Biological Forum — An International Journal, **4**(1): 18-22(2012)

ISSN No. (Print) : 0975-1130
ISSN No. (Online) : 2249-3239

Behavioral Responses of Freshwater Snail, *Viviparus bengalensis* to Plant Toxin in Fruits of *Acacia sinuate*

Jini Deshmane

Department of Zoology, Smt. K.W. College, Sangli, (MS)

(Received 23 November, 2011, Accepted 25 January 2012)

ABSTRACT : The aquatic animals are very sensitive to slight change in their surrounding environment due to which their normal behavior get changed. Visually observed behavioral pattern of snails exposed to plant toxin in fruits of *Acacia sinuate* were categorized into six types: 1. Protective responses, 2. Tentacle movement, 3. Foot movement and mucus secretion, 4. Responses to external stimuli, 5. Mucus secretion of gills, 6. Courtship behavior.

Keywords : *Viviparous bengalensis*, plant toxin, behavior, *Acacia sinuate.*

INTRODUCTION

Any change in surrounding evokes abnormality in an animal's behavior. Therefore, behavior of an animal is its reaction to the surrounding environment. Aquatic animals are very sensitive to slight change in their surrounding environment due to which their normal behavior gets changed. Nagarajah *et al*. (1985) noticed the behavioral changes in some intertidal mollusks after exposure to water soluble fraction of diesel. Compbell *et al*. (2000) reported that aluminum and silicilic acid in environment had changed the behavior of *Lymnaea stagnalis* where as mercury and mercurial salts had changed the behavior of *M. articulata* (Saliba and Vella, 1977) and *V. bengalensis* (Muley and Mane, 1988) respectively. To deal with environmental changes and to maximize the benefits, organisms evolve a complex set of mechanisms, which are seen externally by their behaviors. One can access toxicological nature of its surrounding with the help of behavior of animal (Flarov and Konar, 1974). Akarte and Mane (1988) had reported that, the bivalve molluscs exposed to different test concentrations of folithion in different seasons and it was seen that the condition of shell valve movement, mucus secretion and appearance of excreta was differed from season to season and species to species.

The survey of literature indicated that the behavior of the gastropods, snails and slugs were changed due to toxic compounds including pesticides, metals, phenolic compounds and oils in the surrounding medium. The behavior of land snail, *Helix aspersa* was changed due to application of some organophosphorus compounds (Rorke et al, 1974). The work is scanty in concern with effect of plant toxins on molluscs. Hence the present investigation was undertaken to find out the behavioral changes, if any, in freshwater snails, *V. bengalensis* induced due to plant toxin from *Acacia sinuate*.

MATERIAL AND METHODS

For the present study the animal selected was locally, readily available freshwater snail, *V. bengalensis*. The snails were exposed to fruit extract from *Acacia sinuate* to study the behavioral changes.

The pre-acclimated snails to the laboratory condition were having same size (average length 2.5 ± 1 cm) and equal weight (average weight 3.5 ± 1 gms) were selected for experiment. The snails were exposed to low concentrations (i.e. 60 and 120 ppm) and higher concentrations (i.e. 240 and 480) of plant toxin for 0 hr. to 96 hrs. After exposure to different concentrations of plant toxin, visually observed behavioral responses were recorded and categorized into six types: 1. Protective behavior, 2. Tentacle movements, 3. Foot movements and secretion of mucus, 4. Responses to external stimuli, 5. Mucus secretion on gills / ctenidium, 6. Courtship behavior.

RESULTS

Normally, snails in control group creeping in trough from bottom to surface with the help of foot. They mostly stick to the trough at the surface edge of water. The to and fro radular movement was seen. They rasped food plants by module. Their tentacles were protruded out and moved like whip side to side and front to back. They inhaled water by left nuchal lobe. They showed very quick protective response, (like dragging of body inside shell, excreta discharge, discharge of young ones, eggs, embryos, etc.). There was tentacle movement and foot movement also. They secreted slight mucus on foot. They reacted very quickly in response to external stimuli. They showed very well courting behavior.

