Zagazig J. Agric. Res., Vol. 46 No. (2) 2019 367-375

Plant Protection and Pathology Research

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

EFFICIENCY OF SOME BOTANICALS AGAINST *Varroa destructor* INFESTING HONEYBEE COLONIES AND THEIR IMPACT ON BROOD REARING ACTIVITY AND CLOVER HONEY YIELD

Amany E. El-Nagar*, S.I. Yousif-Khalil, S.M.A. El-Shakaa and Walaa M. Helaly

Plant Prot. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 04/02/2019 ; Accepted: 25/02/2019

ABSTRACT: This work is a study to evaluate the effect of some botanicals-based food mixtures added to sucrose syrup and offered to honeybee colonies on the development of *Varroa* infestation, brood rearing activity and clover honey yield during 2016/2017. The experiments were performed in the apiary of Faculty of Agriculture, Zagazig University. Summarized results are as follow: The rate of *Varroa* infestation increased gradually during summer season until recording the highest value in November. The food mixture composed of lemon juice + garlic extract reduced significantly the rate of *Varroa* infestation as compared to the control in all seasons of the year by 37.02-55.40%. The mixtures composed of parnove extract + orange juice and thyme extract + orange juice reduced significantly the rate of *Varroa* infestation during the period extended from February to August, recording the range of 35.82 – 45.47 and 34.78-48.13% reduction, respectively. The highest brood area (inch^2) was recorded during summer season followed closely by that of spring season, whereas the least activity was noticed in autumn season. The food mixture composed of lemon juice + garlic extract induced the highest brood rearing activity in all seasons of the year. The mixture of parnove extract + orange juice came in the second class. On the other hand, the mixture composed of thyme extract + orange juice showed the least brood rearing activity, being lower than the control. The mean clover honey yield recorded 5.00, 1.70, 6.50 and 4.00 kg/colony in 2016; 3.90, 2.00, 5.60 and 1.50 kg/colony in 2017 which offered the additive mixtures of parnove extract + orange juice, thyme extract + orange juice, lemon juice + garlic extract and sucrose syrup (control), respectively. The respective two years mean clover honey yield recorded 4.45, 1.85, 6.05 and 2.75 kg/colony.

Key words: Botanicals, *Varroa destructor*, brood, honey yield, honey bee.

INTRODUCTION

Honeybees are known to be the most economic insect for their important role in pollination of field and horticultural crops, increasing crops productivity **(Mc Gregor, 1976; Yousif-Khalil and Shalaby, 1992)**. In addition, honeybee products have nutritional and medicinal importance. The apiary as a project nowaday is considered a source of moderate and huge individual to national income **(Hassan, 1997)**. Therefore, the application of modern apicultural techniques become necessary or even obligatory to increase the productivity. However, the apiary usually faces some dificulties and complecations such as the shortage of food sources (**Darhoos, 1990; Abdel-Rahman and Rateb, 2007)**. Invasion of natural enemies and the infection of honeybee pathogens diseases **(Medina-Flores *et al*., 2011; Sakla, 2016**) and climatic variables **(Devi *et al*., 2011; Gebremedin *et al*., 2014)**. The highest brood development recorded in garlic oil added to sugar syrup followed by turmeric oil after 3 weeks exposure of the treatments **(Goswami *et al*., 2014)**. Using clove oil + tobacco extract in controlling *Varroa* mites in field experiment showed the maximum honey production **(Rashid *et al*., 2014)**. From this standpoint, this work was designed to enrich bee colonies with some additives to fortify the

* **Corresponding author: Tel. :** +201019848691
E-mail address: amanyelsayed05@gmail.com

colonies nutrionally, prophyliactically and behaviourlly.

MATERIALS AND METHODS

The present investigations were carried out to study the effect of some botanical-based feed additives added to sucrose syrup offered to honeybee colonies on the progress of *Varroa* mite infestation, brood rearing activity and clover honey production of the test colonies. The experiments were performed in the apiary of Faculty of Agriculture, Zagazig University, Egypt, during 2016/2017.

The Test Honeybee Colonies

Twelve colonies *Apis mellifera* (F2 hybrid Carniolan) were established, each housed in Langstroth hive. These colonies usually nearly with the same strength and headed with sister queens in similar age. They were equivalent to colonies of normal size at the same apiary. The colonies were distributed at random in four groups three colonies, each. Three groups were fed on sucrose syrup (1:1) enriched with three test additives whereas the fourth group was fed on sucrose syrup only and served as control. The test colonies were fed on sucrose syrup fortified with food mixture additives diluted at the rate of 3 parts additive: 7 parts sucrose syrup. Each colony was offered 1 litre/colony/week allover the experimental period. Bees of the test colonies were allowed to free flight to collect any available pollen and nectar in the surrounding areas.

