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DAILY FLIGHT ACTIVITY OF BEES IN THE EXPERIMENTAL GROUPS

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Abstract
The article examines the daily flight activity, speed, and return to the hive with pollen and nectar of Carpathian bee colonies fed with soy milk for 3 minutes during spring, summer, and autumn seasons, and draws relevant conclusions.

Keywords: Mother bee, soybean milk, flight activity, pollen, nectar, flight speed, migration.

Introduction

Recently, due to the limited cultivation of nectar-bearing plants and environmental pollution with harmful chemicals, it has become increasingly difficult to provide bee colonies with protein food. Bees experience a food shortage in early spring. During this period, the flowering of honey plants and weather conditions do not always allow bees to fly out of the hive. In this case, the protein feed reserve quickly depletes, which leads to a delay in the growth and development of bee colonies [1, 2].

Due to the rapid development of bees from colonies where 30-40 ml of protein supplements were added to their feed, early queen bees are being bred from them [3], and even large-scale bee packages are being produced from them, which are being sold to neighboring Kazakhstan and Russia, generating substantial income.

Delaplan et al. observed food-seeking activity in bees fed feed enriched with soy milk [4]. It has been determined that soy milk or feed with soy flour provides more energy for bees to take out and bring pollen.

The productivity of a bee colony is strongly dependent on the amount of nectar and pollen brought to their hive daily. This is closely related to the flight activity of bees during the day, entering and exiting the hive. Data on the daily flight activity and flight speed of bees of different breeds, their influence on the productivity of the family have been studied by many authors in their research.

In our research conducted in the conditions of the Fergana region, we also studied the daily flight activity and its speed during the day of bees of the Carpathian breed.

Location and Methods of Research

Research was conducted in 2022-2023 at the Beekeeping Center of the Fergana State University and the Hungarian University of Agriculture and Life Sciences. The farm has all the conditions for conducting research work. The study was conducted in experimental groups of carpathian bee colonies with 20 ml, 30 ml, and 40 ml of soy milk. In the bee colonies of the experimental groups, every 3 minutes and every day at 630, 900, 1200, 1500, and 1800, we counted the number of bees flying out of the hive and bringing pollen to their hive on their legs according to the method

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described by Thomas D. Selei [5].

In our research work, bee colonies of the control group participated, in which no additives were added to the bee feed, and in the experimental group I, the addition of 20 ml of soy milk was added to 250 ml of sugar syrup, in the experimental group II, the addition of 30 ml of soy milk, and in the experimental group III, the addition of 40 ml of soy milk. We conducted control work in bee colonies of all groups based on pre-established general methods.

Our research work, conducted in all experimental groups at the beginning of 2022, showed that they did not differ from each other in the following indicators, namely, the number of open and closed bee colonies in the hive, feed reserves, the tendency to divide, and the strength of the colony, as well as the degree of varroa infection. During the study period, growth and development were recorded at the same level in all experimental groups.

For this purpose, we studied the flight activity of bees in all three groups in the spring, summer, and autumn seasons of 2022-2023 for 3 minutes. Data on this are presented in Table 1 below.

At the same time, in bee colonies of different breeds, the number of bees that returned to their hive within 3 minutes and carried pollen on their hips was also counted. The more pollen is brought into the family, the faster the family develops, because the pollen is rich in protein, which quickly influences the family's development.

In spring, in the control group, the number of bees that brought pollen to the hive at ^{630} was 8 units, at ^{900} - 28 units, at ^{1200} - 50 units, at ^{1500} - 48 units, and at ^{1800} - 20 units. Similarly, in the I experimental group - 5, 24, 48, 52, and 18 units, respectively, in the II experimental group 9, 25, 55, 48, and 15 units, and in the III experimental group - 10, 31, 59, 55, and 21 units.

It is noteworthy that the bees of experimental group III not only increased their flight activity during the day, but also accelerated their flight activity at any location. For example, at 9^{00} in the morning, their return to the nest was 129.1% more than in experimental group I and 124% more than in experimental group II (P>0.99).

As can be seen from the data in Table 1, the flight of bees in the experimental groups was very active and harmonious. At 6^{30} in the morning, the flight activity of bees in the control group was 10.1 units, which is the same indicator.

9.8 in the I experimental group, 11.3 in the II experimental group, and 14.4 in the III experimental group.

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Table 1 Flying activity of bees in the experimental groups within 3 minutes (2022-2023).

