

## RESEARCH ARTICLE

# Evaluation of toxicity of emamectin benzoate 5 wg to honey bees

■ K. THANGAVEL, R.K. MURALI BASKARAN AND P. PARTHIBAN

### SUMMARY

Laboratory studies were carried out to assess the contact toxicity of emamectin benzoate 5 WG to workers of Indian bee, *Apis cerana indica* and Italian bee, *Apis mellifera*. Emamectin benzoate 5 WG to Indian bees showed that there was no mortality in emamectin benzoate 5 WG @ 100 and 125 g/ha, while emamectin benzoate 5 WG @ 150 g/ha caused 10.00 per cent at 6 (Hours after Treatment) HAT, and it increased to 6.67, 16.67 and 23.33 per cent, respectively after 24 HAT. However, standard insecticides lufenuron 5 EC @ 600 ml/ha, chlorantroniliprole 18.5 SC @ 150 ml/ha and spinosad 45 SC @ 125 ml/ha caused increased mortality of 30.00, 50.00 and 70.00 per cent, respectively. The mortality increased as the time of exposure increased from 6 to 24 HAT. Similar trend was also observed in Italian bees. Hence, emamectin benzoate 5 WG considered could be highly safe to both the species of honey bees than standard insecticides.

**Key Words :** Emamectin benzoate, Honey bees, Safety, Toxicity

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Extensive use of broad spectrum synthetic insecticides results in the destruction of non target organisms. In the recent past, synthetic pyrethroids have been extensively used for the control of insect pests, but with number of problems such as pests developing resistance, pest resurgence and residues in consumable produce at harvest along with destruction of natural enemies and non target insects

like honey bees. It is important to adopt or use some newer insecticide molecule with high toxicity even at lower doses and should also be safer to the natural enemies present in the agro eco-system. One of such insecticides is emamectin benzoate which is a fermentation metabolites of soil actinomycetes, *Streptomyces avermitilis* Burg. (Lasota and Dybas, 1991). It is a second generation avermectin, representing a novel class of macrocyclic lactones that have demonstrated nematocidal, acaricidal, insecticidal and antihelminthic activities. This was discovered in 1984 and has both stomach and contact action effective against lepidopteran pests and safe to non target organisms. Keeping in view, the present investigation was taken up to study the effect of emamectin benzoate 5 WG against honey bees.

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## MATERIAL AND METHODS

A laboratory experiment was conducted at Agricultural College and Research Institute, Madurai (Tamil Nadu) during 2013 – 2014 to study the toxicity of emamectin benzoate 5 WG to workers of Indian bee, *Apis cerana indica* and Italian bee, *Apis mellifera*. Honey bees were kept in refrigerator prior to test to make them calm and for easier transfer. The effect of emamectin benzoate 5 WG to honey bees was assessed by contact toxicity method. The experiment was conducted in Completely Randomized Design (CRD) with eight treatments and each treatment was replicated three times. Safety of emamectin benzoate 5 WG was compared with an existing formulation of emamectin benzoate 5 SG (Proclaim®) and other standard insecticides (lufenuron, spinosad and chlorantriliprole). The insecticidal solutions were prepared by dissolving of 0.20, 0.25 and 0.30g of emamectin benzoate 5 WG (M/s Syngenta India Pvt. Ltd., Pune), 0.44 g of emamectin benzoate 5 SG (Proclaim®), 1.2 ml of lufenuron 5 EC, 0.25 ml of spinosad 45 SC and 0.30 ml of chlorantriliprole 18.5 SC in one lit. of distilled water which were equivalent to field doses.

Plastic containers with perforations were used to allow adequate aeration for the bees. Filter papers were placed inside the container and then wetted with one ml of insecticide solution and then allowed to dry. Honey bees were transferred at the rate of 10 per container. After exposure for one h, 40 per cent sucrose solution soaked in cotton wool was provided as feed for the honey bees (Suganyakanna, 2006). The untreated control was also maintained by confining worker bees unexposed to insecticide by providing only sugar solution for feeding. The bee mortality was observed after 6, 12 and 24 h of

treatment and per cent mortality worked out.

## RESULTS AND DISCUSSION

Contact toxicity of emamectin benzoate 5 WG to Indian bees showed that there was no mortality in emamectin benzoate 5 WG @ 100 and 125 g/ha, while emamectin benzoate 5 WG @ 150 g/ha caused 10.00 per cent at 6 HAT. Emamectin benzoate 5 SG @ 220 g/ha and lufenuron 5 EC @ 600 ml/ha recorded 13.33 and 20.00 per cent, respectively. However, chlorantriliprole 18.5 SC @ 150 ml/ha and spinosad 45 SC @ 125 ml/ha registered more than 30.00 per cent mortality at 6 HAT (Table 1). Lowest dose of emamectin benzoate 5 WG @ 100 g/ha recorded the least mortality of *A. cerana indica* of 3.33 and 6.67 per cent on 12 and 24 h after treatment, followed by emamectin benzoate 5 WG @ 125 g/ha (6.67 and 16.67%) and emamectin benzoate 5 WG @ 150 g/ha (16.67 and 23.33), respectively. Emamectin benzoate 5 SG @ 220 g/ha (20.00 and 26.67%) and lufenuron 5 EC @ 600 ml/ha (26.67 and 30.00%) were equally toxic, followed by chlorantriliprole 18.5 SC @ 150 ml/ha (36.67 and 50.00%) and spinosad 45 SC @ 125 ml/ha (60.00 and 70.00%) at 12 and 24 h after treatment.

