Antagonistic Efficacy of Bacterial Endophytes Against Selected Plant Pathogens

ABSTRACT

Fungal and bacterial pathogens significantly threaten global agricultural productivity, causing substantial losses in crop yield and quality. Chemical pesticides, though effective, raise environmental and health concerns, emphasizing the need for sustainable and safer alternative products. Microorganisms residing symbiotically within plant tissues as endophytes, offer promising biocontrol potential due to their antimicrobial properties. Out of 38 bacterial endophytes that were screened for antifungal efficacy, ten strains that were superior in bioactivity were selected for this study and evaluated against fungal phytopathogens that are economically important on diverse crops. The selected bacterial endophytes, including 143-ENO4, 147-EN2B, 138-EN01, 35-EN34A, 60-EN39A, 50-EN42B, 81-EN13A, 30-EN30C, 8-30B, and 142-EN02A, were evaluated in vitro using dual-culture assays to measure their inhibitory potential against seven phytopathogens: *Phytophthora capsici*, *Botrytis cinerea*, *Alternaria alternata*, *Fusarium oxysporum*, *Rhizoctonia solani*, *Sclerotia rolfsii*, and *Macrophomina phaseolina*. The inhibitory potential of these endophytes was measured by the percentage of inhibition they caused on the pathogen growth. While all selected endophytes caused some inhibition on pathogen growth, endophyte 147-EN2B displayed the highest average inhibition of 58.84% across all seven pathogens, closely followed by 60-EN39A at 58.21%. Endophytes 50-EN42B, 35-EN34A, and 143-ENO4 exhibited moderate inhibitory effects, with IP values near 56% across all seven pathogens. While the inhibitory effects of endophyte 81-EN13A across all pathogens was moderate (56.63%), its efficacy against specific pathogens displayed the highest inhibition against *P. capsici* at 62.5% inhibition percentage and *A. alternata*, (62.79%). In addition, *P. capsici* exhibited strong susceptibility to multiple endophytes, including 143-ENO4 and 30-EN30C. These results exhibit antifungal activities from diverse endophytes against diverse fungal pathogens highlighting their potential as sustainable biological agents for fungal disease intervention. These organisms have to be tested in vivo in greenhouse and field environments to confirm their role as innovative, environmentally safe solutions for sustainable agricultural production systems.

Keywords: Endophytes, antifungal efficacy, biocontrol agents, phytopathogens, dual-culture assays, inhibition zones, sustainable agriculture, crop protection