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Effect of Castor plant extract on *Corcyra cephalonica*

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ABSTRACT

Corcyra cephalonica, the food grain pests were exposed to Castor leaf and fruit extracts for toxicity evaluation at 24, 48, 72 and 96 hrs using percent and probit kill method(Finney-1971). The IIIrd instar larvae were exposed to the sub-lethal doses of 150, 300 and 450 mg of leaf and fruit extracts for 10 days and their total protein and carbohydrates were estimated. The Protein and Carbohydrates were found decreased followed by delayed metamorphosis and deformed adults emerged from the pupae.

Introduction

Corcera cephalonica is a serious pest on stored food grains, belongs to Lepidoptera. Its distribution is worldwide. The Larval stages are more destructive and feed on rice, cocoa, biscuits, pearl millets and sorghum seeds. The larvae no doubt feed on food grains and other eatables, but above all they contaminate food by secreting silken threads that web together food particles, dust and frass.

In recent years, the use of synthetic pesticides for pest management has become highly controversial. These insecticides cause extensive environmental hazards since they accumulate themselves at carious concentrations in different levels of ecosystem, and have lead to the development of pesticide resistance in the insects against the insecticides.

To overcome these problems, attempts were made to develop alternate methods of pest control. Such control measures include the use of cultural practices, biological control, use of anti feedants, hormonal insecticides, plant extracts., etc. (Alloety & Azalekor, 2000).

In the present investigation, an attempt has been made to control the rice pest by using the plant extract of *Ricinus communis* the Castor.

Castor plant is known to contain ricin which is a toxin and is known to give natural protection from insect pests such as Aphids. Ricin has been investigated for its potential use as an insecticide. Castor plant also contains undecylenic acid – which is a natural fungicide. Ricin is poisonous if inhaled, injected or ingested, acting as a toxin by inhibition of protein synthesis. It is resistant, but not impervious, to digestion by peptidases. On ingestion, the effect of ricin is largely restricted to the gastrointestinal tract where it may cause mucosal injuries.

Materials and Methods:

Eggs of *Corcera cephalonica* were collected from (VSI) Vasantrao Sugar Institute located in Manjri, Pune and were reared on broken(half crushed) Jowar seeds free from any kind of contamination. Rectangular plastic containers were used for rearing the larvae, the mouth of the containers were tied with muslin cloth and kept for rearing in metallic rearing box.

Castor extracts were used to test the toxicity on larvae. The fruits and leaves of Castor plant were collected from in and around Pune. These were washed, shade dried and powdered separately to make tablets. 3rd instar larvae were used for the experimentation. 10 larvae were kept in each beaker containing 100 gm of Jowar to determine lethality at doses of Castor leaf and fruit extracts. Tiny holes were made on the polythene, covering the mouth of beakers for aeration. The LD_{50} for 24 hrs., 48 hrs., 72 hrs. and 96 hrs were determined by counting the number of deaths in the given doses.

Separate batches of larvae were maintained using the 3rd instar stage exposed to sub-lethal concentrations (300, 450 and 600 mg) of the Castor leaf and fruit extracts for another 10 days just before the pupation, the larvae were picked and subjected to biochemical analysis. The data was subjected to following statistical equation for arriving at LD_{50} values.

1. A graph was drawn between percent mortality and concentration of the Castor extract.
2. A graph was drawn between probit mortality and concentration of the castor extract.

Protein was estimated using Lowery et al.,(1971) method. Carbohydrates were estimated using anthrone reagent.

Results:

Toxicity evaluation was done by percent kill and probit kill mehod. 3rd instar (20 day old) larvae were exposed to different doses of Castor leaf and fruit extracts (tablets) to evaluate the results of LD 50 .(Table-I to IV and graph-I to IV). Effect of castor extract (both leaf & fruit) on protein and carbohydrate titers are reported in table- V toVIII and graphs V-A to VIII-A) respectively.

Metamorphic changes:

Metamorphic changes were observed in *C. cephalonica* exposed to castor leaf and fruit extracts. There were changes in

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eye colour and antennae of the exposed moths with deformed wings that were unable to fly.

Discussion

Plant products having considerable potential as insecticidal compounds are gaining tremendous importance in recent years. This holds good particularly for the management of stored products as these compounds are environmentally safe and often do not leave their residue in the stored food products meant for human consumption. Studies have shown that botanicals can be readily degradable. (Shadia Abd. El-Aziz,2011).

Efficacy, of various plant products have been reported by several authors against the stored grain (Pugazhvendan, K. et. Al. 2009). Fangnerng Hugant et. al. (2003) studied susceptibility of spinosad by *Corcera cephalonica*.

