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Research Article

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Efficacy of dietary incorporation of *Trogoderma granarium* treated with *Calotropis procera* extract on the growth of *Paederus fuscipes*

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ABSTRACT

Paederus fuscipes (Staphyilinidae) is comman in northen part of india particularly in Punjab and Haryana region. Most commonly found in maize, berseen and rice fields, also causes dermatitis in humans. It is a major polyphagous predator of several pests of agricultural importance. The leaf extract of Calotropis procera showed significant adverse effect on larvae and eggs at 1% and 5% concentration. The dry biomasses of different developmental stages treated with 5% aquous extract of C. procera revealed a significant reduction in growth rate of larvae, pupae and adults as compared to control. However, the negative growth rate was observed in pupae as they do not feed the treated diet. The phytochemical analysis of the extract revealed a wide range of secondary metabolites alkaloid, terpenoid, flavonoid, phenolic compounds and phytosterole. Thus, the present study was conducted to find out the insecticidal activity of C. procera for the control of the Paederus fuscipes.

Key words: *Paederus fuscipes*, Life- Table, Growth – Rate and *Calotropis procera*.

INTRODUCTION

Rove beetle (Staphyilinidae) is one of the largest groups of beetles with a number of species distributed throughout the world wide [1]. The beetle is found in India, Pakistan, Central Africa, Asia, New Guinea, Malaysia, Iran and Europe. Adult *P. fuscipes* are attracted to incandescent and fluorescent light at night [2],[3]. This species contains vesicating fluids [4]. *P. fuscipes* is also well known for causing dermatitis in humans. It is found in cropped areas preferably in maize, berseen and rice fields. Although it is widely occured but very less awareness is observed about its biological and ecological system. It is also useful insect in agricultural fields being a major polyphagous predator of several agricultural pests [5]. The toxic haemolymph of the beetle is known as paederin, causes necrotic blisters when the insect is crushed on human skin. Due to its predatory and medicinal importance, the life - cycle of *P. fuscipes* was studied thoroughly under laboratory conditions mainly for reproductive potential.

EXPERIMENTAL SECTION

Extraction procedure

For the preparation of organic extracts, green leaves of *Calotrpis procera* were collected from their natural habitats and washed thoroughly to remove dust and other particles. After washing, different parts of these plants were kept for shade drying for 10-15 days and finally ground to fine powder. The powdered plant material was extracted with absolute ethanol as solvent in Soxhlet Apparatus for 72 hrs. Crude leaf extract is collected after distillation. The semi-solid crude extract was then transferred in glass vials and stored in refrigerator for experiments. To assess the efficacy of leaf extracts, 1% and 5% concentrations were prepared in distilled water and mixed in diet of *T. granarium*.

Bioassay

The individuals of *P. fuscipes* were reared in the laboratory at 30 ± 2^0C and 70±5% RH in BOD incubator. Initially, the desired number of eggs were collected by allowing the untreated adults of both sexes of similar age-groups to lay eggs in prepared control diets and sifting the eggs. Batches of 10 eggs (n=3) were kept separately in beakers covered with muslin cloth, containing various dietary formulations (the dietery compound *T.granarium* is treated with 1% and 5% aquous extraxt of *C. procera*, that was feeded by *P. fuscipes*) and control with normal diets.

The life-table characteristics of *P. fuscipes* were determined [6], [7]. Accordingly, the following parameters were determined.

Equations

$$l_x = n_x / n_o \quad \text{----------} \quad \text{I}$$

$$d_x = n_x - (n_x+1) \quad \text{----------} \quad \text{II}$$

$$q_x = d_x / n_x \quad \text{----------} \quad \text{III}$$

Where

X = age interval

n_o = number of individuals at the beginning of the experiment.

n_x = observed number of alive individuals at the start of age interval x.

l_x = proportion surviving to start of age interval x .

d_x = number of organisms dying within age interval x to x +1.

q_x = rate of mortality during age interval x to x+1.

To determine the growth - rate of the developmental stages of *Paederus fuscipes* its fresh and dry weights (samples were taken at 60^0C for 24 hrs) were determined using the standard methods [8], [9], [10].

$$\text{Absolute daily growth (mg/day)} = w_2 - w_1 / t_2 - t_1$$

Where

w_1 and w_2 = the mean biomasses of the individuals at times t_1 and t_2 respectively.

Statistical Analysis

All the data of the present study was statistically analyzed using SPSS computer software. The differences in the mean values were subjected to oneway ANOVA.

RESULTS AND DISCUSSION

The observation on various age specific life - table characteristics of the immature and adult stage of *P. fuscipes* reared on *T. granarium* feed with 1% and 5% leaf extract of *Calotropis procera*, indicated total mortality in about 21 days. Similarly, the rate of egg mortality was also fairly high in all the treatments (Control = 19.4%, 1% treatment = 25.0% and 5% treatment = 40.0%). At 5% treatment of *C. procera* leaf extract, L_1 stage larvae were found more susceptible showing 28.3% mortality in comparison to untreated control (10.6%). However, in case of pupa, mortality of 17.8% was recorded in 1% treatment as compared to that of control (8.1%) (Table-1).

C. procera leaf extract adversely affected the survival of larvae and promoted survival of pupae of *P. fuscipes* presumably, on account of its larvicidal, repellency or contact toxicity specific to larvae which is in conformity with the present findings at 5% concentration [11].

