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Evaluation of Dismate (PE) pheromone and its comparison by some chemicals control against wax moths under storage conditions at Menoufia Governorate, Egypt

Amany, Saad M. Abou-Lila[1]; Amro, Ahmed Taha[1 2] and Mohammed, Samir Younis[1]
[1]Plant protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.
[2]Research and Training Station, King Faisal University, Al-Ahsa, Saudi Arabia.

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Abstract:

A study aimed to some chemicals and evaluate four Dismate (PE) pheromone control treatments against the greater wax moth, *Galleria mellonella* L. and the lesser wax moth, *Achroia grisella* Feb. in the storages of waxes was carried out at the apiary (50 colonies) of New Lands, Sadat City, Menoufia Governorate, Egypt during autumn and winter season 2018 and 2019. The Para-dichlorobenzene (PDB) achieved better control against both pests. The mean general reduction percentage reached 96.5%. In addition, the reduction percentage reached 94.4 %, 96.6% and 97.1% during December 2018, January and February 2019, respectively. The mean numbers of male greater and lesser wax moth attractant for trap by using Dismate (PE) pheromone were 14, 27, 45.25, 52.25, 59.5 and 59.5 after treatments for both insects during October, November and December 2018 and January, February and March 2019, respectively (General numbers 41.40). This study is considered one of the modern fields in controlling wax moths using pheromones. It reduces or prevents mating between males and females and its better method than using the PDB used by beekeepers, as it has a harmful effect on stored wax, which is used in the colonies after that and affects the bee products especially honey.

Introduction

Honey bee colonies are infected many pests and diseases. Wax moths are serious pests of bees wax. It can be considered as an extremely destructive pest that can destroy empty combs in a very short time (Burges, 1978 and Watkins, 2005). It can cause huge problems for beekeepers by decimating storage wax combs. The moths neither cause a disease, nor them parasites the individual honey bees, but they are responsible for the tremendous destruction of the colony (Jedruszuk *et al.*, 1994).

Larvae of greater wax moths, *Galleria mellonella* L. (Fam: Galleridae) and lesser wax moth, *Achroia grisella* Fab. (Fam: Pyralidae) are by for the most danger pest, especially to comb both in the weak hive and in storage. The Lepidoptera wax moth *G. mellonella* and *A. grisella* are extremely destructive pests, as they highly damage the empty wax combs during storage in winter in a relatively short time (Watkins, 2005). Adult females at wax moths fly at night and lay eggs on honey wax combs in the tiny crevices in hives. After a few days,

the larvae hatch, crawl onto the combs, and begin to feed, damaging or destroying combs by boring through the cells as they consume cocoons, cast skins and pollens. As they chew through the wax, they spin silken galleries for protection.

Finally, wax combs become a mass of debris and dust. They also pollute the wax combs with faces, which may contain contaminants and a mass of webbing rendering what is left of the wax comb useless (Atallah *et al.*, 1983). Compared among 5 treatments for controlling of wax moths (Mansour, 2008). Mabrouk *et al.* (2009) investigated the efficacy of certain natural and chemical compounds against wax moths (Formic acid 85%, oxalic acid 5%, phostoxin, agrin and Para-dichlorobenzene). Abou-Lila (2012) compared among 3 treatments against *G.mellonella* (Para-dichlorobenzene, formic acid 85% and clove oil).

The present study was designed to evaluate the Dismate pheromone against the wax moths *G. mellonella* and *A. grisella* under storage conditions.

Materials and methods

This experiment was carried out in store under conditions during Autumn and winter 2018 and 2019 for experimental para-dichlorobenzene (PDB) and experimental evaluation of Dismate pheromone at the store, Sadat city , New Lands, Menoufia Governorate during Autumn and winter 2018 and 2019. This experiment for controlling wax moths infested wax combs.

