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Studies on Morphological Effect of Some Pesticides on Fresh Water Fish, *Labeo rohita* in Sai River of Jaunpur District, Uttar Pradesh, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Pesticides are one of the potentially harmful toxic chemicals introduced into the aquatic environment. Fish serve as important bio-indicators for aquatic life. Widely used pesticides formulation two investigate possible chemical biological and toxicological effects of pesticides that may enter into our eco-system. Effects of pesticides (herbicides insecticides, rodenticides and fungicides) to loss protein content of the liver gill and intestinal tissue of the fresh water fish, Labeorohita.The Recent study is aimed two assess the toxicological impacts of treated and

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untreated effluents on aquatic fresh water fish, *Labeo rohita*. The Most common edible fish having diverse characters includes difference in morphology, food and feeding etc. Symptoms were nearly identical on various host spp (*Labeo rohita*. with respect to behaviour of the infected fish. The toxicity of pesticides to an organism is usualy expressed in terms of the LD50 (lethal dose 50 percent) and LC50 (50 percent lethal concentration) observed the behavioural studies of exposed to *Labeorohita*. Therefore, the protection and prevention of aquatic ecosystem will be possible only with the appropriate and rationalized application of pesticides.

Keywords: Aquatic; pesticides; Labeo rohita; toxicity; LC50.

1. INTRODUCTION

Pesticides are the primary achievement of green revolution. Pesticides are employed widely in agriculture process for preventing crops against pest. Pesticides have been described as one of the most significant limited factors such as growth and survival of aquatic living resources. Uses of pesticides on crop cause serious environment hazards affecting on aquatic animal (*Labeo rohita)*. Unfortunately, most of the pesticides are non-biodegradable (DDT) and tend to persist very long years together in soil and water. DDT widely used in the control insects, pest on agriculture corps and aquatic life. However use of DDT has been banned in many country because occurrence of potential adverse effects on wild, aquatic animals and humans.

In Worlds Health Organization (WHO) [1,2] permitted the use of DDT reduce the rate of death caused by Malaria. There are many reports related to toxicity of insecticides on different fish species [3,4], (Wildish, 1971). Toxicity in fish is the climax of a series events involving various chemical physical and biological processes. LC_{50} is indicator to the level of resistance of population response to metals [5] Which act on the higher mortality rates aquatic organism like fishes. It enters the aquatic life through the food chain and show the effects such as vomiting, breathing problem, abnormal reproductive development and others neural disorders (sperm mortality done in fish captured from the pollutants river Sai), causing the decline in the fish pollution of the riverine system [6,7]. The most effective sign of toxic pollution are the behavioral changes. It provides a unique linking the physiology and ecology of an organism and its environments. Consumption of oxygen is widely considered to be a critical factor for evaluating the physiological and biological response Hence oxygen consumption in fishes under stress can indicate the pesticides status of the aquatic environments [8,9]. Environmental pesticides are of particular concern, due to their potential toxic effects and ability to bioaccumulate in aquatic ecosystems and their effects on ecological equilibrium [10,11,12]. Early experiments in combating insect pests indicated that uncontrolled use of might be harmful aquatic life especially fish (*Labeo rohita*) [13,14].