Carpathian bee breeds	Departure, hours					Pollen return, h					Average flight during the season
	$6.^{30}$ X±Sx	$9.^{00}$ X±Sx	$12.^{00}$ X±Sx	$15.^{00}$ X±Sx	$18.^{00}$ X±Sx	$6.^{30}$ X±Sx	$9.^{00}$ X±Sx	$12.^{00}$ X±Sx	$15.^{00}$ X±Sx	$18.^{00}$ X±Sx	
	In spring										
Control	10.1±0.7	31.9±0.5	56.4±0.10	60.1±0.24	41.4±0.3	8±0.01	28±0.5	50±0.10	48±0.8	20±0.4	167.9
Experiment I	9.8±0.8	30.1±0.10	48.5±0.15	66.4±0.19	40.1±0.5	5±0.5	24±0.8	48±0.11	52±0.9*	18±0.9	194.9
Experiment II	11.3±0.4	29.0±0.11	60.1±0.18	66.5±0.14	41.5±0.7	9±0.8	25±0.8	55±0.18	48±0.5	15±0.3	205.4
Experiment III	14.4±0.6	38.4±0.9	69.3±0.11	71.1±0.20	48.1±0.8	10±0.9*	31±0.9**	59±0.21	55±0.5	21±0.8	191.3
	In summer										
Control	15.1±0.4	38.4±0.8	59.1±0.8	63.5±0.4	40.8±0.8	10±0.8	29±0.1	37±0.5	38±0.7	18±0.15	211.9
Experiment I	14.4±0.9	37.8±0.9	61.4±0.5	68.8±0.8	38.5±0.9	11±0.7	31±0.4	36±0.8	35±0.8	14±0.18	220.9
Experiment II	19.3±0.8	38.1±0.4	65.4±0.8	67.4±0.1	41.7±0.10	15±0.8	35±0.8	48±0.11	42±0.5	20±0.17	231.9
Experiment III	24.1±0.8***	42.4±0.6	71.4±0.5	72.4±0.5	45.5±0.7	18±0.9	35±0.4	49±0.12	51±0.15	21±0.20	255.8
	Autumn										
Control	13.1±0.8	31.5±0.8	50.1±0.8	52.1±0.4	21.1±0.15	5±0.8	15±0.1	21±0.7	20±0.1	10±0.5	160.8
Experiment I	12.4±0.5	30.4±0.9	48.4±0.9	50.4±0.5	20.5±0.9	7±0.9	14±0.7	20±0.9	21±0.2	8±0.6	171.1
Experiment II	18.1±0.5	32.1±0.10	51.5±0.8	50.4±0.1	18.4±0.10	10±0.7	17±0.8	25±0.5	22±0.4**	11±0.7	179.5
Experiment III	21.4±0.8***	35.1±0.11	52.1±0.7	52.2±0.5	21.5±0.8	11±0.10	21±0.4	27±0.5***	23±0.5	15±0.8	182.6

Note: *P>0.95; **P>0.99; ***P>0.999

This indicator in the III experimental group was 4.3 more than in the control group, or this indicator was 142.6%. Similarly, in summer, the flight of bees in the control group in a 3-minute period at 6^{30} hours was 15.1 units, while in experimental group I this indicator was 15.1 units. 14.4 pcs., in the II experimental group 19.3 pcs., and in the III experimental group 24.1 pcs. This indicator in the III experimental group was 9 more than in the control group, or 159.6% (P>0.999).

Also, in autumn, at 630 hours, the number of bees in the control group flew out of the bee colony every 3 minutes and amounted to 13.1 units, while in the I experimental group this indicator was 12.4, in the II experimental group - 18.1, and in the III experimental group - 21.4 units, or this is higher than in the control group. 8.3 more, which is 163.3% (P>0.999).

Along with this, we also counted the number of bees in Carpathian bee colonies that returned to their hive and brought pollen on their hips within 3 minutes. The more pollen is brought into the family, the faster the family grows, because the pollen is rich in protein, which quickly affects the family's development.

Similarly, in summer, the amount of pollen brought by bees increased proportionally, and in autumn, the amount of pollen brought by bees decreased significantly. This indicates a significant decrease in the number of flowering plants in field conditions by autumn.

Conclusion

In a bee colony fed with soy milk, the influence on the growth and development of worker, queen, and drone bees from the larval stage, as well as their weight during the imago period, was very strong. As a result, in such bee colonies, the daily egg-laying of queen bees increased, and the bee colony managed to collect a lot of honey.

To prepare the bee colony for wintering, starting from autumn, the use of soy milk and powder,

which are considered one of the protein-rich supplementary feeds, significantly strengthens the physiological state of the bee's body, and during the winter period, in particular, the low amount of feces in their hindgut has a positive effect on their emergence from wintering healthy and resilient. It also had a positive effect on the flight activity of bees within 3 minutes.

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