Active ingredients of leaves of Calotropis and Ipomea have been reported to inhibit some of the enzyme systems and subsequent mortality (Kuroyanagi et al., 1999; Padmavati and Reddi, 1999). Active ingredients of Ocimum has also been known to act as a reversible competitive inhibitor of acetyl cholinesterase (Ryan and Byrne, 1988) like azadirachtin, abundantly present in the neem seeds that has been shown to inhibit the release of prothoracicotropic hormones and allatropins (Banken and Stark, 1997), thereby affecting metamorphosis in insect Snehlata Shukla and S. K. Tiwari*(2011) , L. camara and C. inerme have shown biopesticidal property and interference with normal metabolic activities. C. limon turned out to be ineffective in producing such effect in C. cephalonica under the tested conditions. With the tested parameters L. camara and C. inerme have shown results which are strikingly similar to those of starvation. Morphological abnormalities observed during development also suggest the(JH)Juvenile hormone like activity of the plant components. It is not surprising to see such activity since many plants are reported to possess JH like activity which helps and protect them from insect infestation (Slama, 1969). However, the JH like activity of these plant components has to be experimentally proved before making any final conclusion and for this purpose the work is in progress in such direction Kiran Morya, Sujatha Pillai, Prabhudas Patel(2010).

In the present investigation, effect of toxicity was observed on rice moth. It was also observed that Castor fruit extract were more toxic as compared to leaf extract. This may be due to more concentration of ricin in fruits compared to other plant parts. It was observed that after certain concentration, percent mortality of the rice moth decreased with further increase in concentration. It is not known that if *C. cephalonica* is naturally immune to ricin or has gained tolerance to it due to long exposure of the larvae to the toxicants. The toxicant was able to hamper the carbohydrate metabolism. The percent change in total carbohydrate content was directly proportional to the concentration. But it showed negligible effect on protein metabolism.

Thus, it may be concluded that Castor leaf and fruit extract are toxic and are effective in killing the larvae and delaying their metamorphosis and also causing change at the level of genetics brining in mutations.

There is necessity to find exact effect of toxicant on the genetic material of the rice moth having undergone morphological changes during metamorphosis.

Table I

Percent kill of C.*cephalonica* exposed to leaf extract

CONCENTRATION OF CASTOR LEAF EXTRACT	24 hrs	48 hrs	72 hrs	96 hrs
	%KILL	%KILL	%KILL	% KILL
200	0	0	0	10
400	10	20	20	30
600	10	40	40	50
800	20	40	50	60
1000	20	40	60	70
1200	30	50	60	80
1400	40	60	40	80
1600	50	60	70	90

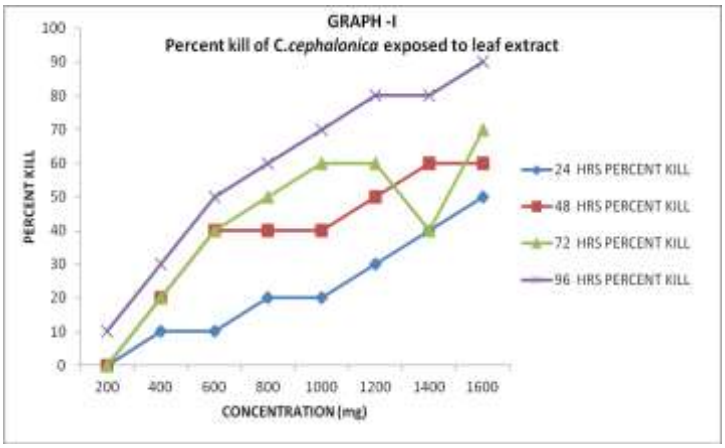


Table – II

Probit kill of C.*cephalonica* exposed to leaf extract

CONCENTRATION OF CASTOR LEAF EXTRACT	24 HRS	48 HRS	72 HRS	96 HRS
	PROBIT KILL	PROBIT KILL	PROBIT KILL	PROBIT KILL
200	0	0	0	3.72
400	3.72	4.1	4.10	4.48
600	3.72	4.75	4.75	5
800	4.10	4.75	5	5.52
1000	4.1	4.75	5.25	5.25
1200	4.48	5	5.25	5.52
1400	4.75	5.25	4.75	4.75
1600	5	5.25	5.52	6.28

