American-Eurasian Journal of Toxicological Sciences 4 (3): 147-150, 2012
ISSN 2079-2050

DOI: 10.5829/idosi.aejts.2012.4.3.65183

Study of Acute Toxicity of Thiodan during Monsoon in Freshwater Bivalve Mollusc *Lamellidens corrianus*

[1]V.S. Kamble, [2]B. Mane and [3]K.R. Rao

[1]Department of Zoology, Sangola College, Sangola Dist. Solapur (MS), India
[2]Department of Zoology, Waghire College, Saswad Dist. Pune, India
[3]Department of Zoology, Walchand College, of Arts and Science, Solapur (MS), India

Abstract: Present investigation was carried out to study the acute toxicity of organochlorine pesticide thiodan (Endosulfan 35 EC) from freshwater bivalve mollusc *Lamellidens corrianus* for 96 hr during monsoon season. After every 24 hour of the treatment, the mortality was recorded which is necessary for obtaining the LC_{50} concentrations during 96 hours exposure. In the present investigation calculated LC_{50} value for 24, 48, 72 and 96 were 0.066, 0.049, 0.038 and 0.029 ppm, respectively.

Key words: *Lamellidens corrianus* · Organochlorine · Pesticide · Mortality · Acute toxicity

INTRODUCTION

Thiodan is a broad spectrum pesticide and acaricide containing the technical Endosulfan 35 % w/w, solvents and emulsifiers' etc 65% w/w. Thiodan 35 EC is a strong contact and stomach poisons highly effective against chewing, sucking and leaf eating pests of cotton, paddy, sugarcane, tea, vegetables, cereals, pulses, food crops and coffee. These pesticides are manufactured by Bayer Crop Science Ltd., Ankaleshwar, Gujarat. The technical active substance comprises, α and β-Endosulfan, which both possesses almost all biological activities. It is also stated from different authors that, there will be a transformation of Endosulfan used in agricultural field to the aquatic environment resulted in great threat to the inhabitants including fish specifically and also to the other aquatic organisms broadly [1-4] Bivalves are considered as suspension feeder and influenced by the organization and fluctuation of the ecosystem [5].

The present investigation was carried out to study acute toxicity of organochlorine pesticide thiodan (endosulfan 35 EC) from fresh water bivalve mollusc *Lamellidens corrianus* during monsoon season.

MATERIALS AND METHODS

The freshwater bivalve mollusc, *Lamellidens corrianus* measuring about 65-70 mm in length were collected from Chincholi tank nearby Sangola Dist. Solapur, Maharashtra (India) during March 2009 to October 2010. Soon after the collection the bivalves were cleaned to remove algal biomass and mud. The animals were maintained in the plastic container in well aerated tap water for one week. During acclimation the water was changed after an interval of 12-13 hrs every day. The well adjusted bivalve mollusc to the laboratory conditions were divided in to ten groups each containing ten molluscs and these groups held separately in experimental plastic containers. Static bioassay test were conducted by using two commercial grade pesticides, Thiodan® (Endosulfan 35 % EC) manufactured by Bayer Crop Science Ltd. Ankaleshwar, Gujarat, to determine LC_{10} and LC_{50} values and simultaneously the molluscan behavior and also during the experiment mortality rate was recorded. The experiments were carried out during monsoon (June to September). The experiments were conducted for 96 hr. The pesticide was dissolved in appropriate volume of distilled water to obtain the required stock solution. The initial range of test concentration was 0.0022 to 0.045 ppm for Thiodan® (Endosulfan 35% EC) which was determined by experimentation. The stock solution and water was renewed after 12-13 hrs intervals. The control group of *Lamellidens corrianus* was also run simultaneously for every treatment.

Corresponding Author: V.S. Kamble, Department of Zoology, Sangola College, Sangola Dist. Solapur (MS), India.

The physicochemical parameters like temperature, pH dissolved oxygen and total hardness of water was recorded during each experiment of the experimental water [6]. The mortality rate and behavior of bivalve molluscs, *Lamellidens corrianus* were recorded before each change of water from containers. The toxicity test was repeated three times for confirmation and observed values of LC_{10} and LC_{50} for 96 hr were determined. Rate of mortality and behavior changes of the bivalves were recorded. The regression equation between log concentration (in ppm) (X) and probit mortality (Y) was derived statistically by using the formula $Y=\alpha+\beta X$ and 95% fiducial limits (Confidence limits) were determined [7].

