

Project Title:

The role of stress factors in predisposing plum trees to invasion by bacterial pathogen *Pseudomonas syringae* pv. *syringae*.

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Objectives and Rationale

There is anecdotal evidence that abiotic factors such as drought, soil conditions, extreme temperatures, etc., impact on bacterial canker outbreaks caused by *Pseudomonas syringae* pv. *syringae* on stone fruit trees. The project objectives were: i) to determine the link between ring nematode infestation and bacterial canker outbreaks, ii) to determine the link between *Phytophthora*, and bacterial canker outbreaks, iii) to study the effect of drought and ring nematode stress combination in predisposing plum trees to *Pseudomonas syringae* infection, and iv) to study the effect of *Phytophthora* or other Oomycetes as a biotic stress factor in predisposing trees to infection. Circumstantial evidence supports the hypothesis that abiotic and other biological factors have an impact on bacterial canker of stone fruit trees. The reason for the inclusion of *Phytophthora*/other Oomycetes is that when visiting plum orchards, typical symptoms associated with this pathogen were noticed.

Methods

Four disease surveys were conducted in September/October 2016, March 2017, October 2017 and March 2018 in the major plum-producing farms in the Western Cape Province to assess disease prevalence and severity as well as to collect plum rhizospheric soil samples for estimating the population of ring nematodes and *Phytophthora* present in the soil.

Bacterial isolations were performed from plum trees displaying symptoms of bacterial canker from all farms visited. A semi-selective (King's B) and general medium (Nutrient agar) was used. Identification of strains was achieved by sequencing *cts*, *gapA*, *gyrB* and *rpoD* genes.

Baiting technique was used to isolate Oomycetes from the rhizospheric soil, followed by the transfer of lesions from the baiting material onto selective media NARPH. Oomycetes from infected plant material (inner bark) were plated directly onto the selective media.

The effect of water stress on predisposing plum trees to infection by bacterial canker-associated pathogens, *Pseudomonas syringae* and/or *P. viridiflava* was investigated under greenhouse conditions using varieties 'Songold' (tolerant) and 'Sapphire' (susceptible).

Key Results

Severe wilting and death of plum trees was observed in the majority of the surveyed plum orchards which is indicative of high levels of water stress. Thirteen to 22% of trees surveyed displayed symptoms of bacterial canker. Additionally, the ring nematode populations in rhizospheric soils were low in 2016 and much higher in 2017 in the majority of the farms surveyed. This change in the population density is probably due to weather pattern shifts from cool conditions at the start of summer to very hot conditions at the end of summer.

Fifteen pseudomonad isolates were delineated to two phylogenetic groups within the *Pseudomonas syringae* species complex, namely, *P. syringae* sensu stricto and *P. viridiflava*, the latter not previously reported to be associated with bacterial canker of plum trees.

Phytophthora and other Oomycete species recovered from the rhizospheric soil were *Phytophthora multivora*, *Phytophthora vexans*, *Pythium coloratum*, *P. diclinum*, *P. irregulare*, and *P. ultimum*. The only species that was recovered from infected plant material was *Phytophthora vexans*.

Results from the greenhouse trial indicated that water stress did not have a significant effect on disease development; however co-inoculation of *Pseudomonas syringae* and *P. viridiflava* yielded larger lesions on both varieties tested.

Conclusion and Discussion

From our surveys, we found that bacterial canker in the Western Cape was caused by both *Pseudomonas syringae* pv. *syringae* and *Pseudomonas viridiflava*. Of the abiotic factors playing a role in plum tree decline, drought proved to be the most significance factor. The presence of ring nematodes had little to no effect on the incidence and severity of bacterial canker outbreaks. A *Phytophthora* sp. and other Oomycetes were isolated from rhizospheric soil surrounding symptomatic trees. Only *Phytopythium vexans* was isolated from symptomatic plant material. To determine if this biotic agents played a role in bacterial canker outbreaks is still in the process of being determined.