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IMPACT OF NEW GENERATION INSECTICIDES ON THE PUPAE OF *TRICHOGRAMMA JAPONICUM* (HYMENOPTERA : TRICHOGRAMMATIDAE)

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Integrated pest management has been the cardinal strategy for plant protection since decades. Ever since efforts were made for holistic approach by integrating chemical and biological means for pest management, the biological tactics using egg parasitoid *Trichogramma* sp. against lepidopterous pests have given promising results. Chemicals especially new generation ones are gaining wide acceptance among the farming community due to their unique mode of action and safety to natural enemies. In the present study, impact of new era chemicals have been evaluated against pupal stage of *Trichogramma japonicum* adopting insecticide dip method of bioassay technique as standardised by IOBC (International Organization for Biological Control of crop pests and weeds). The periodic observations recorded for adult emergence showed that chlorantraniliprole 18.5% SC was harmless with a minimum reduction of adult emergence (5.55%) which was followed by flubendiamide 39.35% SC (13.50%) and buprofezin 25% SC (23.75%). Spinosad 2.5% SC and thiamethoxam 25% WG were slightly harmful with 38.88% and 50.92% reduction in adult emergence.

Key words : Parasitoid, Parasitism viability, Safety scale, Trichogramma, Insecticides

INTRODUCTION

Pests and their management has been a matter of serious concern since ages. Physical, cultural, legal, chemical and biological methods of pest management has gained appreciable acceptance among the farming community. With the advent of time, pest management practices have shifted towards better alternatives and newer tactics. Despite of the importance of biological methods for insect control, the use of insecticides is still preferred within the current agricultural system since it is quick, efficient, easy to use and cost effective (Urech, 2000; Khan *et al.*, 2008). The chemical pesticides have an adverse impact not only on the environment, also leave high level of residues which make the commodities unfit for human consumption. The organic farming is being promoted world over, but it is not adequate to meet the ever increasing requirement of food demand. In this context, multiple tactics have been applied within the Integrated Pest Management (IPM) concept, demonstrating that when insecticides are used in a compatible manner, the effectiveness of biological control may be improved (Wang *et al.*, 2008; Preetha *et al.*, 2009). Ideal insecticides should have minimal side-effects on natural enemies of the insect pests (Mohamed & Chemseddine, 2002; Brugger *et al.*, 2010) hence, knowledge of compatibility and impact of insecticides on natural enemies of insect pests is essential for effective integration of chemical and biological control methods (Moura *et al.*, 2006; Preetha *et al.*, 2009).

A number of novel insecticides with unique modes of action were registered during the late 1990s and early 2000s for insect control in agriculture. These new insecticides offer several additional advantages over conventional insecticides. These new generation

insecticides have unique chemistry, novel mode of action and high selectivity. This group act on insect developmental processes (such as moulting) that humans do not experience. Low mammalian toxicity allows for short re-entry and pre-harvest intervals, allowing the insecticides to be easily incorporated into pest control programs.

The information regarding the direct and indirect impact of these new generation insecticides on sensitive natural enemies is scanty. In this regard, it is very important to study the impact of insecticides on sensitive natural enemies. Among biological control agents, *Trichogramma japonicum* Ashmead (Hymenoptera: Trichogrammatidae) an important egg parasitoid has been reported as most promising natural enemy of lepidopteran pests in rice crop (Rani *et al.*, 2007). The present study is therefore, undertaken on adult emergence of *T. japonicum* by treating the parasitoid at pupal stage during 2015-16.

MATERIALS AND METHODS

The eggs of rice moth, *Corcyra cephalonica* (Stainton) (Lepidoptera : Pyralidae) were procured from the State Biocontrol Laboratory, Mannuthy, Thrissur for mass production of *T. japonicum* on the factitious host, *C. cephalonica.* The study was undertaken under the laboratory conditions at 30 ± 2^{0}C temp and 70 ± 5% R.H. Freshly laid eggs of *Corcyra* were collected in the morning and cleaned from scales and other dust particles. The cleaned eggs were sprinkled on sticky cards of 10 x 2 cm size and were irradiated with UV rays of 30 Watts for 45 minutes at a distance of 2 ft, to prevent hatching. These *Corcyra* egg cards were then kept in polythene bags along with a nucleus tricho card at 6 : 1 ratio for 3-4 days to get parasitized by *T. japonicum.*

