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Sublethal and Chronic Effect of Carbaryl and Malathion on *Clarius batrachus* (Linn.)

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ABSTRACT: The toxicity of carbaryl and malathion to *Clarius batrachus* was studied in a static renewal bioassay for 48 hrs and 96 hrs. Also a chronic dose of 45 days 0.05 ppm malathion and 2 ppm carbaryl was taken to study morphological, physical and behavirourl changes during exposure. The LC50 value of carbaryl for 48 hours was 13.24 ppm and 5.248 ppm respectively and for malathion 48 hours and 96 hours was 0.31 ppm and 0.25 ppm respectively. The fish shows quick response to malathion than carbaryl. The results revealed that malathion is more toxic to *Clarius batrachus* than carbaryl. @ JASEM

The aquatic ecosystem is the greater part of natural environment which is facing the threat of shrinking genetic base and biodiversity due to indiscriminate use of pesticides (Rahman et al., 2002). Pesticides as carbaryl and malathion are useful to control economically important crops (Saeed et al., 2005), but are found very much hazardous to the aquatic flora and fauna and hence ultimately to human being as they depend on aquatic foods like fishes (Mellanby, 1967). Malathion is an organophosphate pesticide widely used an alternative to carbamate pesticide, carbaryl is commonly as sevin (Svoboda et al., 2001). Both are less soluble in water and highly soluble in organic solvents. Organophosphate pesticides such as malathion has low cumulative ability and short term persistent in nature but high pesticidal action (Svoboda et al., 2001).

Increased use of these pesticides in most tropical countries has been reported to results in severe toxicities and bioaccumulation (Palmer, 1972; Parish, 1985). Therefore there is a need to investigate the toxicity of carbaryl and malathion which are oftenly used for pest management in agricultural and run off in aquatic habitat. *Clarius batrachus* (Family Claridae) is one of the commercial important fish widely used for its food value of this fish in India, Burma, and Sri Lanka. Due to the ease in transportation of this fish and accessory respiratory organs it can survive for a long time out of water. Literature review reveals that little work has been carried out on toxicity of these pesticides on fishes (Omitoyin et al., 2006). Hence there is a need to study the toxicity of malathio and carbaryl pesticides. The present investigation is an attempt to study the effect of carbaryl and malathion on *Clarius batrachus*. By determination of the LC50 (medium lethal concentration that kills 50% of test population), and to check the chronic effect of these pesticides exposure for 45 days. Also the objective is to study the physical, morphological and behavioural alteration has been recorded on *Clarius batrachus.*

MATERIALS & METHOD

Two pesticides namely carbaryl and malathion were used for present investigation. Both widely used for pest control in India. For comparative toxicity determination technical grade carbaryl of 50% W.D.P. form Awant's crop limited, India and malathion 50% EC from Krishidev India were used. A small quantity of acetone was used for stock preparation, it was reported to be non-toxic to fish (Pickering et al., 1962). However acetone controls were also maintained to nullify possible effects if any. The bioassay method adopted in the present investigation were as that of Doudoroff et al. (1951), F.A.O. (1986) and APHA (1998). Fish of uniform size (22 ± 2 cm) and weight (155 ± 5 gm) were selected for LC50 determination against carbaryl and malathion. The average mortality in each concentration was taken to determine the LC50 by graphic method, in which mortality was plotted against log concentration of pesticide (Omitoyin et al., 2006). In the present investigation some morphological observation, physical and behavioural changes in altered environment of exposure to sublethal and chronic concentration of these pesticide were studied with the criteria of Das and Konar (1974), Koudinya (1978), Joshi and Rege (1980), Gowda et al., (1981) and Narsimha and Murphy (1983).

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Table No. 1: Mortality of *Calrius batrachus* at different concentration of carbaryl and malathion for 48 hrs and 96 hrs exposure period.

