Exploring the potential of native bacteria as biocontrol agents on grapevine

Livia Lena Sabrina Jerjen

Master thesis in Plant and Microbial Sciences

Grapevine is an economically important crop for table grapes, but more importantly for wine production. The wine market is expanding worldwide, and consequently, winegrowers have to face an increasing demand regarding yields and quality, which are impeded by several diseases and pests. To meet this demand, the grapevine production relies on heavy treatments involving chemical pesticides and copper. The use of such pest control molecules was debated for several years in scientific contexts already, but since recent years, the general public, NGOs and politics are also concerned by the alarming effects of said products on environment and human health. Various alternatives to fight diseases are being explored by scientific research, and this thesis discusses and studies one of those alternatives: biocontrol.

Previous results provided us information about the antagonistic activity of bacteria isolated on Swiss vineyards, in *in vitro* experiments against two pathogens, *Botrytis cinerea* and *Phytophthora infestans* (as a surrogate for *Plasmopara viticola*). In this work, we selected 22 candidate strains from the previous results and explored their antagonistic effects, not only *in vitro*, but this time also *in planta*. *In vitro* grapevine plants were infected with *B. cinerea* spores and inoculated with the selected bacteria. We then observed the effect of the bacteria on the disease development, in search of inhibitions compared to the control without bacteria. To find out more about how the bacteria are able to interfere with the pathogen, we performed several experiments, including *in vitro* germination assays and a RT-qPCR on inoculated *in vitro* leaves, in order to detect induction of genes associated with plant defense. In addition, we wanted to know if some clades of bacteria are especially active against pathogens, and if we could observe differences between *in vitro* and *in planta* experiments.

Out of the six strains which inhibited *B. cinerea* on grapevine leaves significantly, the two strains which showed an inhibition percentage of almost 100% were surprisingly strains previously classified as “inactive”, since they were not able to suppress *in vitro* mycelium growth. These two strains belong to the *Herbaspirillum* and *Variovorax* genera, which are both not especially known as biocontrol agents. Other strains which were also active in planta, belonged mainly to the *Bacillus* and *Paenibacillus* genera. This confirms not only the activity trend of the previous findings, but also the general knowledge on biocontrol, since strains belonging to these genera are already used commercially as biocontrol agents.

The results of this work confirm that grapevine can be protected by selected bacteria isolated from the leaf microbiome, and they contribute a good basis for more in depth analysis of the modes of actions of protective bacteria against grapevine diseases. This work also provides a selection of candidate strains that could be studied further for isolation and identification of active compounds effective against diseases. We also know that all tested strains are able to survive on the leaf surface, and their *in planta* application could be extended to field experiments in the future.

Prof. Dr. Laure Weisskopf