EFFECTS OF DIFLUBENZURON ON LARVAL DEVELOPMENT OF *ZAPRINONUS PARAVITTIGER* (GODBLE AND VAIDYA) (DIPTERA: DROSOPHILIDAE)

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ABSTRACT

Feeding of diflubenzuron to different-aged larvae of banana fruitfly, *Zaprionus paravittiger* (Godble and Vaidya), produced a differential susceptibility. The first-instar larvae were significantly more susceptible than the second- and third-instar larvae. The ID 50 (50% inhibitory dose) values for adult emergence were 0.16, 0.32 and 0.95 ppm for first-, second-, and third-instar larvae, respectively. The frequency of morphological abnormalities increased and F_1 adults failed to reproduce. Furthermore, the total body glycogen increased and total body proteins decreased after feeding diflubenzuron to second-instar larvae for 24 h.

Key Words: Diflubenzuron, larvicidal, *Zaprionus paravittiger.*

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INTRODUCTION

Diflubenzuron, an inhibitor of chitin synthesis, has been reported to be active against the immature stages of a number of insect species (Grosscurt 1978). Its activity is variable from order to order and from species to species within an order, depending upon a number of factors such as dosage, mode of treatment, and the developmental stage at which treatment was applied (Grosscurt 1978). The effects produced on feeding diflubenzuron to the larvae of banana fruitfly, *Zaprionus paravittiger* (Godble and Vaidya), are reported herein.

MATERIALS AND METHODS

Banana fruitflies, *Z. paravittiger,* were reared on the diet described by Ashburner and Thompson (1978). Cultures were maintained at 25 ± 1C, 60 - 70% RH and 12:12 LD photoperiod. The calculated amount of diflubenzuron to produce 1000, 500, 100, 50, 10, 5, 1 or 0.1 ppm AI was thoroughly mixed in slightly warm diet (30 - 35C) and different instar larvae were fed upon treated diet for 24 h, then transferred to untreated diet for the duration of the test. Each concentration for each instar had 10 replications of 25 larvae/replicate. Daily records of pupation, emergence, sex ratio, and morphological abnormalities were maintained. Data were subjected to probit analysis to calculate the ID 50 (50% inhibitory dose) values. Significant differences among the means were calculated by using Mann and Whitney test and analysis of variance for Duncan's multiple range test.

Estimation of the total body proteins and glycogen were made for second-instar larvae after feeding on diets containing 1000, 100, 10, and 1 ppm AI of diflubenzuron for 24 h. Glycogen extracts were prepared by the method of Good

et al. (1933) and estimated by the method of Montogomery (1957). The total body proteins were estimated by the method suggested by Lowry et al. (1951). Each concentration both for glycogen and protein estimation had five replications (each replication had 50 mg larval wt) and the experiment was repeated twice. The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Percentage pupation and emergence significantly ($P < 0.05$) decreased when larvae of *Z. paravittiger* were fed diflubenzuron in diet (Table 1). The ID 50 values for emergence when calculated with probit analysis, were 0.16 , 0.32, and 0.95 ppm AI for the first-, second-, and third-instars, respectively. This clearly indicates that the first-instar larvae were comparatively more susceptible to diflubenzuron than the 2nd and 3rd instars. When the first-instar larvae were fed upon 50 ppm or less concentrations of diflubenzuron in the diet, deaths occurred at the time of emergence from the pupal case (Fig. 1) and the percentage of individuals which failed to expand their wings properly increased from 0.1% to 4.3 % (Fig. 1). Increase in the concentration of diflubenzuron above 50 ppm resulted in deaths before the larvae reached the pupal stage.

The presence of a differential larvicidal activity has been associated with diflubenzuron (Grosscurt 1978). Our study revealed that first-instar larvae were susceptible at doses 6× lower than the third-instar larvae. First-instar larvae of *Culex tarsails* Say were more susceptible than 2nd- and 3rd-instars (Sharma et al. 1979). Takahashi and Ohtaki (1976) also reported ID 50 values of 0.035 ppm and 0.062 ppm for third and fourth instars of *Culex pipiens* L., respectively. However, the late-instar larvae of *Dacus olae* Gmel., *Haematobia irritans* (L.), and *Simulium vitattum* Zetterstedt, have been reported to be more susceptible to diflubenzuron than early-instar larvae (Fytizar 1976; Hopkins and Chamberlian 1976; Lacey and Mulla 1978).

