

EVALUATION OF THE ROLE OF SOME BEE PRODUCTS AND PLANT MATERIALS IN CONTROLLING *Varroa* MITE (*Varroa destructor*) ON HONEYBEES

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ABSTRACT

This work was conducted on honeybee colonies situated in the apiary of the experimental farm of Fac. Agric. South Valley Univ at Qena in the period from 3 Oct. till 28 Nov. 2009. to evaluate the effect of some honey bee products as well as two plant materials for controlling *Varroa* mite on adult worker bees and in sealed worker brood. The used materials were honey solution, bee venom solution, royal jelly solution, honey bee larval extract, El-ader (*Artemisia monosperma*) leaves extract, and worm wood (*Herba alba asso.*) extract. It was found that the reduction percentages in *Varroa* mite on adult bees were: 79.38, 74.15, 73.75, 66.54 57.67 and 49.13%, while the reduction percentages in *Varroa* mite in sealed worker brood were: 90.07, 89.83, 84.61, 74.08, 76.31 and 72.37% for the previous materials, resp. For control colonies, the percentage of infestation was increased from 36.00 to 48.25% on adult bees and from 22.40 to 28.20% in sealed worker brood.

Keywords: Honey bee, *Apis mellifera*, L., Bee products, , El-ader plant (*Artemisia monosperma*) , worm wood plant *Herba alba asso.*

INTRODUCTION

Honey bee colonies are subject to infestation by certain insects, mites and diseases. The ectoparasitic mite *Varroa destructor*, is considered as one of the most serious pests of beehives, causing tremendous damage to honey bee colonies and great economic loss to the beekeeping industry (Al-Abbadi and Nazer, 2003).

Such parasitism can result in a loss of up to 25% of adult weight, severe deformations of the wing and reduced worker and drone bee longevities (Kanga and James, 2002).

Colonies infested with *V. destructor* have significantly reduced worker bee populations and eventually die if left without controlling. (Abd El-Wahab, 1996).

Many scientists used both chemicals (Ritter 1981 ; Abu-Zeid & Ghoniemy ,1992) and plant material (Abd Al-Fattah *et al.*, 1991; Abou-Zeid and Ghoniemy ,1993) for controlling *Varroa* in the honey bee hives

Even if it is agreed that chemical control is very effective. Its use must be constrained due to the pesticide residues in the honey of the hives treated with pesticides for controlling *Varroa* mite (Ogata and Bevenue, 1973). In the short term, *Varroa* mite control may be achieved by using natural compounds, which have low toxicity and low environmental impact, because no residues are left in honey because of their breakdown or rapidly volatilized (Boganor and Kilcherman, 1998). Few natural products have shown effectiveness against *Varroa*, such as formic acid, oxalic acid and thymol essential oil (Imdorf *et al.*, 1999 ; Espinosa *et al.*, 2007 and Romeh, 2009).

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Many authors used natural compounds for controlling *Varroa* mite in honey bee hives (Abou-Zeid and Ghoniemy ,1993; Ghoniemy ,1998 ; Whittington *et al.*, 2000; El-bassiouny *et al.*, 2002; Owayss, 2002; Sheppard *et al.*, 2003; Dimetry *et al.*, 2005; Shaddel *et al.*, 2008 and Yousif *et al.*, 2009).There is no available review about using colony products for control *Varroa* on honey bees. Therefore the aim of the present work was to evaluate the effect of some bee products as well as two plant materials for controlling *Varroa* mite infesting honeybee colonies.

MATERIALS AND METHODS

This work was conducted on honey bee *Apis mellifera* L. colonies situated in the apiary of the experimental farm of Fac. Agric ,South Valley Univ. at Qena in the Autumn of 2009 from (3 Oct. till 28 Nov.) . At the beginning of experimentation, the percentages of infestation with *Varroa* mite in all colonies were determined as follows:

1-For honeybee worker, about 200-250 bees were collected, if possible from combs with open brood and dipped in water to which detergent (washing-up liquid) has been added. The bees are collected in a wire net, and removed after shaking several times .Mites will fallen off them, and can be found at the bottom of the container, Ritter (1981), the bees and *Varroa* mite are counted and the infestation percentage (INFP) was calculated using the relation :-

$$\text{INFP} = \frac{\text{No. of } \textit{Varroa} \textit{ mites}}{\text{No. of, bees}} \times 100$$

2- For sealed brood, an area of 4 sq. inches in the middle of worker brood comb , in every colony was used . Their cells were scratched and the number of *Varroa* female mite in each cell was recorded and the infestation percentage (INFP) is calculated using the same previous relation.