The Test Feed Additives

The test food mixtures were prepared based upon the data of the preliminary laboratory experiments on single additives (juice, oil and extract). The test food mixtures were selected to contain a nutritive and a protective agents each, as follow:

(1) Parnove (*Pluchea dioscoridis*) boiling water extract + orange (*Citrus sinensis*) juice.

(2) Thyme (*Thymus vulgaris*) boiling water extract + orange (*C. sinensis*) juice.

(3) Garlic (*Allium sativum*) boiling water extract + lemon (*Citrus limon*) juice.

Mixing rate was 1 : 1 (*V:V*) of the two compenents of each mixture.

The Studied Parameters

The rate of *Varroa* infestation

The rate of *Varroa* infestation was measured (inspected) before applying any control agent at the onset of the experiment, then weekly inspection was performed allover summer, autumn (2016), winter (2016/2017) and spring, 2017 seasons. Thereafter, the mean rate of *Varroa* infestation per month was calculated according to **Berkani-Ghalem *et al.* (2014)**. The rate of infestation was calculated according to the formula:

$$\text{Infestation (\%)} = \frac{V}{B} \times 100$$

Where:

V: The number of *Varroa* mites found, and B: the number of bee were infested

The (%) of reduction in *Varroa* mite infestation was calculated according to **Henderson and Tilton (1955)** equation:

Reduction of infestation (%) = 100 x 1 – {Ta x Cb} / {Tb x Ca}

Where:

T = infestation (%) of treated mites and C = infestation (%) of untreated mites (a = after; b = before treatment).

Sealed brood area

The areas (sq. in²) of sealed worker cells present in the test colonies were measured separately with a ruler every 12 days, sealed brood at one measurement having emerged before the next made during the experiment period. The measurements were made by Hoffman frame graduated into square inches after all bees having been first shaked off the combs **(El-Shakaa, 1985).**

Clover honey yield

Clover flow period was started at the beginning of May and lasted to the last week of May when the honey yield was estimated for each experimental colony solely. Honey yield was estimated as the difference in the weight of honey combs before and after honey extraction.

Statistical Analysis

Data obtained were statistically analyzed according to **Snedecor and Cochran (1967)** methods, that calculated according to COSTAT computer program **(Anonymous 2005)**.

RESULTS AND DISCUSSION

Effect of the Test Feed Additives on *Varroa* Infestation

Summer season

Results presented in Table 1 indicate that the rate of *Varroa* infestation in the test honeybee colonies offered sucrose syrup enriched with the food mixtures parnove extract + orange juice, thyme extract + orange juice and lemon juice + garlic extract, as well as the control colonies recorded 0.48, 0.52, 0.42 and 0.92% in July; 0.94, 1.08, 0.91 and 3.02% in August and 3.40, 3.06, 2.44 and 4.60% in September, respectively. It is obvious that the infestation during summer season increased gradually till reaching the highest, in all treatments, in September. This event could be attributed to many factors, such as, it taken place towards the more favourable weather conditions to *Varroa* development and reproduction. **Mattila and Otis (2000)** reached to the same conclusion, indicating that *Varroa* infestation increased towards autumn season. Similarly, **Omran *et al.* (2011)** reported that the maximum monthly mean occurrence of *Varroa* inside honeybee colonies was during November and December.

Autumn season

The mean rate of *Varroa* mites infestation in the test honeybee colonies fed on sucrose syrup fortified with the food mixtures parnove extract + orange juice, thyme extract + orange juice and garlic extract + lemon juice, as well as the control colonies offered sucrose syrup only attained 8.10, 7.60, 6.30 and 9.80% in October, 11.50, 10.70, 9.00 and 13.80% in November and 1.20, 1.35, 1.09 and 2.58% in December, respectively. It was noticed that the infestation was severely elevated during October and November months. Statistical analysis indicated that the mixture composes of garlic extract + lemon juice caused the highest reduction in percentage of *Varroa* infestation.

