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Using Medicinal Plants for Controlling *Varroa* Mite in Honey Bee Colonies

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Abstract: *Varroa* is one of the most dangerous honey bee parasites, which has caused serious damages to the bee industry. By now, various herbal and chemical drugs hard been used. In this research, the effect of 7 treatments including tobacco extract, harmel ext, thymus ext, tobacco smoke, harmel smoke and thymus smoke and also one control group each with three replicate in a completely randomized design (CRD) have been examined on 21 colonies. The whole period of experiment was five days. The rate of hive contamination at the beginning and end of the experiment along with daily rate of *varroa* and worker bee contamination were recorded. There was no significant difference between experimental hives at the beginning of the study. However, significant dissimilarity was found between experimental treatments at the end of period ($p<0.05$). Considering the rate of the mortality of *varroa*s in different days and the whole period of the study, a significant different was observed ($p<0.05$) and tobacco ext. had the largest effect on the *varroa* control. Besides, significant dissimilarities in the mortality of the bees were found in various days nad considering this aspect, harmel ext had the highest effect.

Key words: Honey bee, *varroa*, tobacco, harmel, thymus

INTRODUCTION

Like other animals honeybee is affected by various pests and diseases. One of the most and common pest is *Varroa destrutor* that provoke big losses in apiculture. It feed from of hemolymph larva, pupa and adult bees during the whole life. Contamination of colony with *Varroa* lead to decreasing of body weight, deformation and even death (Ritter, 1981; Mosaddeg and Komeyli-Birjond, 1988).

Several researchers are trying to find more effective ways to control of *Varroa* mite and have done it by chemical treatments such as Byvarol, Apistan, Apigurd and Folbex (Ritter,1981; Ebadollahi-Natanzy, 2000). Based on the reports; mites are likely to develop resistance against these chemical treatments, causing low effect on mites (Ritter, 1981; Wallner, 1999; Ebadollahi-Natanzy, 2000; Denisl, 2000).

Using these chemical compounds have disadvantages on wax and honey and also human health. Also remainings of these chemicals have advers effects on environment (Imdorf nad Bogdanov, 1999; Wallner, 1999; Ebadollahi-Natanzy, 2000; Kochanskg nad Wilzer, 2001). Nowadays in some countries, these are so attempts to replace medicinal plants with chemical treatments. Pepper, mint and etc are some of the involved medicinal plants (Rajiter, 1983; Ariana *et al*., 2000; Hagigatian, 2000). Also, tobacco was used to control of *Varroa* because of its substances such as nicotine, nicoteine and nicotelline. A research done by Rajiter (1983), using different amount of tobacco as fumigant during 5 days resulted 50-79% mortalities in mites based on the amount and time of tobacco usages.

From the past harmel has been using by Iranian as disinfectant. Harmel has some alkaloids such as harmine, harmalin and harmalol (Zargari, 1988).

Ariana *et al*. (2000) used harmel extract and powder in Isfahan, Iran apicultures but there was no effect against them.

Thymus kotschyonus which grows wildly in most areas of Iran is known as medicinal plant. This plant have disinfected property due to exist of thymol (Zargari, 1988). Mosaddegh and Komayli (1988) declared tymol has decreased defected hives 67.08%.

The purpose of this study was to determine the effect of tobacco (*Nicotina tobacco*), harmel (*peganium harmela*) and thymus (*thymus kotschyanus*) smoke and extract against *Varroa* mite in honey bee clonies.

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MATERIALS AND METHODS

This study was done in spring 2002 in research farm of Islamic Azad university in Shabestar in East Azerbaijan province, Iran Plot test is latitude 45.41 N, longitude 38.12 S and altitude 1400 m mean sea level with 367 mm precipitation, -27.5 minimum and 40 maximum temperature (Anonymus, 1996).

Twenty one infected longestrut hives by *varroa* mites were chosen with the same population. A sheet of carboard coating a layer of grease was set up into the floor of each hive. Complete randomized design was used with 6 treatments including tobacco, thymus and harmel as both smoke and extract with 20% and 3 replicates during 5 days period. Control hives treated with no extract and smoke.

Experiment was applied every evening when all the honeybees came in hives. Fifteen milliliter of each extract was sprayed by special tip on honeybees and 3 g of each powder was fire and let the smoke get through the hives.

Varroa mites and worker bee mortalities were recorded every day at 10 a.m as if the were moved to the new hives and the carboard were removed and transmitted to the lab for counting the mortalities. Data were analyzed using MSTATC software and means separated with Duncan's multiple range tests.

RESULTS AND DISCUSSION

Percentage of infected hives: The results (Table1) from the beginning and end of the tests indicated that there was no significant difference between the treatments at the first but at the end of the test percentage of infected hives were significantly different ($p<0.05$). Means of mortality percentage showed that tobacco extract had the most effect on infecting hives whereas harmel smoke and extract had no effect (Table 2). It seems that the difference is related to the toxicity dose of their substances (Ariana *et al*., 2000; Hagigatian, 2000). There are different researchers that showed effect of tobacco on *Varroa* mites (Rajiter, 1982; Rajiter, 1983; Rajiter and Eijnd, 1984).