28 colonies with infestation levels ranging between 33 and 42% were used. These colonies were divided into seven groups,(each of four colonies), six groups were treated while the 7th one was used as a control, each treated group received one of the used materials as follows:-

- 1- Honey solution (1 honey: 2 water V/V).
- 2- Bee venom solution (200 mg bee venom: one liter of water).
- 3- Royal Jelly solution (10 gm royal jelly: one liter of water).
- 4- Honey bee larval extract (10 gm honey bee larvae: one liter of water)
- 5- El-Ader leaves extract (10 ml: 50 ml sugar solution 1:1, where the dry leaves of El-Ader plant, *Artemisia monosperma* was blended and 100 gm of its powder was boiled in equal amount of distilled water for 5 minutes, filtered and 10 ml of supernatant was used.
- 6- Worm-wood extract (10 ml: 50 ml sugar solution 1:1, where 100 gm of dry worm wood, *Herba alba* flower were boiled in equal amounts of distilled water for 5 minutes filtered and 10 ml of the supernatant was used.

Each treated group was sprayed with one of the used materials; the bees of every treated colony were sprayed (between combs) with about 2 ml

for each comb side using plastic hand sprayer, For control each colony was sprayed with about 2 ml of water only. Each treatment was repeated weekly and the infestation % was calculated (on adult bees and in worker brood cells in the used colonies) every week.

The number of dropped *Varro* mite was recorded every week after application using plastic sheets (51.5 X 36.5 cm) coated with Vaseline and placed on the bottom board of each treated colony. After 7 days, the sheets were taken to laboratory for *Varro* counting and replaced with new one. The reduction % was calculated according to Henderson and Tilton (1955) using the following equation:-

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

Where:

T_a , is % infestation of mite after treatment.

T_b , is % infestation of mite before treatments.

C_a , is % infestation of mite after treatment for the control.

C_b , is % infestation of mite before treatment for the control.

The data were subjected to analysis of variance (ANOVA) and the means were compared by LSD test at 0.05 level, using SAS program.

RESULTS AND DISCUSSION

As shown in to Tables (1 and 2) and Figures (1 and 2), the average number of dropped *Varroa* mite during the used period were: 134.22, 131.64, 115.78, 98.44, 77.53, 89.86 and 50.00 mite / colony for honey solution, bee venom solution, royal jelly solution, bee larval solution, El-ader extract, worm-wood extract and control, respectively.

The infestation percentages for the same treatments were reduced from: 38.00 to 10.50%; from 38.25 to 13.25%; from 40.50 to 14.25%; from 41.25 to 18.50%; from 35.25 to 20.00% and from 33.00 to 22.50% respectively, And as a result the reduction percentages were 79.38, 74.15, 73.75, 66.54, 57.67, and 49.13 respectively. In control colonies, this percentage was increased from 36.00 to 48.25%. Ghoniemy, (1998) found that the infestation percentage with *Varroa* mite in control colonies increased from 20.57 to 28.78 % Ahmed *et al.*, (2001), reported that the reduction rate in population ranged from 46 to 78 % with a mean of 67.5 ± 16.86 % Owayss (2002), mentioned that the reduction % reached 66.6, 77.7, 68.4, 66.3 for colonies treated with basil, geranium, eugenol and mixture, respectively and Abou-Zeid & Ghoniemy (1993) found that the infestation% with *Varroa* mite on adult bees (treated with worm-wood) were reduced from 38.64% to 28.20% and from 15.54 to 9.54 with reduction %, of 39.20 and 68.80 % in 90/91 and 91/92 years respectively.

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Table 1. Mean number of fallen *Varroa* mites on bottom board in treated and control colonies at seven day intervals at Qena Governorate during autumn of 2009.

