

## ACTIVE BEHAVIOR ASSESSMENT AT *APIS MELLIFERA* *CARPATICA* BEE

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### Abstract

*In order to create, through selection, bee species with high resistance, were done studies about natural resistance of the bee strain Apis mellifera Carpatica from R. of Moldova to principal specific bee diseases on basys of some international standardized tests.*

*The studies were done at the atested weeding apiaries for reproduction of genitorial material. Bee colonies were appreciated after the behavioral characters related to morphoproductive characteristics of the strain. As a result, were selected bee lines with high resistance to specific bee diseases.*

**Key words:** *Apis m. carpatica* race, natural resistance, lines

### INTRODUCTION

According to a continuous development of beekeeping and a good implementation of the program of conservation and improvement of the bee race *Apis mellifera Carpatica* in R. Moldova, with the object of realization through selection lines with high resistance, were done researches on natural resistance of bees to specific diseases.

Researches which were accomplished on an international level, have shown that thorough selection of bee families with a pronounced hygienic behavior, as a mechanism of natural resistance to disease, is not adversely affecting the honey production or other characteristics of bee families, required by beekeepers [1]. On the contrary, bee families testing and selection for this characteristic attendant with other valuable features ensure more productive bees, with an increased natural resistance to disease, excluding medicine usage, treatment costs and pollution of apiarian products.

Nowadays, behavioral mechanisms of bee resistance to some diseases (American and European foul brood, chalk brood, varroosis, acarine disease) are identified [5]. These are different forms of behavior at: hygiene, disinfestations, autodisinfestation etc. This character assessment is done by applying of various standardized tests. Bees can be selected on this character, given the fact that the active behavior is a natural mechanism, genetically determined, with different heritance degree (depending on bee race).

Thus, an improved selection of bee populations which includes hygienic behavior, would bring benefits to apiculture industry in conditions when would be realized lines of bees with a pronounced hygienic behavior.

### MATERIALS AND METHODS

**Hygienic behavior** is one of the main characters of bees, by which can be assessed their resistance to specific brood diseases, especially in case American foul brood [4], chalk brood [3] and even to varroosis.

**To assess the hygienic behavior, will be used 2 specific, standard tests - chilled brood test [4] and killed by pricking brood test [17].** Both tests consist of artificial brood killing on a compact surface (10X10cm) by one of the methods named before, in order to establish the speed with which bees identify and eliminate dead brood. Bees with a pronounced hygienic behavior quickly detect, uncap and eliminate infected brood before disease will increase in the bee colony.

Preliminary observations indicated that there is a certain specialization of bees in such tasks. This character has a heritance  $h^2 = 0.36$ . Hygienic behavior can influence also the infestation with *Varroa destructor* -  $h^2 = 0.18$  [3], [6]. Rothenbuhler demonstrated that hygienic behavior is an hereditary characteristic, controlled by 2 genes locus, but at the same time influenced by many

factors such as: colony power, harvest conditions, bees age etc.. Thus, to obtain a reliable data on this character, assessment is done twice in the same bees colony in different environmental conditions and at different time intervals.

After 24 hours of introducing the honey comb into the brood nest, can be assessed number of cells in which brood has been cleaned. The ratio of removed and initially killed brood from the labeled surface of the comb, expressed in percentages, represents resistance to diseases.

**Disinfestations behavior** is also a specific form of hygienic behavior and consists in removal and injuries of acarines of *Varroa* from one's bee body by another bee. By autodisinfestation behavior, the bee removes by itself the acarines from its body. Standard test [3] consists in taking dead parasites of *varroa* Jacobsony from the hive bottom, which previously was covered with control paper or provided with an "antivarroa" bottom. Acarines which fell down on the hive bottom are collected every 24 hours for a period of 7 days in a special device and are examined in the laboratory under a microscope (40 times). Parasites with lesions in form of mandibles are considered killed by bees. Traumas on the examined parasites bodies indicate the mutilation done by bees while cleaning their bodies. Disinfestations behavior consists mainly of the fact that bee with acarines seek other bees to be disinfected by a specific dance. Bees also detect acarines in cells with uncapped brood and disinfest them.

**Research done in 2007** at apiary „I. Sprânceană Schit” at 30 bee colonies, selected from the progeny group, had **the goal to assess active behavior of *A.m.carpatica* bee race**. On these bee colonies with good productivity, were applied, simultaneously, two tests in order to establish their hygienic behavior: bees disinfestations test and killed by pricking brood test, according to classical methods described above. Cleaning instinct assessment of bees from the apiary was done at the beginning of May.

