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Effect of Pretilachlor on the Mortality of Fish Gambusia

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Abstract: There is a growing concern over aquatic pollution because of its detrimental effects on biological life including human beings. The goal of the present study was to determine the acute toxicity of pretilachlor as potential dangerous organic pesticides to assess mortality effects of these chemicals to the gambusia in the form of LC_{50}. Fish samples (21 fish in each test group) were exposed to different concentrations of pretilachlor (between 0-25ppm for pretilachlor) for 96 h. LC_{50} was determined with probite analysis. The 96h toxicity tests showed 100% mortality in 25 ppm and no mortality in 5 ppm. Further researches are recommended to study the processes by which these chemicals affect physiology and histology of fish and their accumulation in fish tissues.

Key words: LC_{50} · Gambusia · Pretilachlor · Toxicity

INTRODUCTION

Many documents have been proved the toxic effect of pesticides which pollutants to aquatic environment and their presence in surface waters was reported in Europe and North America since 50 years ago [1]. There is a growing concern over aquatic pollution because of its detrimental effects on biological life including human beings [2]. Increased use of pesticides results in contamination of natural ecosystems especially the aquatic ecosystem [3]. These toxic substances may accumulate in the food chain and cause serious ecological and health problems. Chemical pesticides with persistent molecules (long half-life periods) pose a threat to fish and also to the human population consuming the affected fish. Acute toxicity data can help identify the mode of toxic action of a substance and may provide information on doses associated with target-organ toxicity and lethality that can be used in setting dose levels for repeated-dose studies. This information may also be extrapolated for use in the diagnosis and treatment of toxic reactions in humans.

The results from acute toxicity tests can provide information for comparison of toxicity and dose-response among members of chemical classes and help in the selection of candidate materials for further work [4]. Acute toxicity of a pesticide refers to the chemical's ability to cause damage to an animal from a single exposure, generally of short duration. Many workers have been used the acute toxicity tests of pesticides on fish to acquire rapid estimates of the concentrations that cause direct, irreversible harm to test organisms [5, 6]. The acute toxicity data provide useful information to identify the mode of action of a substance and also help to comparison of dose response among different chemicals. The 96-h LC_{50} tests are conducted to assess the vulnerability and survival potential of organisms to particular toxic chemicals. Chemicals with lower LC_{50} values are more toxic because lower concentrations results 50% of mortality in organisms. The present study was performed to determine the acute toxicity of pretila chlor as potential dangerous organic pesticides to assess mortality effects of these chemicals to the fish gambusia.

MATERIALS AND METHODS

The selected fish species for present study was gambusia. Lethal experiments were conducted using 126 young gambusia. Test chambers were glass aquaria of 100 L. All fish were acclimated for a week in these aquaria before assays with continuous aeration. Water temperature was regulated at 27°C by using aquarium

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heater. Fish were feed twice per diem with formulated feed and dead fish were immediately removed to avoid possible water deterioration [7].

Nominal concentrations of active ingredient tested were 0, 5, 10, 15, 20 and 25 ppm of commercial dose (50%) for pretilachlor was used. During acute toxicity experiment, the water in each aquarium was aerated. No food was 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.

Acute toxicity tests carried out according to Hotos and Vlahos [8]. The nominal concentration of butachlor estimated to result in 50% mortality of gambusia within 24 h (24-h LC_{50}), 48 h, 72 h and 96 h was attained by probit analysis by Finney's method [9] and using the maximum-likelihood procedure (SPSS 2002, SPSS Inc., Chicago, Illinois, USA). The LC_{50} value is obtained by fitting a regression equation arithmically and also by graphical interpolation by taking logarithms of the pretila chlor concentrations versus probit value of percentage mortality. The 95% confidence limits for LC_{50} are estimated by using the formula: LC_{50} (95% CL) = $LC_{50} \pm 1.96$ [SE (LC_{50})]

The SE of LC_{50} is calculated from the formula: $SE(LC50) = 1/b\sqrt{pnw}$

Where: b=the slope of the chemical/probit response (regression) line; p=the number of chemical used, n = the number of animals in each group, w = the average weight of the observations [8]. After the acute toxicity test, the LOEC (Lowest Observed Effect Concentration) and NOEC (No Observed Effect Concentration) were determined for each measured endpoint.

RESULTS

No fish died during the acclimation period before exposure and no control fish died during acute toxicity tests. The mortality of gambusia for pretilachlor doses 0, 5, 10, 15, 20 and 25 ppm were examined during the exposure times at 24, 48, 72 and 96 h (Table 1). The mortality of gambusia was increased significantly with increasing concentrations from 10 ppm to higher concentrations for pretilachlor.

