Basis for potato blight control becomes visible

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Potato blight, false mildew, sudden oak death and a disease in salmon are all caused by a group of miniscule, yet destructive, organisms called Oomycetes. Because of their changeability and huge numbers, they are able to overwhelm the defence mechanisms of both plants and animals. The use of chemicals is usually the only remedy but this is also undesirable. Will future research offer a sustainable means of combating these blights and preventing failed harvests? Francine Govers, professor at Wageningen University, can see sporadic openings left by the pathogens and they provide a strategic starting point for combating the infections.

There are between 1000 and 2000 species in the group of micro-organisms, the Oomycetes (‘egg moulds’). They are not fungi. In fact, fungi (including toadstools) are more closely related to man than to these one-celled egg moulds. However, the effect of the latter on crops and animals is disastrous as was demonstrated by the potato blight that entered Europe via Belgium in 1845, advancing very rapidly, and causing the Great Irish Famine.

Prof. Francine Govers listed the limited number of strategies available for keeping the pathogen, *Phytophthora infestans* ('the destroyer of plants ') under control. The approach also provides an opportunity for reducing the quantity of pesticides used per hectare in the Netherlands, the highest levels of which happen to be in potatoes.

Combat takes place on a microscopic scale, the pathogen trying to work

its way through the biological defences of the host, the potato plant. Phytophthora attacks the plant using a special group of proteins, the RXLR effectors. It has a huge and diverse arsenal available with some 560 RXLR effectors, so the odds of it finding a suitable weapon to break through the plant's defence mechanism is very high. If the attack succeeds, the effectors breach the plant's defences by suppressing its resistance. The spores of P. infestans can then make the most of the foodstuffs available and reproduce themselves, causing the death of the plant. Wild potato plants which grow in South America are reasonably resistant to such attacks because potato-resistant proteins recognize the invaders and block their advance.

Research efforts, including those at Wageningen, have meanwhile identified more than 10 resistant genes which make resistant proteins. Seven of those are known to contain the RXLR effector. If recognition is not 100% as, for example, when the RXLR effector looks slightly different, the invader escapes attack and can reproduce after all. This is how the pathogen, after a certain number of years, becomes able to break through the resistance in potatoes crossed with wild strains.

Predictions

Phytopathologists are trying to understand the interaction better. The challenge is to predict whether a pathogen strain is going to infect a field where resistant potato cultivars are growing. By taking samples, a DNA chip can be used to determine which strains are present in the field and what sort of RXRL arsenal they have. It is then possible to establish which potato cultivars will not be affected by Phytophthora and which will. Only in the latter case is it necessary to spray. How long it will take to put this method into practice depends, according to Prof. Govers, on how quickly new combinations of resistant gene and RXLR effectors with all the variants can be identified.

Researchers are not putting all their money on one horse; they are also looking at the weak links in the life cycle of Phytophthora and at the genetic properties that are unique to the Oomycetes. Thus, it has been shown that a certain enzyme, phospholipase D, takes on novel forms in Oomycetes. Precisely these forms are ideal for applying control because the specific inhibition technique has no direct effect on other useful organisms, including the crop itself.

To finish, Prof. Govers pointed to a biological control technique. Soil bacteria belonging to the genus Pseudomonas attack spores of Phytophthora, making use of a small, special protein. It is not yet understood how this protein destroys the spores. By analysing 15,000 genes in Phytophthora, researchers have found candidates which may provide new and specific points of inquiry.

Source: Wageningen University