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Effect of newer insecticides on per cent mortality of *Trichogramma chilonis* Ishii under laboratory conditions

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Abstract
The present studies were conducted under laboratory conditions on evaluation of relative safety of commonly used newer insecticides to *Trichogramma chilonis* Ishii, a potent egg parasitoid of lepidopteran insect pests reared on UV irradiated and Unirradiated eggs of *Corcyra cephalonica*. Eight newer insecticides with different modes of action were chosen for present study. The results revealed that, the treatment of azadirachtin 1500 ppm caused least mortality of *T. chilonis* immature stages developing inside the parasitized *C. cephalonica* eggs. The insecticides viz., chlorantraniliprole 18.5 SC and imidacloprid 17.8 SL recorded less than 30% mortality of *T. chilonis*, thus were found relatively safer as compared to rest of the chemical insecticides. Whereas, a combination product of lambda cyhalothrin 9.5% + thiamethoxam 12.6% ZC recorded least emergence, indicating its detrimental effects on *T. chilonis*. Hence these insecticides can be safely included in bio intensive IPM.

Keywords: *Trichogramma chilonis,* newer insecticides, percent mortality

Introduction
*Trichogramm*a spp. (Hymenoptera: Trichogrammatidae) is amongst the most widely used bioagents for successful biological control of insect pests, worldwide. It is a minute chalcid wasp with more than 150 species, subspecies and strains, occurring in different crop ecosystems. It is primarily an egg parasitoid of about 19 insect species belonging to 10 different families and eight insect orders in diverse habitats. The role of *Trichogrammatids* in the biological control programmes is well understood and its use in many crop ecosystems has achieved appreciable success (Singh and Jalali, 1994; Vennila 2006; Koul and Brar 2008; Liu *et al.* 2014) [10, 12, 5, 7]. However, it should be noted here that, not all the pesticides are equally harmful to the natural enemies, but there are also some safer compounds to different bioagents (Shukla *et al.* 1988; Brar *et al.* 1991; Tiwari and Khan, 2004; Fand *et al.* 2009) [9, 1, 11, 2].

Methods and Material
U.V. irradiated and unirradiated eggs of *Corcyra cephalonica* Stainton (Lepidoptera: Pyralidae),Culture of *T. chilonis* Insecticides for treatments, Ethanol for disinfection and or sterilization of glass wares, Sodium hypochlorite for sterilization, glassware and laboratory equipments were used.
To study the effect of newer insecticides on percent mortality of *T. chilonis* U.V. irradiated and unirradiated eggs of *C. cephalonica* were glued to the egg cards separately (@50 eggs per card strip) and were cut into strips of 5.0 x 2.0 cm size. These cards were then exposed to the adults of *T. chilonis* (@5:1 host parasitoid ratio) for 24 h to obtain adequate parasitization. The parasitized card strips were dipped individually in solutions of test insecticides for 5 seconds on 1st, 3rd and 5th day of parasitoid release. For control, water was used in place of insecticides. The cards were then shade dried and kept in BOD incubator at 27+1 ºC temperature and 65+5% Relative humidity in the laboratory till emergence of parasitoid adults. Three replications were maintained for each treatment and the observations were recorded daily starting at 24 h after parasitoid release and were continued upto parasitoid emergence. The data on parasitoid emergence was recorded. The percent reduction in adult emergence was considered as the percent mortality due to application of insecticide during different developmental stages of *T. chilonis*.

