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BIOLOGICAL AND PRODUCTION CHARACTERISTICS OF CERTAIN LINES OF HONEY BEE IN SERBIA **

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Abstract: During the previous decades the natural populations of honey bee *Apis mellifera carnica* at the territory of Republic of Serbia has been subjected to constant negative influence of man, in first place through deployment of pesticides, herbicides and other chemical substances requisite in agriculture, but also due to uncontrolled import of and crossbreeding with the other breeds of this bee. For the purpose of preservation of existing populations and natural diversity of honey bee and for the purpose of their further selection, researches upon the metric morphology and productive features of certain individual populations of choice at the territory of Republic of Serbia.

In this study the quantity of the nest, of bees and of honey with two East Serbian lines (S and L) of honey bee during the spring season have been the subject of survey. The S line has shown more advanced development having 1.06 frames more and 0.11 bees more in the second year assessed. At the Szabo test of honey productivity the S line has shown in both years assessed that it had collected 29.91% and 49.51% more honey per respective year than the line L bees. Through the survey of morphological parameters we have come to conclusion that the differences in length of the forewing and the rear wing, cubital index, length of the tongue and number of spikes at the rear wing have been statistically very significant ($p < 0.01$).

Key words: *Apis mellifera carnica*, honey bee, honey, nest, metric morphology

Introduction

Within the *Apis mellifera* (L) breed of bees certain geographical breeds exist which inhabit the smaller geographic isolated areas and which have

peculiar morphological and biological features (*Goetze,* 1964). The very first researches upon the populations of the honey-bee in our regions have been conducted by *Grozdanić* (1926), where he had distinguished existence of particular breed of the honey-bee *A. m. banatica* present at the Pannonic plain. Through metric morphology studies upon the honey-bee at the area of central Serbia *Vlatković* (1957) has established that the cubital index with the Pešter highlands bee equalled 2.88, while with the bees from the Zapadna Morava basin this index equalled 2.65 (*Konstantinović,*1965).

As for the length of the tongue, *Goetze* (1964) states that it reaches maximum within the span area of *A. mellifera ligustica, A. mellifera carnica* and *A. mellifera caucasica* breeds, and that to the south of areas of these breeds length of the tongue decreases. *Skorikov* (1930) has distinguished 6 different breeds at the Caucasus according to the length of the tongue. *Chlebo and Kopernicky* (2004) state that length of the tongue with the population *A. mellifera carnica* in Poland ranges from 6.51 to 6.66 mm, while *Mladenović et al.* (2006) have determined variation in tongue length for the honey-bee lines of Western Serbia ranging from 6.22 to 6.44 mm. Examining the populations of the honey-bees in Vojvodina and Slavonija, *Krunić* (1967) has determined that the number of spikes at the rear wing ranges from 21.25 to 21.22, while *Georgijeva* (2006), examining 7 different breeds of East Serbia honey-bees, stated that the number of rear wing spikes varied form 20.44 to 21.88.

Monitoring and improvement of the quantitative features in apiculture such as honey productivity, quantity of the nests, quantity of pollen harvested and several others, represents the foundation for improvement of selection at the contemporary apiculture. For a bee cluster to have a solid spring season development and to provide a satisfying harvest of honey, it is very important that it be provided with a sufficient quantity of nests by the time of acacia blossoming, so far as our regions are concerned. *Georgijeva* (2006) has conducted examination upon the area of the nest with 7 lines of honey-bee at the Eastern Serbia, and established that it had varied from the average of 1.59 frames at the first spring examination up to 3.68 frames at the second spring examination. At their biennial researches *Georgijeva and Plavša* (2005) state the assessment of 2.96 frames at the first spring examination, while in the second year of research they have assessed the same feature as being 1.55 frames. The harvest of honey is a very significant feature in evaluation and selection of parent clusters, which evaluation is conducted on the basis of tertian honey harvest upon the acacia pasture by

the Szabo (1982) method. Based her claims upon the biennial examinations conducted upon several different breeds of the honey-bee as of their honey productivity, *Georgijeva* (2006) states that the average harvest of honey per each year amounted to 11.05 kg and 3.13 kg respectively.

Material and method

The experiment is conducted upon the selected apiary in vicinity of Knjaževac (Serbia), at the local apiary zones, in the years of 2004 and 2005. The bee clusters have been housed at the standard Langstrot-Rut beehives and at the beginning of the experiment they have been balanced by strength.

14 bee clusters have been included at the research, which have been divided into two equal groups by their qualification as for the lines(S or L) of the domestic carnica (*A. m. carnica*) examined.

In the course of the biennial period the areas of nests and quantity of bees have been recorded according to the standard method of evaluation by 1/10 of the frame in the course of two spring season examinations in a month interval, while the honey productivity test has been conducted by the *Szabo* (1982) method.

