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Research Article

EFFECT OF PESTICIDE ENDOSULFAN ON THE GROWTH OF FRESHWATER PRAWN, *MACROBRACHIUM DAYANUM*

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ABSTRACT

The freshwater prawn *Macrobrachium dayanum* was subjected to acute (96 hr) static bioassay toxicity test with the pesticide endosulfan and the LC_{50} values were 0.006 ppm. Prawns were exposed for 30 days under static condition to their sub-lethal concentrations viz. 0.003 ppm, 0.002 ppm and 0.001 ppm of Endosulfan. The growth was found to decrease in direct relation to increase in the concentrations of the toxicants. However there was an increase in growth at lower concentration of endosulfan.

Keywords: Pesticide, Endosulfan, Toxicity, Growth, *Macrobrachium dayanum.*

INTRODUCTION

The environment is being polluted by industrial wastes, animal and plant wastes, acute mobile exhausts and agricultural chemicals which include pesticides and fertilizers. Pesticides are adverse group of widely varying chemical structures ranging from simple inorganic substances to complex organic molecules. Pesticides may be introduced into natural aquatic systems by various means incidentally dewing manufacture, dewing their application and through surface water runoff from agricultural land after application. In addition some pesticides are deliberately introduced into aquatic systems to kill undesirable pests such as weeds, algae and vectors of human disease such pesticides may be resistant to abiotic and biotic degradation and cause sub-lethal effects in a wide range of species.

Most of the chemicals used in agriculture are not selective, but are generally toxic to many non target organisms like fishes, prawns and other desirable forms of life that inhabit the environment. A number of studies have been carried out globally on the acute toxicity of pesticides and insecticides and their effects on the behavior, physiology, biochemistry, growth and various other aspects in finfishes and shellfishes including the freshwater prawns. Effects of various pesticides and insecticides on the freshwater prawns have been documented in different regions of India.

The freshwater prawn *Macrobrachium dayanum* is a medium sized prawn widely distributed all over India and has commercial importance as it is used in fresh or dry forms for human consumption studies on the acute toxicity of different pesticides and their impacts on various biological aspects of the prawn are well documented (Shukla and Omkar, 1983).

The present investigation was carried out with the objective of determining the acute (96 hr.) toxicity of the two most common toxicants i.e. a pesticide endosulfan and a insecticide dichlorovos and their effects at sub-lethal levels on the growth of the prawn *M. dayanum* as this species has some importance as a candidate for aquaculture in the far inland areas of the country.

MATERIALS AND METHODS

The medium sized live freshwater prawn *Macrobrachium dayanum* (average 69 mm, 0.7-

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1.0 g.) were procured from local fish market and brought to the laboratory. The uniformly sized non-berried prawns were initially acclimatized in plastic pool capacity 1000 Lt. for 10 days and the healthy ones were chosen for the experiment. Feeding was done and aeration was not provided during the acclimation period. Acute static bioassay experiments were conducted to find out the LC_{50} values of the pesticide following the methods described by APHA (1976). The experiments were conducted in glass aquarium of uniform size (30 Lt.) filled with 20 Lt. of water in each aquarium. The water collected from the pond was filtered and stored for a day or two before being used for the bioarrays. Commercial grade pesticide, endosulfan 35 endocel (active ingredient of endosulfan 35% m/m) supplied by assisted private. Bioassay experiments were conducted using ten prawns in each aquarium following the method described by APHA (1998). The stock solution was prepared as per the standard procedure (APHA, 1998) and the test solution was not changed throughout the 96 hr duration. Feeding and aeration were stopped during the bioassay mortality data were collected after 96 hrs of exposure in each concentration and the median lethal concentrations LC_{50} were calculated employing the method outlined by Litchfield and Wilcoxon (1949).

The experiment to assess the effects of the pesticide on the growth of the prawns was conducted for 30 days using three sub-lethal concentrations of the pesticide (0.003 ppm) 0.002 ppm and 0.001 ppm.

The pre-acclimatized prawns in the size range of 0.8-1.0 g were used for the assessment of growth prawns were exposed to the pesticide in 30 l capacity glass aquarium containing 20 Lt. water in each aquarium. A set of 10 prawns in each aquarium was maintained. Aeration was provided and feeding was done *ad libitum* throughout the study period using pelletized feed composed of rice brain and mustard oil cake at the ratio of 1:1 water was changed every alternative day with freshly prepared stock solution. The prawns were weighed using an electronic digital balance (0.001 g accuracy).

The water temperature, pH, dissolved oxygen, chloride, total hardness, alkalinity and CO_2 of the experimental medium were monitored (Table 1) during the study tenure following the standard methods (APHA, 1998).

RESULTS

The water quality parameters of experiment and control medium are shown in table 1. The 96 hrs. static median lethal concentration (LC_{50}) of endosulfan to the prawns were found to be 0.006 ppm (1.2 ml).