RESULTS

For the monsoon 24 hr of toxicity experiment 10 animals for each concentration were exposed to each of different Thiodan (Endosulfan 35 EC), concentrations ranging from 0.035 ppm to 0.125 ppm. At the end of 24 hr of the experiment the animals exposed to Thiodan (Endosulfan 35 % EC) concentration of 0.035 ppm there was 10 % mortality in 0.045 ppm 20 % mortality, in 0.055 ppm 30 % mortality, in 0.065 ppm 40 % mortality, in 0.075 ppm 50% mortality, in 0.085 ppm 60 % mortality in 0.095 ppm 70% mortality, in 0.0105 ppm 80% mortality, in 0.115 ppm 90% mortality and in 0.0125 ppm 100% mortality was observed. These results were subjected for statistical analysis to obtain regression equation and 95 % 95% confidence limits. The regression equation for monsoon 24 hr was Y= –1.1740+0.1735X and the 95% fiducial limits are ranging from 0.055 to 0.089 ppm. The calculated LC_{50} value for 24 hr was 0.066 ppm and observed value was 0.075 ppm Table 1.

For 48 hr of toxicity experiment 10 animals for each concentration were exposed to each of different Thiodan (Endosulfan 35 % EC) concentration ranging from 0.02 ppm to 0.0925 ppm. At the end of 24 hr of the experiment the animals exposed to Thiodan (Endosulfan 35 % EC) concentration of 0.02 ppm there was 10 % mortality likewise in 0.03 ppm 20 % mortality, in 0.04 ppm 30 % mortality, in 0.05 ppm 40 % mortality, in 0.065 ppm 50% mortality, in 0.07 ppm 60 % mortality, in 0.075 ppm 70% mortality, in 0.0825 ppm 80% mortality, in 0.0875 ppm 90% mortality and in 0.0925 ppm 100% mortality was observed. These results were subjected for statistical analysis for establishing the regression equation and 95% confidence limits. The regression equation for monsoon 48 hr was Y=-1.3028+0.2096X and the 95% fiducial limits are ranging from 0.039-0.076 ppm. The calculated LC_{50} value for 48 hr was 0.049 ppm and observed value was 0.062 ppm Table 1 and Fig. 1.

For the monsoon 72 hr of toxicity experiment 10 animals for each concentration were exposed to different Thiodan (Endosulfan 35 % EC) concentrations ranging from 0.01 ppm to 0.10 ppm. At the end of 72 hr of the experiment the animals exposed to Thiodan (Endosulfan 35 EC) concentration of 0.01 ppm there was 10 % mortality likewise in 0.02 ppm 20 % mortality, in 0.03 ppm 30 % mortality, in 0.04ppm 40 % mortality, in 0.05 ppm 50% mortality, in 0.06 ppm 60 % mortality, in 0.07 ppm 70% mortality, in 0.08 ppm 80% mortality, in 0.09 ppm 90% mortality and in 0.10 ppm 100% mortality was observed. These results were subjected for statistical analysis for establishment of regression equation and 95% 95% confidence limits. The regression equation for monsoon 48 hr was Y= -1.4155+0.3008X and the 95% fiducial limits are ranging from 0.025 to 0.050 ppm. The calculated LC_{50} value for 72 hr was 0.038 ppm and observed value was 0.050 ppm (Table 1 and Fig. 3).

For the monsoon 96 hr of toxicity experiment 10 animals for each concentration were exposed to each of different Thiodan (Endosulfan 35 EC) concentration ranging from 0.002 ppm to 0.08 ppm. At the end of 96 hr of the experiment the animals exposed to Thiodan (Endosulfan 35 EC) concentration of 0.002 ppm there was 10 % mortality likewise in 0.02 ppm 20 % mortality, in 0.01 ppm 30 % mortality, in 0.02 ppm 40 % mortality,

Table 1: Acute toxicity of Thiodan (Endosulfan % EC) to the freshwater lamellibranches' mollusc, *L. corrianus* during monsoon seasons with regression equation and % fiducial limits

		95% fiducial limits			
Duration in hr	Regression Y= α + βx	M1	M2	Calculated value $LC_{50\ (ppm)}$	Observed value $LC_{50\ (ppm)}$
24	-1.1740 + 0.1735	0.055	0.089	0.066	0.075
48	-1.3028 + 0.2096	0.039	0.076	0.049	0.062
72	-1.4155 + 0.3008	0.025	0.060	0.038	0.050
96	-1.5305 + 0.3440	0.021	0.050	0.029	0.040

