International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Acute Toxicity Test of Two Pesticides Cypermethrin and Rogoron *Clariasbatrachus*

Sanjrambam Sanayaima Devi[1], W. Vidyarani Devi[2]

[1,2]Animal Physiology lab, Life Sciences Department Manipur University, Canchipur

Abstract: ***Pesticides and chemicals used in agriculture may finally inter aquatic environment and accumulate in the food chain and may cause serious ecological and health problems. The aim of the present study was to investigate acute effects of cypermethrin and rogor as dangerous agricultural chemicals and to assess and compare mortality rates of these chemicals on Clariasbatrachus in the form of LC_{50} for 96hrs.Fish were exposed to different concentrations of cypermethrin and rogor (between 0.02 - 0.1mg/l for cypermethrin and 10-18mg/g) for 96 h in 20 L glass aquaria. The 96hrs LC_{50} value obtained for cypermethrin and rogor was .032 mg/l and13.517mg/l and it indicates that cypermethrin and rogor are highly toxic toClariasbatrachus. Further studies arerecommended to investigate the effects of these harmful chemicals on fish physiology and histology and theiraccumulation in fish tissues. Although these chemicals are thought to be less toxic in field conditions due to their adsorption to sediments, these data are useful when assessing potential ecosystem risks.***

Key words: Fish,LC_{50},*Clariasbatrachus*, Toxicity, Cypermethrin, Rogor

1. Introduction

Environmental protection has attracted the attention of the wide cross-section of people all over the world which has now become a global issue amongst scientists and researchers working in this area. Unfortunately several toxic pollutants, few are even unknown or un-identified to the biota, are being regularly introduced in large quantities into the environment, especially into the aquatic environment. Pollution of water by pesticides is an important dimension of environmental degradation. The disposal of the industrial and agricultural wastes directly into the aquatic medium burdens the eco-system and stresses the need to analyze, the concentration of these substances in the medium as well as in the organisms. The pesticides are also found to be highly toxic not only to fish but also to other organisms which constitute food of the fish. Worldwide pesticide usage has increased dramatically during the past two decades, coinciding with changes in farming practices and increasingly intensive agriculture. Contamination of water by pesticides, either directly or indirectly, can lead to fish kills, reduced fish productivity or elevated concentrations of undesirable chemicals in edible fish tissue which can affect the healthof humans consuming these fish[1] Pesticides were found to adversely affect a number of biological functions, thus causing harm to the non-target organisms.

Rogor is a contact organophosphate insecticide used to kill mites and insects systemically.These compounds are one of the most preferred pesticides due to their high effectiveness and low persistence in the environment. It directly inhibits acetylcholinesterase enzyme activity in fishes and invertebrates[2,3,4].Rogoris first described as an organophosphate insecticide and introduced to the market in 1956. Rogor is moderately toxic to birds and mammals [5] (EHC, 1990). The relative less toxicity of rogor in birds and mammals is due to its rapid degradation in the liver and elimination of its metabolic products through the urinary route[6]. The insects cannot hydrolyze rogor easily, therefore, they become more susceptible to the toxin[7].

Cypermethrin is a synthetic, broad-spectrum pyrethroid-based insecticide, extensively used in households, industrial and agriculture fields[8]controlling many insect pests[9]. Cypermethrin enters into the aquatic system through agriculture run-off water and affects the non-target organisms like fishes and thus alter the metabolism[10] haematology[11] and the population of fish[12]. Pyrethroid has been proved to be extremely toxic to fish and some aquatic arthropods, for example, shrimp[13,14,15]. The less toxicity of Pyrethroids on mammals, birds and amphibians have been reviewed by Bradbury and Coats[16].

Acute toxicity of a pesticide refers to the chemical' ability to cause injury to an animal from a single exposure, generally of short duration. The acute toxicity tests of pesticides to fish has been widely used to acquire rapid estimates of the concentrations that cause direct, irreversible harm to test organisms[17]. Thus, the present study is performed to compare the acute toxicity effect of Cypermethrin and Rogor and to assess mortality effects of these chemicals to *Clariasbatrachus*.

2. Material and Methods

The selected fish species for the present study was *Clariasbatracus*. Test chambers were glass aquaria. All samples were acclimated for a week in these aquaria.Fish were fed twice daily and dead fish were immediately removed to avoid possible water quality deterioration[18].

Doses used in this test were 0.10, 0.08, 0.06, 0.04, 0.02 mg/l for Cypermethrin and 18,16,14,12 and 10 mg/l for Rogor. Groups of 10 fishes were exposed for 96hrs in glass aquaria with 20 L of the test medium. Feeding was not provided to the specimens during the assay and test media was not renewed. Mortality rates were recorded at time 0, 24, 48, 72 and 96 h. The acute toxicity tests were carried out following standard method [19].LC_{50} was attained by probit analysis[20] using SPSS 2015(version 23).

