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COMPARATIVE STUDY OF BEHAVIORAL RESPONSE DUE TO ACUTE EXPOSURE OF MALATHION AND CYPERMETHRIN ON FRESHWATER FISH, *LEPIDOCEPHLICTHYS GUNTEA* (HAMBUCH).

Patil M. U.
Dept. Of Zoology, V.U.Patil Arts, and Late Dr. B. S. Desale science college, Sakri, Dist-Dhule

Short Profile

Patil M. U. is a Head at Department of Zoology in V. U. Patil Arts, and Late Dr. B. S. Desale science college, Sakri, Dist-Dhule. She has completed B.Ed., M.Sc., M. Phil., M.Z.S.I. She has professional experience of 7 years and research experience of 9 years. She has done one minor research project.

Co-Author Details :

S. S. Patole[2] and K. D. Ahirrao[3]
[2]Dept of Zoology, V,V,M's S.G.Patil Arts Science and Commerce College, Sakri, District-Dhule .
[3]Head, Dept of Zoology, Rani Laxmibai College, Parola, Dist-Jalgaon .

ABSTRACT:
Aquatic contamination by pesticides is arising as a result of their extensive use in agriculture and public health programmes. However, indiscriminate use of these pesticides for crop protection causes much damage to the non-target animals. The aquatic organisms particularly fish becomes highly sensitive, as water gets contaminated by toxic chemicals, some pesticides are not easily degraded in water and fishes are known to be absorbing them through the skin in high quantities. They affect the growth, metabolism and on physical and physiological activities and ultimately on the survival of the fish. In the present study pesticides, Malathion and Cypermethrin are highly toxic to fish *Lepidocephalichthys guntea* at acute exposure leading the effect on several behaviors. But the synergistic effects are more harmful than any above pesticide.

KEYWORDS
L. guntea, behavior, Malathion, Cypermethrin,

1.INTRODUCTION:

Pesticides have been recognized as serious pollutants of the aquatic ecosystems with drastic effect to aquatic fauna (Sambasiva, 1999). Several workers worked on the fresh water fishes diversity(Jaiswal and Ahirrao, 2012; Ahirrao, 2014) but fish behavior and impact of pesticides and environmental pollutants are not understood properly in an aquatic organism. Chemical pesticides when applied on the field affect the survival, growth, metabolism and on physiological activities on non-target organisms (Murugesen and Haniffa, 1992). The aquatic organisms especially fish becomes highly sensitive in such ecosystem. When the water gets contaminated by toxic chemicals, some pesticides are not easily degraded in water and fishes are known to be absorbing them through the skin in high quantities (Tilak *et. al*., 2001). Toxicants may affects the aquatic organisms in many ways and categorized their effects as direct and indirect (Bhaskar *et. al.*, 2002). These pesticides are not readily removed by usual excretory routes, because they inhibits by the enzymes participating in the detoxification and excretory reaction of fishes (Kulshrestha *et. al*., 1984). Pesticides are known to have hazardous effect on various organ systems of fish. They also alter the cellular morphology and physiology of fishes. The fishes get sicker and killed when pollution develop in the water bodies. However, in that situation they may deliberately leave the polluted area, but sudden pollution of rivers and streams result in the death of fishes (Sahai, 1988).

MATERIALS AND METHODS

The fresh water Fish, Lepidocephlicthys guntea were collected from 'Panzara Kan River' around Sakri, district Dhule, Maharashtra State, India. They were brought to the laboratory, cleaned and were placed in well aerated glass aquaria containing sufficient water for fifteen days for acclimatization. They were fed with fish diet. The healthy, active, mature adults, approximately same sized (4.0 + 0.5 cm length) and weighing about 10.0 + 0.3 grams were exposed to pesticide to calculate LC_{50} values for pesticides viz. Organophosphate (Malathion) and Synthetic Pyrethroid (Cypermethrin). Values are estimated by the method of Probit Analysis (Finney, 1971). The corrected present mortality was calculated by applying Abott's formula(1945).

