J. Agric. Sci. Mansoura Univ., 28(11): 6921 - 6925, 2003

EFFICIENCY OF SOME NATURAL OILS AND CHEMICAL SUBSTANCES AGAINST THE MITE, *Varroa jacobsoni* (Oud.) INFESTING HONEYBEE IN DIFFERENT LOCALITIES IN EGYPT

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ABSTRACT

The present study was conducted at the apiary of Sakha, Agricultural Research Station, Kafr El-Sheikh and the apiary of Gimeza, Agricultural Research Station, El-Gharbia Governorate during 2003 season to evaluate the efficiency of five natural oils, i.e., clove, menthol, anise, citrus and comphor oil (1 & 2 cm^3/hive) comparing with formic acid 60% and oxalic acid (40 gm/liter) for controlling varroa mite. All tested materials reduce mite population. Formic acid, oxalic acid and clove oil were the most effective material on mites (98.40, 96.70 & 91.0% reduction) after the fourth week of treatment; respectively. Statistical analysis indicates significant differences between each of formic and oxalic acid and the five tested natural oils (1 & 2 cm^3/hive). Clove oil gave the highest reduction (91.0%, 2 cm^2/hive) of varroa mite comparing with menthol, anise, citrus and comphor (77.09, 74.80, 52.0 & 73.0% reduction) after four weeks of treatment; respectively. On the other hand, clove, menthol, anise, citrus and comphor oil with 1 cm^3/hive were less effect on varroa mite (78.40, 70.54, 70.0, 45.14 & 68.23% reduction) after the fourth week of treatment; respectively. It could be concluded that beekeepers can use clove oil (2 cm^2/hive) and each of formic acid 60% and oxalic acid (40 gm/liter) safety during winter and summer season; respectively for controlling varroa mite.

INTRODUCTION

Varroa jacobsoni (Oud.) is an ectoparasitic mite of the eastern honeybee (*Apis cerana*) in Asia was transferred to the European honeybee (*Apis mellifera*) (Mobus & Connor, 1988 and Anderson & Trueman, 2000). There are some substances which could be used as an acceptable alternative to Apistan (Fluovolinate), i.e. Menthol, Formic and Oxalic acid, extracts of medicinal plants and oils (Eyrich & Ritter, 1986; Kraus *et al.*, 1994, Imdrof *et al.*, 1996; Floris *et al.*, 1998 and Daniels *et al.*, 1999). On the other hand, some investigators started to breed honeybee resistant to Varroa mites (Woyke, 1989).

The present work aimed to evaluate the effectiveness of five natural oils; clove, menthole, anise, citrus and comphor oil comparing with formic and oxalic acid against varroa mite in two locations in Egypt.

MATERIALS AND METHODS

The experiments were conducted at the apiary of Sakha, Agricultural Research Station, Kafr El-Sheikh and the apiary of Giemeza, Agricultural Research Station, El-Gharbia, Egypt in February and March, 2003. The colonies of honeybee of this experiments were of F_1-Caraniolan hybrid headed by young sister queens, similar in strength; honey, brood and bees and heavily infested by the varroa mite, thirty five colonies (5 combs each) were divided into seven groups (treatments), each of five colonies (replicates) with 2 cm^3 of each natural oil per hive. Another twenty five colonies were divided into five groups (treatments), each of five colonies (replicates) with 1 cm^3/hive five extra colonies were used as a cheek (without treatments).

Treatment:

Each of the following treatments were applied on weekly basis for one month from 10/2/2003 to 10/3/2003.

1. **Natural oils**: One and two milliliters of each oil were applied on a cotton wool and placed on the bottom of the hive. The used oils were clove, menthol, anise, citrus and comphor oil.
2. **Formic acid (60%)**: Ten milliliters were sprayed on a thick sheet of pepper (20 x 20 cm) and placed on the top of the combs (at a rate of 2 ml/comb).
3. **Oxalic acid (40 g/lit.)**: Two ml were sprayed on both sides of each combs using an automizer.
4. **Check colonies:** Hives used as control without any treatment.

Evaluate the efficiency of the different treatments:

In order to evaluate mite infestation, 100 adult workers were collected as a sample from each hive before and after treatments and the occurring mites on different parts of body were counted. Treatment efficacy was expressed as percentage reduction on varroa infestation among adult bees according to Henderson and Tilton (1955). Data were statistically analyzed and the least significant differences (L.S.D.) were calculated between treatments.