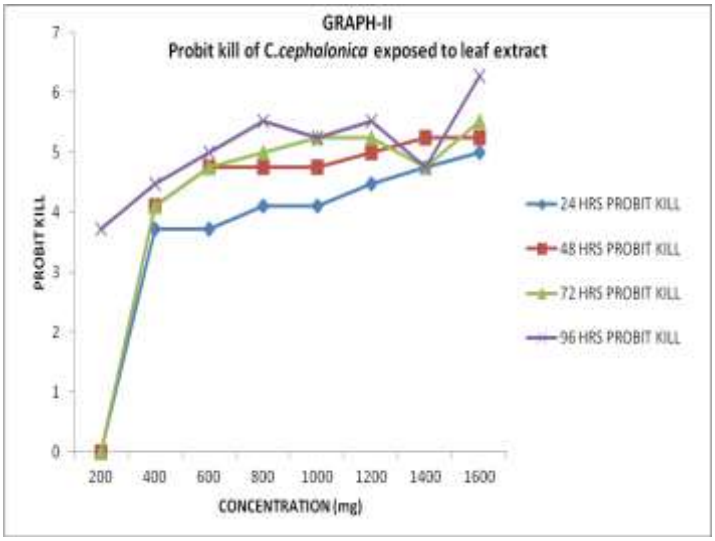


Table – III
Percent kill of C.*cephalonica* exposed to fruit extract

CONCENTRATION OF CASTOR FRUIT EXTRACT	24HRS	48 HRS	72 HRS	96 HRS
	%KILL	%KILL	%KILL	% KILL
200	0	10	10	20
400	10	20	20	30
600	10	40	40	50
800	20	40	50	60
1000	30	50	60	60
1200	40	60	60	60
1400	50	60	70	80
1600	10	70	70	70

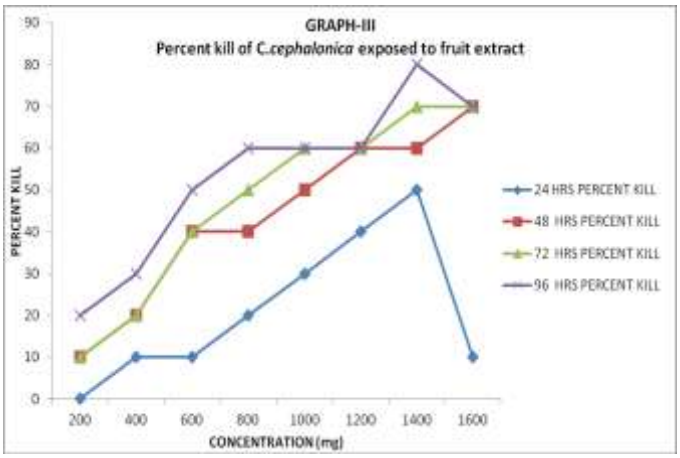


Table – IV
Probit kill of C.*cephalonica* exposed to fruit extract

CONCENTRATION OF CASTOR FRUIT EXTRACT	24 HRS	48 HRS	72 HRS	96 HRS
	PROBIT KILL	PROBIT KILL	PROBIT KILL	PROBIT KILL
200	0	3.72	3.72	4.10
400	3.72	4.10	4.10	4.48
600	3.72	4.75	4.75	5
800	4.10	4.75	5	5.25
1000	4.48	5	5.25	5.25
1200	4.75	5.25	5.25	5.25
1400	5	5.25	5.52	5.84
1600	3.72	5.52	5.52	5.52

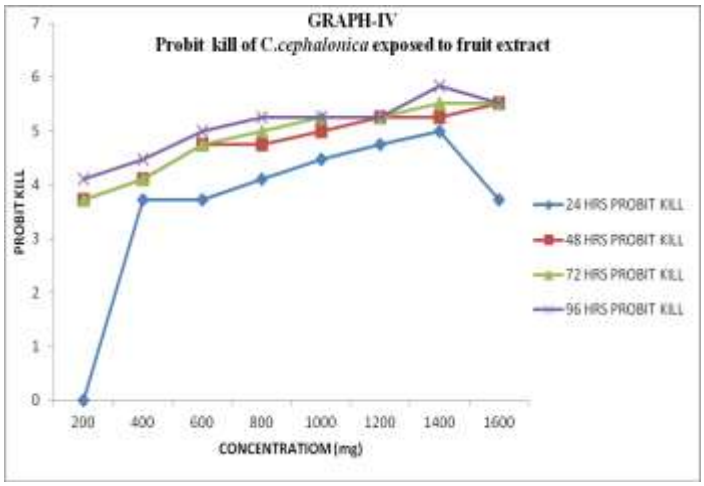
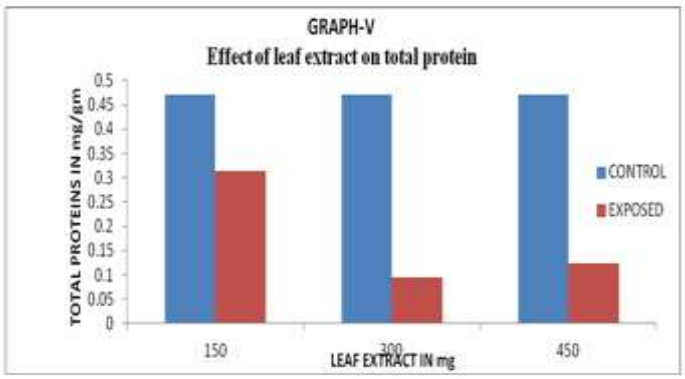


