

EVALUATION OF SOME CHEMICAL MATERIALS FOR CONTROLLING OF VARROA MITE, *Varroa jacobsoni* Oud. ON HONEYBEE

Serag El-Dien, F. Sh. and M.M. Metwally

Plant Protection Research Institute, Sakha Agricultural Research Center

ABSTRACT

The present investigation was achieved at the apiary of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during 2008 season to evaluate the efficiency of five materials, i.e., formic acid 60%, salcelate methyl 60%, Bayvarol strips, malathion powder 1% and Apitol for controlling varroa mite. All tested materials reduce mite population. Malathion powder 1% and formic acid 60% were the most effective material on varroa mite (93.75 & 89.57% reduction) on each of workers and drones after the fourth week of treatment during the first period from 1/2/2008 to 28/2/2008, respectively. Also, during the second period from 1/9/2008 until 28/9/2008, malathion powder 1% gave the highest reduction (93.15 & 94.00%) of varroa mite on each of workers and drones after the fourth week of treatment, respectively. On the other hand, the remaining materials, i.e., formic acid 60%, Apitol (2 gm), salcelate methyl 60% (2 cm³/colony) and Bayvarol strips gave a high reduction (88.19, 86.67, 84.08 & 82.0%) of varroa mite on workers after the four weeks of application during the first period, respectively. Also, during the second period formic acid 60%, salcelate methyl 60% (2 cm³/colony, Apitol (2 gm) and Bayvarol strips exhibited a high reduction (88.13, 88.11, 84.21 & 82.86%) of varroa mite on workers after the fourth week of application, respectively. At the same trend, formic acid 60%, salcelate methyl 60% (2 cm³/colony), Apitol (2 gm) and Bayvarol strips gave a high reduction (91.67, 91.11, 86.67 & 84.11%) of varroa mite on drones after four weeks of treatment during the second period, respectively. It could be concluded that bee keepers can use formic acid 60%, and salcelate methyl 60% (2 cm³/colony) safety during the above two tested periods for controlling varroa mite.

INTRODUCTION

Varroa disease causes a serious problem to *Apis mellifera* L. in many countries, it feeds on haemolymph of broods, drones and workers, causing severe damage to colonies, decreased brood and emerging bees (De Jong *et al.*, 1982) and (Keoniger *et al.*, 1981). It was detected in Egypt for the first time in 1983 (Wienands, 1988) and since then, it spread all over the country in areas where bees are kept, and caused great losses in many apiaries during this period.

Many chemical compounds have been developed and tested in recent years against varroa mites, as well known, none is 100% effective but a few give a partially satisfactory (Giordani and Leporati, 1989). The efficiency of these chemical compounds have been studied by several authors, among them Santas, 1983 and 1986; Luganskii *et al.*, 1987; Abd El-Fattah *et al.*, 1991; Marchetti *et al.*, 1984; Chahin, 1997; Okada and Nakane, 1998; Daniels *et al.*, 1999; Calderone, 2000; Poklukar, 2001; Mansour, 2003; Serag El-Dien and Eissa, 2003 and Abou El-Enain *et al.*, 2007.

The present investigation was conducted to evaluate the effectiveness of five chemical materials; formic acid, salcelate methyl, Bayfarol, malathion powder Apitol against varroa mite in Egypt.

MATERIALS AND METHODS

The present investigation was conducted at the apiary of Sakha, Agricultural Research Station, Kafr El-Sheikh during February and September, 2008. The colonies of honeybee of this study were of F₁-caraniolan hybrid headed by young sister queens, similar in strength, honey, brood and bees and heavily infested by the varroa mite, twenty five colonies (5 combs each) were divided into five groups (treatments), each of five colonies (replicates).

Treatments:

Each of the following treatments were applied on weekly for two months, the first from 1/2/2008 to 28/2/2008, the second from 1/9/2008 until 28/9/2008.

1. 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).
2. Salcelate methyl (60%): Two milliliters were applied on a cotton wool and place down the bottom of the hive.
3. Bayvarol strips: Two strips (3.6 mg of flumethrin) hanged in the mid of brood combs to four weeks.
4. Malathion powder (1%): Malathion 1% was mixed with taic powder in ratio one part malathion to five part powder taic. Each colony was dusted by 3.5 gm of the mixture in between the top of the combs.
5. Apitol (2-(2.4-dimethyl phenylamino)-3 methyl-4 thiazaline hydrochloride, Ciba Geigy). Two gm of Apitol mixed with 100 gm sugar and dissolved in ½ liter of water, then used in the feeding per fifty colony.
6. Control colonies: Five colonies used as control without any treatment.

