



## Toxicity of some insecticides against the oriental hornet *Vespa orientalis* (Hymenoptera: Vespidae)

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### Abstract:

The present investigations were carried out at the laboratory of Shandaweel Agricultural Research Station, Sohag Governorate, Egypt during 2016 season to evaluate toxicity of Lambda-cyhalothrin 10%WP, Acetamiprid 25% SP, Diazinon 60% EC and Emamectin Benzoate 5% SG insecticides against the oriental hornet *Vespa orientalis* L. (Hymenoptera: Vespidae). Also to evaluate diluting these insecticides with sugar, flour and talc powder and its effect against the oriental hornet. Also to study indirect effects of Acetamiprid 25% insecticide with different concentration on *V. orientalis* adults. The results showed that Acetamiprid 25% and Lambda-cyhalothrin 10% recorded the lowest time required for killing the wasps with 1.88 and 3.04 Minutes, respectively, by no significant difference between them. However, the highest time was recorded for Emamectin Benzoate 5% with 122.40 minutes. Diluted all insecticides with sugar recorded the shortest time needed to kill oriental hornet with mean number (3.67, 4.48, 100.10 and 159.10 Minutes) for Lambda-cyhalothrin 10%, Acetamiprid 25%, Diazinon %60 and Emamectin Benzoate %5, respectively. The indirect effects of Acetamiprid 25% recorded the shortest time needed to kill oriental hornet with 25% concentration (2.96 Minutes) for stage1. For stage 2, the 2.5% concentration with sugar recorded the shortest time needed to kill hornet with average (7.14 Minutes).

### Introduction

The oriental hornet, *Vespa orientalis* L. (Hymenoptera: Vespidae) is considered a major pest to honey bees in many arab countries such as Egypt, Iraq, Saudi Arabia, United Arab Emirate, Lebanon, Oman ,Yemen , Sudan, Syria, Jordan and Palestine (Glaiim,2009; Khodairy and Awad, 2013; Abdelaal and El-Defrawy, 2014

and Al-Heyari *et al.*, 2016). Among many pests were found attacking *Apis mellifera* L. (Hymenoptera : Apidae) colony, *V. orientalis* was recorded to be one of the most destructive pests to the bees (Vishwakarma *et al.*, 2012). The oriental hornet, *V. orientalis* is considered one of the factors which effective for the honey bee colonies in

Egypt because it caused heavy losses in apicultural development (Ghania and Abdel-Aziem, 2015). It considered a predatory–carnivorous insects feeding mainly their brood with animal proteins (insects, pieces from fresh or spoiled meat and fish) while the adults are fed with carbohydrates (nectar, honeydew and ripe fruits). Bee hives constitute places where the wasps can find the best combination of proteins from animal origin (bees or larvae) and carbohydrates (nectar and honey) (Bacandritsos *et al.*, 2006). At first they attack on the weak bee colonies, which are the most defenseless and then the damages are extended to the healthier ones. Bee colonies can be weakened by wasp, especially hornet predation (Adlakha, 1975 and Akratanakul, 1986).

In order to control wasps, various methods have been used based either on the use of insecticides or on the traps of free of insecticides. Baits mixed with insecticides were used for wasps control, in this case the adults become victims but before they are killed and transferred the poisoning insecticide to the brood (Tsanakakis and Katsogiannos, 1998 and Sackmann *et al.*, 2001). In other cases, the nest can be detected and sprayed during the night with various insecticides (Ifantidis, 1995). Ghania and Abdel-Aziem (2015) found that dusting the trapped wasps by linnet insecticide 90%

**Table (1): Insecticides used to evaluate the toxicity against the oriental hornet, *Vespa orientalis*.**

Common name	Family	Mode of action
Lambda-cyhalothrin 10%WP	Pyrethroid	contact and stomach action
Acetamiprid 25% SP	Neonicotinoid	contact and stomach action
Diazinon 60% EC	Organophosphor	contact and stomach action
Emamectin Benzoate5% SG	Avermectin	Acts on nerve cells

### 3. Effect of certain insecticides on *Vespa orientalis* adults:

In this experiment, 10 plastic jars were used, each with 5 wasps. These wasps were transferred to jars with the insecticide to be tested and shaken several times. It is then placed in a clean jar and inspected every minute for quick-

at the rate 1 gram to 100 gram powder sugar and return release it every week were reduced the wasps in the traps for three months after releasing. The objective of this study is to evaluate toxicity of Lambda-cyhalothrin 10%WP, Acetamiprid 25% SP, Diazinon 60% EC and Emamectin Benzoate5% SG insecticides against the oriental hornet. Also to evaluate diluting of these insecticides with sugar, flour and talc powder and its effect against the oriental hornet. Indirect effects of dilution Acetamiprid 25% insecticide by different substance (sugar, flour and powder) against *V. orientalis* adults in the laboratory.