	Exposure of 48 hrs Carbaryl						Exposure of 96 hrs Carbaryl				
S.N.	Conc. of Carbaryl in ppm	Log Conc.	Fish Exposed	% Kill	Fish Dead	S.N.	Conc. of Carbaryl in ppm	Log Conc.	Fish Exposed	Fish Dead	% Mortality
1	8	0.9030	10	0%	0	1	2	0.3010	10	0	0%
2	10	1	10	10%	1	2	4	0.6021	10	3	30%
3	12	1.0792	10	40%	4	3	6	0.7782	10	6	60%
4	14	1.1461	10	60%	6	4	8	0.9030	10	8	80%
5	16	1.2041	10	100%	10	5	10	1.00	10	10	100%

	Exposure of 48 hrs. Malathion						Exposure of 96 hrs. Malathion				
S.N.	Conc. of Malathion in ppm	Log Conc.	Fish Exposed	Fish Dead	% mortality	S.N.	Conc. of Malathion in ppm	Log Conc.	Fish Exposed	Fish dead	% Mortality
1	0.20	0.03010	10	0	0	1	0.15	0.01760	10	0	0%
2	0.25	0.03919	10	3	30%	2	0.20	0.03010	10	2	20%
3	0.30	0.04771	10	4	40%	3	0.25	0.03919	10	5	50%
4	0.35	0.05441	10	6	60%	4	0.30	0.04771	10	8	80%
5	0.40	0.06021	10	10	100%	5	0.35	0.05441	10	10	100%

Table No. 2: Physical, Morphological and Behavioural changes during exposure time for Carbaryl (C) and Malathion (M).

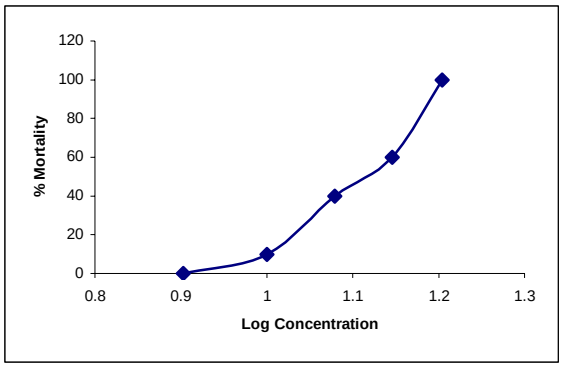
Exposure period / Control	Conc. in ppm	Colour change	Body weight decrease	Opercular activity	Bottom to surface movement	Resting at bottom	Mucus secretion	Loss of equilibrium
Control	—	=	=	=	=	=	=	=
48 hrs C	13.34	=	=	+	+	=	=	=
96 hrs C	5.24	=	=	++	+	=	=	=
45 day C	2.00	+	+	++	=	+	+	=
48 hrs M	0.31	=	=	+	++	=	=	+
96 hrs M	0.25	+	=	++	++	=	=	=
45 day M	0.05	++	++	+++	=	++	++	=

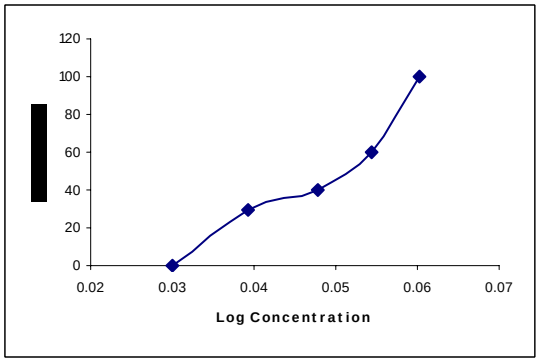
Foot note:

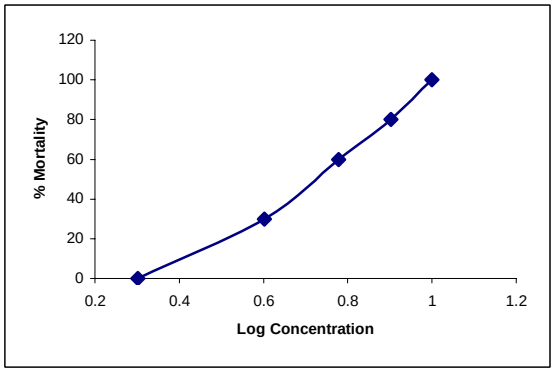
Change occur / increase shown by '+'

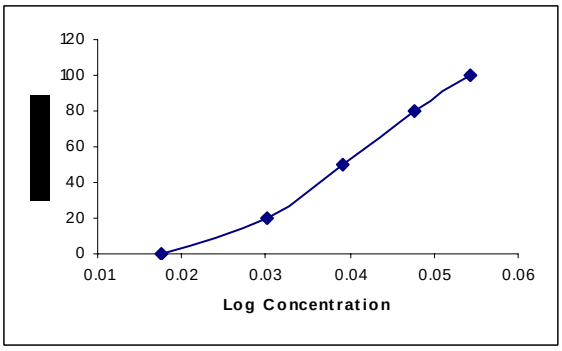
No change or no increase / decrease shown by '='

Figure 1: LC50 values for carbaryl and malathion at different time intervals on *Clarius batrachus*.