Evaluate the efficiency of the different treatments:

In order to evaluate mite infestation, 100 adult each of workers and drones 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 Abbot (1925).

RESULTS AND DISCUSSION

As shown in Table (1) all tested materials reduced mite population. The highest varroa mortality 89.57% was observed with malathion powder 1% application on honeybee adults of workers followed by formic acid 60% (88.19%), Apitol (2 gm), (86.67%) salcelate methyl 60% (2 cm³/colony) (84.08%), and then Bayvarol strips (82.00%) after four weeks of application from 1/2/2008 to 28/2/2008, respectively. On the other hand, formic acid 60% gave the highest mortality 93.75% followed by salcelate methyl (2

cm³/colony) (90.0%), malathion powder 1% (90.0%), Apitol (2 gm) (88.37%) and Bayvarol strips (85.58%) on drones after four weeks of application, respectively. Generally, results indicated slightly reduction of varroa mite with all tested materials, malathion powder 1%, Bayvarol strips, Apitol (2 gm), formic acid 60% and salcelate methyl (2 cm²/colony) being 36.96, 20.72, 16.67, 16.30 and 14.43% on workers after the first week of treatment, respectively. Also, results showed slightly reduction percentage of varroa mite with malathion powder 1%, formic acid 60%, salcelate methyl 60% (2 cm³/colony), Bayvarol strips and epitol (2 gm) (44.81, 18.75, 17.58, 16.22 & 11.60%) on drones after the first week of treatment, respectively. A moderate reduction percentage of *V. jacobsoni* was detected with malathion powder 1%, Apitol (2 gm), Bayvarol strips, formic acid 60% and salcelate methyl 60% (2 cm³/colony) (69.48, 60.42, 57.66, 53.58 & 44.28%) on workers after the second week of treatment, respectively. As well as results exhibited a moderate reduction percentage of varroa mite on drones after the second week of treatment with malathion 1%, Apitol (2 gm), Bayvarol strips, formic acid 60% and salcelate methyl 60% (2 cm³/colony) (73.83, 62.83, 62.61, 57.50 & 45.05%), respectively.

The same trend was obtained during the second period from 1/9/2008 until 28/9/2008 (Table 2) where the highest varroa mortality 93.15% was detected with malathion powder 1% application followed by formic acid 60% (88.13%), salcelate methyl 60% (2 cm³/colony) (88.11%), Apitol (2 gm) (84.21%) and Bayvarol strips (82.86%) on workers after four weeks of application from 1/9/2008 until 28/9/2008, respectively. Similarity, malathion powder 1% application gave the highest varroa mortality 94.0% followed by formic acid 60% (91.67%), salcelate methyl 60% (2 cm³/colony) 91.11%, Apitol (2 gm) (86.67%) and Bayvarol strips (84.11%) on drones after four weeks of application, respectively. All tested materials gave slightly reduction percentage of varroa mite with malathion powder 1%, formic acid 60%, Apitol (2 gm), Bayvarol strips, and salcelate ethyl 60% (2 cm³/colony) being 36.49, 29.14, 28.42, 26.80 and 24.0% on workers after the first week of treatment, respectively. Again, all the previous tested materials exhibited a weak reduction percentage of varroa mite with malathion powder 1%, Bayvarol strips, Apitol (2 gm), formic acid 60%, sacelate methyl 60% (cm³/colony) (51.17, 46.32, 34.31, 30.94 & 25%) on drones after the first week of treatment, respectively. On the other hand, a moderate reduction percentage of *Varroa jacobsoni* was observed with malathion powder 1%, formic acid 60%, Apitol (2 gm), byvarol strips and salcelate methyl 60% (2 cm³/colony) being 65, 75, 58.87, 57.37, 54.29 and 50.27% on workers after the second week of treatment, respectively. Also, after the second week of treatment results showed a moderate reduction percentage of varroa mite with malathion powder 1% (75.0%), Bayvarol strips (68.42%), formic acid 60% (65.56%), Apitol (2 gm) (63.08%) and salcelate methyl 60% (2 cm²/colony) (50.0%) on drones, respectively. From the third week of treatment results indicated a high reduction percentage of varroa mite with malathion powder 1% and formic acid 60% being 84.43 and 88.88% on workers and drones, respectively.

