УДК: 638.139
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THE IMPACT OF CHOLINE CHLORIDE BIOSTIMULANT ON DEVELOPMENT AND PRODUCTIVITY OF BEE FAMILIES

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Abstract. Nowadays, considerable attention is dedicated to the search for new biostimulants intended to accelerate the growth of bee families during spring period and increase their productivity. The aim of our research was to study the impact of choline chloride biostimulant on the development

and honey production of bee families. Feeding bees with a mixture of syrup in concentration of 1:1 and 1.25-3.25 ml/l biostimulant, amounting to 1.0 liter of the mixture per bee family every 7 days from March to the main honey collection, increased strength by 4.12-17.65%, the brood rearing by 17.48-43.98% and honey productivity by 22.88% during the spring period.

Keywords: Bee families, biostimulant, sugar syrup, morphoproductive indices.

Introduction

The honeybee family supplies its own feed, as opposed to other farm animals. It collects, processes, preserves it, and also generates the necessary reserves during the active period of life in the form of honey and perga[4].

Bees should be fed additionally in cases of insufficient forage supply during preparation for the winter period and stimulate the growth of families where there is no sustaining harvesting in spring [1].

Bees are fed with 50% sugar syrup (1 kg of sugar per one liter of water) to encourage brood formation in spring [5]. The downside of this method is that it exhausts bees and shortens their lifespan.

The research has shown that the "Apipro"probiotic additive in sugar syrup contributes to more effective stimulation of the queen bees' oviposition, increasing the number of brood, building up bee families for the main honey harvest and increasing their honey and wax productivity [9].

Every year 20-30% of bee families are reduced during the winter period, and they are noticeably weakened by the beginning of spring. Increasing pollution and unfavorable environmental factors lead to a decrease in the immune defense of bees. It is necessary to stimulate the oviposition process of the queen bees by using a variety of nutrients in order to ensure a sufficient number of worker bees by the time of mass honey collection [3].

The supplementation of bees during spring period with sugar syrup containing steviosides promotes the development of family strength, increases the egg-laying capacity of queen bees and the productivity of bee families in the absence of a supporting honey harvest [2].

Nowadays, considerable attention is dedicated to the search for new biostimulants intended to accelerate the growth of bee families during spring period and increase their productivity.

The aim of our research was to study the impact of the MF-SIP-56 biostimulant on the development and honey productivity of bee families.

Materials and methods

The research object was presented by the Carpathian bee families from the apiary of Ulmu village, Yaloven district.

There were 4 groups of bee families, three in each group to carry out the experiment. The first group of bee families were fed with sugar syrup mixed with chloride choline biostimulant - 1.25 ml/l, the second group received 2.25 ml/l, the third group - 3.25 ml/l, and the fourth group - pure sugar syrup (control). Every 7 days bee families were fed one liter of sugar syrup at a concentration of 1:1, mixed with a biostimulant in the spring period during the absence of a supporting honey harvest.

The feeding of bees was carried out on 26.03.2023; 3.04.2023; 9.04.2023; 17.04.2023 23.04.2023; 30.04.2023; 7.05.2023 and 14.05.2023.

The bee families were examined before feeding on 26.03.2023, at the beginning of white acacia blooming (21.05.2023) and at the end of blooming before the honey harvest (10.06.2023).

The number of honeycombs, bee family strength, number of brood and honey production were studied among experimental groups. The obtained results were processed by the variation statistics method [6] and using a software program.

Research results.

The carried out control study of experimental group of bee families showed that the nest had 4.67-5.67 honeycombs on average, 3.67-4.67 hives, the number of brood was equal to 27.33-28.33 bee space and 2.67 kg of honey stock before the spring feeding (26.03.2023) (Table 1).

The variation coefficient of morphoproductive indices ranged from 12.37% (number of honeycombs) to 53.29% (bee family strength).

Stimulative feeding has resulted in the growth and development of bee families in spring without a supporting honey harvest in April.