The *Corcyra* egg cards (10 x 2 cm) containing the *T. japonicum* pupae (05 days after parasitization) were cut into four bits (5 x 1 cm). Total number of *Corcyra* eggs in each bit was counted and treated by dipping for three seconds in respective insecticide concentrations prepared based on recommended field dosages and taking water dilution @ 500 l/ha. The cards were allowed to dry in air at room temperature. The bits were then kept in test tubes (45 ml) and the mouth of which were secured tightly using muslin cloth and rubber bands. Four replications were kept for each treatment along with an untreated control. Adult emergence was observed three days after treatment. Based on per cent adult emergence parasitism viability was worked out. The effect of insecticides (E) on *T. japonicum* was also measured in terms of reduction in adult emergence *i.e.* reduction in parasitism viability (RPV) as compared to untreated control using the formula given below :

$$E\ (RPV)\ \% = (1\text{-}Pt/\ Pc) \times 100$$

where, Pt is the rate of parasitism/ adult emergence in treatment
Pc is the rate of parasitism/ adult emergence in control

Based on the values of parasitism viability E, insecticides were categorized into following classes according to the IOBC standards (Hassan, 1992).

Class 1 : Harmless (E < 30%)
Class 2 : Slightly harmful (30% < E < 79%)
Class 3 : Moderately harmful (80% < E < 99%)
Class 4 : Harmful (E > 99%)

RESULTS AND DISCUSSION

Adult emergence was significantly reduced (5.55 to 50.92%) when *T. japonicum* pupae were exposed to different insecticides (Table 1). Thiamethoxam 25% WG was found toxic to pupal stage as indicated by the lowest adult emergence (39.75%) resulting in 50.92% reduction in adult emergence. Spinosad 2.5% SC and buprofezin 25% SC were relatively less toxic with 38.88% and 23.75% reduction in adult emergence, respectively. Flubendiamide 39.35% SC caused only 13.50% reduction of adult emergence while 5.55% reduction was recorded with chlorantraniliprole 18.5% SC. According to IOBC safety scale classification, thiamethoxam 25% WG and spinosad 2.5% SC were classified as slightly harmful while chlorantraniliprole 18.5% SC, flubendiamide 39.35% SC and buprofezin 25% SC were classified as harmless to *T. japonicum*.

Table I : Effect of insecticide on adult emergence of *T. japonicum*.

Insecticide formulation	Field dose (g a.i./ha)	Parasitism viability (%)	Emergence reduction (RPV %)	IOBC safety class
Buprofezin 25% SC	200	57.25 (0.8582)^{d}	23.75	Harmless
Chlorantraniliprole 18.5% SC	30	76.50 (1.0647)^{b}	5.55	Harmless
Flubendiamide 39.35% SC	24	70.00 (0.9913)^{c}	13.50	Harmless
Spinosad 2.5% SC	17.5	49.50 (0.7804)^{e}	38.88	Slightly harmful
Thiamethoxam 25% WG	25	39.75 (0.6822)^{f}	50.92	Slightly harmful
Untreated control	Water only	81 (1.1198)^{a}		

Figures in parentheses are angular transformed values arcsine ($\sqrt{x}/100$). In a column, values superscripted by a common letter are not significantly different by DMRT (P=0.05)

Hussain *et al.* (2012) reported high lethality of chlorantraniliprole to the pupal stage of *T. chilonis* which is inconsistent with our findings which may be due to difference in the species of test insect. The impact of an insect growth regulator, buprofezin on the rate of pupation and adult emergence of an ectoparasitoid, *Aphytis melinus* (Hymenoptera : Aphelinidae) was studied by Rill *et al.* (2008). They stated that there was no toxic effect on the biological parameters when the pupal stage was exposed to insecticides. Our studies indicated a marginal reduction in adult emergence due to buprofezin. This might be attributed to the difference in the systematic position of the tested insect.

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