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Is the Widely Used Weedicide Glyphosate that Bad? Toxic Effects of Glyphosate on the Earthworm *Perionyx excavatus* (Perrier, 1872)

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Abstract

Glyphosate is a globally used weedicide in extensive weed control programmes. Although Glyphosate is highly effective against weeds, it has been reported that this weedicide brings about adverse effects on a wide variety of non-targeted soil animals including earth worms. Therefore, an investigation was carried out to assess the toxic effects of Glyphosate on *Perionyx excavatus* (Perrier, 1872), a commonly found earthworm in Sri Lanka.

In this laboratory investigation (i) the 96 hour LC50 of Glyphosate against *P. excavatus*, (ii) the survival of *P. excavatus* upon prolonged exposure (i.e. up to 8 weeks) to the recommended field dose (i.e. 7.059 g/L) of Glyphosate, and (iii) the histopathological changes of both body wall and gut wall of *P. excavatus* upon prolonged exposure (i.e. 8 weeks) to the field dose of Glyphosate, were studied separately following standard laboratory toxicity testing procedures. The results showed that the 96 hour LC50 of Glyphosate against *P. excavatus* was 32578 mg/kg of dry soil. Surprisingly, this LC50 value is 9000 times greater than the recommended field dose of Glyphosate which is calculated to be as 3.6 mg/kg of dry soil. Further, no any mortality of *P. excavatus* was observed upon prolonged exposure to the field dose of Glyphosate, perhaps the Glyphosate concentration is extremely mild to inflict any impact on the survival of these earthworms. Nevertheless comparison of the body wall at the control with those at the end of each successive week of exposure to field dose of Glyphosate showed some notable changes in their tissue structures viz ruptured cuticles of the body wall, fused epidermal cells, fused circular muscle cells, fused longitudinal muscle cells and vacuolated areas in both the circular and longitudinal muscle layers. However, all the above histopathological changes gradually disappeared starting from the 5th week, and a fully regenerated body wall was noted by the 8th week of exposure. In spite of the above changes in the body wall, histology of the gut wall revealed that the gut epithelium, circular muscle layer and longitudinal muscle layer there were not at all affected by the prolonged exposure to the field dose of Glyphosate.

In conclusion, the present study revealed that the 96 hour LC50 value of Glyphosate against *P. excavatus* is an extremely higher value than its recommended field dose, and Glyphosate caused no mortality to earthworms upon prolonged exposure to its field dose. Although Glyphosate initially caused some histopathological aberrations in the body wall, the changes were quickly healed perhaps as an adaptation to face the harmful chemicals in the weedicide formulation. It can therefore be concluded that Glyphosate is a safe weedicide for earthworms if it is correctly used following the product instructions. However, it is also noteworthy that Glyphosate is a highly controversial weedicide and is banned for sale in Sri Lanka at present, but old stocks of this product are still available in the market for illegitimate sale.

Keywords: Glyphosate, Earthworms, Toxicity, Histopathological changes, Weedicides, Field dose