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The Toxic Effect of some Bio Insecticides on Honey Bee Foraging Workers

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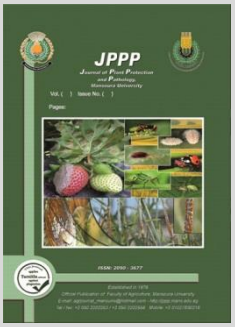

ABSTRACT

Honeybee foraging workers were exposed orally and by contact to the insecticides : chlorpyrifos, alpha- cypermethrin, spinosad, *B.t* and orange oil to evaluate the toxic effect of these insecticides under laboratory conditions. Oral toxicity tests of the tested insecticides to honeybee foragers, indicated that the LC_{50} of chlorpyrifos, alpha- cypermethrin and spinosad recorded 48.0 , 47.0, 45.0 ppm, respectively. Also it cleared that chlorpyrifos value was the height toxicity on honeybee foragers and recorded 96% mortality percentage- but on the other hand orange oil was the lower compound that recorded 25.00ppm and 50% mortality percentage on honeybee foragers at LC_{50} level. As for direct contact toxicity tests, the bees mortality was recorded as well as the mortality lines was illustrated, data cleared that the LC_{50} of chlorpyrifos, alpha-cypermethrin and spinosad 25.0, 20.0, 14.0 ppm, respectively. While orange oil treatment recorded the lowest LC_{50} as 2.0 ppm. In addition , as for the mortality percentages, chlorpyrifos recorded 50% occupied the most toxic insecticides on honeybee foragers while orange oil was the lowest recording only 4% mortality percentage. Regarding to the Initial repellence the result indicated that all tested compounds recorded high repellent during the first and second days through the treatments.

Keywords: Toxicity , bee worker , bioinsecticides , repellence

INTRODUCTION

The cotton leafworm, in particular, is characterized by its wide range of plant hosts, causing a huge damage that led to massive used of chemical compounds in controlling this pest which leads to many problems as pest pesticides resistance, environmental pollution and costs and efforts. Therefore, non-traditional, safe, non-expensive and effective control measure must be found , therefore biocontrol pesticides were applied to control insects. Cotton is one the main source of nectar, pollen and other products to honey bee, therefore, the toxic effect of these pesticides on honey bee colonies must be studied . Jasmine *et al.* (2007) showed that the effect of abamection on honeybees was assessed by contact toxicity test. Abamectin at all rates was highly toxic to workers of Indian, Italian and little bees, causing > 80 to 100% mortality one day after treatment. Seema *et al.* (2007) found that chlorpyrifos repelled honeybee through contact action at 0.4 and 0.2% concentrations. Dobrynin and Colombo (2007) determined the toxicity and rate of hazard of 16 insecticides to bees under field conditions. Vishwas and Gavi (2006) studied the efficacy of *Bacillus thuringiensis* against 3rd instar larvae of *G. mellonella* and honeybee (*A. cerana*) workers in the laboratory. Desuky *et al.* (2012) evaluated the toxic and repellent impact of 6 insecticides against honeybees workers.

From this standpoint, the present work was designed to evaluate the effects of tested agents on honeybee's workers.

MATERIALS AND METHODS

The present study was carried out in the Apiary and the experimental laboratory of the Research Department, Plant Protection Research institute, Sharkia branch , as well as in Plant Protection Dept., Faculty of Agric. Zagazig University during 2015- 2018.

The tested insecticides:

1. *Bacillus thuringiensis* Bt (Dipel 2x 6.4% W.P)
2. Spinosad (Trace 24% SC)
3- Alpha- cypermethrin - lupermethrin (BST, droft E-ISO); alpha-lyperme thrine (CP) draft F- ISO).
4. Orange oil (PREV-AM 6%L) 5- Chlorpyrifos (Robest 48%)

Oral toxicity:

Honeybee workers needed for the laboratory test were collected from the peripheral combs of one colony. Test workers were collected from one colony head by F1 Carniolan queen from the educational and research apiary of Plant Protection Research Institute.

