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CONTENTS

HISTORICAL SCIENCES

Гончаренко А.В.
АМЕРИКАНО-КИТАЙСЬКІ ВІДНОСИНИ ТА ВІЙНА У В’ЄТНАМІ У 1963–1968 РР. 3
Goncharenko A.V.
US-CHINESE RELATIONS AND THE VIETNAM WAR IN 1963–1968 3

Levchuk K.I., Spiridonova L.M.
DEVELOPMENT AND ACTIVITIES OF CHILDREN'S AND YOUTH ORGANIZATIONS IN UKRAINE (1985-2000)...........5

Mazylo I.V.
RECONSTRUCTION AND RESTORATION OF THE WORK OF THE DNIEPER HIGHWAYS IN 1943 - 1945 11

EARTH SCIENCES

Семенова Ю.В.
СЕЙСМІЧНА РЕАКЦІЯ ҐРУНТОВОЇ ТОВЩІ В ОСНОВІ ТАШЛИЦЬКОЇ ГІДРО-АКУМУЛЮЮЧОЇ СТАНЦІЇ НА ДИНАМІЧНІ НАВАНТАЖЕННЯ 14
Semenova Yu.V.
SEISMIC RESPONSE OF SOIL STRATA AT THE BASE OF THE TASHLYK HYDRO-ACCUMULATING STATION TO DYNAMIC LOAD....................14

AGRICULTURAL SCIENCES

Разанова О.П.
ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ РІЗНИХ СПОСОБІВ БОРОТЬБИ З ВАРОАТОЗОМ БДЖІЛ 20
Razanova O.P.
EFFECTIVENESS OF APPLICATION OF DIFFERENT METHODS OF CONTROL OF BEE VAROATOSIS 20

Васильев В.И., Ратников А.Р., Заико К.С.,
МОЛОЧНАЯ ПРОДУКТИВНОСТЬ КОРОВ РАЗНЫХ ПОРОД....................30
Vasiliev V.I., Ratnikov A.R., Zaiko K.S.,
DAIRY PRODUCTIVITY OF COWS OF DIFFERENT BREEDS 30

Hutsol H.V.
AGROECOLOGICAL ASSESSMENT OF SOIL CONDITION OF KHMILNYTSKYI DISTRICT OF VINNYTSIA REGION 31

Каракулов Ф.А.
ОРГАНИЗАЦИЯ АВТОМАТИЗИРОВАННОГО МОНИТОРИНГА ДЛЯ РАСЧЕТА РЕЧНОГО СТОКА С ВОДОСБОРНОЙ ТЕРРИТОРИИ Р.ОКА 37
Karakulov F.A.
ORGANIZATION OF AUTOMATED MONITORING FOR CALCULATION OF THE RIVER RUNOFF FROM THE DRAINAGE TERRITORY OF THE R.OKA 37

Kalynka A., Kazmiruk L.
BREEDING A NEW POPULATION OF MEAT-BASED SIMMENTAL CATTLE IN THE CARPATHIAN REGION OF UKRAINE 41

Titarenko O.M.
THE STATE OF NATURAL FODDER MEADOWS OF THE EASTERN PODILLYA OF UKRAINE IN MODERN ECOLOGICAL CONDITIONS OF THE ENVIRONMENT....................49

AGRICULTURAL SCIENCES

Разанова Олена Петрівна
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ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ РІЗНИХ СПОСОБІВ БОРОТЬБИ З ВАРОАТОЗОМ БДЖІЛ

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EFFECTIVENESS OF APPLICATION OF DIFFERENT METHODS OF CONTROL OF BEE VAROATOSIS

Анотація.

У статті досліджено ефективність використання зоотехнічного та хімічного способів боротьби з варроатозом. Обробку бджіл проводили щавлевою кислотою та біпіном. Мінімальне ураження бджолиних сімей на початку активного сезону була у лютому місяці і складала у середньому 1,86%, максимум – у кінці даного сезону (вересень-жовтень) – у середньому 21,9%. Найбільша закліщеність спостерігалась у трутневому розплоді, починаючи з травня по серпень місяць (з 3,54 до 27,2%), бджолині сім'ї під час весняної ревізії були середньої сили, по 7,2-7,4 вуличок бджіл. Використання зоотехнічного способу боротьби з варроатозом бджіл призводить до зниження закліщеності до 1,6 % восени, за обробки щавлевою кислотою закліщеність бджіл у кінці сезону склала 0,5%, біпіном – 0,4%. Найефективнішою виявилась обробка бджіл біпіном – закліщеність з весни до осені знизилась на 2,8%. У травні місяці відмічено збільшення розвитку бджолиних сімей у другій групі на 14,3% і третій – на 4,8%; червні – на 8,2 і 11,8%; липні – на 11,4 і 14,1%, серпні – на 9,1 і 19,1% та вересні місяці – на 6,7 і 9,3% відповідно, порівняно з контролем. У сім'ях, де обробку від вароатозу проводили біпіном, медова продуктивність більша на 0,9 кг, або на 3,7% порівняно з обробкою щавлевою кислотою. Сім'ї, в яких проводилась обробка щавлевою кислотою (друга група), порівняно з третьою групою (обробка біпіном), принесли обніжжя на 2,2%, виробили воску – на 3,7% більше.

