ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 6, Issue, 01, pp.4500-4501, January, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECT OF 2,4-D PESTICIDE ON FISH PHYSIOLOGY AND ITS ANTIOXIDANT STRESS

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ARTICLE INFO

Article History:
Received 29th September, 2013
Received in revised form
13th October, 2013
Accepted 08th December, 2013
Published online 26th January, 2014

Key words:

Channa striatus, 2,4-D,
Pesticides, Fishes, Toxicity.

ABSTRACT

This study was designed in such a way to assess the toxicity effect of 2,4- D (Dichlorophenoxyacetic acid) pesticide in fish physiology and its antioxidant stress. Channa striatus fish were administered with two different doses compensation of 2,4-D pesticide of 100 and 200 mg/kg. After a matter of time interval the effect of 2,4-D on fish behavior and its toxic level was determined by assessing its blood parameter and antioxidant enzyme level. Hemocyte count has considerably reduced in 2,4-D treatment and its responsive antioxidant enzyme level of Superoxide dismutase (SOD) and Catalase level was also drastically altered. The present study concludes the toxic effect of 2, 4-D usage.

INTRODUCTION

Chemical pollution in the environment by pesticides has been increasing due to their extensive usage in agriculture. Alterations in the chemical composition of natural aquatic environments can affect the freshwater fauna, particularly fish. Many of these compounds or their metabolites have shown toxic effects related to oxidative stress (Winston and Giulio, 1991) Environmental contamination by pesticides may cause physiological and behavioral changes in fish and also affect functions such as reproduction and metabolism (Oruc- and Uner, 1999; Bretaud *et al*., 2000). The 2,4-D is a widely used herbicide in Southern Brazil due to its low cost and good selectivity. This herbicide has poor biodegradability and has been frequently detected in water of courses (Chingombe *et al*., 2006). The 2,4-D can be considered as having low contamination potential for surface waters and as a transitional contaminant of subterranean waters in Southern Brazil (Primel *et al*., 2005). According to Gallagher and Di Giuli, (1991) 2,4-D showed properties similar to natural plant hormones, being used therefore as a weed killer. This herbicide is generally considered to be non-toxic for fish at low doses (Gallagher and Di Giulio, 1991). Generally, biochemical parameters are very sensitive to sub lethal concentration of many stress agents (Sancho *et al*., 1997). Organisms exhibit a characteristic response to a stressor that may be measured through a variety of enzyme activities and metabolic parameters in blood, liver, and muscle. In the present study the effect of 2,4-D stress on antioxidant enzyme status of *C. striatus* fish was evaluated.

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MATERIALS AND METHODS

Chemicals: 2,4-Dichlorophenoxyacetic acid, Enzyme assay kit (Cayman chemicals).

Experimentation: *C. striatus* fishes of 150 grams were grouped in culture tanks. Three groups of fish set up which constitutes Group I: Control, Group II: 100 mg/L 2,4-D treated fishes Group III: 200mg/L 2,4-D treated fishes.

Chemical treatments and assay: 2,4-D pesticide was applied on water in fish tanks and acclimatized for a week time. After a week period fishes were sacrificed and their muscle tissues were dissected out and freezed for antioxidant enzyme assays like Superoxide dismutase, Catalase, Glutathione peroxidase and Glutathione transferase.

Statistical analysis: All experiments were repeated three times with duplicate samples. Data were analyzed by analysis of variance using the ANOVA procedure of SAS (SAS Institute, Cary, NC) for a completely randomized design (Treatment, storage time and treatment×storage).

RESULTS

The antioxidant status of fishes treated with 2,4-D pesticide. Superoxide dismutase (SOD) was relatively altered after 2,4-D treatment and at 200 mg the level of SOD was drastically altered (Table 1). Catalase enzyme and Glutathione peroxidase enzymes are also reflected pronounced change in their level of 7.26±0.32 and 2.08±0.2 respectively which is effected in 200 mg/L of 2,4-D. Glutathione transferase also incredibly reduced after 2,4-D treatment which tends the fishes to get prone to ancillary stress.

Table 1. Antioxidant enzyme status in *C. striatus* fishes after 2,4 D treatment.

Group	Superoxide dismutase (SOD)	Catalase	Glutathione peroxidase	Glutathione transferase
Control	140.00 ± 9.85[a]	4.52 ± 0.16[a]	1.54 ± 0.05[a]	36.05 ± 5.06[a]
100 mg/L	104.37 ± 7.16[b]	6.82 ± 0.37[b]	2.06 ± 0.22[b]	25.19 ± 2.63[c]
200 mg/L	90.8 ± 7.22[c]	7.26 ± 0.32[c]	2.08 ± 0.2[c]	24.63 ± 1.75[c]

[a] Data are represented as means ± standard deviations of three measurements.
[b] Means with the same letter within a row (following the values) are not significantly different (P>0.05).
[c] Means with the same letter within a column (following the values) are not significantly different (P>0.05).

