

EVALUATION OF SOME NATURAL AND ORGANIC COMPOUNDS FOR CONTROLLING VARROA DESTRUCTOR AT DAKAHLIA PROVINCE

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ABSTRACT

Eighteen (1st hybrid carniolan bee race) were chosen to study the efficacy of some natural and organic materials of controlling Varroa destructor (Anderson and Trueman) under Dakahlyia circumstances. The reduction in Varroa infestation on worker bees were 76.4%, 73%, 74.2%, 68.7%, 76.93% and 77.2%, 81.6%, 87%, 70.05, 77.1% on brood and adult bee worker by using Formic acid, Oxalic acid, Photosensitizer, Thymol and clove oil, respectively. Mites mortality was significantly related with repetition of treatment. Significant differences were observed between materials used in this investigation and number of knock down varroa mite on different times. Results obtained indicated that photosensitizer (xanthin) hold a great promising for controlling the ectoparasitic mite Varroa destructor.

INTRODUCTION

Varroa mite is world-wide distributed and will probably invade all countries where *Apis mellifera* is present, Ritter (1981). Winands (1988), mentioned that varroaosis was discovered in Egypt in 1988. The ectoparasitic mite causes a serious damage to Egyptian honey bee industry for producing honey as well as pollinating different crops. Although the number of beekeepers has decreased a little, the total number of bee colonies has not changed much over the last 10 years in Egypt.

Controlling Varroa mite is being difficult because the mite usually hides in brood combs under cell capping, therefore the mite can resist most applied materials used for treatment. Owing to the treatment of infested

colonies by different chemicals, dangerous problems arose, which resulted in high toxicity of bees, and mammals. In addition improper use of these chemicals might cause a serious damage, such as killing bees and destroying brood area beside its residues and side effects in honey bee products, (Ritter 1986). Infestation of honey bee colonies by varroa mite may be associated with Acute Paralysis Virus (APV) and possibly other viral infection, Ball (1983). From varroa infested apiaries near Belgrade APV, Egypt bee virus, cloudy wing virus and black queen cell virus were detected, Kulinčević, et al (1990). So there is an urgent need for natural materials for controlling Varroa mites to protect bee colonies and keep it clean from contamination with chemicals and keep it away from Varroa infestation as well Mikityiak (1980), Fouly

(1993) mentioned that spraying Camphor oil 5% on bee worker gave a good result in controlling Varroa mites. James (1996) stated that essential oils have a great promising price for controlling honey bee parasitic mites.

Accordingly, much effort has been carried out to find effective and safe compounds for controlling the mite. These materials should be effective for a long time, easy to be used without causing danger to beekeepers, and should be with no residues or side effects in the products as well as bees themselves.

MATERIALS AND METHODS

The present study was carried out at an apiary of Dakahlyia governorate, Egypt during (2007).

Eighteen of first hybrid carniolan honey bee colonies infested with Varroa mites were chosen to start the experiment. Each colony consists of one brood chamber and all colonies were equalized at equal strength, 8 combs each covered with bees, and each colony was headed by a prolific queen nearly of the same age. The experimental colonies were divided into six groups of three colonies each. The first groups of these colonies were treated with photosensitizer while the second group was treated with formic acid 60%. The third group was treated with oxalic acid 3.0%. Group number fourth was treated with clove oil 25% (*Eugenia aromatic*) and the fifth group was treated with thymol. The sixth group received no treatment and was used as control. All treatments were repeated four times at four days intervals.

To determine the numbers of Varroa mite

parasiting worker bees, a comb was removed from the center of each experimented colony and workers were swept with bee brush into a beaker containing water soup as a washing liquid. The beaker was shaken carefully for about 5 minutes; and the workers collected in a wire net. Varroa mite individuals which fell off from worker bees were found at the bottom of the white container (Ritter 1981), and Stort (1981). All worker bees and mites were counted for each sample where the number of mite/100 worker was calculated and the ratio was used as an index for the infestation level.

For estimating the degree of Varroa infestation in brood cells, a brood comb was taken out from each tested colony where about thirty cells were opened using a sharp forceps and the number of infested and healthy cells in addition to Varroa mite occurring with there cells were counted. Data obtained were corrected according to the formula of Handerson and Tilton (1955).