Abstract.

The article investigates the effectiveness of zootechnical and chemical methods of combating varroasis. Treatment of bees was performed with oxalic acid and bipin. The minimum number of bee colonies at the beginning of the active season was in February and averaged 1.86%, the maximum - at the end of this season (September-October) - an average of 21.9%. The greatest congestion was observed in the drone brood, from May to August (from 3.54 to 27.2%), bee families during the spring audit were of medium strength, 7.2-7.4 streets of bees. The use of a zootechnical method to control varroasis of bees leads to a decrease in infestation to 1.6% in autumn, with oxalic acid treatment the infestation of bees at the end of the season was 0.5%, bipin - 0.4%. Bipine treatment of bees proved to be the most effective - congestion decreased by 2.8% from spring to autumn. In May, there was an increase in the development of bee colonies in the second group by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. In families where treatment for varroasis was performed with bipin, honey productivity was higher by 0.9 kg, or 3.7% compared to treatment with oxalic acid. Families treated with oxalic acid (the second group), compared with the third group (treated with bipin), brought a drop of 2.2%, produced wax - 3.7% more.

Ключові слова: *вароатоз, закліщеність, біпін, зоотехнічний спосіб, щавлева кислота, продуктивність*

Keywords: *varroasis, congestion, bipin, zootechnical method, oxalic acid, productivity*

Introduction. Ukraine is one of the leading countries with developed beekeeping, producing 4-5% of the world's honey. The volume of honey production is directly affected by the number of bee colonies, which has decreased in recent years. In Ukraine, there are more than 400,000 beekeepers who keep more than 3 million bee colonies [18, 20].

In recent years, beekeepers have suffered significant losses due to the spread of diseases, and one of the obstacles to the development of beekeeping continues to be varroasis. Nowadays, bee disease is becoming more common, and in the absence of timely and proper treatment often lead to the death of bees. This disease is registered annually in almost all regions and is quite difficult to eradicate. The degree of infestation of bee colonies by the varroa mite in Ukraine is from 0.1 to 20%. The International Epizootic Bureau of Varroasis has included quarantine diseases of bees in list B. Therefore, the number and productivity of their bee colonies depends on how well beekeepers control the spread of varroasis in their apiaries [8].

Varroa is affected by larvae, pupae and adults of the bee family, which is caused by the parasitic mite Varroa jacobsoni. Infected bee colonies are the source of infection. The largest number of parasites is found on young bees and drones. The varroa mite is transmitted from one family to another by bees during theft, drones during flight, when healthy bees come into contact with sick honeybees, when the affected brood is moved to healthy families, near watering holes, and apiaries roam. During the active beekeeping period, the main place of concentration of the mite is located on the printed brood and beehives. Drone brood, compared to the brood of worker bees, is affected by 7-15 times more [4, 14].

Fig. 4. Mite on imago and drone brood

The parasitism of the mite on the bee pupa causes various disorders in its body. By parasitizing on adult bees, female mites cause them to weaken. In families affected by ticks, flight activity is reduced and, consequently, medical productivity is reduced. By parasitizing on bee brood, mites cause significant changes in its metamorphosis, due to which defective bees emerge from the cells. The greatest changes occur in the second period of development of the larval stage of the bee. Affected bees are much smaller in size and lighter in weight. Their body contains less protein and fat. Abdominal shrinkage and lack of wings in worker bees and drones are often observed [6, 9].

External signs of the disease in the bee family appear after 2-3 years of mite infestation and when more than 20% of bees are affected. A slight defeat by the varroa mite does not significantly weaken the strength of the family and significantly reduce its productivity [12]. With a strong invasion, especially in autumn, the brood is variegated, part of the caps over the printed brood failed, some holes in the caps of irregular shape, dead larvae and pupae are at different stages of decomposition, and putrefactive mass is easily removed from the cell. The infested bee family does not provide itself with food, weakens sharply and, as a result, dies, especially after the autumn replenishment of food supplies with sugar [4].

Winter sick bees do not form a club well, are restless, there are cases of defecation from feces inside the hive, they have an underdeveloped fat body. Severely affected by varroasis bees die during the winter or weaken rapidly [7].

The beekeeper can determine the affliction of apiaries with varroasis, as well as the effectiveness of the applied anti-varroasis drugs by controlling the rash of ticks. To have complete information on the infestation of bees with varroasis and the effectiveness of the veterinary drugs used, the beekeeper must control the tick rash in 20% of families in the apiary or in every 5th family. Determination of congestion should be performed three times a year. Ticks are counted for the first time in the winter, because part of the tick population dies in winter and falls to the bottom of the hive, which is clearly visible among other debris in the family. Undersea with beehive debris of each hive is sifted on a paper sheet through a sieve with holes of 3-4 mm. Then use a magnifying glass to count the number of dead females of the varroa mite. During the winter, the natural mortality among varroa mites is about 10-30%. If there are several ticks in the winter garbage, it is a low incidence of varroasis in the family, a few dozen - medium, a few hundred - strong.

