



BIOSAFETY OF INSECTICIDES TO THE INDIAN BEE *APIS CERANA INDICA* (F.)

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ABSTRACT

Contact toxicity study was conducted at the Insectary, Agricultural College and Research Institute, Madurai during 2017-18 to determine the safety of new insecticides/ biopesticides to the Indian honey bee *Apis cerana indica*. The results revealed that at 24 hr after exposure, the order of mortality was: thiodicarb 75% WP @ 750g/ ha (100%) > imidacloprid 17.8 SL @ 250 ml/ ha (98.67%) > dichlorvos 76 EC @ 400 ml/ ha (98.33%) > spinosad 45% SC @ 160 ml/ ha (76.67%), spiromesifen 22.9 SC @ 500 ml/ ha (73.33%) > chlorantraniliprole 18.5 SC @ 150ml/ ha (70%) > chlorantraniliprole 18.5 SC @ 125 ml/ ha (63.33%).

Key words: *Apis cerana indica*, contact toxicity, thiodicarb, imidacloprid, dichlorvos, spinosad, spiromesifen, chlorantraniliprole

Many horticultural crops are dependent on insect pollination, and better pollination results in higher yields (Mcgregor, 1976; Free, 1993; Klein et al., 2007). Bitter gourd requires pollinators for effective pollination and better fruit and seed setting (Ashworth and Galetto, 2002; Lenzi et al., 2005). It is a cross pollinated crop and it ranges from 80-100% (Rodelina and Cervancia, 2009) reported that honey bees (*Apis mellifera* and *A. cerana indica*) are the major floral visitors of bitter gourd in the Philippines along with some solitary bees (*Trigona* sp. and *Halictus* sp.). It is necessary to protect pollinators from hazardous chemical insecticides. In IPM programmes, insecticides having selectivity, favouring non-target organisms like parasitoids predators and pollinators are highly preferred. Formulations that are safer to the applicant and more environment friendly are encouraged. Keeping this in view, investigations were carried to evaluate the safety of some insecticides/ biopesticides to the Indian honey bee *Apis cerana indica*.

MATERIALS AND METHODS

Laboratory experiments were conducted at the Insectary, Agricultural College and Research Institute, Madurai to determine the safety of new insecticides to *Apis cerana indica* during the year 2017-18 by following the method of contact toxicity. The worker honey bees of Indian bee were collected from Insectary, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Madurai. The experiments were conducted in a completely randomized block design with eight treatments replicated thrice. Different concentration

of test insecticides viz., thiodicarb 75% WP 3.75 g/ l, imidacloprid 17.8 SL @ 1.25 ml/ l, dichlorvos 76 EC @ 2 ml/ l, spinosad 45 % SC @ 0.8 ml/l, spiromesifen 22.9 SC @ 2.5 ml/ l and chlorantraniliprole 18.5 SC @ 0.75 ml/ l were prepared using distilled water. Plastic containers of 250ml capacity with perforated sides and lids were used for the experiment to allow adequate aeration for the bees. Filter papers (Whatman No. 2) of 10 cm dia were placed inside the container and sprayed with 1 ml of insecticide solution and shade dried for 30 min. Honey bees were kept in refrigerator for 5 min. prior to test to calm them and transferred at 10/ container. After exposure for an hour, the insecticide treated filter papers were removed and honey bees were transferred to fresh containers. Then the honey bees were fed with 40% sucrose solution soaked in cotton wool. The mortality of honey bees were recorded at 6, 12 and 24 hr after exposure.

RESULTS AND DISCUSSION

Table 1 depicts the data on the mortality of adults of Indian bee exposed different insecticides under laboratory condition. chlorantraniliprole 18.5 SC @ 125 ml/ ha treatment exhibited the lowest mortality (63.33) on 24 hr after treatment to Indian bees. Among the treatments significantly higher mortality of Indian bees was recorded in the treatment thiodicarb 75% WP @ 750 g/ ha. This was followed by imidacloprid 17.8 SL @ 250 ml/ ha (98.67%) dichlorvos 76 EC @ 400 ml/ ha (98.33%) spinosad 45 % SC @ 160 ml/ ha (76.67%), spiromesifen 22.9 SC @ 500 ml/ ha (73.33%)

Table 1. Biosafety of insecticides to *Apis cerana indica*

S.no	Treatments	Dose	6 HAT		12 HAT		24 HAT	
			Mortality* (%)	Corrected mortality	Mortality* (%)	Corrected mortality	Mortality* (%)	Corrected mortality
T1.	Chlorantraniliprole 18.5% SC	125 ml/ha	23.33 (28.88) ^b	7.73	43.33 (41.17) ^b	5.84	63.33 (52.73) ^b	5.54
T2.	Chlorantraniliprole 18.5 % SC	150ml/ha	26.67 (31.09) ^c	8.98	53.33 (46.91) ^c	7.42	70.00 (56.79) ^c	6.23
T3.	Spinosad 45 % SC	160ml/ ha	33.33 (35.26) ^e	11.48	60.00 (50.77) ^e	8.47	76.67 (61.12) ^e	6.92
T4.	Imidacloprid 17.8 % SL	250ml/ha	46.67 (43.09) ^f	16.47	76.67 (61.12) ^f	11.11	98.67 (83.38) ^g	9.20
T5.	Spiromesifen 22.9 % SC	500 ml/ha	30.00 (33.21) ^c	10.23	56.67 (48.83) ^d	7.95	73.33 (58.91) ^d	6.58
T6.	Thiodicarb 75 % WP	750 g/ha	50.00 (45.00) ^f	17.72	80.00 (63.43) ^g	11.63	100.00 (90.00) ^h	9.34
T7.	Standard check – Dichlorvos 76 % EC	400ml/ha	36.67 (37.27) ^e	12.73	73.33 (58.91) ^e	10.58	98.33 (82.57) ^f	9.16
T8.	Untreated check	125 ml/ha	2.67 (9.40) ^a	-	6.33 (14.57) ^a	-	9.67 (18.12) ^a	-

HAT : Hours after treatment; * Mean of three replications

and chlorantraniliprole 18.5 SC @ 150ml/ ha (70 %) on 24 hr after treatment.

Results obtained in present study are in accordance with the findings of (Dinter et al., 2010) who reported that chlorantraniliprole demonstrated low intrinsic toxicity to honey bees. They conducted acute toxicity tests with chlorantraniliprole and the formulations, Coragen and Altacor and demonstrated low intrinsic toxicity to honey bees. In their studies, low risk for honey bees was demonstrated in semi-field tunnel tests with flowering Phacelia or wheat (with daily sprays of sugar solution to simulate honey dew) at application rates of Coragen of up to 60 g chlorantraniliprole/ ha. These are also in line with the findings of Tomé et al. (2015). They reported that azadirachtin and chlorantraniliprole exhibited low toxicity at the recommended label rates with negligible mortality to stingless bees. Contact toxicity of nine newer insecticides viz., acetamiprid, clothianidin, imidacloprid, fipronil, thiamethoxam, spiromesifen, chlorantraniliprole, chlorfenapyr and diafenthiuron at half of the recommended dose was tested on honeybee *Apis mellifera* L using the dry film method and found that spiromesifen and chlorantraniliprole relatively safer, while clothianidin, acetamiprid, thiamethoxam, imidacloprid and fipronil proved to be toxic and other insecticides i.e., diafenthiuron, chlorfenapyr were less toxic (Ratnakar et al., 2017)

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