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TOXICITY EVALUATION AND BEHAVIORAL STUDIES OF FRESHWATER BIVALVE *LAMELLIDENS CORRIANUS* EXPOSED TO DIMETHOATE

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Abstract :

Bivalve were exposed to any toxicant of different concentrations, due to stress the physiology gets disturbed, thus considerably affecting the enzyme system. In the present investigation, toxicity evaluation and behavioral studies of freshwater bivalve *Lamellidens corrianus* exposed to Dimethoate in static test and flow through continuous test for 24hrs, 48hrs, 76hrs, 98hrs, were observed. The Lc50 values found to decrease constantly with increasing of exposure periods. It indicates that even low concentration of toxicant was also much toxic to bivalve *Lamellidens corrianus*.

Keywords: Dimethoate, Toxicity evaluation, Behavioural studies and *Lamellidens corrianus.*

Introduction:

Environmental protection has attracted the attention of the wide cross-section of people all over the world which has now become a global issue amongst scientists and researchers working in this area. Unfortunately several toxic pollutants, few are even unknown or unidentified to the biota, are being regularly introduced in large quantities into the environment, especially into the aquatic environment. Pollution of water is an important dimension of environmental degradation. The disposal of the industrial and agricultural wastes directly into the aquatic medium burdens the eco-system and stresses the need to analyse, the concentration of these substances in the medium as well as in the organisms. Pesticidal pollution constitutes the most dangerous health hazard apart from creating adverse effects on bivalve production. As the bivalves are economically important non-target organisms, they are quite sensitive to a wide variety of toxicants and are used as pollution indicator in the water-quality management.

In the present study, an attempt has been made to analyze the toxicity of the Dimethoate on the fresh-water bivalve *Lamellidens corrianus.* The result is expressed as the lethal dose (LD) in the case of terrestrial organism and as lethal concentration in the case of aquatic organisms. Since some members of population may prove to be excessively susceptible and others may prove to be very resistant to the dose or the concentration of the toxicant that affects 50% of the population under consideration is expressed as LD50 or LC30 values, which is statistically calculated on the basis of the observed percentage of mortality at different concentrations of the pesticides. The toxicity tests are being conducted in a variety of methods for instance, the report of the committee on the methods for toxicity tests with bivalve, macro invertebrates and amphibians lists four techniques by which acute toxicity tests are usually conducted. They are:

Static technique: In this method, the test solution and test organisms are kept in the test chambers for a specific duration of the experiment.

Recirculation technique:

This is exactly like the previous method except that test solutions are continuously circulated through an apparatus to maintain water quality by such means as aeration, filtration, and sterilization and then recycled to the test chambers.

Renewal technique:

This is an improved static test in the sense that an attempt is made to maintain the water quality. The test organisms are periodically exposed to fresh test solution of the same concentration. Usually once in every 24 hours, either by transferring the test organisms from one test chamber to another or by replacing the test solution.

Flow through technique:

In this method, there is a continuous flow of test solutions through the test chamber at a fixed rate for the duration of entire test period. Two procedures are recommended. In the first procedure, large volume of the test solutions is prepared before the beginning of the test and these are allowed to flow through the test chambers. In the second and most common procedure, fresh test solutions are prepared continuously for every few minutes in a toxicant delivery system. The first technique described above is what has been termed as the static test and was widely employed in the fifties and sixties (Doudoraff etal., 1951; Henderson and Tarzwell, 1957). It was also accepted as a standard method by the American Public Health Association (1960). However, static tests were being used widely for conducting the toxicity tests. Hence in the present study, static and continuous flow through system is employed.

Duration of the test:

The concentrations of pesticides, which may normally be sub-lethal during short term exposure (say 24 or 48 hrs). May prove to be lethal, if the exposure time is extended (say up to 96 to 120 hrs). Since the toxicity of the poison is a function of time, it is customary to expose the test organisms over a fixed period of time to the toxicant usually for 24, 48, 72 and 96 hours.