To access daily mite mortality the bottom board of each infested colony was covered with white plastic paper coated with Vasline just before each application. It was then removed 24hrs, 48hrs, 72hrs, 1 week, 2 week, 3week, and 4 weeks after treatment and the dead mites which were knock down on the sheet were visually counted. At the time another plastic sheet was replaced the former. Data obtained in this test was indicated following Abbott's formula (1925).

All data obtained for each application were recorded just before and after treatments and were subjected for analysis using Randomized complete block desine analysis of variance

and the differences among materials were evaluated for significant at 5.0% level through using the least significant difference test (L.S.D) according to the method of Mead et al (1993).

$$\text{Reduction} = 100 - (Ta * Cb) / (Tb * Ca)$$

Ta is the infestation % of Varroa in infested colonies after treatment.

Tb is the infestation % of Varroa in infested colonies before treatment.

Ca is the infestation % of Varroa in infested colonies after treatment in control colonies.

Cb is the infestation % of Varroa in infested colonies before treatment in control colonies.

RESULTS AND DISCUSSION

The results of frequent treatments with different materials used in this trials are presented in Table (1) and Fig. 1. The treated colonies showed different responses to these varies substances. It was clear from obtained data that materials used in this investigation were able to greatly reduce population of varroa mites in the experiment colonies, using varies dosages. Further-more the repetition of treatment increase the number of fallen varroa mites from adult worker bees on the bottom board of the hive. These numbers were 168, 100, 143, 139, and 212 using formic acid, oxalic acid, xanthin, thymol, and clove oil respectively . In addition these numbers of fallen Varroa reached its lowest level after the last application of tested materials. Significant differences were observed between materials used in this investigation and the num-

ber of knock down varroa mite on different times. On the other hand the infestation rate in control colonies was increased gradually from $14.73 \pm 3.23\%$ to $22.23 \pm 3.14\%$. The present data revealed that formic acid was found to be having a strong acaricidal effect. Most different application methods demonstrated that formic acid treatment is the acid kills mites on sealed brood. No other materials are effective on killing mite in sealed brood cells. Another advantage of formic acid is that the substances occur as natural component of honey. The reduction of varroa mite using formic acid was 77.4%, and 76.9% on adult and immature stages of honey bees. The results obtained in this study were in agreement with that obtained by Wachendorfer et al (1985) who mentioned that formic acid gave a good result for controlling Varroa. It was also noticed from data in Table (1) that xanthin, as photosensitizer gave a complete treatment comprises four applications in infested colonies. This natural substance is preferred for controlling the ectoparasite Varroa destructor. Results obtained also indicated that reduction occurred on worker bees was 87%, while it was 74.2% in infested brood cells. Data obtained in this investigation proved that thymol reduced varroa infestation on worker bees from $14.53\% \pm 3.73$ to $7.31 \pm 2.96\%$ these finding was agreed with that obtained by Imdorf et al (1999) who found a great reduction in varroa population using natural materials such as thymol which considered an ingredient of many essential oils and has been used in veterinary medicine and consequently used for control varroa mites., their disadvantage is the strong odour. Clove oil also gave a good results for controlling Varroa. The reduction was 77.14% and

76.93% on adult and brood cell respectively. Data in Table (1) also demonstrated that oxalic acid was effective for controlling Varroa destructor. The reduction in infestation was 76.4%, and 77.2% on brood and adult honey bees colonies respectively.

Results obtained in this investigation indicated that the efficacy of treated materials was clearly appeared after fourth application. Similar results are obtained by Caldron (1996). There was a significant increase in knock down number of varroa mite in 48hrs treated colonies compared with control colonies was clear. However, significant decrease in these numbers of varroa after 4 weeks was obtained.

Concerning application of the natural materials, it could be showed that the dosage varies according to out door tem-

perature and filling level of advice, moreover during the time of treatment. In addition, chemical treatment is not the ultimate solution, resistance may develop and residue in honey and other bee byproducts are a constant concern. It could be also reported that Photosensitizer is generally very effective, the beekeepers, however needs to have some experience in order to achieve a good results in all colonies treated. Though xanthin belongs to the group of less dangerous substances used in treating varroa mite was promising. The finding result was in agreement with Haggag (2006) who mentioned that xanthin has a highly effective for controlling American Foul brood (AFB) and other diseases in honeybee colonies.

From results obtained it could be concluded that the application of the medicaments should be considered carefully.

