OPEN ACCESS

Scientific Letters

III 1H-TOXRUN
International Congress 2024
02-03 May, 2024 | Porto, Portugal

Oral Communication 16

Exposure to a glyphosate-based herbicide induces avoidance behavior and impairs coelomocyte viability in *Eisenia andrei* earthworms

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Abstract

Background: Glyphosate-based herbicides (GBH) are the most widely used agrochemicals [1]. Earthworms are key soil organisms used as bioindicators and alternative experimental models for studying the immune system [2,3]. **Objective:** We tested whether agronomic dosages of GBH induce avoidance behavior and alter the immunological profile of earthworms *Eisenia andrei*. **Methods:** Adult earthworms (0.318 ± 0.007 g) were divided into four groups and exposed for 48h: Control group (native soil), GBH1.5, GBH3, and GBH6 groups (native soil with GBH at concentrations equivalent to 1.5, 3.0, and 6.0 L/ha, respectively). Under these conditions, we applied the Avoidance Behavior Test (% of animals that escape from contaminated areas) and Acute Toxicity Test. We used glyphosate (Roundup®, Original DI, Monsanto, 44.5% w/v active ingredient) or water (control) in each experimental unit (n=6; 6 animals/experimental unit, 6 replicates each, in a box with 600g of soil, 95% of dystrophic red latosol:5% organic matter). The coelomocytes were collected by a non-invasive method [4]. **Results:** The highest concentration (GBH6) induced avoidance behavior in earthworms (% avoidance = GBH6 = 83.3±18.2, p=0.01) without modification in the immune profile. Furthermore, there was a reduction in cell viability of the coelomocytes obtained from the GBH6 (p=0.001) and also GBH3 (p=0.01) groups, when the animals had no option to avoid the contaminated area (CTRL: 75.7±18.9%; GBH1.5: 63.7±22%; GBH3: 56.7±29.6%; and GBH6: 56.0±21.4%). **Conclusion**: The presence of GBH in the soil at a typical agronomic dose (3.0 L/ha) or higher (6.0 L/ha) threatens the immune defense of earthworms and may lead to the loss of the ecological function of soil.

Keywords: glyphosate; behavior; immune cells; environmental pollution

Acknowledgments

This study was partially financed by the Coordination for the Improvement of Higher Education Personnel (CAPES) in Brazil, under grant 001, and by The Brazilian National Council for Scientific and Technological Development (CNPq) under grants 307926/2022-2 and 405546/2023-8 to TGH.

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