Our study also revealed that the adults which emerged after feeding on diflubenzuron possessed a ligher-colored thin integument and either failed to oviposit or laid only a few sterile eggs. Longevity of these adults decreased from 55.17 d to 35.52 d when larvae were fed 50 ppm diflubenzuron. This fact has not been reported previously and only Arias and Mulla (1975) have reported a reduction in fecundity of F_1 adults of *C. tarsalis* Say after treatment of 4th-instar larvae with diflubenzuron.

A concentration-dependent quantitative decrease in the total body proteins was observed (Fig. 2). Baümler and Salama (1976) also reported a similar rise in hemolymph proteins of *Porthetria dispar* L. whereas Ker (1978) found no influence of diflubenzuron on synthesis and transport of proteins into the cuticle. The glycogen content of treated larvae increased from 0.082 ± 0.0015 mg/100 mg of larva in the controls to 0.1 ± 0.0026 mg/100 mg of larvae when larvae where fed 1 ppm (Fig. 3). These findings are corroborated by the work of Baümler and Salama (1976) on *P. dispar*. The increase could be associated with the reduced chitin synthesis from the free glycogen entities in the body.

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Table 1. Effect of diflubenzuron on percent emergence of *Z. paravittiger*.

	Stage on which larvae were transferred to treated diet for 24 h		
Conc (ppm)	First instar (94 ± 4 h) Mean ± SE	Second instar (120 ± 5 h) Mean ± SE	Third instar (140 ± 5 h) Mean ± SE
Control	75.00 ± 2.28 a	85.60 ± 5.11 a	86.40 ± 3.22 a
0.1	66.50 ± 3.46 b	67.50 ± 5.11 b	79.50 ± 3.72 a
1.0	23.00 ± 2.26 c	40.33 ± 1.99 c	60.00 ± 5.46 b
5	4.50 ± 1.57 d	12.00 ± 2.46 d	15.33 ± 5.60 c
10	0.00 e	6.00 ± 1.56 de	12.67 ± 3.92 cd
50	0.00 e	4.00 ± 1.56 e	7.33 ± 2.81 de
100	0.00 e	2.67 ± 1.14 e	3.33 ± 2.64 e
500	0.00 e	2.00 ± 1.43 e	4.00 ± 1.78 e
1000	0.00 e	0.00 e	4.00 ± 2.06 e