The family is assessed for the second time in the summer after the main medical collection (late July-early August) after the control of the varroa mite. The degree of family infestation is assessed by calculating the average daily mite rash in the last two weeks of July. If the daily rash of dead ticks is five or more, it indicates a strong defeat of the family by varroasis. Therefore, the beekeeper should start anti-varroa treatments as soon as possible in the fall, because during this period there will be about 3-4 thousand ticks in the family. In families without brood, the average daily mite rash should not exceed 0.5 mites per day. If the tick rash is large, then antivaroatous treatments begin to perform immediately after the last pumping of honey. The third time the tick rash is controlled in late September [15].

Measures to control the pathogen, Varroa mite, are improving from year to year, but it has an extraordinary ability to adapt to most drugs used against it [3].

Many methods and means of combating varroasis have been developed in the world practice of beekeeping [16, 17]. To overcome varroasis, treatment should be comprehensive, using control methods so that they are effective and at the same time not harmful to humans and bees themselves. To control the varroa mite, beekeepers often use the zootechnical method, oxalic acid and bipin.

Zootechnical methods of control of varroa mite: use of building frames; formation of layers with closed brood; use of building frames with open drone brood; artificial swarms [2, 11].

By creating a breeding break in the family, the number of cells available for mite reproduction can be significantly affected. This break can be achieved by isolating or removing the uterus from the family for about 3 weeks. During this time, all the brood is born, so the mites move from the cells to adult bees. This approach alone or in combination with chemical treatment can affect the growth of the varroa mite population [21].

Varroa mites have a higher reproductive rate in the brood of drones than in the brood of worker bees, due to the longer period after sealing, which allows the mites to give birth in the cells of worker bees only 1.3-1.4 pieces. per cell, and 2.2-2.6 pcs. offspring in drone cells. In addition, the period of infection of drone brood is 40-50 hours, in the brood of worker bees - 15-30 hours [1].

In recent years, the most effective against varroa mites have been the treatment of bee colonies with chemicals in the barren autumn-winter period. At this time, the bee families finish growing the brood and the mite turns into bees. There are many of them, but the most popular against ticks are methods using acids (oxalic, lactic, formic), as well as drugs with different active ingredients [10, 13].

The fight against varroasis requires significant financial costs, which consist of organizational and economic, veterinary and zootechnical measures. The difficulty in combating varroasis is primarily that at all stages of development, some adult mites are in cells with sealed drone and bee brood [19]. At present, various foreign and domestic chemicals have been developed to control the varroa mite. However, only the integrated use of various drugs and zootechnical measures can successfully overcome varroasis in apiaries [13].

In connection with the above, the urgent task of beekeeping is the timely detection of the pathogen, as well as the organization of comprehensive measures to control the mite Varroa jacobsoni.

The aim of the research was to determine the impact of various measures to combat bee varroasis on the biological parameters of queen bees, the development of bee colonies and their productivity.

Material and methods of research. A study of the effectiveness of zootechnical biological methods and chemical acaricides in the control of bee varroasis was conducted on bee families of the Ukrainian steppe breed.

Experimental groups were formed by the method of analog groups. For the experiment at the end of March 2018, three groups of bee families were formed, 5 families in each. When forming groups of bee families, the following were taken into account: the strength of the family, the amount of fodder stocks, the number of printed brood and the number of bee colonies.

The study of the effectiveness of the use of comprehensive measures in the fight against varroasis of bees was carried out using generally accepted methods. According to the scheme of the experiment (Table 1) to control varroasis in bee colonies of the control group during the spring-summer period used a zootechnical method, for which the drone brood was removed every 12 days.

Table 1

The scheme of the experiment

Group	Number of families	Means to combat varroasis of bees
1- control	5	Zootechnical method
2 – experimental	5	Zootechnical method + oxalic acid
3- experimental	5	Zootechnical method + bipin

The bees of the family of the second experimental group, in addition to using a zootechnical method to control varroasis, were additionally treated with oxalic acid in two periods per season: after the spring audit (in the third decade of April) and after pumping honey of the main honey harvest (in the last decade of August). Because oxalic acid does not penetrate through the caps, it is most effective in periods without brood, which makes it useful in the early spring [10]. Oxalic acid was used at an ambient temperature of not less than 14 0C in the form of an aqueous solution. The solution was prepared at the rate of 20 g of pure crystalline acid per 1 liter of boiled water cooled to 36 0C. With the help of a sprayer "Rosinka" bees were sprayed on the hives, making sure that the solution does not fall on the open brood. To do this, the honeycombs were pushed to the width of two frames and the solution was directed from top to bottom, as well as to the bees that were on the walls and bottom of the hive. In April and August, the treatment was performed again after 7 days.

