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EFFECT OF SOME INSECTICIDES ON PUPARIA AND ADULTS OF CARCELIA ILLOTA CURRAN (DIPTERA: TACHINIDAE) A LARVAL-PUPAL PARASITOID OF HELICOVERPA ARMIGERA HUBNER (NOCTUIDAE: LEPIDOPTERA)

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ABSTRACT

The tachinid fly *Carcelia illota* Curran is a larval pupal parasitoid of *Helicoverpa armigera* Hubner. The latter is a pod borer. Four different insecticides viz, Cypermethrin (0.006%), endosulfan (0.07%), dimethoate (0.03%) and monocrotophos (0.05%) were applied topically on puparia and adults of *Carcelia illota* Curran. The puparia have no toxic effect. 100 percent adult emergence was recorded with treated puparia. Longevity of adults was less (2.01) days, range 1-3 days) for dimethoate. 100 per cent mortality of adults was resulted after 24 hrs. exposure to dimethoate and monocrotophos. 60 and 70 per cent adult mortality was noted with cypermethrin and endosulfan, respectively.

KEYWORDS: Insecticides, Puparia, Adults, Carcelia Illota, Helicoverpa Armigera

INTRODUCTON

Helicoverpa armigera Hubner is a polyphagous pest and has been recorded feeding on 181 cultivated and uncultivated plant species. Based on present estimates, current economic damage due to *H armigera* largely occurs in pigeon pea, chickpea, tomato, cotton, sorghum, pearl millet, maize, groundnut etc. (Manjunath et *a!.*, 1989). The combined losses caused by *H. armigera* on pigeon pea & chickpea in India have been estimated to exceed U.S. $ 300 million in some years (Reed & Pawar, 1982).

There are more than 77 parasitoid species recorded on *Helicoverpa* spp. from India. *Campoletis chloridae* Uchida (Hymenoptera) and *Carcelia illota* Curran (Diptera) are the most predominant larval parasites of *H. armigera* on pigeon pea and chickpea (Manjunath et al., 1989). Synthetic pesticides have harmful effect on beneficial insects.

In order to develop a sound Integrated Pest Management (IPM) program, it is necessary to have some information on the safety of different pesticides to natural enemy, *C. illota*,

on percent parasitization record on *H. armigera*, revealed 4-52% control of pest in fields on pigeon pea and chickpea (Bilapate, 1989; Chaudhari, 1996). Since the use of insecticides for

controlling *H. armigera* is unavoidable it is necessary to test insecticides safe for its parasitoids. The insecticide tolerance by *C. illota* will help in proper selection of insecticides for control of host. Thus pest control can he attempted efficiently both by chemical as well as biological means.

MATERIALS AND METHODS

Four different insecticides viz., Pyrethroid Cypermethrin 0.006% (Basathrin 25% EC), Organochlorine compound endosulfan 0.07% (Endocel *35%* EC), organophosphorous compounds (i) Dimethoate = 0.03% (Roger 30% EC) and (ii) Monocrotophos 0.05% (Nuvacron 36% SL) were tested against *C. illota* adults and puparia. Field recommended concentrations were chosen for the study and the formulated material was diluted in water to get the desired concentrations. Adults and puparia of *C. illota* were obtained from a culture maintained on *H. armigera* larvae. Freshly emerged adults after 3 hours were used. The adults were not previously exposed to plants or hosts. The insecticides were applied topically to adults and puparia of *C. illota.*

1) Topical application to adults -

Adult *C. illota* parasitoids were refrigerated in a plastic container for approximately 20 minutes at 6-7° C. The insecticide was then sprayed with 250 ml plastic hand pump on the immobilized parasitoids. They were then released in the wooden insect rearing cage of size (60 cm 1 X 40 cm w X 38 cm h). All five sides of cage were of mosquito wire screen, with wooden bottom, the front side with 4” hole having cotton sleeve for handling of flies. 20% honey solution was provided as food on cotton swabs in the cage. Parasitoid survival and their flight activity were observed. Flies that could not fly in the air and remained sluggish on the floor of the cage were considered inactive or moribund. The experiment was replicated five times and each replicate consisted of 5 pairs of parasitoids.

2) Topical treatment of puparia:

Four days old puparia of *C. illota* were treated in a group of 10 per replicate and observed for adult emergence. Number of parasitoids emerged and those dying 24 hours after emergence

were recorded. Longevity and fecundity of the adult parasitoids were also assessed after emergence. Tests were conducted at 27±1^0 C and 60-70 % RH at normal room conditions. Standard methods designed by Hassan (1985) for testing the side effects of pesticides on natural enemies were adapted. Results were statistically analyzed by regression analysis and the level of significance 'P' was tested.