Treatments	After treatments								Mean
	Oct.				Nov.				
	10	17	24	31	7	14	21	28	
Honey solution	330.00	295.00	222.00	173.00	97.00	30.25	25.00	7.00	134.22
Bee venom solution	285.00	250.00	210.00	184.25	102.00	65.00	35.00	10.00	131.64
Royal jelly solution	252.00	190.00	177.25	151.25	90.00	72.00	49.25	15.25	115.78
Honey bee larval extract	195.00	172.25	145.50	110.25	98.25	60.00	40.25	20.00	98.44
El- ader leaves extract	17.50	178.00	128.00	101.50	80.50	50.50	55.50	36.25	77.53
Worm- wood extract	180.25	160.50	133.00	100.00	70.50	40.00	45.25	40.00	89.86
Control	40.00	40.25	38.50	40.00	50.25	65.50	70.00	60.50	50
L.S.D at 0.05 for <i>Varroa</i> mite	3.68	3.27	2.71	21.8	1.99	3.49	1.28	1.28	0.92
	**	**	**	**	**	**	**	**	**

Table 2. Infestation % (and reduction %) with *Varroa* mite on adult bees after eight weeks. at Qena Governorate during Autumn of 2009.

Treatments	Infestation%		Reduction %
	Before treatment	After treatment	
Honey solution	38.00	10.50	79.38
Bee venom solution	38.25	13.25	74.15
Royal jelly solution	40.50	14.25	73.75
Honey bee larval extract	41.25	18.50	66.54
El-ader leaves extract	35.25	20.00	57.67
Worm- wood extract	33.00	22.50	49.13
Control	36.00	48.25	-
LSD 0.05 for infestation on adult	2.07	1.08	0.15
	**	**	**

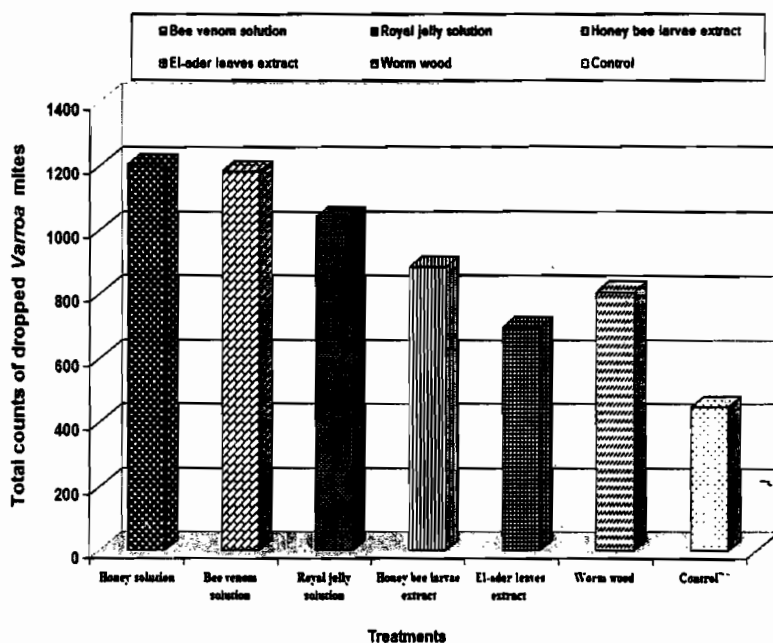


Fig. 1. Mean counts of dropped *Varroa* mites on bottom board in treated and control colonies at seven day intervals at Qena Governorate during autumn of 2009.

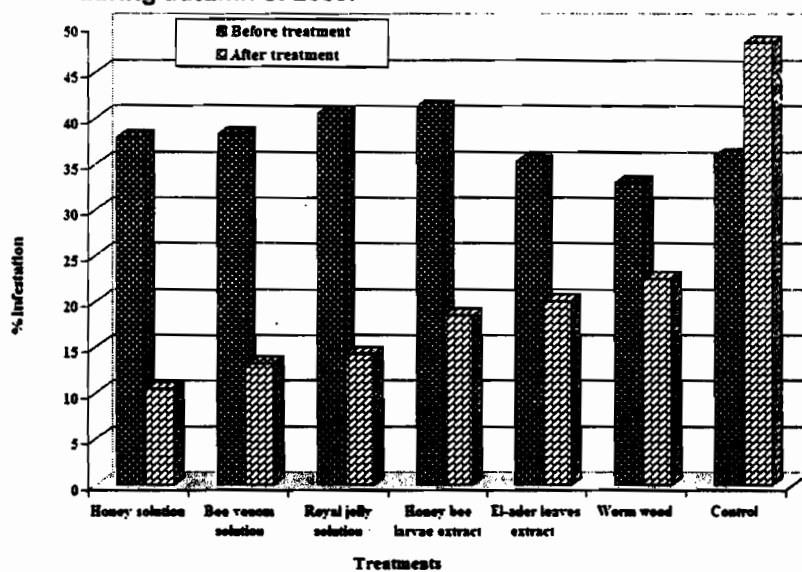


Fig. 2. Reduction percentages in *Varroa* infestation on worker bees after eight weeks of treatment.

