



EFFECT OF CUSTARD APPLE ON BIOLOGY OF RICE

MOTH *C. cephalonica*

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Abstract: The effect of custard apple leaf powder was observed on third instar larvae of rice moth *C. cephalonica*(st.) This custard apple leaf powder caused a depressive effect on the development stages of this moth. A dose level of 3.5% of this leaf powder caused 69.99 per cent mortality, which may be considered as extremely toxic to the pest

Key Words: Botanicals, custard apple, Toxicity, Rice moth, Ontogeny.

Introduction:

According to an FAO study, world - wide loss in store approximates 10% of all stored grain, i.e., 13 million tons of grain lost due to insects or 100 million tons to failure to store properly (Wolpert, 1967). The rice - moth, *Coryra cephalonica* (Staint.) is a notorious pest of stored cereals and cereal commodities in India as well as in other tropical and subtropical regions of the world. This moth was first identified and reported by Stainton (1866), who named it *Melissoblastes cephalonica*. The only recognized species of this genus is *cephalonica*. Ayyar (1919a) made the first record of *Coryra cephalonica*. Its larval stages cause serious damage to rice, gram, sorghum, maize, ground nut, cotton seeds, peanuts, linseeds, raisins, nutmeg, chocolates, army biscuits, wheat, coffee, coco beans and milled products (Atwal, 1976; Piltz, 1977; Cox *et al.*, 1981; Allotey and Kumar, 1985; Allotey, 1991).

The use of organophosphorus and organochlorine insecticides poses problems such as poisoning in man and other animals (Pichat & Philogene 1993), pest resistance to pesticides (Chand & Birthal 1977), and the risk of contamination causing injury to non-target organisms and pollution to our own environment, thus disturbing the ecosystem. Hence there is an urgent need to develop safe alternatives to conventional insecticides for the protection of grain and grain products against insect infestations. Higher plants are a rich source of novel

natural substances that can be used to develop environmentally safe methods for insect control (Jbilou *et al.*, 2006).

Botanical insecticides are broad-spectrum in pestcontrol, and many are safe to apply, unique in action and can be easily processed and used. Locally available plant materials have been widely used in the pest to protect stored produce against damage by insect infestation (Golob and Webley, 1980). The main advantage of botanicals is that they are easily produced by farmers and small-scale industries and are potentially less expensive.

In the present study, Custard apple has been selected as one of the safer substitutes to control the stored cereal pest rice-moth, *C. cephalonica*. Hence, as an objective of such programme the present work, for has been designed and conducted to investigate the effect of neem leaf powder against the ontogeny of rice-moth.

Materials and Methods:

Custard apple leaf was collected from farm of college of Agriculture Kolhapur. The Custard apple leaf was separated from the branches of the plant body, properly washed with fresh tap water and then air dried at room temperature for 5 to 7 days, the dried leaves were grinded to fine powder in mixer and kept in air tight containers for further use.

From the laboratory maintained culture on ground jowar mixed with 5% yeast powder, Newly emerged males and females were transferred to

oviposition chambers. Eggs laid by the females were collected and then placed in, for hatching. Freshly hatched larvae of *C. cephalonica* were allowed to feed on a normal diet. On the 16th day of after larval hatching 1st and 3rd instar larvae were transferred to each similar rearing chambers (500 ml beakers) containing 500 gm. of dietary Medium mixed and treated separately with 6 different dose levels i.e. 1.00, 1.50, 2.00, 2.50, 3.00 and 3.50 % of above all botanicals leaf powder, using 3 replications of each treated as well as control group. Control culture was maintained without any leaf powder treatment under identical condition. On the completion of the life cycle, number of adults emerged and dead pupae were recorded to calculate % pupation and % larval mortality

The effect of botanicals on biology of rice moth was analyzed using one way ANOVA. Significant differences between the treatments were determined using Tukey's multiple range tests ($p \leq 0.05$).

Straight line regression equation was applied between different dose levels of botanicals and percent larval death/per-cent pupation per-cent pupal death and percent adult emergence to observe the significant correlation.

The mortality data of each treatment were considered and subjected to probit analysis (Finney, 1971) after computation of corrected mortality for respective treatment concentrations taking into account the mortality recorded in control using Abbott's formula (Abbott, 1925) and verified using a software programme Indostat software available with the Department of Statistics, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri to know the LD₅₀ values.

Result and Discussion

Effect of Custard apple (*Annonasquamosa*) on biology of rice moth, *Corcyra cephalonica* (St.) under laboratory condition.