### Materials and methods

The present investigation was carried out at the laboratory of Shandaweel Agricultural Research Station, Sohag Governorate, Egypt during 2016 season.

**1.Hornets stock:** The hornets were collected from apiaries using a modified sweep net (with a transparent clothes). Each 5 hornets placed in a plastic jar with some sugar and a piece of cotton wet with water until to execute the experiments.

**2.Insecticides:** Table (1) showed four insecticides were used and evaluated the toxicity against the oriental hornet *V. orientalis*.

acting insecticides and every five minutes for slow-acting insecticides.

### 4. Effect of insecticides diluted with different substance (sugar, flour and powder) on *Vespa orientalis* adults:

In this experiment, the previous insecticides were diluted using sugar,

flour and talcum powder then the wasps were dusted in the same way as before.

**5. Indirect effects of Acetamiprid 25% insecticide with different concentration on *Vespa orientalis* adults:**

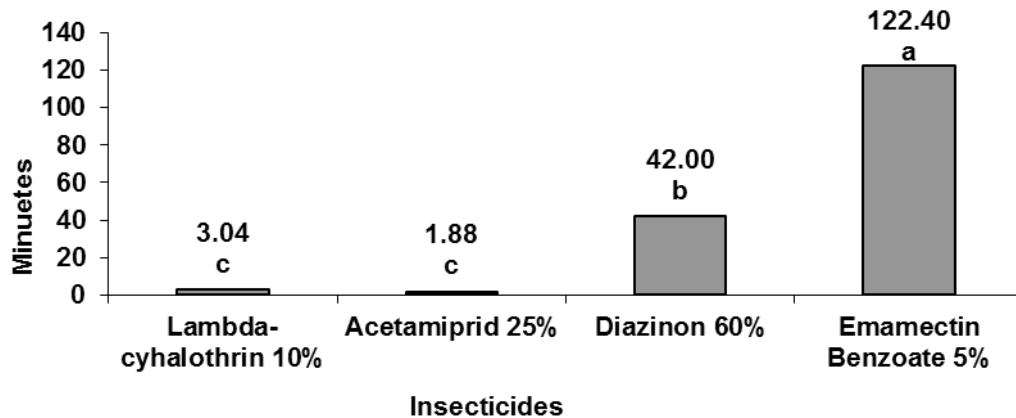
In this experiment, the indirect effect of Acetamiprid 25% diluted with different substance (sugar, flour and powder) on *V. orientalis* adults was studied in two stages:

**Stage 1:** In which a wasp was dusted with the insecticide placed with 5 wasps not treated with insecticide. It was repeated 10 times.

**Stage 2:** In which the wasps were placed from the previous 5 wasps after dead with 5 other untreated wasps. It was repeated 10 times.

**Results and discussions**

**1. Effect of certain insecticides against *Vespa orientalis* adults:**



F. value = 1291.594\*

**Figure (1): Effect of certain insecticides on *Vespa orientalis* adults.**

**2. Effect of insecticides diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults:**

**2.1. Effect of Lambda-cyhalothrin 10% diluted with sugar, flour and powder against *Vespa orientalis* adults:**

Data in Table (2) showed that the effect of Lambda-cyhalothrin 10% diluted with different substance against *V. orientalis* adults. The average of all counts were calculated as shown in Table (2), which indicated that the dilution with sugar recorded the shortest time

Data in Figure (1) showed that the effect of certain insecticides on *V. orientalis* adults. It is clear that Acetamiprid 25% and Lambda-cyhalothrin 10% recorded the lowest time required for killing the wasps with 1.88 and 3.04 Minutes, respectively, by no significant difference between them. However, the highest time was recorded for Emamectin Benzoate 5% with 122.40 Minutes.

