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Acute toxicity of Abamectin to fishes, *Cyprinus carpio* Linnaeus and *Tilapia mosambica* (Peters)

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Laboratory studies conducted to determine the acute toxicity of abamectin, a broad spectrum pesticide to fresh water common carp, *Cyprinus carpio* (Linnaeus) and *Tilapia mosambica* (Peters) revealed that the fish are highly susceptible to abamectin. The median lethal concentration (LC_{50}) of abamectin for *C. carpio* and *T. mosambica* were 0.475 and 6.928 ppb, respectively. Likewise, the median lethal time (LT_{50}) were 3.119 and 1.804 h for abamectin at 0.50 and 0.55 ppb concentration to *C. carpio* and 19.039, 13.933 h for abamectin at 8.0 and 9.0 ppb concentration to *T. mosambica*, respectively.

Key words: Abamectin, *Cyprinus carpio*, *Tilapia mosambica*, $LC_{50,}$ LT_{50}

INTRODUCTION

Extensive use of broad spectrum synthetic chemicals results in the destruction of non target organisms where they are transported. These synthetic insecticides have a long life period, which has resulted in the process of bioaccumulation and biomagnification in the environment and in the living organisms (Sahai, 1992). The toxicity of the insecticides has a greater impact on the aquatic environment as these insecticides enter into the hydrosphere via many pathways like, direct application for pest and disease vectors, surface runoff from non-point sources including agricultural soil, aerosol and particulate deposition, rainfall and absorption from the vapour phase at the air-water inter phase etc. The wide spread usage of synthetic insecticides ultimately pollute the aquatic environment there by affecting the aquatic fauna mainly fishes which constitute the major economy of the country and a valuable source of protein. Moreover, fish is one of the components of integrated farming in certain parts of the country. It is observed that the structure and stability of natural fish populations would be adversely affected if the water where their development takes place is contaminated even at sublethal concentrations.

MATERIALS AND METHODS

The acute toxicity of abamectin to common carp was assessed as per Sprague (1969 and 1970). The aquarium tanks of dimensions 15 cm x 30 cm x 45 cm with 80 l capacity were provided with artificial aeration facilities. Abamectin 1.9 EC at different concentrations *viz*., 7, 9, 10, 11 and 12 µl 20 l^{-1} of water were taken as different treatments after range finding test and control tanks were maintained without abamectin. Each experiment was replicated four times. In each tank, a school of twenty fish of same size was released. Observations on mortality were made on 3, 6, 12, and 24 h and per cent mortality was worked out for each concentration and sufficient replicates were used to construct a reliable regression line known as log concentration probit mortality (lcpm) line/ curve. The mortality data obtained were corrected for the mortality in control by Abbott's formula (Abbott, 1925) and the data were subjected to probit analysis (Finney, 1971) and confirmed by EPA probit analysis program used for calculating LC/ EC values Version 1.5. Another experiment to asses the acute toxicity of abamectin to *T. mosambica* was conducted in the same method. The fishes were exposed to slightly higher concentrations of 100, 120, 140,160 and 180 µl of abamectin in 20 l^{-1} of water after range finding test and the mortality observed and statistically analysed.

RESULTS AND DISCUSSION

The LC50 values of abamectin to fresh water common carp C. carpio and a common fish, T. mosambica were 0.475 and 6.928 ppb, respectively (Table 1) (Fig.1 & 2). The median lethal time (LT50) were 3.119 and 1.804 h for abamectin at 0.50 and 0.55 ppb concentration to C. carpio and 19.039 and 13.933 h for abamectin at 8.0 and 9.0 ppm concentration to T. mosambica, respectively (Table 2). Toxicity of abamectin for the two fish tested

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Table 1. Concentration – mortality response of fishes to abamectin 1.9 EC

Organisms	LC_{50} (ppb)	95 per cent fiducial limit		Regression equation	χ^2 at P = 0.05
		LL	UL		
C. carpio	0.475	0.439	0.507	Y = 8.125 + 9.652 ±1.955X	2.077 ^{NS}
T. mosambica	6.928	6.306	7.617	Y = -1.017 + 7.158 ±1.590X	1.143 ^{NS}