During the tests, optimal conditions for bee colonies development have been provided. Were assessed with an active behavior and selected those bee colonies,

which during the tests had a greater speed to clean dead brood and at the same time had a greater number of dead acarines, with lesions like bee mandibles.

To test potential bee colonies for transmitting active bee behavior in descent from colonies, selected according to obtained results, after applying standard tests, were raised every 5 queen daughters, which were planted in artificial swarms, similar formed by following indices: colony power, quantity of brood and food. To bee colonies, during the tests, which lasted 30 days, were applied same active (hygienic) behavior assessing tests and provided optimum development conditions. Were realized power bee colonies synchronizing with major forages. During 7 days were counted and examined under a microscope felt with injuries acarines. Every 14-16 days were performed control revisions with registration of following indices: bee colony power, honey and pasture production, brood quantity and number of acarines killed by bees.

Hygienic behavior is influenced a lot by external factors, that's why works were done simultaneous at all colonies from apiary. In order to obtain reliable data about controlled family, test was repeated 2 times and the average per family was taken.

Also were considered morphoproductive characteristics (honey production, queen oviposition, tegument color, proboscis length, cubits index and discoidal displacement) according to zootechnical rules about bee colonies inventory and certification of apiculture materials.

## RESULTS AND DISCUSSIONS

Bee colonies, selected by production indices, were characterized on average with a resistance of 70 - 95% at overwinter, honey production - 25-30 kg / per bee colony, queen oviposition - 1600 - 1800 eggs per day, brood quantity - 190 -260 s. c.

By morphometric indices, for bee colonies selection in study groups were characterized as following: proboscis length - 6.3 - 6.6 mm, discoidal displacement – 75-79% positive and 25 -21% neutral, cubits index -52 - 55 %.

Table 1  
 Assessment of morphoprodutiv and behavior characters at bee colonies from the apiary of Hîrtop, Criuleni district (standard test)

Ser Nb	Bee colony nb	Overwinter resistance, %	Honey production, kg	Brood quantity, c. h.	Overwinter resistance, %	Race indices				Test results				Selected acc. test results		
						Proboscis length, mm	Oviposition, eggs/24 hours	Discoidal displacement, %		I		II		I	II	Bothe of them
								+	neutral	Cleaned cells from 100	Total of dead acarines	Acarines killed by bees	Results ratio			
1	1	88	3,3	220	18,6	6,4	1500	80	20	91	6,7	4,8	72	*	*	**
2	2	78	3,2	260	15,9	6,6	1500	68	29	68	5,5	3,4	62			
3	4	80	3,1	230	15,8	6,6	1800	80	20	89	5,2	2,5	48			
4	5	77	3,1	190	15,9	6,5	1850	85	15	91	4,0	1,5	38			**
5	7	92	3,5	178	17,2	6,4	1715	75	25	92	6,5	5,7	87	*	*	
6	8	81	3,1	155	15,9	6,5	1400	85	15	67	7,8	4,2	53			
7	9	84	3,0	215	16,8	6,6	2020	87	13	97	4,8	1,5	31	*	*	
8	11	88	3,1	220	16,2	6,7	1980	78	22	88	5,5	2,3	42	*	*	
9	12	68	3,3	260	16,4	6,4	1400	70	30	30	5,6	2,5	45			
10	14	79	3,3	240	16,6	6,6	1850	80	20	92	8,2	3,7	45	*	*	
11	15	86	3,1	190	16,3	6,5	1650	80	20	91	7,4	4,4	59	*	*	
12	17	73	3,2	195	15,9	6,9	1400	70	30	65	4,4	2,8	63		*	
13	19	79	3,5	225	15,8	6,2	1450	75	25	35	5,2	3,1	65			
14	21	85	3,5	240	16,6	6,5	1700	79	21	79	6,8	3,3	48			
15	25	92	3,1	190	16,5	6,6	1900	85	15	85	6,6	4,1	62		*	
16	29	81	3,0	250	16,6	6,5	1870	78	22	80	3,8	1,5	39			**
17	32	86	3,2	260	15,0	6,6	2000	83	17	86	5,8	2,4	41			
18	33	91	3,5	265	17,8	6,2	1980	85	15	91	8,1	6,8	83	*	*	
19	37	69	3,5	235	16,8	6,9	1400	75	25	30	7,5	5,1	68		*	
20	44	72	3,4	240	16,7	6,2	1600	75	25	50	6,6	3,4	52			**
21	45	78	3,1	260	16,9	6,4	1980	77	33	44	4,9	1,2	24			
22	48	76	3,3	245	16,6	6,2	1400	71	29	30	6,7	3,3	50			
23	49	87	3,1	220	17,6	6,1	1850	85	15	92	5,9	4,8	82	*	*	
24	53	82	3,2	155	16,3	6,6	1650	83	17	52	4,8	1,2	25			
25	56	80	3,5	215	15,9	6,5	1400	78	22	67	5,8	2,2	38		*	
26	57	82	3,5	220	15,8	6,2	1450	79	21	35	4,5	3,1	69	*	*	
27	76	72	3,4	260	16,6	6,4	1700	81	19	90	7,7	5,1	67		*	**
28	81	85	3,2	240	16,5	6,4	1900	77	23	64	6,8	2,4	36			
29	86	75	3,0	190	16,6	6,5	1870	73	27	91	5,4	3,2	60	*	*	
30	88	93	3,5	245	17,5	6,3	1880	90	10	94	4,5	4,1	91	*	*	

