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TOXIC EFFECT OF PESTICIDES AGAINST THE FRESH WATER FISH, *OREOCHROMIS MOSSAMBICUS*

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ABSTRACT

Lethal effect of botanical extracts of *Hyptis suaveolens*, *Ocimum gratissimum*, bio control agent *Bacillus thuringensis isralensis* and synthetic organophosphorus pesticide chlorpyrifos against the fresh water fish, *Oreochromis mossambicus*. The median lethal dose (LC_{50}) of *H. suaveolens* was 1198.25 ppm. *O. gratissimum* caused fifty percent mortality at 1284.67 ppm. The median lethal dose fluctuated between 1279.54 and 1289.73 ppm. *Bacillus thuringensis* registered 665.68 ppm as median lethal dose.

KEYWORDS: LC_{50}, Median Lethal Dose, *Hyptis suaveolens, Ocimum gratissimum, Bacillus thuringensis isralensis* and *Oreochromis mossambicus*.

INTRODUCTION

Pesticides are considered as a source of pollution to aquatic environment as they make through various modes like direct dispose from point source, surface runoff from fields and aerial spray (Smitha Shukla *et. al*., 2005). Insect control measures adopted with insecticides frequently non-selective and most often lead to heavy mortality of fishes and game birds (Dustman and Stickel, 1996). The pesticide once applied to the field do not remain there, but are blown by wind or rain to river, lakes, ponds and seas adversely affecting the growth and survival of fish (Westle and Gunthur, 1966; Holden, 1973; Johnson, 1973; West,1996).

Among different classes of pesticides, organophosphorus insecticides represent one of the most widely used classes of insecticidal with potential of human exposure in both rural and urban or residential environment (Ngoula *et. al*., 2007). The shift from organochlorine to organophosphates has resulted into increased occurrence of organophosphorus into water bodies causing acute and chronic toxicity in fish. Organophosphate pesticide reach water bodies in sub lethal concentrations and their bioaccumulation in aquatic animal caused alteration in their normal behavior (Ravi and Selvarajan, 1990).

Fish have been a popular and useful test organism in aquatic toxicological studies with the logic, that is fish life is protected the rest of aquatic food chain is as well protected. The important commercial of fisheries is also a factor that goes in favor of this choice (Mahananda *et. al*., 2008). Aquatic toxic substances alter the chemical properties of aquatic body, thereby brings about behavioral, physiological and bio-chemical changes in fishes (Edwards, 1973; Arunachalam *et. al*., 1980; Dubale and Shah, 1981; Arunachalam and Palanichamy, 1982). In aquatic toxicology, LC_{50} test is often used to measure the potential risk of a chemical (Jack de Brujis *et. al*., 1991). By probit analysis the 96 hour LC_{50} value of monocrotophos was 4.9mg/l. After 96 hours exposure to acute levels of monocrotophos, the brain acetyl cholinesterase activity decreased progressively as the concentration of monocrotophos increased against tilapia fish, *O. niloticus*. Tilapia species is one of the most popular fresh water fish consumed in several countries. They are mainly lacustrine fish that are well adapted to enclosed water. Therefore, *Oreochromis mossambicus* was chosen for the present study to evaluate the lethal effect of botanical extracts, bio control agent and chlorpyrifos.

MATERIALS AND METHOD

The freshwater fish, *Oreochromis mossambicus* ranging in length from 7 to 10 cm and weight ranging from 14 to 17 gm was procured from the Aliyar dam (Coimbatore district, Tamilnadu, India) and transported to the laboratory in well aerated polythene bag and acclimatized under laboratory condition (28±0.2ºC). Fishes were fed everyday with oil cake mixed with rice flour. Water changed at 24 hours interval. The period of acclimatization lasted for two weeks.

Preparation of botanical extracts

The leaves of *Ocimum gratissimum* and *Hyptis suaveolens* were washed in tap water and shade dried. Dried leaves were grinded with the help of mixer grinder. 100 gm of finely

grinded powder of respective plants extracted with 300 ml of methanol with the help of soxhlet apparatus (Vogel, 1978). The extracted liquid was subjected to rotary evaporation in order to remove the chemicals. The dried residues dissolved in ethanol to prepare the stock solution. From the stock solution different concentrations of test solutions (50 to 800 ppm) were prepared as recommended by WHO, 1996.

Bioassay

Different concentrations of test solutions of *H. suaveolens, O. gratissimum, Bti* and chlorpyrifos were mixed with water containing known number of healthy fishes introduced from the stock culture tank. Each experiment was repeated thrice. Observations made on the mortality of fish after 96 hours of introduction of fish. The mortality percentage was corrected by using Abbott's formula (Abbott, 1962). Median lethal dose (LC_{50}) was calculated from the observed data through probit analysis (Finney's, 1971).