The bees of the family of the third experimental group after the end of honey collection and the release of the last brood were additionally treated with bipin 2 times in late October, after 7 days. Bipin was used as an aqueous suspension - one ampoule (1 ml of concentrate) was dissolved in two liters of clean water. The bees were sprayed with a syringe at the rate of 10 ml per bee street. During the spring-summer period, drone brood was regularly removed from bee colonies of the third experimental group every 12 days, similarly to families from the first and second groups.

In the experiments, before and after treatment, bees were sampled from each family and the level of entrapment was determined by the Petrov method. According to this method, 50-100 bees were placed in a glass jar filled with hot soap solution and stirred periodically for several minutes. After the bees floated to the surface and the mites settled to the bottom of the jars, the solution was carefully drained with the bees in each sample and the sediment was examined by counting the number of mites. Counting the number of bees and mites, determined the percentage of congestion. Clogging up to 2% was considered small, up to 4% - medium, more than 4% - strong.

The level of congestion was also determined in the brood. To do this, the lids of 100 cells with brood were cut with a heated sharp knife and examined the elongated larvae and cells. After removing the larva from the cell, counted the number of mites that are on it. During the examination, the number of mites that are directly in the cell was counted. Then the obtained data of brood larvae were summed with the data of adult bee infestation and the average value of bee colonies was determined.

For preliminary diagnosis of the presence of bee colonies for varroasis in the winter-spring period, after exposing the bees from the wintering ground and the first cleaning flight of bees, the presence of mites in samples of plague collected with wax caps and debris from the bottom of the hive.

The strength of bee colonies was determined by the number of streets occupied by bees at the end of March, during the spring audit of bees and at the end of October, during the autumn audit of bee colonies. It was assumed that the standard honeycomb size of 435x300 mm contains 250 g, or 2500 bees, which corresponds to one street. The outer parts of the extreme frames were taken as 0.5 streets. Multiplying the number of streets occupied by bees by the number of bees corresponding to one street determined the strength of the families.

The presence of brood in the nest was determined by two indicators: the number of frames on which the brood is placed and the absolute number of brood in the family per cell. The number of brood during the spring audit of bee colonies was determined using a frame-grid divided into squares of size 5x5 cm. One square of such a grid contains 100 bee or 75 drone cells. Determining the number of squares occupied by the brood, multiplied by the corresponding number of brood (100 or 75).

The yield of marketable honey was determined by the amount of honey pumped from each bee family during the beekeeping season.

Wax productivity of families was determined by the number of frames of rebuilt honeycombs based on honeycomb, which was substituted in bee families regularly, as they rebuilt [5].

Results and discussion. The conducted researches carried out the analysis of extensiveness of defeat of bee families by a varroa mite. Based on the data obtained, four related to the biology of the bee family during the development of the Varroa mite in bee colonies [14].

The first period, from March to May, was associated with the change of overwintering bees, new ones and the beginning of the increase in the number of bees in the families. During this period, the extensive infestation of families with the varroa mite did not exceed 3.27%, which is due to the natural death and rash of mites during the winter and spring.

The second period, from May to August, was characterized by an increase in the number of bees in the families and an increase in the extent of bee infestation by the varroa mite.

The third period (from August to October) was determined by the cessation of uterine oviposition and, accordingly, the growth of the family, the change of summer bees by young ones that go into winter, and the formation of a winter club. At the end of this period, there was a peak in the extent of bee infestation by the varroa mite, averaging 21.9%.

The fourth period - wintering (from October to March). This period was characterized by the absence of brood. Therefore, varroa mites did not reproduce and only female mites were present in the families.

The extent of adult invasion reached critical values during the formation of winter generation of bees (August-September) and therefore posed a threat to the viability of bee colonies in the autumn and family development in the spring of next season (Fig. 1).

