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The effect of endosulfan on behavioral activity on fresh water female crab *Brytelphusa guerini.*

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Abstract
Behavior includes all those process by which an animal senses the external world and internal state of its body, and responds to changes which it perceives. Many of such processes will take place inside the nervous system and may not be directly observed but reflected through the behavior of the animal. When a toxic compound is administered, some changes occur from the normal behavior, and they can be observed externally. These behavioral changes would be caused by the changes in the nervous system caused directly or through metabolic or physiological activities. The paper deals with toxic effect of endosulfan on fresh water female crab *Barytelphusa guerini* and its behavioral study. The experimental animal shows various activities which is recorded and discussed.

Keywords: Behavioral study, Endosulfan, Fresh water female crab *Barytelphusa guerini*

INTRODUCTION

Fishes and other aquatic organisms, including crustaceans, is a sensitive indicator of the quality of aquatic environment, since they are susceptible to low concentrations of several insecticides. The special branch of biology that deals with the study of animal behavior is the 'Ethology'. The study of behavior begins with observation of an animal movement, and other activities. It is common observation that the same stimulus given to the same animal at different times does not reply the same response.

Some behavior workers refuse to them and concentrate entirely on directly observable aspects of use them and concentrate entirely on directly observable aspects behavior. However most of the workers who have worked with animal under natural conditions recognize the necessity to invoke variables in behavior.

The first step in collecting information on the site and mode of action of insecticides is the categorization of poisoning symptoms. It was found that there are two types or classes of parathyroid based on the symptoms produced [4].The type-I poisoning Syndrome or 'T' syndrome is characterized by restlessness,in coordination, prostration and paralysis in cockroach [7] and aggressive sparring behavior, elevated startle response, whole body tremors and prostration in the rat [22]. Type II poisoning syndrome or 'CS' Syndrome is characterized by in coordination, convulsions and intense hyperactivity in cockroach [8], where as in rats, burrowing behavior, tremors, chronic seizures and profuse salivation without lacrimation [21] are observed.

The literature available on behavioral changes of aquatic animals with references to pesticide toxicity is scanty though the synthetic insecticides are extensively used in agricultural sectors. The reports of [19] showed significant behavioral changes in fish such as hyperactivity, jerky movements and frequent opening of operculum following frequent administration. Neerajakumari [17] Also reported similar behavioral changes like impaired locomotion and hyperactivity in crabs under fenvalerate intoxication.

MATERIAL AND METHODS

Both control and experimental crab were placed in glass aquarium. The movement of the crabs in the aquarium feeding response, response to close human presence and threat and other relevant behavioral changes has been monitored.

The crab *Barytelphusa guerini* was selected for the present study. *Barytelphusa guerini*, a freshwater female crab was collected from the paddy field. They were collected from the natural habitat. Healthy female crabs weighing between 30 – 45 gm were selected for experimentation. The selected animals were divided into different groups each containing 10 animals.

The animals were kept in the glass aquarium. The volume of water was adjusted such that the animals were just submerged under the water. The glass aquarium was cleaned with 1% $KMNO_4$, before use. The crabs were fed with small pieces of goat muscles, frog muscles, earth worm, to unable the animals from effect of starvation. In the laboratory, the animals were acclimatized to laboratory conditions for three days prior to experimentation.

The temperature was 25°C to 32°C; healthy female crabs were selected for present work to avoid the effect of sex and size [2, 20].

In toxicity bioassay test, group of test animals are exposed to wide range of pesticides and are closely observed for signs of intoxication and mortality. Crabs were divided into several batches,

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each batches containing 10 crabs. The crabs were exposed separately to different concentration of endosulfan and mortality was recorded after 24hrs, 48hrs, 72 hrs and 96 hours.

RESULTS

The female crabs *Barytelphusa guerini* showed very quick & notable response against endosulfan. Crab exposed to lethal concentration of endosulfan settled at the bottom of the trough. The locomotary activity was disturbed water media in the first day itself. Crab occupied larger area than to that of control group. Irregular, erratic and darting movements with imbalanced activity and attempt to jump out of the toxic medium observed.

Crab in non-toxic media showed full covering of the trough during the first two days. No other notable behavior was observed in control. The detail observations are given in Table

Symptoms Observed

Behavioral changes were noted time to time in different groups of animals exposed to pesticide Endosulfan pollutant. The acute toxicity has been studied with endosulfan with various concentrations and different groups.

Study of Behavioral Acute Toxicity with Endosulfan

As shown in Table indicates acute toxicity data with different concentration of endosulfan solution to which the animals *Barytelphusa guerini*, a freshwater female crab were exposed, observed behavioral symptoms from eleven response of groups were noted.

Response of Group No.1:

The first group serves as control in which crabs, *Barytelphusa guerini* were exposed in tap water. The animal has been showed normal activity up to the end of experimental set. The crabs were healthy and showed normal activity up to 96 hours.

Response of Group No.2 and No.3:

After 24 hrs. of exposure time the animals exhibited following symptoms. The animals seem to be uneasy with their activity. They showed immediate activity and more movements. Response to pollutant to avoid the contact of water, they stand one upon one at the corner of aquarium. The mortality was not observed in response group no.2. The mortality observed in response group no.3 was 10% within 96 hrs.

Response Group No.4 and No.5:

In this response group the concentration of endosulfan show distinct behavioral changes like increase in respiratory metabolism, active movement of chelate legs. They were always in the attacking position. The animal show higher excretion. Rate of feeding decreased due to sensitivity of pesticide pollutant endosulfan.

The mortality of response group no.4 was 20% and mortality of group no.5 was 30% mortality and behavioral response against pollutant increased in the group no.2 and no.3.

