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Exploring soybean cultivar susceptibility to sudden death syndrome: Insights into isoflavone responses and biocontrol potential

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ABSTRACT

Sudden Death Syndrome (SDS) caused by *Fusarium tucumaniae* is a significant threat to soybean production in Argentina. This study assessed the susceptibility of SY 3 × 7 and SPS 4 × 4 soybeans cultivars to *F. tucumaniae* and studied changes in root isoflavone levels after infection. Additionally, the biocontrol potential of plant-growth promoting rhizobacteria (PGPR) against SDS was also examined. Our results demonstrated that the SY 3 × 7 cultivar exhibited higher disease severity and total fresh weight loss than SPS 4 × 4. Both cultivars showed induction of daidzein, glycitein, and genistein in response to infection, with the partially resistant cultivar displaying significantly higher daidzein levels than the susceptible cultivar at 14 days post infection (dpi) (2.74 vs 2.17-fold), declining to a lesser extent at 23 dpi (0.94 vs 0.35-fold, respectively). However, daidzein was not able to inhibit *F. tucumaniae* growth in in vitro assays probably due to its conversion to an isoflavonoid phytoalexin which would ultimately be an effective fungal inhibitor. Furthermore, the PGPR bacterium *Bacillus amyloliquefaciens* BNM340 displayed antagonistic activity against *F. tucumaniae* and reduced SDS symptoms in infected plants. This study sheds light on the varying susceptibility of soybean cultivars to SDS, offers insights into isoflavone responses during infection, and demonstrates the potential of PGPR as a biocontrol strategy for SDS management, providing ways for disease control in soybean production.

1. Introduction

Soybean (*Glycine max*) is one of the main oleaginous crops in the world (Voora et al., 2020). Argentina is the third largest producer, after Brazil and the United States, accounting for more than 18 % of the global soybean production (Pérez-Brandán et al., 2014). As soybean production has expanded in Argentina, anthropogenic activities have impacted on agroecosystems, resulting in agrochemical contamination, biodiversity loss, deforestation, soil degradation and emergence of different diseases (Pérez-Brandán et al., 2014). Among them, sudden death syndrome (SDS) is one of the most significant soybean diseases in the main soybean-producing countries (Wrather et al., 2001). A survey of 60,000 ha in the main productive areas monitored during the 2020/21 campaign in Argentina revealed that 19 % were affected by vascular diseases, including sclerotinia stem rot (SSR) and SDS (AAPPCE,). Among the four described soil-borne species of *Fusarium* capable of inducing soybean SDS, *Fusarium tucumaniae* is the dominant SDS pathogen in Argentina (Aoki et al., 2005; Rosati et al., 2018). In contrast to other SDS pathogens, *F. tucumaniae* has a facultative sexual cycle, thus it is more likely to overcome soybean resistance mechanisms and affect

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