International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

E-ISSN 2347-2677
P-ISSN 2394-0522
https://www.faunajournal.com
IJFBS 2024; 11(5): 60-62
Received: 10-08-2024
Accepted: 15-09-2024

M Pranitha
Assistant Professor, Department of. Zoology, Govt Degree College for Women, Hussainialam Hyderabad, Telangana, India

G Shamitha
Professor, Departmetn of Zoology, Kakatiya University, Warangal, Telangana, India

Corresponding Author:
M Pranitha
Assistant Professor, Department of. Zoology, Govt Degree College for Women, Hussainialam Hyderabad, Telangana, India

Studies on relative toxicities of two pestticides on epigeic earthworm, *Eisenia fetida* from semi-arid tropical regions of Medak district

M Pranitha and G Shamitha

DOI: https://doi.org/10.22271/23940522.2024.v11.i5a.1071

Abstract
The study aimed to assess the toxicological effects of imidacloprid and chlorpyrifos on *Eisenia fetida*. They were fed on laboratory with cow dung as culturing material and tested for toxicity. Imidacloprid was found to be the most hazardous insecticide at a 24-hour period, with an LC50 value of 5.84 mg kg−1 DW, while chlorpyrifos was the least toxic. The soil toxicity test showed that imidacloprid had the highest toxicity over a 14-day interval, with an LC50 value of 2.82 mg kg−1 DW. Chlorpyrifos showed minimal intrinsic toxicity to *Eisenia fetida*. The study concluded that imidacloprid is highly effective against target pests.

Keywords: Imidachloprid, chlorpyrifos, toxicity, *Eisenia fetida*. LC50

Introduction
Soil is the basis for survival of all the living organisms. Due to soil digging, consumption, and casting formation, earthworms are regarded as ecosystem engineers (Lavelle *et al.*, 1998) [1] and have a significant impact on soil structure (Lavelle and Spain, 2002) [2]. When used in agricultural settings, pesticides can have an impact on the Earthworms and other non-target soil species seriously harm the ecosystem (Reinecke and Reinecke 2007) [3]. There may be a chance that these pesticides will reach higher trophic levels because amphibians (Lescure 1966) 4, reptiles (Catling and Freedman 1980) [5], birds (Harlin 1977) [6], and mammals. Earthworms have been proposed by a number of studies as an ecotoxicological model for pesticide bioassay and risk assessment (Edwards and Bohlen 1992) [7].

Experiments were conducted to assess imidacloprid and chlorpyrifos on *Eisenia fetida*. This species is found throughout India and is regarded as an ecologically significant soil organism due to its ability to improve soil fertility and its potential for use in vermin compost production. According to Goulson (2013) [8], insecticides are frequently employed in agricultural production and can enter edge-of-field habitats through leaching, runoff, and spray drift. Due to their inherent toxicity and poor species selectivity, insecticides can also adversely affect sensitive non target creatures, like earthworms (Wang *et al.* 2012a) [9].

Earthworms are among the most significant soil creatures because of their vital responsibilities in enhancing soil fertility. Because of their significant ecological roles, ease of handling in the lab, and recognition as an appropriate indicator species for eco toxicological evaluation of insecticides to soil contamination, earthworms are employed as sentinel species (Rich *et al.* 2015; Rico *et al.* 2016) [10, 11].

Materials and Methods
The study was conducted in crop fields at Atmakur village, Medak district of Telangana, a state in peninsular part of southern India to know the toxicity of imidacloprid and chlorpyrifos on *Eisenia fetida*. The study site is located between 17.48 latitude and 78.31 longitudes. It is situated in the Telangana State is characterized by Rainy and winter and Summer Seasons. Adult earthworms (weighing 350-500 mg), E. fetida (Oligochaeta, Lumbricidae), with well-developed clitella were fed on laboratory with cow dung as culturing material at a temperature of 25±3 °C and randomly selected for the toxicity tests. Before testing, these worms were acclimated for 7 days under laboratory conditions in feed boxes containing

different layers of uncontaminated red soil at the bottom (Base soil), a thin layer of leaves, meshed cow dung plus soft soil in a 1:1 ratio, and a thin layer of dried grass on top (Growth medium). Wet gunny bags were placed as a cover on the feed boxes.

