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# INFLUENCE OF ACARICIDES AMITRAZ AND FLUVALINATE ON AVERAGE DAILY EGG AND TOTAL HONEY PRODUCTIVITY OF HONEY BEE COLONIES

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**Resume**

Varroa destructor Anderson & Trueman is widespread parasitic mite in honey bee population which causes varroosis. In Russia varroosis lead to mass losses of honey bee Apis mellifera L. colonies and their honey productivity. We have shown in our research negative impact of acaricides amitraz and fluvalinate on total honey and average daily egg productivity of honey bee colonies. We recommend in beekeeping no using against *Varroa* chemical acaricides and try treatment bees by alternative flours and extracts of medicinal plants in the season of honey collecting in summer. For most economically effectiveness of honey bee colonies treatment against *Varroa* by amitraz and fluvalinate can only in spring before honey collecting and in autumn after honey collecting seasons.

**Keywords:** amitraz, fluvalinate, productivity, *Varroa destructor*, *Apis mellifera mellifera*.

## Introduction

More than 150 species of parasitic mites are living in hives and causing significant damages of honey bee colonies. Mites of genus *Varroa* most dangerous parasites of bees of genus *Apis*. In first time had thinked that varroosis of honey bees *Apis mellifera* Linnaeus, 1758 caused by *Varroa jacobconi* Oudemans, 1904 and later had showed that only *Varroa destructor* Anderson & Trueman, 2000 parasited on *A. mellifera* and *Apis cerana* Fabricius, 1793 but *V. jacobconi* – on *Apis florea* Fabricius, 1787 and *Apis dorsata* Fabricius, 1793 [Zhang, 2000; Anderson & Trueman, 2000; Kuznetsov, 2005].

Varroosis lead to mass losses of honey bee colonies and their honey productivity. Many beekeepers had been using different chemical acaricides against varroosis. Varroosis is difficult to detecting at the early stage and it usually detected in peak of the disease developing. These diseased honey bee colonies need in prompt treatment by acaricides. Untreated bee colonies can to die in next year [Grobov, Lihotin, 2003]. All varroosis honey bee colonies characterized by low honey productivity. But treatment by acaricides had not decided all problems of low honey productivity of honey bee colonies – after return to health of colonies honey productivity had not increased.

Acaricides based on fluvalinate ($C_{26}H_{22}ClF_3N_2O_3$) (N'-(2,4-Dimethylphenyl)-N-{(E)-[(2,4-dimethylphenyl)imino]methyl}-N-methylimidoformamide) and amitraz ($C_{19}H_{23}N_3$) (Cyano(3-phenoxyphenyl)methyl N-[2-chloro-4-(trifluoromethyl)phenyl]-D-valinate) are most popular among beekeepers in Russia (Figure 1).

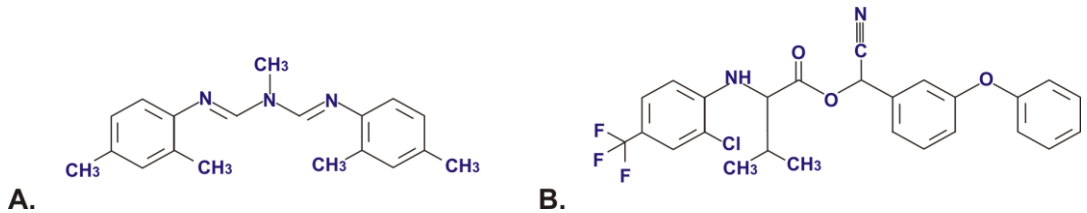


Figure 1. Chemical structure of acaricides: A. Fluvalinate B. Amitraz.

These chemical acaricides are very effective against *Varroa destructor*, but need remember that it must be harmless for bee and human organisms [Kozin, Kirsanov, 2005]. For saving unique population of dark european bees *Apis mellifera mellifera* L. in Ural we must to control disease spreading and keep immunity of bees [Nikolenko et al., 2002; Ilyasov et al., 2007]. In this paper we had researched negative impacts of acaricides amitraz and fluvalinate on honey bee health and his honey productivity.

**Materials and methods**

In our work we had researched 60 colonies of dark European bees *A. m. mellifera* from Bashkortostan Republic of Russia Federation (Figure 2). We were studied the impact of fluvalinate and amitraz on honey and average daily egg productivity of honey bee colonies.


Figure 2. Geographical localisation of experimental colonies of dark European bees *A. m. mellifera* in Bashkortostan Republic

First experimental group (20 colonies) was treated by therapeutic dose of fluvalinate, second experimental group (20 colonies) - by therapeutic dose of amitraz, third control groups (20 colonies) - not treated and feeded only sugar syrup.

Average infestation of honey bee colonies by *Varroa* mites was calculated by formula:

**I = (M / B) * 100 (%),**

where I - average infestation of honey bee colonies by *Varroa*, M - number of mites, B - number of bees in colony.

Average daily egg production of queens was calculated by formula:

**EP = E / D**

where EP – average daily egg production of queens, H – full number of laid eggs by queens in colony in pcs for 3 days, D - 3 days when eggs was laid.

Average honey production of honey bee colonies was calculated by formula:

**HP = H / M,**

where HP - average honey production of honey bee colonies, H – full produced honey mass in colony in kilograms, M - number of monthes when honey produced.

