CONTACT TOXICITY OF COMMONLY USED INSECTICIDES AND NEW MOLECULES AS PER RECOMMENDED DOSE FOR CROP PESTS AGAINST INDIAN HONEY BEE, *APIS CERANA INDICA* FABR. IN LABORATORY CONDITION

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Abstract: The effect of insecticides on honey bee population was observed least mortality in neem oil, flubendiamide, thiamethoxam, and imidacloprid at 6 hour after treatment. However, the lowest mortality was recorded in neem oil (2.5%) during 12 hour after treatment whereas neem oil and fipronil was found safer at 24 hour after treatment whose mortality was 2.5 and 7.5 per cent, respectively. Thus neem oil was found safest for Indian honey bee. The bio-pesticides (neem oil) and phenyl pyrazole (fipronil) had least negative effect on Indian honey bee whereas the phosphamidon, monocrotophos, chlorpyriphos, profenophos and cypermethrin were highly toxic.

Keywords: *Apis cerana indica*, Toxicity, Insecticides, Laboratory

INTRODUCTION

Indian honey bee, *Apis cerana indica* is an economically important insect due to the products of the hive (honey, pollen, royal jelly and wax) which generate considerable income for beekeepers, as well as farmers due to crop pollination. But the crops are subjected to depredation by various insect pests which need to be suppressed by application of insecticides even at the flowering stage of the crop when the pollinating bees are active. Thus the bees are exposed directly to the insecticides as well to the residues of the insecticides on the crop so bees should be protecting from insecticides.

MATERIAL AND METHOD

The experiment was undertaken at Rajmohini Devi College of Agriculture and Research Station, Ambikapur, Surguja (C.G.) of Indira Gandhi Krishi Vishwavidyalaya Raipur (Chhattisgarh) India during 2012-13. The forager honey bees of equal age were collected from the existing bee colonies from one bee hive kept in apiary of college. Half a liter of spray solution of different tested insecticides was prepared. The filter papers (whatman No.42) were dipped in insecticides solution and allowed to dry under the fan at room temperature for one hour. The treated papers were kept in glass jar and forager honey bees were exposed in it for 10 minutes and then transferred to clean Petri dishes. Honey soaked cottons were supplied inside the petri dishes as food for test honey bees. Parallel untreated control (Plane water) treatment was kept for comparison. Four replications were made in the treatment. For the assessment of toxic effects the mortality per centage counts were taken for 6, 12 and 24 hours after the treatment.

Statistical method

The statistical analysis was done in Completely Randomized Design (CRD) with parentheses of transformed value square root $\sqrt{x+0.5}$.

Toxicity of some commonly used insecticides and new molecules as per recommended dose for crop pests against *A. cerana indica*. The experiment was conducted as per the method described by Panda *et al*. (1989).

Treatments details

Treatments	Insecticides	Groups	Dosages (ga.i./ha)
T_1	Monocrotophos (36 EC)	OP	400
T_2	Chloropyriphos(20EC)	OP	500
T_3	Phosphamidon(40SL)	OP	500
T_4	Profenophos(50EC)	OP	500
T_5	Cypermethrin(10EC)	CP	50
T_6	Cartap hydrochloride(50SP)	NT	300

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T_7	Ethofenprox(10EC)	ED	75
T_8	Fipronil(5SC)	PP	50
T_9	Imidaclorpid(17.8SL)	NN	25
T_{10}	Thiamethoxam(25WG)	NN	25
T_{11}	Indoxacarb(14.5SC)	OD	30
T_{12}	Flubendiamide39.35SC)	DA	25
T_{13}	Neem oil(0.15%)	BOT	2500
T_{14}	Fenvalerate(20EC)	CP	200
T15	Control (Plane water)	-	500L

RESULT AND DISCUSSION

Total 14 insecticides were tested against Indian honey bee, *Apis cerana indica* in laboratory condition among them neem oil found safest and honey bee per cent mortality was recorded after 6 hour, 12 hour and 24 hour of treatment. The details are given below:

6 Hours After treatment

After 6 hour of treatment the highest per cent mortality of worker honey bees was recorded in phosphamidon 500 g.a.i./ha (77.5%) and it was significantly superior over control followed by monocrotophos 400 g.a.i./ha (75.0 %), chlorpyriphos 500 g.a.i./ha (75.0 %), profenophos 500 g.a.i./ha (70.0 %), cypermethrin 50 g.a.i./ha (60.0%), fipronil 50 g.a.i./ha (40.0%) and ethofenprox 75 g.a.i./ha (37.5%). However, the low mortality was recorded in cartap hydrochloride 300 g.a.i./ha (7.5 %) followed by indoxacarb 30 g.a.i./ha (2.5 %) and fenvalerate 200 g.a.i./ha (2.5%). Whereas no mortality was recorded in treatments imidacloprid 25 g.a.i./ha, thiamethoxam, flubendiamide 25 g.a.i./ha, neem oil 2500 g.a.i./ha and in control (Table 1 and Fig.1).