Table 1. Morphoproductive indices of bee families at the beginning of the study, 26.03.2023

Group	Indices	Numberofh oneycombs, pcs.	Bee family strength, bee space.	Number of brood, sq. m.	Honeyreser ve, kg
I. Sugar syrup + choline chloride, 1,25 ml/l	$\bar{x} \pm S\bar{x}$	5,67±0,882	4,67±0,882	28,33±7,265	2,67±0,667
	V,%	26,96	32,73	44,41	43,30
II. Sugar syrup + choline chloride, 2,25 ml/l	$\bar{x} \pm S\bar{x}$	5,67±1,667	4,33±1,333	27,67±5,487	2,67±0,667
	V,%	50,94	53,29	34,77	43,30
III. Sugar syrup + choline chloride, 3,25 ml/l	$\bar{x} \pm S\bar{x}$	4,67±0,667	3,67±0,667	27,33±5,487	2,67±0,333
	V,%	24,74	31,49	34,77	21,65
IV. CONTROL (PURE SUGAR SYRUP)	$\bar{x} \pm S\bar{x}$	4,67±0,333	3,67±0,333	28,33±2,028	2,67±0,333
	V,%	12,37	15,75	12,39	21,65

It was found that the number of honeycombs in the nest of bee families increased to an average of 14.7-16.7 pieces and had the strength of 11.3-14.7 bee spaces, the number of brood was equal to 117.0-137.7 square meters and the honey reserve was 5.0-6.0 kg resulting from the control study before the beginning of white acacia blooming on the 21.05.2023(Table 2).

Bee families of the second and third experimental group produced on average 5.58% and 14.75% more brood than families of the IV experimental group.

It was identified that bee families of experimental group produced an average of 20-21.3 honeycombs or 3.63-10.36% higher than the control group and 17.7-20.0 hives or 4.12-17.65% more than the control group after white acacia honey crop collection on June 10, 2023(Table 3).

Table 2. Morphoproductive indices of bee families before the blossoming of white acacia, 21.05.2023

Group	Indices	Numberofh oneycombs, pcs.	Bee family strength, bee space.	Number of brood, sq. m.	Honeyreser ve, kg
I. Sugar syrup + choline chloride, 1,25 ml/l	$\bar{x} \pm S\bar{x}$	16,0±1,528	13,0±1,00	117,0±4,359	5,7±0,333
	V,%	16,54	13,32	6,45	10,19
II. Sugar syrup + choline chloride, 2,25 ml/l	$\bar{x} \pm S\bar{x}$	15,3±2,404	14,3±2,404	137,7±38,559	6,0±0,577
	V,%	27,15	29,05	48,51	16,67
III. Sugar syrup + choline chloride, 3,25 ml/l	$\bar{x} \pm S\bar{x}$	16,7±2,848	14,7±2,404	126,7±6,009	5,3±0,577
	V,%	29,60	28,39	8,22	10,82
IV.CONTROL (PURE SUGAR SYRUP)	$\bar{x} \pm S\bar{x}$	14,7±0,667	11,3±0,667	120,0±6,807	5,0±0,00
	V,%	7,87	10,19	9,82	0,00

Bee families of the II and III groups produced the largest amount of brood equal to 148.3 and 145.3 square meters or 43.98% and 41.07% more than the control group. Fertility of the queen bees amounted to 1236 and 1211 eggs within 24 hours, while it totaled 846 eggs in the control group.

Spring supplementation increased the fertility of queen bees and brood raising by 17.48-43.98% which is higher than the control group.

The largest amount of honey was collected by bee families of the II experimental group equaled 37.6 kg or 7.0 kg higher than the control group.

Thereby, stimulating feeding of bee families with a mixture of 50% sugar syrup and biostimulant increased honey production by 22.88%.

It was found that bee families of experimental groups exceeded the control group at the completion of the second collection of linden honey by 5.26-12.11% in honeycomb number, 1.87-10.62% in strength, 27.12-41.86% in brood and 0.55-16.57% in honey production.

Table 3. Morphoproductive indices of bee families beforeacaciahoneyextraction, 10.06.2023

Group	Indices	Numberofhoneycombs, pcs.	Bee family strength, bee space.	Number of brood, sq. m.	Honeyreserve, kg
I. Sugar syrup + choline chloride, 1,25 ml/l	$\bar{X} \pm S\bar{x}$	21,0±0,577	17,7±0,333	121,0±14,00	29,7±0,578
	V,%	4,76	3,27	16,36	3,38
II. Sugar syrup + choline chloride, 2,25 ml/l	$\bar{X} \pm S\bar{x}$	21,3±1,333	20,0±1,00	148,3±12,574	37,6±4,247
	V,%	10,82	8,66	14,68	19,58
III. Sugar syrup + choline chloride, 3,25 ml/l	$\bar{X} \pm S\bar{x}$	20,0±0,577	18,0±1,528	145,3±7,839	32,0±7,529
	V,%	5,00	14,70	9,34	40,750
IV.CONTROL (PURE SUGAR SYRUP)	$\bar{X} \pm S\bar{x}$	19,3±0,667	17,0±0,577	103,0±2,517	30,6±1,617
	V,%	5,97	5,88	4,23	9,15

It was found that bee families of the experimental groups collected on average 47.8-57.7 kg of honey from two honey harvests during the season. The highest amount of honey was obtained from the II group that was equal to 58.7 kg with a variation from 49.1 to 58.1 kg or 20.53% higher than the control group (Table 4).

