

## STUDY OF PRODUCTIVITY INDICES OF CARPATHIAN BEES

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### Abstract

The scientific paper presents the results of the productivity indices of Carpathian bees. The honey production is among the main indicators according to which the selection in beekeeping is done. The selection of high-productive valuable colonies and their reproduction are of scientific and practical interest. It was found that during the active season, using pastoral beekeeping, from the valuable bee colonies with local queens were obtained, on average, 101.36 kg of honey, from those with Carpathian queens imported from abroad – 103.20 kg and from colonies with queens of the first generation F<sub>1</sub> (♀ import + ♂ local) - 104.5 kg. Under the action of the heterosis effect, in the colonies with first generation F<sub>1</sub> queens (♀ imported + ♂ local) the viability of the bees increased, due to this fact, their colonies collected 1.26% more honey than the maternal forms and by 3.1% compared to the paternal ones. There were obtained 350.626 kg of honey from 350 bee colony or, on average, 64.64 kg from each colony at the apiary in Seliste village, Nisporeni district during 2019.

**Keywords:** bee colonies, honey, imported queens, local Carpathian bees.

### Introduction

Increasing the productivity of bee colonies is the main task of beekeeping. The success depends, to a large extent, on the organization and level of development of the breeding base, the technology of queens' breeding and the exploitation of bees. Valuable breeding material can be quickly produced by raising queens. The development and productivity of bee colonies depend very much on the value of queens, their quality and their genetic potential (Eremia and Neicovcena, 2011; Eremia et al., 2018).

A series of valuable biological and productive characteristics are typical for the Carpathian bees, which allow them to grow, productive, strong colonies, in a short time, able to use all types of harvests, starting with early spring (Malkova, 2007; Malkova and Vasilenko, 2007).

It has been found in practice, that, under the same environmental conditions, with the same breeding technology, bee colonies, with equal populations, make different productions in terms of quantity. Therefore, in order to obtain colonies with high productivity, it is necessary to know these genetic differences, with the subsequent application of the corresponding improvement works (Mărghitas, 1997, 2002).

Carpathian bees have a wider range when using the diversity of genes of honey and pollen flora compared to forest brown bees (Boytsenyuk, 2008). Their use increases the production of bee products by 25-40% (Levchenko, 2007; Malkova, 2008).

The full realization of the genotype of Carpathian bees can be obtained by using contemporary methods applied in beekeeping.

Obtaining of the bees' production is cost-effective with the use of the strongest and most productive bee colonies adapted to local climate conditions (Kashkovsky, 2000; Komlasky et al., 2006).

The strong bees' colony is accumulating a greater number of physiologically young bees, which actually are using existing honey sources in nature. With the increase of the live mass of the bee colony, the accumulated honey production increases not only entirely per colony, but also per unit of their body weight. In strong colonies, up to 66% of bees participate in intensive harvests, and in weak colonies only 15-20%, which is 3-4 times less (Melzer, 1989; Tunikov et al., 2001).

During the honey harvesting the maximum amount of nectar stored in the hive in one day was: from white acacia - 9.1 kg, from linden - 5.5 kg (2016) and from sunflower - 6.9 kg (2015). The results were influenced by climate conditions, especially by air temperature during the harvesting period (Eremia, 2018).

A successful development of beekeeping is unimaginable without a good supply of apiaries with young fertilized queens, which possess an increased egg laying and transmit the high productivity and vital qualities through heredity. The growth rate of the population, the power and the productivity of the bee colony is dependent on the queens' prolificacy.

Thus, the purpose of the investigations consists in the study of the productivity indices of the local Carpathian bees, imported bees, bees of the first generation, also the identification and the selection of the valuable (highly productive) bees' colonies and their reproduction.

## **Material and method**

In order to achieve the proposed objectives, the Carpathian bee colonies served as the objects of investigations. The experiment was held at the apiary from Seliste village, Nisporeni district.

Following the selection, the most valuable bee colonies were identified and selected under their honey production obtained during the active season, in 2019, and 3 groups were formed. The first group included the bee colonies with queens from the local population, the second group - the bee colonies with queens imported from Mukacev (Ukraine), the third group - the bee colonies with queens from the first generation F1 (♀ import + ♂ local).