In the present study when the prawns were exposed continuously for 30 days in three sub-lethal concentrations of the endosulfan, there was a distinct decline in growth while the control animals showed normal increase in weight. The prawns exposed to sub-lethal concentrations of endosulfan suffered reduction in growth in correlation of the toxicants (table 2). The reduction in growth was estimated to be the highest in the sub-lethal concentration I (0.003 ppm) moderate at 0.002 ppm and low at 0.001 ppm of endosulfan. There was an increase in growth of the prawns as compared to that of the control. The reduction in growth of the prawn was observed up to 44.52% due to endosulfan.

Table 1. The water quality parameters.

S.No.	Parameters	Range
1.	Temperature	22° - 30°C
2.	pH	7.5 – 8.5
3.	Dissolved oxygen	5.6 – 9.2 mg/l
4.	Free CO_2	0 – 8 mg/l
5.	Alkalinity	22 – 88 mg/l
6.	Total hardness	136 – 328 mg/l
7.	Chloride	29.99 – 156.99 mg/l

Table 2. Effect of the pesticide endosulfan on the growth of the prawn *M. dayanum.*

Concentration	Initial weight (mg)	Final weight (mg)	Growth in 30 days (mm)
Control	882	1088	206
Sub-lethal Con.I 0.003 ppm	898	973	75
Sub-lethal Con.II 0.002 ppm	905	1044	139
Sub-lethal Con.III 0.001 ppm	925	1077	152

DISCUSSION

India is a major user of pesticides for its agricultural and public health purposes. Pollution of rivers, estuaries and seas by these pesticides cam adversely affect the prawn fishery (Kurian and Sebastian, 2002).

In the present study the LC_{50} values of endosulfan at 96 hrs for *M. dayanum* were found to be 0.006 ppm. The 96 hrs static median lethal concentration (LC_{50}) of endosulfan and 2.4 dichloro phenoxy acetic acid to the prawns were found to be 0.009 ppm and 0.5 ppm, respectively (Chandrasekaran *et al*., 2000). The earlier studies on the acute toxicity of endosulfan to different species of freshwater prawns revealed that the acute 96 hrs LC_{50} values were 0.006 ppm for the post larvae of *M. rosenbergii* (Natarajan *et al.*, 1992) and 0.005 ppm for the adults of *M. malcolmsonii*. The 96 hrs LC50 value estimated for *M. rosernbergii* post larvae exposed to the organophosphorus pesticide, malathion was 0.013 ppm (Natarajan *et al.,* 1992).

In the present study when the prawns were exposed continuously for 30 days in three sub-lethal concentrations of the pesticide, there was a distinct decline in growth of the prawn exposed to higher sub-lethal concentrations, Chandrasekaran *et al.* (2000) observed the maximum reduction (45.01%) in growth of the prawn when they were exposed to the highest sub-lethal concentration of endosulfan for 30 days. The reduction in growth of the prawn upto 44.52% due to endosulfan was observed in this study and it is a matter of concern for water quality management in culturing this species. However, the ill effects of the chemicals are to be confirmed by conducting investigations at the field level in situ in the prawns stocked in the ponds.

CONCLUSION

It is inferred that the decrease in growth of freshwater prawn *Macrobrachium dayanum* in the present study may be due to bioassay toxicity test with the pesticide endosulfan. The growth was found to decrease in direct relation to increase in the concentrations of the toxicants. The prawns were exposed continuously for 30 days in three sub-lethal concentrations of the pesticide, there was a distinct decline in growth of the prawn exposed to higher sub-lethal concentrations.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this article.

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REFERENCES

APHA, 1976. Bioassay methods for aquatic organism. In: Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, DC. 14th Edition, pp. 685-743.

APHA, 1998. Standard methods for Examination of Water and Wastewater, 16th Edition, American Public Health Association, Washington DC, USA, pp. 880.

Chandrasekaran, V.S., Bisht, H.C.S. and Sharma, A. P., 2000. Pesticide toxicity to freshwater

prawn *Macrobrachium lamarrei. Adv. Aquacult.*, 214-220.

Cremlyn, R., 1978. Pesticides Preparation and Mode of Action. John Wiley and Sons Publications, New York, pp. 246.

Downie, N.M. and Health, R.W., 1970. Basic Statistical Methods. 3rd Edition, Harper International Edition, Harper and Row Publishers, New York, pp. 356.

Edwards, R.R.C., 1977. Field experiments and growth and mortality of *Penaeus vannaei* in American coastal lagoon complex. *Estuarine Coastal Mar. Sci.*, 5(1): 107-122.

Litchfield, J.T. and Wilcoxon, F., 1949. A simplified method of evaluating dose effect experiments. *J. Pharmac. Exp. Ther*., 96 : 99-113.

Natarajan, E. Birador, R.S. and George, J.P., 1992. Acute toxicity of pesticide to giant freshwater prawn *Macrobrachium rosenbergii* (De Man), *J. Aqua. Tropics*, 2: 183-188.

Kurian, C.V. and Sebastian, O., 2002. Prawns and Prawn Fisheries of India. pp. 340-361.

Shukla, G. S. and Omkar, R., 1983. Acute toxicity of insecticide to freshwater prawn *Macrobrachium lamarrei* (M. Edwards). *Indian J. Environ. Health*, 25: 61-63.