1. Baradix (Para-dichlorobenzene) PDB:

Was tested as a commercial chemical compound commonly used to kill and repel the greater and lesser wax moths. PDB crystals were sprinkled on the tops of combs at a rate of 25 g/hive box (Recommended 50 g./m^3). Each treatment was represented by 3 replicates for a period 3 months (10 combs each/ box) and one box was untreated to be used as a check (Shimanuki, 1991 and Mansour, 2003). The results were calculated according to the formula of Henderson and Tilton (1955):

$$\text{Reduction (\%)} = 1 - \frac{T_a \times C_b}{T_b \times C_a} \times 100$$

Where: Ta is % infestation of mite after treatment, Tb is % infestation of mite before treatment, Ca is % infestation of mite after treatment for the control and Cb is % infestation of mite before treatment for the control.

2. Evaluation of Dismate (PE) pheromone:

Three hive boxes were chosen for conducting this experiment. Each hive box was supplied by 10 infested waxes combs contain different stages of wax moths. The input of this wax combs at storage. Dismate pheromone 2 capsules and 2 traps were used in storage (2.25x2.25x3.25 meters= 16.453 m^2). Data all 15 days until experiment end.

Trade name: Dismate PE.

Company name: Russel IPM Ltd (United Kingdom); Active substance: Z-9, E-12-Tetradecadien-1-yl acetate; Functions (uses); Repellent and attractant.

Chemical name: (9,12-Tetradecadien-1-01, acetate, (9z,12E) Figure (1).

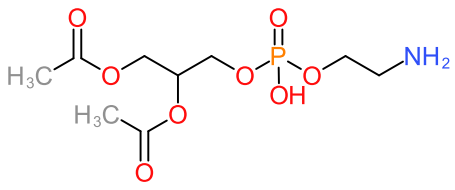

Figure (1): Chemical structure of Dismate (PE) pheromone.

Source: Ministry of Agriculture, Agric. Pesticide Committee Effective amounts pheromone for 3 months (Pesticide Committee, 2017).

Application: the Dismate PE dispensers trap should attach to walls at 2-meter heights, 2 meter in between, before moth emergence and changed every 3 months. Mode of action: This product acts by disrupting the mating between male and female moths. Populations of the insects are reduced as the adult insects die and are not replaced by the next generation. The data were recorded all of 15 days from before and after treatments, 2018 and 2019 years. Statistical analysis was determined according to SAS Institute (1988).

Results and discussion

1. Baradix (Para-dichlorobenzene):

Data presented in Table (1) and Figure (2) shows mean reduction percentages in infestation with the greater and lesser wax moth, which reached 94.4, 96.6 and 97.1 % (general mean 96.5 %) after using Baradix during December 2018, January and February 2019, respectively. Analysis of the obtained data showed significant differences between the months and years. Mabrouk *et al*., 2009; Abou-Lila, 2012; Mansour, 2008 and Mansour *et al*., 2010 investigated the efficacy of certain natural and chemical compounds against wax moths. These compounds were more effective in controlling wax moths.

2. Evaluation of Dismate (PE) pheromone:

As shown in Table (2) and Figure (3) mean numbers of greater and lesser male wax moths after using Dismate (PE) pheromone attractant. These means were 14, 27, 45.25, 52.25, 59.5 and 59.5 (General means 41.4) during October, November and December 2018 and January, February and March 2019, respectively. Analysis of the obtained data showed significant differences between months and years.

In conclusion, this study is considered one of the modern fields in controlling wax moths using pheromones. It reduces or prevents mating between males and females and its better method than using the PDB used by beekeepers, as it has a harmful effect on stored wax, which is used in the colonies after that and affects the bee products especially honey.

Table (1): Reduction percentages of wax moths by using Baradix (Para-dichlorobenzene) in store at Minoufia Governorate.