Response Group No.6 and No.7:

The important symptoms were noted as high activity of animals, fast movement of chelate legs. These groups showed feeding it normal and locomotion's were not normal. The activity of mouth parts was fast, bubbles were released in water with small sound.

The mortality of group no.6 was 40% and response group no.7 was 60% within 96h LC_{50} was in between group no.6 and group no.7.

Response Group No.8 and No.9:

The symptoms observed in these groups were hyper activity of respiration. Anterior and ventral surface was with air bubbles. Excretion rate was also increased with pronounced movements of legs.

Animals became sluggish and violent, color changes yellowish to dark. Increase in concentration media all these symptoms were observed. The mortality recorded 70% and 80% within 96 hrs.

Response Group No.10 and No.11:

In these groups animal showed hyper excitation, loss of locomotion and decrease in expire of oxygen. The animals became sluggish and inactive.

The mortality recorded in these groups is 90% and 100%. The mortality was high at 48h, 72h and 96 hours.

Table shows acute toxicity data with various (PPM) concentrations of endosulfan to which crab *Barytelphusa guerini* was exposed.

Observation made during lethal concentration exposure of freshwater female crab *Barytelphusa guerini*

Observations	Endosulfan
Response against pollutant	In endosulfan crabs show immediate excitation. Try to move come out of aquarium.
Activity of mouth parts	Quick and continuous movement of mouth parts, before 24h, but after 24h activity slows down. Bubbles out the air with a sound.
Activity of eye lead	Crabs exposed in Endosulfan eye stalk always excited movement but after two days they always closed. They open eyes slowly by striking any disturbance.
Activity of chelate legs	Chelate legs always upward position, after 48h they slow down, not in excited mode.
Position of crabs in aquarium	When crabs exposed in endosulfan they scattered from one another. After 48h they gathered / come in groups. These died at the middle part of aquarium.
Locomotary Activity	Uneasy normal position later became abnormal in Locomotion.
Balance equilibrium and coordination	Almost total loss of coordination in first few hours only. It was high at 72 & 96h.
Attacking excitement	In endosulfan crabs attacking excitement within 24h. After 48h there attacking excitement slow down. After 48h crabs show imbalanced attacking.
Offence and defense	Offensive but after few hours could not attack due to un-coordinated movement
Food & Feeding	In endosulfan crabs take very fast food within 36 hrs. Feeding slowly after 48 hrs.

DISCUSSION

Organochlorine insecticides are neurotoxicant, which act directly on excitable membranes and thereby interfere with membrane ionic conductance in target organisms.In the present report irregular movements and impairment of locomotion and weak response to external stimuli and final paralysis. Some of the effects observed which are indicative of the influence of endosulfan on nervous system [11].

Disorders in the central nervous system could affect the locomotors ability of crab. Endosulfan was found in induce aggressive behavior in rats [1, 3]. The principle symptoms of endosulfan poisoning were hyperexcitability, tremors and convulsions in Cat [11]. These were more intense from 15 min. to 1h, mild up to 2 hrs and had subsided after 4h of endosulfan treatment. Snapping of mandibles, regurgitating mouth was noticed in the crabs to endosulfan exposure. Similar observations were noticed in crabs during fenvalerate injection [17,14] have observed that the crab, *P. jacquemontii* are immediately stupefied after exposure to greater concentration of pollutants and remain stationary for some time, then move slowly and later on vigorously. They also observed that the crabs come to rest after a short period but continue beating their limbs. [12] Have reported that Kelthane affects feeding, moulting and motor cycle of grass shrimps, *Crangon franciscorusm*.

In the present study a progressive deteriorated feeding response was observed in the crab *Barytelphusa guerini* during endosulfan intoxication. [5] Reported ineffective feeding and un-coordinated movements in field crab *O. senex senex* exposed to sumithion. This reflects the effects of Ach accumulation at nerve endings, thus disrupting the synaptic transmission of nerve impulses from one neuron to another. A decreased intake of food in the fish, *C. carpio* to methyl parathion intoxication was reported by [15] and in the field mouse, *Mus booduga* to BHC treatment [10]. Dark fluid exuded out from the mouth of the crab to endosulfan intoxication. Dark frothing fluid exuding from the mouth of the crab, *O. senex senex* was observed during sumithion intoxication [5].Sumithion exposure causes morphological changes, such as swelling of clitellum region in earthworm, *L. mauritii* [6], and mucous secretion oozing out from the foot, decreased locomotion and feeding in the freshwater snail *P. globosa* [21].

When dissected, haemorrhage was observed in the form of tearing off the tissues in the crab and also coagulation film appeared on the whole of mantle and the interior visceral parts. Hemorrhages were observed at the bases of dorsal and ventral fins in *C. carpio* to methyl parathion treatment [15]. Formation of coagulation film and the color change of gill lamellae from red to pale red were observed in *T. mossambica* to fenvalerate [18] and *C. carpio* to methyl parathion [15] intoxication. Whatever may be the nature of pesticide compound more or less similar behavioral symptoms were noticed in different animal groups [13, 16, 9, 18].

The morphological and behavioral changes exhibited by the crab can taken as useful parameter in assessing the extent of pollution caused by pesticides, because the crab serves as a bio-indicator of aquatic pollution.

Control crabs behaved normally in the sense that they are very active and the movements are well coordinated. They are alert and at the slightest possible disturbance scuttle fast indicating an escape reaction. They exhibited a tendency to retreat when human finger was brought close to them. They react aggressively by extending lifting the chelate legs.

On exposure of under sublethal concentration the crabs responded snapping of mandibular and regurgitating of the mouth was observed. Limb movement was arrested after sometime and the animal reached a state of flaccid paralysis. Locking of the pedipalps with one another and elevated posture on the tips of walking legs was also observed.

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