The bee colonies were maintained in hives with 2 bodies for 10 frames dimensions 435 x 300 mm, two shops for 10 frames each measuring 435 x 145 mm.

In the selected bee colonies, productive indices were studied, including the power of the colony during the control in autumn and spring, honey production during the active season, using pastoral beekeeping at honey harvesting of white acacia, linden and sunflower. The *strength of bee colonies* was determined by counting the number of bees populating the spaces between the frames in the nest.

The obtained data were processed by the method of statistical variations with using the Microsoft Excel computer programs.

## Results and discussions

From the multitude of nectar-polleniferous plant species in the Republic of Moldova we can mention that the most important from which valuable harvests are obtained are: white acacia, lime and sunflower. White acacia occupies an area of over 98630.2 ha, and lime plantations - 4580.3 ha. Sunflower is cultivated in Moldova on an area of over 223910.6 ha, of which in the northern region it occupies an area of 95492.8 ha or 42.65% of the total area of this crop, in the southern region - 76810, 2 ha (34.30%), in the Center it is of 51607.6 ha (23.05%) (Eremia, 2018).

The research results showed that the strength of bee colonies with local queens in 2017-2018 (group I) was on average of 7.8 spaces populated with bees. It was determined during the control realized in spring.

The strength of these bee colonies was on average of 8 spaces between the frames populated with bees during the autumn control.

The bee colonies with local queens produced on average of 34.89 kg of honey while harvesting from white acacia, with the variation between 32.9-37.6 kg, from linden - 33.35 kg (31.5- 35.1 kg) and from sunflower - 33.12 kg (30.5-35.3 kg) (Table 1).

Table 1. The strength of bee colonies with local queens from 2017-2018, group I, and the amount of honey extracted

Index	$\bar{X} \pm s_{\bar{x}}$	V, %	Limits
The strength of bee colonies at the control during the spring of 2019	7.80±0.200	9.93	6 – 9
Honey extracted after harvesting from white acacia, kg	34.89±0.314	3.49	32.9 – 37.6
Honey extracted after harvesting from linden, kg	33.35±0.292	3.39	31.5 – 35.1
Honey extracted after sunflower harvesting, kg	33.12±0.345	4.03	30.5 – 35.3
Totally extracted honey per season, kg	101.36±0.729	2.79	96.2 – 106.5
The strength of bee colony at the control during autumn of 2019	8±0.00	0.00	8 – 8

Using pastoral beekeeping, per season, an average of 101.36 kg of honey (96.2-106.5 kg) were extracted from a bee colony. The coefficient of variation ranged between 0.0% (the strength of bee colony at the control in autumn of 2019) and 9.93% (the strength of bee colonies at the control in spring of 2019).

The bee colonies with Carpathian queens from 2017-2018, imported from Mukacev (group II), at the control in spring had the strength at the average of 7.38 spaces between the frames populated with bees, and at the control in autumn - 8.0 spaces.

In the second group there were extracted, in the bee colonies on average: 34.89 kg of honey (31.2-39.5 kg) from white acacia, 34.08 kg (30.5-37.6 kg) from linden and 33.86 kg (31.0-37.1 kg) from sunflower (Table 2).

The total amount of honey extracted from a bee colony was on average of 103.20 kg (96.4-113.5 kg). The coefficient of variation ranged between 0.00% (the strength of bee colony at the control in autumn of 2019) and 14.37% (the strength of bee colonies at the control in spring of 2019).