Materials and methods:

The fresh water bivalve *Lamellidens corrianus* size 12-14 cm and weight 20-24gm were brought from Waghur Dam (Jalgaon) . The Bivalve *Lamellidens corrianus* were acclimatized to the laboratory conditions at 26+ 2°C. The bivalve were fed daily with alge and fungi of same dam once in two days, and allowed to acclimate 15 days Water was renewed every day to provide to provide freshwater, rich in oxygen. The sample water is clear, colorless and odorless.

If in any batch, mortality exceeds 5% during acclimatization, that entire batch of bivalve was discarded. The experimental bivalve were exposed to different concentrations of Dimethoate was obtained on trail and error basis. The water used for acclimatization and conducting experiments was clear unchlorinated ground water and the hydrographic conditions of water are shown. The containers of the test media are of liter capacity, where in each test five containers were used and each container consisted of ten bivalves.

The mortality rate was taken into consideration and while taking the data, dead bivalve was removed immediately. Pilot experiments were conducted to choose the mortality range between10% and 90%.Basing on the pilot experiments, the experiments were conducted to determine the toxicity in five different concentrations for 24, 48, 72 and 96 hours with organophosphate compound Dimethoate in static system and continuous flow through. The data of each concentration was pooled up to calculate the LC50 values. The un-weighted regression method of probit analysis (Finney, 1971; Robert and Boyce, 1972) was used to calculate the LC30 values.The following results are in mg/liter

Parameter	Value
Turbidity	**6 silica units**
Electrical conductivity at	**616 micro**
pH value at 28°C	**6.1**
Alkalinity:	
Total Hardness	**228**
Non-carbonate Hardness	**Nil**
Calcium Hardness (as N)	**Nil**
Sulphate (as SO4)	**Trace**
Chloride (as Cl)	**36**
Fluoride (as F)	**1.4**
Iron (as Fe)	**Nil**
Dissolved oxygen	**6-8 ppm**
Temperature	**26 + 30°C**

Tabel 1. The observed percentage mortality of dimethoate for 24, 48, 72, and 96 hours of bivalve *Lamellidens corrianus* in static test.

24Hours		**48Hours**		**72Hours**		**96Hours**	
Cone. mg/1	**Observed mortality (%)**	**Cone. mg/1**	**Observed mortality (%)**	**Cone. mg/1**	**Observed mortaiity (%)**	**Cone. mg/1**	**Observed mortaiity (%)**
16	20	14	20	12	20	11	20
16.5	40	14.5	40	12.5	30	11.5	40
17	50	15	60	13	50	12	60
17.5	60	15.5	70	13.5	70	12.5	80
18	90	16	90	14	90	13	90

Table 2. The LC50 values of dimethoate to bivalve *Lamellidend corrianus* for 24, 48, 72 and 96 hours in static test and flow through test.

24 Hours	Static	15.6226
	flow through	10.6403
48 Hours	Static	14.0224
	Flow through	10.8611
72 Hours	Static	11.1062
	Flow through	08.6831
96 Hours	Static	10.7645
	Flow through	9.3264

Table 3. The observed percentage mortality of dimethoate for 24, 48, 72 and 96 hours of bivalve *Lamellidens corrianus* flow through continuous test.

24Hours		**48Hours**		**72Hours**		**96Hours**	
Cone. mg/1	Observed mortality (%)	Cone. mg/1	Observed mortality (%)	Cone. mg/1	Observed mortality (%)	Cone. mg/1	Observed mortality (%)
12	10	11	20	10	20	9	20
12.4	30	11.4	30	10.4	40	9.4	30
12.8	50	11.8	60	10.8	50	9.8	50
13.2	60	12.2	70	11.2	70	10.2	80
13.6	80	12.6	80	11.6	90	10.6	90

Results and discussion

In the present investigation the test species, *Lamellidens corrianus* has shown differential toxicity level with the function of period. The 96 hours LC50 concentration is less than the 24 hours and 48 hours concentration, which shows that the more is the duration period the less is the concentration required. The observed percentage of mortality of *Lamellidens corrianus* for Dimethoate in static tests continuous for 24, 48, 72 and 96 hours were shown in Table 1 and 2. The observed LC30 values of *Lamellidens corrianus* for Dimethoate in static and continuous flow through tests for 24, 48, 72 and 96 hours were shown in Table 3.

