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Studies of the Effect of Insecticides on *Trichogramma achaeae* Nagaraja and Nagarkatti (Hymenoptera : Trichogrammatidae)

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ABSTRACT

The effect of 15 insecticides used in one or the other time in cotton on the susceptibility and emergence of *Trichogramma achaeae* Nagaraja and Nagarkatti was studied under laboratory conditions. All the insecticides except fenvalerate gave 100 per cent mortality. Maximum parasitism was observed when the unparasitized eggs of *Corcyra cephalonica* (Stainton) were treated with permethrin, oxydemeton methyl and fenvalerate. When the insecticides were tested on parasitized eggs, it was found that fenvalerate, permethrin, oxydemeton methyl, DDT, dimethoate, deltamethrin and phosphamidon were comparatively safe to this parasitoid. Emergence of parasitoids was significantly affected in 1 and 2 day-old parasitized eggs. Emergence in all the insecticidal treatments was significantly reduced.

KEY WORDS: *Trichogramma achaeae*, insecticide susceptibility

Trichogramma achaeae Nagaraja and Nagarkatti (Hym., Trichogrammatidae) is an important indigenous egg parasitoid of cotton bollworms, *viz.*, *Earias* sp. and *Pectinophora gossypiella* (Saunders). Parasitism on the former varied from 14-72 per cent and on latter from 12-54 per cent (Maninder *et al.*, 1983). Mass rearing and periodical releases of egg parasitoids have been advocated in India for the control of cotton bollworms (Anonymous, 1987a). Insecticides are known to be highly harmful to the beneficial insects especially the egg parasitoids (Awate *et al.*, 1977; Xie *et al.*, 1984; House *et al.*, 1985; Singh and Varma, 1986; Varma and Singh, 1987). A substantial amount of insecticides are used on cotton crop for the control of insect pests (Anonymous, 1987b). Therefore, it was desirable to know the effect of various insecticides used in cotton environment on the egg parasitoid, *T. achaeae* so as to select insecticides which would be less harmful to the parasitoid, for integrated control programme.

MATERIALS AND METHODS

Fifteen insecticides as shown in Table 1 which are used for the control of insect pests of cotton in Punjab were employed for this study (Anonymous, 1987b). Adults of *T. achaeae* were multiplied on the eggs of rice moth, *Corcyra cephalonica* (Stainton). Frozen eggs of *C. cephalonica* were mounted on cards (10.0 × 2.5 cm) @ 200 per card. The cards were sprayed with different insecticides by employing the technique of Varma and Singh (1987). The spray fluid used for each treatment was 1.5 ml. The cards used for control were sprayed with tap water. The cards after shade drying were exposed in glass tubes (15 × 2.5 cm) to fifty unsexed adult parasitoids with a sex ratio of 1:3.2 (male: female) (24 hr old). The treatments were replicated three times.

TABLE 1. Effect of insecticides on the mortality of *Trichogramma achaeae* and its parasitism

Treatment	Concentration %	% mortality of parasitoid	% parasitism	Parasitoid emergence %
BHC (BHC 50 WP)	0.4	100.0c	3.3d	0.0d
Carbaryl (Hexavin 50 WP)	0.4	100.0c	3.3d	0.0d
Cypermethrin (Ripcord 10 EC)	0.016	100.0c	14.3c	0.0d
DDT (DDT 50 WP)	0.4	100.0c	0.0e	0.0d
DDT + BHC (DDT + BHC 50 WP)	0.4	100.0c	0.0e	0.0d
Deltamethrin (Decis 2.8 EC)	0.0036	100.0c	0.0e	0.0d
Dimethoate (Rogor 30 EC)	0.06	100.0c	12.7c	14.7c
Endosulfan (Endocel 35 EC)	0.28	100.0c	0.0e	0.0d
Fenvalerate (Sumicidin 20 EC)	0.016	80.9b	82.3ab	85.0a
Malathion (Malathion 50 EC)	0.18	100.0c	0.0e	0.0d
Monocrotophos (Monocil 36 WSC)	0.14	100.0c	0.0e	0.0d
Oxydemeton methyl (Metasystox 25 EC)	0.06	100.0c	76.3b	84.7a
Permethrin (Permacet 25 EC)	0.016	100.0c	82·7ab	79.3b
Phosalone (Zolone 35 EC)	0.24	100.0c	0.0e	0.0d
Phosphamidon (Dimecron 85 WSC)	0.05	100.0c	15.3c	15.7c
Control	—	9.7c	86.0a	90.3a

Means followed by the same letters are not different statistically (p=0.05) by L.S.D.

