

TOXICITY AND RESIDUAL EFFECTS OF THREE RECOMMENDED PESTICIDES IN MENUOFIA GOVERNORATE (EGYPT) ON HONEY BEE (*APIS MELLIFERA*) COLONIES AND ITS PRODUCTS

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ABSTRACT: *This work was carried out during the beginning of the 2011 season in the experimental apiary of both Economic Entomology and Agricultural Zoology Department, Faculty of Agriculture ,Menoufia University ,Shebin El-Kom ,Menoufia ,Egypt, and plant protection research institute ,(ARC) , to study the effect of used pesticides (Cord 72 % , Kuik 90% and Chlorzan48%) on two honey bee strains (F1, F2 Carniolan and F1, F2 Italian) colonies and its products. Results indicated that the nursery bees showed the highest tolerance ratios to all tested insecticides, followed by the forager workers, while the newly emerged workers demonstrated the highest susceptibility. Residues of the three insecticides were measured in both of honey and wax samples. Results indicated that the insecticide Chlorzan 48 % showed the highest value followed by the Cord 72 % , and Kuik 90 % . These results stayed under the acceptable limits of the food & agriculture organization (FAO).*

Key words: *Honeybee, pesticides, residue levels, tolerance and susceptibility.*

INTRODUCTION

Honeybee *Apis mellifera* L. is considered as one of the most important beneficial insects for the people. Honey bee populations have been declining rapidly over the past 40 years (NRC, 2007). Much of this decline, particularly over the last two decades, can be attributed to known causes such as parasitic mite *Varroa destructor* and the pesticides. More recently, however, extensive losses of honey bee colonies in the continental United States have been attributed to a poorly understood phenomenon referred to as Colony Collapse Disorder or CCD (van Engelsdorp *et al.*, 2007). CCD is defined by a specific set of symptoms, including the rapid loss of the adult population with no dead bees in or in proximity to the hive (Cox-Foster *et al.*, 2007). Pesticide has got a wide range of impacts on human and other living beings. The direct impacts are on soil microorganisms, which has got special role in various nutrient cycles (Jan *et al.*, 2001; Cycon *et al.*, 2006). Besides this, majority of pesticides, especially organochlorine pesticides, have got bio-accumulative capacity (Shokrzadeh and Ebadi, 2006). Its

negative impact on flora and fauna can also be linked to the continuous direct exposures as for example cypermethrin, having a half life of 4 weeks and remains in soil for up to seven months (Class, 1992). While the direct spray, which remain affective for few days, can affect macro fauna (Ahmad *et al.*, 2009). This study was aimed to test the effect of the three pesticides on wide spread strains of honey bee and its residue levels in honey and wax samples.

MATERIALS AND METHODS

The experiments were conducted in the apiary and laboratory of Economic Entomology and Agricultural Zoology Department, Faculty of Agriculture, Menoufia University, Shebin El-Kom, Menoufia, with cooperation of Plant Protection Research Institute, ARC, Dokki, and Giza, Egypt.

I-Tested bees.

1- Two honeybee strains (F1, F2 Carniolan and F1, F2 Italian) colonies.

2-Twenty colonies with about 25,000 bees/colony and 1 mated queen and with a

normal brood pattern (eggs, larvae and pupae) were used. At the start of the trial the colonies occupied 10 frames: the 3 to 4 middle frames contained brood while the other frames contained the pollen and honey stores.

II- Tested pesticides.

1- To determine the effects of the three pesticides (Cord 72% EC "Prophenofos" ,Kuik 90%. SP "Methomyl" and Chlorzan 48% EC " Chlorpyrifos") on newly emerged nursery and foraging workers, one drop (2 µl) of insecticide-acetone solution was applied by using micropipette on the ventral mesothorax of workers anaesthetized by CO₂.

2- The unsealed brood in combs treated by LD₁₀ and in the check were taken shortly before emergence and placed in separate full frame wire screen cages then kept in the colonies. Until the adults emergence.

3- Samples of honey and wax were collected from each treated hive, to estimate the presence of the three pesticide residues.

RESULTS AND DISCUSSION

Data concerning the relative susceptibility of honey bee workers representing to different ages and belonging to four strains of bees are given in (Table 1.) the mortality records of the three progressive ages of workers in response to different doses of the tested insecticides at 24 hr. observation period were used for computing the LD₅₀ and LD₉₀ values ,whereas the tolerance ratio was based on the least LD₅₀.the calculated tolerance ratios on the LD₅₀ values revealed that nurse bee workers remarkably tolerated different insecticides much more than both other ages regardless of strain or / and insecticide tested. Likewise, Comparisons on the basis of LD₉₀ at 24 hr. post treatment demonstrate the same performance for worker bees of different ages belonging to different strains of bees. Data in (Table 2.) showed that treatment of unsealed brood with LD₁₀ from tested pesticides caused decrease in the brood rearing and the numbers of population. The Chlorzan had the higher effect followed by the Cord and the Kuik had

the lower effect. The residue of tested pesticides was higher in wax than in honey.

