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Impact of insecticides recommended for sugarcane on parasitization and emergence of high temperature tolerant and Ludhiana strains of *Trichogramma chilonis* Ishii

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ABSTRACT: **The studies to evaluate the effect of insecticides recommended on sugarcane in Punjab, on parasitization and adult emergence of high temperature tolerant (PDBC, Bangalore) and Ludhiana (Punjab) strains of *Trichogramma chilonis* Ishii conducted during April - July 2004 at Entomological Research Farm and Biological Control Laboratory of Punjab Agricultural University, Ludhiana revealed that Ludhiana strain of *T. chilonis* was more tolerant to insecticides as compared to the high temperature tolerant strain. Among the insecticides, endosulfan (Thiodan 35EC) @ 395g a. i. / ha was the safest followed by imidacloprid (Confidor 200 SL) @ 20g a. i. / ha, triazophos (Hostathion 40EC) @ 600g a. i. / ha, chlorpyriphos (Dursban 20EC) @ 175g a. i. / ha and malathion 50EC @ 1250g a. i./ ha. The latter two at the applied doses were highly deleterious to the parasitoid.**

KEY WORDS: Insecticides, parasitism, strain, sugarcane, *Trichogramma chilonis*

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.), an agro-industrial crop, is an integral component of agriculture crop system. *Trichogramma chilonis* Ishii and other trichogrammatids are being used against sugarcane borers in India and around the world since long (Narayanan, 1933; Greenberg *et al.*, 1998; Singh and Jalali, 1994; Shenhmar *et al.*, 2003). Moreover, nowadays under global competition, only quality agro-products free from insecticide residues are in demand, but it is not possible to rely totally on the bioagents. So in order to maintain the ecological balance as well as meet the demands of the international market it will be of utmost importance to intensively incorporate biological control in IPM of sugarcane by evaluating the compatibility of the bio agents with insecticides. Thus the studies were undertaken with an objective to find out the safety of some insecticides recommended for different sugarcane insect pests to two important strains of *T. chilonis*.

MATERIALS AND METHODS

Experiments on impact of insecticides recommended on sugarcane in Punjab were conducted during April-July 2004 at Entomological

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Research Farm and Biological Control Laboratory of Punjab Agricultural University (PAU), Ludhiana. The high temperature tolerant strain of *T. chilonis* was obtained from Project Directorate of Biological Control (PDBC), Bangalore while Ludhiana (Punjab) strain was obtained from the culture maintained in the Biological Control Laboratory, Department of Entomology (PAU). The selected insecticides, *viz.* malathion @ 1250g a. i./ ha, endosulfan @ 395g a. i./ ha, imidacloprid @ 20g a. i./ ha, triazophos @ 600g a. i./ ha and chlorpyriphos @ 175g a. i./ ha are recommended against the various sugarcane insect pests in Punjab.

Tricho-cards (thick paper pieces glued with 7-days-old eggs of *Corcyra cephalonica* (Stainton) parasitized by trichogrammatids) of 1 x 2 cm each with one hundred eggs parasitized by each strain were stapled on the lower leaf surface of the upper canopy of sugarcane @ 3 per plot (20 x 20 m). The plots containing tricho-cards were sprayed with each of the insecticide and the cards removed after one hour. Only water was sprayed on control plots. The removed cards were brought to the laboratory and kept separately in glass vials (2 dram) marked with glass marker for further observations. The experiment was repeated 4 times. The per cent adult emergence from parasitized eggs of each tricho-card was recorded by counting the adults under a stereoscopic binocular microscope. From the emerged adults ten mated females were exposed to 100 fresh *C. cephalonica* eggs to record the per cent parasitism by counting the number of parasitized eggs (turned dark brown) under the stereoscopic binocular microscope and per cent emergence on the basis of adults emerged. The data obtained were transformed using arcsine transformation and analyzed by factorial analysis in completely randomized design.

RESULTS AND DISCUSSION

Adult emergence

All the tested insecticides, *viz.* malathion, endosulfan, imidacloprid, triazophos and chlorpyriphos affected the adult emergence of two strains of *T. chilonis* as is clear from the emergence in control (89.08%) (Table 1). Among the insecticidal treatments, highest emergence (71.17%) was recorded in case of endosulfan, which was significantly higher than all other insecticides tested. The mean emergence (41.88%) in imidacloprid was significantly higher than triazophos (30.58%), which in turn was significantly higher than chlorpyriphos (20.17%) and was on par with malathion (18.13%). Mean emergence in case of Ludhiana strain was 38.75 per cent, which was significantly higher than high temperature tolerant strain (34.02%).

Parasitization efficiency

The highest mean parasitism (86.42%) was recorded in the control (Table 2). Among the insecticides highest mean parasitism (69.38%) of two strains was recorded in endosulfan which was significantly higher than all other insecticidal treatments, followed by imidacloprid (41.50%) and triazophos (34.38%). The least (13.71%) mean parasitization was recorded in malathion and was on par with chlorpyriphos (14.13%). Highest (36.63%) mean parasitism was recorded by Ludhiana strain and it was significantly higher than high temperature tolerant strain (32.60%). The interaction between strain and insecticide was significant with highest parasitization (71.33%) recorded by Ludhiana strain, when treated with endosulfan and this was significantly higher than all other combinations except by high temperature tolerant strain (67.42%) with same insecticide.

Adult emergence from the parasitized eggs

The highest (79.95%) emergence was recorded in the control, while among insecticidal treatments endosulfan recorded highest (62.58%) followed by imidacloprid (34.92%) and triazophos (29.00%) (Table 3). The least emergence was recorded in malathion and was on par with chlorpyriphos (8.79%). The highest mean emergence (30.72%) was recorded in Ludhiana strain, which was significantly higher than high temperature tolerant strain (26.80%) of *T. chilonis*.

