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Toxic effects of two Insecticides on Andhra Pradesh Common earth worm Lampito mauritii(Kinberg)

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ABSTRACT

The study aimed to assess the toxicological effects of imidacloprid and chlorpyrifos on Lampito mauritii(Kinberg) The lethal concentrations (LC50) were measured experimentally by exposing the earthworms (L. mauritii) in moist vermiculite . The study revealed that Imidacloprid was found to be the most hazardous insecticide at a 48-hour period,with an LC50 value of 5.84mgkg−1 DW, while chlorpyrifos was the least toxic. The soil toxicity test showed that imidacloprid had the highest toxicity than Chlorpyrifos. The study concluded that imidacloprid is highly effective against the earthworms.

Keywords: Imidachloprid, Chlorpyrifos, toxicity,LC50 ,Lampito mauritii(Kinberg)

1. INTRODUCTION

Earth worms are invertebrates belonging to the family lumbricidae and dominant in the temperate and tropical soils. They are hermaphrodites, both male and female reproductive organs are present in every single earthworm but self-fertilization does not generally occur. They represents a significant proportion of the soil biomass and hence makes an important contribution to the decomposition of organic matter, cycling of nutrients and pedogenesis (Sizmuret al.,2011). Because of their widespread distribution and importance to the soil system, earthworms are very useful organisms for evaluating contamination of the soil environment with toxic chemicals (Edwards CA,1992) . The earthworm diversity of India represent 11.1% out of total earthworm diversity in the world. There are more than 505 species and sub-species of earthworms belonging to 67 genera and 10 families (Julka, 2001; Kathireswari, 2016). Earthworms are the supreme component of soil macrofauna and are the most Experiments were conducted to assess Imidacloprid and Chlorpyrifos on Lampito mauritii(Kinberg)

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. Studies on this aspect are important because earthworms are the common prey of many terrestrial vertebrate species such as birds and small mammals, and thus they play a key role in the biomagnification process of several soil pollutants. The earthworm species Lampito mauritii(Kinberg was used as a model organism. Contact toxicity was studied by filter paper method and to observe the mortality rate of different concentrations of pesticide for 24 and 48 hrs. This work will provide information to estimate the toxic level of Imidacloprid and Chlorpyrifos against the earthworm (L. mauritii). According to Goulson (2013) , insecticides are frequently employed in agricultural crop production and can enteredge-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) .The laboratory experiment was conducted according to the OECD guidelines. The earthworms Lampito mauritii(Kinberg) were exposed to the artificial soil supplemented with different concentrations of the tested insecticides Imidacloprid and Chlorpyrifos according to the recommended agricultural doses (RAD). The mixture of pesticides was found ecologically more dangerous to Lampito mauritii(Kinberg).

The 50% lethal concentration (LC 50) values of both insecticides were higher than the highest concentration used in the experiment. The pesticides has shown toxicity after a long-time exposure, and it had an impact on the parameters of the life cycle. The results of the field experiment demonstrated that over usage of pesticides are more toxic to the soil earthworm population. This points out that the chemicals must be used with the maximum responsibility. Information about long-term effects can be important for understanding the field experiment data, which typically show a high variability and, therefore, are difficult to interpret.

2. MATERIALS AND METHODS

The study was conducted in crop fields at Joharapuram village, Kurnool district of Andhra Pradesh, is a state in peninsular part of southern India to know the toxicity of Imidacloprid and chlorpyrifos on Lampito mauritii(Kinberg). The study site is located between 15.83 latitude and 78.06 longitudes. Adult earthworms (weighing 320-500 mg), Lampito mauritii (Oligochaeta, Lumbricidae), with well-developed clitella were fed on laboratory with cow dung as culturing material at a temperature of 27±3 °C and randomly selected for the toxicity tests. Before testing, these worms were acclimated for 7 days under invitro conditions in bamboo trays. Three layers of contaminatedfree loam soil at the bottom (Base soil), a thin layer of crushed leaves, wet powder of cow dung plus soft soil in a 1:1 ratio, and a thin layer of dried grass on top (Culture medium).Wet jute clothes were placed as a cover on the bamboo boxes. Imidacloprid [96.2% technical product (TC)] is a chemical, Frequently used for agricultural crops by the local farmers, a neo nicotinoid pesticide and Chlorpyrifos, is a organophosphate insecticides (Garcia et al. 2011; Wang et al. 2012a) . Imidacloprid's residue has been widely found in the soil environment as a result of its widespread and frequent use, which could endanger to the surrounding fauna (Goulson 2013) . Chlorpyrifos is an organophosphate which significantly effects the nervous system by inhibiting acetyl cholineesterase enzyme(a neurotransmetor).

Different concentrations of Insecticides were administered to earthworms in the filter paper contact test (OECD 1984)15 to understand the lethal concentration (LC). After the application of pesticides the earthworms were cleaned with purified tap water, they were kept on a piece of Whatman filter paper in a 300 ml beaker and left in the dark for 24 hours at 27±3 °C and a relative humidity of 80-87%. A piece of Whatman filter paper (pure grade) in a Petri dish was then filled with 3 ml of acetone containing the test material. After the solvent had evaporated, 3 mL of distilled water was added to the filter paper. A Single earthworm was kept on the filter paper to avoid the negative effect of worm death in the same Petri dish. Here in this experiment the control substance was acetone. The earthworm mortality rate was reported following a 48- hour exposure period.