The metric morphology examinations have been conducted upon the sample of 35 bees taken from two geographically rather distant sites (about 20km) of the Eastern Serbia. Each bee has been fixated at the 70% ethanol, and then the permanent microscopic preparations have been made of the following body parts: the right forewing and the right rear wing, the mandible and the right hind leg.

The preparations have been viewed through the Leica XTL-3400D binocular microscope, and the measurements of lengths of the forewing and the rear wing, lengthy of the tongue, cubital index and the number of the spikes upon the rare wing have been conducted by the IL 1009 software package in compliance with the *Ruttner* (1978) methods. The data have been statistically processed, and the basic descriptive statistic parameters and the variant analysis (ANOVA) have been calculated. All statistical analyses were conducted using the Statistica 6 software package (*StatSoft*, 2001).

Research results and Discussion

On occasion of the first spring examination we have established that the initial quantity of the nest has been higher at the L line by 0.26 frames, while

during the following 30 days, by the second spring examination, development of the nest of the S line has been higher by 0.38 frames (Table 1). Also at the following year of 2005, higher quantity of the nest (1.06) has been established with the S line, but with no statistical significance due to high degree of variability. The Table 1 also shows that the variation quotient at the second spring examination is higher as compared to the values of the first spring examination, which data are not concurrent with the assessments of the West Serbia honey-bee lines, where decrease in variation of the quantity of the nest at the second spring examination and stabilization of laying with the queen-bees by lines assessed had been established. (*Nedić et al*., 2006).

Table 1. Spring examination of brood quantity in some honeybee lines of carnica

First spring examination								
Year	2004				2005			
Measure of variation	$\bar{x}$	Sd	Cv, %	$F_{exp.}$	$\bar{x}$	Sd	Cv, %	$F_{exp.}$
Line S	1,20	0,483	40,25	$1,07^{ns}$	0,89	0,527	59,48	$0,51^{ns}$
Line L	1,46	0,814	55,75		0,51	0,318	62,35	
Second spring examination								
	2004				2005			
Measure of variation	$\bar{x}$	Sd	Cv, %	$F_{exp.}$	$\bar{x}$	Sd	Cv, %	$F_{exp.}$
Line S	2,61	1,108	42,45	$1,15^{ns}$	3,09	2,16	69,90	$0,32^{ns}$
Line L	2,23	1,436	64,39		2,03	1,47	72,41	

P – Probability values: ^{ns} = P>0,05; * = P<0,05; ** = P<0,01.

The Table 2 shows that at the first year of research the L line has had more bees than the S line at both spring examinations by 0.372 and 0.742 respectively, which data are concurrent with the researches of *Georgijeva* (2006) in which the L line has had 0.82 frames of bees more than the S line. At the second year of research the S line has demonstrated more rapid development, which has influenced increase in number of bees in this line at the spring examinations by 0.343 and 0.110 frames respectively. In both years assessed no statistically significant difference in quantities of bees at the lines assessed has been established.

Table 2. Spring examination of bees quantity in some honeybee lines of domestic carnica

First spring examination								
Year	2004				2005			
Measurement of variation	$\bar{x}$	Sd	Cv, %	$F_{exp.}$	$\bar{x}$	Sd	Cv, %	$F_{exp.}$
Line S	0,871	0,304	34,90	$1,37^{ns}$	0,857	0,506	59,00	$2,73^{ns}$
Line L	1,243	0,727	58,49		0,514	0,219	42,61	
Second spring examination								
	2004				2005			
Measurement of variation	$\bar{x}$	Sd	Cv, %	$F_{exp.}$	$\bar{x}$	Sd	Cv, %	$F_{exp.}$
Line S	1,487	1,064	49,32	$1,92^{ns}$	1,70	1,03	60,59	$0,02^{ns}$
Line L	2,229	1,116	75,10		1,59	1,002	63,02	

P – Probability values: ^{ns} = P>0,05; * = P<0,05; ** = P<0,01.

The table 3 shows that at the Szabo test of honey productivity by the research year the S line had achieved better results by 29.91% and 49.51% respectively. The variation quotient for the feature assessed is high so that no statistically significant difference in harvest of honey has been established which result is concurrent with the results obtained by *Georgijeva* (2006).

Table 3.Honey yield test in some honeybee lines of domestic carnica,kg

First spring examination								
Year	2004				2005			
Measurement of variation	$\bar{x}$	Sd	Cv, %	$F_{exp.}$	$\bar{x}$	Sd	Cv, %	$F_{exp.}$
Line S	1,39	0,751	54,03	$4,34^{ns}$	1,54	1,14	74,03	$1,18^{ns}$
Line L	1,07	0,718	67,10		1,03	0,547	53,11	

P – Probability values: ^{ns} = P>0,05; * = P<0,05; ** = P<0,01.