Static-with-renewal acute toxicity tests were conducted with ten fish in each graded concentration. Fish were placed in five glass aquaria containing dechlorinated tap water. The physic chemical parameters of water were carried out according to APHA, (1998). Before to starting of experimentation and values are as follows:

PH = 7.1 + 1.0 ; Temperature: 26.0 + 2.0^{0}C ; Dissolved Oxygen : 5.0 to 5.5 mg/l.; Free CO_2 = 2.9 to 3.1 mg/l.; Alkalynity(CO_3)= 33 to 35 mg/l ; Alkalynity(HNO_3)=380 to 390 mg/l ; Chloride=540 to 550 mg/l ; Sulphate 10.50 to 11.0 ppm ; Hardness=145 to 160 mg/l

Thereafter, Malathion and Cypermethrin were added as per the ascending series of various concentrations (1 to 20 ppm). The fish kept in chlorine free tap water served as a control. Food was withheld 24 hours prior to acute toxicity tests. The test solution was replaced and mortality monitored at 24, 48, 72 and 96 hours. Fishes were considered dead if they don't respond to stimulus touching with glass rod. Dead fish were removed immediately and the observations were recorded. The entire experiment was repeated five times. Behavioral changes of the experimental fishes are recorded during the exposure period upto 96 hours. Fishes were exposed to predetermined LC_{50} Values of Malathion (11 ppm) and Cypermethrin (5.2 ppm) for 96 hours.

OBSERVATIONS AND RESULTS:

Table:1. Behavioral changes during intoxication in experimental fish, *L. guntea* observed with exposure to Malathion, Cypermethrin and Synergistic effects of Malathion and Cypermethrin.

Behavior	Observations	Control	Malathion	Cypermethrin	Synergistic effects	
					3/4thMal.+ 1/4th Cyp	1/4th Mal +3/4thCyp
Mucous Secretion	More mucous secretion takes place	Normal secretion of the mucous all over the body of L. guntea	+	++	+	+++
Respiratory activity	Repeatedly opening and closing of mouth because of cough	Normal opening and closing of mouth	+	++	++	+++
Yawn	Wide opening of mouth	Normal movement of jaws of mouth	++	++	++	++
Body Color	Changes occur due to pesticide	It is bright brownish at dorsal side and milky white at ventral side	+	++	++	+++
Swimming Activities	Frequently come to the water surface and erratic swimming	Swimming normally	+	++	++	+++
Jerking movements	S jerk: Movement of body sequentially from head to tail	No jerking movements	+	+	++	+++
	Partial jerk: Movement of Head or tail	No jerking movements	+	+++	+++	+++
	Bending body	Normal movements	+	+	+++	++
Abnormal behavior	Dash to the wall of an aquaria	Not dashed even though they may be overcrowded	+	++	+	+++
	Jumping out from aquaria	Generally this behavior is not found.	+	++	++	+++
Aggressive behavior	Nudge (Movement of fish towards another fish)	Normally move	++	++	++	+++
	Nip (Biting to another fish)	Don't nip	++	++	++	+++
Gill size	Swelling at gill side and it gets reddish in color	Normal shape size and color of gill	+	++	++	+++
Equilibrium	Lost Equilibrium	Do not loss equilibrium and all movements are found normally	+	++	+	+++
	Paralysis	Never suffering from paralysis	++	++	++	+++
	Death	Survive normally	+	+	++	+++

Values from table: + = less number of observations recorded (Hypo activity)
++ = Moderately recorded observations
+++ = More activities recorded (Hyperactivity).

