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Evaluation of acute toxicity levels of Organic Pesticide M Impact on mortality of local freshwater fish, *Nemacheilus botia*

J.D. Vasait, Shweta Pathak and Sonali Deore

Department of Zoology, M.G. V's, Arts, Science and Commerce College Manmad Dist. Nashik 423 103, M.S., India

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ABSTRACT

The acute toxicity of M-Impact on the mortality and behavior of *Nemacheilus botia* has been studied. The Lc_{50} values for 07 days exposure was 0.9 mg/l. The observed result indicates that the mortality of the test fish to M Impact was dose-time dependant. The altered behavioral responses were also observed under investigations in the test organism exposed to M Impact.

Key words: *Nemacheilus botia, M-Impact, Lc_{50} Behavior.*

Introduction

Ever increasing human population greatly depends on the agroecosystem for food and sustenance. On the action programmed to meet out the food security, agrochemicals such as insecticides, herbicides and fungicides are extensively being used. These agrochemicals in general and pesticides in particular help to increase the agricultural production by protecting the crops from pests during pre and post harvest periods (Abhilash and Nandita Singh, 2009). Such pesticides are bound to create problems like soil and water pollution. Natural water bodies are most often the recipients of the residues of pesticide used in agriculture, through runoff from fields, leaching and subsurface drainage from the treated area. Consequently, often mortality of fish and other aquatic organisms are reported to be observed in lakes, ponds and canals located in the vicinity of fields. Such polluted water becomes unsuitable for drinking, irrigation and fish production. During the last decade continuous use of herbicides into the agricultural activities has resulted in frequent detection of these chemicals in both surface and ground water which can impose adverse effect on non-target organisms (Gilliom, 2007). Among these non target organisms, fishes are the most important and played significant roles in assessing potential risk associated with contamination in aquatic environment (Lakra and Nagpure, 2009). They served as bio-indicators of environmental pollution and permit early detection of aquatic environmental problems (Lopez-Barea, 1996).

Toxicity studies have long played an important role in man's efforts to monitor and modify the effects of his activities on the biota. The toxicity studies especially useful in determining the sensitive species of an ecosystem that can be used as indicator species, for a particular type of pollution. The results of toxicity are generally reported in terms of median lethal concentration LC_{50} or median tolerance limit (TLm). The major groups of insecticides in common

use are the organophosphorous compounds. Many of the organophosphates are considered hazardous because of their ability to kill or immobilize various organisms at extreme low conditions. Like other herbicides M Impact may be toxic for fishes and various assays are required for its toxicity evaluation. For short term lethality assays many different fish species have been used based on their ease of culture, ecological relevance and economic importance. The fish species *Nemacheilus botia* was selected for the present study because of wide distribution in the freshwater environment, non-invasive, availability throughout the season and easy acclimation to laboratory conditions. In addition to above, the fish is a bottom dweller which makes it to be in contact with xenobiotics in water as well as in sediment. For the studies on toxicity of chemicals on animals most of the test guidelines recommend use of measured concentrations of the test chemical (OECD, 1992; USEPA, 1996; ASTM, 2007). But ecotoxicological models generally have large data requirements so must be based on use of both measured and nominal concentrations of testing chemical. As per ecotox database, 66% of such studies are based on nominal concentrations (ECOTOX; http://www.epa.gov/ecotox/). Raimondo *et al.* (2009) compared toxicity data on fishes reported as nominal and measured concentrations and developed an interspecies correlation estimation model for 12 pairs of fish species. They found that they were not significantly different for any species pairs and models developed from one concentration type predicted the reported toxicity of the other with high certainty. They concluded that acute toxicity test results reported as either measured or nominal concentrations may be included in ecotoxicological models. As the reports regarding the acute toxicity of pretilachlor on *C. batrachus* is lacking in available literature first we had chosen the nominal concentration of herbicide in the present study which will be followed by measured concentration in near future.

In view of the above the present study has been carried out to evaluate the acute toxicity of herbicide pretilachlor on fresh water teleost *Clarias batrachus* (Linnaeus) and to observe four behavioural activities, i.e number of buccal movement per minute, number of feeding attempt per 5-minute, number of burst swimming per 5 minute and number of occurrences of grouping per 5 minute after herbicide exposure.