RESULTS AND DISCUSSION

Lethal dose of *H. suaveolens*, *O. gratissimum*, *B. thuringensis isralensis* (*Bti*) and chlorpyrifos against the fresh water fish, *Oreochromis mossambicus* is presented in Table - 1. The median lethal dose (LC_{50}) of *H. suaveolens* was 1198.25 ppm against *O. mossambicus*. The LC_{90} value was 2420.55 ppm. The 95% fiducial limit fluctuated between the lower limit of 1193.61ppm and upper limit of 1203.40ppm. *O. gratissimum* required 1284.67ppm to produce fifty percent mortality. The LC_{50} value fluctuated between 1279.54 and 1289.73ppm. The LC_{90} value was 2562.35 ppm. This correlates with the earlier findings of Suwannee *et. al*., 2006. They found that the extracts of *M. siamensis* are also effective against the larvivorus fish guppy (*Poecilia reticulata*). *M. siamensis* has been reported to contain proanthocyanidin polymers as the active compounds producing piscicidal effects (Balza *et. al*., 1989). The LC_{50} of stem bark extracts of *Euphorbia royleana*, *Jatropha gossypifolia*, *Nerium indicum* and *Thevetia peruviana* against fresh water fish, *Channa punctatus* were decreased from 0.050 g/l (24 hr.) to 0.020 g/l (96 hr.), 4.61 g/l (24 hr.) to 4.34 g/l (96 hr.), 0.097 g/l (24 hr.) to 0.04 g/l (96 hr.) and 4.05 g/l (24 hr. to 3.17 g/l (96 hr.), respectively (Digvijay Singh and Ajay Singh, 2002). Abhishek kumar *et.al*., (2011) reported that acute exposure of azadirachtin caused a progressive decrease in the serum calcium levels after 48 hours in fish *Heteropneustes fossilis*, which persists till 96 hours.

In the present study, the median lethal dose (LC_{50}) for the bio-control agent *Bacillus thurienginsis* was 665.68ppm. The fiducial limit was 661.07ppm (lower limit) and

670.35ppm (upper limit). The LC_{90} value was 1528.37ppm. Brown *et. al*., (2002) reported that *Bti* and insect growth regulators had no acute toxic effects at up to 10 and 12 times the estimated environmental concentration (EEC), respectively. This experiment revealed that the synthetic chemical pesticide, chlorpyrifos produced 50 percent mortality in a population at 78.63ppm. The lethal dose (LC_{50}) ranged between 73.38 and 83.54ppm. The LC_{90} value for the synthetic pesticide was 465.61ppm. This correlates with the earlier studies of Mathivanan (2004) made bioassay studies by using the organophosphorus pesticide, quinalphos in *O. mossambicus*. Brown *et. al*., (2002) found temephos and pirimiphos-methyl were found to be toxic to the juveniles of *Molantaemia duboulayi*, with 24 hour exposure LC_{50} values of 27 and 15 µg/liter (ppb), respectively. Bioassay studies of the present work shows that pesticide chlorpyrifos, *Bti*, *H. suaveolens* and *O. grattissimum* are toxic to *O. mossambicus* and the cause mechanism of mortality of fish may be due to damage in the respiratory epithelium as found in *Mystus vittatus* and *Labeo rohita* (Datta and Sinha, 1990). Gills are the major respiratory organ and all metabolic pathways depend on the efficiency of the gills for their energy supply and damage to these vital organ cause chain of destructive events, which ultimately lead to respiratory distress (Radhaiah, 1987).

Table 1: Lethal concentration (LC_{50}) of botanical extracts, bio control agents the freshwater fish, *Oreochromis mossambicus.*

Treatment	LC_{50} (ppm)	LC_{90} (ppm)	95% Fiducial limit (ppm)		Mean ($\bar{x}$)	SD	SE	Regression
			Upper	Lower				
H. suaveolens	1198.25	2420.55	1203.4	1193.61	35.41	18.11	2.99	Y= 0.0342X+8.913
O. gratissium	1284.67	2562.35	1289.73	1279.54	32.91	17.57	5.34	Y= 0.032X+7.64
Bt. isralensis	665.68	1528.37	670.35	661.07	38.33	19.11	10.20	Y=0.0464x+19.19
Chlorpyrifos	78.63	465.61	83.54	73.28	58.75	23.21	16.50	Y=0.103x+41.76

CONCLUSION

The present investigation revealed that the lethal concentrations of botanical extracts, bio control agent and synthetic pesticide used in agro ecosystem for pest management to the non target fresh water fish, *O. mossambicus*. *Bti* is the least effective to the fish when compared to plant extracts and synthetic pesticide. Next to *Bti*, plant extracts are safer than chlorpyrifos. The commonly used organophosphorus pesticide lethal to the fish at very low concentration.

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