Average acaricide effectiveness of amitraz and fluvalinate was calculated by formula:

**E = (IB – IA) / IB * 100 (%),**

where E - average acaricide effectiveness, IB - infestation honey bee colonies before acaricides treatment, IA - infestation honey bee colonies after acaricides treatment.

Statistical significance of our research was calculated by Student's t test and probability P ($P \leq 0.05$ mean statistical significance with 95% reliability) using Statisica 8.0.

**Results**

The experimental honey bee colonies were treated by therapeutic doses of chemical acaricides amitraz and fluvalinate in comparing with not treated in control colonies for assess of impact on their productivity. In control group average daily egg productivity was 1650 pcs, honey productivity was average 28 kg and average infestation by varroa was average 19%.

Acaricide effectiveness in the first group of honey bees treated by fluvalinate was 98.7%, and in the second group of honey bees treated by amitraz – 97.4% (Table 1).

Table 1

Effectiveness of acaricides fluvalinate and amitraz on honey bee colonies treated against *Varroa*.

| Group | N | Infestation, *M*±*m* (%) | | Acaricide effectiveness, *M*±*m* (%) |
|---|---|---|---|---|
| | | before treatment | after treatment | |
| Fluvalinate | 20 | 16,2±2,8 | 0,2±2,1 | 98,7±2,3 |
| Amitraz | 20 | 15,4±1,9 | 0,4±2,0 | 97,4±2,5 |
| Not treated | 20 | 15,8±2,5 | 19,3±2,3 | - |

*M* –mean, *m* - error of mean.

In the first group of honey bees treated by fluvalinate average daily egg productivity was decreased relative to the control on 10%, and in second group of honey bees treated by amitraz average daily egg productivity was decreased on 8% (Table 2).

Table 2

Average daily egg productivity of honey bees treated by fluvalinate and amitraz

| Group | N | *lim* (pcs.) | *M*±*m* (pcs.) | *Cv* (%) | *td* |
|---|---|---|---|---|---|
| Fluvalinate | 20 | 1280-1650 | 1490±55.2 | 16.5 | 2.55* |
| Amitraz | 20 | 1250-1740 | 1520±59.7 | 19.5 | 2.20* |
| Not treated | 20 | 1310-1840 | 1650±53.6 | 17.4 | - |

*P<0.05, *lim* – extremes of characteristics, *M* –mean, *m* - error of mean, *Cv* - coefficient of variation, *td* - Student's t test.

Honey productivity in first group of honey bees treated by fluvalinate was decreased relative to the control on 11%, but in second group treated by amitraz honey productivity was increased on 13% (Table 3).

Table 3

Honey productivity of honey bees treated by fluvalinate and amitraz

| Group | N | *lim* (kg) | *M*±*m* (kg) | *Cv* (%) | *td* |
|---|---|---|---|---|---|
| Fluvalinate | 20 | 20.3-26.4 | 24.6±2.1 | 4.3 | 2.9* |
| Amitraz | 20 | 26.6-34.7 | 31,5±2,9 | 4.8 | 3.8* |
| Not treated | 20 | 25.2-28.6 | 27.7±1.2 | 2.8 | - |

*P<0.05, *lim* – extremes of characteristics, *M* –mean, *m* - error of mean, *Cv* - coefficient of variation, *td* - Student's t test.

**Discussion**

Thus, our experiment on honey bee colonies had showed that treatment of varroosis by both acaricides amitraz lead to losses of honey and average daily egg productivity. But only treatment of honey bee colonies by amitraz lead to little grow of honey productivity which not economically profitable in commercial beekeeping. Our research has showed negative impact of acaricides amitraz and fluvalinate on honey productivity of honey bee colonies. We recommend in beekeeping no using against *Varroa* chemical acaricides and try treatment by alternative flours and extracts of medicinal plants in the season of honey collecting in summer. For most economically effectiveness of honey bee colonies treatment against *Varroa* by amitraz and fluvalinate can only in spring before honey collecting and in autumn after honey collecting seasons. We hope that our research can help to successfully develop for beekeeping.

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## ВЛИЯНИЕ АКАРИЦИДОВ АМИТРАЗА И ФЛУВАИНАТА НА СРЕДНЕСУТОЧНУЮ ЯЙЦЕНОСКОСТЬ И ОБЩУЮ ПРОДУКТИВНОСТЬ СЕМЕЙ МЕДОНОСНОЙ ПЧЕЛЫ

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**Резюме**

*Varroa destructor* Anderson & Trueman широко распространенный во всем мире вид паразитического клеща, вызывающий у пчел болезнь варроатоз. В России варроатоз приводит к потере продуктивности семей пчел *Apis mellifera* L. В исследовании мы показали негативное влияние акарицидов амитраз и флувалинат на общую медопродуктивность и среднесуточную яйценоскость семей медоносной пчелы. Мы рекомендуем в сезон медосбора при лечении варроатоза не использовать химических акарицидов и применять только альтернативные препараты на основе порошков и экстрактов лекарственных растений. Наибольшая экономическая эффективность и продуктивность пчелиных семей достигается при обработке пчел от варроатоза флувалинатом и амитразом весной и осенью – до и после сезона медосбора.

**Ключевые слова:** амитраз, флувалинат, продуктивность, *Varroa destructor*, *Apis mellifera mellifera*.