1. Summary

Fusarium species are the most common plant pathogens that cause several plant diseases. They produce various secondary metabolites in which the mycotoxins and extracellular lytic enzymes contribute to weakening and invading the host plant successfully. The major objectives of the study were to monitor the *in vitro* and *in vivo* effect of pea plant extracts on the lytic enzymes and mycotoxins produced by *Fusarium* and to understand the effect of pea plant-derived secondary metabolites on the growth and metabolism of *Fusarium* strains.

For differential activity analysis, we selected a susceptible (Santana) and a resistant cultivar (Sokolik) of pea and their extracts were used for the lytic enzyme induction along with other carbon sources such as glucose, citrus pectin and oat bran. The strains of *Fusarium* were selected based on a mycotoxin analysis, of which two *F. proliferatum* strains (PEA1 and PEA2) produced higher amount of fumonisins and two *F. oxysporum* strains (34 OX and 1757 OX) produced more beauvericins when compared with other strains.

The production of cell wall-degrading enzymes such as polygalacturonase, pectate lyase, xylanase, cellulase, chitinase, lipase and protease were studied in all four *Fusarium* strains. The pea extracts could elicit higher activities of β-glucosidase, pectate lyase and xylanase in liquid cultures. However, the pea infection studies revealed that more enzymes with higher activity levels were produced than the *in vitro* cultures and the type of enzymes produced highly depended on the type of strain used and the disease resistance capacity of the host plant.

Gene expression studies revealed that Santana extract could induce the expression of lytic enzyme encoding genes in all the pathogen strains as soon as they were added. Additionally, Sokolik extract elicited reduced expression, which increased over time. The coherent observation was that the biochemical profile of host plant plays a major role in regulating the fungal gene expression.

Similarly, the biosynthesis of mycotoxins depends greatly on the metabolic profile of the host plant. In our study extracts from the resistant (Sokolik) and susceptible (Santana) pea cultivars were found to alter the toxin biosynthesis and could limit the fungal growth. The increased disease resistance by Sokolik could be related to the increased levels of secondary metabolites such as flavonoids and phenolics identified as a part of metabolite profiling. Moreover, a higher concentration of secondary metabolites present in the pea extract could inhibit the growth of the *Fusarium* species as well as limit/completely inhibit the production of mycotoxins such as fumonisin and beauvericin. The metabolites most effective in inhibiting the FB_1 production were: p-coumaric acid>chlorogenic

acid>spermidine>coumarin. In addition, all the metabolites inhibited the beauvericin synthesis by the four strains compared to the control.

Pea plant infection studies revealed that the resistant cultivar Sokolik accumulates very little/no mycotoxins, whereas the susceptible cultivar Santana accumulates more. Being the causal agent of pea wilt, *F. oxysporum* strains 34 OX and 1757 OX were found to be more pathogenic than *F. proliferatum* strains.