INDIRECT METHOD OF PRODUCTIVITY APPRECIATION OF THE BEE FAMILIES BASED ON QUANTIFICATION OF THEIR ACCUMULATION SYSTEM

Şt. Lazăr[1], V. Maciuc[1], O.C. Vornicu[2], C. Bodescu[1]

[1]University of Agricultural Sciences and Veterinary Medicine Iaşi
[2]Apiary Bases, Iaşi
e-mail: lazar_stef@yahoo.com

Abstract

Appreciation of bee families' productivity based on honey yield is the most important criteria of selection. In the conditions in which determination of honey yield represent a laborious operation which involve various experiments, finding a simple method is very useful, knowing from practice that a family is more productive as much as the accumulation instinct is more intense.

In our research were involved 45 bee families from three beehives and from different areas situated at 30 km each to other, all of them placed in the pedo-climatic conditions of Moldavian Plateau. In each apiary were studied 15 equal families.

For each family was made a special frame cage, divided in two separated compartments but communicating at the bottom. Each compartment was separated through a wire mesh so that the 100 bees introduced in cage to have free access at honey syrup from the feeder placed at the upper part and also on the both sides of the comb with empty cells. Were realized three successive administrations of 100 ml honey syrup at intervals of 24 hours. With the help of adequate equipments we measure the syrup takeover time.

At the ending of acacia honey harvesting we determine through usual methods the yield of honey obtained from each studied family.

After data processing, by using correlation analyze and regression analyze, results the existence of some strong correlations between analyzed parameters, and we recommend this indirect method to appreciate the honey yield of a bee family.

Key words: bees, honey, cell, accumulation instinct

INTRODUCTION

Adaptation of bees' organisms at specific environmental condition from different geographic areas and transmission in descendent of some features were realized by natural selection, from which were developed races and populations with the demanded morphologic and biologic features.

Between bees' races and populations created in this way exist a great variability regarding productivity, reason which occurs man intervention on the line of development and consolidation of the useful characters from economic point of view, based on the actions which are focused on artificial selection. Selection criteria used at bee are very numerous also as the number of determinations for this, and if we consider the morphologic behaviors the situation is more amplified (2,3).

So in bees' breeding must have in view the possibility of reducing the criteria number and to establish some correlations between them to be able to reduce the number of tests. Appreciation of bee family productivity based on honey yield seems to be one of the most important criteria for breeding. In concretion of total honey yield are necessary various stages and determinations, the operation being very laborious. (2,4).

In the literature are presented some research focused on some indirect modalities for appreciation, with results more or less correct. (2,4,5). In USA was made a study on groups of 50 bees aged one day which were placed in cages containing one piece of honey-comb and the same quality of sugar syrup into

a small feeder. The cages were placed in an incubator, recording the necessary time for syrup transfer. The bees who worked slowly belonged to the less productive families. American test we consider to be non-concluded because at bees of one day and in number of 50, isolated in a cage placed in incubator we can't talk about an intake accumulation of feed reserves and also we could not take about a stable relation between individuals, it is known that accumulation instinct appear strongly after 20 days.

Another indirect appreciation modality consist in sugar content determination from bees' hemolimpha. Prost JP (1987) citing Bunias from INRA- France which observed a direct ratio between sugar content (glucose and fructose) from bees' hemolimpha and honey quantity gathered from beehive in the context of the ones presented by the author our research team proposed to develop the American experiment by comparison of another system of large cages with bees raised in individual households.

MATERIAL AND METHOD

In our research were involved 45 families of bees from three apiaries situated in different areas at a distance of over 30 km each to other, all of them placed in the Moldovian Plateau area. In each apiary were studied and controlled 15 families from the same strength.

For each family was made a special cage frame, made by a feeder for stimulative feeding, divided in two compartments which communicate at inferior part, so that the honey syrup from one compartment to raise at the same level following the principle of communication vessels.

Each compartment was isolated with wire-net so that 100 bees placed in each compartment to have free access at the honey syrup administrated in feeder, three times, at 2 hours period of time, in 100 ml quantities, bee acces from each compartment being free on bouth sides of the two frame halfs of honeycomb.In all the situations bees introduced in cage were gathered at the last level of frame.