These results are in partially agreement with Al-Heyari *et al.* (2016) who tested 4 insecticides against the hornets and found that the total number of the dead oriental wasps counted after one hour of treatment were 80.42% , 78.50%,75.17% and 68.33 % for Fipronil, Imidacloprid, Diazinon and Deltamethrin, respectively.

needed to kill hornet with mean time (3.67 Minutes) followed significantly by flour (4.89 Minutes) and powder (5.01 Minutes) with no significant difference between them. The highest concentration gives the lowest time and the inverse is correct. The concentrates 5% and 1% recorded (3.30 and 5.74 Minutes respectively).

The interaction between concentrates and the dilution substance was significant. The shortest time was found at concentrate 5% with sugar (3.14 Minutes) followed insignificantly by

flour and powder at 5% and sugar at 1%. However, the longest time was observed in concentrate 1% with powder with insignificant difference with flour at the same concentration with (6.64 and 6.38 Minutes, respectively). These results are

**Table (2): Effect of Lambda-cyhalothrin 10% diluted with sugar, flour and powder against *Vespa orientalis* adults.**

Time per Minutes			
	5%	1%	Mean
Sugar	3.14 b	4.20 b	3.67 b
Flour	3.40 b	6.38 a	4.89 a
Powder	3.38 b	6.64 a	5.01 a
Mean	3.30	5.74	-----

F. value for matters= 6.1977\*, F. value for concentrates= 46.5985\* and F. value for interaction=3.7622\*L.S.D. value for matters= 0.9177

## 2.2. Effect of Acetamiprid 25% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults:

Data in Table (3) showed the effect of Acetamiprid 25% diluted with different substance against *V. orientalis* adults. The mean of all counts were calculated as shown in Table (3), which indicated that the dilution with sugar recorded the shortest time needed to kill hornet with mean number (4.48 Minutes), however, the longest time was recorded in powder (11.07 Minutes). The highest concentration gives the lowest time and the inverse is correct. The

in partially agreement with Raghavendra *et al.* (2011) whom found that in insecticide susceptibility tests, *Anopheles culicifacies* Giles (Diptera : Culicidae), registered 97% mortality to Malathion and 93% to Lambda-cyhalothrin.

concentrates 12.5% and 2.5% recorded (5.13 and 9.50 Minutes respectively).

The interaction between concentrates and the dilution substance was significant. The shortest and the longest times were found in concentrate 12.5% with sugar (3.04 Minutes) and in concentrate 2.5% with powder, respectively. These results are in partially agreement with Iwasa *et al.* (2004) who conducted a laboratory bioassays to determine the contact honey bee toxicity of commercial and candidate neonicotinoid insecticides and found that the LD50 for acetamiprid was 7.1mg/bee.

**Table (3): Effect of Acetamiprid 25% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults.**

Time per Minutes			
	12.5%	2.5%	Mean
Sugar	3.04 d	5.92 c	4.48 c
Flour	4.64 c	8.18 b	6.41 b
Powder	7.72 b	14.42 a	11.07 a
Mean	5.13	9.50	-----

F. value for matters= 82.0548\*, F. value for concentrates= 153.2809\* and F. value for interaction= 11.1370\* L.S.D. value for matters= 1.153

### 2.3. Effect of Diazinon 60% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults:

Data in Table (4) showed the effect of Diazinon 60% diluted with different substance against *V. orientalis* adults. Data indicated that the dilution with sugar recorded the shortest time needed to kill hornet with mean number (100.1 Minutes) compared with, flour (113.00 Minutes) and powder (116.60 Minutes) with insignificant difference between the last two.

The highest concentration gives the lowest time and the inverse is correct. The concentrates 3% and 6% recorded

**Table (4): Effect of Diazinon 60% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults.**

Time per Minutes			
	30%	6%	Mean
Sugar	81.80 c	118.40 b	100.10 b
Flour	87.20 c	138.80 a	113.00 a
Powder	90.20 c	143.00 a	116.60 a
Mean	86.40	133.40	-----

F. value for matters= 9.9061\*, F. value for concentrates= 328.8290\*, and F. value for interaction= 4.0430  
L.S.D. value for matters= 8.494