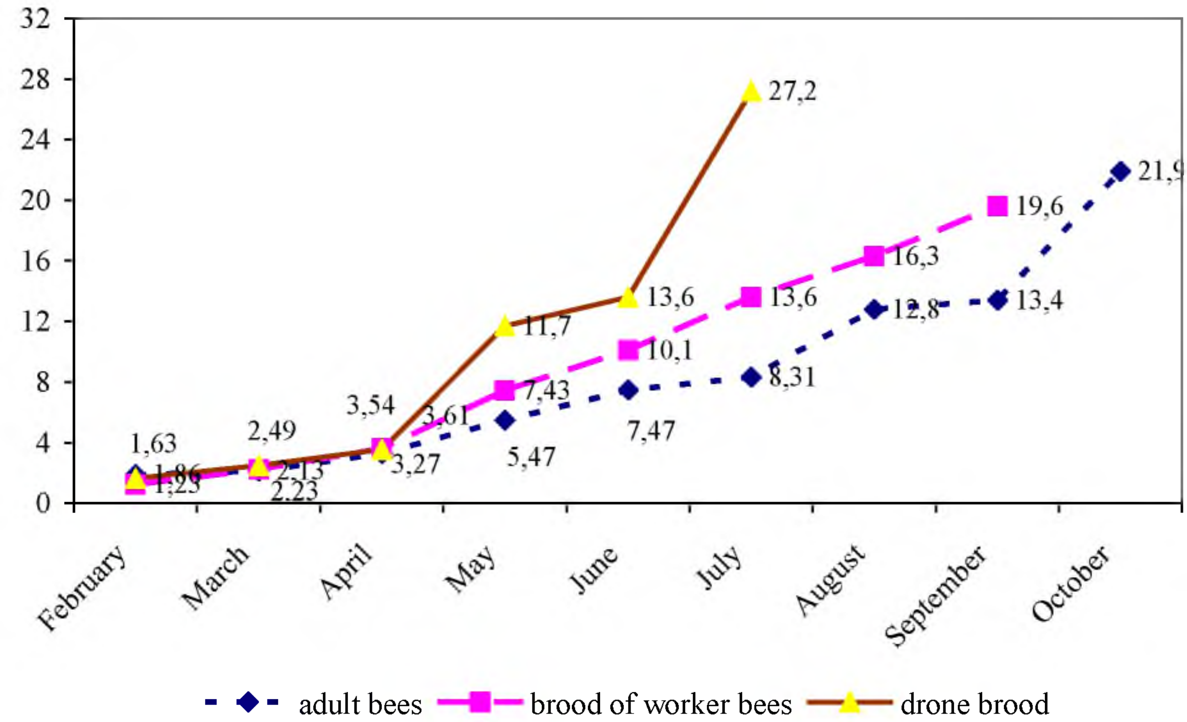

Fig. 1.
Dynamics of development of extensiveness of varroasis infestation in bee colonies during the active season,%

When studying the dynamics of development of varroasis, it was found that the minimum damage to bee colonies was in February and averaged 1.86%, the maximum - in late September-early October - an average of 21.9%.

Mass development of the Varroa mite occurs in the summer, which feeds and develops mainly on drone brood. The highest infestation was observed in drone brood from May (3.54%) to August (27.2%). Congestion of drone brood in March, compared with February, increased by 0.86 percentage points. Then in each subsequent place compared to the previous increase was as follows: in April - by 1.05 percentage points, in May - by 8.16 percentage points, in June - by 1.9 percentage points, in July - by 13 , 6 p.p. There have been no drone broods in families since August, so this figure has not been studied this month.

The congestion of brood of worker bees had a similar dynamics. At the beginning of the active season, this figure was almost on a par with the data of drone brood. Starting from April, the number of mites on brood of worker bees during the year increased (from 3.54% to 19.6% in September). However, the increase in the larvae of worker bees was gradual, in May - by 3.82 percentage points, in June - by 2.67 percentage points, in July - by 3.5 percentage points, in August - by 2.7 percentage points. .p., September - by 3.0 p.p.

Invasive disease varroasis in brood of worker bees developed less than in drone, but more than in adult bees. If at the beginning of the season in the first three months this figure was almost the same, then in the following months there was a noticeable difference in favor of brood of worker bees. This is due to the fact that in the summer months of the active season, the mite develops mainly on the drone brood. In May, the reduction in brood entanglement of worker bees was by 4.27 percentage points, in June - by 3.5 percentage points, in July - by 13.6 percentage points.

At the end of the active season, the uterus reduces egg-laying, ie the brood is smaller, and the mite increases in adults. And at the end of the active season (September) in bee colonies congestion is 21.9%, an increase over the previous month by 8.5 percentage points.

Determining the level of infestation of bee colonies with varroa mites is the most important component of measures to treat bees from varroasis. Mite infestation of more than 3% causes a significant departure of their bees. If bees are affected by ticks in autumn, more than 10% have no guarantee of their survival, even if the bees are treated with anti-varroa drugs. If in July the degree of mite infestation of bees is less than 1%, treatment against mites can be postponed until the fall, after pumping out the honey. If in the beginning of summer till October the defeat of bees by a tick in families makes 5-6%, their number increases depending on force of families. In particular, in weak families up to 28%, in strong - up to 20%, ie the number of mites increases 4-5 times over the summer.

Treatment of bees for varroasis involves primarily reducing the number of varroa mites to a safe level for bees. In our experiment conducted in the apiary of the farm in the beekeeping season of 2018, the fight against varroasis was carried out according to the scheme during the months of May-August (Table 2).

Table 2

Scheme of control of bee varroasis

Types of work	Months of the year																											
	I			II			III			IV			V			VI			VII			VIII			IX			X
	Decade																											
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
Rest period, hibernation of bees	■	■	■	■	■	■	■	■																				
Exhibition of bees from the wintering ground									■	■	■																	
Oxalic acid treatment (group 2)												■	■											■	■			
Stimulating feeding for bee growth												■	■															
Zootechnical control measures (1, 2, 3 groups)													■	■	■	■	■	■	■	■	■	■	■					
Bipin treatment (group 3)																												■

Treatment of bee colonies of the second experimental group with oxalic acid was carried out in two periods: spring and late summer, and the third experimental group (bipin treatment) - only in autumn. All groups of experimental families for their removal from the winter, according to the results of the spring audit, are characterized by the same indicators of strength, number of feed stocks, printed brood and the level of congestion (Table 3).