With the help of a special equipment were recorded the time of honey syrup processing, at the finish of the syrup the connection is turn off and the time is displayed on the screen.

The treatment took place in the period 4-20 April 2009, before harvesting acacia.

After harvesting acacia, at the studied families was determinate by individual weighting the resulted quantities of honey.

The obtained data for the two types of determinations were statistically processed with SPSS 1600 program and for graphs was used Excell office and REML (1).

RESULTS AND DISCUTIONS

Observations regarding bee behavior during experiment.

After placing the cage frame in the middle of two nests in short time this one was covered on the both sides by bees from the near frames. Bees from cage worked at syrup processing, and were no relations between syrup quantity from feeder and the syrup placed in cage honeycomb.

Syrup processing activity was realized only by the isolated bees, through self feeding, by giving to the bees from outside of cage, or by placing syrup in the cells of the isolated honeycomb. These aspects did not influence the experiment results, the aim being to measure the processing speed of the syrup from feeder.

Recording time of honey syrup processing.

For each syrup administration was recorded the processing time.

For apiary A, processing time 1 varied between 185 minutes to 245 minutes, the average value being 204.60 minutes, time 2 varied from 189 to 250 minutes, with a mean of 208.53 minutes and time 3 between 192 and 255 minutes and the mean value was 209.07 minutes. The differences regarding time average at our three experiments increased from one administration to another, probably due to the increase of usage degree of the isolated bees (tab. 1).

For apiary B and C processing time evaluated in the same manner, even if there were some value differences between the studied families from the three beehives (tab.1).

Table 1 The syrup intaking times and honey production of bees families taken in control from the three apiaries.

Apiary	n	Statistics	Time 1 of intake (min)	Time 2 of intake (min)	Time 3 of intake (min)	Avarege time of intake (min)	Honey production
A	15	$\overline{X}$	204,60	209,53	216,40	209,07	20,69
		± s $\overline{X}$	4,095	4,440	4,516	4,769	0,878
		V %	7,752	8,207	8,083	8,835	16,440
		Val. Min	185	189	192	189	15,30
		Val. max	245	250	255	250	25,50
B	15	$\overline{X}$	213,67	221,47	226,33	224,73	15,93
		± s $\overline{X}$	4,514	4,548	4,602	6,398	0,801
		V %	8,183	7,954	7,875	11,025	19,481
		Val. Min	185	190	192	189	12,05
		Val. max	242	247	252	271	23,59
C	15	$\overline{X}$	219,80	228,07	229,93	229,67	10,73
		± s $\overline{X}$	4,182	4,573	4,272	5,814	0,849
		V %	7,369	7,765	7,196	9,807	30,619
		Val. Min	185	191	195	190	6,50
		Val. max	240	245	250	270	17,50
TOTAL	45	$\overline{X}$				221,16	15,78
		± s $\overline{X}$				3,477	0,776
		V %				10,547	32,97
		Val. Min				189	6,50
		Val. max				271	25,50

After statistic prelucration of the obtained data the significance of differences regarding processing times and the mean time shows significant differences between apiary A and C and non-significant between apiaries C and B, B and A, regarding time 1 and 2 mean time (tab. 2).

Table 2 The significance of differences for the studied indicators

Indicator	Fisher Test	Tukey Test								
		Indicator 1	Indicator 2	Mean Difference	Q1	Q2	W1	W2	Signification	Limit
T_1	3,2710 (F)>F 0,050 (2,42) 3,23*	C	A*	15,2	0	0	0	0	significant	0,05
		C	B	6,13	0	0	0	0	n.s	
		B	A	9,07	3,42	4,33	14,59	18,46	n.s	
T_2	4,3180 (F)>F 0,050 (2,42) 3,23*	C	A	18,53	0	0	0	0	significant	0,05
		C	B	6,6	0	0	0	0	n.s	
		B	A	11,93	3,42	4,33	15,46	19,55	n.s	
T_3	2,4636 (F)>F 0,050 (2,42) w.s.	C	A	13,53	0	0	0	0	n.s	
		C	B	3,6	0	0	0	0	n.s	
		B	A	9,93	3,42	4,33	15,27	19,31	n.s	
T mean	3,5607 (F)>F 0,050 (2,42) 3,23*	C	A	20,6	0	0	0	0	significant	0,05
		C	B	4,93	0	0	0	0	n.s	
		B	A	15,67	3,42	4,33	19,49	24,65	n.s	
Honey quantity	34,8558 (F)>F 0,001 (2,42) 8,25***	C	A	9,95	0	0	0	0	significant	0,01
		C	B	5,2	0	0	0	0	significant	0,01
		B	A	4,76	3,42	4,33	2,88	3,65	significant	0,01

Honey quantity obtained at extraction

In the case of apiary A the results obtained at the studied families varied between 15.30 kg and 25.50 kg the mean value being 20.69 kg.