Table – V
Effect of leaf extract on total protein

CONCENTRATION OF CASTOR LEAF EXTRACT (mg)	150	300	450
TOTAL PROTEIN FOR CONTROL (mg/gm wet tissue)	0.471	0.471	0.471
TOTAL PROTEIN FOR EXPOSED (mg/gm wet tissue)	0.3145	0.095	0.123
PERCENT CHANGE	-7.198	-7.983	-7.398



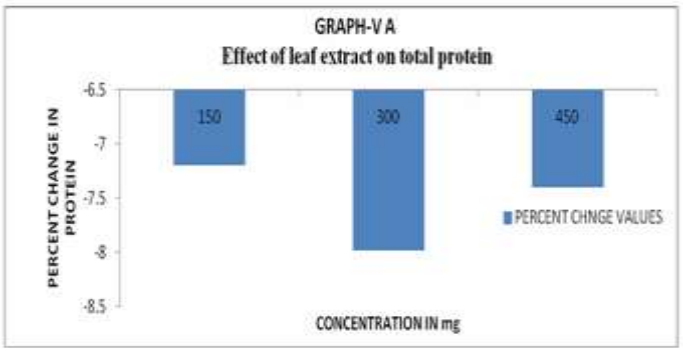
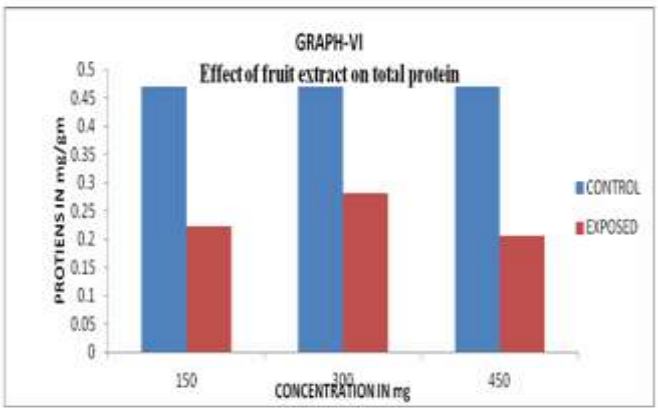


Table – VI
Effect of fruit extract on total protein

CONCENTRATION OF CASTOR FRUIT EXTRACT (mg)	150	300	450
TOTAL PROTEIN FOR CONTROL (mg/gm wet tissue)	0.471	0.471	0.471
TOTAL PROTEIN FOR EXPOSED (mg/gm wet tissue)	0.223	0.281	0.206
PERCENT CHANGE	-5.265	-4.034	-5.605



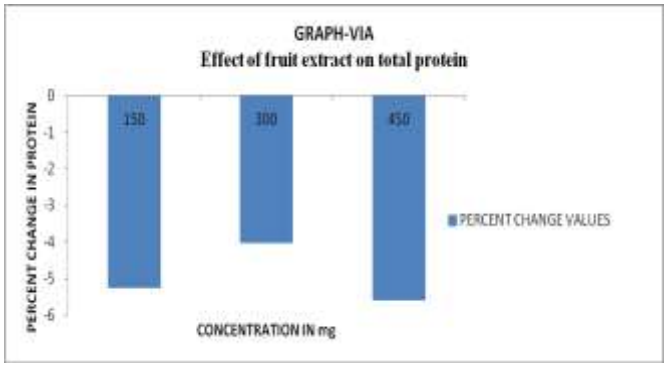
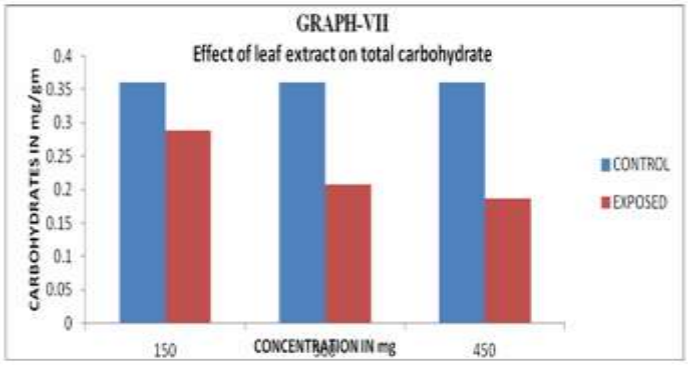