Number of fish used (20) NS = Not significant

was higher which is proved from the low LC_{50} values in the ppb. These findings corroborate that of Halley et al. (1993) who reported that LC_{50} values of abamectin and ivermectin to fish (rainbow trout) were 3.2 ppb and 3.0 ppb, respectively and it was 0.34 ppb and 0.025 ppb for Daphnia magna Straus, a freshwater crustacean. Various symptoms of poisoning can be observed during the study. i.e. they become irritable and hyperexcited. Jumping movements as well as restlessness were observed and finally the fish turned up side down. Mucus secretion and loss of equilibrium were also observed. They slowly became sluggish with short jerky movement, surfacing, and gulping of air and erratic circular movements. Finally, they settled down at the bottom with loss of equilibrium and died. But in the control tank, they were very active with their well co-ordinated movements and alert at the slightest disturbance. The behavioural difference might be due to potency of pesticide in the test conditions. The unusual behaviour of fish, in stress condition may be due to obstructed functions of neurotransmitters.

Toxicants from the environment mainly enter fish by means of their respiratory systems (Tovell *et al.*, 1975). A mechanism of toxicant uptake through gills probably occurs through pores by simple diffusion and is then absorbed through cell membranes (Opporhuizen *et al.*, 1985). The observed decrease in oxygen consumption by the whole animal may due to the respiratory distress as a consequence of the impairment of oxidative metabolism.

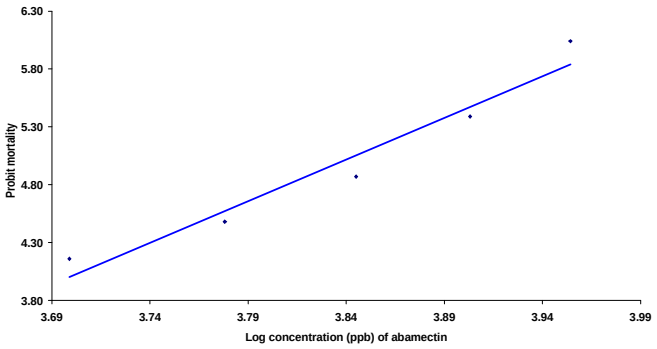

Fig 1. Log concentration probit mortatily curvefor Abamectin to Tilapia mosambica(peters) after 24 h

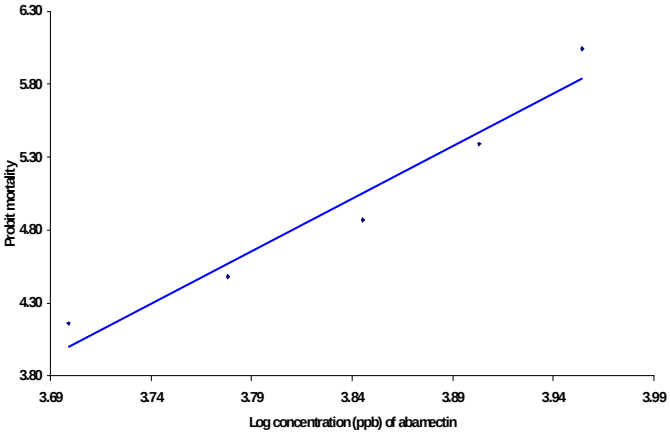

Fig 2. Log concentration probit mortality curve for Abamectin to Tilapia mosambica (Peters) after 24 h.

Table 2. Time – mortality response of fishes to abamectin 1.9 EC

Organisms	Concentration (ppb)	LT_{50} (h)	95 per cent fiducial limit		Regression equation	χ^2 at P = 0.05
			LL	UL		
C. carpio	0.50	3.119	132.656	631.170	Y = - 0.428 + 2.389 ±0.769X	1.618 ^{NS}
	0.55	1.804	89.562	139.472	Y = -1.944 + 3.413 ± 0.756 X	1.236 ^{NS}
T. mosambica	8.0	19.039	13.269	102.580	Y =2.274 + 2.130 ± 0.772 X	1.320 ^{NS}
	9.0	13.933	10.294	35.917	Y = 2.705 +2.006 ± 0.691X	0.199 ^{NS}

Number of fish used (20) NS = Not significant

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