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Statistical analysis proved that there were highly significant differences in the % of *Varro* infestation on adult worker before and after the treatment.

According to Table (3) and Figure (3), the infestation percentages in sealed worker brood were reduced from 20.40 to 2.50%; from 25.00 to 3.20%; from 22.20 to 4.30%; from 19.00 to 6.20%; from 22.80 to 6.80%; and from 23.00 to 8.00%; for the same treatments, respectively. In control colonies, this percentage was increased from 22.40 to 28.20%, and as a result the reduction percentages were, 90.07, 89.83, 84.61, 74.08, 76.31, and 72.37, for honey solution, bee venom solution, royal jelly solution, honey bee larval extract, El-ader extract, and worm-wood extract, respectively, Oways (2002), mentioned that the reduction % in sealed worker brood reached 64.0, 21.5, 35.0, 57.2 for colonies treated with basil, geranium, eugenol and mixture, respectively

Statistical analysis proved that there were highly significant differences in the % of *Varroa* infestation on worker brood before and after the treatment.

Table 3. Infestation % (and reduction %) with *Varroa* mite on sealed worker brood after eight weeks, at Qena Governorate during Autumn of 2009.

Treatments	Infestation%		Reduction %
	Before treatment	After treatment	
Honey solution	20.40	2.50	90.07
Bee venom solution	25.00	3.20	89.83
Royal jelly solution	22.20	4.30	84.61
Honey bee larval extract	19.00	6.20	74.08
El-ader leaves extract	22.80	6.80	76.31
Worm - wood extract	23.00	8.00	72.37
Control	22.40	28.20	-
L.S.D at 0.05	1.26 **	0.91 **	1.37 ***

Table 4. Mean number of dead bees on bottom board in treated and control colonies at 7 day intervals at Qena Governorate during autumn of 2009.

Treatments	After treatments								Mean
	Oct.				Nov.				
	10	17	24	31	14	21	28		
Honey solution	3.75	3.00	2.25	0.00	2.00	0.00	5.00	2.00	2.22
Bee venom solution	3.00	5.00	6.00	3.00	5.00	3.00	0.00	3.00	3.44
Royal jelly solution	2.00	1.00	0.00	0.00	3.00	3.00	2.00	1.00	1.44
Honey bee larval extract	3.00	3.00	4.00	3.00	2.00	5.00	0.00	6.00	3.56
El-ader leaves extract	1.00	2.25	1.75	1.00	1.00	2.00	0.00	1.00	1.22
Worm - wood extract	3.00	2.75	1.25	5.00	1.00	0.00	1.00	0.00	1.56
Control	1.00	2.00	1.75	0.00	1.00	1.00	2.00	0.00	0.97
L.S.D at 0.05	3.76 **	0.88 **	0.84 **	0.78 **	1.12 **	0.64 **	0.76 **	0.78 **	0.61 **

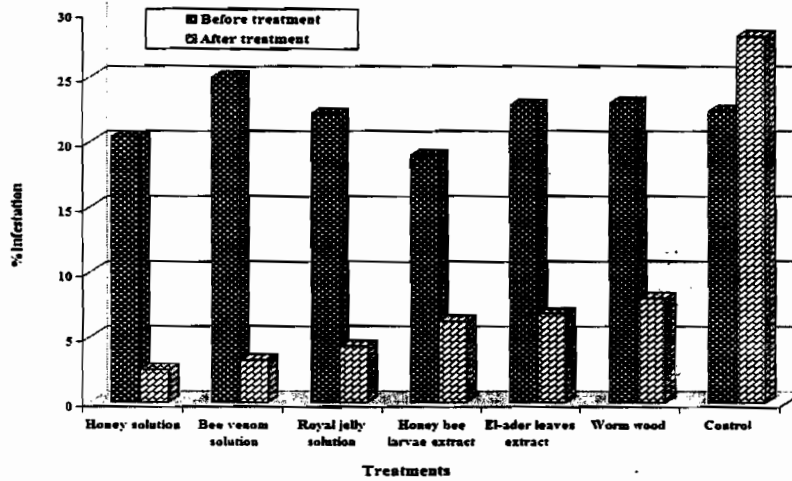


Fig. 3. Reduction percentages in *Varroa* on sealed worker brood in different treatments.

