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The Potential of Rhizospheric Bacteria for Mycotoxigenic Fungi Suppression

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Abstract : The rhizosphere soil refers to the plant roots' dynamic environment characterized by their inhabitants' high biological activity. Rhizospheric bacteria are recognized as effective biocontrol agents and considered cardinal in alternative strategies for securing ecological plant diseases management. The need to suppress fungal pathogens is an urgent task, not only because of the direct economic losses caused by infection but also due to their ability to produce mycotoxins with harmful effects on human health. Aspergillus and Fusarium species are well-known producers of toxigenic metabolites with a high capacity to colonize crops and enter the food chain. The bacteria belonging to the Bacillus genus has been conceded as a plant beneficial species in agricultural practice and identified as plant growth-promoting rhizobacteria (PGPR). Besides incontestable potential, the full commercialization of microbial biopesticides is in the preliminary phase. Thus, there is a constant need for estimating the suitability of novel strains to be used as a central point of viable bioprocess leading to market-ready product development. In the present study, 76 potential producing strains were isolated from the rhizosphere soil, sampled from different localities in the Autonomous Province of Vojvodina, Republic of Serbia. The selective isolation process of strains started by resuspending 1 g of soil samples in 9 ml of saline and incubating at 28° C for 15 minutes at 150 rpm. After homogenization, thermal treatment at 100° C for 7 minutes was performed. Dilution series (10-1-10-3) were prepared, and 500 µl of each was inoculated on nutrient agar plates and incubated at 28° C for 48 h. The pure cultures of morphologically different strains indicating belonging to the Bacillus genus were obtained by the spread-plate technique. The cultivation of the isolated strains was carried out in an Erlenmeyer flask for 96 h, at 28 °C, 170 rpm. The antagonistic activity screening included two phytopathogenic fungi as test microorganisms: Aspergillus sp. and Fusarium sp. The mycelial growth inhibition was estimated based on the antimicrobial activity testing of cultivation broth by the diffusion method. For the Aspergillus sp., the highest antifungal activity was recorded for the isolates Kro-4a and Mah-1a. In contrast, for the Fusarium sp., following 15 isolates exhibited the highest antagonistic effect Par-1, Par-2, Par-3, Par-4, Kup-4, Paš-1b, Pap-3, Kro-2, Kro-3a, Kro-3b, Kra-1a, Kra-1b, Šar-1, Šar-2b and Šar-4. One-way ANOVA was performed to determine the antagonists' effect statistical significance on inhibition zone diameter. Duncan's multiple range test was conducted to define homogenous groups of antagonists with the same level of statistical significance regarding their effect on antimicrobial activity of the tested cultivation broth against tested pathogens. The study results have pointed out the significant in vitro potential of the isolated strains to be used as biocontrol agents for the suppression of the tested mycotoxigenic fungi. Further research should include the identification and detailed characterization of the most promising isolates and mode of action of the selected strains as biocontrol agents. The following research should also involve bioprocess optimization steps to fully reach the selected strains' potential as microbial biopesticides and design cost-effective biotechnological production.

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