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COMPARATIVE STUDY ON THE PERFORMANCE OF BEES POPULATIONS OF BUCKFAST HYBRID AND THE NATIVE RACE *Apis melifera carpatica*, EXISTING IN THE AREA OF IAȘI

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Abstract

Given the performances of the bees of the native breed Apis melifera and those of the Buckfast hybrid, it was desired to find out what are the performances of some products obtained from the crossing of the two populations. The study was conducted between 15.04.2017 and 10.06.2018 at the acacia harvest, where four families of different breeds were selected, respectively 2 families from the native breed Apis melifera carpatica (A1 and A2) and 2 families from the Buckfast hybrid. (B1 and B2). The families taken in the study were chosen from the hive depending on the degree of development. The characters pursued for the obtained products were: the quantity of honey harvested, the gentleness, the instinct of roasting, the building of artificial honeycombs as well as the amount of pollen harvested in the ascending and descending population during 2017 and 2018. Regarding the amount of pollen harvested in 10 days, the B2 family recorded 2.6 kg, for honey production, the harvest is significant in favor of the daughters of the Buckfast hybrid.

Key words: *bees, honey, pollen.*

INTRODUCTION

The improvement of bee populations implies the conservation and improvement in purebred, based on the artificial selection of productive and adaptability to the environment that the population has acquired during its evolution (Drăgănescu et al., 2006; Bienefeld et al., 2007) In a balanced population (Hardy-Weinberg law), in natural conditions (geographical breed) in bees, the performance of the offspring is intermediate between the performance of the parents. The situation occurs when a character is controlled by additive genes (honey production).

Interracial hybridization (crossbreeding between individuals belonging to different races) causes the effect of heterosis or hybrid vigor, a phenomenon found in all plant and animal species (Boeking et al., 2000). In bees, the effect is controlled only in order to obtain the first generation (F1), the results leading to the improvement of certain performances only in the first generation. Performance improvement occurs only at the level of the individual and not to improve the performance of the population that is subject to selection (Meixner et al., 2013).

The phenomenon of heterosis that occurs in a hybrid can be explained as follows: the products resulting from the crossing of individuals belonging to different genetic populations (hybrids) are more vigorous (heterozygous) than purebred individuals (parents), these being homozygous (Căuia et al., 2009).

The superiority of hybrids is given by the manifestation of the phenomenon of more intense heterozygosity (different alleles of a gene appear on the same locus) as well as of non-additive genetic interactions (dominance, superdominance, epistaxis). The resulting individuals may be more vigorous or productive compared to their parents (Horia and Pascal, 2005; Bura and Pătruică, 2011).

The honey bee is the only species of economic interest that is totally dependent on the natural environment. It has evolved for millions of years,

being largely under the control of natural selection (Căuia and Siceanu, 2009).
Due to the species' biology, breeding and developed technologies, human intervention has focused on maintaining and supporting the development of bee families in order to ensure optimal production conditions. But the most important role is played by the environment, which is the space for obtaining food naturally (nectar and pollen) and reproduction (Drăgănescu et al., 2008; Ruttner, 1980).
The Romanian bee has been studied since 1937-1939 (Fişteag and Farcaş), when it was proposed as an independent breed - *Apis melifera carpatica*. In 1965, at an international level, Foti conducted extensive studies that are currently being continued by the Research and Development Institute for Beekeeping. In 1958, the Romanian Beekeepers Association, and in 1974 the Research-Development Institute for Beekeeping conducted research on the conservation and improvement of the local genetic fund (Foti et al., 1965).
Considering the performances of the bees of the native breed *Apis melifera* and those of the hybrid Buckfast, it was interesting to see the performances of some products obtained from the crossing of the two populations. Thus, the aim of the paper is to study the performance of the bee population obtained from the hybrid Buckfast and the native breed *Apis melifera*, bred in the Oţeleni area, Iaşi county. For this, the characters were followed: the amount of honey harvested, gentleness, family development, swarming instinct, artificial honeycomb building and the amount of pollen harvested from the ascending and descending population, during 2017 and 2018.

