

Influence of some plant extracts on *Varroa* mite and performance of honey bee *Apis mellifera* colonies

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ABSTRACT

Nowadays the ectoparasite mite, *Varroa jacobsoni* still a serious problem affecting apiculture among Lybian beekeepers. Recently, the alternative control based on natural products extracted from medicinal and ornamental plants as control agents for the *Varroa* mite considered more save to human being and bees. plant extract of Thyme, mixture of Fenugreek & Santonica, Fenugreek alone and Santonica alone were evaluated against *Varroa* mite at the apiaries located at Sebha, Lybia during (March – April), 2012.

The data clearly show that, an increased the efficiency of any extracts used for *Varroa* control with the superiority of Thyme followed by mixture of Fenugreek & Santonica, Fenugreek alone and finally Santonica alone. This extracts caused an obvious reduction of the rate of infestation either in the sealed brood or on the adult bees, moreover increase in the number of sealed worker brood cells and, lastly, an increase in the number of combs covered from both sides with adult worker bees (colony strength) in the treated colony.

Keywords: Honey bee, *Apis mellifera*, *Varroa* mite, Thyme, Santonica, Fenugreek

INTRODUCTION

Nowadays the ectoparasite mite, *Varroa jacobsoni* (Oud) still a serious problem affecting apiculture among Egyptian beekeepers. It caused damage to individual bees that emerge from infested brood cells. At high levels of *Varroa* infestation, there is a rapid decline in the number of adult bees, severe damage to the brood and death of the colony usually occur, (Elbassiouny *et al.*, 2004). Also at high infestation level, bees have reduced their life span (Elbassiouny, 1998). The mites also feed on adults between reproductive periods in brood. Their feeding leads to the possible spread of viral pathogens (Sammataro, 1997) and bacteria (Glinski and Jarose, 1992). These various effects of feeding lead to a complex of symptoms due to a parasitic mite syndrome (Shimanuki *et al.*, 1994), which proved as a sudden loss in number of worker bees in a colony and subsequent death of the colony. The main

method of protection against varroa mite is the use of acaricides (Eischen, 1998), but the repeated treatment strategy induced resistance in *V. jacobsoni* to acaricides (Colin *et al.*, 1997; Pettis *et al.*, 1998 and Elbassiouny, 2003). Moreover, contamination hive products were occurs, which harmful for human health (Wallner, 1995).

Therefore, the present study aimed to find out alternative control strategies based on natural products extracted from medicinal and ornamental plants as control agents for the *Varroa* mite.

MATERIAL AND METHODS

The present work was conducted at the apiaries located at Sebha, Lybia during (March-April), 2012. Twenty-five colonies, headed with natural mated local *Carnica* queens (*Apis mellifera carnica*), were divided into five groups (four experimental and the last one was left untreated as control), each group consisting of five colonies nearly equal in

their strength which contain only combs covered with adult worker bees and the surplus combs were removed, therefore colonies were comprised the actually occupied number of combs to reduce the colony space.

Plant extracts from fenugreek, santonica and thyme were used for this study. One kilogram of each tested material was tested, they were heated in an equal volume of distilled water and placed overnight. An amount of 100 ml from each extract (the mixture of fenugreek and santonica was prepared by mixing equal parts of each extracts of them) were applied. Each amount (100 ml) was used by two ways: the first (50 ml), sprayed on the frames covered with bees and the hive cavity and the second (50 ml) added to the sugar syrup offered to the tested colonies. Each plant extract was applied four times at four-day intervals. All experimental colonies received sugar syrup (50%) two times weekly, immediately before the beginning of the application and every week after the application and normal beekeeping.

The colonies were examined before and after treatment to determine the effect of these treatments on:

1- *Varroa* mite infestation levels which estimated in both adult bees and sealed brood before the treatment and after each application. The infestation level of adult honey bees was estimated according to the method described by Shimanuki and Knox (2000). The infestation level of

Varroa mite in brood was estimated by opening 10 sealed worker brood cells using forceps and counting adult varroa mite.

2- Colony vigor which measured by counting the worker sealed broods at 13-day interval and number of combs covered from both sides with adult bees as colony strength.

RESULTS AND DISCUSSION

Plant extract of Thyme, mixture of Fenugreek & Santonica, Fenugreek alone and Santonica alone were examined in experimental honeybee colonies to determine the effect of these treatments on the following parameters

Worker brood infestation with *V. jacobsoni*

The rate of honeybee sealed worker brood infestation with *Varroa* mite in the experimental colonies just before treatments ranged between 10.2 - 13.1.0 %. Treating these colonies on March, 28 and every four days with different plant extract gradually decreased the rate of sealed worker brood infestation with this mite to reach the lowest infestation rates 5 weeks after treatment, Table (1). The highest reduction percentage could be applied for experimental colonies received Thyme which reached 61.7 %, followed by Fenugreek & Santonica mixture (54.2 %), Fenugreek alone (43.4 %) and the least reduction (37.4 %) was, however, obtained after using Santonica alone.