The data one effect of Custard apple on biology of rice moth, *C. cephalonica* are presented in the Table 1 and graphically depicted in Fig.1, Result were presented in Table 1 revealed that the per cent

larval mortality rate significantly increased with the increase in the custard apple leaf powder concentration or dose level. The toxicity of custard apple leaf powder increases significantly with the increase in its concentration on each developmental stage i.e. larva, pupa and adult, being maximum at 3.5 % custard apple leaf powder concentration with highest larval mortality, followed by 3 %, 2.5 %, 1.5 % and then 1 %, respectively. Per cent larval mortality of *C. cephalonica* treated with all treatments was significantly more as compared to untreated control.

All the Custard apple leaf powder concentration found to be significantly superior over untreated control. The highest per cent larval mortality was recorded in treatment with Custard apple leaf powder @ 3.5 % were 69.99 per cent larval mortality was recorded which was followed by Custard apple leaf powder @ 3% (66.66 per cent). The next best treatment in order were Custard apple leaf powder @ 2.5 % (56.66 per cent) Custard apple leaf powder @ 2 % (43.33 per cent), Custard apple leaf powder @ 1.5 % (33.33 per cent) and Custard apple leaf powder @ 1% (26.66 per cent) There was no larval mortality observed in untreated control.

The some larva goes in pupation. There pupation was observed in Custard apple leaf powder @ 3.5 % (26.66 per cent) and Custard apple leaf powder @ 3 % (33.33 per cent). The next treatment in pupation were Custard apple leaf powder @ 2.5 % (43.33 per cent), Custard apple leaf powder @ 2 % (56.66 per cent), Custard apple leaf powder @ 1.5 % (66.66 per cent) and leaf Custard apple leaf powder @ 1 % (73.33 per cent). There was 100 per cent pupation observed in untreated control.

Pupal mortality increased insignificantly with increase Custard apple leaf powder concentration. There pupal death observed in Custard apple leaf powder @ 3.5 % (16.66 per cent) and Custard apple leaf powder @ 3 % (19.99 per cent). The next treatment in pupation were Custard apple leaf powder @ 2.5 % (29.99 per cent), Custard apple leaf powder @ 2 % (43.33 per cent), Custard apple leaf

powder @ 1.5 % (46.66.per cent) and Custard apple leaf powder @ 1 % (46.66 per cent).

Table 1: Effect of Custard apple (*Annona squamosa*) on biology of rice moth under laboratory condition

Sr. No.	Treatment No.	Treatments	Larval death	Pupation	Pupation death	Emergence
1	T ₁	Custard apple leaf powder@ 3.5%	69.99 *(56.76)	26.66 (31.08)	16.66 (24.08)	9.99 (18.41)
2	T ₂	Custard apple leaf powder@ 3%	66.66 (54.72)	33.33 (35.26)	19.99 (26.30)	13.33 (21.41)
3	T ₃	Custard apple leaf powder@ 2.5%	56.66 (48.83)	43.33 (41.17)	29.99 (33.21)	13.33 (21.41)
4	T ₄	Custard apple leaf powder@ 2%	43.33 (40.97)	56.66 (48.83)	43.33 (40.97)	13.33 (21.41)
5	T ₅	Custard apple leaf powder@ 1.5%	33.33 (35.26)	66.66 (52.31)	46.66 (43.09)	19.99 (26.56)
6	T ₆	Custard apple leaf powder@ 1%	26.66 *(31.08)	73.33 (58.91)	46.66 (43.09)	26.66 (31.00)
		SE±	0.67	0.94	0.54	0.35
		C.D.@5%	2.09	2.89	1.67	1.10

*Figures in parenthesis are arcsine transformed.

Rice moth, *C. cephalonica* emergence was observed with decrease custard apple leaf powder concentration, there was emergence observed in Custard apple leaf powder @ 3.5 % (9.99 per cent) Custard apple @ 3 % (13.33 per cent) The next treatment in emergence were Custard apple leaf powder @ 2.5 % (13.33 per cent) Custard apple leaf powder @ 2 % (13.33 per cent) Custard apple leaf powder @ 1.5 % (19.99 per cent) and Custard apple leaf powder @ 1 % (26.66 per cent).

Thus, overall results on effect of botanicals on biology of rice moth, *C. cephalonica* (indicated that treatment with Custard apple leaf powder @ 3.5 % (69.99 per cent) was found to be superior as compared to other treatments. However, treatment with Custard apple leaf powder @ 3 % was found to be next effective treatment in order of toxicity effect.