Table 3

Characteristics of experimental groups of bee colonies, group average

Group	Number of families, pieces	The strength of the family, the cells	Amount of feed, kg	Number of printed brood, pcs.	Clogging of bee colonies,%
1- control	5	7,4	6,7	830	3,1
2 – experimental	5	7,3	6,5	840	3,2
3- experimental	5	7,2	6,8	820	3,1

As can be seen from Table 4, bee families during the spring audit were of medium strength, 7.2-7.4 bee streets in each family, and had an average of 4 squares of 5x5 cm on each frame on two hives printed brood.

After the equalization period, on April 24, the second experimental group was treated with oxalic acid. This treatment was repeated after 7 days at a temperature of 14-15 0C. Before and after treatment of bee colonies, the degree of Varroa mite infestation was determined. The degree of infestation of bee colonies by the varroa mite for this period was average and amounted to 3.1-3.2% with an intensity of invasion of 1-2 specimens.

From May to the end of August, the following zootechnical measures to control varroasis were carried out in the apiary in all bee families according to the scheme:

- the use of wax frames, on which bees rebuild drone cells, and after sealing the drone brood removed it from the nest with mites every 12 days;
- the use of mesh subframes to catch mites, which fell from the bees to the bottom of the hive and rarely climbed back to the bees.

The intensity of the use of zootechnical and chemical agents to combat varroasis can be judged from the data in table 4.

Table 4

Degree of defeat of bee families,%

Group	The degree of damage to bees Varroa J.,%				± before the start of the season,%
	Date of examination				
	31 March	24 April	6 September	18 October	
1- control	3,1	3,1	1,7	1,6	-1,5
2 - experimental	3,2	1,2	1,8	0,5	-2,7
3- experimental	3,2	3,2	1,7	0,4	-2,8

During the summer, the number of mites in bee colonies does not decrease, and they focus mainly on drone brood, so it was removed from the hives of all three groups every 12 days. This zootechnical measure restrained the growth of congestion.

These tables show that the use of only a zootechnical method to control varroasis of bees in the first control group leads to a reduction in congestion by almost half (from 3.1% in spring to 1.6% in autumn). However, the zootechnical method is not effective enough to remain the only means of controlling varroa mites. The use of chemicals to combat invasive disease in the experimental groups had a significant effect on reducing bee infestation. Thus, the treatment of bees of the second experimental group with oxalic acid had a positive effect on their recovery. The infestation of these bees at the end of the beekeeping season was only 0.5%, which is 2.7% less than the initial infestation rate (at the end of March).

Treatment of bee colonies of the second experimental group with oxalic acid (2 times in spring and 2 times in autumn) significantly reduced the rate of congestion. Immediately after treatment of families with this drug in the spring congestion decreased to a minimum (from 3.2 to 1.2%), but in the process of development of bee colonies congestion increased again and on September 5 amounted to 1.8%, and after autumn treatment with oxalic acid decreased again and amounted to 0.5%.

The treatment of bees of the third experimental group with bipin in the beginning of October proved to be the most effective. As a result of treatment with this drug, the congestion decreased by 2.8% compared to the spring period.

Thus, due to the use of chemicals to combat varroasis by the end of the beekeeping season it was possible to reduce the rate of congestion to 0.4-0.5% against 1.6% using only zootechnical control measures.

Thus, as a result of the use of various means of combating varroasis in the complex (zootechnical + chemical) gives a relatively better effect than the use of only zootechnical means.

However, it should not be forgotten that chemicals to some extent affect the health of bees and the quality of bee products. Therefore, with such a relatively low congestion of families in the spring, you can avoid treating them with chemicals during this period (Table 5).

Table 5

Changing the enclosure of bee colonies as a result of the use of chemicals (autumn treatment)

Group of bee families	The name of the drug used to treat bees	Clogging,%	
		before processing	after processing
2 – experimental	Oxalic acid	1,8	0,5
3- experimental	Bipin	1,7	0,4

It is better during the spring-summer period to regularly, every 12 days, remove drone brood and treat families in the fall with bipin or oxalic acid.

During the beekeeping season, the rate of increase in the strength of bee colonies of different groups was not the same and almost did not depend on the means of combating varroasis, and varied greatly from period to year (Table 6).

Table 6

Changes in the strength of experimental families during the beekeeping season

Date of observation	Number of honeycombs occupied by bees			Number of bees, thousands		
	group of bee families			group of bee families		
	1	2	3	1	2	3
31 March	7,4	7,3	7,2	18,5	18,3	18,0
24 April	6,5	6,5	6,4	16,4	16,4	16,0
15 May	10,5	12	11	26,3	30,0	27,5
16 June	17,0	18,4	19	42,5	46,0	47,5
15 July	18,4	20,5	21	46,0	51,3	52,5
20 August	11	12	13,1	27,5	30,0	32,8
11 September	7,5	8,0	8,2	18,8	20,0	20,5

The production of brood in bee colonies is best determined during the beekeeping season by the strength of the family, ie by the number of streets well populated by bees. The data of the obtained researches show that the development of experimental families of all groups during the season took place in comparison with the same intensity. In the development of bee colonies, there was a general pattern inherent in the biological properties of bees: after the winter, the strength of the family decreases slightly, then increases, and before the onset of wintering decreases again.

