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Field evaluation of trichogrammatids for the control of *Helicoverpa armigera* (Hübner) on tomato

PARMINDER KUMAR, M. SHENHMAR and K. S. BRAR
Department of Entomology
Punjab Agricultural University
Ludhiana, 141 004, Punjab, India

ABSTRACT: ***Trichogramma chilonis*** **Ishii,** ***T. pretiosum*** **Riley and** ***T. brasiliense*** **Ashmead were field evaluated at three different dosages (50,000, 75,000 and 100,000/ha) against** ***Helicoverpa armigera*** **(Hübner) on tomato. No significant difference was observed in mean egg count in all the treatments. However, significant difference was observed in larval population and lowest mean larval population (0.5 larvae/5 plants) was recorded in** ***T. chilonis*** **@ one lakh/ ha dosage. Highest parasitism (41.07%) was recorded where releases of** ***T. chilonis*** **were made @ one lakh/ ha, and it was on par with the treatment of 75,000/ha of** ***T. chilonis*** **(40.00%). Lowest fruit damage (8.01%) was recorded in treatment where** ***T. chilonis*** **was released @ one lakh/ha, which was followed by the release of** ***T. chilonis*** **@ 75,000/ha (9.20%), one lakh/ha of** ***T. brasiliense*** **(11.66%), and** ***T. pretiosum*** **@ 1,000,000 and 75,000/ha (10.88 and 11.82%, respectively). Highest (261.07q/ha) yield was form treatment of** ***T. chilonis*** **@ one lakh/ha, followed by** ***T. chilonis*** **75,000/ha (248.27q/ha).**

KEY WORDS: Dosages, field evaluation, *Helicoverpa armigera*, tomato, Trichogrammatids

INTRODUCTION

Tomato fruit borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is a serious and regular pest and has developed resistance to almost all the major groups of synthetic insecticides (Mehrotra, 1993). In view of the indiscriminate and excessive use of insecticides and their well-documented adverse affects, biocontrol is being accepted as one of the main components of pest management. In India, *H. armigera* is attacked by 100 species of parasitoids (Nikam and Gaikwad, 1989). In tomato ecosystem alone, 13 parasitoid and 3 predator species have been recorded (Krishnamoorthy and Mani, 1988). Roltsch and Mayse (1983) reported that eggs of *Heliothis* in commericial fresh-market tomato fields were parasitized throughout the year by *Trichogramma* sp. Gupta *et al.* (1984) observed 87.5 to 100 per cent parasitism of eggs of *H. armigera* by *Trichogramma brasiliense* Ashmead, *T. chilonis* Ishii and *T. pretiosum* Riley on potted tomato plants. However, Kakar *et al.* (1990) observed 100 per cent parasitism of eggs of *H. armigera* by *T. brasiliense* and *T. chilonis* under field conditions in Himachal Pradesh. Divakar and Pawar (1987) observed 92.4 per cent reduction in larval population of *H. armigera* by releasing *T. brasiliense*, *T. chilonis* and *T. pretiosum*. According to Rawat and Pawar (1993) *T. brasiliense* and *T. pretiosum*, proved effective for the control of *H. armigera*. The present study was therefore conducted to find out the most

effective trichogrammatid and to identify the optimum dosage for release against *H. armigera* on tomato under Punjab conditions.

MATERIALS AND METHODS

The studies were conducted at Entomology Research Farm, Punjab Agricultural University, Ludhiana on tomato variety, Punjab *Chhuhara* during 2003. There were 11 treatments comprising three species of trichogrammatids, *viz.*, *T. chilonis*, *T. brasiliense* and *T. pretiosum* with 3 dosages of each (50,000, 75,000 and 1,00,000/ha), a recommended insecticide (Endosulfan) and a control. The experiment was laid out in a Randomized Block Design with three replications in a plot size of 25m^2. Five releases of parasitoid were made with the initiation of moth catches in pheromone traps per five plants at weekly interval. Endosulfan (Thiodan 35EC) was sprayed @800ml/acre three times at fortnightly interval. To record the egg parasitism, one hundred eggs of *H. armigera* were collected from five plants selected at random from each plot and observed in the laboratory at fortnightly interval and mean parasitism was worked out. The observations on the fruit damage were recorded at each picking and cumulative damage was worked out. The marketable yield was recorded on whole plot basis. The data were subjected to Analysis of Variance.