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Table 1

Table 2

**السمية والتأثير الجانبى لثلاث من مبيدات الافات الموصى بها فى محافظة المنوفية
(مصر) على أفراد نحل العسل ومنتجاته**

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المخلص العربى

اجريت هذه التجربة بالمنحل والمعمل البحثى لقسم الحشرات الاقتصادية - كلية الزراعة - جامعة المنوفية ومعهد بحوث وقاية النباتات ، مركز البحوث الزراعية . لدراسة سمية ثلاث من المبيدات الحشرية الموصى بها على شغالات سلالتان من سلالات نحل العسل (الكرنيبولى هجين اول وثانى - الايطالى هجين اول وثانى) وكذلك الاثر المتبقى لهذة المبيدات فى شمع النحل والعسل.

أظهرت نتائج تجارب السمية ان النحل الحاضن هو الاعلى فى معدل تحمل المبيدات يلية النحل السارح بينما اظهر النحل حديث الخروج اقل معدلات تحمل للمبيدات المختبرة ، كما أظهرت تجارب اختبار الاثر المتبقى تواجد المبيدات المستخدمة فى كل من شمع النحل والعسل ولكن فى الحدود الدولية المسموح بها من قبل منظمة الاغذية والزراعة.

Table (1): The relative susceptibility to insecticides based on LD₅₀ and LD₉₀ of honey bee workers.

Bee ages	F1 Carniolan			F2 Carniolan			F1 Italian			F2 Italian				
	LD ₅₀	T.R.	LD ₉₀	T.R.	LD ₉₀	T.R.	LD ₅₀	T.R.	LD ₉₀	T.R.	LD ₅₀	T.R.	LD ₉₀	T.R.
Chlorzan 48% EC (Chlorpyrifos)														
Newly emerged	0.003	1.01	0.001	1.001	0.0039	1.000	0.001	1.001	0.0005	1.010	0.0009	1.001	0.0016	1.002
Nursery	0.015	45.0	0.067	72.11	0.0261	65.45	0.088	79.50	0.0603	100.1	0.0595	95.20	0.1160	94.85
Foragers	0.001	3.64	0.004	4.520	0.0026	6.550	0.010	10.54	0.0046	7.610	0.0049	1.001	0.0124	1.010
Kuik 90%. SP (Methomyl)														
Newly emerged	0.022	1.01	0.071	1.010	0.0370	1.000	0.084	1.002	0.0580	1.010	0.0568	1.001	0.0115	1.001
Nursery	1.010	35.18	2.430	31.28	1.7300	41.60	3.120	32.43	2.2120	34.91	2.2110	22.45	2.9912	24.42
Foragers	0.282	10.59	1.255	15.94	0.3320	8.320	1.771	17.98	0.7600	10.55	0.7760	16.85	2.1240	14.52
Cord 72% EC (Prophenofos)														
Newly emerged	0.274	1.06	1.022	1.005	0.4440	1.000	1.300	1.001	1.0390	1.001	1.0330	1.001	2.5980	1.001
Nursery	7.136	24.04	12.59	15.32	12.192	27.90	21.45	16.98	14.577	14.69	13.987	11.65	27.980	10.60
Foragers	2.640	9.56	11.16	10.00	4.4120	8.720	14.56	11.28	7.7280	6.950	7.1540	5.980	17.560	5.984

LD₅₀, LD₉₀= µg/bee T.R. =Tolerance ratio

Table (2): Sealed brood area, Mean Numbers of bee population, Residues in honey and wax in the experimental hives before and after treatment.

Treatment	Sealed brood area (cm ²) / hive		Mean No. of bee population / hive		Residue (µg)	
	Before	After	Before	After	Wax	Honey
Chlorizan 48% EC " Chlorpyrifos	3149.91 ± 99.40	993.01 ± 63.20	38477.49 ± 2694.6	28729.33 ± 990.60	0.039	0.0020
Kuik 90%. SP "Methomyl	2886.17 ± 278.5	1027.61 ± 38.2	39824.61 ± 1166.8	27738.67 ± 1981.3	0.021	0.0012
Cord 72% EC "Prophenofos	3067.78 ± 66.60	1042.32 ± 41.4	41191.92 ± 2423.4	29720.00 ± 0.000	0.041	0.0030
Colony Collapse Disorder (CCD)	3034.62 ± 148.16	1020.98 ± 47.6	39831.34 ± 2094.93	28729.33 ± 990.63	0.0336	0.00206