Table (D): Evaluation of some natural and organic compounds for controlling *Vарroa destructor* at Dakahlyia province (2007)

No.	Materials and its conc.	Infestation before treatment		Number of <i>Vарroa</i> after treatment										Infestation%		Reduction%		Average of reductio n%
		G Brood	G adult	B 24h	a 48h	C 76h	D week	E 2wee k	F 3week	H 4week	brood	adult	brood	adult				
1	Formic acid (60% CD (b))	18	17	29	52	42	18	10	8	4	6	4	76.4%	77.2 %	76.8%			
		22	20	32	61	38	25	17	10	6	5	6						
		17	15	19	55	29	18	12	11	5	7	5						
Sum		57	52	80	168	109	61	39	29	15	18	15						
Average		19	17.3	26.7	56	36.3	20.3	13	9.7	5	6	5						
2	Oxalic acid 3%	15	19	29	32	25	15	8	4	2	8	6	73%	81.6 %	77.3%			
		23	20	25	27	18	8	12	3	—	8	5						
		20	22	30	41	21	6	9	7	6	5	4						
Sum		58	61	84	100	64	29	29	14	8	21	15						
Average		19.3	20.3	28	33.3	21.3	9.7	9.7	4.7	2.772	7D	5						
1	Photosinitizer 0.5% C	17	20	59	70	45	25	13	8	5	8	3	74.2%	87%	80.6%			
		24	21	49	55	38	31	12	7	3	7	5						
		29	32	31	18	29	18	9	6	4	9	4						
Sum		70	73	139	143	112	74	34	21	12	24	12						
Average		23.3	24.3	46.3	47.6	37.3	24.6	11.3	7	4	8C	4H						
1	Thymol 2.5% B	16	19.5	44	61	52	41	46	35	4	8	7.03	68.7%	70.05 %	69.4%			
		20	25.4	29	33	19	36	55	21	15	8	12.1						
		12	13.7	31	45	27	39	61	23	11	4	2.8						
Sum		48	58.6	104	139	98	116	162	79	30	20	21.93						
Average		16	19.53	34.57	46.33	32.67	38.67	54	26.3	10	6.67E	7.31D						
2	Clove oil 2.5% A	16	17.5	55	63	42	67	44	53	12	4	3.5	76.93%	77.14 %	77.04%			
		22	27.6	76	99	89	79	65	84	23	8	8.14						
		12	11.7	84	44	31	44	26	32	18	4	4.6						
Sum		52	56.8	215	212	156	190	135	169	53	16	16.24						
Average		17.33	18.93	71.67a	70.67b	52	63.3c	45	56.33	17.67	5.33	5.41						
3	Control DE (a)	12	11.8	5	9	17	14	28	31	14	16	15.03	—	—	—			
		20	22.9	8	14	21	29	31	32	31	28	27.61						
		16	18.5	7	9	16	13	28	16	25	20	24.05						
Sum		48	53.2	20	32	54	56	87	69	70	64	66.6						
Average		16	17.73	6.67	10.6	18	8.67	29	23	23.33	21.33B	22.23a						

Analysis of Variance Table

K Value	source	Degrees of freedom	Mean square	F value	prob	
1	Replication	2	1489.258	744.629	1.9442	0.1935
2	Factor A	5	15456.536	3091.307	8.0713	0.0028
-3	Error	10	3829.981	382.998		
4	Factor B	8	14917.173	1864.647	27.4668	0.0000
6	AB	40	18083.490	452.087	6.6594	0.0000
-7	Error	96	6517.181	67.887		
Total		161	60293.620			

Coefficient of variation : 31.00%

s_ for means group 1: 2.6632 Number of observations: 54

y

s_ for means group 2: 3.7663 Number of observations: 27

y

s_ for means group 4: 1.9420 Number of observations: 18

y

s_ for means group6: 4.7570 Number of observations: 3

y

Analysis of Variance Table

DRSAID

K Value	source	Degrees of freedom	Sum of square	Mean square	F value	prob
1	Replication	2	76.277	38.139	2.5232	0.1297
2	Factor A	5	1259.989	251.998	16.6717	0.0001
-3	Error	10	151.153	15.115		
4	Factor B	1	7.290	7.290	3.6304	0.0810
6	AB	5	26.033	5.207	2.5929	0.0819
-7	Error	12	24.097	2.008		
Total		35	1544.839			