3. Results

There was no recorded mortality in fish during the acclimation period before exposure and in control group during acute toxicity tests. The mortality of *Clariasbatrachus* for cypermethrin and ragor were examined during the exposure times of 24,48,72,96 hrs. (Figure 1&2).There was no recorded mortality in fish during the acute toxicity test in the control group. For cypermethrin, there was 100% mortality at 0.10 mg/l in 96 hrs (Table 1). For rogor100% mortality was observed at18mg/l in 96hrs(Figure 2).

The 96 hrs $LC_{50}$was calculated to be 0.032mg/l for cypermethrin and13.72 mg/l for rogor,thus cypermethrin is more toxicthen rogor on fish (Table 3 & 4). Previous studies indicate the high toxicity of cypermethrin to fish species and our result are in good agreement with those reports.

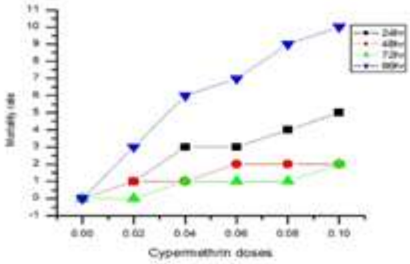

Figure 1: Cumulative mortality of Clariasbatrachus (n=10,each concentration) exposed to acute cypermethrin

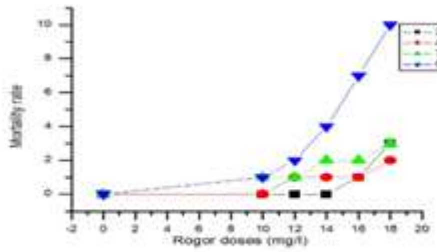

Figure 2: Cumulative mortality of Clariasbatrachus (n=10,each concentration) exposed to acute Rogor

Table 3: Lethal concentration (LC_{10-90}) of cypermethrin on 96 hrs

probability	95%confidence limit for concentration of 96 hrs		
	Estimate	Lower bound	Upper bound
LC_{10}	12.64	2.48	21.13
LC_{20}	17.42	4.98	26.48
LC_{30}	21.95	8.17	31.45
LC_{40}	26.75	12.31	36.83
LC_{50}	32.17	17.75	43.47
LC_{60}	38.70	24.79	52.96
LC_{70}	47.16	33.52	69.18
LC_{80}	59.43	44.00	102.55
LC_{90}	81.91	58.63	193.69

Table 4: Lethal concentration (LC10-90) of rogoron 96 hrs

probability	95% confidence limit for the concentration of 96 hrs		
	Estimate	Lower bound	Upper bound
LC_{10}	10.13	7.33	11.49
LC_{20}	11.19	8.84	12.39
LC_{30}	12.01	10.06	13.17
LC_{40}	12.77	11.15	13.98
LC_{50}	13.52	12.14	14.94
LC_{60}	14.31	13.04	16.19
LC_{70}	15.21	14.33	18.95
LC_{80}	16.33	14.80	18.95
LC_{90}	18.03	16.00	24.41

4. Discussion

The obtained results of the present study indicate that both chemicals cypermethrin and rogor varied in their acute toxicity to *Clariasbatrachus*. The toxicity of cypermethrin and rogor on this fish increased with increasing concentrations and exposure time. It was observed that the cypermethrin was more toxic than rogor which was consistent with the study reported [21]. It was agreed that the mortality rate was more acute in cypermethrin because of being pyrethroid as they have been potentially more toxic to the non-target organism like fishes and could affect faster at small doses than organophosphate like rogor which was consistent with the findings of[22,23].
It was also reported that rogor also affected the nerve cell of non-target organism particularly fishes that resulted in uncoordinated behaviour and a potential carcinogen[24] whereas the carcinogenicity was less in cypermethrin. The effectiveness of rogor on mortality on the selected fishes was observed at the higher dose at the treated condition. This showed that cypermethrin was more effective and toxic than rogor in this selected fishes.

5. Conclusion

From the present investigation, it was concluded that the selected pesticides affect the population size and the trophic relationship of an organism. Therefore the proper application of such common use pesticides at the appropriate dose should be encouraged by conducting mass awareness programme highlighting their pros and cons.