Winter season

The mean percentage of *Varroa* mites infestation in F2 Carniolan honeybee colonies fed on the test food additives, as well as the control colonies recorded 2.82, 2.18, 1.84 and 3.67 in January; 3.56, 2.97, 2.67 and 6.41% in February; 4.16, 4.01, 3.77 and 7.56% in March for the abovementioned treatments and the control, respectively. The range of reduction in *Varraa* infestation recorded 23.20–45.00, 40.60 – 53.70 and 49.90–50.10% for the respective food mixtures. Analysis of data clear that the rate of *Varroa* infestation in the colonies offered the three food mixtures was significantly lower as compared to that recorded in control colonies.

Spring season

Obtained results indicated that *Varroa* infestation (%) attained 5.30, 5.60, 4.92 and 8.10% in April, 6.10, 6.40, 5.62 and 9.30% in May and 7.20, 7.00, 6.47 and 9.8% in June for the colonies offered the food additives parnove extract + orange juice, thyme extract + orange juice and garlic extract + lemon juice, as well as the control, respectively. The test food additives reduced significantly (%) *Varroa* infestation by 26.50 -37.60, 28.60 - 31.20 and 34.00- 39.60% for the three respective additives.

Regarding the efficiency of the tested food additives in reducing the rate of *Varroa* infestation, it is clear that the food mixture garlic extract + lemon juice caused the highest effect in this respect, the mixture parnove extract + orange juice came in the second rank. Many research workers had detected the efficiency of garlic and thyme as natural efficient control agents against *Varroa destractor* infesting honeybee colonies. For instance, **Goswami and Khan (2013) and Qayyoum *et al.* (2013)** stated that garlic treatment against *Varroa* mite in honeybee colonies gave significant superior results (75.030% mite mortality). Also, **Goswami *et al.* (2014)** added that the highest mite mortality (77.54%) with the highest brood development (21.74% increase) was recorded with garlic oil treatment. The protective action of garlic may be due to its content of tomatin and other sulphetic components **Ghasemi *et al.* (2011)**, **Gregorc and Planine (2012) and Ahmed *et al.* (2013)** stated that essential oil of thyme has potential of practical value for controlling

Table 1. The occurrance of *Varroa* mite infestation in honeybee colonies fed on sucrose syrup enriched with the test food additives during the four seasons of 2016/2017

Month	Parnove ex. + orange juice		Thyme ex. + orange juice		Garlic ex. + lemon juice		Control	General mean	LSD 0.05
	Infestation (%)	R (%)	Infestation (%)	R (%)	Infestation (%)	R (%)			
Pre treatment	**0.17**		**0.31**		**0.30**		**0.61**		
				Summer season					
July	0.48	33.69	0.52	11.2	0.42	7.17	0.92	0.58	
August	0.94	68.90	1.08	64.20	0.91	69.9	3.02	1.48	
September	3.40	26.10	3.06	33.50	2.44	45.00	4.60	2.87	
Mean/ season	1.61 b	45.47	1.55 b	43.94	1.25 b	55.40	2.85 a	1.81	0.69
				Autumn season					
October	8.10	17.30	7.60	22.40	6.30	35.70	9.80	7.95	
November	11.50	16.70	10.70	22.50	9.00	34.80	13.80	11.25	
December	1.20	1.20	1.35	47.70	1.09	57.80	2.58	1.55	
Mean /season	6.93 ab	20.06	6.55 ab	24.45	5.46 b	37.02	8.73 a	6.92	2.31
				Winter season					
January	2.82	23.20	2.18	40.60	1.84	49.90	3.67	2.62	
February	3.56	44.50	2.97	53.70	2.67	58.30	6.41	3.90	
March	4.16	45.00	4.01	47.00	3.77	50.10	7.56	4.87	
Mean /season	3.53 b	40.03	3.05 b	48.13	2.76 b	53.06	5.88 a	3.81	1.51
				Spring season					
April	5.30	34.60	5.60	30.90	4.92	39.30	8.10	5.98	
May	6.10	37.60	6.40	31.20	5.62	39.60	9.30	6.85	
June	7.20	26.50	7.00	28.60	6.47	34.00	9.80	7.62	
Mean /season	6.20 b	35.82	6.30 b	34.78	5.67 b	41.30	9.66 a	6.96	0.99
General mean	4.56		4.37		3.79		6.63	4.83	

R (%) = reduction of infestation.
Means followed by the same letter in the same row are not significantly different.

