J. Plant Prot. and Path., Mansoura Univ., Vol.6 (10): 1349 – 1355, 2015

RESIDUAL EFFECT OF SOME PESTICIDES ON FIELD HONYBEE WORKERS(*Apis mellifera* L.) AT BEHIERA GOVERNORATE, EGYPT

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ABSTRACT

The effect of the tested insecticides with a field experiments for studying the residual effect of the Helban (48% EC), Icton (2.5% EC) and Teleton (72% EC), were experimental by spraying on cotton plants at Kafre El-Dawar District, Behiera Governorate during July-August month, 2015. The tested materials could be arranged according to their toxicity (initial kill) and residual effect on the field honeybee workers in the following ascending order: The initial kill of these insecticides were: 59.35%, 64.15% and 69.41% for Helban, Icton and Teleton, respectively. The residual effect of these insecticides were (32.02%, 40.82% and 40.56% after 14 days from the treatments, respectively. From the obtained results, it could be recommended to beekeepers to protect their colonies from the use of pesticides on cotton during at least the first 10 days of spraying- conduct spraying operations in coordination with the control field official and beekeepers in the early morning or end of the day, with the closure of the hives and put ventilation box or moved away from direct spray. in case of the time spraying

INTRODUCTION

The beekeeping industry in Egypt, is becoming one of the marked agricultural industries. The honeybee, *Apis mellifera* L., is also considered as a crop pollinator. This important industry has sustained serious losses from using agricultural pesticides. When the hives is contaminated, the queen ceases to lay eggs, forages stop bringing in pollen and the workers can not longer rear a new queen or accept the introduction of a new one [Petukhov(1970), Todd and Reed (1970), Schwan (1971), Wojtowski *et al.* (1971) and Johansen (1971 & 1979)].

The present work includes a field experiment for studying the residual effect of some insecticides in relation to honeybee to different aged a field workers, more than 21-day-old (Anderson and Atkins, 1966, Farid, 1971, El-Ansary, 1972 and Mokayess, 1976).

MATERIALS AND METHODS

The first hybrid of Carniolan field honey bee workers was used. Field honey bee workers, more than 21-days old were collected by the replacement of the mother colony by an empty hive containing honey combs (Abou-Lila, 1981). Bees returning from the field were collected and tested at Kafre El-Dawar District, Behiera Governorate.

Chemical used (recommended insecticides):

Three insecticides were used as follow:

1-Trade name: Helban (48% EC), an organophosphate compound (Chlorpyriphos-ethyl), was applied at a rate of 1 Liter/Fed.

Chemical name:O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphoro - thioate.

2-Trade name: Icton (2.5% EC), a pyrethroid compound (lambda cyhalothrin), was applied at a rate of ¾ Liter/Fed.

Chemical name: RS)-alpha-cyano-3-phenoxybenzyl 3-(2-chloro-3,3,3-trifluoropropenyl)-2,2,-dimethylcyclopropanecarboxylate.

3-Trade name: Teleton (72% EC) an organophosphate compound (profenofos), was applied at a rate of ¾ Liter/Fed.

Chemical name: O-(4-bromo-2-chlorophenyl)-)-ethyl S-propyl phosphorothioate (The Pesticide Manual, 2007).

The concentrations of insecticides was the same used on cotton plants were applied shortly before the treatment and the blooming season were sprayed and then covered. This application was dance a time used the 6 wire cages (125x125x150 cm), 3 cages/treatment and 3 cages for them (untreated)/ insecticide. Hundred field workers anaesthetized (bees by ether on cotton pieces in plastic holdings cups. Field bees were introduced every cages. The bees mortality were counts after 24 hours from treatments, and the bees were removed outside the cage. The experiment continued until the mortality was equivalent to the untreated (control) for calculate of residual effect.

Statistical analysis:

The percent of mortality (M%) obtained in checks according to the equation of Schneider-Orelli (1947).

$$\textbf{Effectiveness of the pesticide} = \frac{\textbf{Treatment (M\%)-Control (M\%)}}{\textbf{100- Control (M\%)}} \textbf{X100\%}$$

The daily mean number of mortality worker bees were analyzed statistically using a one way ana

lysis of variance. When ANOVA indicates that significant differences were found, ($P<0.05$) means were separated by a least significant difference test (LSD) and the mean values compared with the least significant differences as well as, SAS program (SAS Institute 1988).

RESULTS AND DISCUSSION

Results in Tables 1, 2 and 3 indicated that the percentages of kill workers after spraying with three insecticides (Helban 48% EC, Icton 2.5% EC and Teleton 72% EC) with intervals beginning with initial kill to 14 days. The mean toxicity reached 59.35, 64.15 and 69.41%, respectively. The residual effects of each insecticide and rate of desperation were calculated and the data are depicted in Tables (1, 2 and 3).

Table(1): Residual effect of Helban 48%EC insecticide on the field honeybee workers *(Apis mellifera* L.) on cotton plants.