References

[1] O.B.Adedeji, and R.O.Okocha Overview of Pesticide Toxicity in Fish, Advances in Environmental Biology", 6(8): pp.2344-2351, 2012.
[2] Fulton, M.H. and P.B. Key: Acetylcholinesterase inhibition in estuarine fish and invertebrates as an indicator of organophosphorus insecticide exposure and effects. Environ. Toxicol. Chem., 20, 37-45 (2001).
[3] Rao, J.V., G. Begum, R. Pallela, P.K. Usman and R.N. Rao, 2005. Changes in behaviour and brain acetyl cholinesterase activity in mosquito fish Gambusiaaffinis in reference to the sub lethal exposure of chlorpyrifos. Intl. J. Environ. Res. Public 2(3-4): 478-483.
[4] Agrahari, S., K. Gopal and K.C. Pandey: Biomarkers of monocrotophos in a fresh water fish Channapunctatus (Bloch). J. Environ. Biol., 27,453-457 (2006).

[5] EHC: Environmental Health Criteria World Health Organization. International pogramme on chemical safety. pp. 1-51 (1990)
[6] Begum, G. and S. Vijayaraghavan: In vivo toxicity of dimethoate on protein and transaminases in the liver tissue of fresh water fish Clariasbatrachus (Linn.). Bull. Environ. Contam. Toxicol., 54, 370-375 (1995)
[7] Cope, W.G., R.B. Leidy and E. Hodgson: A Text Book of Modern Toxicology.John Wiley and Sons Publication, New Jersey, USA (2004)
[8] Kakko, I., T. Toimela and H. Tahti, 2003.The synaptosomal membrane bound ATPase as a target for the neurotoxic effects of pyrethroids, permethrin and cypermethrin. Chemosphere,51(6): 475-480.
[9] Yilmaz, M., A. Gul and K. Erbasli, 2004. Acute toxicity of alpha-cypermethrin to guppy (Poeciliareticulata,Pallas, 1859). Chemosphere, 56(4): 381-385
[10] Polat, H., F.U. Erkoc, R. Viran and O. Kock, 2002.Investigation of acute toxicity of beta-cypermethrin on guppies, Poeciliareticulata. Chemosphere,49: 39-44
[11] Adhikari, S., B. Sarkar, A. Chatterjee, C.T. Mahapatraand S. Ayyappan, 2004. Effects of cypermethrinandcarbofuran on certain hematological parameters andprediction of their recovery in a freshwater teleostLabeorohita (Ham.).Ecotoxicology and Environment Safety,58(2):220-226. 11. Cullen, M.C. and D.W. Connell, 1992.
[12] Bioaccumulation of chlorohydrocarbon pesticides by fish in the natural environment. Chemosphere, 25(11): 1579-1587.
[13] Viran, R., F.U Erkoc, H. Polat and O. Kocak, 2003.Investigation of acute toxicity of deltamethrinonguppies (Poeciliareticulata). Ecotoxicology andEnvironmental Safety, 55: 82-85.
[14] Bradbury, S.P. and J.R. Coats, 1989. Comparativetoxicology of the pyrethroid insecticides. Rev.Environ. Contamin. Toxicol., 108: 133-177.
[15] Srivastav, A.K., S.K. Srivastava and S.K. Srivastav,1997. Impact of deltamethrin on serum calcium andinorganic phosphate of freshwater catfish,Heteropneustesfossilis. Bull. Environ. Contam.Toxicol., 59: 841-846.
[16] Parrish, P.R., 1995. Acute toxicity tests. InFundamentals of Aquatic Toxicology: Effects,Environmental Fate and Risk Assessment, 2nd, ed.G. M. Rand, Taylor and Francis, Washington DC.,pp: 947-973.
[17] Gooley, G.J., F.M. Gavine, W. Dalton, S.S. De Silva,M. Bretherton and M. Samblebe, 2000. Feasibility of aquaculture in dairy manufacturing wastewater to enhance environmental performance and offset costs.Final Report DRDC Project No. MAF001. Marine andFreshwater Resources Institute, Snobs Creek, pp: 84
[18] Hotos, G.N. and N. Vlahos, 1998. Salinity tolerance of MugilcephalusandChelonlabrosus, Pisces:
[19] Mugilidae/fry in experimental conditions. Aquaculture, 167: 329-338.
[20] Finney, D.J., 1971. Probit Analysis. Univ. Press,Cambridge, pp: 333
[21] K. P. Srivastava, A Text Book of Applied Entomology, Kalyani Publisher, India, New Delhi, 1996.
[22] Doharty, J. D., Nishimura, K., Kurihare, N., Fujita, T.: Promotion of norepinephrine release and inhibition of calcium uptake by pyrethroids in brain synoptosomes. Pestic. Biochem. Physiol.,1987; 29: 187-196.
[23] Malla Reddy, P., Bashamohideen, M.: Fenvalarate and Cypermethrin induced changes in the haematological parameters of Cyprinuscarpio. Acta. Hydrochim. Hydrobiol., 1989; 17 (1): 101-107.