

CRISPR-FIRE

Project title: Durable resistance of apple against fire blight: functional validation of a major QTL through gene editing

Acronym: CRISPR-FIRE

Project duration: 18 months - Start date: 3/10/2018 End date: 2/04/2020

Key-words: apple, fire blight, resistance, durability, cloning, gene-editing, CRISPR

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Summary:

Context:

Fire blight caused by the bacterium *Erwinia amylovora* has a major economic impact because many apple and pear varieties are very susceptible to this disease. In Europe, antibiotic applications are forbidden, therefore chemical control methods are limited and the release of resistant varieties is necessary. Only one major fire blight resistance gene has been cloned in apple and it is already overcome by several strains of the bacteria. We have decided to study a resistance source a priori durable because not yet overcome in culture: 'Evereste'. This pollinator variety carries a QTL of resistance with a very strong effect, independently identified in two apple genotypes ('Evereste' and *Malus floribunda* #821). In collaboration with ETH-Zürich, the QTL region has been precisely mapped on chromosome 12 and reduced to 78 kb.

Goals:

The aim of the project is the functional validation of the fire blight resistance QTL by gene editing and the cloning of responsible gene(s). In the long term the goal will be to propose a prototype of resistant variety developed by intragenesis or by knock-in via CRISPR. Such models are necessary to initiate a debate over the advantages/drawbacks of this type of biotechnological approaches for fruit tree breeding.

Methodology:

The project is based on two innovative advances recently achieved at IRHS: i) the high quality sequencing of an apple genome ii) the mastery of a CRISPR knock-out method for this species. This last method belongs to the « New Breeding Technologies » and has never been applied for a functional validation of an apple gene.