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RESULT & DISCUSSION

The LC50 values were determined using different concentrations of pesticide for 10 fishes is present mortality (table no. 1) for different time of exposure.

The 48 hrs LC50 of carbaryl to *Clarius batrachus* was 13.24 ppm (Fig. 1a) which was relatively higher than *Channa punctatus* (8.5 ppm) reported by Sambasiva Rao (1999). And for 96 hrs it was found 5.248 ppm (Fig. 1b) which is high when compared with the literature of Kartz (1961) for Coho Salmon (1.3 ppm), for brook trout (1007) and for rainbow trout (1.47). The value obtained was also higher than juveniles of *Clarius garipinius* (0.38 ppm) studied by Omitoyin et al. (2006). The LC50 of malathion for 48 hrs and 96 hrs was found 0.31 ppm and 0.25 ppm (Fig. 1c and 1d). These values were relatively low when compared with 48 hrs. Literature of Pickering et al. for Fathhead fish (25 ppm), and gold fish (0.79 ppm) and also lower than Killifish 1.8 ppm studied by Tsuda et al. (1997). Vittozi and De Angelis (1991) summarized the 96 hrs LC50 values of malathion 0.091 to 22.09 ppm for different species.

The difference in toxicity to the different species mentioned above might be due to differences in absorption pesticide, their accumulation, biotransformation and excretion. Differences in metabolic pathways among species may result in different patterns of biotransformation leading to more or less toxic metabolites (Johnson and Taledo, 1993). 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; Murthy, 1986 and Alkahem et al., 1998). The physical, morphological and behavioural changes observed for there doses of LC50 as well as for chronic dose of 45 days 0.05 ppm malathion and 2 ppm of carbaryl presented in table no. 2. It was observed that body weight decrease in chronic dose. The increase in opercular movement and bottom to upward movement to overcome on hypoxic condition was seen in the 48 hrs and 96 hrs dose. Resting at bottom, excess secretion of mucus, colour change was observed in the chronic dose of 45 days. The loss of equilibrium of fish were also seen in the 45 days dose of malathion. These findings agreed with the studies of Alkahem et al. (1998); Omitoyin et al. (1999); Fafioye (2001); Waiwood and Johnson (1974); Srivastava et al. (1979) and Sambasiva Rao (1999). The result of the present study indicates that carbaryl and malathion exerts toxic effect on fish and show quick and lethal response to these toxicants. Thus the use of carbaryl and malathion should be properly and strictly control and regulated by appropriate legislation in order to prevent its bioaccumulation in the environment, aquatic animals and ultimately to the human being.

REFERENCES

Alkahem H. F; Ahmed Z; Al-Akel A. S; Shamsi M. J. K. (1998). Toxicity Bioassay and changes in haematological parameter of *Oriochromis niloticus* induced by trichloroform. Arab Gulf J. Scient. Res. 16: 581-593.

APHA / AWWA / WEF (1998). Standard methods for the examination of water and waste water, 20th edition, American Public Health Association, New York, USA, 1976.

Das M. K; Konar S. K. (1974). Effect of sublethal level of pesticides on the feeding behaviour, survival and growth of fish. Proc. Nat. Sci. Acad., India, 44(B): 235-240.

Doudoroff P; Anderson B. O; Burdick G. E; Galtsoff P. S; Hart W. B; Parick R; Strong E. R; Surber E. W; Vanhorn W. M. (1951). Bioassay methods for the evaluation of acute toxicity of industrial wastes to fish, Sewage Industry Wastes, 23: 1380-97.

Fafioye O. O. (2001). Lethal and sublethal effects of extract of *Parkira biglobosa* and *Raphia vinifera* on some freshwater fauna. Ph.D. Thesis, University of Ibadan, Ibadan, Nigeria. 216.

FAO (1986). Manual of Methods in Aquatic Environment Research. Part 10. Short term static Bioassays. FAO Fisheries Technical Report Paper; 247-264.