12 Hours after Treatments

The higher mortality was observed in ethofenprox 75 g.a.i./ha (55.0 %) and it was at par with cypermethrin 50 g.a.i./ha (40.0%), fipronil 50 g.a.i./ha (37.5%), cartap hydrochloride 300 g.a.i./ha (32.5%), profenophos 500 g.a.i./ha (30.0%), monocrotophos 400 g.a.i./ha (25.0 %), chlorpyriphos 500 g.a.i./ha (25.0%), imidacloprid 25g.a.i./ha (25.0%), fenvelerate 200 g.a.i./ha (25.0%), phosphamidon 500 g.a.i./ha (22.5%), flubendiamide 25 g.a.i./ha (20.0%) and indoxacarb 30 g.a.i./ha (17.5%). Whereas, less mortality was recorded in thiamethoxam 25 g.a.i./ha (7.5%) followed by neem oil 2500 g.a.i./ha (2.5 %) and no mortality was observed in control (Table 1 and Fig. 1).

24 Hours after treatments

There was total mortality in phosphamidon 500 g.a.i./ha, profrnophos 500 g.a.i./ha and cypermethrin 50 g.a.i./ha. Whereas, the mortality in fenvalerate 200 g.a.i./ha was 40.0 per cent followed by flubendiamide 25 g.a.i./ha (37.5%), cartap hydrochloride 300 g.a.i./ha (30.0 %), imidacloprid 25 g.a.i./ha (27.5 %), indoxacarb 30 g.a.i./ha (20.0%), ethofenprox 75 g.a.i./ha (10.0%), and thiamethoxam 25 g.a.i./ha (10.0%). Fipronil 50 g.a.i./ha (7.5%) and neem oil 2500 g.a.i./ha (2.5%) were found less toxic as least mortality was observed (Table 1 and Fig. 1).

These results almost support the findings of Gour and Pareek (2005) recorded that cypermethrin was observed to be most toxic whereas dimethoate, imidacloprid and acephate as moderately toxic and cartap hydrochloride, malathion, neem extract and ethofenprox as less toxic to bees adults as against standard check endosulfan. Sharma and Abrol (2005) confirmed the toxicity of different insecticides after 8 hour of treatment and the order of toxicity was malathion > cypermethrin > demeton s-methyl > fenvalerate > deltamethrin for *Apis mellifera* and malathion > demeton-s- methyl > cypermethrin > fenvalerate > deltamethrin for *Apis cerana*. All the insecticides were highly toxic to honey bees. Pastagia and Patel (2007) recorded the mortality of *A. c. indica* worker bees at 24 hours after exposure to different treatments and reported that profenophos and indoxacarb were highly toxic. Thiamethoxam, imidacloprid, ethofenprox and fenabucarb were moderately toxic and endosulfan was least toxic. Akca *et al.* (2009) reported that carbosulfan was highest toxicity whereas methiocarb and carbaryl were comparatabily less toxic. Kumar *et al*. (2010) reported that the spirotetramet 150 OD at 45, 60 and 75 ai.ha^{-1} caused 3.30, 10.00 and 20.00 per cent mortality to Indian bees after 6HAT, thereafter, it increased to 10.00, 16.67 and 30.00 per cent after 24HAT. However, chloronycotinyl compounds, imidacloprid, acetamiprid and conventional insecticides, monocrotophos, and methyl demeton caused increased mortality of 46.67, 43.33, 56.67 and 63.33 per cent, respectively.

