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Research Article

Toxicity of flubendiamide 20 WG against egg parasitoid, *Trichogramma chilonis* (Ishii). (*Hymenoptera: Trichogrammatidae*) under laboratory conditions

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ABSTRACT: The impact of flubendiamide 20 WG, on egg parasitoid was studied in laboratory experiments to assess its safety *Trichogramma chilonis* (Ishii). Among the insecticides tested, the highest per cent parasitization (84.16 %) was recorded in flubendiamide 20 WG at 50 g a.i. ha-1, followed by 60 and 70 g a.i. ha-1 (80.20 and 80.04 %). Maximum adult emergence per cent was 89.70 at 50 g a.i. ha-1 followed by 82.91 and 87.30 per cent for flubendiamide 20 WG at 60 and 70 g a.i. ha-1, respectively at 72 h after the treatment and flubendiamide 20 WG at all the doses tested caused no adverse effect when compared to other insecticides.

KEY WORDS: Toxicity, Safety, Flubendiamide, Egg parasitoid, *Trichogramma chilonis*

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INTRODUCTION

Chemical control is necessary for controlling the pests, but the use of non selective insecticides greatly reduces the importance of the biological control agents in agriculture. The parasitic Hymenoptera are often far more susceptible to insecticides than their hosts. Several species of *Trichogramma chilonis* are reared and released around the World annually on an estimated 80 million acres of agricultural crops and forests in 30 countries. *Trichogramma spp.* Hewa-Kapuge *et al*. (2003) parasitize the eggs of over 400 species belonging to at least seven insect orders Bao (1989) and Chen, (1989). A range of harmful effects of insecticides on *Trichogramma* spp. have been described by different workers Hewa-Kapuge *et al*., (2003); Desneux *et al*. (2007); Vianna *et al*. (2009). Apart from direct toxic effects, insecticides may interfere with the feeding behaviour as repellents, inhibitors, or olfaction disruptors Desneux *et al*. (2007). In addition to the negative effects of fresh insecticide residues, some persistent compounds can exert their lethal and sub lethal effects on the *Trichogramma* for a longer period of post application. Egg parasitoid, *Trichogramma chilonis* (Ishii) play a vital role in biological control of lepidopteran pests in sugarcane crop, the impact of insecticides used in sugarcane field to control borer pests' needs to be explored for its safety. The present investigation was undertaken with a view to assess the safety of flubendiamide 20 WG to egg parasitoid *T. chilonis*.

Evaluation of safety of insecticides to parasitoid, *Trichogramma chilonis*

Laboratory experiments were conducted at Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore to assess the safety of insecticides to egg parasitoid, *T. chilonis*. The treatment details were as follows.

S. No.	Treatments	Dose g a.i.ha^{-1}
1.	Flubendiamide 20 WG	50
2.	Flubendiamide 20 WG	60
3.	Flubendiamide 20 WG	70
4.	Chlorantraniliprole 18.5 SC	75
5.	Chlorpyrifos 20% EC	250
6.	Fipronil 5% SC	75
7.	Thiodicarb 75% WP	675
8.	Untreated check	-

MATERIALS AND METHODS

Mass culturing of *Trichogramma chilonis*

Trichogramma chilonis was mass cultured on the eggs of rice moth *C. cephalonica* as per the method described by Prabhu (1991). Fresh *C. cephalonica* eggs were collected in the early morning and sterilized under UV radiation of 15 W for 20 min at a distance of 15 cm to kill the embryo.

The sterilized eggs were then pasted on paper cards of 21 x 30 cm size containing thirty, 7 x 2 cm rectangles. These egg cards were placed in polythene bags along with nucleus card at 6:1 ratio for parasitization. Parasitized eggs turned black and after parasitization, three days old, hundred per cent parasitized eggs were used for conducting the experiment.

The bioassay for safety of *T. chilonis* was conducted by using the method as described by Jalali and Singh (1997) and the experiment was performed in the Department of Agricultural

Table 1. Effect of flubendiamide 20 WG on egg parasitoid, *Trichogramma chilonis*

S. No	Treatments	Dose (g a.i. ha-1)	*T. chilonis*			
			Adult emergence (%)			Parasitisation (%)
			24 hrs	48 hrs	72hrs	
1	Flubendiamide 20 WG	50	23.12 (28.74)^{b}	59.24 (50.32)^{a}	89.70 (71.28)^{b}	84.16 (66.55)^{b}
2	Flubendiamide 20 WG	60	18.50 (25.47)^{c}	57.3 (49.20)^{b}	87.30 (69.12)^{b}	80.20 (63.58)^{c}
3	Flubendiamide 20 WG	70	15.90 (23.50)^{e}	49.92 (44.95)^{c}	82.91 (65.58)^{c}	80.04 (63.46)^{c}
4	Chlorantraniliprole 18.5 SC	75	17.41 (24.66)^{d}	49.69 (44.82)^{c}	81.78 (64.73)^{c}	75.86 (60.57)^{d}
5	Chlorpyrifos 20% EC	250	14.09 (22.05)^{g}	40.52 (39.54)^{e}	68.70 (55.98)^{f}	67.38 (55.17)^{f}
6	Fipronil 5% SC	75	14.16 (22.10)^{g}	44.97 (42.11)^{d}	78.24 (62.19)^{d}	73.23 (58.84)^{e}
7	Thiodicarb 75% WP	675	15.02 (22.80)^{f}	41.41 (40.05)^{e}	71.45 (57.70)^{e}	73.56 (59.06)^{e}
8	Untreated check	-	25.02 (30.01)^{a}	58.73 (50.03)^{a}	95.01 (77.09)^{a}	92.60 (74.21)^{a}

In a column means followed by a common alphabets are not significantly different by DMRT (P = 0.05).
Figures in parentheses are arc sine transformed values.