RESULTS AND DISCUSSION

Results in Table (1) indicate that all tested materials reduced mite population. The highest parasite mortality 98.40% , was observed with formic acid 60% application followed by that of oxalic acid (96.70%, 40 gm/liter) and then clove oil (91.00%, 2 cm/hive) while (the remaining natural oils, i.e. menthol, anise, comphor and citrus oil were 77.09, 74.80, 73.00 and 52.00% reduction (2 cm^3/hive) after four weeks of application, respectively. Statistical analysis indicates significant differences between each of formic and oxalic acid and the five tested natural oils (1 & 2 cm^3/hive). Clove, menthol, anise, citrus and comphor oil with 1 cm^3/hive were less effect on varroa mite (78.40, 70.54, 70.0, 45.14 & 68.23% reduction)

than with 2 cm^3/hive (91.0, 77.09, 74.80, 52.0 & 73.0% reduction) after the fourth week of treatment; respectively. However, clove oil gave the highest reduction (91.00%) on varroa mite with 2 cm^3/hive comparing with the other tested oils after four weeks of application. Also, results showed slightly reeducation percentage of varroa mite with clove, mentol, anise, citrus and comphor oil (46.42, 29.87, 22.85, 10.20 & 22.85% (2 cm/hive) comparing with formic and oxalic acid (65.70 & 76.60%) after the first week of treatment. A good reduction percentage of *V. jacobsoni* was detected with clove oil (80%, 2 cm^2/hive) and each of formic and oxalic acid (88.0 & 83.63%) after the second week of treatment, respectively. On the other hand, results exhibited a high reduction percentage of varroa mite from the third week of treatment with clove oil (88.15%, 2 cm^3/hive) and each of formic and oxalic acid (95.20 & 96.69%), respectively. A moderate reduction percentage was recorded with mentol, anise, citrus and comphor oil (65.55, 64.47, 41.22 & 57.36%, 2 cm^3/hive) after the third week of treatment, respectively. The present results agree with the findings of Steen-J-Van-der (1994) who used successfully three different mixtures containing thymal, eucalyptus, menthol and or comphor which gave 74 to 92% of varroa mortality. At the same trend, Kraus *et al.* (1994) indicated that clove and cinnamon oil proved to be a clear attractant effect on varroa mite. Also, our results supported by Floris *et al.* (1998) who obtained the best result (82% $\pm$ 16.9 percentage varroa mortality) by using the spray treatment of oxalic acid in water (30 gm/liter) during winter. Shawer *et al.* (1993) referred to formic and oxalic acid as efficiency chemical for controlling *V. jacobsoni* mite in the brood and no direct or side adverse effect on honeybee worker, drone or brood. Similar results were also obtained by Daniels *et al.* (1999) and Calderone (2000) who reported that formic acid vapours have been shown to an acceptable alternative and or as consistent as Apistain (Fluvalinate) in the control of *V. jacobsoni.*

Table (1):Reduction percentages (% R) of *V. jacobsoni* after each week of treatment of the tested materials on honeybee adults.

Tested materials		Infestation percentage before treatment	% R after 4 weeks							
			1st week		2nd week		3rd week		4th weeks	
			% Infestation	% reduction	% Infest.	% red.	% Infest.	% red.	% Infest.	% red.
Clove oil	1 cm	20.10	16.43	22.85	11.10	49.50	8.10	64.47	5.30	78.40
	2 cm	24.00	12.86	46.42	4.80	80.00	2.84	88.15	2.16	91.00
Menthol oil	1 cm	22.02	18.86	14.28	12.00	45.45	9.48	56.93	6.48	70.54
	2 cm	22.00	15.25	29.87	10.80	50.90	7.58	65.55	5.04	77.09
Anise oil	1 cm	18.10	15.25	14.28	10.25	43.33	8.10	55.26	5.40	70.00
	2 cm	20.00	15.25	22.85	10.20	49.00	7.10	64.47	5.04	74.80
Citrus oil	1 cm	21.10	19.14	9.29	15.07	28.57	13.72	34.96	11.75	45.14
	2 cm	21.10	18.95	10.20	13.26	37.14	12.40	41.22	10.13	52.00
Comphor oil	1 cm	17.00	16.86	0.84	12.00	29.41	8.53	49.84	5.38	68.23
	2 cm	20.00	15.43	22.85	10.80	46.00	8.53	57.36	5.40	73.00
Formic oil	1	20.02	6.86	65.70	2.36	88.00	0.96	95.20	0.32	98.40
Oxalic acid 40 gm/liter		22.00	5.15	76.60	3.60	83.63	0.73	96.69	0.72	96.70

It could be concluded that, bee keepers can use safety clove oil (2 cm^3/hive) and each of formic acid 60% and oxalic acid (40 gm/liter) during winter and summer season, respectively for controlling varroa mite.

REFERENCES

Anderson, D. and J.W.H. Trueman (2000). *Varroa jacobsoni* (Acari: Varroidae) is more than one species. Experimental and Applied Acarology., 24: 165-189.

Calderone, N.W. (2000). Effective fall treatment of *Varroa jacobsoni* (Acari: Varroidae) with a new formulation of formic acid in colonies of *Apis mellifera* (Hymenoptera: Apidae) in the northeastern United States. Journal of Ecoomic Entomology, 93(4): 1065-1075.

Daniels, R.S.; A.R. Hamid; R. El-Rogres and K. Mackenzie (1999). Membrane-barrier delivery of formic acid, a chemical used to mite control on honeybees (*Apis mellifera*). Journal of Apicultural Research, 38(1-2): 63-69.

