

Controlling Olive Anthracnose with Antifungal Metabolites from *Bacillus* Species: A Biological Approach

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Abstract : Anthracnose disease in olive, caused by the fungal pathogen *Colletotrichum acutatum*, is considered one of the most critical issues in olive orchards in Pakistan. This disease poses a significant threat as it results in infections that can lead to the complete damage of olive plants, affecting leaves, stems, and fruits in the field. Controlling this disease is particularly challenging due to the absence of an effective fungicide that does not pose risks to farmer health and the environment. To address this challenge, our study aimed to evaluate the antagonistic activity of a biosurfactant produced by the *Bacillus subtilis* PE-07 strain against the anthracnose-causing agent in olive plants. This strain was selected after screening sixty rhizobacteria strains. Additionally, we assessed the heat stability, pH range, and toxicity of the biosurfactant produced by strain PE-07. Our results revealed that the biosurfactant exhibited maximum antifungal activity against *C. acutatum*. In vitro studies indicated that the biosurfactant could reduce fungal activity by inhibiting the spore germination of *C. acutatum*. Furthermore, the biosurfactant demonstrated a wide pH and temperature range, displaying antifungal activity at pH levels ranging from 5 to 10 and a temperature range from room temperature to 110°C. To evaluate the biosurfactant's safety, we conducted toxicity tests on zebra fish (*Danio rerio*). The results showed that the biosurfactant had minimal harmful effects, even at maximum concentrations. In conclusion, our study confirmed that the biosurfactant produced by *B. subtilis* exhibited high pH and heat stability with minimal harmful effects. Therefore, it presents a promising alternative to chemical pesticides for effectively controlling olive anthracnose in Pakistan.

Keywords : biological control, heat stability and PH range, toxicity, *Danio rerio*

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