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Effect of Cartap hydrochloride and Imidacloprid on biochemical parameters of *Cerastus moussonianus*

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ABSTRACT

Land snails are major pests of various crops in India and their control primarily depends on the use of molluscicides to limit the effect of these pests below damaging level. Synthetic molluscicides are considered to be the most effective for the control of terrestrial gastropods. The present study deals with the biochemical effect of two pesticides namely, Cartap hydrochloride and Imidacloprid on Albumin (ALB), Alkaline phosphatase (ALP), Glucose (GLU), Total Proteins (TP) and Uric acid (UA) to know their toxicity in land snail *C. moussonianus*. LC10 was taken based on the LC50 concentration 0.08 ppm and 0.11ppm of both Cartap hydrochloride (0.41ppm) and Imidacloprid (0.54ppm) respectively for study. The findings conclude that Cartap hydrochloride and Imidacloprid show significant decrease in ALB, ALK, GLU and TP whereas slightly increase in UA content was noticed. This reveals that Cartap hydrochloride and Imidacloprid may be used for control land snail *C. moussonianus.*

Keywords: *Cerastus moussonianus,* Cartap hydrochloride, Imidacloprid, Albumin, Alkaline Phosphatase, Glucose, Total Protein, Uric Acid.

INTRODUCTION

Control of land snails on different crops is heavily dependent on the use of molluscicides to minimize the effect of these pests below damaging level. Synthetic molluscicides are the most effective measures available at present for the control of terrestrial gastropods (Heiba, *et al.*, 2002; Genena, 2003; Abd-El-Ail, 2004; Ismail, *et al.*, 2005; Zedan, *et al.*, 2006 and Genena and Mostafa, 2008). Both carbamate and metaldehyde are successfully used in Egypt as well as in many other countries for the control of land snails (Heiba, *et al.*, 2002). Bait formulation of molluscicides is the most effective application method in the field for controlling terrestrial gastropods rather than any other technique (Kassem, 2004).

Very little information is available on the significance of albumin (ALB) in the snails. Albumin is used as positive (with enzyme) and negative control (without enzyme) in both gastric and duodenal digestion (Dreon, *et al.*, 2010).

Alkaline phosphatase (ALP) plays an important role in the transport of metabolites across the membrane (Vorbrodt, 1959). ALP plays a critical role in shell formation, protein synthesis (Pilo, *et al.*, 1972), other secretary activities (Ibrahim, *et al.*, 1974) and its inhibition may result in the reduction of protein level (Singh and Singh, 1995 and Singh and Agrawal, 1989) in gastropods. Due to the intoxication of pesticides most of the developmental stages showed the gradual decline not only in the number of protein fractions but also showed gradual decline in the intensities of some protein fractions as reported

by Gupta and Bhide (2001 and 2004) in *Lymnaea stagnalis* after Nuvan treatment.

Upon the depletion of the polysaccharide stores, net protein catabolism occurred. Also some observations came in focus that the snail which stores the polysaccharide more prior to estivation can survive for long time (Rees and Hand, 1993). So, the polysaccharide (storage form of glucose) is essential for the survival of snails.

Protein is the main component which plays major role in the progressive development as investigated by Holmes (1900), Ranjah (1942), Yonge, *et al.* (1964), Hyman (1967), Barth and Broshears (1982) and Goel (1999). Lipids constitute a restricted energy fuel which is proposed for tissues if necessary after carbohydrates, but proteins are mainly involved in the architecture of the cell. During chronic periods of stress, they are also a source of energy (Padmaja and Rao, 1994).

In other organisms displaying elevated tissue contents of urea, methylamine compounds, which can offset the disruptive effects of urea, are commonly accumulated. It is not known whether methylamines accumulate during estivation in snails with high urea. If not then urea could reach toxic levels and be a factor limiting the duration of estivation (Rees and Hand, 1993).

The aim of this work was to determine the biochemical effect of Cartap hydrochloride and Imidacloprid on the Albumin (ALB), Alkaline phosphatase (ALP), Glucose (GLU), Total Proteins (TP) and Uric acid (UA) with the respect to toxicity and mode of action of these pesticides in the land snail *Cerastus moussonianus*.