Additional treatment of bee colonies of experimental groups with chemical acaricides against varroasis somewhat affected their development. During the treatment of bees with chemical acaricides, the number of bees in the experimental families was higher since May. In May, the increase in the second group by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. Because additional treatment of bee colonies with oxalic acid and bipin chemicals had a greater effect on varroa mite shedding than only the biological method of removing drone brood, this contributed to better development of bee colonies in the experimental groups.

The various measures to control varroasis used in the experimental apiary during the study period significantly affected the productivity of bee colonies (Table 7).

Table 7

Productivity of bee colonies, on average per 1 family

Month active season	Group		
	1-control	2-experimental	3-experimental
Production of marketable honey, kg	21,5±0,18	23,3±0,47	24,2±0,25
Rebuilt honeycombs, pieces	7,1±0,08	7,6±0,12	7,3±0,14
Produced wax, kg	1,2±0,02	1,4±0,01	1,33±0,02

The highest rates of honey productivity of bee families were in the third group, where per bee family per season received honey by 2.7 kg, or 12.6% more. In the second group, bee colonies produced 1.8 kg, or 8.4% more honey than in the control, but compared to the third group, less than 0.9 kg, or 3.7%.

The bees of the experimental families produced more wax during the reconstruction of the hives. The second experimental group was the best in terms of the number of reconstructed cells. Thus, the advantage in this group was 0.5 pcs. honeycombs more per bee family, or 7.0% compared to the control. When comparing the studied indicator between the experimental groups, the bees of the second group, compared with the third, rebuilt by 0.3 pieces, or 4.1% more honeycombs.

The wax capacity of bees of the second group was higher by 16.6%, the third - by 10.8% against the same indicator of the first group. The advantage between the experimental groups was the second - by 5.3%.

In May, almost the same amount of protein feed was collected from the bee families of the experimental groups - 115.5-118.3 g, in June the indicators already differed between the groups. Thus, the bees of the second group collected 6.8 g, or 6.4% more bee pollen, in June the difference was more significant, in the second group more by 18.8 g, or 17.7%, the third - by 9, 4 g, or 8.9% (Fig. 2).

During the experimental period (from May to July) from bee families of experimental groups collected a larger amount of bee pollen, namely, in the second group 354.6 g, which is 27.2 g, or 8.3%, the third - 347.1 g, which is 19.7 g, or 6.0% more than the first control (327.4 g).

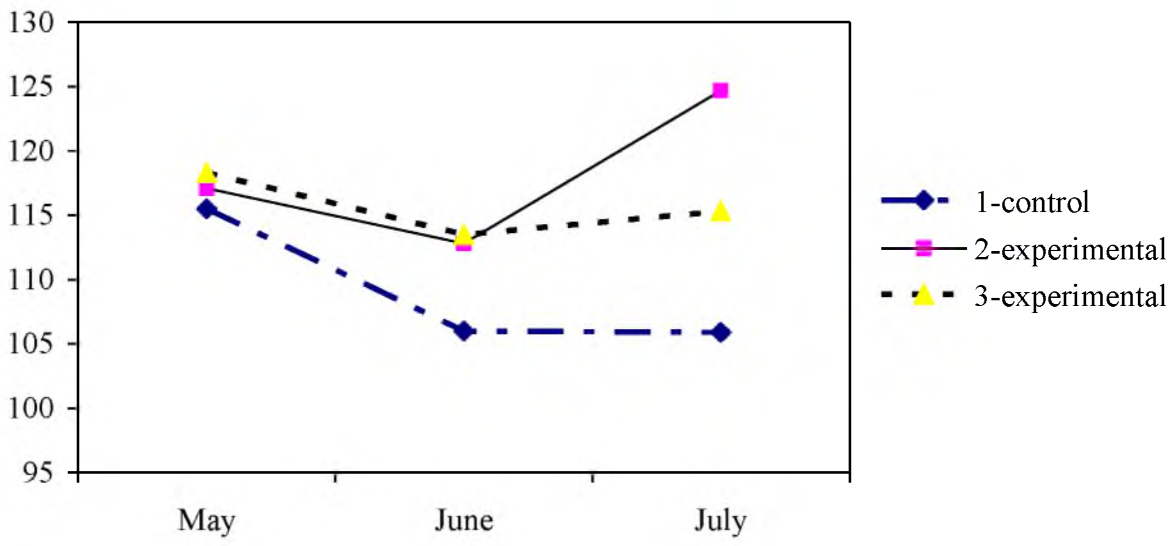

Fig.2. Monthly collection of pollen bees, g

Families treated with oxalic acid (group 2) compared to the third group (bipin treatment) brought 7.5 g, or 2.2% more pollen, into the nest (Fig. 2).