Date	Treatment	Infestation % (3 months)		Reduction % (Month)	Reduction % Mean Month
	Replicates	Before Treatments	After Treatments		
December, 2018	1	50	7.5	93.7	94.4[b]
	2	40	5.0	94.8	
	3	55	7.0	94.7	
January, 2019	4	55	5.0	96.2	96.6[a]
	5	25	2.0	96.7	
	6	35	2.5	97.0	
February, 2019	7	45	3.0	97.2	97.1[a]
	8	25	2.0	96.7	
	9	50	3.0	97.5	
$F_{0.05}$	-	-	-	-	27.26**
LSD	-	-	-	-	0.9628
General Mean Reduction %		-	-	-	96.5 %
Untreated (control)		40	95.0		-

Replicates= 3 boxes (each 10 wax combs/ box)/ month
Rate of Baradix (per day= 25g./box)
LSD = Least Significant Deference

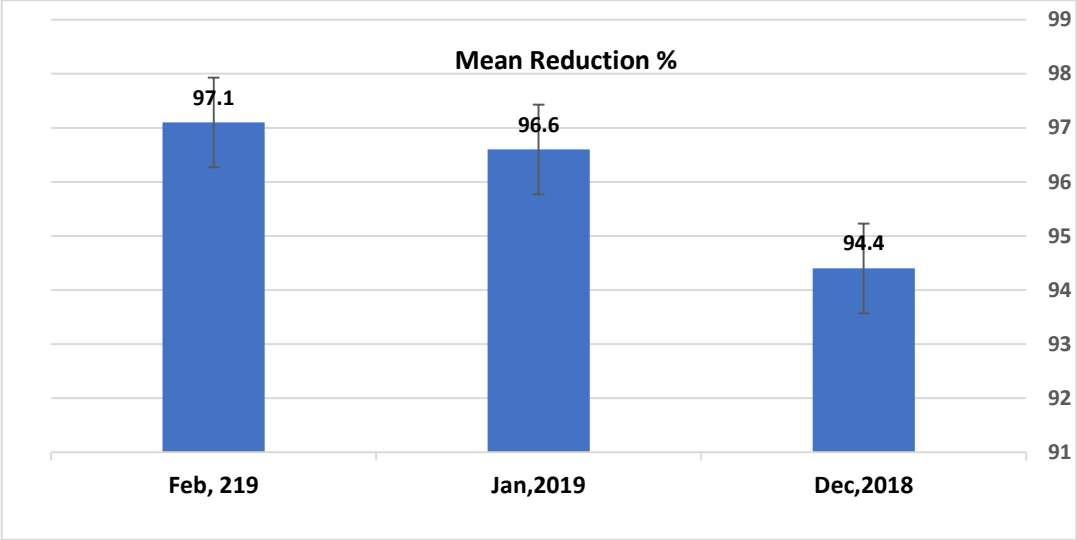

Figure (2): Mean Reduction percentages (3 months) of wax moths by using paradix in store at Minoufia Governorate.

Figure (3): The stages of using Dismate PE pheromone during the experimental period in store at Minoufia Governorate.

Table (2): The numbers of greater and lesser males of wax moths by Dismate (PE) pheromone under store conditions at Minoufia Governorate.

Dates	Numbers of flies of wax moths		Total No./trap	Mean	
	Near to the trap	Far from the trap		Traps	month
15/10/2018	15	11	26	13	**14.0**[e]
30/10/2018	17	13	30	15	
15/11/2018	25	25	50	25	**27.0**[d]
30/11/2018	33	25	58	29	
15/12/2018	51	36	87	43.5	**45.25**[c]
30/12/2018	58	36	94	47	
15/1/2019	62	40	102	51	**52.25**[b]
30/1/2019	65	42	107	53.5	
15/2/2019	69	50	119	59.5	**59.5** [a]
28/2/2019	69	50	119	59.5	
13/3/2019	69	50	119	59.5	**59.5** [a]
$F_{0.05}$	-	-	-	-	722.96***
LSD	-	-	-	-	2.13
Total	533	378	911		45.55
Mean	48.45	34.36	82.81		41.40

LSD = Least Significant Deference

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