Imidacloprid [95.3% technical product (TC)] is a chemical, agricultural crops are frequently treated with imidacloprid, a neo nicotinoid pesticide and chlorpyrifos, which are organophosphate insecticides (Garcia *et al.* 2011; Wang *et al.* 2012a) [12, 13]. Imidacloprid's residue has been regularly found in the soil environment as a result of its widespread and frequent use, which could endanger wildlife (Goulson 2013) [14]. Chlorpyrifos is an organophosphate targets the nervous system by inhibiting acetyl choline esterase enzyme.

Insecticides of different concentrations were administered to earthworms in the filter paper contact test (OECD 1984)15 in order to determine the lethal concentration (LC).After being cleaned with tap water, the earthworms were put on a piece of Whatman filter paper in a 500 mL beaker and left in the dark for 24 hours at 25±3 °C and a relative humidity of 80-85%. A piece of Whatman filter paper (grade 1) in a 9-cm Petri dish was then filled with 2 mL of acetone containing the test material. After the solvent had evaporated, 2 mL of distilled water was added to the filter paper. Only one earthworm was put on the filter paper to prevent the negative effect of worm death in the same dish. The control substance was acetone. The earthworm mortality rate was reported following a 48-hour exposure period. An earthworm was deemed dead once its front end did not react to a light mechanical touch.

Results

The filter paper contact test findings showed that the contact toxicities of the various pesticides to E. fetida differed greatly. Imidacloprid was the most hazardous at a 24-hour period, with an LC50 value of 6.52 (3.94~29.97) mg. L−1, whereas chlorpyrifos was the least toxic, with an LC50 value of 4546 (1929~7574) mg L−1.Imidacloprid continued to exhibit the highest intrinsic toxicity to the worms over a 48-hour interval, with an LC50 value of 1.50 (1.11~2.10) mg L−1. Additionally, chlorpyrifos showed the least amount of toxicity to the worms, with an LC50 value of 974 (658.1~1124) mg L−1. The average acute toxicity to E. fetida at 48 and 24 hour intervals was comparable. Insecticide toxicity data from artificial soil tests demonstrated a definite concentration-dependent relationship, and longer exposure times resulted in higher death. The amount of toxicity of each insecticide to E. fetida varied. Imidacloprid exhibited the maximum toxicity to E. fetida over a 7 day interval, with an LC50 value of 2.14 (1.84~2.46) mg kg−1 DW. Chlorpyrifos came in second, with an LC50 value of 381.3 (297.7~421.9) mg. kg−1 DW. With an LC50 value of 2.12 (2.10~3.12) mg kg−1 DW, imidacloprid continued to exhibit the highest toxicity over a 14-day interval. Chlorpyrifos came in second with an LC50 value of 281.4 (321.5~394.1) mg kg−1 DW.

Discussion

In the soil toxicity test, imidacloprid's 14-day LC50 value to E. fetida was in line with earlier findings (Wang *et al.* 2015a) [16]. Imidacloprid was the most harmful insecticide, according to the study's findings. Compared to chlorpyrifos, imidacloprid has a detrimental effect on earthworms. In this investigation, chlorpyrifos showed minimal intrinsic toxicity to E. fetida. Because imidacloprid is extremely effective against target pests, pesticide regulators should focus more on its use in integrated pest management programs (IPM) to prevent unforeseen harm to soil ecosystems (Furlan and Kreutzweiser 2015) [17]. To assess the toxicological effects of pesticides on earthworms, numerous test methods have been devised. Only the artificial soil test and the filter paper contact test have drawn the greatest attention among these techniques; the OECD (1984) [18] accepted filter paper test. Since the pesticides are mostly absorbed by the skin, the filter paper contact test is a quicker, easier, and less expensive way to determine the relative toxicity of chemicals to earthworms. However, it does not accurately reflect the actual conditions in the soil ecosystem (Wang *et al.* 2012a) [19]. The artificial soil test, on the other hand, is a more accurate representation of the earthworms' natural habitat, and in this exposure protocol, the pesticides are primarily absorbed by the gut (Zhang *et al.* 2014) [20]. As a result, the artificial soil test is more useful for determining how hazardous pesticides are to earthworms. Remember that the amounts of pesticides we utilized in our studies were far higher than those typically seen in soil environments (EPA 1994) [21]. The study found that imidacloprid, a highly effective insecticide, has a detrimental effect on earthworms.