Varroa mites. Also, **Abd-El-Halim *et al.* (2006)** reported the efficiency of thyme, garlic and orange against *Varroa* infestation in honeybee colonies. Moreover, **Rashid *et al.* (2014)** found that thymol in combination with formic acid was effective against *Varroa* mite with no effect upon queen and adult honeybee attendants. Also, **Emsen and Dodologlu (2015)** found that thymol- bee cake killed 92.85 % of *Varroa* mite. Regarding lemon juice, **Ardeshir *et al.* (2002)** reported that lemon has no acaricidal effect against *Varroa* mite. On the other hand, **Mourad *et al.* (2000) and El-Zemity *et al.* (2006)** reported lemon juice as effective acaricidal agent against *Varroa* mites. Similarly, **Abdel-Rahman and Rateb (2007)** reported that lemon juice at 50, 75 and 100% in sucrose syrup offered to honeybee colonies killed over 80% of *Varroa* mite. Also, **Abd El-Wahab and Ebada (2006)** recorded 100% *Varroa* mite mortality after the 4th week of treatment with sour orange (Vitam. C source).

Brood rearing activity

The effect of feeding honeybee colonies on sucrose syrup fortified with the test food additives on brood rearing activity during summer, autumn, winter and spring seasons was studied (Table 2). Obtained results were follows:

Summer season

Brood rearing activity during summer season was started in relatively lower rates, thereafter, a gradual increase was taken place starting on July that continued until recording the highest activity (peak) allover summer season in August,

Table 2. Sealed brood area (inch²) measured at 12-day intervals in the test colonies fed on sucrose syrup enriched with the tested food additives during the four seasons of 2016 and 2017

Month	Parnove ex. + orange juice	Thyme ex. + orange juice	Garlic ex. + lemon juice	Control	General mean	LSD 0.05
			Summer season			
July	238.3	157.3	259.7	158.0	203.3	
August	271.1	154.3	259.9	200.6	221.5	
September	190.8	169.5	226.3	188.2	193.7	37.47
Mean /season	233.4 a	160.4 b	248.6 a	182.3 b	206.2	
			Autumn season			
October	103.7	71.7	148.3	64.9	97.2	
November	124.9	59.9	166.7	79.2	107.7	44.06
December	87.5	59.9	178.5	88.3	103.6	
Mean /season	105.4 b	63.8 b	164.5 a	77.5 b	102.8	
			Winter season			
January	127.5	116.8	136.2	52.1	108.2	
February	139.9	134.4	168.1	100.9	135.8	
March	176.6	137.0	181.6	83.0	144.6	39.59
Mean /season	148.0 a	129.4 a	161.9 a	78.7 b	129.5	
			Spring season			
April	156.6	107.5	196.5	104.2	141.2	
May	243.3	195.9	269.7	173.6	220.6	
June	179.5	162.5	242.3	150.9	183.8	44.83
Mean /season	193.1 b	155.3 b	236.2 a	142.9 c	181.8	
General mean	169.9	127.2	202.8	120.3	155.1	

Means followed by the same letter in the same row are not significantly different.

recording 271.1, 259.9 and 200.6 inch²/colony/ interval for the colonies fed on sucrose syrup fortified with the food additive mixtures parnove extract + orange juice and garlic extract + lemon juice, as well as the control colonies, respectively (Table 2). The recorded peak could be attributed to the abundance of pollen in the fields during that period especially maize (*Zea mays*), in addition to some secondary summer crops (kidney bean, safflowers, peanut and sesame) which inhance brood rearing activity of honeybee colonies. A decrease was then taken place during September. Generally, the mean sealed brood area measured in the test colonies during summer season recorded 233.4, 160.4, 248.6 and 182.3 inch²/colony for the colonies offered sucrose syrup fortified with the food mixtures parnove extract + orange juice, thyme extract + orange juice and garlic extract + lemon juice as well as the control colonies offered sucrose syrup only, respectively. Analysis of data clear that the food mixture garlic extract + lemon juice caused the highest significant mean sealed brood area being insignificantly differed as compared to the action of the mixture composed of parnove extract + orange juice.

Autumn season

Brood rearing activity during autumn season started with higher rate then decreased irregularly during the following two intervals before re-increased again, recording a peak on November. The area of sealed brood on that peak reached 124.9, 59.9, 166.7 and 79.2 inch²/ colony, respectively. The recorded peak of brood rearing activity is coincided with the blooming of *Eucalypus* and some herbs. Generally, the respective mean sealed brood area reared in the test colonies that offered sucrose syrup enriched with the food additives parnove extract + orange juice, thyme extract + orange juice, garlic extract + lemon juice and control colonies recorded 105.4, 63.8, 164.5 and 77.5 inch²/colony. Analysis of variance indicated

that the diet mixture garlic extract + lemon juice induced the highest significant mean sealed brood area during autumn. Other differences are all insignificant (Table 2).