At apiary B the variation limits were 12.05 and 23.50 kg, the mean value being

15.93 kg. The poor results were recorded at apiary C, with variation limits from 6.50 kg to 17.50 kg with a mean value at the studied families of 10.73 kg.

The yield differences between the three apiaries were significant in all the situations (tab. 2).

Correlation between mean processing time and honey quantity

Pearson correlation was determinate and was graphical draw the regression line.

Pearson correlation index represent a measure of linear association between two variables, with other words the degree in which a bivalent representation under a bivalent representation under a spread diagramme.

Noting with X and Y the two variables and with x_i and y_i, i = 1…n the variables values, formula is:

$$r_{xy} = \frac{\Sigma (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{(\Sigma (x_i - \bar{x})^2)((\Sigma (y_i - \bar{y})^2)}}$$

Correlation index is between - 1 and + 1, with positive/negative association significance in according with the index sign and lack of association for $r_{xy} = 0$. Statistic significance is estimated with $t = r_{xy}\sqrt{\frac{n-2}{1-r^2_{xy}}}$, having n-2 liberty degrees.

Linear regression. In according with the above mentioned notations, by regression-function is understood a function y = f(x) which is useful for the made observation. Usually the chosen criteria is the one of the smallest square, a f function for which it is minimalized the sum $\Sigma (y_i - f(x_i))$. If f is a linear function we will obtain a linear regression represented graphical through a line (regression line).

Regression line together with standard deviation of X and Y variables of Pearson correlation between mean processing time of syrup and the honey quantity (tab. 3).

Table 3 Pearson correlation index between the average intaking time and quantity of honey syrup harvested

Correlations		Mean time	Honey quantity
Mean time	Pearson Correlation	1	-0.629**
	Sig. (2-tailed)		.000
	N	45	45
Honey quantity	Pearson Correlation	-0.629**	1
	Sig. (2-tailed)	.000	
	N	45	45

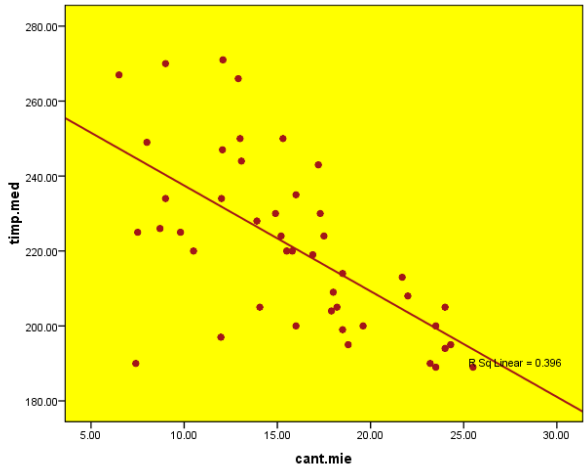

Fig. 1 Regression line between mean processing time of syrup and the harvested honey quantity

From the data presented in tab 3 and figure 2 is put in light a negative correlation between X and Y indices (processing time and honey yield) showing that bee productivity is higher at the same time as the syrup processing time is lover.

CONCLUSIONS

1. Even isolated in cages, the bees keep nutrition relations with the bees from beehive, and the activity of them is not disturbed;

2. If the processing time of the syrup were greater also the honey yield is higher;

3. Was established a negative correlation between intaking times and honey production, fact which demonstrate the fact that processing speed of the syrup could be consider an indirect method of appreciation of accumulation instinct which influence the yield level.

4. Are necessary new studies to be able to observe the correlation between intake speed of syrup and feeding time by stimulation and bees productivity, without isolating bees in cage.

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