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Biocontrol mechanisms of *Bacillus* sp., isolated from tomato rhizosphere, against *Fusarium oxysporum* f. sp. *lycopersici*

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Abstract: *Bacillus* sp. are well-known biocontrol agents against various fungal plant pathogens. The present work was conducted for characterization of antagonistic *Bacillus* sp., isolated from tomato rhizosphere, and its control mechanisms against *Fusarium oxysporum* f. sp. *lycopersici*. A collection of 49 *Bacillus* isolates was obtained from the rhizosphere of tomato plants from infested field. Dual culture antagonism assay was carried out to assess the potential role of the strains against the pathogen. The evaluation of the strains was done for their antifungal ability and plant growth promoting properties including β-1,3-glucanase, protease, chitinase, ammonia, siderophore, hydrogen cyanide, IAA and biofilm formation. Strain B44, identified as *Bacillus* sp. based on ribotyping (Accession no. MG779639), which exhibited maximum number of antifungal properties tested, was selected for further study. The strain was capable of producing hydrolytic enzymes such as β-1,3-glucanase (15.61 U ml^{-1} min^{-1}), protease (1608.15 U ml^{-1} min^{-1}), and chitinase (129 U ml^{-1} min^{-1}), volatiles and non-volatile metabolites. Volatiles were extracted by solid phase micro extraction (SPME) technique. The major compounds identified by GC-MS analysis were 1,2-benzenedicarboxylic acid (23.99%), 6-undecylamine (6.61%), 2-methyloctacosane (5.91%), 9-octadecenoic acid (5.13%) and 1-tetradecanamine, N,N-dimethyl (5.05%). The prominent compounds identified by UPLC-MS were tert-butyl difluorophosphine (31.45%), 5-(4,4,5,5-tetramethyl-1, 3, 2-dioxaborolan-2-yl)-3,6-dihydro-2H-pyran (14.76%), 6-bromo-4-tert-butyl-1,1-dimethyl-1,2-dihydronaphthalene (8.35%), 2-amino-N-butyl-1,8-naphthyridine-3-carboxamide (6%), N,N-diethyl-2-[(ethylamino)methyl]-3-phenyloxirane-2-sulfonamide (5.12%). The isolate showed approx. 36% reduction in disease incidence in tomato plant under green house conditions and could serve as an efficient agent for biocontrol of wilt disease in tomato.