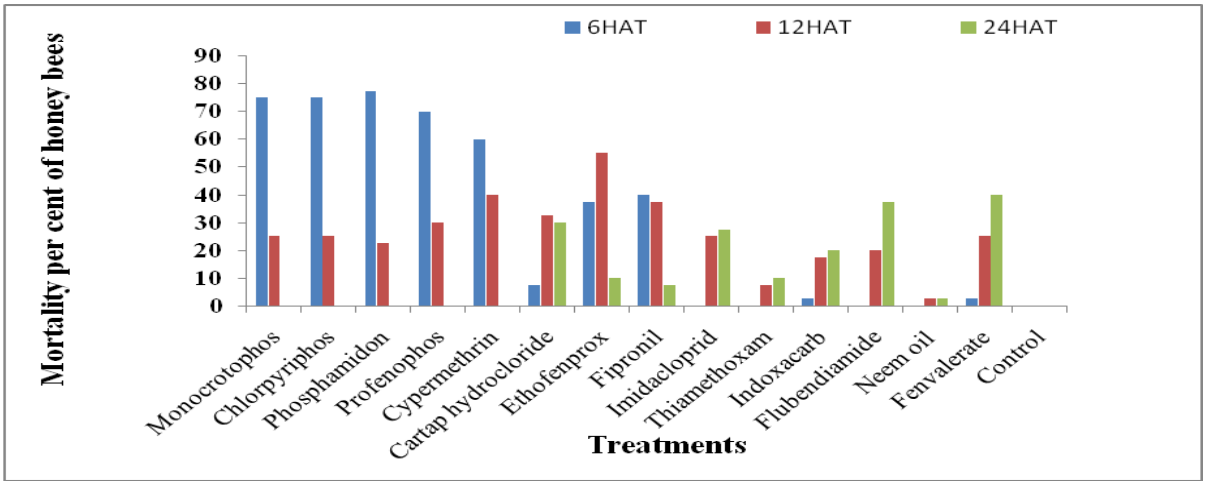

Fig. 1. Contact toxicity of insecticides against Indian honey bee, *Apis cerana indica* in laboratory condition

Table 1. Toxicity of some commonly used insecticides and new molecules as per recommended dose for crop pests against *Apis cerana indica* during the year 2012-13

Treatments	Dosage (g.ai/ha.)	Mortality (%) 6 HAT	Mortality (%) 12 HAT	Mortality (%) 24 HAT
T1-Monocrotophos (36 SL)	400	75 (7.69)	25 (3.03)	0 (0.70)
T2-Chlorpyriphos (20 EC)	500	75(7.69)	25 (3.03)	0 (0.70)
T3-Phosphamidon (40 SL)	500	77.5(8.33)	22.5 (4.28)	0 (0.70)
T4-Profenophos (50 EC)	500	70 (7.92)	30 (3.99)	0 (0.70)
T5-Cypermethrin (10 EC)	50	60 (7.20)	40 (5.40)	0 (0.70)
T6-Cartap hydrochloride (50 SP)	300	7.5 (2.29)	32.5 (4.93)	30 (3.99)
T7-Ethofenprox (10 EC)	75	37.5 (5.17)	55 (7.26)	10 (2.54)
T8-Fipronil (5 SC)	50	40 (5.40)	37.5 (4.63)	7.5 (2.29)
T9-Imidacloprid (17.8 SL)	25	0 (0.70)	25 (3.88)	27.5 (4.63)
T10-Thiamethoxam (25 WG)	25	0 (0.70)	7.5 (1.91)	10 (2.61)
T11-Indoxacarb (14.5 SC)	30	2.5 (1.34)	17.5 (3.26)	20 (3.51)
T12-Flubendiamide (39.35 SC)	25	0 (0.70)	20 (3.51)	37.5 (5.88)
T13-Neem oil (0.15%)	2500	0 (0.70)	2.5 (1.34)	2.5 (1.34)
T14-Fenvalerate (20 EC)	200	2.5 (1.34)	25 (3.03)	40 (5.40)
T15-Control (Plane water)	500L	0 (0.70)	0 (0.70)	0 (0.70)
SEM ±		1.3759	1.7765	0.643
CD (5%)		3.92 **	5.32**	1.929*

** Significant at 1% level, * significant at 5% level

Figures in parentheses are square root transformed value, HAT-Hours after Treatment,

CONCLUSION

The finding concluded that the different insecticides were tested against the forager bees, *Apis cerana indica* the order of contact toxicity was phosphamidon > monocrotophos > chlorpyriphos > profenophos > cypermethrin > fipronil > ethofenprox > fenvalerate > flubendiamide > cartaphydrocloride >imadacloprid > indoxacarb > thiamethoxam > neem oil. Neem oil was found safest insecticide against the honey bee.

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