RESULTS AND DISCUSSION

There was no significant difference in mean population of healthy eggs of *H. armigera* in different treatments on all the dates of observation (Table 1). The pooled analysis of data showed no significant difference in mean count of *H. armigera*

Table 1. Effect of trichogrammatid releases on egg counts of *H. armigera* during 2003

Treatment #	Dosage (per ha)	Mean no. of healthy eggs /five plants on different dates				Mean
		24/3/03	1/4/03	9/4/03	17/4/03	
T. pretiosum	50,000	2.0 (1.73)	5.3 (2.53)	7.7 (2.95)	6.0 (2.63)	5.3 (2.48)
T. pretiosum	75,000	2.7 (1.93)	6.0 (2.63)	8.3 (3.04)	6.3 (2.69)	5.9 (2.59)
T. pretiosum	100,000	1.7 (1.64)	5.3 (2.53)	7.7 (2.95)	4.7 (2.39)	4.8 (2.40)
T. brasilense	50,000	3.3 (2.05)	7.0 (2.83)	8.3 (3.07)	5.7 (2.59)	6.1 (2.65)
T. brasilense	75,000	2.3 (1.83)	5.7 (2.53)	7.7 (2.95)	5.0 (2.44)	5.2 (2.47)
T. *brasilense*	100,000	2.7 (1.93)	4.3 (2.29)	8.0 (2.99)	5.7 (2.59)	5.1 (2.45)
T. chilonis	50,000	2.7 (1.93)	5.0 (2.43)	8.7 (3.10)	6.0 (2.63)	5.6 (2.55)
T. chilonis	75,000	3.0 (1.99)	4.7 (2.39)	7.0 (2.82)	5.3 (2.53)	5.0 (2.43)
T. chilonis	100,000	2.3 (1.83)	5.0 (2.43)	7.0 (2.82)	5.7 (2.59)	4.9 (2.42)
Endosulfan	2L	2.0 (1.73)	6.3 (2.69)	9.0 (3.15)	8.0 (2.98)	6.3 (2.68)
Control	-	3.3 (2.6)	9.7 (3.29)	10.3 (3.36)	8.3 (3.04)	7.9 (2.97)
CD (P=0.05)		NS	NS	NS	NS	NS

Figures in parentheses are square root transformed values

Dates of *Trichogramma* releases = March 21, 29, April 6, 14, 22

Dates of Endosulfan sprays = March 23, April 8, 24

eggs between the treatments. The releases of parasitoid did not hinder the egg laying and also endosulfan did not kill the eggs, so there was no significant difference in eggs counts in different treatments. Where *T. brasiliense* @50,000/ha was released, 6.1 eggs/ 5 plants were recorded followed by *T. pretiosum* @75,000/ha with 5.9 eggs/5 plants as compared to 4.8 eggs/5 plants in *T. pretiosum* released @one lakh/ha.

There was significant difference in larval population in different treatments on all the dates of observation. The mean larval population in the control was significantly higher (3.5 larve/5 plants) than all other treatments (Table 2). The lowest (0.5 larvae/5 plants) larval population was recorded when *T. chilonis* was released @one lakh/ha and it was significantly lower than the treatment with 3 sprays of endosulfan (1.3 larvae/5 plants). The releases of *T. pretiosum* @ 50,000/ha, and *T. brasiliense* at 50,000 and 75,000/ha was on par with other treatments. The population of the larvae in the release fields was low because there was mortality of the eggs due to parasitization.

The parasitisation of *H. armigera* eggs in the plots where parasitoids were released was higher than control and endosulfan treatment on all the dates of observation (Table 3). The mean egg parasitisation was quite high (43.33%) where *T. chilonis* was released @one lakh/ha and it was on par with *T. pretiosum* when released at same dosage (41.07%), *T. chilonis* @75,000 /ha (40.00%) and *T. brasiliense* @one lakh/ha (38.87%), but was significantly higher than all other treatments. The mean egg parasitisation was 6.11 per cent in endosulfan treatment, which was significantly lower than control (9.45%).

