Persistence of *Salmonella enterica* in the plant environment

Jasper Schierstaedt[1], Sven Jechalke[2], Rita Grosch[1], Kornelia Smalla[3] and Adam Schikora[3]
[1]Leibniz-Institute of Vegetable and Ornamental Crops (IGZ), Department Plant-microbe systems, Grossbeeren
[2]Justus-Liebig-Universität, Institute for Phytopathology, Giessen,
[3]Julius Kühn-Institut, Institute for Epidemiology and Pathogen Diagnostics, Braunschweig,
E-mail of corresponding author: jasper.schierstaedt@julius-kuehn.de

In the last years, foodborne zoonotic infection outbreaks were increasingly associated with fruits and vegetables. *Salmonella* has been reported as the second most abundant cause of foodborne diseases in Europe in 2015. This indicates that plants are suitable vectors for *Salmonella enterica*. Contamination of produce can occur along the whole production chain. While the post harvest contaminations can be avoided by hygiene specifications, the possible contamination at production site (e.g. in field) is a more complex issue. *Salmonella* can contaminate soil and plants *via* irrigation water or organic fertilizers. Therefore, it is essential to understand the persistence of *Salmonella* in soil in order to gain insight into its ability to colonize plants and the subsequent hazard of foodborne diseases. Today, the knowledge about factors influencing the persistence of *Salmonella* in soil and plant environment is scarce, and the question whether *Salmonella* colonizes plants as opportunistic bacterium or if it uses plants as alternative hosts is still controversially discussed.

We analyzed the influence of soil fertilization and soil sterilization on the survival of *Salmonella*. We observed an adaption and enhanced persistence in soils with reduced diversity. While fertilization with pig manure had a positive effect on the survival of *Salmonella* in soil, chicken manure had no influence. Sterilization of soil by autoclaving led to a drastic reduction of the abundance of soil bacteria. Denaturing Gradient Gel Electrophoresis (DGGE) as well as Illumina sequencing data revealed changed communities in the autoclaved soils. *Salmonella* was able to survive in this soil up to 6 months and seemed to adapt to this environment. These results indicate strong influence of the indigenous bacterial community in the agricultural soil on the survival ability of *Salmonella.* As an invader in this environment it likely competes for resources with the native community. Despite an initial decline, our data indicated a long-term survival of *Salmonella* in agricultural soil. In another experiment we localized *Salmonella* in the rhizosphere of crop plants using a GFP marked strain. By means of confocal laser scanning microscopy we showed that *Salmonella* moves towards plant roots.

Together, our results indicate that *Salmonella* can persist in soil for extended times. Adaptation to the soil environment may enhance the risk of contamination of fresh produce. The fact that *Salmonella* may use plants as alternative hosts strongly suggests that plants represent a much larger reservoir for animal pathogens than so far estimated.