Table1: Percentages of infestation with *Varroa* mite in honeybee sealed worker brood after treating the colonies with different plant extract during (March – April), 2012.

Inspection date	Plant Extract				Control
	Fenugreek	Santonica	Fenugreek & Santonica	Thyme	
Before treat. 21/3/2012	10.4±4.3	10.2±3.2	11.2±3.6	13.1±4.8	12.1±4.4
After treat. 28/3	9.3±3.1	9.4±4.2	9.8±4.6	11.0±5.3	12.4±4.3
4/4	8.8±4.8	9.1±4.8	8.9±3.6	9.9±5.1	13.3±2.9
11/4	7.7±4.5	8.1±3.7	8.8±4.7	9.7±4.4	14.1±3.3
18/4	7.2±3.3	7.4±4.5	7.8±3.2	8.1±2.8	14.3±5.1
25/4	6.8±2.6 ^b	7.3±2.4 ^c	5.9±2.8 ^a	5.8±3.1 ^a	13.9±5.3
Reduction %	43.4 %	37.4 %	54.2 %	61.7 %	
F value	1.81*				
LSD	0.41				

In spite of there was decrease in the percentages of infestation in brood cell occurred for all treatments. The analysis of variance indicated that there was no significant difference for the percentages of infestation in brood cell among colonies treated with Thyme and mixture of Fenugreek & Santonica, but there was a significant difference between them and all other treatments especially untreated colonies.

Adult infestation with *V. Jacobsoni*

The rate of honeybee adult infestation with *Varroa* mite ranged between 14.0-16.3% just before treatments, Table (2). Five weeks after treatments, the rate of infestation with *Varroa* mite gradually decreased as the time after treatment progressed to reach the minimum infestation rate after using Thyme which recorded (6.0%), followed by the mixture of Fenugreek & Santonica (7.4%), and Fenugreek only (8.5%). The maximum (9.4%) was however, recorded after using Santonica alone.

Table 2: Percentages of honeybee adult workers infestation with *Varroa* mite after treating the colonies with different plant extract during (March – April), 2012.

Inspection date	Plant Extract				Control
	Fenugreek	Santonica	Fenugreek & Santonica	Thyme	
Before treat. 21/3/2012	14.0±4.8	14.5±3.2	16.3±4.4	15.5±2.7	15.8±3.6
After treat. 28/3	12.6±3.5	13.7±4.2	14.8±3.6	13.3±4.7	15.1±5.2
4/4	11.9±2.9	12.2±5.0	13.1±3.3	11.8±3.5	16.4±4.6
11/4	10.7±3.5	11.5±5.1	11.2±2.3	9.5±3.3	15.9±4.4
18/4	10.3±2.7	10.4±4.1	9.1±1.9	8.4±4.1	16.6±3.7
25/4	8.5±3.4 ^c	9.4±4.8 ^c	7.4±1.2 ^b	6.0±3.8 ^a	16.9±5.5 ^d
Reduction %	43.5 %	39.7 %	58.1 %	64 %	
F value	2.471*				
LSD	0.961				

The analysis of variance for the obtained data found significant decrease in the percentages of adult infestation in colonies treated with thyme (64 %) when compared with other compounds and untreated colonies, followed by mixture of Fenugreek & Santonica (58.1%). Meanwhile, no significant difference was found in colonies treated with either fenugreek (43.5 %) or santonica (39.7 %).

Sealed worker brood cells:

The increase in the number of sealed worker brood in the honeybee colony is considered as good indicator for queen vitality and viability moreover, the colony strength and health. Therefore, the mean numbers of sealed worker brood cells were obtained 13 days after treating the *Varroa* infested

colonies with different compounds, Table (3). From the obtained data, the mean number of sealed brood cells before treatments ranged between 2033 - 2276 cells/colony. After treatments, this number increased gradually in treated colonies but fluctuated in untreated colonies with 13 days interval.

After three brood cycles from treatments, the number of sealed brood cells varied according to the type of compound used for controlling *Varroa* mites. The highest number of sealed brood cells per colony was obtained after using Thyme (4579), followed by mixture of Fenugreek & Santonica (4181) and Fenugreek alone (3377). The least number (3058) was obtained after using Santonica alone. However, in the later case, the number of sealed brood

cells was still significantly higher than that of the untreated colonies, which recorded (2217) cells/colony. From the analysis of variance for the obtained data, it was noticed that there are no significant difference was found in

colonies treated with either Thyme or Fenugreek & Santonica. Otherwise, no significant difference was evident in colonies treated with Fenugreek alone and Santonica alone.