The oral toxicity of *Bacillus thuringiensis*, spinosad, orange oil, alpha- cypermethrin and chlorpyrifos by spraying to honeybee foragers was investigated. These tested compounds were offered in sucrose syrup (2:1) to honeybees (50 workers) in feeding cages (12x 20 cm) at the recommended field rate. Control workers were offered (2:1) sucrose syrup only. The experiment was carried out during spring of 2018 at (20- 28ºC and R.H 70 ± 5%). Mortality counts were calculated after 24 and 48 hrs of application and mortality percentages were corrected by Abbott's (1925) formula.

Contact toxicity:

Honeybee workers at foraging age (over 21 days old) were used in this test. Fresh cotton leaves were washed by water and then left to dry. After drying the cleaned leaves then there were dipped in the recommended concentration of each of *B. thuringiensis*, spinosad, orange oil, alpha- cypermethrin and chlorpyrifos. Sprayed leaves left for dry and then offered in cages to the honeybee workers which anaesthetized before by chilling (15 minutes in deep- freezing). Each cage contained 50 honeybee workers. Three replicates were prepared for each compounds. Untreated leaves were introduced to other honeybee workers as control.

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Statistical analysis:

The obtained data were subjected to statistical analysis of variance (ANOVA) at 5 % probability, and the measurements were separated using Duncan's Multiple Range Test (DMRT) through CoStat software program (Version 6.400).

RESULTS AND DISCUSSION

Under laboratory conditions honeybee foraging workers were tested orally and by contact methods to some recent insecticides **:** chlorpyrifos, alpha- cypermethrin, spinosad, *B.t* and orange oil to evaluate the toxic effect of these insecticides, as well as the repellent effect of the tested insecticides was determined on honey bee workers

The obtained results in Table (1) indicated that The LC_{50} of chlorpyrifos alpha-cypermethrin and spinosad as oral method was 48.0, 47.0 and 45.0 ppm, respectively, while the values reached 49.0, 48.0 and 46.0 ppm, respectively as oral toxicity at the second treatment.

It is cleared that chlorpyrifos is the most toxic insecticide on honeybee foragers causing the highest mortality percentage 96%, meanwhile, orange oil was the least potent compound on honeybee foragers recording 25.0 ppm and mortality percentage 50% on honeybees foragers at LC_{50} level. These results are confirmed by those of Reddy and Reddy 2006 , and Desuky *et al*., 2012.

The obtained data in Table (2) clear that the LC_{50} of chlorpyrifos, alpha- cypermethrin and spinosad as direct contact method were 25, 20 and 14 ppm, respectively and the mortality percentage recorded 50% at LC_{50} for chlorpyrifos that proved to be the most toxic insecticides to honey bee workers. Whereas, orange oil was the least toxic one that recorded only 4% mortality percentage (2.00ppm) at LC_{50} .

The data proved that the chemical insecticide, chlorpyrifos (The standard) at LC_{25} was the most toxicity on honeybee workers, while orange oil was the lower toxicity on the honeybee foragers .

These results are confirmed by those of Muranjan *et al*., *et al*. (2006) who conducted laboratory studies on *Apis cerana* by using the contact technique to assess the acute toxicity of the ready mix formulations, i.e. Decidan (endosulp an 32% + deltamethrin 0.8%), Koranda (acephate 25%+ fenvalerate 3%), nurelle D-505 (chlorpyriphos (chlorpyrtfos) 50%+ cypennethrin 5%) and spark (triazophos 35%+ deltamethrin 1%).

Table 1. Toxicity of some pesticides on honeybee foragers applied as spray method under laboratory conditions (26±1 C° & 65±5 RH.)

Compound	1 day	2 days	3 days
Chlorpyrifos	48.00 ± 1.00^{a}	49.00± 1.00^{a}	49.67± 0.58^{a}
alpha- cypermethrin	47.00 ± 1.00^{a}	48.00± 1.00^{a}	48.00± 1.00^{b}
Spinosad	45.00 ± 1.00^{b}	46.00± 1.00^{b}	46.33± 0.58^{c}
B. thuringiensis	42.00 ± 1.00^{c}	43.00± 1.00^{c}	45.00± 1.00^{c}
Orange oil	25.00 ± 1.00^{d}	33.00± 1.00^{d}	36.00± 1.00^{d}
Control	0.00 ± 0.00^{e}	0.00± 0.00^{e}	0.00± 0.00^{e}
LSD 5%	1.6240	1.6240	1.3907

Means with the same letter in each column are not significant different (p<0.05).