Also, reduction percentage of varroa mite with the remaining materials as salcelate methyl (60 (2 cm³/colony-, Apitol (2 gm) and Bayvarol strips were (77.84 & 83.22%), (71.58 & 79.49%) and (71.09 & 78.65%) on workers and drones after the third week of treatment, respectively. The present results supported by Moosbeckhoger and Derakhshifa (1986) and Shower *et al.* (1993) referred to formic acid and lactic acid as efficiency chemical for controlling *V. jacobsoni* mite in the brood. They found that formic and lactic acid have 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 and vapours have been shown to an acceptable alternative and or as consistent as Apistain (Fluvalinate) in the control of *V. jacobsoni*. At the same trend, Abou El-Enain *et al.* (2007) who indicated that colonies treated with formic acid 60% were higher in the amount of broad rearing, stored pollen and honey than in untreated ones. On the other hand, Eissa *et al.* (2006) found that salcelate methyl 60% (2 cm³ /colony) was the highest varroa mortality (94.12 & 93.50%) after the four week of treatment during 2004 and 2005 seasons at El-Gharbia and Kafr El-Sheikh region, respectively. Mansour (2003) indicated that mitac 20% (acaricide) was the most effective compound on varroa mite; *V. jacobsoni* after a period of 8 days from treatment followed by malathion powder 1%, formic acid 60% while oxalic acid 0.4% had the least effect.

Acknowledgment

The authors grateful Professor Dr. Gamal A. El-Mezayyen, Head of Research, Plant Protection Research Institute, Sakha Agricultural Research Station, Agric. Res. Center for his valuable guidance and reviewing the manuscript.

REFERENCES

- Abbot, W.S. (1925). A method of computing the effectiveness of an insecticide. J. Econ. Ent. 18(2): 265-267.
- Abd El-Fattah, M.A.; M.E. Nour and A.A.M. El-Shemy (1991). Efficacy of some chemical compounds to control varroa mite (*Varroa jacobsoni*) in honeybee colonies in Egypt. J. Appl. Sci., 6(120): 139-152.
- Abou El-Enain, H.T.; A.A. Gomaa and Amany, S.M. Abou Lila (2007). Productivity increase of honeybee colonies treated with formic acid oxalic acids for controlling varroa mite. J. Agric. Mansoura Univ., 32(2): 1451-1459.
- 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 north-eastern United States. Journal of Economic Entomology, 93(4): 1065-1075.
- Chahin, M.E.Z.M. (1997). Current concepts concerning, haemocytes of honeybees and their feature according to varroa parasitism. M.Sc Thesis, Fac. Agric. Cairo Univ. pp. 108.