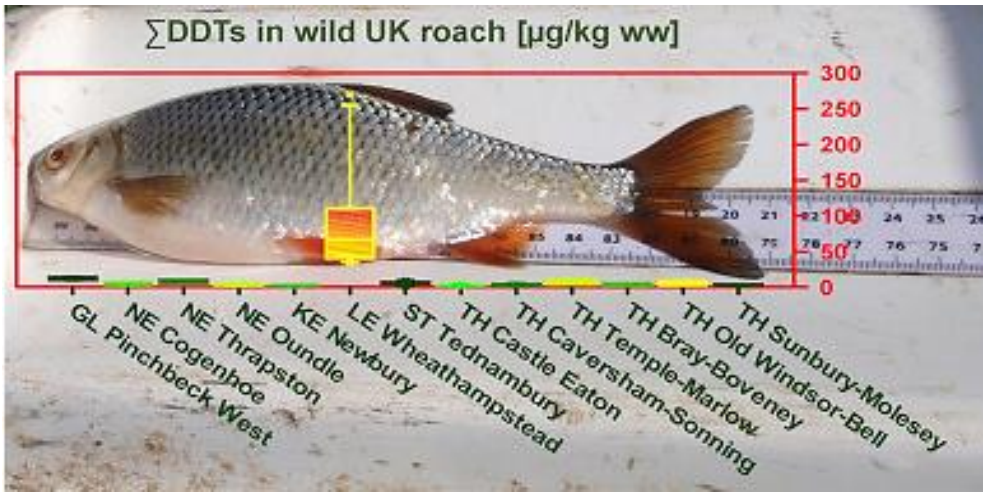


Fig. 1. Presence of DDTs in wild roach

2. MATERIALS AND METHODS

2.1 Study Area

The survey was conducted half year during March 2023 to August 2023 from River Sai at district Jaunpur especially from the city area. The aim of the study is to find out the effect of pesticides on fishes and water quality of the Sai River. The Sai River, also referred to as the Adi Ganga, is a tributary of the Gomti River in the Indian state of Uttar Pradesh. River Sai rises from a pond in village Bijgwan near Pihani in district Hardoi and travel about 600 km to form district boundary between Lucknow and Unnao. After passing through Hardoi, Raebareli and Jaunpur district where it finally joins the Gomati River at Rajepur in Jaunpur district (25°39'8.63"N 82°48'5.00"E). Therefore, the total length of River Sai from its origin point to its confluence with Gomti River at Jaunpur is approximately 750 kms which included 594 kms of polluted stretch identified under Priority-V of list of rivers for their rejuvenation and restoration. In Hardoi local call the stretch as “Jhabar” from where a river called Bhainsta take shap.

The river flows for a good 10 kms before getting it more popular name Sai. The area under study is a part of the Indo-Gangetic Plains, which lies between the latitude 27°42'22.52"N to 25°39'44.86"N and the longitude 80°8'34.27"E to 82°46'45.10"E in various districts of Uttar Pradesh. The Sai catchment is bounded in north by Ghaghara catchment while in south by Ganga catchment. Throughout its journey Sai River travel in the alluvial terrain and transports the sediment derived from Himalayan terrain. In its long journey, the river receives water from other streams also namely Bhainsta, Loni, Sakarni and Bakulahi rivers.

2.2 Experimental Organism

The experiment fish *Labeo rohita* is one of the most important edible species of freshwater fish in India. This major carp is easily found in all over part of India. It is also found in Sai and Gomati Rivers in India. *Labeo rohita* belongs to the family Cyprinidae, and commonly known as ‘rohu’. It is rich protein lipids and very suitable for human consumption. Hence this carp has a great economical and commercial value.

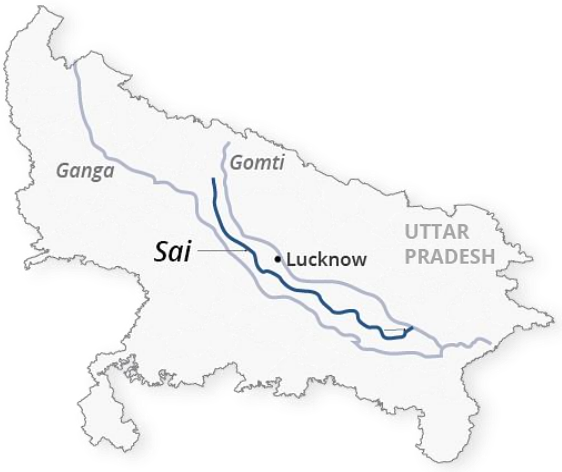


Fig. 2. Map of study area

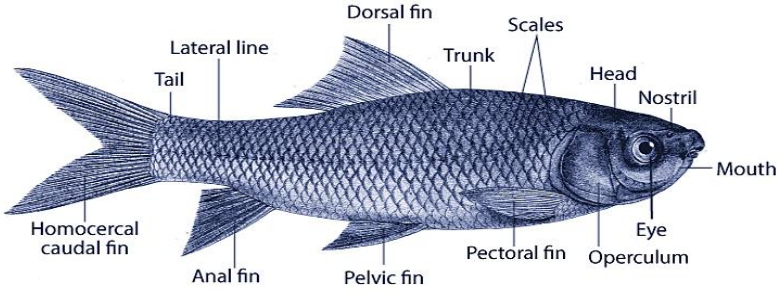


Fig. 3. *Labeo rohita*

Table 1. Toxicity level

S. N	Toxicity Category	High Toxicity	Moderate Toxicity	Low Toxicity	Very low Toxicity
1.	**Oral LD50**	Less than 50 mg/kg	50-500 mg/kg	500-5000mg/kg	Greater than 5000mg/kg
2.	**Inhalation LC50**	Less than 0.2 mg/l	0.2- 2 mg/l	2-20mg/l	Greater than 20mg/l
3.	**Dermal LD 50**	Less than 200mg/kg	200- 2000 mg/kg	2000-5000mg/kg	Greater than 5000mg/kg
4.	**Skin Effects**	Corrosive	Severe irritation at 96 hours	Moderate at 96 hours	Mild irritation at 96 hours
5.	**Eye Effects**	Corrosive	Irritation Persisting for 7 days	Irritation reversible within 7 days	No Irritation

2.3 Fish Collection and Acclimatization

Labeo rohita (2.94±0.5) was collect from the Ramdayalganj near Jaunpur district, Uttar Pradesh, India. They were acclimated to the laboratory condition for 3 weeks, during which they were feed 38% protein diet. The fish were hungry one day prior to the experiment the bioassay test.

