GLYPHOSATE TOLERANCE IS MODULATED BY LIPID SATURATION AND MEMBRANE PERMEABILITY CHANGES IN BACTERIA.

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ABSTRACT:

The cell membrane system in Gram-negative bacteria provides an efficient permeability barrier against external harmful agents, due to the biochemical activities that occur in the lipopolysaccharide components of the membrane structure. However, these interactions may be affected by toxic agents, as herbicides, increasing the permeability of the membranes. Thus, the composition of fatty acids, such as phospholipids, phosphatidylglycerols, phosphatidylethanolamines and cardiolipins, can be a bioindicator of contamination levels by agrochemicals. This work had as objective to analyze if the bacterial lipid profile could be modified in response to herbicides. The bacterial strain *Pseudomonas veronii*, isolated from water used to wash flasks of 30 trends of herbicide, was treated with glyphosate. The bacteria were grown in Tryptic Soy Broth (TSB:), with 0x, 1x, 10x, 40x and 50x field rate concentrations of glyphosate, and incubated for 20h, 30h and 40h. Lipid extraction was performed in four steps: saponification, methylation, extraction and cleaning of the samples. The identification of saturated fatty acids profile, consisting of a chain between 9 and 20 carbons, was performed by Gas Chromatography with Flame Ionization Detector (GC-FID). At 20 h in the initial log phase, lipid saturation was lower, according to dendrograms obtained from GC-FID, increasing in the phases of 30h (median log) and 40h (final log phase). The lipid saturation level also increased in the higher concentrations of glyphosate, with a probable increase of permeability for this herbicide. Comparing with our previous data obtained with *P. veronii*, the indicators of oxidative stress, hydrogen peroxide and malondealdehyde, also had their levels increased. However, stress was controlled by increasing the activity of the catalase and superoxide dismutase enzymes, but only up to the 10x herbicide concentration. From 40x on, the lipid saturation increased, as well the membrane permeability and probably the level of entry of toxic agents into the cell. The consequences were higher levels of oxidative stress and lower rates of viability and cellular growth of *P. veronii*. This strain, isolated from a stressful environment, presented a system of responses to tolerate high doses of glyphosate, by the modulation of saturated lipids profile, and further studies may be interesting for understanding *quorum sensing* and the optimization of herbicide bioremediation processes.

Key words: lipid saturation, glyphosate, bacterial membrane, *Pseudomonas*.