

BIOLOGICAL CONTROL OF SOYBEAN PATHOGENS USING *Trichoderma lignorum* AND *Pseudomonas fluorescens*

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The aim of this study is to determine the biological activity of the microfungus *Trichoderma lignorum* (syn. *T. viride*) CNMN-FD-14 and the bacterium *Pseudomonas fluorescens* AP-33 (V-3481) - producers of the biological agents Trichodermin, SC, and Rizoplan - against pathogens that cause soybean diseases.

Phytopathogens were isolated from infected soybean roots, stems, leaves, pods, and seeds using standard microbiological methods. The antagonistic activity of the biological agents against phytopathogenic fungi was evaluated on agar plates using the dual culture assay. *T. lignorum* and the phytopathogens were cultivated on malt agar, whereas *P. fluorescens* and the phytopathogens were grown on potato-sucrose agar. Phytopathogens grown alone served as the control. Antagonistic activity was assessed by determining the percentage inhibition of pathogen growth based on colony radius measurements after 10 days of co-cultivation.

A total of ten phytopathogenic species were isolated in pure culture from infected soybean tissues. The root rot complex included *Fusarium oxysporum*, *F. gibbosum*, *F. solani*, *Rhizoctonia solani*, and *Phytophthora sojae*. The pathogens isolated from stems, leaves, and seeds were *Botrytis cinerea*, *Alternaria* sp., *Colletotrichum glycines*, *Trichothecium roseum* and *Sclerotinia sclerotiorum*.

The study found that the primary mechanism of *T. lignorum*'s antagonistic interaction with soybean pathogens is territorial antagonism - the overgrowth of the pathogen colony by the fungus *Trichoderma*, which results in stunted growth of the pathogen.

Growth inhibition reached 89.1% for *F. oxysporum*, 70.4% for *F. gibbosum*, 70.6% for *F. solani*, 70.6% for *R. solani*, 71.2% for *Ph. sojae*, 80.9% for *B. cinerea*,

72.8% for *Alternaria* sp., 71.5% for *C. glycines*, 78.3% for *T. roseum* and 70.9% for *S. sclerotiorum*.

In dual cultures, *P. fluorescens* AP-33 (V-3481) exhibited a different antagonistic mechanism, namely antibiosis. This effect was characterized by reduced pathogen growth and the formation of clear inhibition zones resulting from the production of antimicrobial metabolites by the antagonist. The inhibition zones measured 24.8 mm against *F. oxysporum*, 16.5 mm against *F. gibbosum*, 22.2 mm against *F. solani*, 20.8 mm against *R. solani*, 22.5 mm against *Ph. sojae*, 28.0 mm against *B. cinerea*, 19.2 mm against *Alternaria* sp., 22.5 mm against *C. glycines*, 21.7 mm against *T. roseum* and 13.5 mm against *S. sclerotiorum*.

Conclusions. *Trichoderma lignorum* (viride) CNMN-FD-14 and *Pseudomonas fluorescens* AP-33(V-3481), producer strains of the bioproducts Trichodermin, SC and Rizoplan, exhibited strong antagonistic activity against soybean pathogens. In dual culture assays, *T. lignorum* inhibited pathogen growth through mycoparasitic overgrowth (territorial antagonism), with inhibition rates ranging from 70.4% to 89.1%, whereas *P. fluorescens* AP-33 (V-3481) suppressed pathogen development through antibiosis, producing inhibition zones ranging from 13.5 to 28.0 mm. These findings highlight the potential of both microorganisms as effective biological control agents for the management of soybean diseases.

Keywords: antagonists, phytopathogens, micromycetes, rhizobacteria, soybean.

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