TABLE 2. Effect of insecticides on the emergence of *Trichogramma achaeae* adults of parasitized eggs of *Corcyra cephalonica*

Treatment	Concentration (%)	% emergence from parasitized eggs of different age							Mean
		1-day	2-day	3-day	4-day	5-day	6-day	7-day	
BHC	0.4	21.7h	35.0g	50.0h	56.3f	85.0bc	85.0de	78.7e	58.2g
Carbaryl	0.4	0.0i	0.0h	0.0i	10.0g	38.7f	45.3i	52.7g	20.9h
Cypermethrin	0.016	60.7f	54.0f	82.7ef	71.0e	79.3cd	85.0de	91.0bc	74.8ef
DDT	0.4	79.0cd	78.7bcde	90.0bcd	90.0b	85.3bc	76.7fg	93.3ab	80.7cd
DDT BHC	0.4	48.0g	72.7e	78.0f	84.3bcd	81.0cd	87.7bcde	93.3ab	77.9de
Deltamethrin	0.0036	65.3ef	74.0de	91.0bc	81.3cd	92.0b	90.0bcd	93.3	83.9b
Dimethoate	0.06	82.7cd	74.7de	84.3ef	88.3bc	82.0cd	88.7bcde	91.7b	84.6b
Endosulfan	0.28	59.3f	76.3cde	85.3bcde	84.3bcd	68.3e	74.3gh	67.0f	73.4f
Fenvalerate	0.016	84.0c	83.7b	84.3def	90.0b	80.7cd	89.3bcd	91.7b	86.2b
Malathion	0.18	84.3bc	82.7bc	85.7cde	87.3bc	85.3bc	35.0j	40.3h	71.5f
Monocrotophos	0.14	89.7ab	53.3f	84.7cdef	78.3de	82.3cd	86.7cde	85.7cd	80.1d
Oxydemeton methyl	0.06	77.0cd	77.0bcde	81.0ef	89.0bc	87.3bc	91.3bc	94.0ab	85.2b
Permethrin	0.016	79.3cd	89.0a	91.3d	90.3d	87.3bc	82.7f	82.0de	86.0b
Phosalone	0.24	80.7cd	81.7bcd	65.0g	90.b	82.3cd	68.3h	47.0gh	73.6f
Phosphamidon	0.05	74.0de	89.7a	80.3ef	93.7a	74.3de	91.7ab	81.3de	83.6bc
Control	—	98.3a	94.0a	97·0a	97.3a	96.7a	96.0a	96.3a	96.5a

In vertical columns, means followed by same letters are not different statistically (p = 0.5) by L.S.D.

The glass tubes were kept in an incubator at 26 ± 1.3°C and 72 ± 3.4 per cent relative humidity.

The effect of various insecticides was also studied on 1-7 day old paarasitized eggs of *C. cephalonica* at 26 ± 1.3°C and 72 ± 3.4 per cent relative humidity. One hundred parasitized eggs of each group mounted on cards, were sprayed with these insecticides with an atomizer. For each treatment, 1.5 ml spray fluid was used and only tap water was used in the case of control. The experiment was replicated three times. The emergence of parasitoids was observed for 3 days after the start of emergence.

The data obtained in both the experiments were analysed statistically after angular transformation.

RESULTS AND DISCUSSION

All the insecticides except fenvalerate inflicted 100 per cent mortality of *T. achaeae* (Table 1). Parasitism, however, was not affected in permethrin and fenvalerate which recorded 82.7 and 82.3 %parasitism respectively. Oxydemeton methyl recorded 76.3 % parasitism. Parasitism obtained in other treatments was very low. The emergence of parasitoid was also maximum in eggs treated with fenvalerate, oxydemeton methyl and permethrin but it was significantly lower than in control.