MATERIALS AND METHODS

Five times less concentration of LC_{50} concentration (0.08ppm and 0.11ppm) of Cartap hydrochloride (0.41ppm) and Imidacloprid (0.54ppm) was taken for treating the laboratory acclimatized test animal by spraying it on a food given to snail after starving it for 24hrs. The treatment period was 7 days and 14 days the re-after food (untreated) was provided to recover them for next 7 days of post treatment. After this tissue samples were taken for biochemical observations after 7 days and 14 days for treatment and recovery effect of snails.

Sample preparation:
After 7 days of treatment followed by 7 days of recovery, tested snails were taken. Foot and hepatopancreas tissues were dissected out and homogenized in distilled water (50mg/ml). The homogenates were centrifuged at 8000 rpm for 15 min. at 5ºC in refrigerated centrifuge. The supernatants were kept in a deep freezer (20^0C) till use to determine the activities of ALB, ALP, GLU, TP and UA.

Prepared homogenate was then processed as per the procedure according to the respective parameters. Readings were taken by using the Quantiamate Turbidimetry Chemistry, Auto Analyzer for biochemical tests of Tulip Diagnostics (P) Ltd. Goa, India.

RESULTS AND DISCUSSION

The significant change in the content of ALB, ALP, GLU, TP and UA was observed and shown in the Table 1 and Graph 1-5.

Mohamed *et al.* (2012) found that the snails treated with LC_{10} and LC_{25} of Basudin, Selecron and Bayuscide and 100 and 250 ppm of Colchicine indicated a marked decrement in the albumin concentration in comparison with the control group. Corroborates the present study where significant decrease in the content of albumin was noted in the foot and hepatopancreas.

Significant ($P<0.05$) recovery in alkaline phosphatase activity was observed in the nervous tissue of *L. acuminata* earlier fed on 60% of 96h LC_{50} of eugenol bait (20% of control), when discontinued for the next 72h (34.66% of control), the inhibition in ALP and AChE activities may be due to the direct interference of these active molluscicidal with enzyme (Kumar, *et al.*, 2012). The combination of amino acids

Table-1. Changes observed in foot and hepatopancreas

Tissue	Pesticide	Set	ALB	ALP	GLU	TP	UA
Foot		Control	11.6±0.04	3.42±0.07	0.15±0.009	0.23±0.01	0.17±0.01
	Cartap hydrochloride	Treated	7.44±0.05 ***	2.34±0.1 ***	0.10±0.005 ***	0.11±0.03 **	0.20±0.006 ***
		Recovery	8.7±0.45 **	2.68±0.08 ***	0.13±0.007 ***	0.12±0.04 **	0.18±0.008 ***
	Imidacloprid	Treated	7.44±0.35 **	1.88±0.17 **	0.13±0.01 ***	0.16±0.02 ***	0.19±0.02 ***
		Recovery	8.58±0.48 *	2.32±0.15 ***	0.14±0.003 ***	0.17±0.01 ***	0.18±0.04 **
Hepatopancreas		Control	12.2±0.16	4.1±0.15	0.22±0.005	0.24±0.02	0.21±0.07
	Cartap Hydrochloride	Treated	7.68±0.56 *	3.32±0.12 **	0.14±0.01 ***	0.14±0.01 ***	0.25±0.04 **
		Recovery	10.9±0.6 **	3.74±0.09 ***	0.16±0.01 ***	0.15±0.001 ***	0.23±0.05 **
	Imidacloprid	Treated	8.08±0.37 **	3.42±0.08 ***	0.17±0.009 ***	0.17±0.006 ***	0.25±0.03 ***
		Recovery	10.9±0.67 *	3.8±0.06 ***	0.18±0.003 ***	0.18±0.02 **	0.22±0.05 **

Note: Cartap hydrochloride (LC_{10}) and Imidacloprid (LC_{10}) were used and found significantly different from control at *p<0.05, **p<0.01 and ***p<0.001.

such as valine, aspartic acid, lysine and with active molluscicides, eugenol, ferulic acid, umbelliferone and limonene, in bait formulations caused maximum inhibition in ALP (23.57% of control) in nervous tissue of *Lymnaea acuminata* exposed to 60% of 96h LC_{50} of ferulic acid and umbelliferone, respectively and LC_{25} of Basudin (Kumar, *et al.*, 2012). Mohamed, *et al.* (2012) found that the snails treated with LC_{10} of Selecron and Bayuscide indicated elevation in the alkaline phosphatase.