After acclimatization, healthy fish of *Labeo rohita* were separated from the stock. The fish were acclimatized for the laboratory conditions at 30.1±2^{0}C for 10 days before exposure to pesticides to observe the mortality. The supply of oxygen (O_2) in to the water of containers was done by electrical aerators. All the precautions laid down by committee on toxicity tests to aquatic organism APHA [15] (10) were followed at the time of acclimatization.

2.4 Acute Toxicity Test

"An acute toxicity (LC_{50}) test by renewal bioassay method was conducted to determine the toxicity of DDT (Dichlorodiphenyltrichloroethane) on fresh water fish *Labeo rohita*. Toxicity experiments were performed by Singh and Agrawal. Which were exposed to 4.0 mg/l concentration of DDT for 96 hours and the pesticides was obtained from the jaunpur city. After 96 hours of the exposure the data obtained to finny' s probit analysis method [16] to determine LC_{50} value. The concentration at 50% mortality/survivability occurred in DDT treated fish was taken as the median lethal concentration (LC_{50}) for 96 hours. The toxicity reported by other studies differs from this study probably due to different species used, age, shape size of the organism, test, method and water quality can toxicity effect" [17]. of metal may vary depending upon their permeability and detoxification mechanism [18]. "The magnitude of toxic effects of pesticides also depends on length and weight, corporal surface to body weight ration and breathing rate" (Singh and Narain, 1982; Alkahem et al.,1998). Surendra KY [19]. Pesticide applications - threat to ecosystems. J. Hum. Ecol., 32(1):37-45.

3. RESULTS AND DISCUSSION

The morphological and ethological changes of *Labeo rohita* were found to be different. Pesticides causes serious morphological and physiological health status When they exposed to toxic concentration of DDT. At lethal concentration 500mg/kg is the lethal oral dose (Toxicity table). The best method is to evaluate the toxicity of the toxicants by the determination of lethal concentration (LC). It represents the amount of chemical requires for the death of 50% population among the organism. The LC_{50} values differs from the species to species for the same pesticides as well as for the different pesticides due to their mode of action on fishes. Durairaj and Selvarajan [20] estimated LC50 value.

DDT is poorly absorbed through skin, but it is easily absorbed through eating, breathing, or touching products contaminated with DDT [7]. Laboratory animals exposed to DDT develop hyperexcitability, tremors, incoordination, convulsions and chronic on toxicity category and **LD50/LD50.** DDT has very highly toxic the lethal concentration of water kills 50% of test fish within a continuous period of exposure which is usually 96hrs.

"The impurities may contribute to the toxicity of the pesticide may alter the morphological and physical properties of the products" [21].

"Pesticides have the properties of biomagnification and bioaccumulation and they will derive long lasting impacts on the human health and environment" [22].

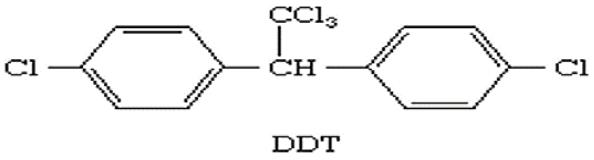
DDT (Dichlorodiphenyltrichloroethane) is an organochlorinated compound that is stable in nature. It is highly soluble in the fats of the living organism and so, it shows persistence in the food chain.

It is seen that the level of DDT increases as the food chain progresses. It means, the primary consumers will have more DDT concentration than the producers, the secondary consumers will have more than primary consumers and so on. The highest concentrations will be seen in the top carnivore. This is because the consumers at the successive trophic level consume more than the previous level to fulfil the energy requirements. Due to this, DDT keeps on accumulating in the successive trophic levels in higher concentrations. This process is called the biomagnification. 0.000003 ppm in water, 0.04 ppm in zooplankton, 0.5 ppm in small fish, 2 ppm in large fish, 25 ppm in large fishes eating bird.

"The rate of oxygen consumption of *Labeo rohita* exposed to lethal (1.2µg/l) and sub lethal; 1/10(0.121µg/l) LC and 96 hours 0f 50%. A similar decrease in oxygen uptake has been reported in *Labeo rohita"* [23]. The results of study confirm the earlier report [24] on oxygen consumption by fish in pesticides mixed water.

