Research on the Effect of Acidifying Substances on Bee Families Development and Health in Spring

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Abstract
The paper prezents a study on the effect of acidifying substances on the development the bee families during spring. The research was made at beeyards from Jebel, Timis county from 15 April to 4 May 2011. The biological material being represented by 30 bee families of Apis mellifica carpatica, Banat ecotype, divided in 3 experimental grups of 10 families each with equal strength. The bee families of experimental grups were fed sugar syrup where incorporated lactic or acetic acid. During the research period was analized the number of brood cells at 7, 14, 21 days. Experimental groups that were fed acidifying substances recorded statistical differences in terms of the number of brood cells at 14 and 21 days comparend with control grup.

Keywords: acidifying substances, bee families, spring.

1. Introduction

The development of bee family during spring season and their maintenance at high biological and productive levels requires the existence of a melliferous base that should provide nectar and pollen gathering during the entire active season, and also the rational bee feeding during the periods lacking natural gathering [1, 2, 3].
Bee feeding with sugar syrup, with incorporation of acidifying substances, aims at the reduction of pH at intestinal level, with positive effects on the inhibition of the pathogen microbial flora. This improves bees' health status, considering that most bee diseases are transmitted by digestive ways [4, 5].

2. Materials and methods

The biological material was represented by bee families belonging to the *Apis mellifica carpatica* breed, distributed in three experimental variants of approximately similar power, maintained in multi-stage beehives. The queens of the 30 bee families were the same age old. The experiments were carried out in Jebel, Timiş County, during 15.04.2011–4.05.2011. The experimental organization scheme is presented in table 1.
The sugar syrup was administrated warm, in quantity of 1.4 l/family (200 ml/ day) at the beginning of the experiment, at 7 and at 14 days. The control variant was fed only with sugar syrup.
In the case of the group LE_1, we incorporated apple vinegar in the sugar syrup, 12.5 ml /l syrup, and offered this to the bees in the same amount like in the control variant.
In the variant LE_2, we incorporated, in the sugar syrup, lactic acid in concentration of 98%, in quantity of 1.5 ml/l syrup, and offered this to the bee families in the same amount like in the other experimental variants.
The statistical result processing was carried out with the help of the software MINITAB.

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Table 1. The experimental organization scheme and the percentage of the preparations offered

No.	Specification	Experimental variants		
		LM	LE_1	LE_2
1.	Sugar syrup (ml)	1000	1000	1000
2.	Apple vinegar (ml)	-	12.5	-
3.	Lactic acid 98% (ml)	-	-	1.5

3. Results and discussion

In order to determine the effect exerted by acidifying substances (apple vinegar and lactic acid) on bee family development in the spring season, we measured, with the help of the frame Netz, the number of cells with brood bees at 7, 14 and 21 days after the administration. There was a strongly positive correlation between bee family development and health status. Table 2 presents the number of cells with brood bees at 7 days

Table 2. The number of cells with brood bees at 7 days after the administration of the acidifying substances

No	Statistical indicators	Control group	LE_1	LE_2
1	n	10	10	10
2	$\bar{x}$	25070	21270	21440
3	$S_{\bar{x}}$	±1513	±1562	±1766
4	S	4785	4941	5585
5	CV	19.09	23.23	26.05

We may notice, in table 2, that the number of cells with brood bees measured at 7 days presented differences between the groups analyzed.
The group LE_1, fed with sugar syrup 1:1 with incorporation of apple vinegar in quantity of 12.5 ml, presented a number of cells with brood bees that was smaller with 3800 cells compared with the control variant. The group LE_2, fed with sugar syrup with incorporation of 1.5 ml lactic acid 98%, recorded a number of brood cells that was smaller with 3630 cells compared with the control variant. Between the experimental group 1 and the experimental group 2, we recorded a difference of 170 cells with brood bees in the favour of the group fed lactic acid. From a statistical viewpoint, the differences were insignificant (table3).

Table 3. The statistical significance between the number of cells with brood bees studied at 7 days after the administration of acidifying substances

Specification	Control group (n=10) $\bar{x}$ =25070	LE_1 (n=10) $\bar{x}$ =21270	LE_2 (n=10) $\bar{x}$ =21440
LE_2 (n=10) $\bar{x}$ =21440	NS	NS	-
LE_1 (n=10) $\bar{x}$ =21270	NS	-	NS
Control group (n=10) $\bar{x}$ =25070	-	NS	NS

14 days after the administration of the acidifying substances in sugar syrup, the group LE_1 presented a number of cells with young bees that was with 4050 bigger than in the control variant. The group

LE_2, which was fed sugar syrup with lactic acid in quantity of 1.5 ml /l syrup, presented a number of cells that was bigger with 3450 compared with the control variant.

We may notice a remarkable increase of the number of cells with brood bees at 14 days in the case of the experimental variants fed acidifying substances, although the first determinations were in favour of the control variant.

Between the group fed acidifying substances (LE_1 and LE_2), we recorded a 600-cell difference in the favour of the group fed apple vinegar in quantity of 12.5 ml/l syrup (table 4).

From a statistical viewpoint, the differences between the 2 experimental variants fed sugar syrup with addition of acidifying substances were insignificant; however these differences were significant ($p<0.5$) compared with the control variant (table 5).