Table No.1 : The life-table characteristics of *P. fuscipes* reared on *T. granarium* at 30±2ºC
(L_1- L_2=Larval Instars)

Treatment	LIFE STAGE	DURATION (Days)	TOTAL AGE (Mean)	n_x	l_x	d_x	q_x
Untreated *T. granarium* (Control)	EGG	3.5	0	100	1.0000	19.4	0.194
	L_1	3.0	03.5	80.6	0.806	08.6	0.106
	L_2	4.5	06.5	72.0	0.720	04.0	0.055
	PUPA	6.0	11.0	68.0	0.680	02.7	0.081
	ADULT	4.0	17.0	65.3	0.653	65.3	1.000
	ADULT	-	21.0	0	0	0	0
T. granarium treated with 1% extract of *C. procera*	EGG	3.5	0	100	1.0000	25.0	0.250
	L_1	3.0	03.5	75.00	0.750	05.0	0.066
	L_2	4.5	06.5	70.00	0.700	06.7	0.095
	PUPA	6.0	11.0	63.30	0.633	11.3	0.178
	ADULT	4.0	17.0	52.00	0.520	52.00	1.000
	ADULT	-	21.0	0	0	0	0
T. granarium treated with 5% extract of *C. procera*	EGG	3.5	0	1000	1.0000	40	0.400
	L_1	3.0	03.5	60.00	0.600	17	0.283
	L_2	4.5	06.5	43.00	0.430	08	0.186
	PUPA	6.0	11.0	35.00	0.350	04	0.114
	ADULT	4.0	17.0	31.00	0.310	31	01.00
	ADULT	-	21.0	0	0	0	0

The leaf extract of *C. procera* adversely affected the developmental stages of *P. fuscipes* reducing the dry biomasses of L_2, pupae and adult at 5% treatment up to 0.28, 0.49 and 0.38 mg, respectively, which were significantly lower ($P<0.05$ and $P< 0.01$) in comparison to those of control (L_2=0.44, pupae = 0.94 and adult = 0.91mg). The leaf extract of *C. procera* inhibited the biomass accumulation at different developmental stages of *P. fuscipes* at 5% dose [11], [12] which supports the present data proving it as a powerful antifeedant and insecticidal for larvae (Table-2).

Table No. 2 : Analysis of developmental stages of *P. fuscipes* reared on *T. granarium*

Dietary Mixture	Wt. of life stages of *P. fuscipes* (mg) (Mean ± SE)				
	EGG	**L_1**	**L_2**	**PUPA**	**ADULT**
Untreated *T. granarium*	0.015 ± 0.0005	0.077 ± 0.0140	0.447 ± 0.0591	0.946 ± 0.0106	0.914 ± 0.0062
T. granarium treated with 1% *C. procera* extract	0.014 ± 0.0002	0.068 ± 0.0020	0.403 ± 0.0145	0.731** ± 0.0398	0.62** ± 0.0264
T. granarium treated with 5% *C. procera* extract	0.014 ± 0.0004	0.062 ± 0.0057	0.283* ± 0.0202	0.494** ± 0.0211	0.386** ± 0.0088
CD at 0.01 LEVEL	0.00231	0.04642	0.19408	0.14024	0.08647
CD at 0.05 LEVEL	0.00152	0.03064	0.12811	0.09257	0.05708

*Significant at *P < 0.05; **P < 0.01*

The observation on the absolute growth of the various developmental stages of *P. fuscipes* revealed an almost identical rate of earlier immature stages in all the experiments. Beyond L_4 stage, however, the growth rates of developmental stages reared on 1% leaf extract (L_2=0.074 mg/day, pupa= 0.054 mg/day and adult = -0.02 mg/day) and those reared on 5% treatment with *C. procera* leaf extract (L_2 = 0.049 mg/day, pupa= -0.004 mg/day and adult = -0.026 mg/day) were lower than those of control (L_2 =0.08 mg/day, Pupa = 0.083 mg/day and adult = -0.008 mg/day). Obviously, a negative growth rate in adults occurred on account of the fact that pupae do not feed and use their body nutrient for metabolism. The adverse effects of *C. procera* reducing the growth of body tissues in the immature stages of *P. fuscipes* [13]. Similar observations were also recorded in the present study confirming the fact that the same plant extract brought about a reduction in growth - rate of *P. fuscipes* (Table-3).

Table No. 3: Absolute growth - rates of immature and mature stages of *P. fuscipes* reared on *T. Granarium*

Life Stage	Life span (days)	Absolute growth rate of *P. Fuscipes* reared on extract treated diet (mg/day)		
		Untreated *T. granarium*	***T.granarium* treated with 1% *C. procera* extract**	***T. granarium* treated with 5% *C. procera* extract**
Egg	3.5	0	0	0
L_1	3.0	0.020	0.018	0.016
L_2	4.5	0.082	0.074	0.049
Pupa	6.0	0.083	0.054	0.035
Adult	4.0	-0.008	-0.027	-0.027

The aqueous leaf extract is found to be effective as larvicidal, growth-rate inhibitor, insecticidal thus governing the mortality rate of the economically important insect. It is concluded that *C. procera* a weed can be useful as insecticide and herbicide for the rove beetle.

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