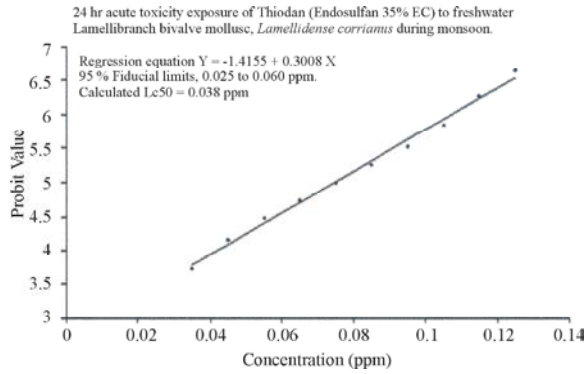

Fig. 1:

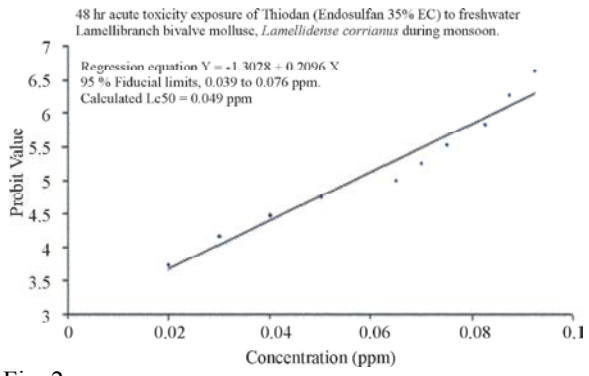

Fig. 2:

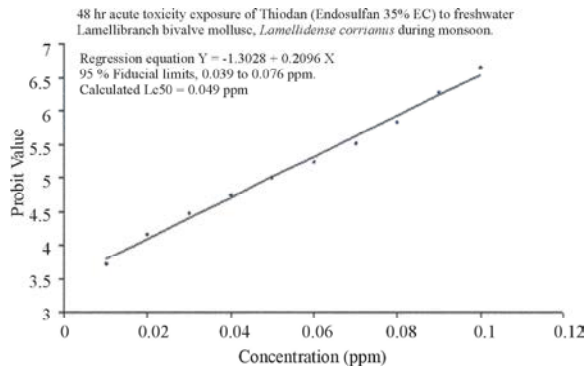

Fig. 3:

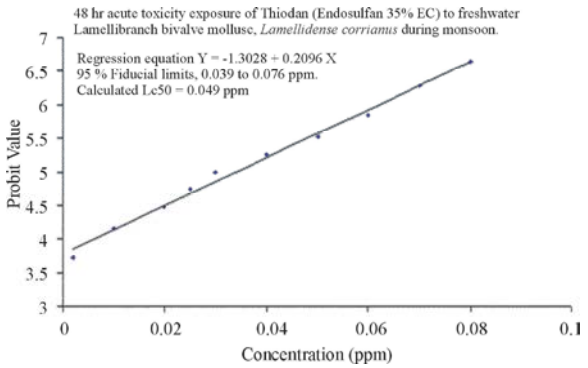

Fig. 4:

in 0.025 ppm 50% mortality, in 0.03 ppm 60 % mortality, in 0.04 ppm 70% mortality, in 0.06 ppm 80% mortality, in 0.07 ppm 90% mortality and in 0.08 ppm 100% mortality was observed. These results were subjected for statistical analysis for establishing the regression equation and 95% confidence limits. The regression equation for monsoon 96 hr was Y= -1.5305+0.3440X and the 95% fiducial limits are ranging from 0.021 to 0.050 ppm. The calculated LC_{50} value for 96 hr was 0.029 ppm and observed value was 0.040 ppm (Table 1 and Fig. 4).

DISCUSSION

There are several reports of LC_{50} values for organochlorine toxicity using static bio-assay test for various aquatic organisms and these reflect alterations in behavior of the animals. Verma *et al.* [8] while studying acute toxicity of twenty three pesticides to freshwater teleost, *Sacobranchus fossilis* observed 0.006 and 0.108 LC_0 values for 96 hr to Thiotox and Thiodan to fish, respectively. Rao *et al.* [9] while studying the toxicity and metabolism of endosulfan to the fish, *Macrognathus aculeatus* and observed 0.035 ppm LC_{50} value for 96 hr.

Bhagyalakshmi and Ramamurthi [10] studied the toxicity of Sumithion to freshwater crab *Oziotelphusa sensex* and observed 0.60, 0.40, 0.30 ppm LC_{50} values for 24, 48 and 72 hours, respectively. Sharma *et al*. [11] studied the acute toxicity of Rogor and Kitazine to freshwater fish, *Channa punctatus* and found 17.7 ppm as 96 hr median tolerance limit for Rogar and 14.75 ppm median tolerance for Kitazin.