Table - VII
Effect of leaf extract on total carbohydrate

CONCENTRATION OF CASTOR LEAF EXTRACT (mg)	150	300	450
CON. FOR CARBOHYDDRATE FOR CONTROL (mg/gm wet tissue)	0.36	0.36	0.36
CON. FOR CARBOHYDDRATE FOR EXPOSED (mg/gm wet tissue)	0.288	0.207	0.187
PERCENT CHANGE	-20	-42.5	-48.05



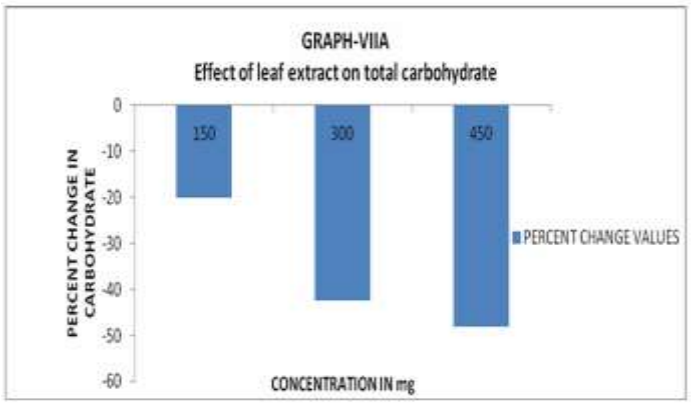
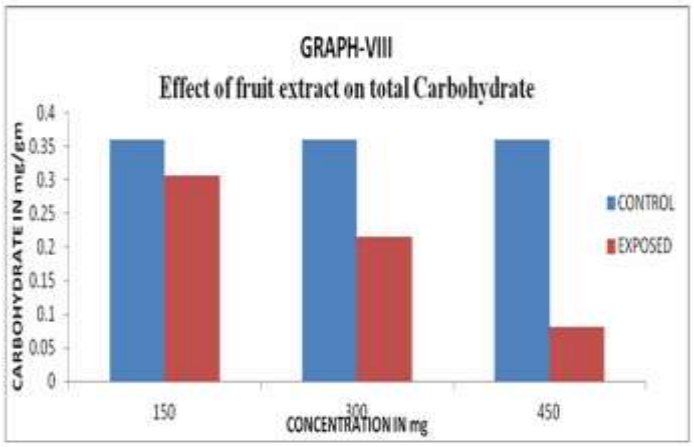
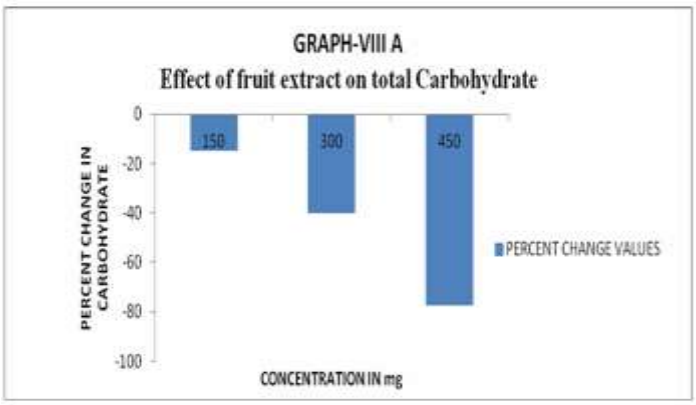


Table – VIII
Effect of fruit extract on total Carbohydrate

CONCENTRATION OF CASTOR FRUIT EXTRACT (mg)	150	300	450
CON. OF CARBOHYDRATE FOR CONTROL (mg/gm wet tissue)	0.36	0.36	0.36
CON. OF CARBOHYDRATE FOR EXPOSED (mg/gm wet tissue)	0.306	0.216	0.081
PERCENT CHANGE	-15	-40	-77.5





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