Our results from harmel extract and smoke is compatible with Ariana *et al*. (2000), results but the results from Thyme were not. This might be due to different species of Thymus which applied in each experiment. *Thymus vulgarus* was species of Ariana *et al*. (2000) test, while in current research was *thymus kotschyanus*.

***Varroa* mortality:** Table 3 showed that there was a significant difference in the mortalities of mites between treatments ($p<0.05$). Means followed by the same letter indicate that tobacco extract had the most impact against mites and there was no difference between the treatments (Table 4). Previous works by other researchers in agreement with our results (Rajiter, 1982; Rajiter, 1983; Rajiter and Eijnd, 1984; Mosaddeg and Komeyli-Birjond, 1988).

Table 1: Analyses of variance in start and end of experiment

Source of variation	Start of experiment	End of experiment
Treatment	2.33^{ns}	2.82^{*}
Error	3.19	3.17

ns: no significantly different, * : $p<0.05$

Table 2: Mean effect of experimental treatment on controlling *varroa* mites during experimental period

Treatment parameter	Control	harmel smoke	thymus smoke	tobacco smoke	harmel ext	thymus ext	tobacco ext
MPS	4.66^{a}	5.3^{a}	3.67^{a}	5.2^{a}	4.66^{a}	4.67^{a}	5^{a}
MPE	4.66^{b}	5.3^{b}	2.33^{b}	4.76^{b}	4.66^{b}	4.4^{b}	0.82^{a}
MDP	0	0	36.51	8.46	0	5.78	83.6

a and b: means within same column with differing superscript are significantly different; MPS: Mean of *varroa* infection percentage in start of experiment; MPE: Mean of *varroa* infection percentage in end of Experiment; MDP: Mean of Decreasing infection percentage

Table 3: Analyses of variance for *varroa* mites mortality during experimental period

Source of variation	1st day	2nd day	3rd day	4th day	5th day	Total
Treatment	5.66*	87.32**	3.49**	21.97*	2.27*	15.91**
Error	1.53	13.67	0.54	7.2	0.67	2.78

* : $p<0.05$, ** : $p<0.01$

Table 4: Mean separation of experimental treatments for *varroa* mites mortality during experimental period

Day treatment	1st day	2nd day	3rd day	4th day	5th day	Total
tobacco ext	30.67^{a}	14.67^{a}	10.67^{a}	7.33^{a}	2.33^{a}	65.67^{a}
thymus ext	0.33^{b}	1^{b}	0^{b}	0.67^{b}	0.33^{b}	2.33^{b}
harmel ext	1.33^{b}	0^{b}	0^{b}	0^{b}	0^{b}	1.33^{b}
tobacco smoke	1^{b}	0.67^{b}	0^{b}	0^{b}	0^{b}	1.67^{b}
thymus smoke	0.67^{b}	0^{b}	0^{b}	0.67^{b}	0^{b}	1.33^{b}
harmel smoke	1^{b}	1^{b}	0^{b}	0^{b}	0^{b}	2^{b}
Control	0^{b}	0^{b}	0^{b}	0^{b}	0^{b}	0^{b}

a and b : means within same column with differing superscript are significantly different

Table 5: Analyses of variance for worker honey bees mortality during experimental period

Source of variation	1st day	2nd day	3rd day	4th day	5th day	Total
Treatment	867.86**	457.33**	128.76**	160.19**	448.05**	9219.05**
Error	86.14	60.19	14.48	4.91	82.05	796.33

** : $p<0.01$

Bee mortalities: Considering possible effect of treatments against honey bees was essential.Variance analysis of bees mortalities showed that there was significant difference between the treatments in different days of the experiment (Table 5).

The highest mortalities were observed in harmel extract and no difference ($p<0.01$) between other treatments (Table 6). Although, the effect of harmel powder has not considered by other researchs. Ariana *et al*. (2000) showed that using thymus powder

Table 6: Mean separation of different treatment effect on number of worker honey bees mortality in total period

Treatment	Control	harmel smoke	thymus smoke	tobacco smoke	harmel ext	thymus ext	tobacco ext
NWHM	0[a]	0[a]	0[a]	0[a]	146.7[b]	0[a]	0[a]

a and b: means within same column with differing superscript are significantly different; NWHM: Number of Worker Honey Bees Mortality in total period

increased bees' mortalities but it was not in line with our results. It might be due to two different species of thymus applied in each experiment.

CONCLUSION

In an overall, Conclusion results showed that tobacco extract without harmful effect against honeybees decreased percentage of *varroa* mites mortalities than the other treatments, but harmel extract not only had no effect on controlling *varroa* mite but also resulted in increasing bee's mortality.

Therefore, we can suggest using tobacco extract for controlling *varroa* mites in honey bee colonies with no adverse effect on colony population.

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