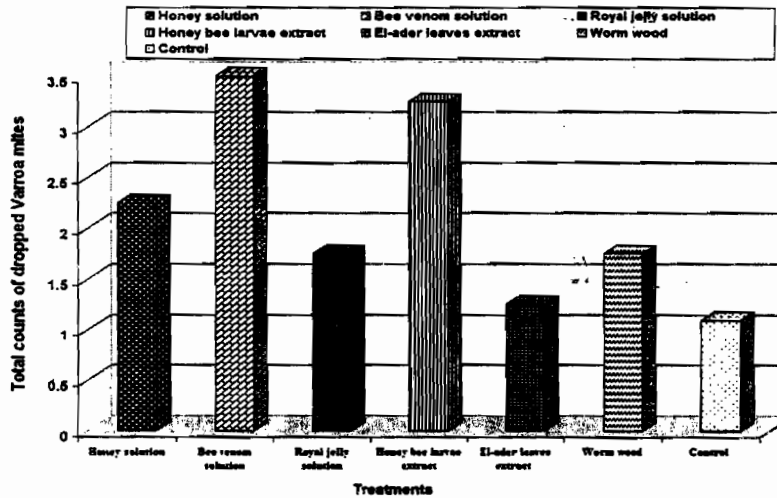


Fig. 4. Mean counts of dead bees dropped on bottom boards in treated and control colonies at seven day intervals at Qena Governorate during 2009.

The mean number of dead bees in treated and control colonies were: 22.2, 3.44, 1.44, 3.56, 1.22, 1.56 and 0.97 bees / colony for bee venom solution, honey bee larval extract, honey solution, royal jelly solution, worm-wood extract and control, respectively. Ghoniemy ,(1998) using formic acid for controlling *Varroa* mite ,and ,reported that concerning the average number of dead bees there were no significant differences between different treatments .

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These field results strongly support the use of colony products as an inexpensive, labor-efficient and non – toxic treatment for the control of *Varro* mite.

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تقييم دور بعض منتجات نحل العسل والمواد النباتية في مكافحة طفيل الفاروا علي نحل العسل

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أجرى هذا البحث على طوائف نحل العسل بمنحل مزرعة كلية الزراعة بمحافظة قنا في خريف ٢٠٠٩ وذلك لتقييم دور بعض منتجات نحل العسل والمواد النباتية في مكافحة طفيل الفاروا علي نحل العسل وكانت المواد المستخدمة هي : محلول العسل مع الماء ، محلول سم النحل مع الماء، محلول الغذاء الملكي مع الماء ، مستخلص يرقات النحل مع الماء ، مستخلص نبات العاثر، مستخلص نبات الشاي، واستخدمت هذه المواد رشاً بمعدل ٢ مل على جانبي كل قرص .

وقد أظهرت النتائج أن معدل الخفض في نسبة الإصابة في الطوائف المعاملة وصل الي ٧٩,٣٨% ، ٧٤,١٥% ، ٧٣,٧٥% ، ٦٦,٥٤% ، ٥٧,٦٧% ، ٤٩,١٣% عند استخدام محلول سم النحل، محلول الغذاء الملكي، مستخلص اليرقات، مستخلص نبات أوراق العاثر ثم مستخلص الشاي على التوالي وذلك على النحل البالغ. بينما وصل معدل الخفض في نسبة الإصابة داخل الحضنة المعاملة الي ٩٠,٠٧% ، ٨٩,٨٣% ، ٨٤,٦٤% ، ٧٤,٠٨% ، ٦٧,٣١% ، ٧٢,٣٧% بنسب للمواد السابقة على الترتيب بينما ارتفعت نسبة الإصابة في طوائف الكونتروال من ٣٦,٠٠ إلى ٤٨,٢٥ علي للنحل البالغ ومن ٢٢,٤٠ إلى ٢٨,٢٠% علي الحضنة

قام بتحكيم البحث

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