Hence, the data revealed that larval mortality rate increases with the increase in dose level of Custard apple leaf powder. On the basis of percent larval death, pupation, pupal death and adult emergence, at different dose levels of neem leaf powder, it is possible to categorize the relative effectiveness of their dose levels (Fitzpatrick and Dowell, 1981).

2. Toxicity of Custard apple (*Annona squamosa*) leaf powder against the ontogeny of *C. cephalonica* (St.)

The data on effect of Custard apple on biology of rice moth, *C. cephalonica* are presented in the Table 2 and graphically depicted in Fig.5 In this table Straight line regression equation was applied between different concentrations of custard apple leaf powder and their corresponding percent larval death, percent pupation, percent pupal death, percent emergence to observe the significant correlation.

Result were presented in Table 2 revealed that a significant larval mortality was obtained with the increase of Custard apple leaf concentration. 1% dose level of Custard apple leaf powder larval mortality was only 26.66 % while 69.99 % mortality was recorded at 3.50% dose level of custard apple leaf powder. As the Custard apple leaf concentration increases, a significant reduction in pupation and adult emergence did occur. Pupation was 73.33 % at 1% dose level which decreased to 26.66 % at 3.50 % dose level of the custard apple leaf. Pupal mortality was 46.66 % at 1 % dose level which decreased to 16.66 % at 3.50% dose level of the custard apple leaf. Similarly, 26.66 % adult emergences were recorded at 1 % dose level which decreased to 10% at 3.5 % dose level of Custard apple leaf. Percent larval death

($y = 5.42 + 19.80x$; $r = 0.99$, $P < 0.001$), pupation ($y = 94 + -19.80x$ $r = 0.99$; $P < 0.001$), pupal death ($y = 65.16 + -13.90x$; $r = 0.95$, $P < 0.001$) and emergence ($29.39 + -5.90x$; $r = 0.90$; $P < 0.001$)

Thus, overall results on effect of botanicals on biology of rice moth, *C. cephalonica* indicated that treatment with Custard leaf powder @ 3.5 % (69.99 per cent) was found to be superior as compared to other treatments.

Hence, the data revealed that different dose levels of Custard apple leaf exerted a depressive effect on the life cycle stages of *C. cephalonica*. It also deserves mention that 3.50 % dose level of Custard apple leaf powder caused 69.99 % larval mortality and hence, this dose level may be used for the effective control of *C. cephalonica* in stored product.

Table 2: Toxicity of Custard apple (*Annonasquamosa*) leaf powder against the ontogeny of *Corcyra cephalonica* (Staint.)

Custard leaf powder dose (%)	Total no. of larvae	Larval death (%)	Pupation (%)	Pupation death (%)	Emergence (%)
Control	30	0	100	0	100
3.5	30	69.99 ± 3.53	26.66 ± 2.35	16.66 ± 2.35	9.99 ± 0.94
3	30	66.66 ± 2.35	33.33 ± 1.18	19.99 ± 2.35	13.33 ± 0.46
2.5	30	56.66 ± 1.18	43.33 ± 2.58	29.99 ± 0.24	13.33 ± 0.47
2	30	43.33 ± 1.18	56.66 ± 0.47	43.33 ± 1.18	13.33 ± 0.47
1.5	30	33.33 ± 1.18	66.66 ± 1.17	46.66 ± 0.24	219.99 ± 0.47
1	30	26.66 ± 2.35	73.33 ± 1.18	46.66 ± 0.24	26.66 ± 0.24
	Regression Equation	$y = 7.01 + 18.85x$	$y = 94 + -19.80x$	$y = 65.16 + -13.90x$	$y = 29.39 + -5.90x$

Note: Values have been expressed as the mean SD ± of three replicates. Straight line regression equation was applied between different concentrations of Custard apple leaf powder.

Toxicity of Custard apple (*Annona squamosa*) to rice moth, *C. cephalonica* (Staint.) under laboratory condition

The result from the data given in Table No 2. The custard apple tested their toxicity in laboratory condition against Rice moth, *C. cephalonica*. The chi

square (X^2) test was found significant; therefore, the used Custard apple leaf powder doses were homogenous. The Fiducial limit of custard apple leaf was in the range of 1.8530-2.6469 whereas, the LD₅₀ value for rice moth, *C. cephalonica* 2.25. The slope of concentration probit (LCP) line (b) was 0.20.

Sr. No.	Botanicals	LD ₅₀ (Fiducial limit)	Slope ± SE (b)	Heterogeneity (X ²)	Regression Equation
1	Custard apple	2.25 (1.8530-2.6469)	0.20	0.5519	$Y = 2.3871x + 4.2410$

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