As indicated in Table 2, the emergence from one-day old parasitized eggs was highest (98.3 per cent) in control followed by monocrotophos, the latter being at par with malathion. There was no emergence from the eggs treated with carbaryl. Emergence from two day-old parasitized eggs was highest in permethrin, phosphamidon and control and these were superior to all other insecticides. The emergence from the eggs treated with BHC, carbaryl and cypermethrin was very poor. The emergence in control from three-day old parasitized eggs was significantly more than in all other treatments. Among the insecticidal treatments, emergence was more (91.3 per cent) in permethrin which was significantly higher than in all other treatments except DDT and endosulfan. Emergence in BHC and carbaryl was again very poor. Phosphamidon and control were on par with each other in the four-day old parasitized eggs and were significantly higher than all other insecticides. Emergence in carbaryl was only 10 per cent and it was significantly less than in all other treatments. In control, 96.7 percent parasitoids emerged from 5 day-old parasitoid eggs and it was significantly higher than in all other insecticides except deltamethrin. When the 6 day-old parasitized eggs were observed, it was found that mortality in control was on a par with phosphamidon, the latter being on a par with DDT + BHC, deltamethrin, dimethoate and oxydemeton methyl. There was considerable increase in emergence from 5 to 7 day-old parasitoid eggs treated with BHC but there was decrease in emergence from 6 and 7 day-old eggs treated with malathion. The emergence in control was 96.3 per cent from the 7 day-old parasitoid eggs and it was significantly higher than in all other treatments except DDT, DDT + BHC, deltamethrin and oxydemeton methyl. Significantly lower emergence was recorded in carbaryl, malathion and phosalone.

The pooled analysis of the data revealed that the emergence in control was 96.5 per cent and it was significantly higher than in all other treatments. Emergence among the insecticidal treatments was maximum in fenvalerate and it was significantly higher than in all other insecticides except deltamethrin, dimethoate, oxydemeton methyl, permethrin and phosphamidon. BHC and carbaryl proved significantly inferior to all other treatments.

It can be concluded that fenvalerate, permethrin, oxydemeton methyl, DDT, dimethoate, deltamethrin and phosphamidon were relatively safer than other insecticides to the parasitoid in the patasitized eggs. Fenvalerate was also relatively safe to the adults of *T. achaeae*; while maximum parasitism was observed in eggs treated with permethrin, oxydemeton methyl and fenvalerate. Awate *et al.* (1977) reported that endosulfan was safer to *Trichogramma brasiliensis* Ashmead than carbaryl and quinalphos. But endosulfan was not found to be safe to *T. achaeae* in the present investigations. The results of the present studies

showing fenvalerate to be safe for *T. achaeae* confirms the findings of Singh and Varma (1986) and Varma and Singh (1987) on *T. brasiliensis*.

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Host Range, Development and Sex Ratio of *Leptomastix dactylopii* on different stages of Citrus mealybug, *Planococcus citri*

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ABSTRACT

An exotic parasitoid *Leptomastix dactylopii* How., introduced ino India against the citrus mealybug *Planococcus citri* (Risso) also attacked *P. lilacinus* (Ckll.) under laboratory conditions. Five other species were not attacked in the laboratory. The ovipositional preference, development and sex ratio of *L. dactylopii* were studied on different stages of *P. citri*. The result indicated that third instar nymphs and adult mealybugs were preferred for oviposition. Paratisitoid development was significantly faster when exposed to later stages of the mealybug. The sex ratio depended upon the stage of the host parasitized. More parasitoid females were obtained when partially gravid females of *P. citri* were exposed to *L. dactylopii*. For mass rearing of *L. dactylopii* 15 to 20-day old *P. citri* are ideal stages.

KEY WORDS: *Leptomastix dactylopii*, host range, development, sex ratio, different stage, *Planococcus citri*.

Leptomastix dactylopii Howard (Hym., Encyrtidae) is believed to be a specific parasitoid of mealybug, *Planococcus citri* (Risso) (Homo., Pseudococcidae) in the field (Lloyd, 1964). However, Bess (1939),Clancy (1944) and Lloyd (1964) reported that the parasitoid would attack other species of mealybugs under laboratory conditions. Under the All India coordinated Research Project on Biological Control of Crop Pests and Weeds, *L. dactylopii* was imported from West Indies in 1983 for trials against *P. citri*. Efforts were therefore made to examine the host range of the parasitoid on common mealybugs to use them as factitious hosts for laboratory multiplication. To develop a mass rearing technique, another study was conducted to determine the development and sex ratio of the parsasitoid on different stages of *P. citri* under laboratory conditions.

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