### 2.4. Effect of Emamectin Benzoate 5% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults:

Data in Table (5) show the effect of Emamectin Benzoate %5 diluted with different substance against *V. orientalis* adults. Data indicated that the dilution with sugar recorded the shortest time needed to kill hornet with mean number (159.10 Minutes) compared with, flour (230.00 Minutes) and powder (233.90 Minutes) with insignificant difference between the last two. The highest concentration gives the lowest time and the inverse is correct. The concentrates 2.5% and 0.5% recorded (190.13 and 225.20 Minutes respectively). The interaction between concentrates and the dilution substance was significant. The concentrate 2.5% with sugar recorded the

(86.40 and 133.40 Minutes, respectively). The interaction between concentrates and the dilution substance was significant. The means can arrange in three significantly groups. The highest included concentrate 6% with flour and powder (138.80 and 143.00 Minutes), the moderate was the concentrate 6% with sugar and the lowest group consisted of concentrate 30% with sugar, flour and powder (81.80, 87.20 and 90.20 Minutes). These results are in partially agreement with Al-Heyari *et al.* (2016) who found that the total number of the dead oriental wasps counted after one hour of was 75.17% for Diazinon insecticide.

shortest time needed to kill hornet with mean number (136.60 Minutes), however, the longest time was recorded by concentrate 0.5% with powder (247.20 Minutes) followed insignificantly by the same concentrate with flour (246.80 Minutes).

These results are in partially agreement with Bengochea *et al.* (2014) who tested emamectin benzoate against the different stages of *Spodoptera exigua* (Hübner) (Lepidoptera: Noctuidae) and found that it progressive neonate mortality at all concentrations, culminating at 72 hours after hatching, when 100% of the larvae from the treated young eggs died. Also second and fourth instar *S. exigua* larvae did not exhibit significant mortality when exposed to the inert surfaces which were treated.

**Table (5): Effect of Emamectin Benzoate 5% diluted with different substance (sugar, flour and powder) against *Vespa orientalis* adults.**

Time per Minutes			
	2.5%	0.5%	Mean
Sugar	136.60 d	181.60 c	159.10 b
Flour	213.20 b	246.80 a	230.00 a
Powder	220.60 b	247.20 a	233.90 a
Mean	190.13	225.20	-----

F. value for matters= 92.3436\*, F. value for concentrates= 207.1703\*

F. value for interaction= 4.8439\* L.S.D. value for matters= 13.50

### 3. Indirect effects of Acetamiprid 25% insecticide with different concentration against *Vespa orientalis* adults:

Data in Table (6) showed the indirect effects of dilution of Acetamiprid 25% insecticide by different substance (sugar, flour and powder) against *V. orientalis* adults. For stage1, the shortest time needed to kill hornet was recorded at 100% treatment (2.96 Minutes) followed insignificantly with sugar 12.5% and sugar 2.5% by means (4.26 and 5.70 Minutes). On the other hand, the highest

time recorded with flour 2.5% by mean (113.00 Minutes).

For stage 2 the sugar 2.5% recorded the shortest time needed to kill hornet with mean numbers (7.14 Minutes) followed insignificantly with sugar 12.5% (8.30 minutes). However the highest time was recorded at 100% treatment with mean (11.12 Minutes). It is clear evidence that insecticide diluted with sugar recorded the least time of mortality may be it backs to hornets feeding on sugar so the insecticide effect by two ways as a contact poison and a stomach poison.

**Table (6): Indirect effects of Acetamiprid 25% insecticide with different concentration against *Vespa orientalis* adults.**

Time per minutes		
	Stage 1	Stage2
100%	2.96 e	11.12 a
Sugar 12.5%	4.26 e	8.30 b
Sugar 2.5%	5.70 e	7.14 b
Flour 12.5%	90.40 b	No
Flour 2.5%	113.00 a	No
Powder 12.5%	29.50 d	No
Powder 2.5%	41.40 c	No

No: Mean that no death in hornets till three days.

F. value for first worker= \* F. value for second worker= \*

If beekeepers, know the hornets' nest place or expected it is near the apiary they can use the fast killer insecticides Lambda-cyhalothrin 10%WP and Acetamiprid 25%SP insecticides. While if they, don't know the hornets' nest place or expected it is far from the apiary they can use the slow killer insecticides , Diazinon 60% EC

and Emamectin Benzoate5% SG by dusting the hornets and rerelease it.

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