Pseudomonas vs *Phytophthora infestans*: The direct effects of the bacteria alone or in consortia and the induced resistance in the potato plant

Fanny Germanier

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Potato is one of the most cultivated food-crop in the world after wheat, maize and rice. Unfortunately, nowadays, potatoes are threatened by several pathogens including *Phytophthora infestans*. This oomycete, responsible of the late blight disease, was the cause of the Great Famine that affected the Irish during the 19th century. Different strategies are used to fight against this pathogen including chemicals. While these treatments are efficient to prevent the disease, they are often not environmentally friendly and the pathogen develops resistance towards them. Nowadays, the use of living organisms such as bacteria, fungi or insects, called biocontrol, is expanding and presents in general no harm for the environment. In this work, five different *Pseudomonas,* previously isolated from the rhizosphere and phyllosphere of the potato plant, were selected and tested against *Phytophthora infestans*. First, the direct effects of the bacteria alone or in consortia were studied on different stages of the development of the oomycete. Furthermore, the survival of each strain with others was assessed in order to try to understand the good potential of certain combinations against *P. infestans*. Secondly, the question of a possible induced resistance triggered in the plant by the *Pseudomonas* was addressed. While the results obtained in an experiment with *in vitro* potato plants did not give any positive results, the experiment where bacteria were pre-inoculated on a mother tuber of pot-grown plants showed interesting results. Indeed, some protection of the leaf tissues was observed as well as an upregulation of different defense genes. Unfortunately, these observations were not confirmed in the second replicate. The last part of this work concerned the colonization of the hyphae of the oomycete by the bacterial strains. The results of the experiments conducted in order to understand this phenomenon indicated that the mycelium was not killed by the colonizing bacteria, since it was able to regrow after colonization. Furthermore, all tested *Pseudomonas* were able to move with the help of the hyphae as the presence of all the strains was observed on the whole mycelium. Finally, on a poor medium, the strains seemed to develop more and to be more abundant in the presence of *P. infestans* hyphae, which could indicate that the oomycete could be used as a source of nutrients. All these results indicated an interesting potential of these *Pseudomonas* strains to fight against the pathogen *Phytophthora infestans* even if more experiments, notably field experiments, are needed to have a more realistic idea of the effects of these bacteria in natural conditions. Furthermore, the *in vitro* tests performed in this work allowed a better understanding of the mechanisms behind the inhibition of *P. infestans* infection and the interaction between the bacteria and the oomycete.

Prof. Laure Weisskopf