Table 4. The number of cells with brood bees at 14 days after the administration of the acidifying substances

No.	Statistical indicators	Control group	LE_1	LE_2
1	n	10	10	10
2	$\bar{x}$	28070	32120	31520
3	$S_{\bar{x}}$	±1281	±1559	±1132
4	S	4051	4931	3579
5	CV	14.43	15.35	11.36

Tabe 5. The statistical significance between the number of cells with brood bees studied at 14 days after the administration of acidifying substances

Specification	Control group (n=10) $\bar{x}$ =28070	LE_1 (n=10) $\bar{x}$ =32120	LE_2 (n=10) $\bar{x}$ =31520
LE_2 (n=10) $\bar{x}$ =31520	*	NS	-
LE_1 (n=10) $\bar{x}$ =32120	*	-	NS
Control group (n=10) $\bar{x}$ =28070	-	*	*

**p<0.01

The number of cells with brood bees recorded at the end of the experiment proved differences between the three groups analyzed.

The group LE_1, fed with supplementation of apple vinegar 12.5 ml, recorded a number of cells with brood bees that was bigger with 5690 in comparison with the control variant.

The group LE_2, fed with sugar syrup with incorporation of 1.5 ml lactic acid, recorded a number of cells that was with 4700 bigger compared with the control variant.

There was a difference of 990 cells with brood bees between the two experimental groups LE_1 and LE_2, in the favour of the bee families fed with sugar syrup with addition of apple vinegar (table 6).

21 days after administration of sugar syrup with incorporation of acidifying substances, there were significant differences between the control variant and the experimental variants (table 7) as regards the number of cells with brood bees; the biggest differences were observed in the variant fed sugar syrup with incorporation of apple vinegar ($p<0.01$).

Table 6. The number of cells with brood bees at 21 days after the administration of the acidifying substances

No.	Statistical indicators	Control group	LE_1	LE_2
1	n	10	10	10
2	$\bar{x}$	37090	42780	41790
3	$S_{\bar{x}}$	±1182	±1055	±1059
4	S	3737	3337	3348
5	CV	10.07	7.80	8.01

Table 7. The statistical significance between the number of cells with brood bees studied at 21 days after the administration of acidifying substances

Specification	Control group (n=10) $\bar{x}$=37090	LE_1 (n=10) $\bar{x}$=42780	LE_2 (n=10) $\bar{x}$=41790
LE_2 (n=10) $\bar{x}$=41790	*	**NS**	-
LE_1 (n=10) $\bar{x}$=42780	**	-	**NS**
Control group (n=10) $\bar{x}$=37090	-	**	*

**p<0.01

Table 8 presents the results of the administration of acidifying substances (apple vinegar and lactic acid) on the development of bee families during the spring season, for the entire experimental period.

The data presented in table 8 shows that, at the first determination of the surface with brood bees, the biggest value was recorded in the control variant (25070 cells), and the smallest in the experimental group 1 (21270 cells).

14 days after the administration of the acidifying substances, the control variant presented the smallest surface with brood bee-cells (28.070) compared with the other two experimental variants (32120 cells in LE_1 and 31520 cells in LE_2).

At the end of the experiment, the experimental variant 2, fed sugar syrup with addition of lactic acid, recorded 41.790 cells with brood bees, and the group fed with addition of apple vinegar presented 42790 cells with brood bees.

The control variant presented the most reduced number of cells with brood bees (37090).

Table 8. The results of the administration of acidifying substances (apple vinegar and lactic acid) on the development of bee families during the spring season

No.	Experimental variants	Number of cells with brood bees		
		at 7 days	at 14 days	at 21 days
1.	LM	25070	28070	37090
2.	LE_1	21270	32120	42780
3.	LE_2	21440	31520	41790

4. Conclusions

1. 7 days after the administration of the acidifying substances, the group fed sugar syrup 1:1 with incorporation of apple vinegar in quantity of 12.5 ml recorded a number of cells with brood bees that was smaller with 3800 cells compared with the control variant. The group LE_2 fed sugar syrup with addition of 1.5 ml lactic acid 98% recorded a number of cells that was smaller with 3630 compared with the control variant. There was a difference of 170 cells with brood bees between the experimental group 1 and the experimental group 2, in the favour of the group fed lactic acid.

2. 7 days after the incorporation of the lactic acid and apple vinegar in the sugar syrup, there were not any significant differences between the experimental variants and the control variant, as regards the number of cells with brood bees.
3. At 14 days, the experimental group 1 recorded a number of cells with brood bees that was bigger with 4050 compared with the control variant. The experimental group 2, fed sugar syrup with incorporation of lactic acid 1.5 ml /l syrup, recorded a number of cells that was bigger with 3450 compared with the control variant.
4. We may notice a remarkable increase of the number of cells with brood bees at 14 days in the case of the experimental variants fed with acidifying substances, although this was in the favour of the control variant at the first determination.
5. At 14 days, there were significant differences from a statistical viewpoint between the analyzed groups and the control variant as regards the number of cells with brood bees ($p<0.5$).
6. At the end of the experiment, the experimental group 1, fed with addition of apple vinegar 12.5 ml, recorded a number of cells with brood bees that was bigger with 5690 compared with the control variant. The experimental group 2 fed sugar syrup with addition of 1.5 ml lactic acid recorded a number of cells that was bigger with 4700 compared with the control variant. The differences were significant from a statistical viewpoint ($p<0.01$).
7. The acidifying substances determined the increase of the number of cells with brood bees and at the same time the amount of working bee with about 1 kg. This fact is reflected upon bigger honey productions / family and that is why I recommend the utilization of these.
8. The acidifying substances, beside pH modification at intestinal level, inhibit the development of the pathogenic bacteria, exerting a positive influence on the health condition of bee families.

Acknowledgments

This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/89/1.5/S/63258 "Postdoctoral school for zootechnical biodiversity and food biotehnology based on the eco-economy and the bio-economy required by eco-san-genesys"

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