DISCUSSION:

During pesticide treatment, fishes responded by expressing changes of their physical mode of behavior. These behavioral responses of fishes varied in accordance with predetermined sub-lethal concentration of pesticides viz. Malathion, Cypermethrin and synergistic effects of Malathion and Cypermethrin at concentration of 3/4th Mal. + 1/4th Cyp and 1/4th Mal + 3/4th Cyp at 96 hours to experimental fish *L. guntea.*

Lethal concentrations are gaining importance now a day. This is so because distinct behavioral changes are infested under sub-lethal exposure considering the amount of pesticide used in field application (Patil and Patole , 2011Ganesan, *et al*., 1989;). It is lost degradation, spill over, runoff etc. It is ultimate mixing to the rivers, tanks and irrigation canals and of the volume of water present in these stronger systems. It is more appropriate that inhabitants of the fresh water ecosystem are more likely to expand to the low concentration of pesticides than to high concentration. Beside pointed that most of the pesticides are relatively toxic even at low concentrations, from all these studies under sub-lethal

concentration. Hence it is selected for the present study.

Similar observations have been reported by earlier researchers in fishes intoxicated by different pesticides in different species at different period of exposure. The behavioral changes in the manifestation of the motivational, biochemical (Patil and Patole 2012), physiological and environmentally influenced state of organism. They decreased opercular movement and corresponding increased in frequency of surfacing of fish clearly indicates that fish adoptively shift towards aerial respiration(by obtaining atmospheric oxygen surfacing) and the fish tries to avoid contact with the pesticides through gill chamber (Santkumar and Balaji, 2000). The erratic swimming of the treated fish indicated loss of equilibrium. It is likely that the region in the brain. Which is associated with the maintenance of the equilibrium should have been affected (Rao and Rao, 1987). The erratic swimming jerky movement and the convulsions before death were evident and the severity varied with pesticide concentration indicates the sign of asphyxiation as indicated by death (Kalavathy *et. al.,* 2001). The surfacing phenomenon of fish observed under cypermethrin exposure might be due to hypoxic condition of the fish as reported by Radhaiah and Jayntha Rao (1988). The increased surfacing during the initial period of exposure to Cypermethrin and Malathion concentrations suggest and elevated rate of metabolism changes in ventilation rate and changes in surfacing frequencies are the general symptoms noticed in the fish after exposure to pesticide and these activities help the fish to avoid contact with poison and fight against stress (Jain, 2001).

Aggressive behavior such as nudge and nip were increased following exposure to the toxic material. Orientation and locomotory pattern were found to be involved in most aspects of fish behavior such as migration, feeding, mating and courtship. Which were altered under stress conditions of environmental toxicants (Shanthakumar and Balaji, 2000; Prasad et al., 2002). The accumulation of increased secretion of mucous in the fish exposed to Cypermethrin may e adoptive response perhaps providing additional protection against corrosive nature of the pesticide and to avoid the absorption of the toxicant by the general body surface. Jagdish and Sahai (1989) reported at higher concentration of pesticides, *Heteropnuestus fossils* and *Mystus vittatus* exhibited rapid opercular movement as well as erratic swimming. They often lost their balanced dashed against the wall of aquaria and even tried to escape out. Jyoti *et al*.,(1989) observed increased opercular movements in *Channa puntatus* on administration of pesticides , Malathion. The body color of the treated fish become pale on prolonged exposure the movements of the fish were greatly arrested and opercular movement shows down. Khillare(1990) observed negative response to the stress environment in *Channa gachua* exposed to Dimethoate and Rogor. Normal activities of the fin movements and the response o the stimuli were very much affected. We agree with the earlier findings because same observations were found in present studies.

CONCLUSION:

In the present study it has been found that both pesticides i.e. Malathion and Cypermethrin are highly toxic to fish Lepidocephalichthys guntea at acute exposure leading the effect on several behaviors of fish as well as entire physiological studies are found to be sensitive change in the physiological indicators which reflects change in normal activities of various functional systems. The synergistic effects are more harmful than that of the individual higher concentration of pesticide. The random use of pesticide must be avoided for pressuring aquatic biota.