Days after treatment	Mean mortality numbers		Mortality (%)	Residual effect (M %)
	Treated±SE	Control±SE		
Initial kill	62.33±1.45	7.33±0.33	59.35	
2nd	60.66±0.33	6.00±0.58	58.14	
3rd	57.33±0.88	6.00±1.15	54.60	
4th	52.33±1.45	5.66±0.33	49.47	
5th	50.00±0.58	5.33±0.88	47.18	
6th	47.00±1.73	5.33±0.33	44.01	
7th	41.66±1.45	4.66±0.67	38.80	
8th	37.33±2.03	4.66±0.33	34.26	
9th	40.33±0.33	5.00±0.00	37.18	
10th	30.33±0.58	4.33±0.88	27.17	32.02%
11th	18.66±0.67	4.66±0.33	14.68	
12th	10.33±0.33	4.33±0.33	6.27	
13th	7.66±0.33	4.33±0.67	3.48	
14th	5.66±0.33	4.66±0.33	1.04	
F value	314.26***	-	-	
$LSD_{0.05}$	3.213	-	-	

SE = Standard error.
Means were separated by Duncan's multiple range test.
PHI (pre-harvest interval) = 13 days.

$$\text{Residual effect (X`)} = \frac{\sum x \text{ (from No. 2 : No. 14 days)}}{\text{n (13 days)}} = 32.02\%$$

Table (2): Residual effect of Icton 2.5%EC insecticide on the field honeybee workers *(Apis mellifera* L.) on cotton plants.

Days after treatment	Mean mortality numbers		Mortality (%)	Residual effect (M %)
	Treated±SE	Control±SE		
Initial kill	66.66±1.67	7.00±0.58	64.15	
2nd	65.00±2.89	6.66±0.67	62.50	
3rd	64.33±2.33	6.66±0.88	61.78	
4th	63.66±1.86	6.33±0.33	61.20	
5th	61.00±1.00	6.66±0.67	58.21	
6th	60.66±0.67	5.66±0.33	57.60	
7th	60.00±0.58	5.66±0.88	57.60	
8th	50.66±1.20	5.33±0.33	47.53	40.82%
9th	37.33±1.45	5.66±0.67	33.57	
10th	31.00±1.00	6.00±0.58	26.59	
11th	30.00±1.00	6.00±0.58	25.53	
12th	29.00±0.58	6.00±0.58	24.46	
13th	13.66±0.88	6.00±0.00	8.14	
14th	11.33±0.67	5.66±0.33	6.01	
F value	191.14***	-	-	
$LSD_{0.05}$	4.1853	-	-	

SE = Standard error.
Means were separated by Duncan's multiple range test.
PHI (pre-harvest interval) = 21 days.

$$\text{Residual effect (X`)} = \frac{\sum x \text{ (from No. 2 : No. 14 days)}}{\text{n (13 days)}} = 40.82\%$$

Table (3): Residual effect of Teleton 72%EC insecticide on the field honeybee workers *(Apis mellifera* L.) on cotton plants.

Days after treatment	Mean mortality numbers		Mortality (%)	Residual effect (M %)
	Treated±SE	Control±SE		
Initial kill	71.66±1.67	7.33±0.33	69.41	
2nd	69.33±0.67	5.66±0.33	67.45	
3rd	66.33±0.88	5.66±0.67	64.30	
4th	62.33±0.33	5.66±0.33	60.06	
5th	61.00±1.00	5.00±0.58	58.94	
6th	58.66±0.67	5.00±0.00	56.48	
7th	55.66±0.67	5.66±0.88	52.99	
8th	44.33±0.88	5.66±0.88	40.99	40.56
9th	40.66±0.33	5.33±0.88	37.31	
10th	36.33±0.67	6.00±0.58	32.26	
11th	30.66±0.67	5.33±0.67	26.75	
12th	22.33±1.45	5.33±0.33	17.95	
13th	15.66±1.20	5.33±0.88	10.91	
14th	7.66±0.33	6.33±0.33	1.41	
F value	533.70***	-	-	
$LSD_{0.05}$	2.6192	-	-	

SE = Standard error.
Means were separated by Duncan's multiple range test.
PHI (pre-harvest interval) = 14 days.

$$\text{Residual effect } (X`) = \frac{\sum x \text{ (from No. 2 : No. 14 days)}}{\text{n (13 days)}} = 40.56\%$$

Table (4): Residual effect of Helban 48% EC, Icton 2.5% EC and Teleton 72% EC insecticides on the field honeybee workers of *Apis mellifera* L. on cotton plants.

Insecticides	Residual effect±SE
Helban 48%EC	32.02±0.01
Icton 2.5%EC	40.82±0.47
Teleton 72% EC	40.56±0.32
F value	228.77***
$LSD_{0.05}$	1.1456

SE = Standard error.
Means were separated by Duncan's multiple range test.

The values of standard error (SE) and F values were also calculated. The data in Tables (1, 2 and 3) show that the initial kill and residual effect of Helban 48% EC, Icton 2.5% EC and Teleton 72% EC, when tested by spraying with rate of 1, ¾ and ¾ Liter/Fed. on the field bees.