In control group snails, behavioral pattern was not so distinct. Observations were made from 0 hrs. Upto 96 hrs. More or less all snails behaved normally as they behaved in their natural environment.

Observations of snails are recorded in table no: 1 to 5.

Table 1 : Behavioral observations of control snails, *V. bengalensis.*

Behavioral response	Control snails			
	24 hours	48 hours	72 hours	96 hours
Protective responses	They were creeping in trough and moving.	Mostly attach to the trought at the water surface edge.	Same	Same
Tentacle movement	The tentacle moved like whip slowly.	Same	Same	Same
Foot movement mucus	The peristaltic wave motions were seen and little mucus was secreted.	Same	Same	Same
Responses to external stimuli	Quick and sharp	Same	Same	Same
Mucus secretion by gills	No whitish secretion by gills.	Same	Same	Same
Courtship behavior	Creeping in pairs touches foot, tentacle to each other's.	Came closer to each other and touches each other.	Same	Same

Table 2 : Behavioral observations of *V. bengalensis* during intoxication of plant toxin from. *Acacia sinuate* in lower concentration i.e. at 60 ppm.

Behavioral response	Duration of intoxication in plant toxin from *Acacia sinuate*			
	24 hours	48 hours	72 hours	96 hours
Protective responses	They drag their body inside shell and close their mouth by operculum.	They were creping in troughs very slowly.	They creep in trough slowly, but to avoid water contact they closed their shells frequently.	They creep in trough slowly.
Tentacle movement	Quite normal	It was little fast.	Reduced to normal	Reduced
Foot movement mucus secretion	Foot movement was increased and also little increase in secretion of mucus.	Again movement was slightly increased slight increase in secretion.	Movement goes slow down with increase in secretion.	Slow down and no much increase in secretion.
Responses to external stimuli	Quick and sharp.	Quick and sharp.	Weakened	Weakened
Mucus secretion by gills	No whhitish secretion by gills	Same	Same	Same
Courtship behavior	Snails were creeping in pairs	Snails showed well courtship behavioral pattern	Showed normal behavior.	Quite normal

Table 3 : Behavioral observations of *V. bengalensis* during intoxication of plant toxin from *Acacia sinuate* in lower concentration i.e. at 120 ppm.

Behavioral response	Duration of intoxication in plant toxin from *Acacia sinuate*			
	24 hours	48 hours	72 hours	96 hours
Protective responses	The snails drag their bodies inside shell and close their mouth by operculum for long time.	No much change occurred.	Creeping in trough at bottom slowly.	Creeping in trough at bottom slowly.
Tentacle movement	Little increase was seen.	Still it was increasing.	Reduced.	Reduced very much.
Foot movement mucus secretion	Increase in peristaltic waves and mucus was secreted little more.	Still both were increased.	Movement was reduced but increase in mucus secretion.	Peristaltic waves affected and slowed down mucus secretion increased.

Responses to	Quick and sharp.	Quick and sharp.	Poor	Very Poor.
external stimuli Mucus secretion by gills	No much change occurred.	Little mucus was secreted.	Whitish mucus was secreted.	Whitish mucus was secreted.
Courtship behavior	Snails were moving in pairs	They were shown courting behavioral pattern	They still shown courting behavior	They liked to be isolated one.

Table 4: Behavioral observations of *V. bengalensis* during intoxication of plant toxin from *Acacia sinuate* in higher concentration i.e. at 240 ppm.