Materials and Methods

Nemacheilus botia is an inhabitant of Panzan River flowing near Manmad (Nashik), India. The live fishes were netted from this river, brought to the laboratory and released in glass aquaria (size 3*1*1* ft.). The fishes were fed on fish meal procured from market and allowed to acclimatize to laboratory conditions for one week. The physico-chemical characteristics of test water were analysed during experimentation period (APHA, 1989). The bioassay methods adopted in present investigation were the same as that of Doudoroff *et al.* (1951). An organic insecticide M impact W/w commercial grade procured from market and used for treatment. Preliminary experiments using different concentrations of M impact was conducted to find concentrations that resulted in 10%-100% mortality. For experimentation, the laboratory-acclimatized fishes were exposed to the different concentrations of M Impact. The water of aquarium was aerated twice a day to prevent hypoxic conditions and changed at every 24 hours. A batch of control fish was also maintained along with experimented fish. The behavior of the fish Nemacheilus botia was studied in the control groups as well as after exposure to M Impact.

Results and Observations

The Lc_{50} values of M Impact 0.6 mg/lit found for fourteen days.

Animal Behavior: (Control) The *Nemacheilus botia* shows shoaling behavior. The constant opercular movement, normal body balance and posture were observed in control fish.

Treatment: The exposed fishes shown the altered behaviors as compared to the control fish. The fishes were faced suffocation, irregular, erratic and jerky movements. The paralysis of body parts with unusual inclined posture also observed in fishes.

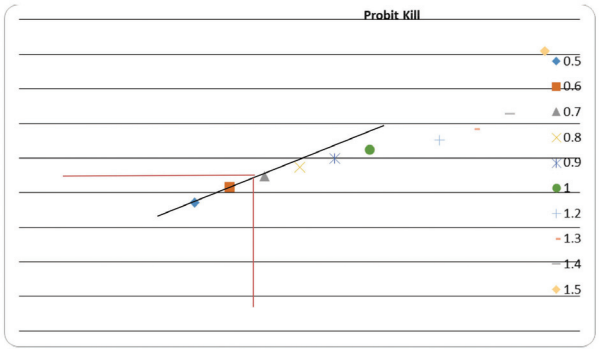
Discussion

In the present investigation the LC_{50} concentrations of M Impact was calculated. It was found that; M Impact is hazardous. The present study was carried out to evaluate the acute toxicity and behavioural responses in N*emacheilus botia* (Linnaeus) exposed to organic insecticides M impact. The results clearly indicated that exposure of fishes to M impact based

Table 1.

S. No.	Conc. of Pesticide	Log of Conc.	No. of Fish Exposed	No. of Fish Killed	Percent of fish killed	Probit kill
1	0.5	-0.301029996	10	1	10	3.72
2	0.6	-0.22184875	10	2	20	4.16
3	0.7	-0.15490196	10	2	20	4.48
4	0.8	-0.096910013	10	4	40	4.75
5	0.9	-0.045757491	10	5	50	5.00
6	1	0	10	6	60	5.25
7	1.2	0.07918124	10	7	70	5.52
8	1.3	0.11394335	10	8	80	5.84
9	1.4	0.14612803	10	8	90	6.28
10	1.5	0.17609125	10	10	10	8.09

organic insecticides resulted in increased mortality with increasing concentration of the organic insecticides. The 7 days LC_{50} value reported in the present study for commercial formulation of M impact is lower that the value reported by Ali and Mohammad in gambusia (2013) in pretilachlor organic pesticide. The value obtained by Maryam *et al.* (2013) in grass carp is greater. These differences in obtained values of LC50 for different species were may be due to age, size and health (Abdul-Farah *et al.,* 2004. Behavioral changes are one of the most sensitive indicators of potential toxic effect in fishes (Banaee *et al.,* 2011) but very few works has been done so far regarding the behavioral sensitivity of the fish to the pesticides used in agricultural fields. Behavioral alterations were observed in fishes exposed to glyphosate-based herbicides (Langiano and Martinez, 2008; Lushchak *et al.,* 2009; Nwani *et al.,* 2010; Shiogiri *et al.,* 2012), and butachlor (Chang *et al.,* 2011). Similar to the observations of previous workers the present study demonstrates that fish *Nemacheilus botia* display immediate and various behavioural responses to organic insecticides M impact. and thus, helpful in assessment of sub-lethal effects of contaminants in fish and can also be used as an indicator of acute changes in the chemical environment.



Graph: Showing Probit mortality

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