RESULTS

1) Topical application to adults:

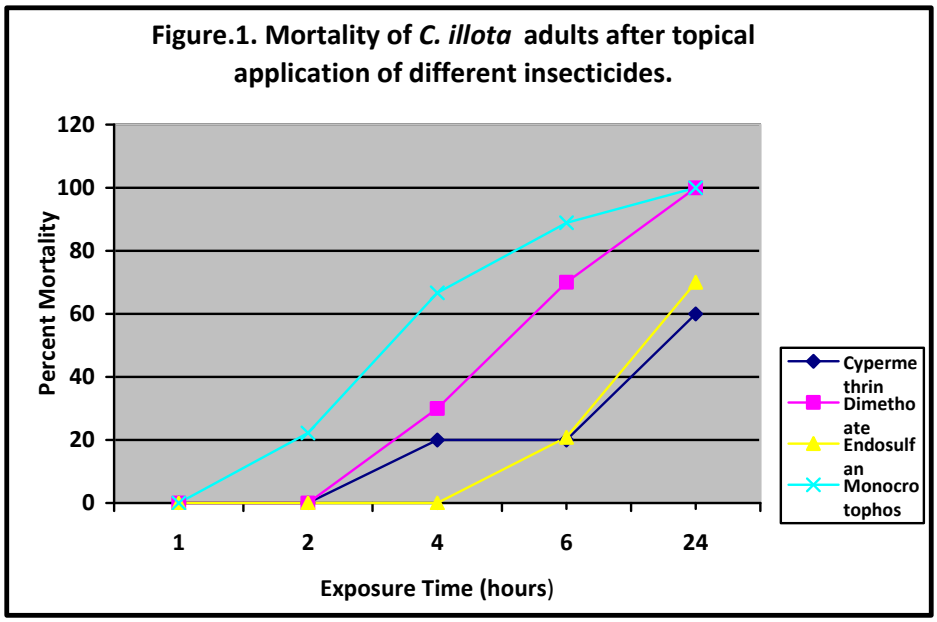
Results of topical application of insecticides on adults have been given in Table 1 and Fig. 1. Dimethoate and monocrotophos were more toxic to C. *illota* adults. 100% mortality was observed after 24hrs. exposure. Monocrotophos was more toxic than dimethoate and 22.22% initial mortality was observed after 2 hrs. Both the sexes male & female were equally affected. 20.83% mortality and 62.5% inactivation were resulted after 6 hrs. of exposure to endosulfan. 70 % mortality was observed when exposed for 24 hrs. 20% and 60% mortality with cypermethrin was observed after exposure of 4 hrs. & 24 hrs., respectively. The order of toxicity was cypermethrin < endosulfan < dimethoate < monocrotophos.

Table1A. Percent mortality (M) and percent inactivation (I) of *C. illota* adults at different time intervals after topical application of different insecticides.

Insecticides	Exposure time (hrs.)				
	1	2	4	6	24
Cypermethrin	00.00 M	00.00 M	20.00 M	20.00 M	60.00 M
	70.00 I	70.00 I	50.00 I	50.00 I	10.00 I
Dimethoate	00.00 M	00.00 M	30.00 M	70.00 M	100.00 M
	00.00 I	60.00 I	70.00 I	30.00 I	00.00 I
Endosulfan	00.00 M	00.00 M	00.00 M	20.83 M	70.00 M
	00.00 I	16.66 I	37.5 I	62.5 I	30.00 I
Monocrotophos	00.00 M	22.22 M	66.67 M	88.89 M	100.00 M
	33.33 I	77.78 I	33.33 I	11.11 I	00.00 I

Table1B. Percent mortality (M) of *C. illota* adults at different time intervals for different insecticides.

Exposure time (hrs)	Cypermethrin (%) Mortality	Dimethoate (%) Mortality	Endosulfan (%) Mortality	Monocrotophos (%) Mortality
1	00.00	00.00	00.00	00.00
2	00.00	00.00	00.00	22,22
4	20.00	30.00	00.00	66.67
6	20.00	70.00	20.83	88.89
24	60.00	100.00	70.00	100.00



Initial activation was seen before death, it must be due to inhalation of the toxic compounds. The parasitoids were unable to fly remained moving in circles on the floor of cage, moving their wings, legs, and abdomen. Rubbing abdomen with hind legs. moving head, and movement of mouthparts (labellum). Later their abdomen become v-shaped and death resulted. No significant correlationship exits between exposure time and % mortality of adults and the r = 0.7288 for monocrotophos. There exists a significant correlationship between exposure time and % mortality of adults treated with cypermethrin, dimethoate & endosulfan (P>0.05) and the values of r were 0.9693, 0.8722, 0.9847, respectively.