Behavioral response	Duration of intoxication in plant toxin from *Acacia sinuate*			
	24 hours	48 hours	72 hours	96 hours
Protective responses	Young once are discharged with excreta	Excreta discharge was increase still young ones were discharged.	Some were creeping slowly.	Movement of creeping snails was reduced very much.
Tentacle movement	Increased.	Increased.	Reduced.	Very much reduced.
Foot movement mucus secretion	Increase in foot movement and mucus secretion was seen.	Mucus secretion was increase with peristaltic movement	Movement was affected and slowed down but thick mucus was secreted.	Thick mucus came out of mouth of same snails.
Responses to external stimuli	Sharp.	Poor.	Very poor.	Very very poor.
Mucus secretion by gills	Little mucus was secreted.	Thick whitish mucus was secreted.	Thick and whitish mucus was secreted and came out of mouth.	Whitish thick mucus came out of mouth of snail.
Courtship behavior	Some snails creep in pairs	No much change had occurred.	They become isolated.	No courtship behavior was seen.

Table No. 5:- Behavioral observations of *V. bengalensis* during intoxication of plant toxin from *Acacia sinuate* in higher concentration i.e. at 480 ppm.

Behavioral response	Duration of intoxication in plant toxin from *Acacia sinuate*			
	24 hours	48 hours	72 hours	96 hours
Protective responses	Young once were discharged and excreta also discharged.	Snails tried to avoid toxic environment by dragging their bodies inside shell.	Decrease in excreta discharge. Snails were creeping very very slowly.	All snails were died.
Tentacle movement	Fast.	Rapid.	Reduced.	—
Foot movement mucus secretion	Slight increase in mucus secretion and foot movement.	Foot movement was fastened. More increase in mucus secretion.	Reduced foot movement and the thick mucus came out of snail's mouth.	—
Responses to external stimuli	Quick.	Quick.	Weakened very much.	—
Mucus secretion by gills	Slight secretion of mucus was seen.	Whitish secretion of mucus was seen.	Whitish thick mucus was secreted which came out of snails.	—
Courtship behavior	Some snails showed this behavior.	Snails like to be isolated one.	No courtship behavior was seen.	—

Visually observed behavior of the snails, *V. bengalensis* was categorized into six types :-1. Protective behavior, 2. Tentacular movement, 3. Foot movement and secretion of mucus, 4. Responses to external stimuli, 5. Mucus secretion by gills 6. Courtship behavior.

DISCUSSION

The normal behavior of the snail was changed when exposed to plant toxin from fruits of *Acacia sinuate*. These changes were time dependent. It was also found that irrespective of concentrations of plant toxins, behavior of snail at 24 hrs. was quite different from that of 48 hrs. and behavior of snails at 48 hrs. was different from that of 72 hrs. and so on. In intoxicated snails movement in lower doses of plant toxin was changed and snails tried to avoid direct contact of plant toxin. Therefore, they took shelter in the shell and closed their mouth by operculum. Such protective response was dose and time dependent. Muley and Mane (1988) have also observed such behavioral changes in this snail due to toxicity of mercury salts.

The movements of tentacles were fastened initially at lower concentrations of plant toxin in fruits of *A. sinuate*. But in higher concentration of this toxin these movements were affected and become slowed down from 72 hrs in 480 ppm lulled due to toxic effect of this plant toxin.

The secretion of mucus by foot is the normal phenomenon of snails while creeping on substratum. Such mucus secretion by foot was also observed in this aquatic snail *V. bengalensis*. But interestingly it was noticed the quantitative and qualitative changes in mucus secretion during intoxication of this plant toxin in this snails. At lower concentration little, colorless mucus was secreted by these organs. But with increase in concentration of plant toxin, the secretion of mucus was also increased. The foot secretes thick and large amount of mucus while gills secrete more whitish mucus, which comes out of mouth in higher concentrations of plant toxins with increasing time interval. Gokhale and Mane (1990) found there was diapedesis started from 12 hrs. in fluoride exposed animals in form of white coagulated matter with mucus. The change in quantity and quality might have been to conteract the toxic chemical reactions in the cells of contact organs. Thus, it might have involved in detoxification process of the organism. But as the thickness and quantity of the mucus increased, there seemed a load on the respiration of the snails. Hence voluminous thick secretions of mucus on the ctenidium near mouth may cause the death of snails at 240 ppm from 72 hrs. intoxication. Such type of more secretion of mucus on foot, proboscis and ctenidium in *V. Bengalensis* due to intoxication by folithion and lebaycid was observed by Muley and Mane (1988).