Table 2. Effect of trichogrammatid releases on larval population of *H. armigera* during 2003

Treatment #	Dosage (per ha)	* Mean larve / five plants on different dates (No.)				Mean
		24/3/03	1/4/03	9/4/03	17/4/03	
T. pretiosum	50,000	1.3 (1.52)	1.7 (1.63)	1.3 91.52)	1.0 (1.41)	1.4 (1.53)
T. pretiosum	75,000	1.0 (1.41)	1.3 (1.52)	1.0 (1.41)	1.3 (1.52)	1.2 (1.47)
T. pretiosum	100,000	0.7 (1.28)	0.7 (1.28)	0.7 (1.28)	1.0 (1.41)	0.8 (1.32
T. brasilense	50,000	1.7 (1.63)	2.0 (1.72)	1.7 (1.63)	1.7 (1.63)	1.8 (1.65)
T. brasilense	75,000	1.3 (1.52)	1.7 (1.52)	1.3 (1.52)	1.7 (1.63)	1.5 (1.59)
T. *brasilense*	100,000	0.7 (1.28)	1.3 (1.52)	1.0 (1.41)	1.3 (1.52)	1.1 (1.45)
T. chilonis	50,000	1.0 (1.41)	1.3 (1.52)	0.7 (1.28)	0.7 (1.28)	1.0 (1.41)
T. chilonis	75,000	0.7 (1.28)	1.0 (1.41)	0.7 (1.28)	0.7 (1.28)	0.7 (1.30)
T. chilonis	100,000	0.3 (1.14)	0.7 (1.28)	0.3 (1.14)	0.7 (1.28)	0.5 (1.22)
Endosulfan	2 L	1.0 (1.41)	1.7 (1.63)	1.3 (1.52)	1.0 (1.41)	1.3 (1.50)
Control	-	2.7 (1.88)	3.3 (2.06)	3.7 (2.13)	4.3 (2.29)	3.5 (2.11)
CD (P=0.05)		(0.33)	(0.31)	(0.41)	(0.34)	(0.27)

5 releases of trichogrammatids and 3 applications of endosulfan
Figures in parentheses are square root transformed values
Dates of *Trichogramma* releases = March 21, 29, April 6, 14, 22
Dates of endosulfan sprays = March 23, April 8, 24

Table 3. Effect of trichogrammatid releases on parasitism of eggs of *H. armigera* during 2003

Treatment #	Dosage/ ha	Mean per cent parasitism on different dates			Mean
		24/3/03	9/4/03	25/4/03	
T. pretiosum	50,000	25.00 (29.91)	36.66 (37.24)	45.00 (42.10)	35.56 (36.57)
T. pretiosum	75,000	23.33 (28.84)	40.00 (39.22)	50.00 (44.98)	37.77 (37.89)
T. pretiosum	100,000	28.33 (32.13)	43.33 (41.05)	52.66 (45.94)	41.07 (39.77)
T. brasilense	50,000	20.00 (26.55)	38.33 (38.23)	43.33 (41.05)	33.88 (35.54)
T. brasilense	75,000	21.66 (27.69)	35.00 (36.26)	38.33 (38.23)	31.67 (34.23)
T. *brasilense*	100,000	25.00 (29.91)	40.00 (39.22)	51.66 (45.94)	38.87 (38.54)
T. chilonis	50,000	26.66 (31.06)	38.33 (38.23)	48.33 (44.02)	37.76 (37.88)
T. chilonis	75,000	28.33 (32.12)	40.00 (39.22)	51.66 (45.94)	40.00 (39.19)
T. chilonis	100,000	30.00 (33.19)	45.00 (42.10)	55.00 (47.86)	43.33 (41.05)
Endosulfan	2L	3.33 (8.61)	6.67 (14.75)	8.33 (16.59)	6.11 (14.28)
Control	-	6.67 (14.75)	8.33 (16.59)	13.33 (21.33)	9.45 (17.79)
CD (P=0.05)		(5.33)	(4.19)	(4.46)	(2.76)

5 releases of trichogrammatids and 3 application of endosulfan
Figures in parentheses are arcsine transformed values.