Dichlorodiphenyltrichloroethane

$C_{14}H_9Cl_5$



DDT

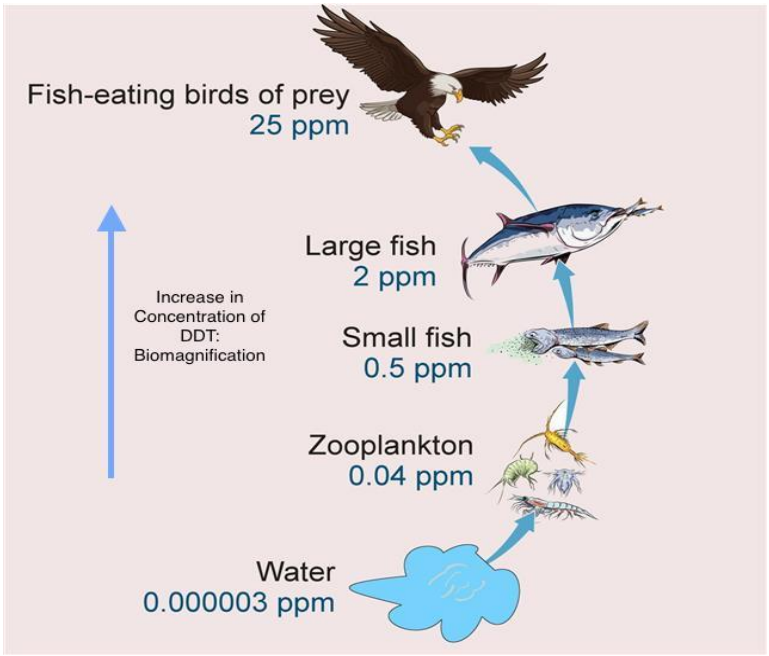


Fig. 4. Food chain

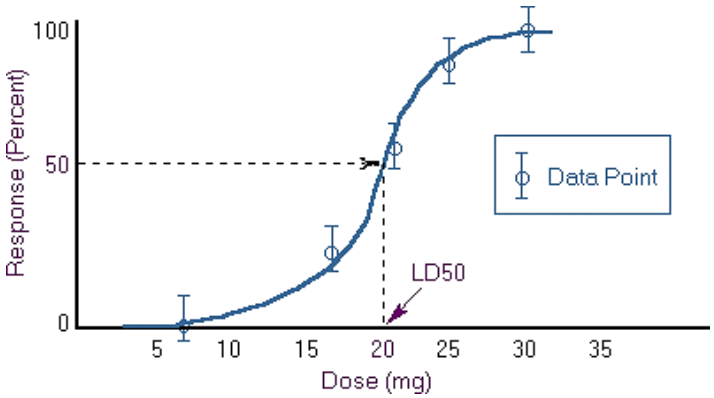


Fig. 5. LD 50

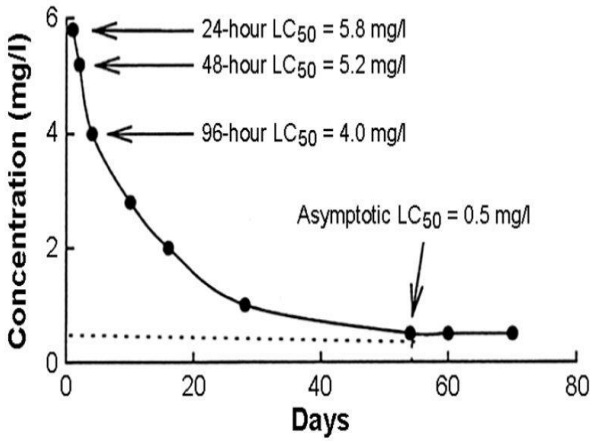


Fig. 6. LC 50

4. CONCLUSION

The present study confirms that DDT in high concentrations has effects on *Labeo rohita* fingerlings affecting growth parameter, skin, scales, gill structure, ethological and morphological changes. Which thereby could cause toxicity effects on its survivability. Toxicity evaluation LC_{50} values and behavioral change in the fish are particularly sensitive marker of pesticides toxicity. The fish's overall health is affected by the pesticides. For this reason, DDT use must be regulated contaminated runoff from agricultural fields can deteriorate fish health and significantly reduce fish and aquatic organism productivity of water bodies. Therefor it is issue of enormous healthiness consequence to habitually supervise the concentration of pesticides residues in foods materials and measure the resident's exposure to the pesticides. More experiments induce significant lethal and sub-lethal effects on the aquatic organism.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Worlds Health Organization (WHO) In, permitted the use of DDT reduce the rate of death caused by Malaria; 2006.
2. WHO. World malaria report 2008 *Global malaria program.* World health organization; 2008.

