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Growth Inhibition of Some Plant-Pathogenic Fungi by *Streptomyces vellosus* HR29

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Extended Abstract

Recently there is an increasing interest in biological control of plant-pathogenic fungi in agriculture, which can replace chemical pesticides for prevention of fungal diseases in agricultural crops. So far many studies have been performed to isolate microorganisms with antifungal activity, and numerous bacteria have been reported. However, most of them were rhizobacteria residing at plant rhizosphere, and not so many actinomycetes have been reported to show activities against plant-pathogenic fungi (Gopalakrishnan et al., 2011). Actinomycetes have been well known to produce various antimicrobial antibiotics, and the studies on actinomycetes have been mainly focused on antibiotics production until now. Although they may have some antifungal activities, most antifungal agents used in agriculture are composed of other soil bacteria. In this study actinomycetes were isolated and their antifungal activities and mechanisms were investigated. Over 300 strains of actinomycetes were isolated from various soils collected in S. Korea and their antifungal activity against several plant-pathogenic fungi was examined using a disc plate diffusion method. Among the isolates, strain HR29 showed the highest growth inhibition of fungi, and it was identified as *Streptomyces vellosus* HR29 based on 99.0% of 16S rDNA sequence homology with *Streptomyces vellosus* NRRL8037 type strain. *S. vellosus* HR29 inhibited the growth of several *Fusarium* spp. causing Fusarium wilt in different crops, such as *Fusarium oxysporum* f. sp. *raphani*, *F. oxysporum* f. sp. *niveum,* and *F. oxysporum* f. sp. *lycopersici* and *Rhizoctonia solani* (pathogen of sheath blight) by 41.4, 39.7, 34.5 and 17.2%, respectively compared to the control after 7-day incubation on potato dextrose agar plate. *S. vellosus* HR29 had several mechanisms of antifungal activity (Mohandas et al., 2013). It showed 4.65 and 21.28 μmol/min/mg of chitinase and β-1,3 glucanase activity, respectively, which can degrade fungal cell wall, and consequently inhibit fungal growth. *S. vellosus* HR29 also produced other antifungal substances such as 89 mg L^{-1} of rhamnolipid and 0.98 mM of siderophore in 2-day incubation. Siderophore is an iron-chelating agent and siderophore-producing actinomycetes can suppress fungal growth through selective iron absorption from soil. Because rhamnolipid is a kind of surfactant that can disturb membrane lipid, rhamnolipid-producing bacteria can inhibit plant-pathogenic fungi (Stanghellini and Miller, 1997). *S. vellosus* HR29 also secreted some antimicrobial peptides (AMPs), and thin layer chromatography of culture supernatant of *S. vellosus* HR29 suggested the production of antifungal lipopeptides iturin A, fengycin and surfactin as secondary metabolites. Among them, iturin-like lipopeptides significantly inhibited fungal growth in a bioassay with plant-pathogenic fungi. As such, *S. vellosus* HR29 showed multiple mechanisms of antifungal activity against several plant-pathogenic fungi, however, in a stability test it did not inhibit several microorganisms that are beneficial to most plants such as *Bacillus* spp., *Rhizobium* spp., *Saccharomyces cerevisiae*, and other microbes indicating its harmlessness as a biopesticide. In addition, *S. vellosus* HR29 secreted 53.13 μM of indole-3-acetic acid in 2-day incubation, that is one of a typical plant growth promoting hormone, auxin. These results suggest that *S. vellosus* HR29 may be utilized as an environment-friendly biocontrol agent against some important plant-pathogenic fungi with simultaneous plant-growth promoting capability.

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