Data expressed as mean ±standard deviation (SD).

Table 2. The toxic rate of LC_{50} in ppm by contact method for honeybee foragers under laboratory conditions (26±1 C° & 65±5 RH.)

Period	Chlorpyrifos	alpha-cypermethrin	Spinosad	*B. thuringiensis*	Orange oil	Control	LSD5%
1 day	25.00±1.00^{a}	20.00±2.00^{b}	14.00±1.00^{c}	10.00±1.00^{d}	2.00±1.00^{e}	0.00±0.00^{e}	2.05
2 day	35.00±2.00^{a}	28.00±1.00^{b}	18.33±1.53^{c}	14.33±1.15^{d}	4.33±1.15^{e}	0.00±0.00^{f}	1.62
3 day	41.00±1.00^{a}	33.00±2.00^{b}	24.00±1.00^{c}	19.00±1.00^{d}	9.00±1.00^{e}	0.00±0.00^{f}	1.96
4 day	45.00±1.00^{a}	37.00±3.00^{b}	26.67±0.58^{c}	24.33±0.58^{d}	13.00±2.00^{e}	0.00±0.00^{f}	2.71
5 day	46.67±0.58^{a}	40.00±2.00^{b}	30.00±1.00^{c}	28.00±1.00^{c}	16.00±3.00^{d}	0.00±0.00^{e}	2.81
6 day	47.33±1.15^{a}	44.00±1.00^{b}	35.00±2.00^{c}	31.00±2.00^{d}	20.00±4.00^{e}	0.00±0.00^{f}	3.63
7 day	48.33±1.15^{a}	46.33±0.58^{a}	41.00±1.00^{b}	33.67±2.52^{c}	22.67±3.51^{d}	0.00±0.00^{e}	3.22
8 day	49.00±1.00^{a}	47.00±1.00^{b}	43.00±2.00^{b}	36.67±1.53^{c}	24.67±2.52^{d}	0.00±0.00^{e}	5.11
9 day	49.33±0.58^{e}	48.33±0.58^{a}	46.00±1.00^{b}	38.67±0.58^{c}	26.67±2.52^{d}	0.00±0.00^{e}	2.05
10 day	49.67±0.58^{d}	49.00±1.00^{a}	48.00±1.00^{a}	40.67±0.58^{b}	28.00±2.00^{c}	0.00±0.00^{d}	1.68

means with the same letter in each column are not significant different (p<0.05). data expressed as mean ±standard deviation (SD).

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التأثير السمى لبعض المبيدات الحشرية الحيوية على شغالات نحل العسل

لمياء لطفى أحمد شحاتة[1] ، رفعت مصطفى محمد شريف[2] ، سعدابراهيم يوسف خليل[2] و وحيد محمود حسين دسوقي[1]

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تم دراسة الأثر الجانبي للمركبات ألفاسيرمثرين وسبانوزاد وباسيلس ثيورنجينسير وزيت البرتقال ومعهم كلوروبيريفوس للمقارنة كمبيد تقليدي على شغالات نحل العسل كحشرة نافعة وملقحة في الحقول. وقد أوضحت النتائج بتجربة هذه المركبات بالملامسة على شغالات نحل العسل أنها أحدثت سمية عالية ونسب موت عالية في الشغالات أعلاها مع مركب الكلوروبيريفوس ثم ألفاسيرمثرين ثم سبانوزاد على الترتيب (99.33٪ ±1.15)، (98٪ ±2)، (94.67٪ ±3) مقارنة بالكنترول صفر٪ . وفي تجربة اختبار السمية الفمية أظهرت النتائج أن أعلى المركبات سمية كان الكلوروبيريفوس بينما كان أقلهم هو زيت البرتقال مقارنة بالكنترول صفر. وبذلك يعتبر الكلوروبيريفوس هو أكثر المبيدات سمية سواء فمية أو بالملامسة لشغالات نحل العسل .