Winter season

Results presented in Table 2 indicate that sealed brood area measured during winter in the colonies fed on sucrose syrup enriched with the food mixtures parnove extract + orange juice, thyme extract + orange juice and garlic extract + lemon juice, as well as the control colonies was the least on the first interval (Jan.). Thereafter, a gradual increase was taken place in this activity by time, until recording the highest sealed brood area allover the season attaining 127.5, 116.8, 136.2 and 52.1 inch²/colony for the test colonies and the control, respectively. This peak is concided with the blooming of some winter crops (pea, lentil, lupine, faba bean) as well as winter weeds. A noticeable decrease was recorded on February 28 that followed by a remarkable increase starting on March 13 (the last interval in winter season). Generally, the corresponding mean sealed brood area recorded 123.0, 106.6, 138.2 and 73.5 inch²/colony.

Spring season

Brood rearing activity during spring season manifested stability during the first three intervals at the beginning of the season. Thereafter, a gradual increase was taken place starting on May 1st up to May 25th where sealed brood area peaked in all treatments, recording 243.3, 195.9, 269.7 and 173.6 inch²/colony for the test colonies. Generally, the respective mean sealed brood area reared in the test colonies attained 179.5 , 162.5 , 242.3 and 150.9 inch²/ colony fed on sucrose syrup fortified with one of the mixtures parnove extract + orange juice, thyme extract + orange juice and garlic extract + lemon juice as well as control colonies, respectively.

Discussing the results concerning the effect of the test food additives on brood rearing activity cleared that the highest brood rearing activity was recorded during summer season followed by spring. On the other hand, the least sealed brood area was measured during autumn season and this could be attributed to botanic (shortage in pollen supply) and climatic factors (lower prevailing temperature and higher relative humidity). In addition, the food mixture composed of garlic extract+ lemon juice induced the highest brood rearing activity. It is seemed that the nutritive effect of lemon juice as a rich source of vitamin C which elevates brood rearing activity. In addition, the protective effect of garlic extract and lemon juice in the mixture play (acted) a role in saving the sanitary status of the colony, *i.e.* in keeping the colony *Varroa* clean as possible. This action could be attributed to the protective and prophylactic effect (acaricidal action) of garlic extract that reported by many researchers. For instance **Howis and Nowakowski (2010)** stated that honeybee colonies with low *Varroa* infestation during winter associated with larger area of brood (r=0.63) and larger value of the nest (r= 0.74) in the early spring of the next year. **Goswami *et al.* (2014)** recorded the highest *Varroa* mites mortality (77.5%) and the highest brood development (21.74% increase) with garlic oil treatment among the plant oils tested. Regarding lemon juice it is well known that lemon juice is a rich source of vitamin C which elevates brood rearing activity. On the other hand, the mixture composed of thyme extract+orange juice caused the least brood rearing activity in all seasons. This effect could be attributed to the possible supprising effect of thyme extract (main component is thymol) on honeybee. In this respect, **Ruffinengo *et al.* (2007), Gregore and Planinc (2012) and Zheng *et al.* (2012)** agreed that some plant oils have acaricidal effect against *Varroa* mites, however some others were toxic to honeybee to some extent. **Charpentier *et al.* (2013)** found that thymol offered to bee/larvae caused a significant decrease of larval survival and mass (weight occurred from 500 mg/1 kg food). Finally vitellogenin expression, which reached a maximum at the fifth instar larvae is delayed for individual exposed to 50 mg thymol/kg food. That is times higher than the theorefied level of exposure. Moreover, **Al-Zarog and El-Bassiouny (2013)** reported that thymol and fengreek alone and in mixture increased the number of sealed brood cells.

Clover honey production

Results presented in Table 3, clear that the mean clover honey yield attained 5.00, 1.70, 6.50 and 4.00 Kg/colony in 2016; 3.90, 2.00, 5.60, and 1.50 Kg/colony offered the additive mixtures parnove extract + orange juice, thyme extract+orange juice, garlic extract+ lemon juice

Table 3. Clover honey yield (kg) of honeybee colonies offered sucrose syrup enriched with the tested food additives in 2016 and 2017 seasons

Season	Parnove ex. + Orange juice	Thyme ex. + Orange juice	Garlic ex. + Lemon juice	Control	LSD 0.05
2016	5.00 ab	1.70 c	6.50 a	4.00 b	2.09
2017	3.90 b	2.00 c	5.60 a	1.50 c	1.28
Two years mean	4.45	1.85	6.05	2.75	

Means followed by the same letter in the same row are not significantly different.

and sucrose syrup only (control), respectively in 2017. The corresponding two years mean clover honey yield recorded 4.45, 1.85, 6.05 and 2.75 Kg/colony.