In present study the significant decrease in the content of alkaline phosphatase was noticed in the foot and hepatopancreas. These results are in agreement with the results of Kumar, *et al.* (2012) and contrary to Mohamed, *et al.* (2012).

Mello-Silva, *et al.* (2006) observed a significant elevation in the glucose content of hemolymph of *B. glabrata* exposed to *E. splendens* latex which was not observed at the other concentrations used. Hamlet, *et al.* (2012), noted the effects of thiamethoxam insecticide commercial formulation on hepatopancreatic total carbohydrates of *Helix aspersa* were estimated after six weeks of treatment and noted that at lower concentration the content of total carbohydrates did not reduced significantly whereas reduced significantly at higher concentration of thiamethoxam.

In present study glucose content significantly decreased in foot and hepatopancreas and recovered significantly after seven days post treatment. These results are in agreement with that of Grara, *et al.*, 2012 and Hamlet, *et al.*, 2012.

In mammals (rabbit) oral administration of Basudin reduced the total protein content levels (Salih, 2010). Singh and Singh (2010) observed the effect of aqueous extract of bark and leaf of *Euphorbia pulcherijma* plant on freshwater snail *Lymnaea acuminata* the total protein levels in hepatopancreas and ovotestis tissues were reduced following treatment with aqueous 40% of concentration of bark extracts. The effect of sublethal feeding of bait formulations containing molluscicidal component of *Ferula asafoetida* (ferulic acid, umbelliferone), *Syzygium aromaticum* (eugenol) and *Carum carvi* (limonene) on biochemical changes in the ovotestis of snail *Lymnaea acuminata* resulted significant decrease in protein levels Kumar, *et al.* (2011) while significant recovery in protein

Figure-1. Changes in ALB content

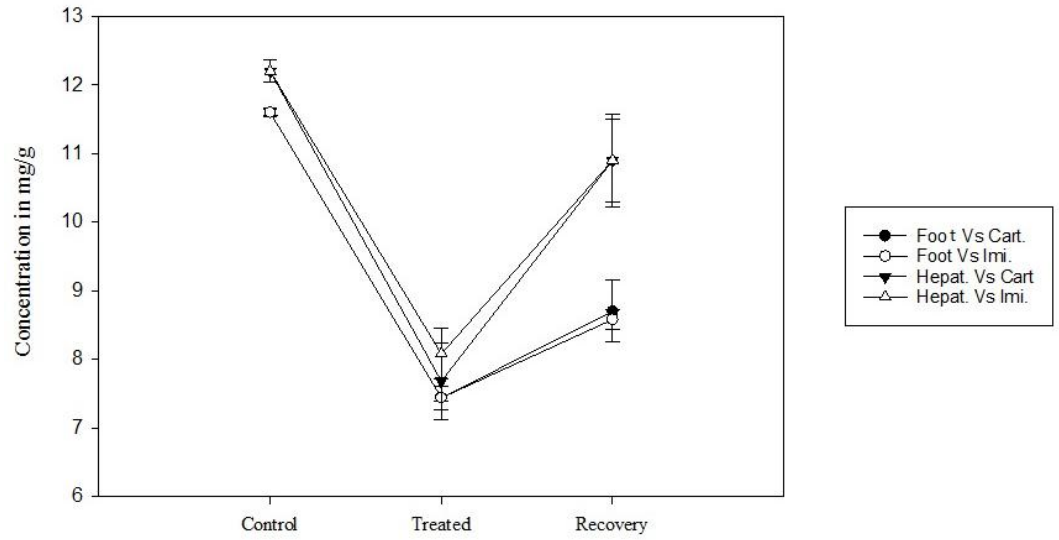
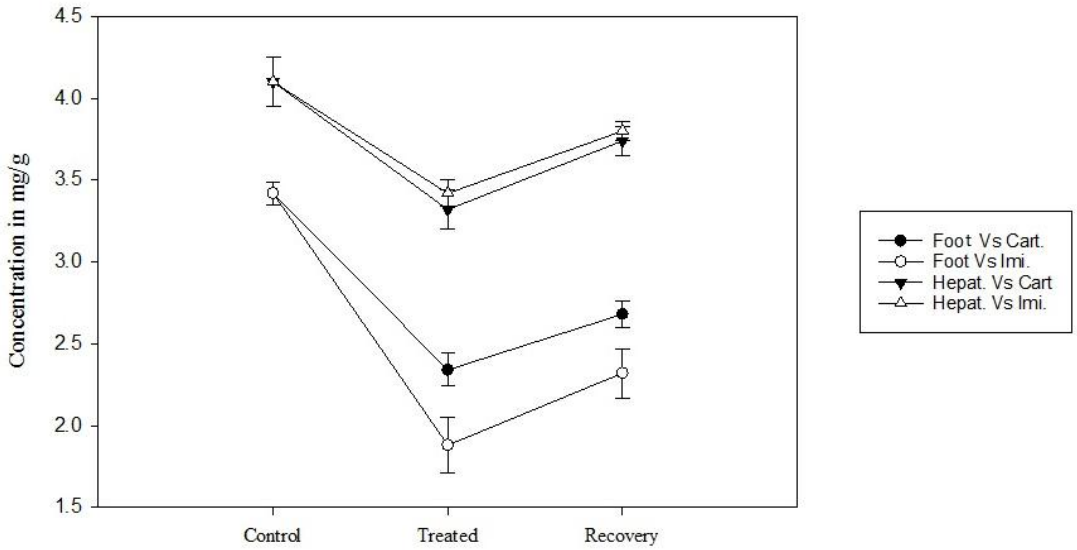