Table 1: Cumulative mortality of gambusia Fish (n=21 each concentration) exposed to acute pretilachlor

	No. of mortality			
Concentration (ppm)	24h	48h	72h	96h
Control	0	0	0	0
5	0	0	0	0
10	0	4	7	11
15	12	15	17	19
20	17	18	20	20
25	21	21	21	21

Table 2: Lethal Concentrations (LC_{1-99}) of pretilachlor depending on time (24-96h) for gambusia

	Concentration (ppm) (95 % of confidence limits)			
Point	24h	48h	72h	96h
LC_1	7.529	3.751	3.316	1.982
LC_{10}	11.219	8.271	7.283	5.949
LC_{20}	12.773	10.175	8.954	7.619
LC_{30}	13.893	11.547	10.158	8.823
LC_{40}	14.850	12.720	11.187	9.852
LC_{50}	15.745	13.816	12.149	10.814
LC_{60}	16.640	14.912	13.111	11.776
LC_{70}	17.597	16.085	14.141	12.805
LC_{80}	18.717	17.457	15.345	14.010
LC_{90}	20.271	19.361	17.016	15.680
LC_{99}	23.961	23.881	20.983	19.646

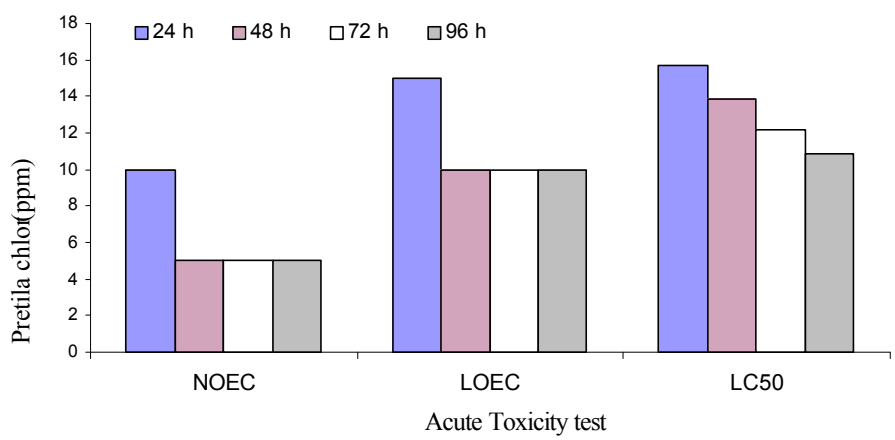

Fig. 1: Acute toxicity testing statistical endpoints in gambusia Fish exposed to crude pretilachlor in different times (24h, 48h, 72 h and 96 h respectively)

There was 100% mortality at 25 ppm concentration within the 96 h dosing for all fishes. Median lethal concentrations of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% and 90% test are presented in Table 2. Because mortality (or survival) data are collected for each exposure concentration in a toxicity test at various exposure durations (24, 48, 72, or 96 hours), data can be plotted in other ways; the straight line of best fit is then drawn through the points. These are time–mortality lines. The LT_{50} (median lethal survival time) can be estimated for each concentration.

Toxicity Testing Statistical Endpoints are in Fig 1. LOEC (Lowest Observed Effect Concentration) and NOEC (No Observed Effect Concentration) were same for all studied fishes, however LC_{50} (the median Lethal Concentration).

DISCUSSION

The results of the present study indicate that chemical pretilachlor varied in their acute toxicity to gambusia.

Pretilachlor systemic herbicide, clorstamyd group has selected a property which is inhibiting the synthesis of long-chain fatty acids and a range of slim and broad-leaved weeds in rice fields destroys the transplant.

Occurrence of pesticides in high concentrations in agricultural wastewaters and their toxicity to aquatic organisms especially fish species have been reported by many researchers [10-12]. Contamination of aquatic environment with pesticides via rainfall runoff is very possible [13]. Fishes are sensitive to aquatic contamination and serious concerns remains due to their potential to cause adverse effects on human and wildlife populations. In addition we found that pretilachlor is lethal substrates to gambusia. The 96h LC_{50} was calculated to be 10.814 ppm for pretilachlor. The results of the present study indicate that both chemicals pretilachlor varied in their acute toxicity to gambusia. The toxicity of pretilachlor on gambusia increased with increasing concentration and exposure time. Used a variety of methods to detect the acute and chronic toxicity of pretilachlor by preparing various water. This makes comparisons between fish species difficult. For example, it was reported 96 h LC_{50} values for the *Misgurnus anguillicaudatus* 14.57 ppm [14] and for *Lutjanus argentimaculatus* 11.86 ppm [15].

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