Initially behavioral responses were quick and sharp. But during intoxication such responses were delayed and weakened. The responses were dependent on the concentration of plant toxin used and duration of intoxication. Akarte and Mane (1988) had reported that, the mollusks exposed to different test concentration in different months of season showed the condition of shell valve movement, mucus secretion and appearance of excreta differed from season to season and from species to species. When bivalves were dead due to intoxication, the parts of body comes out of shell with swollen foot. In present investigation it was seen that at 72 hrs. in 240 ppm and at72 and 96 hrs in 480 ppm, some snails were dead and some body parts of that snails also came out of shell with swollen foot.

Therefore, in present study it was seen that the responses at 24 hrs, 48 hrs, 72 hrs and 96 hrs were different. At higher doses snails didn't respond, it might be due to intoxication effect on central nervous system which get affected and snails were die off. In present study, these snails due to closing of their shells tolerated the plant toxin at all concentrations. With lapse of time as the toxic water slowly penetrated into the visceral body due to frequent opening and this may be the cause of swelling of foot and visceral part and also physiological damage of the tissues. From present investigation it may be concluded that the plant toxins from *A. sinuate* affects the central nervous system which leads to abnormal behavior of snails, *V. bengalensis*.

ACKNOWLEGEMENTS

Authors are thankful to Head, Zoology Department And Shivaji University, Kolhapur for providing facilities to complete this work

REFERENCES

Akarte, S.R. And Mane, U.H. (1988). Toxicity of folithion to three freshwater bivalve mollusks in different seasons. *J. Envt. Biol.* **9**, 27.

Compbell, M.M., White, K.K., Jugdaohsingh, R., Powell-jonathan, J., Mc Crohan Catherine, R. (2000). Effect of aluminum and silicic acid on the behavior of the freshwater snail, *L. stagnalis*. *Canadian Journal of Fisheries and Aquatic Sciences (Print)*.**57**, (6):1151-1159.

Flarov, P.K. And Konar, S.K. (1974). Area toxicity on the freshwater teleost. *Gidrobia, Zn*, **10**: 114-120.

Gokhale, A.A. And Mane, U.H. (1990). Acute fluoride toxicity to the freshwater bivalve molluscs, *Lamellidens marginalis* (Lam) *Ind. J. Inv. Zool. And Aqua. Biol.* **2**, (1): 11-14.

Gupta, S. (1995). Uptake of lead acetate by freshwater molluscs *L. acuminata*. *Indian J. Environ. And Toxicol*., **5**, (2), 63-64.

Muley, D.V. And Mane, U.H. (1988). Seasonal variations in the toxicity of folithion and lebaycid to a freshwater gastropod, *V. bengalensis* (Lam) from Godavari river, M. S. India. Ad. *Biosci*. **1**, (7), 37-46.

Muley, D.V. And Mane, U.H. (1988). Survival and behavior of freshwater gastropod *V. bengalensis* (Lam) after exposure to mercurial salts in different seasons. *Trop. Ecol*. **29**: 71-78.

Nagarajah, N.N., A.J. Antonette Sophia And T. Bakasubramanian (1985). Behavior of some intertidal mollusks exposed to water-soluble fractions of diesel. *Mar. Pollu. Bull.* **16** (7), 167-271.

Rorke, M.A., Gardner, D.R. And Greenhalgh, R. (1974). Lethality and behavioral symptoms produced by some organophosphorus compounds in the *Helix aspersa*. *Bull. Environ. Contam. Toxicol*., **11**, 417-424.

Saliba, L. J. And M.g. Vella (1977). Effects of mercury on the behavior and oxygen consumption of *Monodonta articulata*. *Mar. Biol. (Berl.),* **43** (3): 277-282.