Mane and Muley [12] observed the LC_{50} values of endosulfan toxicity after 96 hr to bivalve, *Lamellidens corrianus* from Godavari River, Paithan and were 0.017, 0.040 and 0.044 ppm values for summer, monsoon and winter seasons, respectively. Mane *et al*. [13] studied the acute toxicity of endosulfan to the freshwater bivalve *Indonaia caeruleus* and estuarine bivalve, *Katelysia opima.* The 96 hr acute toxicity under static bio-assay showed 0.0008 and 0.0056 ppm for LC_0 and LC_{50} value, respectively for *Indonaia caeruleus*, whereas for *Katelys*ia *opima* the LC_0 and LC_{50} values are found to be 0.0004 and 0.0008 ppm, respectively. They have further stated that the estuarine animals are very sensitive to the fluctuations in the environmental parameters than that of the freshwater one.

In the present investigation similar trends are also observed as far as 96 hr LC_{50} value are concerned from Chincholi tank, taluka Sangola District Solapur Maharashtra (India) Therefore, our results are in

agreement with Godavari River, Paithan acute toxicity studies. It is further observed that a minor difference in the Thiodan concentration caused behavioral changes in bivalve which reflected the servility of the animal. It can be stated that, Thiodan (Endosulfan 35 % EC) applications for controlling the different crop pest is creating major threat for the non-target inhabitants from the freshwater biota, especially the tiny detritus filter feeders like bivalve molluscs.

REFERENCES

1. Rao, D.M.R. and A.S. Murty, 1980. Persistence of endosulfan in soils. J. Agric. Food Chem., 28:1099-1101.
2. Mel, D.E., G.H.J.L. Vtm and A.C. Parthiratne, 2005. Toxicity assessment of insecticides commonly used in rice pest management to fry of common carp, *Cyprinus carpio*. A food fish cultivable in rice field. J. Appl. Ichthyol., 21(2): 146-150.
3. Shah and A. Kanraj, 2003. Acute toxicity of synthetic parathyroid cypermethrin to fresh water catfish; *Heterpneustus fossilis* (Bloch). Ind. J. Toxicol., 22(4): 325-328.
4. Zohra, K. and S. Shreshesth, 2006. Effect of glycophosphate or various blood parameters of freshwater fishes *Heterpneustus fossilis*, Flora and Fauna, 72(1): 100-104.
5. Akarte, S.R., D.A. Kulkarni and U.H. Mane, 1987. Effect of Cythion-Malathion 50 EC(W/W) on the estuarine clam *Katelysia opima*. Indian Ocean. Biology of Mary Manisson and Menon (199).
6. American Public Health Association and Others, 1980. Standard methods for the examination of water and wastewater (15th ed.). Washington DC., pp: 1134.
7. Finney, D.J., 1971. Probit analysis, Cambridge University, Press London, pp: 25-66.
8. Verma, S.R., A.K. Bansal, N. Gupta, A.K. Pal, M.C. Tyagi, K. Kumar and R.C. Dalela, 1979. Acute toxicity of twenty three pesticides to freshwater teleost, *Saccobranchus fossilis*, Proc. Symp. Environ. Biol., India, pp: 481-497.
9. Rao, D.M.R., A.P. Devi and A.S. Murty, 1981. Toxicity and metabolism of endosulfan and its effects on oxygen consumption and total nitrogen execration of the fish *Macrognathus aculeatus*, Pestic. Biochem. Physiol., 3: 282-287.
10. Bhagyalakshimi, A. and R. Ramamurthi, 1987. Toxicity of Sumithion to the freshwater field crab, *Ossiotelphusa Sensex* (Fabricus). Comp. Physiol. Ecol., 6(3): 191-192.
11. Sharma, R.K., Smita Shandilya and Sashi Sharma, 1982. Toxicity of organophosphorus compound to a freshwater fish, *Channa punctatus*. Geobios, 9: 161-162.
12. Mane, U.H. and D.V. Muley, 1984. Acute toxicity of endosulfan 35 EC to two freshwater bivalve molluscs from Godavari River at Paithan, Maharashtra state, India, Toxlett., 23: 147-155.
13. Mane, U.H., D.V. Muley and S.R. Akarate, 1983. Toxicity of endosulfan to freshwater and estuarine bivalve. Indian J. Comp. Anim. Physiol., 1(2): 1-9.