3. Results

The filter paper contact test observations showed that the contact toxicities of the various pesticides to Lampito mauritii(Kinberg) differed greatly. Imidacloprid was the most hazardous at a 24-hour period, with an LC50 value of 6.52 (4.03~30.17) mg. L−1, whereas chlorpyrifos was also toxic, with an LC50 value of 4.621 (1932~7570) mg L−1. Imidacloprid continued to exhibit the highest intrinsic toxicity to the worms over a 48-hourinterval, with an LC50 value of 1.50 (1.15~2.16) mg L−1. Another pesticide Chlorpyrifos showed the less amount of toxicity to the worms, with an LC50 value of 9.81 (674.1~1314) mg L−1. Insecticide toxicity data from Laboratory tests Explained a definite concentration- dependent relationship, and longer exposure periods resulted in higher death rate of the earth worms . Surviving worms also had reduced body weight, and in some cases, morphological changes.

4. Discussion

In the soil toxicity test, imidacloprid's 48Hr LC50 value to E. fetida was in coincide with earlier findings (Wang et al. 2015a) Imidacloprid was the highly Toxic and hazardous insecticide when compared to chlorpyrifos. In this pesticide comparative test Chlorpyrifos, imidacloprid has a significant effect on earthworms. In this experiment chlorpyrifos showed less intrinsic toxicity to Lampito mauritii(Kinberg)

To understand the toxicological effects of insesticides on earthworms, several test methods have been devised. Among all the artificial soil test and the filterpaper contact test have drawn the greatest attention among these techniques; the OECD (1984) 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) . 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) . 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) . The study found that Imidacloprid, a highly effective insecticide, has a detrimental effect on earthworms.

5. Conclusion

In the present study demonstrated that toxicity increased with the length of exposure to Insecticides. This suggests that the toxicity is associated with accumulation of insecticides in excess amounts and inhibition of acetylcholine , cholineesterase which proves to be injurious and lethal effect to the earthworms. Depending on the chemical category influencing the characteristics of the earthworm lifecycle, certain insecticides are more or less harmful to earthworms. Therefore farmers must be educated regarding the beneficial role of earthworms because of its importance and to reduce or minimize the use of pesticide to provide the threshold to the environment and biodiversity. In order to reduce the effect of pesticides there should be input of sufficient organic manures instead of chemical

fertilizers with minimal disturbances in soil and can be adapted for optimum activity of earthworms in the soil for healthy and fertile soil.

References

1. Edwards CA, Bohlen PJ. The effects of toxic chemicals on earthworms. Rev Environ Contam Toxicol.1992;125:23-99.
2. Goulson D. Review: an overview of the environmental risks posed by neonicotinoid insecticides. J Appl Ecol. 2013;50(5):977-987.
3. ENVIRONMENTAL PROTECTION ACT 1994 Garcia M, Scheffczyk A, Garcia T, Römbke J. Theeffects of the insecticide lambda-cyhalothrin on the earthworm Eisenia fetida under experimental conditions oftropical and temperateregions. EnvironPollution.2011;159(2):398-400.
4. Julka JM. VII National symposium on soil biology and ecology. Bangalore: Bangalore University of Agricultural Sciences; 2001. Earthworm diversity and its role in agroecosystem; pp. 13 [Google Scholar]
5. Kathireswari P. Science Communicators meet (103rd ISCA) Mysore: 2016. DNA Barcoding of Earthworms. [Google Scholar]
6. OECD (1984) Earthworm, Acute Toxicity Tests. OECD Guidelines for Testing of Chemicals, Organisation for Economic Cooperation and Development, Paris, Test No. 207.sanja.s,et al.
7. Organisation for Economic Co-operation and Development (OECD). Guideline for Testing of Chemicals No. 207: Earthworm acute toxicity. OECD; c1984.
8. LavelleP,SpainAV.Soilecology.2002. zLavelle P, Pashanasi B, Charpentier F, Gilot C, Rossi J, Derouard L, et al. Influence of earthworms on soilorganic matter dynamics, nutrient dynamics and microbiological ecology. In: Edwards CA, editor. Earthworm ecology. Boca Raton: Lewis Publishers; c1998. p. 103.
9. Reinecke SA, Reinecke AJ. The impact of organophosphate pesticides in orchards on earthwormsin the Western Cape, South Africa. Ecotoxicol Environ Saf. 2007;66(2):244-251.Lescure JL. The food of common toad Bufo bufo. Vie Milieu. 1966;15:757-764.
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. Sizmur, T., Tilston, E. L., Charnock, J., Palumbo-Roe, B.,Watts, M. J. and Hodson, M. E. (2011)Impacts of epigeic,anecic and endogeic earthworms on metal and metalloidmobility and availability.Journal of Environmental Monitoring, 13 (2):66-273.
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. 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.
15. 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.