- Danieles, R.S.; A.R. Hamid; R. El-Rogres and Wk. Mackenzie (1999). Membrane-barrier delivery of formic acid, a chemical used to mite control on honeybees (*Aphis mellifera*). Journal of Apicultural Research, 38 (1-2): 63-69.
- De Jong, D.; R.A. Mors and G.C. Eickwort (1982). Mite pests of honeybees. Annu. Rev. Entomol., 27: 229-252.
- Eissa, A.A.; F.Sh. Serag El-Dien and H.T. Abou El-Enain (2006). Efficiency of some commercial detergents and chemical substances on varroa mite, *Varroa jacobsoni* Oud. Infesting honeybee in different locations in Egypt. First International Environmental Forum. 1-3 April 2006, Tanta, Egypt.
- Giordani, G. and M. Leporati (1989). Field trails against *Varroa jacobsoni* with Apitol in "present status of varroaosis in Europe and Progress in the Varroa mite control" Edited by Cavalloro, R. Proc. of A meeting of the EC Exerts' Group/Udine, Italy, 28 to 30 Nov., 1988 pp. 267.
- Keoniger, N.; G. Koeniger and N.H. Wijacyagunasekara (1981). Observations on the adaptation of *Varroa jacobsoni* to its natural host *Apis cerana* in Sri Lanka. Beobachtungen Uber die Anpassung von *Varroa jacobsoni* an Ihren Natuerlichen wirt *Apis cerana* in Sri Lanka. Apidologie, 12(1): 37-40.
- Luganskii, S.N.; E.T. Popov and R.T. Klocko (1987). Effectiveness of lactic acid against *Varroa jacobsoni* infestations of honeybee. Veterinarnoi, Moscow, USSR, No. 9: 41-44 (C.F. Apic. Abst., 39(4): 1295/88.
- Mansour, H.M. (2003). Efficiency of some chemical compounds against the mite *Varroa jacobsoni* on honeybee. J. Agric. Sci. Mansoura Univ., 28(9): 7067-7072.
- Marchetti, S.; R. Barbattini and M.D. Agaro (1984). Preliminary trials on the use of some plant species for the control of *Varroa jacobsoni*. Milan, Italy, Studio Edizioni. p. 56-67 (C.F. Apic. Abst., 36(3): 652-85.
- Moosbeckhofer, R. and I. Derakhshifar (1986). Comparison of the effectiveness of perizin, Folbex-VA and formic acid treatments for controlling *V. jacobsoni* in honeybee nuclei. Apidologie, 17(4): 376-379.
- Okada, N. and T. Nakane (1998). Oxalic acid fumigation a new control measure against the varroa mite. (C.F. Apic. Abst., 39(1): 247/88).
- Poklukar, J. (2001). The number of varroa mite fall estimated in spring in relation to the consecutive economically important trials of bees. Proc. 37th Int. Apic. Congr., 28 Oct.-1 Nov. 2001, Durban, South Africa.
- Santas, L.A. (1983). Varroa disease in Greece and its control with malathion in *V. jacobsoni* and effective honeybees present status and needs. Proceeding of the meeting of the E.C. Experts Group, Wageningen, 7-9 February, pp. 184-187.
- Santas, L.A. (1986). Present status of the control of varroa disease in Greece proceedings of Meeting of the EC experts group/Bad Hamburg. 15-17 October pp. 187-189.

- Serag El-Dien, F.S.H. and A.A. Eissa (2003). Efficiency of some natural oils and chemical substances against the mite, *Varroa jacobsoni* (Oud.) infesting honeybee in different localities in Egypt. J. Agric. Sci. Mansoura Univ., 28(11): 6921-6925.
- Shawer, M.B.; H.A. Boraie; R. El-Sufty and H.M. Mansour (1993). Effectiveness of substances used for the control of varroaosis in Egypt. J. Agric. Res. Tanta Univ., 19(4): 815-821.
- Wienands, A. (1988). The varroa mite has spread over most of the world. Amer. Bee, J. 128(5): 358-359.

تقييم بعض المواد الكيميائية لمكافحة طفيل الفاروا على نحل العسل
فريد شوقي سراج الدين و ممدوح محمد متولى
معهد بحوث وقاية النباتات - محطة البحوث الزراعية بسخا - مركز البحوث الزراعية

أجرى هذا البحث بمنحل محطة البحوث الزراعية بسخا - كفر الشيخ - مركز البحوث الزراعية خلال موسم 2008م وذلك لتقييم تأثير معاملة طوائف نحل العسل بخمسة مواد كيميائية وهى حمض الفورميك 60% وسلسيلات الميثايل 60% بمعدل 2سم³ توضع على قطعة قطن على قاع الخلية أسفل أقراص الحضنة وشرائط البايفيرول بمعدل 2 شريط تعلق وسط أقراص الحضنة فى الخلية والملاثيون بودر 1% ثم الإيبتول بمعدل 2جم يضاف مع محلول التغذية.