The mean fruit damage in all the treatments was significantly lower than control (Table 4). The lowest fruit damage (8.01%) was recorded when *T. chilonis* was released @1 lakh/ha and it was significantly lower than *T. pretiosum* released @50,000/ha, *T. brasiliense* @50,000/ha and sprays of endosulfan. Similar results were reported by Krishnamoorthy and Mani (1996), according to whom *T. pretiosum* was comparatively more effective than *T. brasiliense*. They reported that borer damage in biocontrol field was 8.92 and 7.27 per cent, respectively, as against 23.06 and 13.72 per cent in control where *T. brasiliense* and *T. pretiosum* were released @ 2.5 lakh/ha. Release of *T. prestiosum* @ 5 lakh/ha reduced the borer damage to 1.09 per cent as against 8.92 per cent in the control. Singh *et al.* (2001) also reported *T. pretiosum* to be comparatively more effective than *T. brasiliense*. The present results are in close agreement with those of Brar *et al.* (2003). They reported 49.33 and 43.20 per cent parasitism of eggs of *H. armigera* by *T. pretiosum* and *T. brasiliense*, respectively. The per cent reduction in fruit damage was comparatively high (28.72%) in *T. pretiosum* treatment than *T. brasiliense* treatment (22.54%) and increase in yield was comparatively high (23.88%) in plots where *T. pretiosum* was released than where *T. brasiliense* was released (16.27%). The results are comparable to those of Chandrashekhar *et al.* (2003) reporting *T. chilonis* as most efficient followed by *T. pretiosum* and *T. brasiliense*. They reported that parasitization of *H. armigera* eggs was highest (37.93%) by *T. chilonis* followed by *T. pretiosum* (31.08%) and *T. brasiliense* (28.50%). However, Kakar *et al.* (1990) observed 100 per cent parasitisation by *T. brasiliense* and *T. chilonis*.

All the treatments gave significantly higher yield than control (Table 4). Highest marketable yield (261.07q/ha) was obtained in plots where *T.*

Table 4. Effect of trichogrammatid releases on fruit damage by *H. armigera* and marketable yield of tomato during 2003

Treatment #	Dosage/ ha	Mean Fruit Damage %	Yield (Q/ha)
T. pretiosum	50,000	12.07 (20.16)	215.33
T. pretiosum	75,000	11.82 (19.87)	227.07
T. pretiosum	100,000	10.88 (19.25)	237.33
T. brasilense	50,000	13.08 (21.12)	190.53
T. brasilense	75,000	12.39 (20.52)	211.13
T. *brasilense*	100,000	11.16 (19.16)	225.07
T. chilonis	50,000	11.94 (20.19)	221.33
T. chilonis	75,000	9.20 (17.65)	248.27
T. chilonis	100,000	8.01 (16.39)	261.07
Endosulfan	2 L	12.59 (20.77)	205.73
Control	-	21.19 (27.37)	151.87
CD (P=0.05)		(3.76)	16.20

chilonis was released @ one lakh/ha and it was on par with releases of *T. chilonis* at 75,000/ha (248.27/ ha). The yield in case of endosulfan was 205.73q/ ha, which was significantly lower than all other treatments except control (151.87 q/ha) and 50,000/ ha dosage of *T. brasiliense* (190.53q/ha).

The results indicated that *T. chilonis* proved comparatively more effective for the control of *H. armigera* on tomato followed by *T. pretiosum* and *T. brasiliense*. According to Yadav *et al.* (1985) *T. chilonis* was effective in checking *H. armigera* infestation in tomato.

It can be concluded that for the management of *H. armigera* on tomato, egg parasitoid, *T. chilonis* should be released @1,00,000 per ha five times at weekly interval, starting with initiation of egg laying/ moth catches.

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