The highest mortality of Italian bees was observed in spinosad 45 SC @ 125 ml/ha (50.00, 63.33 and 76.67%) at 6, 12 and 24 HAT, respectively. While the lowest mortality was observed in emamectin benzoate 5 WG @ 100 g/ha on 6, 12 and 24 HAT (0.00, 6.67 and 10.67%), followed by emamectin benzoate 5 WG @ 125 g/ha (3.33, 10.00 and 10.67%) and emamectin benzoate 5 WG @ 150 g/ha (13.33, 20.00 and 26.6%). Emamectin benzoate 5 SG @ 220 g/ha (20.00, 26.67 and 33.33%), lufenuron 5 EC @ 600 ml/ha (30.00, 36.67 and 40.00%)

**Table 1 : Effect of emamectin benzoate 5 WG on two species of honey bees**

Treatments	Doses (g/ml ha <sup>-1</sup> )	Mortality (%)*					
		Indian bee			Italian bee		
		Hours after treatment					
		6	12	24	6	12	24
Emamectin benzoate 5 WG	100	0.00 (0.28) <sup>a</sup>	3.33 (10.49) <sup>b</sup>	6.67 (14.96) <sup>b</sup>	0.00 (0.28) <sup>a</sup>	6.67 (14.96) <sup>b</sup>	10.00 (18.43) <sup>b</sup>
Emamectin benzoate 5 WG	125	0.00 (0.28) <sup>a</sup>	6.67 (14.96) <sup>c</sup>	16.67 (24.10) <sup>c</sup>	3.33 (10.49) <sup>b</sup>	1.00 (18.43) <sup>c</sup>	16.67 (24.10) <sup>c</sup>
Emamectin benzoate 5 WG	150	10.00 (18.43) <sup>b</sup>	16.67 (24.10) <sup>d</sup>	23.33 (28.88) <sup>d</sup>	13.33 (21.41) <sup>c</sup>	20.00 (26.56) <sup>d</sup>	26.67 (31.09) <sup>d</sup>
Emamectin benzoate 5 SG	220	13.33 (21.41) <sup>c</sup>	20.00 (26.56) <sup>e</sup>	26.67 (31.09) <sup>e</sup>	20.00 (26.56) <sup>d</sup>	26.67 (31.09) <sup>e</sup>	33.33 (35.26) <sup>e</sup>
Lufenuron 5 EC	600	20.00 (26.56) <sup>d</sup>	26.67 (31.09) <sup>f</sup>	30.00 (33.21) <sup>f</sup>	30.00 (33.21) <sup>e</sup>	36.67 (37.27) <sup>f</sup>	40.00 (39.23) <sup>f</sup>
Spinosad 45 SC	125	46.67 (43.09) <sup>f</sup>	60.00 (50.77) <sup>h</sup>	70.00 (56.79) <sup>h</sup>	50.00 (45.00) <sup>e</sup>	63.33 (52.73) <sup>h</sup>	76.67 (61.12) <sup>h</sup>
Chlorantriliprole 18.5 SC	150	30.00 (33.21) <sup>e</sup>	36.67 (37.27) <sup>g</sup>	50.00 (45.00) <sup>e</sup>	36.67 (37.27) <sup>f</sup>	43.33 (41.17) <sup>g</sup>	50.00 (45.00) <sup>e</sup>
Untreated check	--	0.00 (0.28) <sup>a</sup>	0.00 (0.28) <sup>a</sup>	3.33 (10.49) <sup>a</sup>	0.00 (0.28) <sup>a</sup>	0.00 (0.28) <sup>a</sup>	3.33 (10.49) <sup>a</sup>

\* Mean of three replications; Figures in parentheses are arcsine transformed values

In a column, means followed by a common letter(s) are not significantly different by DMRT (P=0.05)

and chlorantroniliprole 18.5 SC @ 150 ml/ha (36.67, 43.33 and 50.00 %) were next safe to Italian bee on 6, 12 and 24 HAT (Table 1).

In this study, the lowest dose of emamectin benzoate 5 WG @ 100 g/ha recorded the least mortality of *A. cerana indica* of 3.33 and 6.67 per cent on 12 and 24 h after treatment, followed by emamectin benzoate 5 WG @ 125 g/ha (6.67 and 16.67%) and 150 g/ha (16.67 and 23.33), respectively. The mortality increased as the time of exposure increased from 6 to 24 HAT. Similar trend was also observed in Italian bees. Hence, emamectin benzoate 5 WG considered could be highly safe to both the species of honey bees than standard insecticides. This is comparable with the results of Govindan (2009) who reported that emamectin benzoate 5 SG was relatively safe to honey bees (Indian bee, *A. cerana indica*, Italian bee, *Apis mellifera* and little bee, *Apis florea*) than spinosad and endosulfan. In the present study, spinosad was more toxic to honey bees than emamectin, lufenuron and chlorantroniliprole. These results are in agreement with Husain *et al.* (2014) who stated that spinosad was highly toxic to the honey bees. Similar results were also obtained by Miles (2003) who reported that spinosad proved more toxic to honey bees than imidacloprid and endosulfan. This might be due to more pronounced neurological effects of spinosyn A and D on honey bees.

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