Thus, analyzing the productivity of bee colonies, it can be stated that the congestion of bee colonies from spring to autumn with different methods of treatment against varroasis significantly affected their honey and wax productivity and collection of pollen.

Conclusions. The minimum number of bee colonies in February was 1.86%, and the maximum in late September and early October was 21.9%. The largest congestion in the drone brood, from May to August (from 3.54 to 27.2%). The use of a zootechnical method to control bee varroasis leads to a decrease in congestion by 1.5, with treatments with oxalic acid - 2.7 and bipin - by 2.8%. In May, the development of bee colonies in the second group increased by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. During the season, honey was obtained in the second group by 12.6%, the third - by 8.4% more honey compared to the first group, which did not treat bees with chemical acaricides. From bee families of the second group more pollination was collected, in comparison with control, by 8,3%, the third - by 6,0%. Wax secretion in families of the second group was higher by 16.6%, the third - by 10.8%.

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МОЛОЧНАЯ ПРОДУКТИВНОСТЬ КОРОВ РАЗНЫХ ПОРОД

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DAIRY PRODUCTIVITY OF COWS OF DIFFERENT BREEDS

Аннотация.
В статье показана эффективность молочной продуктивности разных пород коров. Рассматривается влияние внешних характеристик на продуктивность.
Abstract.
The article shows the effectiveness of milk production of different breeds of cows. The influence of external characteristics on productivity is considered.

Ключевые слова: *продуктивность, скот, молочность, выращиваемость, генофонд, климат, коровы.*
Keywords: *productivity, livestock, milk production, rearing, gene pool, climate, cows.*

Айрширская порода коров. Получила свое название в честь региона, где ее начали разводить, – Эйршир, Шотландия, где ее успешно выращивают и сегодня. Выведена при помощи длительного улучшения видов местного скота с последующим скрещиванием с несколькими породами КРС – голландской, гернсейской, девонской и геренфордской породами. Самостоятельной породой Айширская объявлена в 1862 году. Этот КРС предпочитают суровый климат жаркому – потому широко распространен в Канаде, США, Финляндии, а также в Северо-Западном и Центральном округах России, занимающей второе место по наличию популяции, а самая большая общая численность айрширов имеется в Финляндии. Тем не менее, разводят таких коров и в Австралии [1]. Голштинская или голштино-фризская порода коров. Самый распространенный вид КРС в мире. Впервые появилась на территории Нидерландов. Была ввезена в Северную Америку в 1852 году, затем для повышения молочной продуктивности была скрещена с немецким крупным рогатым скотом. В США и Канаде буренок совершенствовали в основном по величине удоя и живому весу при несильном отборе по жирномолочности. Долгое время носила название голштино-фризской в связи со слиянием Ассоциаций заводчиков соответствующих видов. Затем, в 1983 году, ее название сократили до нынешнего – голштинская. В России появилась в 1956 году: здесь разводят преимущественно черно-пестрых коров этого направления, однако, есть и пестро-красные. Их получили при помощи скрещивания голштинских быков с коровами симментальской породы [2].

Джерсейская порода коров. Считается одной из самых старых и жирномолочных культурных разновидностей. Получила свое имя в честь одного из Нормандских островов – Джерси, где ее начали разводить как племенной скот, используя генетический материал нормандского и британского КРС. Долго сохраняла свою чистокровность в связи с запретом властей на экспорт племенного скота. Племенную книгу джерсейской породы завели в 1866 году. За пределы своей родины джерсейские животные были впервые вывезены только в начале XIX века: сначала – в Англию и США, а позже – в Австралию, Африку и Новую Зеландию, где живут и сегодня. Помимо этого, широкое распространение получили в Дании, Канаде и Франции, а также в Воронежской и Московской областях России. Черно-пестрая порода коров. Советский крупный рогатый скот молочного направления и высокой, в том числе мясной, продуктивности. Имеет характерный окрас, за что и получила свое название. Иногда ее ошибочно отождествляют с голштинской породой. В начале 1930-х годов животные черно-пестрого окраса завозились в СССР из Германии и стран Прибалтики. Также эту породу получали путем скрещивания местных коров с быками, поставляемыми из Нидерландов, а окончательно ее утвердили в 1959 году после дифференциации животных с красным окрасом. К концу 1970-х годов численность животных черно-пестрого окраса превысила 10 млн голов [3]. Симментальская порода коров. Этот КРС считается одним из самых древних в мире. В V веке его генетических предков привезли на территорию Швейцарии, затем скот постоянно совершенствовался вплоть до второй половины XX века. Животные хорошо приспособлены к акклиматизации, вследствие чего получили широкое распространение во всем мире. Впоследствии уже ее генетический материал использовался для получения многих других пород – болгарской красной, венгерской пестрой, словацкой красно-пестррой, сычевской, монбельярдской, французской симментальской, флекфи, и других. В России известна с

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