Table 2. The strength of bee colonies with imported Carpathian queens from 2017-2018, group II, and the amount of honey extracted

Index	$\bar{X} \pm s_{\bar{x}}$	V, %	Limits
The strength of bee colonies at the control during the spring of 2019	7.38±0.208	14.37	5 – 9
Honey extracted after harvesting from white acacia, kg	34.89±0.413	6.04	31.2 – 39.5
Honey extracted after harvesting from linden, kg	34.08±0.378	5.66	30.5 – 37.6
Honey extracted after sunflower harvesting, kg	33.86±0.316	4.76	31.0 – 37.1
Totally extracted honey per season, kg	103.20±1.018	4.41	96.4 – 113.5
The strength of bee colony at the control during autumn of 2019	8±0.00	0.00	8 – 8

The strength of bee colony with the first generation F<sub>1</sub> queens (♀ import + ♂ local, 2018) was on average of 5.52 spaces between frames populated with bees at the at the control in spring of 2019 and 8.0 spaces at the control in autumn of 2019.

The quantity of honey extracted from the bee colonies from group number III, was on average: from white acacia - 35.06 kg (30.8-37.9 kg), from linden - 34.98 kg (32, 8-37.9 kg), from sunflower - 34.31 kg (30.5-36.7 kg) (table 3).

Table 3. The strength of bee colonies with queens of the first generation F<sub>1</sub> (♀ import + ♂ local, 2018), group III, and the amount of extracted honey

Index	$\bar{X} \pm s_{\bar{x}}$	V, %	Limits
The strength of bee colonies at the control during the spring of 2019	5.52±0.174	15.79	5 – 8
Honey extracted after harvesting from white acacia, kg	35.06±0.379	5.40	30.8 – 37.9
Honey extracted after harvesting from linden, kg	34.98±0.305	4.36	32.8 – 37.9
Honey extracted after sunflower harvesting, kg	34.31±0.347	5.05	30.5 – 36.7
Totally extracted honey per season, kg	104.50±0.737	3.07	98.0 – 110.5
The strength of bee colony at the control during autumn of 2019	8±0.00	0.00	8 – 8

The total amount of honey extracted per season using pastoral beekeeping was, on average of 104.5 kg from a bee colony, with a variation between 98.0 and 110.5 kg. The coefficient of variation ranged between 0.00% (the strength of bee colony at the control in autumn of 2019) and 15.79% (the strength of bee colonies at the control in spring of 2019).

The bees build up well and maintain the strength of the colony throughout the season, with the nomadic organization of beekeeping. In the literature is said that the Alma-Ata beekeepers received 150-200 kg of marketable honey using the method (Mysochkin, 2000). The productivity of bee colony depends on their strength, presence of honey crops, climatic conditions, etc. (Lazar, 2002; Kuzmina, 2011; Korzh and Kiryushin, 2013).

Analyzing the data from table 4, we can mention that, during the active season of 2019, from the bee colony which were selected from group I, with local queens, were extracted, on average of 101.36 kg of honey per colony, and the total amount per group was 1520.4 kg, from the colony with imported queens in the second group was collected 103.20 kg, the total amount being 2673.5 kg, from bees in group III, with queens of the first generation F<sub>1</sub> (♀ import + ♂ local) was collected - 104.5 kg per colony (figure 1) and total quantity being 2608.6 kg.

Table 4. The total amount of honey extracted from the experimental groups

Group	Nr. of family in group	Honey extracted from white acacia, kg	Honey extracted from linden, kg	Honey extracted from sunflower, kg	Extracted honey per season, kg	
					Average per colony	In total
I – bee colony with local queens	15	523.3	500.3	496.8	101.36±0.729	1520.4
II - bee colony with imported queens	26	907.1	886.1	890.0	103.20±1.018	2683.2
III - bee colony with first generation F <sub>1</sub> queens (♀ import + ♂ local)	25	876.4	874.4	861.7	104.50±0.737*	2612.5
<b>Total honey on the apiary</b>	<b>350</b>	<b>7354</b>	<b>7563</b>	<b>7709</b>	<b>64.64</b>	<b>22626</b>

Note: The significance of the differences between the means is authentic: after the honey extracted on average from a colony of bees I-III \* B ≥ 0.95

