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DISCOVERY OF NOVEL MICROORGANISMS AND ANTIMICROBIAL TRAITS IN NATURAL DISEASE SUPPRESSIVE SOILS

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Soil ecosystems represent an enormous untapped resource for discovering novel microorganisms, traits and bioactive genes. Specific soils have been identified worldwide in which beneficial microorganisms guard plants against infections by soil-borne pathogens. However, the microbiological and molecular mechanisms underlying this soil immune response are largely unknown. In the present work, the microorganisms and mechanisms involved in natural suppressiveness of soils to the fungal pathogen *Rhizoctonia solani* were investigated by culture-dependent and independent approaches. Culture-based analyses revealed quantitative and qualitative differences in bacterial populations between *Rhizoctonia* suppressive and conducive soils. Subsequent genotyping and functional analyses led to the identification of novel *Pseudomonas* species producing yet unidentified chlorinated peptide antibiotics. The cultivation-independent approaches included PhyloChip-based community analysis and activity profiling by metagenomic analysis of rhizosphere RNA. The Phylochip analysis distinguished the bacterial communities from soils with different levels of disease suppressiveness and specifically pointed to the Proteobacteria as an important rhizosphere competent phylum and dynamic group associated with disease suppression. Although the richness observed in either suppressive or conducive soils was not significantly different, the relative abundance for some groups correlated well with the different levels of soil suppressiveness. While the cultivation-dependent approach resulted mainly in isolates of the γ-Proteobacteria class, the Phylochip analysis revealed bacteria belonging to several phyla, including Proteobacteria, Firmicutes, Actinobacteria, Bacteroidetes, Acidobacteria, Planctomycetes and Chloroflexi. In conclusion, this study provides new insights into the microbial diversity and fundamental mechanisms underlying multitrophic interactions in natural disease suppressive soils.