Results and Discussion
Effect of newer insecticides on percent mortality of *T. chilonis.*
The results on percent mortality observed in *T. chilonis* Ishii when UV irradiated and

unirradiated eggs of *C. cephalonica* treated with different test insecticides after 1st, 3rd and 5th day of parasitization indicate that azadirachtin recorded lowest mortality whereas, highest mortality recorded in lambda cyhalothrin + thiamethoxam which was found most toxic compound to the bioagent *T. chilonis*. The insecticides *viz*., chlorantraniliprole 18.5 SC and imidacloprid 17.8 SL recorded less than 30% mortality of *T. chilonis*, thus were found relatively safer as compared to rest of the insecticides. Whereas, the results of present study on percent mortality of *T. chilonis* under the influence of insecticidal treatments indicated the relative toxicity of test insecticides in following order: chlorantraniliprole < spiromesifen < acephate < imidacloprid < diafenthiuron < buprofezin < lambda cyhalothrin + thiamethoxam. Our results are strongly supported by the finding of earlier researchers Jayashri Ughade (2003) [3], Fand *et al.* (2009) [2] observed only 25 percent mortality with 75 percent adult emergence in the treatment of neem oil. They further reported that, though the neem oil, being an oviposition repellent, reduced the parasitization by the *T. chilonis* on treated host eggs but has no any ill effect on development and survival of the bioagents. Lingathurai *et al.* (2015) [5] observed maximum emergence of adult *T. chilonis* in case of neem treatment. Khan and Ruberson (2017) [7] reported that buprofezin, chlorantraniliprole and spiromesifen caused no significant mortality to immature stages of *Trichogramma pretiosum.* Saha *et al.* (2017) [8] reported only 7.87 percent pupal mortality in *T. chilonis* when treated with neemazal 1% EC (0.002%) which is in agreement with the present findings.

Table 1: Effect of newer insecticides on percent mortality of *T. chilonis* reared on U.V. irradiated & unirradiated eggs of *C. cephalonica*

S. No.	Treatment	Conc. (%)	Mortality of *T. chilonis* (%)					
			1st day		3rd day		5th day	
			UV Irradiated	UV Unirradiated	UV Irradiated	UV Unirradiated	UV Irradiated	UV Unirradiated
1.	Chlorantraniliprole 18.5% SC	0.005	20.67 (27.00)	27.33 (31.48)	17.33 (24.60)	12.00 (20.23)	13.33 (21.33)	11.33 (19.56)
2.	Imidacloprid 17.8% SL	0.005	43.33 (41.16)	40.67 (39.61)	28.67 (32.28)	32.67 (34.82)	31.33 (33.99)	30.00 (33.20)
3.	Acephate 75% SC	0.05	32.00 (34.29)	48.00 (43.85)	37.33 (37.65)	43.33 (41.16)	41.33 (40.00)	44.00 (41.55)
4.	Diafenthiuron 50% WP	0.06	51.33 (45.76)	49.33 (44.61)	39.33 (38.83)	43.33 (41.15)	36.00 (36.83)	45.33 (42.31)
5.	Buprofezin 25% SC	0.005	67.33 (55.21)	65.33 (53.94)	46.00 (42.70)	40.00 (39.20)	42.67 (40.78)	46.00 (42.70)
6.	Spiromesifen 22.9% SC	0.006	31.33 (33.99)	32.67 (34.75)	47.33 (43.46)	32.67 (34.84)	25.33 (30.19)	33.33 (35.24)
7.	Azadirachtin 1500Ppm	0.005	11.33 (19.24)	10.00 (17.93)	8.00 (16.08)	8.00 (16.35)	10.67 (18.95)	10.00 (18.38)
8.	Lambdacyhalothrin 9.5% + thiamethoxam 12.6% ZC	0.002	86.00 (68.06)	83.33 (65.96)	85.33 (67.55)	84.67 (66.98)	88.00 (69.77)	84.67 (67.02)
9.	Control	Water Spray	4.67 (12.42)	4.00 (11.28)	4.67 (12.42)	6.67 (14.80)	4.67 (12.42)	4.67 (12.42)
10.	F test		Sig	Sig.	Sig.	Sig.	Sig.	Sig.
11.	SE (diff.)		2.94	2.78	2.57	2.08	1.98	1.91
12.	CD (%)		6.17	5.85	5.39	4.37	4.17	4.03

*Figures in parentheses are arc sin transformed values

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