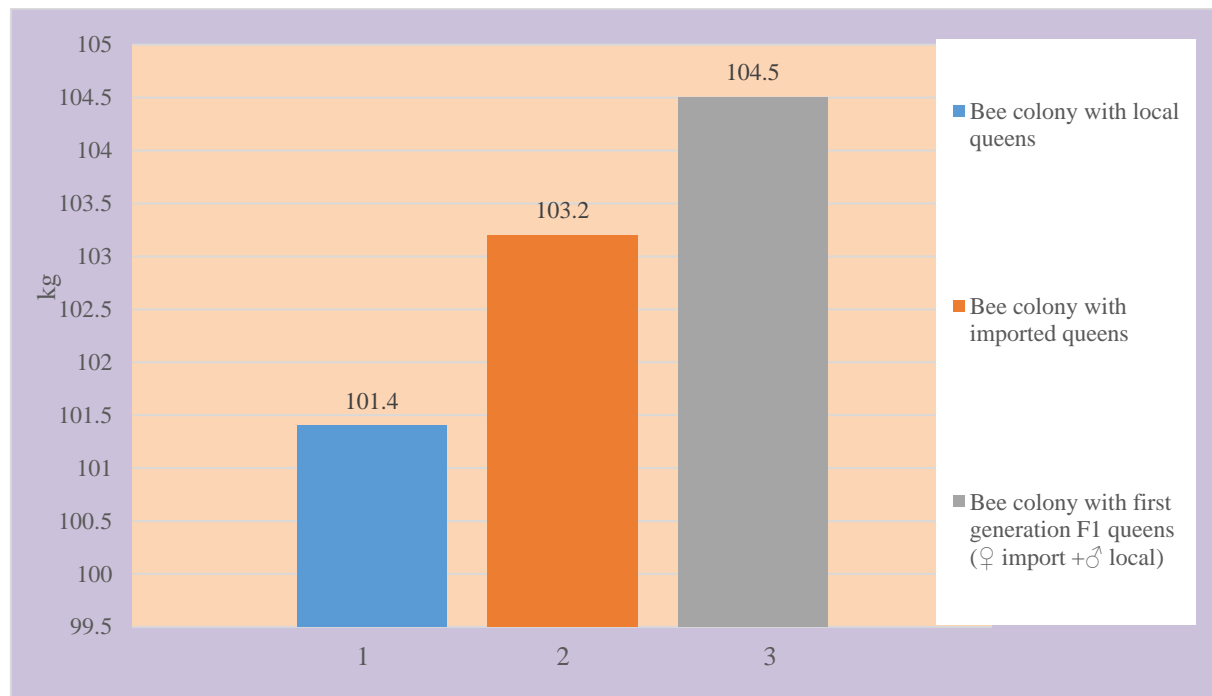


Figure 1. The amount of honey extracted from a bee colony per season, kg

It is observed that, due to the heterosis, the viability of the bees increased, and due to this fact, from the bee colony from group III, with queens of the first generation F<sub>1</sub> (♀ imported + ♂ local), there were extracted, on average of 3,14 kg more honey comparing to the bees with local queens from group I, or by 3.10% more, and by 1.3 kg or by 1.26% more than the imported Carpathians from group II. The results obtained confirm the opinion of some scientists (Bura et al., 2005; Mărghitaș, 2008) that the crossing of daughter queens of one line with drones of another line leads to the production of spring with valuable traits superior to the two original lines. There was shown that in terms of honey productivity, hybrids of different types of Carpathian bees are superior to parental forms (Kerek et al., 2002).

In total there were obtained 22626 kg of honey from 350 bee colony or on average of 64.64 kg from each colony at the apiary in Seliste village, Nisporeni district.

## Conclusions

From valuable bee colonies with local queens, during the active season, using pastoral beekeeping, an average of 101.36 kg of honey was obtained, from those with imported Carpathian queens - 103.20 kg and from colonies with first generation F<sub>1</sub> queens (♀ imported + ♂ local) - 104.5 kg.

Under the action of the heterosis effect, in the colonies with queens of the first generation F<sub>1</sub> (♀ imported + ♂ local) the viability of the bees increased, and due to this fact their colonies collected by 1.26% more honey than the maternal forms and with 3.1% more compared to the paternal ones.

There were obtained 22626 kg of honey from 350 bee colony or on average of 64.64 kg from each colony at the apiary in Seliste village, Nisporeni district.

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