EDITORIAL

Streptomyces sp. UT4A49 metabolite analysis and biological control of tomato bacterial wilt disease

David Harrison

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ABSTRACT

Streptomyces isolated from Udhagamandalam, The Nilgiris, Tamilnadu, India, was tested for biocontrol ability and metabolite profiling against the phytopathogen Ralstonia solanacearum. Streptomyces strains were tested in vitro for their ability to promote plant development and antagonistic activity against R. solanacearum. Gas Chromatography-Mass Spectroscopy (GC-MS) analysis was used to investigate the metabolite profile of strain UT4A49. In addition, an in-silico docking research was performed on the discovered lead chemical 2,4-Di-Tert-Butylphenol (2,4-DTBP) to determine its mode of action. Through pot culture studies, the Bio-organic Fertilizer (BOF) augmented potential Streptomyces strain UT4A49 was tested for biocontrol ability against *R. solanacearum* on tomato seedlings. *In vitro,* the *Streptomyces* strain UT4A49 produced Indole Acetic Acid (IAA) (76.0 2.0 g/ml), siderophore, ammonia, amylase, protease, and cellulase, as well as solubilized phosphate. In vitro, the strain UT4A49 demonstrated high antagonistic activity against R. solanacearum, with a 19.83 0.44 mm inhibitory zone. The identified main chemical, 2,4-Di-tert-butylphenol, inhibited R. solanacearum effectively. According to an in silico docking investigation, the 2,4-DTBP had a lower binding energy score with all of the targeted proteins, indicating that it had greater protein-ligand binding stability. In a pot experiment, BOF modified Streptomyces strain UT4A49 demonstrated substantial biocontrol efficiency against R. solanacearum in tomato seedlings, with a biocontrol efficacy of 78.5 percent. Based on visual and molecular characteristics, the strain UT4A49 was identified as Streptomyces sp. This is the first report on significant bioactive activities of 2,4-DTBP against R. solanacearum, according to a thorough literature review. The results of this study show that a bioorganic fertilizer containing Streptomyces sp. UT4A49 is a promising biocontrol agent for tomato bacterial disease control.

Key Words: *Streptomyces; Ralstonia solanacearum*

INTRODUCTION

Ralstonia solanacearum is a Gram-negative rod-shaped bacterium that is the world's second-largest bacterial phytopathogen. In mo-ost tropical, subtropical, and mild temperate parts of the world, R. solanacearum possesses a large genetic variety that affects over 200 plant species belonging to 54 families [1]. This bacterium's aggressive pathogenicity is due to its production of huge amounts of Exopolysaccharides (EPS) [2]. The pathogen's synthesis of EPS may aid in the obstruction and disruption of water and nutrient transport in plant xylem vessels. Furthermore, as a saprophyte, this bacterium may persist for several years in the soil or water. Due to its intricacy in biology, species complicated, and type of infection, this disease is difficult to manage and has a wide host range [3]. For the control of R. solanacearum, resistant cultivars, field sanitation, crop rotation, and chemical fertilizers are mainly suitable, but not recommended. Furthermore, the above-mentioned agricultural technology, as well as the use of chemical fertilizers, improve plant development and output. However, they are not cost-effective, pollute the environment, and are detrimental to human health, as is the case with chemical fertilizers [4]. Microorganisms in the soil are a recognized source of agro-active natural chemicals. Nowadays, agricultural researchers are concentrating their efforts on developing bio-fertilizers/bio-control agents based on beneficial microorganisms to reduce the usage of chemical-based fertilizers, pesticides, and other agrochemicals while maintaining yield. The plant rhizosphere is home to Actinobacteria, one of the biggest groups of bacteria. They can break down a wide range of biopolymers and live in hostile conditions by producing spores by secreting a high number of hydrolytic enzymes. They have received a lot of attention in agriculture because of their great antibacterial ability and their dominance in the soil environment as saprophytes [5]. Streptomyces is a well-known actinobacterial genus that generates plant growth-promoting phytohormones such as IAA, ammonia, and siderophore, as well as phosphate solubilization. However, research on actinobacteria in relation to agricultural uses is sparse.

Editorial Office, Journal of Clinical Microbiology and Infectious Disease, Windsor, United Kingdom

Correspondence: David Harrison , Editorial Office, Journal of Clinical Biology and Infectious Disease, Windsor, United Kingdom, e-mail clinicalmicro@scienceresearchpub.org

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Streptomyces strains from tomato rhizosphere soil were isolated and evaluated for in-vitro PGP and antagonistic activities against R. solanacearum in this work. In a pot culture experiment, the biocontrol effectiveness of bioorganic fertilizer augmented Streptomyces strain UT4A49 against R. solanacearum on tomato seedlings was investigated. GC-MS study found the bioactive chemical 2,4-DTBP generated by the strain UT4A49.

CONCLUSION

Streptomyces sp. UT4A49 produces strong plant growth stimulating and extracellular enzymatic characteristics, according to the findings of this study. GC-MS study revealed that the main component 2,4-Di-tert-butylphenol, generated by Streptomyces sp. UT4A49, is a potential bioactive molecule with a significant antibacterial action against *R. solanacearum*. In docking investigations, the chemical 2,4-DTBP exhibited a promising binding affinity for several proteins, and its antagonistic potential by drug-like properties was confirmed by docking analysis. Furthermore, bioorganic fertilizer's biocontrol efficacy improved Streptomyces sp. UT4A49 has been found to be effective against *R. solanacearum*, suggesting that it might be used as a biocontrol agent to prevent bacterial wilt in tomato seedlings. *Streptomyces sp.* UT4A49 appears to be a potential microorganism for the creation of a bio-organic fertilizer (BOF-UT4A49) against the bacterial phytopathogen *R. solanacearum,* based on the findings of this study.

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