Statistical analysis cleared that the differences between the treatments were mostly significant in both seasons. The mixture of garlic extract + lemon juice proved to be the most potent in enhancing honey production. On the other hand, the mixture of thyme extract + orange juice may possess adverse effect on the colony productivity. This statement is in accordance with that of **Mattila and Otis (1999)** who recorded 30% reduction in honey production with Apiguard (thymol based gel miticide) treatment, leaving 1.55-2.64 ppm residues in honey. On the contrary, **El-Shaarawy (1999)** reported that honey yield increased after Apiguard treatment.

REFERENCES

Abd El-Halim, M.I., H.A. Ghoniemy and A.A. Owayss (2006). Combatting honeybee *Varroa* mites by plant oils alone or in an ipm program. Agric., Fayoum Univ., 172-185.

Abdel-Rahman, M.F. and S.H. Rateb (2007). Evaluation of lemon juice for controlling *Varroa destructor* in honeybee colonies. Ass. J. Agri. Sci., 39 (2): 195-206.

Abd El-Wahab, T.E. and M.A. Ebada (2006). Evaluation of some volatile plant oils and mavrik against *Varroa destuctor* in honeybee colonies. J. Appl. Sci. Res., Egypt, 2: 514- 521.

Ahmed, K.J., R. Asif, H.A. Khalida, S. Muhammad, S. Muhammad and A. Muhammad (2013). Thymol as control agent of mites (*Varroa destructor*) on honeybees (*Apis mellifera*). Pak. J. Agric. Res., 26 : 34.

Al-Zarog, A.A. and A.M. El-Bassiouny (2013). Influence of some plant extracts on *Varroa* mite and performance of honey bee (*Apis mellifera*) colonies. Egypt. Acad. J. Biol. Sci., 5 (2): 15 -20.

Anonymous (2005). COSTAT Computer Program Version 6.311, Copyright (C), Coltart Software 798 Lighthouse Ave. PMB 320, Monterey, CA, 93940 , USA.

Ardeshir, A., E. Rahim and T. Gholamhosein (2002). Laboratory evaluation of some plant essences to control *Varroa destructor* (Acari: Varroidae). Exp. Appl. Acarol., 27 (4): 319-327.

Berkani-Ghalem, Z., H. Hami and B.M. Laid (2014). Variation in the dynamics of development of *Varroa destructor* population from the effects of climate in Northern Algeria. Silva Lusitana, 21(2): 219-234.

Charpentier, G., C. Vidau, J.B. Ferdy and J. Tabart (2013). Lethal and sub-lethal effects of thymol on honeybee (*Apis mellifera*) larvae reared *In vitro*, Pest Manag. Sci., 70 (1): 140-147.

Darhoos, A. (1990). Effect of artificial feeding on honeybees, *Apis mellifera* L. M.Sc.Thesis, Fac. Agric., Zagazig Univ., Egypt.

Devi, H.S., B.K. Sontakke, L.N. Mohapatra and P. Jayaraj (2011). Influence of weather on the colony characteristics and foraging activity of *Apis mellifera* L. in constal Orissa. J. Appl. Zool. Res., 22 (1): 64-67.

El-Shaarawy, M.O. (1999). Evaluation of Apiguard and formic acid as control agents against *Varroa jacobsoni* infesting honeybee colonies. Proceed. Apimondia' 99, Congress, Vancouver 12-17 Sept., Canada, 266-267.

El-Shakaa, S.M.A. (1985). Some factors affecting the longevity of honeybee workers (*Apis mellifera* L., Apidae, Hymenoptera) in Zagazig distric. Ph.D. Thesis, Fac. Agric., Zagazig Univ., Egypt.

El-Zemity, S.R., H.A. Rezk and A.A. Zaitoon (2006). Acaricidal activity of some essential oils and their monoterpenoidal constituents against the parasitic bee mites, *Varroa destructor* (Acari: *Varroidae*). J. Appl. Sci. Res., 2 (11): 1032-1036.