Table 4. Amount of harvested honey from white acacia and linden trees, kg

Group	Amountofharvestedhoney	V,%	Limits (min. – max.)
I.Sugar syrup + choline chloride, 1,25 ml/l	47,8 ± 0,967	3,50	45,9 – 48,8
II. Sugar syrup + choline chloride, 2,25 ml/l	58,7 ± 5,580	16,46	49,4 – 58,1
III. Sugar syrup + choline chloride, 3,25 ml/l	48,8 ± 7,338	26,05	36,4 – 61,8
IV. CONTROL (PURE SUGAR SYRUP)	48,7 ± 3,180	11,31	42,4 – 52,6

Thus, spring feeding of bee families with a mixture of syrup at a concentration of 1:1 and 0.75-2.5 ml/l biostimulant, in a quantity of 1.0 l of mixture per family every 7 days from March to the main honey collection increases the strength of bee families, the number of brood and honey production.

The work was financially supported by the Applied Research Project *Hybrid materials functioned with carboxyl groups, based on plant metabolites with activity against human pathogens and agricultural pests No. 20.80009.5007.17* of the National Agency for Research and Development of the Republic of Moldova.

CONCLUSION

Spring feeding of bees with a mixture of sugar syrup at a concentration of 1:1 and 1.25-3.25 ml/l choline chloride biostimulant, in a quantity of 1.0 l of the mixture per bee family every 7 days

from March to the main honey collection, increased the strength by 4.12-17.65%, brood rearing by 17.48-43.98% and honey production by 22.88%.

List of references:

1. Eremia, N. Apicultura. Chişinău, Ediţia a II. Tipogr. „Print-Caro", 2020, 455 p. ISBN 978-9975-56-754-1.
2. Eremia N., Macaev, F., Pogrebnoi, S., Znagovan, A., Neicovcena, I., Coşeleva, O., Sarî, N., JEREGHI, V. Procedeu de hrănire a albinelor. Brevet de invenție de scurtădurată. Chișinău, MD 1607 Z 2022.10.31. BIOPI nr. 3/2022.
3. Gupta, D., Chauhan, H., Gupta, R. Effect of Colony Collapse Disorder on Honeybees. JournalofComputationalandTheoreticalNanoscience. 2019, v. 16, nr. 10.
4. Красочко, П., Еремия, Н.Продукты пчеловодства: свойства, получение, применение. Монография. 2-ое изд. перераб. и доп. Кишинэу-Витебск. „Print-Caro", 2022. 723 с. ISBN 978-9975-164-76-4.
5. 5. Кривцов, Н.И., Лебедев, В.И., Туников, Г.М. Пчеловодство. Москва, Колос, 2000, с. 192-200.
6. Меркурьева, Е.К. Биометрия в селекции и генетике сельскохозяйственных животных, М: Колос, 1970. 312 с.
7. Тронина, А.С., Воробьева, С.Л., Колбина, Л.М., Мануров, И.М., Васильева, М.И. Влияние пробиотиковСпасипчел и ПчелоНормоСил на продуктивные показатели пчелиных семей. В: Пчеловодство, 2020, № 2, с. 18-20. ISSN 0369-8629.
8. Тронина, А.С., Воробьева, С.Л., Юдин, В.М., Васильева, М.И. Влияние бактерий рода BacillusSubtilis на пчелиные семьи. В: Пчеловодство, 2022, № 5, с. 12-14. ISSN 0369-8629.
9. Щепеткова, А.Г., Лщйко, И.М., Скудная, Т.М., Халько, Н.В., Кричевцова, А.Н., Лепеев, С.О. Эффективность пробиотической кормовой добавки апипро в пчеловодстве. В: Пчеловодство 2021, № 2, с. 14-17. ISSN 0369-8629.