Finney D. J. (1971). Probit Analysis, 3rd edn. Cambridge University Press, Cambridge, 20.

Gowda R. K; Tripathy N. K; Dass C. C. (1981). Toxicity of demecron, sevin and lindane to *Anabas scandens* and *Heteropneustis fossilis*. Comp. Physiol. Eco; 6(3): 170-172.

Johnson C. M; Toledo M. C. F. (1993). Acute toxicity of endosulphan to the fish *Hypesbrycon bifasciatus* and *Branchydanion rerio*. Archiv. Environ. Contam. Toxicol. 24 : 151-155.

Joshi A. G; Rege M. S. (1980). Acute toxicity of some pesticides and a few inorganic salts to the mosquito fish, *Gambusia affinis*. Ind. J. Exp. Biol: 18(4): 435-437.

Kartz M. (1961). Acute toxicity of some organic insecticides to three species of Salmonoids and to three spine stickle back. Trans. Amer. Fish Soc., 90: 264-268.

* Corresponding author: [1]Yogesh, H. Wasu.

Mellanby K. (1967). "Pesticide and Pollution". The Fontana New Naturalist. Collins Clear-type Press, London and Glasgow, 132-134.

Murthy A. S. (1986). Toxicity of pesticide to fish. CRC Press Inc. Boca Raton, F. L. USA, 143.

Narasimha Murthy B. (1983). Studies on the toxic potentiality of lindane on the fresh water teleost, *T. mossambica* with special emphasis on nitrogen metabolism. Ph.D. Thesis, S. V. University, Tirupati, India.

Omitoyin B. O; Ajani E. K; Adesina B. T; Okuagu C. N. F. (2006). Toxicity of lindane (Gamman Hexachloro-Cyclohexane) to *Clarius garippinus*. International Digital Organization for Scientific Information, 1(1), 57-63.

Omitoyin B. O; Ogunsanmi A. O; Adesina B. Y. (1999). Studies on acute toxicity of pesticidal plant extracts (*Tetrapleura tetraptera*) on Tilapia (*Sarotherodon galilaeus*) fingerlings. Trop. J. Anim. Sci. 2 : 191-197.

Palmer I. (1972). Science and agriculture production CIWRUD, Geneva.

Parish P. R. (1985). Acute toxicity test, In Fundamental of aquatic toxicology; Rand, S. M. and S. R. Petrocelli (Eds.) Hemisphere Publishing Corporation, Washington; 666.

Pickering O. H; Henderson C. (1966). The acute toxicity of some pesticide to fish, Ohio J. Sci., 66: 508-513.

Rahman M. Z; Hossain Z; Mollah M. F. A; Ahmad G. U. (2002). Effect of diazinum 60EC on *Anabas testudineus*, *Channa punctatus* and *Barbodes gonionotus* 'Naga'. The ICLARM Quarterly, 25: 8-12.

Saeed T; Sawaya W. N; Ahmad N; Rajgopal S; Al-Omair A. (2005). Organophosphorus pesticide residue in the total diet of Kuwait. The Arab. J. Sci. Engr; 30: 17-27.

Sambasiva Rao K. R. S. (1999). Pesticide impact on fish metabolism, Discovery publishing house, New Delhi, 232.

Singh B. B; Narain A. S. (1982). Acute toxicity of Thiodon to Catfish *Heteropneusies fossilis*. Bull. Environ. Conta. Toxicol. 28 : 122-127.

Svoboda M; Luskova V; Drastichova J; Zlabek V. (2001). The effect of Diazinon on hematological indices of common carp (*Cyprinus carpio* L.). Acta. Vet. Brno, 70: 457-465.

Vittozi O. L; De-Angelis G. (1991). A critic review of comparative acute toxicity of data on fresh water fish. Aqua. Toxicol. 19: 167-204.

Waiwood K. G; Johnson P. H. (1974). Oxygen consumption and activity of white sucker (*Catastomus conmerson*) in lethal and nonlethal levels of organchlorine insecticide methoxychlor. Wat. Res; 8: 401-406.

Welsh J. H. and Smith R. K. (1961). Laboratory exercises in Invertebrate Physiology, Burgess Publishing Co; Minneapolis.

* Corresponding author: [1]Yogesh, H. Wasu.