Eyrich, U. and W. Ritter (1986). The distribution and damage of bee mites (Varroa and Tropilaelaps) in China in Africanized Honeybees and bee mites. pp. 417-419. Chichester, UK; Ellis Horwood (C.F. Fathy & Fouly, 1995).

Floris, I.; A. Satta; F.Mutinelli and L. Prandin (1998). Efficacy of winter applications of oxalic acid agaistn *Varroa jacobsoni* Oudemans in beehives in Mediterranean area (Sardinia, Italy). Redia., 81: 143-150.

Henderson, C.F. and F.W. Tilton (1995). Tests with acaricides against the brown wheat mite. J. Econ. Ent., 48: 157-161.

Imdrof, A.; J.D. Charriere; C. Maquelin; V Kd. Chenmann and B. Bochofen (1996). Alternative varroa control. American Bee Journal., 136(3): 189-193.

Kraus, B.; N. Koeniger and S. Fuchs (1994). Screening of substances for their effect on *Varroa jacobsoi*: Attractiveness, repillenty and masking effects of ethereal oils. Journal of Apicultural Research, 33 1: 34-43.

Mobus, B. and L. Connor (1988). The varroa handbook, biology and control. Northern Bee Books; Hebden bridge, UK; 52 pp.

Shawer, M.B.; H.A. Boraei; R. El-Sufty and H.M. Mansour (1993). Effectiveness of substances used for the control of varroatosis in Egypt. J. Agric. Res. Tanta Univ., 19(4): 815-821.

Steen-J-Van-Der (1994). The effect of a mixture of etheric oils on *Varroa jacobsoni* infesting honeybee colonies. Apidologie, 23 (4): 383-385.

Woyke, J. (1989). Breeding of honeybees resistant to *Varroa jacobsoni*. Am. Bee J., 129(1): 21-24.

J. Agric. Sci. Mansoura Univ., 28(11), November, 2003

تقييم بعض الزيوت الطبيعية والمواد الكيميائية في مكافحة طفيل الفاروا على نحل العسل

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أجريت هذه الدراسة بمنحل محطة البحوث الزراعية بسخا ــ كفرالشيخ ومنحل محطة البحوث الزراعية بالجميزة ــ الغربية خلال موسم ٢٠٠٣ وذلك لتقييم تأثير معاملة طوائف نحل العسل بخمسة زيوت طبيعية وهى زيت القرنفل ــ النعناع ــ الينسون ــ البرتقال ــ الكافور واثنين من المركبات الكيماوية وهى حمض الفورميك ٦٠% والاكسالك بمعدل ٤٠ جم/لتر ماء أما الزيوت الطبيعية فقد استخدمت بمعدل ١ سم^3 ، ٢ سم^3 توضع على قطعة قطن على قاع الخلية اسفل اقراص الحضنة.

أوضحت النتائج المتحصل عليها ان حامض الفورميك ٦٠% وحامض الاكسالك (٤٠ جم/لتر ماء) وزيت القرنفل بمعدل ٢ سم^3/خلية كانت اكثر المركبات تأثيرا على طفيل الفاروا حيث خفض التعداد بنسبة ٩٨,٤٠ ، ٩٦,٧٠ ، ٩١% على الترتيب وذلك بعد الاسبوع الرابع من المعاملة وكذلك اوضح التحليل الاحصائى وجود فروق معنوية بين كل من حامض الفورميك والاكسالك والزيوت الطبيعية الخمسة المستخدمة سواء عند المعاملة بمعدل ١ سم^3 أو ٢ سم^3 من كل زيت للخلية الواحدة. كذلك أعطى زيت القرنفل اعلى خفض فى تعداد الطفيل (٩١% بمعدل ٢ سم^3/خلية) مقارنة بالزيوت الطبيعية الاخرى وهى النعناع والينسون والبرتقال والكافور حيث خفض تعداد الطفيل بسنة ٧٧,٩ ، ٧٤,٨٠ ، ٥٢ ، ٧٣% على الترتيب وذلك بعد اربعة اسابيع من المعاملة. بينت النتائج ايضا ان استخدام الزيوت الطبيعية بمعدل ١ سم^3 لكل خلية كانت اقل تاثيرا على طفيل الفاروا حيث خفضت التعداد بنسبة ٧٨,٤٠ ، ٧٠,٥٤ ، ٧٠ ، ٤٥,١٤ ، ٦٨,٢٣% لكل من زيت القرنفل ــ النعناع ــ الينسون ــ البرتقال ــ الكافور على الترتيب بعد اربعة اسابيع من المعاملة. يتضح من الدراسة أنه يمكن للنحالين استخدام زيت القرنفل بمعدل ٢ سم^3 للخلية ، وكذلك استخدام حامض الفورميك ٦٠% وحامض الاكسالك (٤٠ جم/لتر ماء) حيث كان اكثر امانا على النحل وذلك خلال موسمى الشتاء والصيف على الترتيب لمكافحة طفيل الفاروا.