MATERIALS AND METHODS

The biological material was represented by four families of bees, exploited in a private PFA apiary, located near the forest of the Forest District Iloaei Forest and has a herd of 150 bee families, of which 120 families produce honey and other bee products. The difference of 30 families are intended for reproduction. The study was conducted between 15.04.2017 and 10.06.2018.
At the acacia harvesting, 4 production families from different breeds were chosen, respectively: 2 families from the native breed *Apis melifera carpatica*; 2 families from the Buckfast hybrid.
The families studied were chosen from the apiary, depending on the degree of development. During the study, the characteristics of gentleness and instinctive swarming were followed, continuing with a series of production characteristics: the amount of pollen harvested, the amount of honey extracted, the degree of development of families.
1. Two families with native bee *Apis melifera carpatica* (A1 and A2) (Figure 1) from breeding families. The selected families have achieved in the past years the following results: the amount of honey: rapeseed honey 8 kg/family; acacia honey 19.5 kg/family; lime honey 18 kg/ family; sunflower honey 17 kg/family; pollen harvested 2 kg/family.

Family A1

Family A2

Figure 1. *Selected families of the native breed Apis melifera carpatica*

2. Two families with the Buckfast hybrid (B1 and B2) (Fig. 2) from instrumentally seeded breeding families. The selected families have been tested for several years, their results in previous years were: the amount of honey: rapeseed honey 14 kg/family; acacia honey 42 kg/family; lime honey 40 kg/family; sunflower honey 41.5 kg/family; pollen harvested 5 kg/family.

Family B1

Family B2

Figure 2. Families selected from the Buckfast hybrid

The characteristics of the breed were also followed in terms of meekness and the manifestation of the swarming instinct.

RESULTS AND DISCUSSIONS

Pollen harvest results

Pollen harvesting from Oţeleni commune was carried out between 15.04.2017 and 15.10.2017. For 2017, the mother family *Apis melifera* recorded a production of 3.4 kg pollen/year, compared to the amount of 5.0 kg pollen/year harvested from the hybrid mother family Buckfast (+1.6 kg pollen/year) (Table 1).

Table 1. The amount of pollen harvested in 2017

Specification	The amount of pollen collected (kg/an)	
	Apis melifera	*Hybrid Buckfast*
The mother family	3.4	5.0
Daughter 1	3.6	5.3
Daughter 2	3.2	5.0

Thus, daughter 1 of the *Apis melifera* breed collected a quantity of 3.6 kg pollen/year, and daughter 2 - 3.2 kg pollen/year. Comparing the amount of pollen with that harvested in Buckfast hybrid daughters, the results show a harvest of 5.3 kg pollen/year in daughter 1 (+1.7 kg pollen /year) and 5.0 kg pollen/year in daughter 2 (+ 1.8 kg pollen/year).

The study on pollen harvesting of fruit trees in the commune of Oteleni, was conducted between 15.04.2017 and 10.06.2017, corresponding to the harvest of acacia, the results being shown in Table 2.

The research period was 10 days, after which 1.2 kg of pollen were recorded in family 1 *Apis melifera* and 1.45 in family 2 *Apis melifera*. In the Buckfast families, the harvest recorded a value of 2.1 kg/family in B1 and 2.6 kg in B2.

The analysis of Table 2 shows the performance of Buckfast hybrid families, the differences being significant (+0.9 kg pollen in family B1 and 1.15 kg pollen in B2).

Table 2. The amount of pollen harvested in 2018

Specification	***Apis melifera***		***Hybrid Buckfast***	
Pollen (kg)	*Family A1*	*Family A2*	*Family B1*	*Family B2*
	1.2	1.45	2.1	2.6

Results on the amount of honey extracted

The amount of honey extracted was recorded for all types of harvesting: rapeseed, acacia, raspberry, linden, sunflower and hay (polyfloral honey). For 2017, the mother family *Apis melifera* recorded a honey production of 81.5 kg of honey/year, compared to the amount of 166.5 kg of honey/year harvested from the Buckfast hybrid mother family (+85.0 kg of honey/year) (Table 3). The largest quantities of honey were extracted at the harvest of acacia (19.5 kg of honey/year), at the harvest of lime

(18 kg of honey/year), followed by the harvest of sunflower (17 kg of honey/year), and for polyfloral honey (11 kg of honey/year).
From the daughters *Apis melifera*, coming from the mother family, in 2017, 87.5 kg of honey / year were extracted from daughter 1 *Apis melifera* and 77.0 kg of honey/year from daughter 2 *Apis melifera* (Table 3).
Analyzed by types of harvest, the daughters of *Apis melifera* recorded the following quantities of honey: from daughter 1 *Apis melifera*, the best yields were obtained by picking lime (22 kg of honey/year), by picking acacia (21 kg honey/year), followed by sunflower harvesting (16 kg honey/year); from daughter 2 *Apis melifera,* the best yields were obtained by picking acacia (19 kg of honey/year), by picking linden (18 kg of honey/year), followed by picking sunflower (15 kg of honey/year). year (Table 3).