3. Sharma GD. Toxicity of BHC on the gills of *H.fossilis*. Proceedings of the 78. Session of Indian Science of Congress, Indore; 1991.
4. Shivaji Rao TS, Mangaish H. TLm values of some modern pesticides to the fresh water fish. Env. Health. 1967;9:103-105.
5. Reda F, Bakr A, Ahmad M, Kamel Sayad, Sheba A, Doaa R et all. A mathematical model for estimation the LC50 or LD50 among an in seet life cycle Egypt. Acad, J. Bio, Sci. 2010;32:75-81.
6. Adhikari S, Sarkar B, Chatterjee A, Mahapatra CT, Ayyappan S. Effects of cypermethrin and carbofuran hemato-logical parameters and prediction of their recovery in a freshwater teleost, *Labeo rohita* (Hamilton) Ecotoxicol. Environ. Saf. 2004;58:220–226.
7. DDT. Extension toxicology network (EXTOXNET); oregon state university: Cirvallis, Oregon; 1996.
8. Kaur S, Kaur A. Variability in antioxidant/detoxification enzymes of Labeo rohita exposed to an azo dye, acid black (AB). Comp Biochem Physiol C Toxicol Pharmacol. 2015, Jan;167:108-16. Doi:
9. Kumar Manoj, Singh Shailendra Kumar. Toxicity effect of pesticide on fresh water fishes. International Journal of Food and Nutritional Sciences. 2022, Dec;11(11). ISSN: 2320-7876.
10. LS Balistrieri, CA Mebane. Predicting the toxicity of metal mixtures. Sci. Total Environ 466-467. 2014;788-799.
11. Singh A. Agrawal RA. Possibility of using latex of euphorbiales for snail control. The science of tot Environ. 1988;77:231-236.
12. Ullah S, Li Z, Hasan Z, Khan SU, Fahad S. Malathion induced oxidative stress leads to histopathological and biochemical toxicity in the liver of rohu (*Labeo rohita,* Hamilton) at acute concentration. Ecotoxicol Environ Saf. 2018, Oct;161-270-280. DOI:
13. Singh NN, Das VK, Singh S. Effect of aldrin on carbohydrate protein and ionic metabolism of a freshwater cat fish *Heteropneustes fossi*. Bull. Environ. Contom. Toxicol. 1996;57(2):204-210.
14. Warner K, Fenderson OC. Effects of DDT spraying for forest insects on Maine trout streams. J. Wildl. Mgmt. 1962;26:86-93.
15. APHA. Standard Method for Examination of Water and Wastewater (19th Edition) APHA, AWWA, WPCF, Washington, D.C; 1995.
16. Finny DJ. Probit analysis, University Press Cambridge. 1971;333.
17. McCahon C, Pascoe D Use of *Gammarus pulex* L.in safety evalution tests: Culture and selection of a sensitive life stage. Ecotoxicol. Environ Saf. 1988;15(3):245-252.
18. Darmono D, Denton GRW. The pathology of cadmium and nickel toxicity in the banana shrimp *Penaeus merguiensis* De Man. Asian fish sci. 1990;3(3):287-297.
19. Surendra KY. Pesticide applications - Threat to ecosystems. J. Hum. Ecol. 2010;32(1):37-45.
20. Durairaj S, VR Selvarajan. Influence of quinophos and organophosphorus pesticides on the biochemical constituents of the tissues of *Orechomis mossambicus*. J. Env. Biol. 1992;13(3):181-185.
21. Ambrus ADJ Hamilton, HA Kuiper, KD Racke. Significance of impurities in the safety evaluation of crop production products (IUPAC) Technical Report), Pure Appl. Chem. 2003;75(7):937-973.
22. Shah BP, Devkota B. Obsolete pesticides: Their environmental and human health hazards. The Journal of Agriculture and Environment. 2009;10:60-66.
23. Sivakumar B, Kumarasamy P, Muthukumaravel K. Impact of pesticide monocrotophos on the oxygen consumption of the freshwater fish *Labeo rohita*. International Journal of Current Zoological Research. 2013;1(10):27-30.
24. Saradhamani NK, Shanthi M Manimegalal, Binu Kumari S. Efficacy of herbicide glyphosate on oxygen consumption of a freshwater fish *Catia catla*. Indian J. Environ. & Ecoplan. 2009, 21;16(1):239-243.

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