Note: Test I- Killed by pricking brood test; Test II – Test of acarines disinfestations by bees

Test application to establish bee colonies with a pronounced hygienic behavior deducted to following results (table 1):

Of the 30 bee colonies under test (test I), in order to establish the speed with which bees identify and eliminate dead brood, after 24 hours of test applying, manifested total of 11 families with a **pronounced hygienic behavior** – bee colonies number (1, 5, 7, 9, 14, 15, 33, 49, 76, 86, 88) , they had a brood cleaning process over 90 per cent. The remaining families of bees tested had a hygienic behavior with **middle intensity and weak instinct of hygiene** (between 20 and 90%).

Of those 30 examinations, test (II) of bees disinfestations showed that total parasites number collected from the hive bottom, in a period of 7 days (average of 2 assessments), to 13 families of bees (1, 2, 7, 17,19, 25, 33, 37, 49, 57, 76, 86, 88) the ratio between

dead acarines and those killed by bees was 1:3. Such colonies were assessed with an active behavior comparing to the rest of colonies which had a lower ratio of bees disinfestations (1:1-4 colonies and 2:1 – 13 colonies).

Based on results obtained through application of two tests taken cumulatively, were selected 5 bee colonies (1,7,33,49,88) with a pronounced hygienic behavior, so through the test of brood pricking as well as the test bee disinfestations. After assessing in lineage of active bee behavior, experiment repeated 3 times, it was observed that most of daughters were at the same level as their mothers on this character, some of them even overcome their mothers, so was assessed the daughter obtained from mother-colony No. 88, from 9 killed acarines, all 9 of them had injuries as a result that they were killed by bees (Table. 2).

Table 2  
 Active behavior assessment at bees in lineage  
 (Average results for every colony from 2 assessments)

Indices	Queen-daughters from bee colonies					
	1	7	33	49	88	
1. Power of bee colony, bee kg	1,5	1,6	1,5	1,5	1,6	
2. Food quantity, honey kg	6,2	6,5	6,4	6,7	6,8	
3. Brood quantity, h. c.	120	135	125	130	140	
4. Test I Cleaned cells from 100, %	88	89	87	90	93	
5. Test II	Total dead acarines	8,5	8,8	10,4	7,3	9,7
	Acarines killed by bees	7,3	6,4	9,1	6,3	9,2
	Results ratio, %	86	73	88	86	95

After assessing of active behavior of bees in lineage, experiment repeated 3 times, was observed that most of daughters were at the same level as their mothers on these characters, even some of them overcame their mothers, so was assessed daughter obtained from colony No. 88, from 9 felt acarines all of 9 had injuries as a result, they were killed by bees (Table. 2).

Bee colony No. 88 was selected as "mother-colony" for obtaining queen daughters to create lines of bee colonies with high resistance to diseases.

## CONCLUSIONS

1. Among 30 bee colonies has been identified a number of 11 bee colonies (36%) with a pronounced hygienic behavior (eliminating over 90% of bee brood) of which only a total of 5 bee colonies (17%) have acted simultaneously quick to both tests for hygienic behavior.

2. After the disinfestation test were assessed 13 bee colonies with a pronounced active behavior(43%)

3. Simultaneous application of both tests allowed selecting 5 bee colonies with an

active hygienic behavior for testing them in lineage.

4. In beekeeping practice, we recommend to beekeepers to test the hygienic behavior of bee colonies through both methods in order to reproduce biological materials for beekeeping.

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