Table 3. The amount of honey harvested for 2017

Assortments of honey	***Apis melifera***			***Hybrid Buckfast***		
	Mother family	Daughter 1	Daughter 2	Mother family	Daughter 1	Daughter 2
Rape	8.0	10.0	9.0	14.0	16.0	11.0
Acacia	19.5	21.0	19.0	42.0	43.0	38.0
Raspberry	8.0	9.0	7.0	16.0	12.0	13.0
Linden	18.0	22.0	18.0	40.0	39.0	41.0
Sunflower	17.0	16.0	15.0	41.5	48.0	18.0
Polyfloral	11.0	9.5	9.0	13.0	15.0	16.0
Total kg/year	**81.50**	**87.50**	**77.00**	**166.5**	**173.0**	**137.0**

Also for 2017, the parent family of the Buckfast hybrid recorded a honey production of 166.5 kg of honey/year.
The largest quantities of honey were extracted at the harvest of acacia (42 kg of honey/year), at the harvest of sunflower (41.5 kg of honey/ year), followed by the harvest of linden (40 kg of honey/year).
From the daughters of the Buckfast hybrid, coming from the mother family, in 2017, 173 kg of honey/year were extracted from daughter 1 Buckfast and 137 kg of honey/year from daughter 2 Buckfast. The number of dairy cows has continuously decreased during the period 1990-2010, with a negative impact upon milk production.
Milk yield is the only positive aspect, because it has increased reaching 3,980 kg per cow in the year 2010.
As a consequence of the reduced number of cows but an increased milk yield, milk production has continuously increased, except the year 1995 when it recorded the lowest level.
The North Eastern region is traditionally suitable for cow rearing, due to its pastures and meadows, the important number of cow livestock and possibilities to produce ecological milk.
The differences in harvested honey production are significant in favor of the daughters of the Buckfast hybrid, with a difference of +85.5 kg honey/year for daughter 1 Buckfast and +60 kg honey/year for daughter 2 Buckfast.
For 2018, the differences in harvested honey production are significant in favor of the daughters of the Buckfast hybrid, with a difference of +85.5 kg honey/year for daughter 1 Buckfast and +60 kg honey/year for daughter 2 Buckfast (Table 4).
For the native breed *Apis melifera*, the amount of honey harvested was 18.6 kg from the two warehouses and 4.3 kg of honey harvested from the nest on the marginal frames of the A1 family.

Table 4. Quantities of honey extracted from the studied families

SPECIFICATION	***Apis melifera***		***Hybrid Buckfast***	
	Family A1	*Family A2*	*Family B1*	*Family B2*
Store	18.6	17.4	31.5	28.8
Nest with framed frames	4.3	2.60	10.5	7.2
TOTAL	22.9	20.0	42.0	36.0

In family A2, the amount of honey harvested was 17.4 kg (+ 1.2 kg compared to A1) and 2.6 kg of honey from the nest (-2 kg compared to family A1). The total amount of 20 kg of honey was distributed as follows: 87% of the warehouses and 13% harvested from the nest on the marginal frames. For the families from the Buckfast hybrid, the quantities of honey varied from 42 kg in the B1 family to 36 kg harvested in the B2 family. The B1 family produced 4 warehouses ½ reduced of merchandise honey, and due to the selection and improvement of this hybrid 75% of the merchandise honey was found in the 4 warehouses (31.5 kg) and 25% in the nest, placed above the brood located on frames (7.2 kg). The B2 family made 3 warehouses ½ reduced merchandise honey, of which 80% of the honey was found in warehouses (28.8 kg) and 20% in the nest, located above the 10 frames with brood (7.2 kg).

