelic markers. *Theor Appl Genet* 97: 60-73.
Van Ooijen J.W. and Maliepaard C. (1996). MapQTL version 3.0; software for the calculation of QTL positions on genetic maps. (PRO-DLO), Wageningen, The Netherlands.