Table 1. Effect of insecticides on adult emergence of Ludhiana and high temperature tolerant strains of *T. chilonis*

Treatment	Dose g (a. i./ ha)	Per cent adult emergence		
		Ludhiana strain	Htt strain	Mean
Malathion 50EC	1250	19.58 (26.24)	16.67 (24.07)	18.13 (25.16)
Endosulfan (Thiodon 35 EC)	395	73.92 (59.27)	68.42 (55.78)	71.17 (57.53)
Imidacloprid (Confidor 200 SL)	20	44.92 (42.06)	38.83 (38.53)	41.88 (40.30)
Triazophos (Hostathion 40EC)	600	31.50 (34.13)	29.67 (32.98)	30.58 (33.55)
Chlorpyriphos (Dursban 20EC)	175	23.83 (29.20)	16.50 (23.94)	20.17 (26.57)
Control (Water)	—	89.00 (70.23)	89.17 (70.91)	89.08 (70.82)
Mean (X)		38.75 (38.18)	34.02 (35.06)	—

	CD (5%)
Strain	1.01
Treatment	1.74
Strain x Treatment	NS

Figures in parentheses are arcsine-transformed values.

Htt- high temperature tolerant

Table 2. Effect of insecticides on parasitization of host eggs by Ludhiana and high temperature tolerant strains of *T. chilonis*

Treatment	Dose g (a. i./ ha)	Per cent adult emergence		
		Ludhiana strain	Htt strain	Mean
Malathion 50 EC	1250	14.67 (22.49)	12.75 (20.90)	13.71 (21.70)
Endosulfan (Thiodon 35 EC)	395	71.33 (57.62)	67.42 (55.20)	69.38 (56.41)
Imidacloprid (Confidor 200 SL)	20	45.75 (42.54)	37.25 (37.60)	41.50 (40.07)
Triazophos (Hostathion 40 EC)	600	35.08 (36.30)	33.67 (35.45)	34.38 (35.88)
Chlorpyriphos (Dursban 20 EC)	175	16.33 (23.83)	11.92 (20.12)	14.13 (21.97)
Control (Water)	—	86.08 (68.09)	86.75 (68.64)	86.42 (68.37)
Mean (X)		36.63 (36.56)	32.60 (33.86)	—

	CD (5%)
Strain	1.00
Treatment	1.73
Strain x Treatment	2.45

Figures in parentheses are arcsine-transformed values.

Htt- high temperature tolerant

Table 3. Effect of insecticides on adult emergence of Ludhiana and high temperature tolerant strains of *T. chilonis* from parasitized host eggs

Treatment	Dose g (a. i./ ha)	Per cent adult emergence		
		Ludhiana strain	Htt strain	Mean
Malathion 50EC	1250	9.25 (17.67)	7.75 (16.15)	8.50 (16.91)
Endosulfan (Thiodon 35 EC)	395	64.50 (53.42)	60.67 (51.17)	62.58 (52.29)
Imidacloprid (Confidor 200 SL)	20	39.17 (38.73)	30.67 (33.61)	34.92 (36.17)
Triazophos (Hostathion 40EC)	600	30.17 (33.30)	27.83 (31.83)	29.00 (32.56)
Chlorpyriphos (Dursban 20EC)	175	10.50 (18.89)	7.08 (15.36)	8.79 (17.13)
Control (Water)	—	80.25 (63.59)	79.67 (63.18)	79.95 (63.39)
Mean (X)		30.72 (32.40)	26.80 (29.62)	—

	CD (5%)
Strain	1.02
Treatment	1.77
Strain x Treatment	NS

Figures in parentheses are the arcsine-transformed values.
Htt- high temperature tolerant

On the basis of adult emergence and parasitization efficiency of two strains, it can be concluded that all the tested insecticides were deleterious for both the strains, while Ludhiana strain was slightly better than the high temperature tolerant one. Endosulfan @ 395g a.i./ ha, followed by imidacloprid @ 20g a.i./ ha, was comparatively safer than other insecticides at the tested dosages. The results are in tune with those of Kao and Tzeng (1985) reporting endosulfan as harmless and chlorpyriphos as moderately harmful to *Trichogramma* spp. The results are further supported by Kumaraswami and Santharam (1985) reporting highest (70.90%) emergence with endosulfan. These results, however, are not in accordance with those of Paul *et al.* (1979) reporting low rate of parasitism in case of eggs treated with endosulfan. Brar *et al.* (1991) reported that endosulfan was comparatively safe for the emergence of *T. chilonis* from 7-day-old parasitized eggs. This was also supported by Rajendran and Gahukar (2000) reporting endosulfan (0.05%) to be comparatively safer to *T. chilonis* than quinalphos (0.05%), monocrotophos (0.04%) and fenvalerate (0.04%). Ingle *et al.* (2004) reported that of the four species of *Trichogramma*, *T. chilonis* was most tolerant to endosulfan with LC_{50} value increasing from 0.0432 per cent of base colony to 0.0495 percent of selected F_{15} colony, while Kumar and Santharam (1999) reported no adverse effect of imidacloprid on emergence and parasitism of *T. chilonis* at the tested dose (0.01 and 0.015%). Thus the increasing order of toxicity of these insecticides was as follows: endosulfan > imidacloprid > triazophos > chlorpyriphos > malathion and the former two can be integrated in the sugarcane IPM programme with less impact on this hymenopterous parasitoid.

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