Entomology - Insectary unit, Tamil Nadu Agricultural University, Coimbatore. The parasitized egg cards were cut into one square centimetre bits and sprayed with different doses of chemicals (mentioned in Table 1.) using hand atomizer. Stock solutions of test insecticides were prepared using double distilled water with their respective doses. Distilled water alone was sprayed for untreated check. The treated egg cards were kept for dryness at ambient room temperature for 10 min. Immediately after drying, the egg cards were placed in the glass tubes (15 x 2.5 cm) and the tubes were covered tightly with muslin cloth using rubber bands and kept for adult emergence up to all healthy parasitoids had emerged. The number of parasitoids emerged after 24 and 48 h after treatment was recorded and per cent adult emergence was worked out. The paper cards of 6 cm^2 (1:6 ratio) was slightly glued and UV treated *C. cephalonica* eggs were placed firmly and these cards were offered for 24 h to freshly emerged *Trichogramma* adults in each glass tubes. The entire bioassays were maintained in a controlled condition (27±2°C, 60±5 % RH and 14:10 L:D). Three replications were maintained and the experiment was carried out in a Completely Randomized Design (CRD).

T. chilonis parasitization from the different treatments.

$$\text{Per cent adult emergence} = \frac{\text{Number of wasps emerged}}{\text{Total number of eggs in 1 cm}^2} \times 100$$

Fresh sterilized *C. cephalonica* eggs treated with respective acaricides/insecticides were exposed to parasitoids at 6:1 ratio and the per cent parasitization was worked out.

$$\text{Per cent adult emergence} = \frac{\text{Number of parasitized eggs}}{\text{Total number of } C. \text{ cephalonica eggs}} \times 100$$

For analysis, the per cent parasitisation were transformed to arcsine percentage and subjected to statistical analysis adopting completely randomized design. The mean values of treatments were then separated by Duncan's Multiple Range Test (DMRT) Gomez (1984) and Gomez (1984).

RESULTS AND DISCUSSION

Adult emergence

Trichogramma parasitized *Corcyra* eggs sprayed with different doses of flubendiamide 20 WG showed a maximum adult emergence per cent of 89.70 at 50 g a.i. ha^{-1} followed by 82.91 and 87.30 per cent for flubendiamide 20 WG at 60 and 70 g a.i. ha^{-1}, respectively at 72 h after the treatment. Flubendiamide 20 WG at 70 g a.i. ha^{-1} was on par with chlorantraniliprole 18.5 SC at 75 g a.i. ha^{-1} (81.78 %). The standard check, chlorpyrifos 20 EC at 250 g a.i.ha^{-1}

recorded the least emergence per cent of 68.70 and the untreated check recorded the highest emergence of 95.01 per cent (Table 1).

Parasitisation

Flubendiamide 20 WG was also found to have less effect on the parasitisation of *T. chilonis*. The highest per cent parasitisation was recorded in untreated check (92.60 %). Among the different doses, the highest per cent parasitisation (84.16 %) was recorded in flubendiamide 20 WG at 50 g a.i. ha^{-1}, followed by 60 and 70 g a.i. ha^{-1} (80.20 and 80.04 %) and were on par. The per cent parasitisation was 67.38 in chlorpyrifos 20 EC at 250 g a.i. ha^{-1} treated eggs, while it was 73.23, in fipronil 5 SC at 75 g a.i. ha^{-1}, 73.56 in thiodicarb 75 WP at 675 g a.i. ha^{-1}, 75.86 in chlorantraniliprole 18.5 SC at 75 g a.i. ha^{-1} sprayed eggs (Table 1). In the present study, regard to adult emergence and parasitization, flubendiamide 20 WG at all the doses tested caused no adverse effect when compared to other insecticides. Ovipositional deterrence to *T. chilonis* Ishii was reported to be nil in respect to flubendiamide 480 SC and recorded more than 75 per cent parasitism. Similarly, adult emergence of the parasitoids was also not affected Thilagam (2006). Studies conducted by Sekh *et al*. (2007) revealed that the per cent parasitisation in the flubendiamide 480 SC treated plot was close to those of the untreated plots. Flubendiamide 480 SC at 24 and 30 g a.i. ha^{-1} was soft to egg parasitoids of stem borer and larval parasitoids of leaf folder. Flubendiamide (Belt)® 480 SC (80 mg a.i. L^{-1}) was highly safer to *T. chilonis* for its development, survival and fecundity Shahid *et al*. (2011). The present findings are in agreement with the above. The conclusions regarding the safety of the chemical to the insect are also in concurrence with that of Cristina *et al*. (2006). The harmlessness of flubendiamide to the immature stages of *Trichogramma* is confirmed by Carvalho *et al*. (2005) and Rezende *et al*. (2005) for the larval and pupal stages of *T. pretiosum* and *T. atopovirilia*, respectively. The present findings also derive the support from Kubendran *et al*. (2008), who reported that flubendiamide was safer to natural enemies and similar results were also reported by Dilbar *et al*. (2012).

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