Emsen, B. and A. Dodologlu (2015). The efficacy of thymol and oxalic acid in bee cake against bee mite (*Varroa destructor* Anderson and Trueman) in honey bee (*Apis mellifera* L.) Colonies. Kafkas Univ. Vet. Fak. Derg., 21 (1): 45-48.

Gebremedin, H., A. Tadesse and T. Belay (2014). Relating climatic factors to foraging behavior of honeybee (*Apis mellifera*)during blooming period of *Guizotia abyssinica* (LF) Livestock Res. Rural Dev., 26 (4): 60 - 62.

Ghasemi, V., S. Moharramipour and G. Tahmasbi (2011). Biological activity of some plant essential oils against *Varroa destructor* (Acari: Varroidae), an ectoparasitic mite of *Apis mellifera* (Hymenoptera: Apidae). Exp. Appl. Acarol., 55: 147.

Goswami, V. and M.S. Khan (2013). Management of varroa mite, *Varroa destructor* by essential oil and formic acid in *Apis mellifera* Linn. colonies. J. Nat. Prod., 6: 206-210.

Goswami, V., S. Poonam and M.S. Khan (2014). Efficacy of essential oils against *Varroa destructor* infesting *Apis mellifera* Linn. colonies and their impact on brood development. J. Appl. and Nat. Sci., 6 (1): 27-30.

Gregorc, A. and I. Planinc (2012). Use of thymol formulations, amitraz and oxalic acid for control of the *Varroa* mite in honeybee (*Apis mellifera carnica*) colonies. J. Apicul. Sci., 56 (2): 61-69.

Hassan, A.R. (1997). Studies on division and backages production in honeybee, *Apis mellifera* L. M.Sc., Fac. Agric., Zagazig Univ., Egypt, 245.

Henderson, C.F. and W. Tilton (1955). Tests with Acaricides against the brown wheat mite. J. Econ. Entomol., 48 (2): 157-161.

Howis, M. and Nowakowski (2010). Effect of the level of *Varroa destructor* invasion on honey production and mean body mass of single bee in bee colony prepared for wintering. Zeszly Naukowe Uniwersptetu Prezyrodniczeg Wroclawlu- Biologia (Hodowla Zwierzat, 61 (579):125-130.

Mattila, H.R. and G.W. Otis (1999). Trials of Apiguard, a thymol miticide. Part 1. Efficacy for control of parasitic mites and residues in honey. Ame. Bee J., 139 (12): 947-952.

Mattila, H.R. and G.W. Otis (2000). The efficacy of Apiguard against *Varroa* and tracheal mites, and its effect on honey production. Ame. Bee. J., 140 (12): 969-973.

Mc Gregor, S.E. (1976). Insect pollination of cultivated crop plants. USDA Agric. Handb., 441- 496.

Medina-Flores, C.A., E. Guzman-Novoa, C.F. Arechiga-Flores, J. Aguilera-Soto and F.F. Gutierrez-Ping (2011). Effect of *Varroa destructor* infestation on honey yield of *Apis mellifera* colonies in Mexiceris semigrid high plateau. Revista Mexican a de Ciencians Peeuarias, 2 (3): 313-317.

Mourad, A.K., N.F. Mohanna, O.A. Zaghloul and K.M.A. Hamid (2000). Control of *Varroa jacobsoni* (Acari:Varroidae) on the honeybee by using some natural materials in Egypt. Mededelingen-Faculteit landbouwkundige en Toegepaste Biologische Wetenschappen, Univ. Gent., 65 (2a): 401-421.

Omran, N.S.M., M.H. Hussein, M.M. Khodairy and A.M. Awad (2011). Occurrence of *Varroa* mites inside honeybee colonies and

control it's using volatile oils. Res. J. Agric. and Biol. Sci., 7 (1): 89-97.

Qayyoum, M.A., B.S. Khan and M. Bashir (2013). Efficacy of Plant extracts against honey bee mite, *Varroa destructor* (Acari: Varroidae). World J. Zool., 8 (2): 212- 216.

Rashid, M., U.M. Atta, A. Samia, R. Shazia and S. Ghulam (2014). Integrated control of *Tropilaelaps clareae* And *Varroa destructor* in *Apis mellifera* L. colonies. Scholarly J. Agric. Sci., 4 (1): 32-37.

Ruffinengo, S., M. Maggi, C. Faverin, D.S.B. Garcia, P. Bailac, J. Principal and M. Eguaras (2007). Essential oils toxicity related to *Varroa destructor* and *Apis mellifera* under laboratory conditions. Zootec Trop., 25: 63–69.