In order to analyze the development of bee families in 2017, observations were made in several periods, taking into account the following elements: - between 15.04.2018 and 15.07.2017 bee families developed reaching a varied number of frames, between 7 and 12 frames in *Apis melifera* bees and between 10 and 15 frames in Buckfast hybrid families (Table 5); - after 20.07.2017 and artificial swarms were formed, as a result of which extracts of framed frames were made, 3 for each family, so that the number of frames varied from this period until 15.09.17 between 9 and 6 frames in the *Apis melifera* families and in a number of 9 frames in the Buckfast families

Table 5. The development of the families studied in 2017

Assortments of honey	***Apis melifera***			***Hybrid Buckfast***		
	Mother family	Daughter 1	Daughter 2	Mother family	Daughter 1	Daughter 2
15.04.2017	9	7	8	10	10	9
15.05.2017	10	8	9	12	11	10
15.06.2017	12	11	11	14	12	11
15.07.2017	12	11	11	15	12.5	12
ARTIFICIAL SWARM FORMATION - FRAMEWORK HARVESTING						
20.07.2017	-3	-3	-3	-3	-3	-3
15.08.2017	9	8	8	9	9	9
15.09.2017	7	6	6	9	9	9
FORMATION OF WINTER NESTS ON BEES						
15.10.2017	8	8	8	10	10	9

Starting with 15.10.17 the bee families regardless of breed or hybrid went into hibernation, the family being composed of 8 frames for *Apis melifera* and between 9 and 10 frames for the Buckfast hybrid

Family development in 2018

To the acacia harvest, when the families reached their apogee and registered a uniform development on the nest side, the warehouses for honey merchandise were added.

Therefore, for *Apis melifera*, family A1, which had 7 frames with brood, 2 warehouses of honey goods were added, and for family A2, which had 8 frames with brood, 2 warehouses were added (Table 6).

Table 6. The development of the families studied in 2018

SPECIFICATION	***Apis melifera***		***Hybrid Buckfast***	
	Family A1	*Family A2*	*Family B1*	*Family B2*
Frames puiet	7	8	9	10
Honey merchandise stores	2	2	4	3
TOTAL	9	10	13	13

For the Buckfast hybrid, the B1 family, which had 9 frames with brood, added 4 warehouses of honey, and for the B2 family, which had 10 frames with brood, 3 warehouses were added.

Manifestation of bee gentleness in 2017 During 2017, stings were recorded only from the *Apis melifera* families. Thus, from the mother family received 9 stings, 7 stings in daughter 1 *Apis melifera* and 13 stings in daughter 2 *Apis melifera* (Table 7).

Table 7. The result on gentleness in bee families studied in 2017

Specification	*Apis melifera*			*Hybrid Buckfast*		
	Mother family	Daughter 1	Daughter 2	Mother family	Daughter 1	Daughter 2
Number of stings	9	7	13	0	0	0

The manifestation of the bees' gentleness in 2018, in the Buckfast hybrid families, the bees showed gentleness, not being cases of attack on the beekeeper (Table 8).

Table 8. Assessment of the character of gentleness in the studied families

SPECIFICATION	*Apis melifera*		*Hybrid Buckfast*	
	Family A1	*Family A2*	*Family B1*	*Family B2*
Number of stings	7	13	-	-

The manifestation of the swarming phenomenon in 2017

In 2017, in the studied families, the swarming phenomenon was manifested only in the native breed, *Apis melifera* (Table 9).

The manifestation of the swarming phenomenon in 2018

After the honey extract, the two autochthonous families underwent directed multiplication, obtaining two artificial swarms, reducing one store for each family. In the harvest season for fruit trees, the A1 family built 3 barrels, and the A2 family a number of 8 barrels. At the acacia harvest, the A1 family built a number of 5 hulls, compared to the A2 family, with 12 hulls built (Table 10).

Table 9. Manifestation of swarm instinct and number of barrels

Specification	*Apis melifera*			*Hibrid Buckfast*		
	Mother family	Daughter 1	Daughter 2	Familia mama	Daughter 1	Daughter 2
Picking acacia	3	7	11	0	0	0
Pick lime	3	23	7	0	0	0
Total boots	6	30	18	0	0	0

Table 10. Manifestation of swarm instinct and number of barrels in 2018

COMB	*Apis melifera*		*Hybrid Buckfast*	
	Family A1	*Family A2*	*Family B1*	*Family B2*
Number of barrels of fruit trees	3	8	0	0
Number of acacia barrels	5	12	0	0
Total combs	8	20	0	0

Number of artificial honeycombs in 2017 For 2017, the number of artificial honeycombs built by the studied bee families ranged from 1 honeycomb in polyflora harvesting to 6 honeycombs in acacia harvesting in the mother family *Apis melifera* (Table 11), compared to 2 honeycombs when picking lime from the Buckfast mother family, up to 7 honeycombs when picking acacia. Throughout 2017, the studied mother families recorded a total of 16 honeycombs in *Apis melifera* and 22 honeycombs in the Buckfast hybrid (+6 honeycombs) (Table 11).

