***Trichoderma harzianum* Thar23 induced defense mechanism against *Sclerotium rolfsii* causing stem rot of groundnut in tripartite interaction system**

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*Sclerotium rolfsii* Sacc. is one of the important soil borne pathogen causing stem rot of groundnut prevalent in all growing area worldwide. The use of multifunctional native *Trichoderma* spp. in the biological management of stem rot of groundnut could be an alternate for the use of chemicals. Keeping this in view, the research was focused on the induction of defense related enzymes and genes in groundnut during pathogen infection by quantitative real time analysis. The leaves of biocontrol agents treated groundnut plants challenged with stem rot pathogen were collected for the estimation of following defense-related enzymes phenylalanine ammonia-lyase (PAL), peroxidase (PO) and, polyphenol oxidase (PPO). The enzyme activity was observed after 30 days of sowing with respective treatments of *T. asperellum* Tasp49, *T. harzianum* Thar23, *T. longibrachiatum* Tlongi5, *T. citrinoviride* Tcitri2 and un-inoculated control. The leaf samples were collected at 0 h, 24 h, 48 h, 72 h, 96 h, and 120 h up to 7 days at 24 h interval. Among the selected isolates, *T. harzianum* Thar23 (31.36 U/ml) significantly produced higher amount of phenylalanine ammonia lyase (31.36 U/ml), peroxidase (4.1 U/ml) and polyphenol oxidase (2.76 U/ml) on day 7 after challenge inoculation with pathogen. The defense related genes namely PR2, PR3 and PAL genes were quantified using quantitative real time PCR. The treatment with *T. harzianum* Thar23 and *S. rolfsii* challenged inoculation (T3) expressed higher degree of fold increase of pathogenesis-related genes in host. PR2 gene was increased up to 15.92±1.68 fold, PR3 (22.12±1.98) and PAL (41.28±1.02) in comparison with housekeeping gene α-actin. The obtained results suggest that *T. harzianum* Thar23 enhanced the defense related enzymes and genes during pathogen infection in groundnut.

**Root exudates mediated plant defense by *Trichoderma* spp. and their rhizospheric interactions against soil borne pathogens**

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Plant diseases caused by soil-borne pathogens Pythium sp., Rhizoctonia sp., Fusarium sp, Sclerotinia sclerotiorum and Sclerotium rolfsii affecting crops have been recognized worldwide as important factor in agriculture due its productivity loss and alteration in soil health. Roo**t** exudates, the major mechanism by which plants and microbes interact, are being increasingly important in rhizosphere biology research. Plants have the remarkable ability to release low-molecular-weight compounds into the rhizosphere. The composition of the root exudates mainly includes water, ions, enzymes, sugars, phenolic compounds, amino acids and organic acids. Many strains of *Trichoderma* spp. can form establish interactions with other microorganisms in the rhizosphere and plants. The *Trichoderma* and root interactions were initiated with root surface, followed by attachment, penetration of conidia, and colonization. Plant beneficial microbe *Trichoderma* spp. are known for its antagonistic ability and growth promoting traits and can interact with other microbes in the rhizosphere and successful in eliminating the soil pathogens in almost all crops. The root exudates released during the interaction between the plant, pathogen and *Trichoderma* has significance in the enhancement of the defence molecules against soil borne pathogens and also improve the plant health.