It is clear from earlier studies that LC50 of pesticides for a fresh water bivalve varies from species to species and in the same species under the influence of number of factors including size and time of exposure. The response is initiated at the threshold dose when increase intensity of dose and exposure time is increased. This is reported in the basic concepts of the dose- response relationship. Disruption of schooling behavior of the bivalve, due to the lethal and sub lethal stress at the toxicant, results in increased swimming activity and entails increased expenditure of energy (Venkata rathnamma et al., 2008), Change in the normal physiological and biochemical aspects in the treated bivalve in the present study could be attributed to the disruption of the schooling activities as suggested by Murthy (1987). Excited and erratic movement was observed by Jayantha Rao (1988), Sandheinrich and Atchison (1990). These behavioural changes were seen and confirmed in the present investigation also. The surfacing phenomenon of bivalve observed under deltamethrin exposure might either be due to hypoxic condition of the bivalve as reported by Radhaiah and Jayantha Rao (1988) and Sulaiman et al., (1989), (Venkata rathnamma et al., 2008, Charjan et al., 2008).

The increased ventilation rate by rapid, repeated opening and closing of the mouth and opercular coverings accompanied by partially extended foot was observed. This could be due to clearance of the accumulated mucus debris in the gill region for proper breathing. The hyperexcitability of the bivalve invariably in the lethal and sublethal exposure of deltamethrin may probably be due to the hindrance in the functioning of the enzyme AchE in relation to nervous system as suggested by many authors (Shahul Hameed and Vadamalai, 1986). It leads to accumulation of acetylcholine which is likely to cause prolonged excitatory post synaptic potential. This may first leads to stimulation and later causes a block in the cholinergic system. The accumulation of mucus over the gill, observed in the treated bivalve was evidenced by Kumaraguru et al., (1982). Loss of Positive rheotaxis of the bivalve is a good indication of toxic response. In the present study as evidenced by the results the abnormal changes in the bivalve exposed to lethal concentration of deltamethrin are time dependant. Thus, behavioral changes of the bivalve under insecticidal stress may have deleterious effects of making the bivalve fall an easy prey in their natural habitat and may affect the stability of the population.

Behavioural characteristics are obviously sensitive indicators of toxicant effect. It is necessary, however, to select behavioural indices for monitoring that relates to the organisms behaviour in the field in order to derive a more accurate assessment of the hazards that a contaminant may pose in natural systems. Insecticide toxicity is influenced by physical factors like temperature and biological factors like size (Jayantha Rao, 1982), (Venkata rathnamma et al.,2008; Charjan et.al., 2008), Nutritional status (Das and Garg, 2014) species specificity (Gouda et al.,1981; and Janardhan et al., 1987). Mittal et al., (1991) reported that Monocrotophos is less toxic compound compared to fenvalerate in the case of bivalve . Tewari et.al.,(1990) reported that relative toxicity of other insecticides in the descending order is Decamethrin> Quinolphos > Cypermethrin > Fenvalerate > Monocrotophos > Permethrin > Carbaryl > Dimethoate. Inbamani and Sreenivasan (1998) reported that toxic effect of the organophosphate pesticide phosphamidon in thiourea medium, on the fresh water bivalve, Mathivanan (2004) has estimated LC50 value as 4 ppm for organophosphate quinolphos was exposed to freshwater bivalve. Shivakumar, et al., (2015) reported that bivalve in sublethal concentration were found understress but that was not fatal. Prasanth et al., (2015) reported that the abnormal changes in the bivalve exposed to lethal concentration cypermethrin are time dependent. Venkata rathnamma et al., (2008), reported that the abnormal changes in the bivalve exposed to lethal and sublethel concentration deltamethrin are time dependent. Prasanth et al., (2015) observed that the bivalve is exposed to cypermethrin, erratic swimming, hyper and hypoactive, imbalance in posture, increase in surfacing activity, opercular movement, gradual loss in equilibrium, spreading of excess of mucus all over the surface of the body.

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