References

1. Lavelle P, Spain AV. Soil ecology. 2002.
2. Lavelle P, Pashanasi B, Charpentier F, Gilot C, Rossi J, Derouard L, *et al.* Influence of earthworms on soil organic matter dynamics, nutrient dynamics and microbiological ecology. In: Edwards CA, editor. Earthworm ecology. Boca Raton: Lewis Publishers; c1998. p. 103.
3. Reinecke SA, Reinecke AJ. The impact of organophosphate pesticides in orchards on earthworms in the Western Cape, South Africa. Ecotoxicol Environ Saf. 2007;66(2):244-251.
4. Lescure JL. The food of common toad Bufo bufo. Vie Milieu. 1966;15:757-764.
5. Catling PM, Freedman B. Food and feeding behavior of sympatric snakes at Amherstburg, Ontario. Can Field Nat. 1980;94:28-33.
6. Harlin J. Comparison of diets of the black bird and the starling. Zool Listy. 1977;26:45-56.
7. Edwards CA, Bohlen PJ. The effects of toxic chemicals on earthworms. Rev Environ Contam Toxicol. 1992;125:23-99.
8. Goulson D. Review: an overview of the environmental risks posed by neonicotinoid insecticides. J Appl Ecol. 2013;50(5):977-987.
9. Wang Y, Cang T, Zhao X, Yu R, Chen L, Wu C, *et al.* Comparative acute toxicity of twenty-four insecticides to earthworm, *Eisenia fetida*. Ecotoxicol Environ Saf. 2012;79:122-128.
10. Rich CD, Blaine AC, Hundal L, Higgins CP. Bioaccumulation of perfluoroalkyl acids by earthworms (*Eisenia fetida*) exposed to contaminated soils. Environ Sci Technol. 2015;49(2):881-888.
11. Rico A, Sabater C, Castillo MÁ. Lethal and sub-lethal effects of five pesticides used in rice farming on the earthworm *Eisenia fetida*. Ecotoxicol Environ Saf. 2016;127:222-229.
12. Garcia M, Scheffczyk A, Garcia T, Römbke J. The effects of the insecticide lambda-cyhalothrin on the earthworm *Eisenia fetida* under experimental conditions of tropical and temperate regions. Environ Pollut.

2011;159(2):398-400.
13. Wang Y, Cang T, Zhao X, Yu R, Chen L, Wu C, *et al*. Comparative acute toxicity of twenty-four insecticides to earthworm, *Eisenia fetida*. Ecotoxicol Environ Saf. 2012;79:122-128.
14. Goulson D. Review: An overview of the environmental risks posed by neonicotinoid insecticides. J Appl Ecol. 2013;50(5):977-987.
15. Organisation for Economic Co-operation and Development (OECD). Guideline for Testing of Chemicals No. 207: Earthworm acute toxicity. OECD; c1984.
16. Wang Y, Chen C, Qian Y, Zhao X, Wang Q. Ternary toxicological interactions of insecticides, herbicides, and a heavy metal on the earthworm, *Eisenia fetida*. J Hazard Mater. 2015;284:233-240.
17. Furlan L, Kreutzweiser D. Alternatives to neonicotinoid insecticides for pest control: case studies in agriculture and forestry. Environ Sci Pollut Res. 2015;22(2):135-147.
18. Organisation for Economic Co-operation and Development (OECD). Guideline for Testing of Chemicals No. 207: Earthworm acute toxicity. OECD; c1984.
19. Wang Y, Cang T, Zhao X, Yu R, Chen L, Wu C, Wang Q. Comparative acute toxicity of twenty-four insecticides to earthworm, *Eisenia fetida*. Ecotoxicol Environ Saf. 2012;79:122-128.
20. Zhang QM, Zhang BH, Wang CX. Ecotoxicological effects on the earthworm *Eisenia fetida* following exposure to soil contaminated with imidacloprid. Environ Sci Pollut Res. 2014;21(14):12345-12353.
21. Environmental Protection Agency (EPA), U.S. ECO update: catalogue of standard toxicity tests for ecological risk assessment. Intermittent Bull. 1994;2:1-4.