Sakla, R.S.S. (2016). Miticidal impact on certain biological activities of honeybee (*Apis mellifera* L.). Ph.D. Thesis, Fac.Agric., Zagazig Univ., Egypt, 84

Snedecor, G.W. and W.G. Cochran (1967). Statistical Methods Applied to Experiments in Agricultural and Biology. The Iowa State College 5th Ed. Iowa, USA.

Yousif-Khalil, S.I. and A.A. Shalaby (1992). Pollinating activity of honeybee (*Apis mellifera* L.) as influenced by some insecticidal residues. Zagazig J. Agric. Res., 19 (2): 909-922.

Zheng, S.L. and H.F.L. El-Zhong (2012). Effectiveness of herbal essential oils as fumigants to control *Varroa destructor* in laboratory assays. Chinese J. Appl. Entomol., 5.

فاعلية بعض المواد النباتية ضد إصابة نحل العسل بحلم الفاروا وتأثيرها على نشاط تربية الحضنة ومحصول عســـل البرسيم

أماني السيد النجار - سعد إبراهيم يوسف خليل - سعد محمد علي الشكعة - ولاء مجاهد هلالي

قسم وقاية النبات – كلية الزراعة – جامعة الزقازيق - مصر

أجريت الدراسة لتقييم تأثير عدة مخاليط غذائية من أصل نباتي مضافة إلى المحلول السكري لطوائف نحل العسل على معدل الإصابة بالفاروا ونشاط تربيه الحضنة وكذا محصول عسل البرسيم خلال ٢٠١٧/٢٠١٦، هذا وقد أجريت التجارب في منحل كليه الزراعة - جامعة الزقازيق، وقد أظهرت النتائج ما يلي: النسبة المئوية للإصابة بالفاروا: زاد معدل الإصابة بالفاروا تدريجيا خلال الصيف حتى بلغ ذروتها في موسم الخريف، نتج عن المخلوط الغذائي المكون من عصير الليمون ومستخلص الثوم نقصا معنويا في معدل الإصابة بالفاروا مقارنه بالكنترول لجميع مواسم السنة حيث تراوحت نسبه الخفض من ٣٧,٠٢-٥٥,٤٠% في حين أحدث المخلوطان المكونان من مستخلص البرنوف مع عصير البرتقال ومستخلص الزعتر مع عصير البرتقال نقصا معنويا في معدل الإصابة خلال الفترة من فبراير حتى أغسطس مقارنة بالكنترول حيث سجل معدل الخفض مدى قدره ٣٥,٨٢ -٤٥,٤٧، ٣٤,٧٨ -٤٨,١٣% على الترتيب، مساحة حضنة الشغالات المقفلة: سجل أقصى نشاط لتربية الحضنة في موسم الصيف تلاه مباشرة موسم الربيع في حين سجل أقل نشاط في موسم الخريف أحدث المخلوط الغذائي المكون من عصير الليمون مع مستخلص الثوم أعلى نشاط لتربيه الحضنة في كل المواسم وجاء المخلوط المكون من مستخلص البرنوف مع عصير البرتقال في المركز الثاني وأعلى معنويا عن الكنترول، على النقيض كان المخلوط المكون من مستخلص الزعتر مع عصير البرتقال أقل نشاط لتربية الحضنة، محصول عسل البرسيم: بلغ متوسط محصول عسل البرسيم ٥,٠٠ ،١,٧٠ ، ٦,٥٠ و٤,٠٠ كجم/طائفة في موسم ٢٠١٦ و ٣,٩٠ ، ٢,٠٠، ٥,٦٠ و١,٥٠ كجم/طائفة في موسم ٢٠١٧ التي تغذت على المخاليط المكونة من مستخلص البرنوف مع عصير البرتقال ومستخلص الزعتر مع عصير البرتقال ومستخلص الثوم مع عصير الليمون والكنترول علي الترتيب وبلغ متوسط محصول السنتين ٤,٤٥ ، ١,٨٥ ، ٦,٠٥و ٢,٧٥ كجم/طائفة على التوالي.

المحكمـــــون:

١- أ.د. محمد عطية عويس أستاذ الحشرات الاقتصادية المتفرغ – كلية الزراعة – جامعة القاهرة.

٢- أ.د. محمد علـــي الـديب أستاذ الحشرات الاقتصادية المتفرغ– كلية الزراعة – جامعة الزقازيق.