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Antibacterial Activity of *Penicillium fimorum* Extract Against Pathogenic Bacteria

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Structured Abstract

Background: *Penicillium* species are an important source of bioactive secondary metabolites and are widely recognized for their role in the development of antibiotics. However, the antibacterial properties of *Penicillium fimorum*, a fungus isolated from unique environments such as Arctic soil, have not been extensively studied. This study aimed to evaluate the effectiveness of *P. fimorum* crude extract against specific pathogenic bacteria and to analyze the effects of various culture media on the fungal growth, morphology and antimicrobial activity.

Methods: *P. fimorum* was subcultured on Czapek-Dox Agar (CZA) and Potato Dextrose Agar (PDA), and then fermented at 4°C in Czapek-Dox Broth (CZB) and Potato Dextrose Broth (PDB). Ethyl acetate was used for the extraction of the secondary metabolites from the fungus. The antibacterial activity was tested against *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 10145), *Salmonella enterica (ATCC 13076), Salmonella typhimurium* (ATCC 14028), *Shigella sonnei* (ATCC 25931) and *Enterococcus faecium* (ATCC 51858) using the disc diffusion method. Ciprofloxacin served as a positive control, while dimethyl sulfoxide (5%) used as a negative control. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were also determined.

Results: Microscopic and macroscopic examinations revealed that *P. fimorum* cultured on PDA exhibited faster growth, denser aerial mycelium and greater sporulation compared with cultures grown on CZA. In antibacterial assay, the extract derived from CZB showed no inhibitory activity against the tested pathogens. In contrast, PDB extract demonstrated antibacterial activity, with mean zones of inhibition (± SD) ranging from 9 ± 0.00 to 19.67 ± 0.00 mm. The minimum inhibitory concentration (MIC) values for the PDB extract ranged from 313 to 1250 µg/mL. Furthermore, MBC analysis confirmed that the PDB extract exhibited a bactericidal effect against all susceptible bacterial strains.

Conclusion: In conclusion, the findings demonstrated that the use of different culture media results in distinct morphological variations in fungal growth. Moreover, the culture medium significantly influences the antibacterial activity of *Penicillium fimorum*'s extract. These results highlight the potential of *P. fimorum* as a promising source of fungal-derived antibacterial agents and provide a foundation for further investigation into its bioactive compounds.

Keywords: *Penicillium fimorum*, antibacterial activity, Arctic fungal extract, pathogenic bacteria, culture media

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