Coefficient of variation : 16.47%

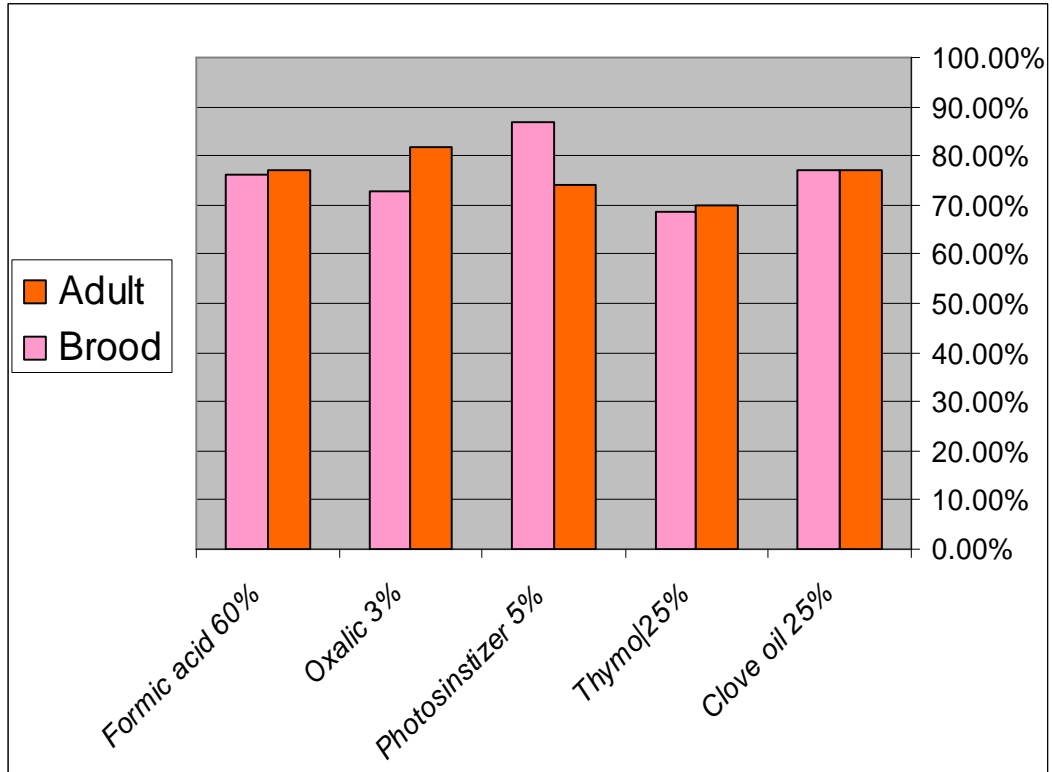
s_ for means group 1: 1.1223 Number of observations: 12

y

s_ for means group 2: 1.5872 Number of observations: 6

y

s_ for means group 4: 1.3340 Number of observations: 18



Fig(I) : Reduction of Varroa mite infestation using different materials.

Note : the control hives recorded the highest percentage of the infestation so the reduction was 0% and these were swarming.

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الملخص العربى
تقييم فاعلية بعض المركبات الطبيعية والعضوية فى مكافحة
طفيل الفاروا بمحافظة الدقهلية

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تهدف هذه الدراسة إلى تقدير فاعلية بعض المركبات الطبيعية والعضوية فى مكافحة طفيل الفاروا فى طوائف نحل العسل وقد أوضحت النتائج فعالية المواد المستخدمة فى التجربة مع عدم وجود فروق معنوية بينها حيث بلغت نسبة خفض طفيل الفاروا فى طوائف النحل ٤.٧٦٪، ٧٣٪، ٧٤.٢٪، ٦٨.٧٪، ٧٦.٩٣٪، ٧٧.٢٪، ٨١.٦٪، ٨٧٪، ٧٠.٥٪، ٧٧.١٤٪ على النحل البالغ وكذا فى حضنة النحل باستخدام حامض الفورميك، الأكساليك والمسحث الضوئى والثيمول وزيت القرنفل، توالياً.

كما تلاحظ وجود فروق معنوية فى أعداد الفاروا المتساقطة بتكرار المعاملة ٤ مرات كل ٤ أيام، وقد وجد أن استخدام مركب الزانثين (المسحث الضوئى) أفضل تلك المركبات المستخدمة فى مكافحة لسهولة استخدامه وكذا رخص سعره وفعاليتها ضد معظم الأمراض والآفات داخل طوائف النحل.

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