2) Topical treatment of puparia:

Toxic effects of topical application to puparia have been given in Table 2. Cypermethrin, dimethoate, endosulfan and monocrotophos were non toxic and 100 percent emergence of adults was recorded. None of the treated puparia showed incomplete emergence. Adult longevity was 7.8 (7- 10 days), 2.01 (1-3 days), 3.07 (2- 6days) & 8.3 (1-15 days) for cypermethrin, dimethoate, endosulfan and monocrotophos, respectively. In control test 100% emergence 9.2 days (range 3-16 days) of longevity and 76% fecundity were recorded.

Table2. Toxicity of different insecticides when applied topically to puparia of *C. illota.*

Insecticides	Adult emergence (%)	Mortality of Puparia (%)	Longevity of adult emergence		Fecundity (%)
			Mean	Range	
Cypermethrin	100	00	7.8	7-10	57.14
Dimethoate	100	00	2.01	1-3	10.00
Endosulfan	100	00	3.07	2-6	40.00
Monocrotophos	100	00	8.3	1-15	66.60
Control	100	00	9.2	3-16	76.00

DISCUSSION

In the present study organophosphorus compounds - monocrotophos (0.05% SL) and diamethoate (0.03% EC) showed 100% mortality after 24 hrs. indicating highly toxic to *C. illota* adults. Endosulfan was moderately toxic (70% mortality), while the pyrethroid cypermethrin (60% mortality) was least toxic in comparison with other three insecticides. These insecticides were found to be non toxic to the puparia. The longevity of adults was found to be less with dimethoate treated puparia. The order of toxicity was cypermethrin < endosulfan < dimethoate < monocrotophos when topically applied to adults and puparia. Ballal and Kumar (1991) reported, with *Allorhogas pyraloophagus* Marsh (Hymenoptera: Braconidae), that dimethoate, phosphomidon endosulfan and fenitrothion were highly toxic, monocrotophos was moderately toxic and cypermethrin was quite toxic. In the present study report dimethoate and monocrotophos showed 100% mortality after 24 hrs and 70 and 60% mortality with endosulfan and cypermethrin indicating toxic to adults of *C. illota.* Mani and Nagarkatti (1983) reported that dimethoate, endosulfan, Malathion, methyomyl,

phosphamidon, methyl demeton were highly toxic to the parasitoids, *Bracon kirkpatricki* Wilkinson and *Apanieles angaleti* Muesebeck, causing 100% mortality within 1-6 hrs. exposure. Here in the present parasitoid dimethoate caused 70% mortality after 6 hrs. exposure. The present findings are not in agreement with Bhatnagar *et al.* (1982). They suggested endosulfan for reducing *H. armigera* populations and it is less damaging to the Diptera and Hymenoptera. They have observed no consistent effects between the host larvae collected from pesticide free and pesticide protected fields on the percentage of parasites. But larvae collected from farmer's pigeon pea crop, where farmers have used pesticides revealed a very low incidence of parasitism. It supports the present findings. Insecticides topically applied on adults showed toxic effects than those applied on puparia where adult emergence was normal. Sellamal and Parameswaran (1979) indicated pyrethroid permethrin and the quinalphos were highly lethal to *Eucelatoria bryani* Sabrosky (Diptera: Tachinidae). In this study also pyrethroid was found to be toxic effecting 60% mortality of adults after 24 hrs. However, pyrethroid has less toxic effects than dimethoate, endosulfan & monocrotophos. The results obtained in this study support the statement made by Mani and Nagarkatti (1981). They stated that indiscriminate use of the permethrin & quinalphos may delay or even prevent establishment of the tachinid. Hence it can be concluded that the use of insecticides must be limited. We must concentrate on use of natural enemies for controlling the pest. The larval parasites like C. *chloridae* Uchida (Hymenoptera) and *C. illota* Curran (Diptera) reduces the pest population in niches which have not been heavily treated with insecticides (CICR, 1993). *H armigera* has developed resistance to commonly used pesticides such as fenvalerate, cypermethrin and endosulfan (Dhingra *et al.*, 1988). Though the parasitoids may be in the process of developing resistance to insecticides presently they are harmful to the parasitoids and hence to go eco-bio friendly we must avoid the use of insecticides and natural enemies must be used for effective control of pests.

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