Table 11. Number of artificial honeycombs in 2017

The type of picking	*Apis melifera*			*Hybrid Buckfast*		
	Mother family	Daughter 1	Daughter 2	Mother family	Daughter 1	Daughter 2
Rape	2	2	2	3	3	3
Acacia	6	5	5	7	6	6
Linden	4	4	4	6	6	6
Sunflower	3	3	3	4	4	4
Polyfloral	1	1	1	2	2	2
Total combs	16	15	15	22	21	21

Analyzing table 11, it is observed that among the daughters, the number of artificial honeycombs per year was maintained at 15 for the daughters *Apis melifera* and at 21 for the hybrid daughters Buckfast.

The number of artificial honeycombs in 2018

The families from the Buckfast hybrid did not show swarming instinct and therefore no seedlings were harvested, being maintained to test the predisposition to swarm. As of June 10, 2017, the hybrid families did not show signs of swarming, but a greater development of the brood area comprising 5 reduced frames.

The F1 family managed to build a number of 4 artificial honeycombs when picking fruit trees and 6 honeycombs when picking acacia. The F2 family managed to build a number of 3 artificial honeycombs when picking fruit trees and 5 honeycombs when picking acacia.

Table 12. Number of artificial honeycombs formed in 2018

COMB	*Apis melifera*		*Hybrid Buckfast*	
	Family A1	*Family A2*	*Family B1*	*Family B2*
Harvesting from fruit trees	2	3	4	6
Acacia picking	3	4	3	
Father honeycombs	5	7	7	

CONCLUSIONS

Following the study performed on the productive performances and the characters of the native breeds *Apis melifera* carpatica and of the hybrid Buckfast, the following conclusions can be drawn:

For 2017, the mother family *Apis melifera* recorded a production of 3.4 kg pollen/year, compared to the amount of 5.0 kg pollen/year harvested from the hybrid mother family Buckfast (+1.6 kg pollen/year). For 2018, the research period was 10 days, following which 1.2 kg of pollen were registered in the A1 family and 1.45 in the A2 family. In the Buckfast families, the harvest recorded a value of 2.1 kg/family in B1 and 2.6 kg in B2.

In 2017, the differences in harvested honey production are significant in favor of the daughters of the Buckfast hybrid, with a difference of +85.5 kg honey/year for daughter 1 Buckfast and +60 kg honey/year for daughter 2 Buckfast.

In 2018 the differences registered between the 4 families were in favor of the Buckfast hybrid, which compared to the same family of *Apis melifera* registered an increase of: Family B1 - 12.9 kg for honey harvested from warehouses and +5.9 kg for honey harvested from the nest and for Family B2 - +11.4 kg for honey harvested from warehouses and +4.6 kg for honey harvested from the nest.

For 2017, between 15.04.2018 and 15.07.2017, the bee families developed reaching a varied number of frames, between 7 and 12 frames for bees from the *Apis melifera* family and between 10 and 15 frames for Buckfast hybrid families, and after 20.07.2017 and artificial swarms were formed, as a result of which extracts were made with brood frames, 3 for each family, so that the number of frames varied from this period until 15.09.17 between 9 and 6 frames in the *Apis melifera* families and in a number of 9 frames in the Buckfast families. For the year 2018, the A1 family that presented 7 frames with broods introduced 2 warehouses of honey goods, and for the A2 family that presented 8 frames with broods, 2 warehouses were also introduced. For the Buckfast hybrid, the B1 family which had 9 frames with brood was

introduced 4 warehouses of honey, and for the B2 family which had 10 frames with brood, 3 warehouses were also introduced.

In both years, in the Buckfast hybrid families, the bees showed gentleness, with no cases of attack on the beekeeper. Reverse situation in the autochthonous race, where both families showed a high aggressiveness towards the administrator.

In 2017, 6 barrels were registered for the mother family, while for the daughters the highest number was 23 barrels, made by the daughter 1 *Apis melifera*, when the lime was harvested. Daughter 2 *Apis melifera* made 11 barrels, but at the acacia harvest

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