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Tolerance and metabolic adaptability of *Bacillus* sp. isolated from peanut soil exposed to imazapic and S-metolachlor

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In peanut-based production systems associated with sugarcane renovation, residual herbicides may act not only as weed-control agents but also as ecological filters capable of modulating soil bacterial communities. Among the microorganisms subjected to this chemical pressure, members of the genus *Bacillus* deserve particular attention due to their physiological resilience, metabolic plasticity, and ecological relevance in soil environments. In this context, assessing the response of *Bacillus* isolates to imazapic and S-metolachlor may contribute to a better understanding of bacterial tolerance under herbicide-induced stress. This study evaluated the response in growth and enzymatic activity of a bacterial isolate identified as *Bacillus* sp. (isolate 6) when exposed to these herbicides under controlled conditions in culture medium supplemented with the compounds. Bacterial growth was monitored by optical density at 600 nm (OD600), allowing for the assessment of cellular performance under chemical stress. In addition, enzymatic assays for esterase, lipase, and manganese peroxidase were performed to investigate metabolic responses associated with herbicide exposure. The results demonstrated that *Bacillus* sp. (isolate 6) maintained active growth in the presence of both herbicides, indicating high physiological tolerance to these compounds. No degradation of the herbicides was detected under the tested conditions according to visible UV analysis. However, the isolate remained metabolically responsive under exposure, suggesting an adaptive adjustment rather than biodegradative capacity.The enzymatic profile indicates that for lipase, treatment with S-metolachlor increased activity; for esterase, both herbicides decreased activity; and for manganese peroxidase, both compounds increased activity when compared to the control (without herbicide). Taken together, these findings demonstrate that exposure to imazapic and S-metolachlor did not impose pronounced inhibitory effects on the functional viability of *Bacillus* sp. (isolate 6) in the experimental system used, reinforcing the relevance of this isolate for studies on bacterial persistence and physiological response in agricultural environments impacted by herbicides.

KEYWORDS: enzymatic activity, soil bacteria, herbicide tolerance, physiological adaptation , xenobiotic stress.

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