Results in Table (1) clearly that Helban 48% EC gave low initial kill (59.35%). Also, the toxicity effects of Helban 48% EC gradually decreased to reach 1.04 until the end of experiments 14th day. Data proved that the residual effect remained active to the 13th day, also statistical analysis yielded high significant differences between residual effects in days when spraying with Helban 48% EC (F value = 314.26, LSD = 3.213).

The obtained results are agreed with those obtained by Whitehorn *et al.* (2012) found that treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with

control colonies. Given the scale of use of neonicotinoids, we suggest that they may be having a considerable negative impact on wild bumble bee populations across the developed world.

Results in Table (2) show that Icton 2.5% EC caused high initial kill (64.15%) after spraying with ¾ Liters/Fed. This toxicity decreased gradually to reach 6.01% after 14 days. Statistical analysis gave high significant differences between residual effects in days when spraying with Icton 2.5% EC (F value = 191.14, LSD = 4.1853).

Results in Table (3) show that Teleton 72% EC caused high initial kill (69.41%) after spraying with ¾ Liters/Fed. This toxicity gradually decreased to reach 1.41% after 14 days. Statistical analysis gave high significant differences between residual effects in days when spraying with Teleton 72% EC (F value = 533.70, LSD = 2.6192).

Data in Table (4) indicated that when comparing between the residual effect (M %) of the three insecticides (Helban 48% EC, Icton 2.5% EC and Teleton 72% EC) reached to 32.02, 40.82 and 40.56%, respectively. Statistical analysis of the data proved that the average in residual effect of the three insecticides (Helban 48% EC, Icton 2.5% EC and Teleton 72% EC) were highly significant differences between them after 14 days of spraying (F value = 228.77, LSD = 1.1456).

From the data presented in Tables (1-3) the tested insecticides could be arranged, according to the initial kill on honey bees, in a descending order as follows: Teleton (69.41%), Icton (64.15%) and Helban (59.35%).

It is generally concluded that the tested insecticides were highly toxic on the honeybee workers and precautions must be taken during application in the field from the beginning of the spraying program. Cresswell (2010) found that imidacloprid (IGR) at field-realistic levels in nectar will have no lethal effects, but will reduce expected performance in honey bees by between 6 and 20%. Statistical power analysis showed that published field trials that have reported no effects on honey bees from neonicotinoids were incapable of detecting these predicted sublethal effects with conventionally accepted levels of certainty. While, when treated with sublethal of Imidacloprid has not shown any increased mortality in bees that were fed with this sublethal doses (Visser and Blacquière2010).

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الأثر الباقي لبعض مبيدات الآفات علي شغالات نحل العسل الحقلية في محافظة البحيرة - مصر

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تم إجراء هذا البحث بأحد حقول القطن بمركز كفر الدوار – محافظة البحيرة خلال شهري يولية وأغسطس ٢٠١٥ وذلك بهدف: دراسة الإبادة الفورية والأثر الباقي لبعض المبيدات الموصي بها ضد ديدان اللوز (وقت التزهير) في محصول القطن علي شغالات نحل العسل الحقلية. حيث تم عمل أقفاص سلكية لعزل نباتات القطن المعاملة وغير المعاملة لكل مبيد بعد الرش ثم تجميع عدد ١٠٠ شغالة نحل حقلية من أمام الطوائف في أطباق بلاستيك ثم تخديرها بقطعة من القطن مشبعة بالأثير وإدخالها داخل القفص السلكي وذلك يوميا بعد التخلص من الشغالات الحية والميتة من اليوم السابق طوال فترة البحث. تم حساب النسبة المئوية للإبادة الفورية بعد ٢٤ساعة من المعاملة والأثر الباقي وعدد الأيام وأوضحت النتائج ما يلي:

١- **الأبادة الفورية:** بلغت متوسطات النسبة المئوية للموت ٥٩.٣٥%، ٦٤.١٥%، ٦٩.٤١% لمبيدات الهلبان، الأكتون، والتيليتون علي التوالي.

٢- **الأثر الباقي:** بلغت المتوسطات ٣٢.٠٢%، ٤٠.٨٢%، ٤٠.٥٦% بعد ١٤ يوم من المعاملات للمبيدات السابقة وبنفس الترتيب. حتي تساوت تقريبا نسب الموت للشغالات في المعاملات والمقارنة.

ومن النتائج المتحصل عليها من البحث يمكن توعية مربي النحل لحماية الطوائف من استخدام المبيدات الحشرية علي القطن خلال الـ ١٠ أيام الأولي من الرش على الأقل- إجراء عمليات الرش بالتنسيق مع مسئول المكافحة الحقلية ومربي النحل في الصباح الباكر أو آخر النهار (وقت عدم أو قلة سروح النحل)، مع غلق الخلايا ووضع صندوق تهوية أو نقلها بعيدا عن أماكن الرش المباشر في حالة وجود الطوائف وقت الرش بالمبيدات.