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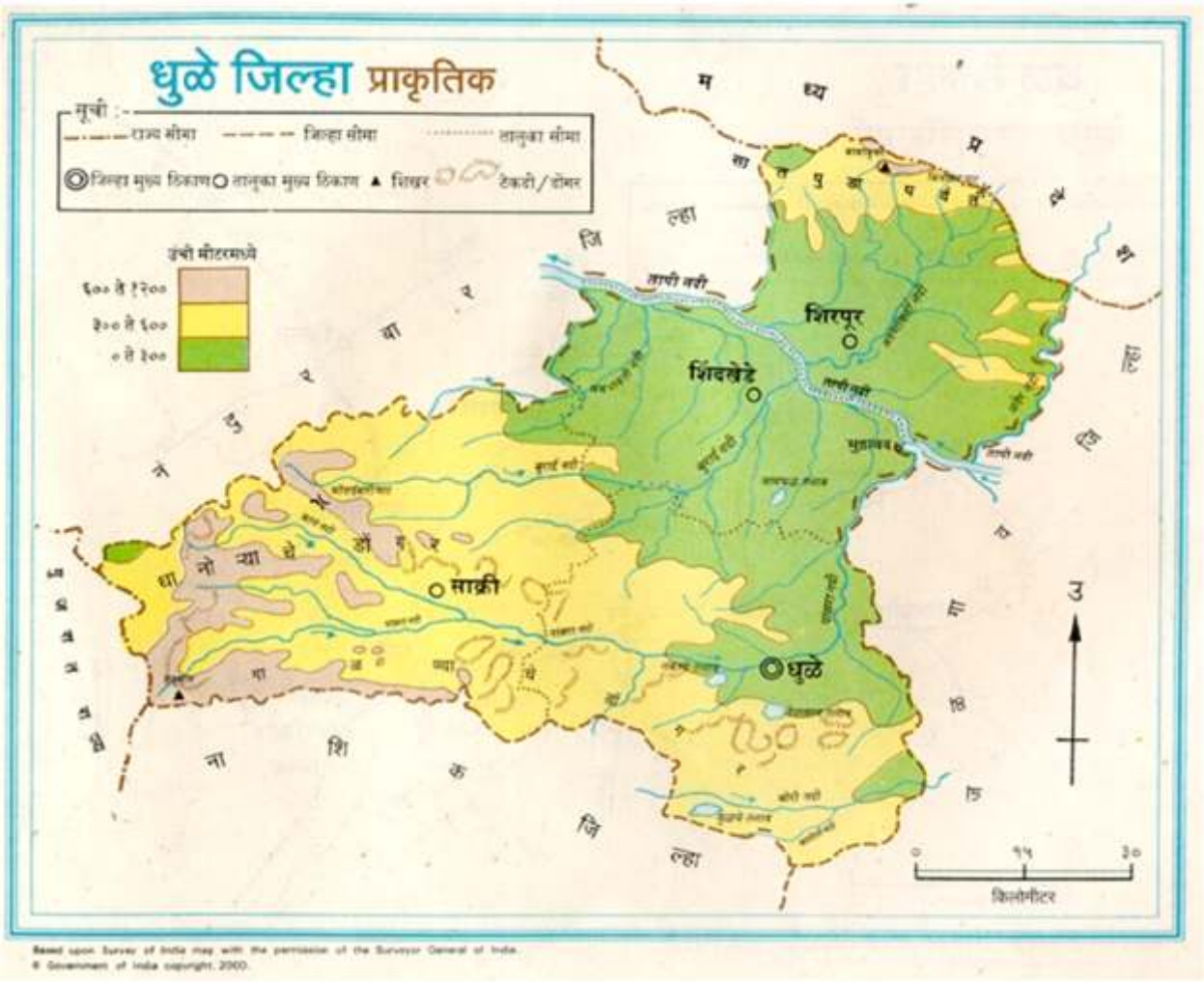
Map: Showing Collection site at Panzara Kan River near Sakri, Tal-Sakri, district-Dhule(MS), India.



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