أوضحت النتائج المتحصل عليها أن الملاثيون 1% وحمض الفورميك 60% كانت أكثر المركبات تأثيرا على طفيل الفاروا بنسبة 89.57% ، 93.75% على كل من الأفراد الكاملة للشغالات والذكور على الترتيب بعد الأسبوع الرابع من المعاملة وذلك خلال الفترة الأولى من 2008/2/1م إلى 2008/2/28م أما خلال الفترة الثانية من 2008/9/1م إلى 2008/9/28م أوضحت النتائج أن الملاثيون 1% أعطى معدل خفض فى تعداد الطفيل بنسبة 93.15% ، 94.00% على كل من الشغالات والذكور بعد الأسبوع الرابع من المعاملة على الترتيب ومن ناحية أخرى فإن باقى المواد مثل حمض الفورميك 60% والإيبتول بمعدل 2جم وسلسيلات الميثايل 60% وشرائط البايفيرول أعطت معدل خفض فى تعداد الطفيل بنسبة 88.19% ، 86.67% ، 84.08% ، 82.00% على الشغالات على الترتيب بعد الأسبوع الرابع من المعاملة خلال الفترة الأولى أما خلال الفترة الثانية فإن حامض الفورميك 60% وسلسيلات الميثايل 60% بمعدل 2سم³/خلية والإيبتول بمعدل 2جم وشرائط البايفيرول أعطت معدل خفض فى تعداد الطفيل بنسبة 88.13% ، 88.11% ، 84.21% ، 82.86% على الشغالات على الترتيب بعد الأسبوع الرابع من المعاملة وفى نفس الاتجاه أيضا فإن حامض الفورميك 60% وسلسيلات الميثايل 60% والأيتنول وشرائط البايفيرول أعطت انخفاض عالى فى تعداد الطفيل بنسبة 91.67% ، 91.11% ، 86.67% ، 84.11% على الترتيب وذلك على الذكور بعد الأسبوع الرابع من المعاملة خلال الفترة الثانية. يتضح من الدراسة أنه يمكن للنحالين استخدام حامض الفورميك 60% وسلسيلات الميثايل 60% بمعدل 2سم³ لكل خلية حيث كانت أكثر أمانا على النحل وذلك خلال فترتى الدراسة لمكافحة طفيل الفاروا.

Table (1): Reduction percentage (%R) of *V. jacobsoni* after each week of treatment of the tested materials on honeybee adults each of workers and drones during the first period from 1/2/2008 to 28/2/2008.

Tested materials	Infestation percentage before treatment		% R after 4 weeks							
			1 st week		2 nd week		3 rd week		4 th week	
			% infestation	% reduction	% infestation	% reduction	% infestation	% reduction	% infestation	% reduction
Formic acid 60%	Workers	22.02	18.43	16.30	10.20	53.68	6.10	72.30	2.60	88.19
	Drones	24.00	19.50	18.75	10.20	57.50	5.00	79.16	1.50	93.75
Salcelate methyl 60% 2 cm	Workers	20.10	17.20	14.43	11.20	44.28	5.20	74.13	3.20	84.08
	Drones	20.02	16.50	17.58	11.00	45.05	4.02	79.92	2.00	90.00
Bayvarol strips	Workers	22.2	17.60	20.72	9.40	57.66	6.20	72.02	4.00	82.00
	Drones	22.2	18.60	16.22	8.30	62.61	5.70	74.32	3.20	85.58
Malathion powder 1%	Workers	23.00	14.50	36.96	7.02	69.48	4.40	80.87	2.40	89.57
	Drones	21.02	11.60	44.81	5.50	73.83	3.50	83.35	2.10	90.00
Apitol 2 gm	Workers	24.00	20.0	16.67	9.50	60.42	5.00	79.17	3.20	86.67
	Drones	22.06	19.50	11.60	8.20	62.83	5.00	77.33	2.60	88.37

Table (2): Reduction percentage (%R) of *V. jacobsoni* after each week of treatment of the tested materials on honeybee adults each of workers and drones during the second period from 1/9/2008 to 28/9/2008.

Tested materials	Infestation percentage before treatment		% R after 4 weeks							
			1 st week		2 nd week		3 rd week		4 th week	
			% infestation	% reduction	% infestation	% reduction	% infestation	% reduction	% infestation	% reduction
Formic acid 60%	Workers	17.02	12.06	29.14	7.00	58.87	3.10	81.79	2.02	88.13
	Drones	18.00	12.43	30.94	6.20	65.56	2.00	88.88	1.50	91.67
Salcelate methyl 60% 2 cm	Workers	18.50	14.06	24.00	9.20	50.27	4.10	77.84	2.20	88.11
	Drones	18.00	13.50	25.00	9.00	50.00	3.02	83.22	1.60	91.11
Bayvarol strips	Workers	17.50	12.81	26.80	8.00	54.29	5.06	71.09	3.00	82.86
	Drones	19.00	10.20	46.32	6.00	68.42	4.06	78.65	3.02	84.11
Malathion powder 1%	Workers	16.06	10.20	36.49	5.50	65.75	2.50	84.43	1.10	93.15
	Drones	20.00	9.67	51.17	5.00	75.00	2.60	87.00	1.20	94.00
Apitol 2 gm	Workers	19.00	13.60	28.42	8.10	57.37	5.40	71.58	3.00	84.21
	Drones	19.50	12.81	34.31	7.20	63.08	4.00	79.49	2.60	86.67