DISCUSSION

Pesticides may induce oxidative stress leading to the generation of free radicals and cause lipid peroxidation as molecular mechanisms involved in pesticide-induced toxicity (Agrawal *et al*., 1991; Khrer, 1993). Increased lipid peroxidation and oxidative stress can affect the activities of protective enzymatic antioxidants that have been shown to be sensitive indicators of increased oxidative stress. The 2,4-D functions by maintaining high levels of the plant hormone auxin, resulting in overstimulation of plant growth and death (Ateeq *et al*., 2005). It is known, that 2,4-D causes changes in the animal nervous system through complex formation with acetylcholine and inhibition of Acetylcholinesterase (AChE). (Sarikaya and Selvi, 2005; Benli *et al*., 2007). This study shows that 2, 4-D has drastic effect in lowering the antioxidant enzyme status of *C. striatus* fishes where by the fishes can prone to other diseases which tentatively cause fish mortality in aquaculture society. Hence, the usage of 2,4-D on fish aquaculture should be very curious.

Acknowledgement

The authors are very much thankful to the University Grants Commission for providing the financial support for carrying out UGC-SAP project.

REFERENCES

Agrawal, D., P. Sultana and G.S.D. Gupta, 1991. Oxidative damage and changes in the glutathione redox system in erythrocytes from rats treated with hexachlorocyclohexane. *Food and Chemical Toxicology*, 29: 459–462.

Ateeq, B., M.A. Farah and W. Ahmad, 2006. Evidence of apoptotic effects of 2,4-D and butachlor on walking catfish, *Clarias batrachus,* by transmission electron microscopy and DNA degradation studies. *Life Science*, 78: 977–986.

Benli, A.C., R. Sarikaya, A. Sepici-Dincel and M. Selvi, 2007. Investigation of acute toxicity of (2,4-dichlorophenoxy) acetic acid (2,4-D) herbicide on crayfish (*Astacus leptodactylus Esch*. 1823). *Pesticide Biochemical Physiology*, 88: 296–299.

Bretaud, S., J.P. Toutant and P. Saglio, 2000. Effects of carbofuran, diuron and nicosulfuron on acetylcholinesterase activity in goldfish (*Carassius auratus*). *Ecotoxicology and Environmental*. Safety, 47: 117–124.

Chingombe, P., B. Saha and R.J. Wakeman, 2006. Effect of surface modification of activated carbon on the sorption of 2,4-dichlorophenoxyacetic acid and benazolin from water. *Journal of Colloid Interfere Science*, 297: 434–442.

Gallagher, E. and R. Di Giuli, 1991. Effects of 2,4-D dichlophenoxyacetic acid and picloran on biotransformation, peroxisomal and serum enzyme activities in channel catfish (*Ictalurus punctatus*). *Toxicol. Letters*, 57: 65–72.

Khrer, J.P., 1993. Free radicals as mediator of tissue injury and disease. Critical Review in Toxicology, 23: 21–48.

Oruc, E.O., Y. Sevgiler and N. U¨ner, 2004. Tissue-specific oxidative stress responses in fish exposed to 2,4-D and azinphosmethyl. *Comparative Biochemistry and Physiology Part* C, 137: 43–51.

Primel, E.G., R. Zanella, M.H.S. Kurz, F.F. Gonçalves, S.L.O. Machado and E. Marchezan, 2005. Pollution of water by herbicides used in the irrigated rice cultivation in the central area of Rio Grande do Sul state, Brazil: theoretical prediction and monitoring. Química Nova, 28: 605-609.

Sancho, E., M.D. Ferrando and E. Andreu,1995. Sublethal effects of an organophosphate insecticide on the European eel, *Anguilla Anguilla*. Ecotoxicol. Environ. Safety, 36: 57–65.

Sarikaya, R. and M. Selvi, 2005. Investigation of acute toxicity of (2,4- dichlorophenoxy) acetic acid (2,4-D) herbicide on larvae and adult Nile tilapia (*Oreochromis niloticus* L.). Environ. Toxicol & Pharmaco, 20: 264–268.

Winston, G.W. and R.T. Di Giulio, 1991. Prooxidant and antioxidant mechanisms in aquatic organisms. Aquatic Toxicology, 19: 137-161.

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