Table 3: Average numbers of sealed worker brood in honeybee colonies after treating them with different plant extract during (March – April), 2012.

Inspection date	Plant Extract				Control
	Fenugreek	Santonica	Fenugreek & Santonica	Thyme	
Before treat. 21/3/2012	2276±772	2104±871	2082±658	2188±791	2033±571
After treat. 3/4	2454±1004	2320±984	2536±1021	2787±889	1967±568
16/4	2710±1013	2633±688	3110±793	3354±993	2014±991
29/4	3377±887 ^b	3058±947 ^b	4181±916 ^a	4579±1107 ^a	2217±798 ^c
F value	2.546*				
LSD	751				

Colony strength

The number of combs covered with adult bees from both sides indicted to colony strength and therefore population density of the adult worker bees in the colony. So, data in Table (4) show that, the mean number of combs covered with adult bees in the experimental colonies

before treatment ranged between 3.6 – 4.2 combs/colony. After treatments and as the time progress towards the end of the experiments (five weeks after treatments), an obvious and gradually increase in the number of combs covered with bees was obtained.

Table 4: Average numbers of combs covered with adult bees (colony strength) in honeybee colonies after treating them with different plant extract during (March-April), 2012.

Inspection date	Plant Extract				Control
	Fenugreek	Santonica	Fenugreek & Santonica	Thyme	
Before treat. 21/3/2012	4.0±0.71	4.2±0.89	3.8±0.83	3.6±0.90	4.2±1.30
After treat. 28/3	4.0±1.0	4.2±1.3	4.0±0.71	3.8±0.83	4.0±0.71
4/4	4.2±0.89	4.4±0.89	4.2±1.30	4.0±0.71	3.8±0.83
11/4	4.2±1.3	4.4±1.34	4.2±0.89	4.4±0.90	3.8±1.09
18/4	4.6±1.14	4.6±1.14	4.8±0.84	5.0±1.22	4.±1.0
25/4	5.2±1.3 ^b	5.0±1.22 ^b	5.8±1.31 ^a	6.2±0.84 ^a	3.6±0.55 ^c
F value	2.962*				
LSD	0.473				

At this period, the number of combs covered with adult bees reach the maximum, in spit of variation between them according to the type of compound used. The maximum number of combs/colony was obtained after using Thyme (6.2 combs), followed by Fenugreek & Santonica mixture (5.8

combs), Fenugreek alone (5.2 combs) and Santonica (5.0 combs). This number was significantly higher than that of the corresponding number in untreated colonies where the mean number of combs/colony recorded 3.6 combs. The analysis of variance showed that there are significant difference was found between

Thyme or mixture of Fenugreek & Santonica in one side and Fenugreek alone or Santonica alone on the other side.

Generally, comparing the experimental colonies, which were, received different plant extract clearly show that, an increased the efficiency of any extracts used for *Varroa* control with the superiority of Thyme followed by mixture of Fenugreek & Santonica, Fenugreek alone and finally Santonica alone. This extracts caused an obvious reduction of the rate of infestation either in the sealed brood or on the adult bees, and obvious increase in the number of sealed worker brood cells and, lastly, an increase in the number of combs covered from both sides with adult worker bees (colony strength) in the treated colony. This findings coincide with those of Baxter *et al.*, 1998; Sammataro *et al.*, 1998 and El-Bassiouny, 2003

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ARABIC SUMMARY

تأثير بعض المستخلصات النباتية على حلم الفاروا وأداء طوائف نحل العسل

عبد الله عبدالقادر الزروق و عادل محمد البسيوني
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مازال حلم الفاروا من أهم مشاكل النحالة والنحالين في ليبيا. حاليا استخدام بدائل علاجية من المنتجات الطبيعية المستخلصة من النباتات الطبية والعطرية كوسيلة لمكافحة طفيل الفاروا ضرورية لآمانها على كل من النحل والانسان. لذلك تم تقييم مستخلصات الزعتر و خليط الحلبة والشيح البلدى والحلبة والشيح ضد طفيل الفاروا في منحل بسبها – ليبيا، أثناء (مارس – ابريل) 2012 حيث تم تقدير نسب اصابة النحل البالغ والحضنة بالطفيل – عدد عيون الحضنة – واعداد الاقراص المغطاه بالنحل. اظهرت النتائج فعالية جميع المستخلصات مقارنة بالنل الغير معامل مع تفوق واضح للزعتر بلية خليط الحلبة والشيح البلدى ثم الحلبة فقط وأخيرا الشيح فقط في مقاومة هذا الطفيل على كل من النحل البالغ وفي عش الحضنة مع زيادة مساحة الحضنة واعداد الاقراص الشمعية المغطاه بالنحل البالغ