Figure-2. Changes in ALP content



level was observed in the ovotestis of *L. acuminata* 96h, when feeding was discontinued for the next 72h. A dose dependent decrease of total proteins and total lipids from 100 mg/L of thiamethoxam was noted in tissues of the treated snails when compared with the control (Hamlet, *et al.*, 2012). Mohamed, *et al.* (2012) found that the snails treated with LC_{10} and LC_{25} of Basudin, Selecron and Bayuscide indicated a marked decrement in the total protein concentration in comparison with the control group.

Present study shows that the total protein content are significantly decreased in foot and hepatopancreas and significantly recovered after 7 days of treatment corroborates with the results of Salih, 2010; Singh and Singh, 2010; Somaih et al 2014; Kumar, *et al.*, 2011; Mohamed, *et al.*, 2012 and Hamlet, *et al.*, 2012.

Rees and Hand (1993); Venkanna Lunavath and Estari Mamidala (2014) observed that over 7 months of estivation resulted increase in uric acid and similarly observed by Mello-Silva, *et al.* (2006). In present study uric acid content are significantly increased in foot and hepatopancreas and recovery was observed after 7 days of treatment.

Figure-3. Changes in GLU content

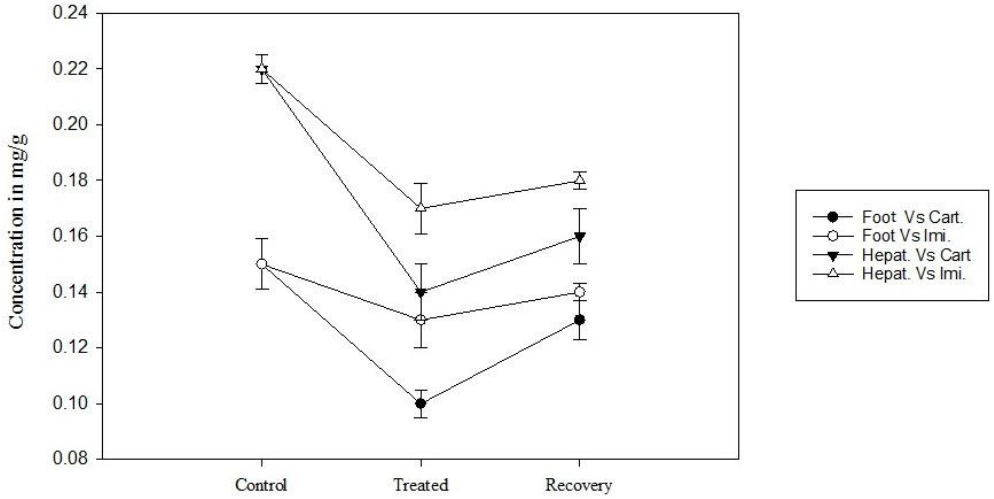


Figure-4. Changes in TP content

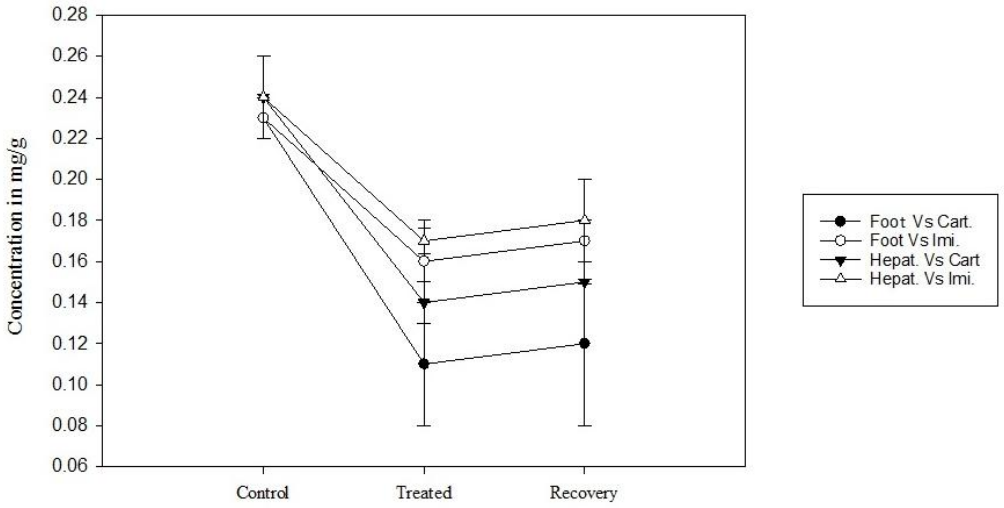
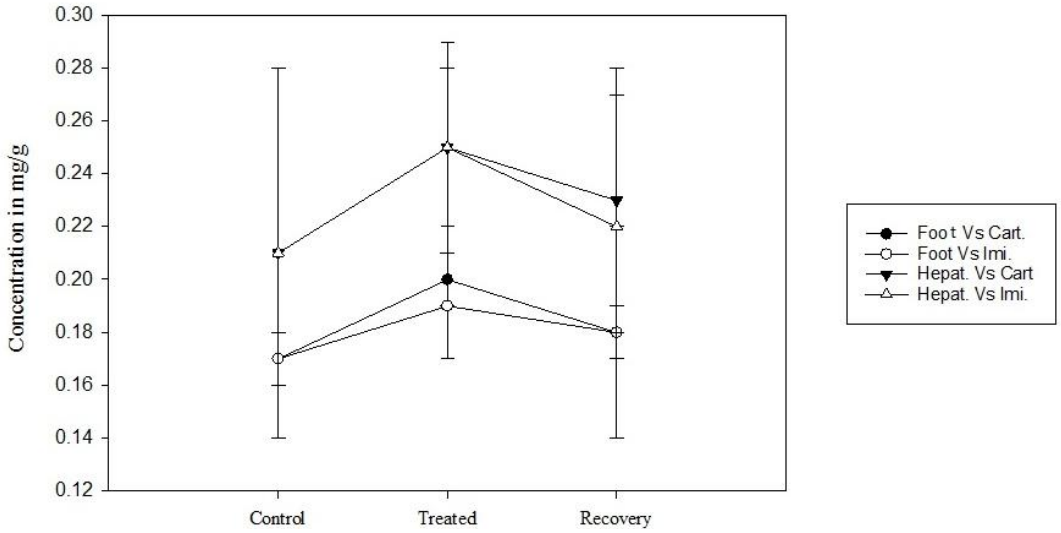


Figure-5. Changes in UA content



CONCLUSION

Cartap hydrochloride and Imidacloprid at lowest concentration i.e. ($LC_{50/5}$) (0.41ppm) and ($LC_{50/5}$) (0.54ppm) respectively show the significant changes in the ALB, ALP, GLU, TP and UA of foot and hepatopancreas of the pest snail *C. moussonianus*.

The present study concludes that the pesticides Cartap hydrochloride and Imidacloprid after treatment show significant decrease in ALB, ALP, GLU and TP while slightly increase in UA content in land snail *C. moussonianus*. Thus, can help to reduce the population of land snail *C. moussonianus* and damage caused thereby.

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