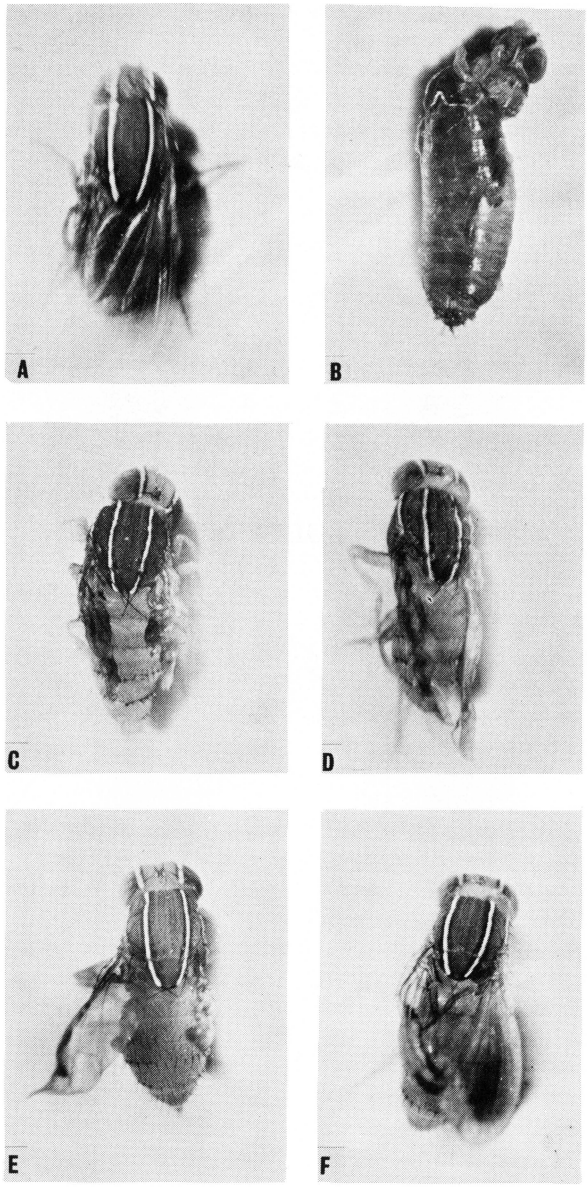

Fig. 1. Effect of diflubenzuron on *Z. paravittiger*.
A : Normal adult
B : Failure of fly to emerge
C-F: Various degrees of abnormalities in wings

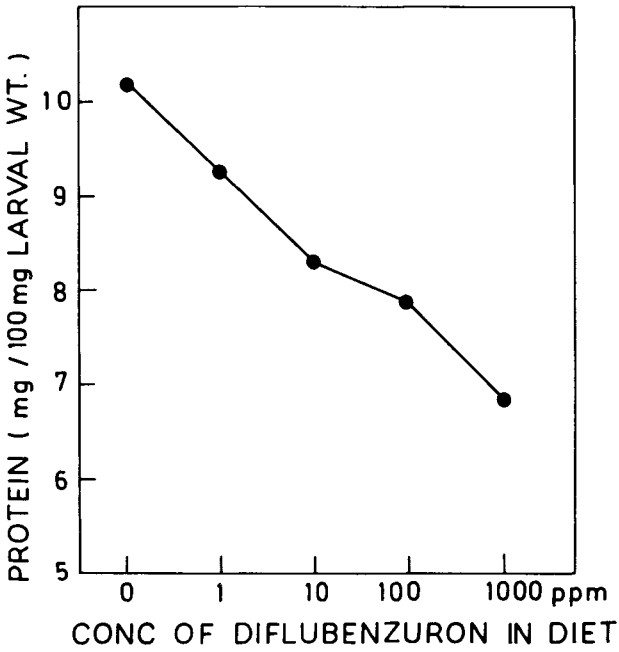

Fig. 2. Effect of diflubenzuron on total body protein of *Z. paravittiger* larvae.

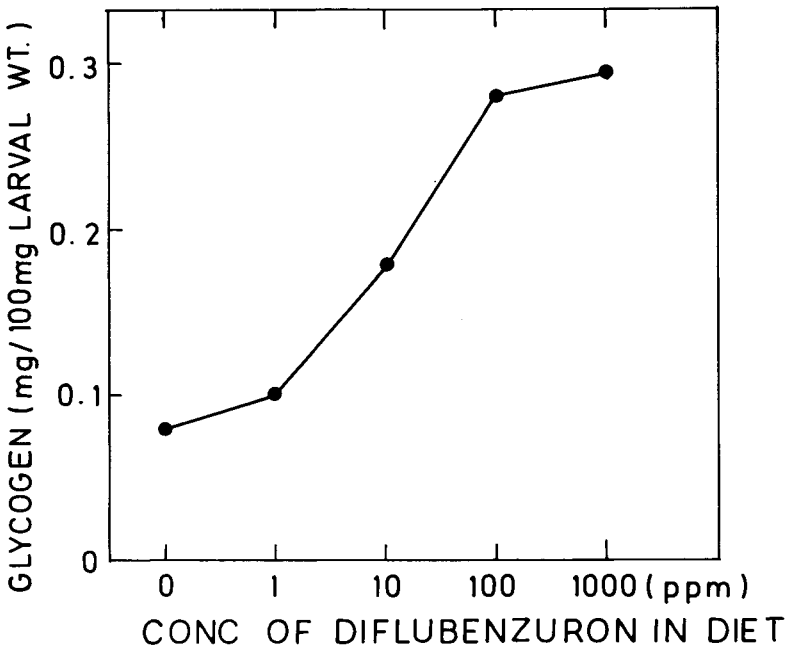

Fig. 3. Effect of diblubenzuron on total body glycogen of *Z. paravittiger* larvae.

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