The Table 4 displays the results of the metrical morphology parameters of the two lines of honey-bees assessed. It has been established that length of the forewing is higher at the S line, equalling 8.908 mm, while at the L line it has equalled 8.556 mm. The difference established is statistically very

significant (P<0.01). At the researches of *Georgijeva* (2006) it has been established that length of the forewing vary with the population East Serbia of honey-bees, ranging from 9.27 mm to 9.79 mm.

Table 4. Morfometric characteristics in honeybee lines of domestic carnica

Line	Fore wing lenght, µm						$F_{exp.}$
	n	$\bar{x}$	min.	max.	s	c.v., %	
S	35	8908,7	8631,2	9172,8	136,0	1,53	
L	35	8556,1	8307,3	8977,6	147,9	1,73	107,71**
Line	Hind wing lenght, µm						$F_{exp.}$
	n	$\bar{x}$	min.	max.	s	c.v., %	
S	35	6292,5	6072,8	6539,7	128,3	2,04	
L	35	6106,3	5910,1	6383,0	116,2	1,90	40,49**
Line	Cubital index						$F_{exp.}$
	n	$\bar{x}$	min.	max.	s	c.v., %	
S	35	2,46	1,62	3,13	0,328	14,98	
L	35	2,19	1,88	3,17	0,359	14,59	10,67**
Line	Tongue lenght, µm						$F_{exp.}$
	n	$\bar{x}$	min.	max.	s	c.v., %	
S	35	6338,8	5866,2	6624,5	148,9	2,35	
L	35	6116,2	5556,7	6439,0	179,4	2,93	31,92**
Line	Hind wing hamuli number						$F_{exp.}$
	n		min.	max.	s	c.v., %	
S	35	22,06	20	25	1,43	6,48	
L	35	21,17	18	24	1,29	6,09	7,35**

P – Probability values: ^{ns} = P>0,05; * = P<0,05; ** = P<0,01.

Length of the rear wing with the S line bees (6,293 mm) has been statistically very different (P<0.01) form the one present with the L line bees (6.106 mm).

The cubital index is the parameter rather often applied in characterizations of all *Apis mellifera* breeds, and for the breed kranjska it varies from 2.5 to 2.8 (*Rinderer*, 1986). In our research the average value of the cubital index of the S line has equalled 2.46, and it has been statistically significantly higher (P<0.01) than the value of the cubital index of the L line

of bees (2.19). *Vlatković* (1951) quotes that the cubital index of the bees of Peštersko-Sjenička highlands varies from 2.3 to 3.6, while *Krunić* (1967) in his researches quotes that the cubital index for the carnica population of the mountain regions of Serbia (Čačak, Prijepolje, Niš, Batočina, Priština) equalled 2.764, and for the population of the yellow bee in Vojvodina (Serbia) and Slavonija (Croatia) it equalled 2.708.

Length of the tongue of the S line bees (6.339 mm) is statistically significantly higher than length of the tongue of the L line bees (6.116 mm). In the researches of *Krunić* (1967) the bees of the mountain regions of Serbia and Montenegro have had the average length of the tongue of 6.50 mm, while the population of the yellow bee of Vojvodina and Slavonia has been 6.40 mm. *Georgijev*-a (2006) quotes that length of the tongue with the East Serbia bee populations varies from 6.34 to 6.50 mm.

The number of spikes (lat. hamulae) at the rear wings statistically significantly varies with the lines of bees assessed ($P<0.01$), which is in concurrence with the researches of *Georgijeva* (2001), where the values of the parameter assessed equal 20.44 – 22.00. *Krunić* (1967) had not found any significant differences at the number of spikes at the rear wing between the carnica mountain population (21.25) and the population of the yellow bee of Vojvodina and Slavonija (21.21).

Conclusion

On the basis of herewith elaborated researches upon the Biological and production characteristics of certain lines of honey bee in East Serbia the following conclusion can be reached:

- at the first spring examination it has been established that the bee clusters have had the average of 1.05 (S) and 0.99 (L) nesting frames in both years assessed;
- at the second spring examination the S line bee clusters have had 0.38 and 1.06 nesting frames more per respective year than the L line bees, which indicates higher degree of vitality of the S line queen-bees and ability of rapid development till the beginning of the season of acacia pasture;
- the quantity of bees in the first year assessed has been 0.37 and 0.74 frames higher at the L line of bees, respectively, while in the second year the S line has had 0.34 and 0.11 frames of bees more than the L line, respectively;

- at examination of honey productivity the S line bee clusters in both years assessed have had higher average harvest of honey by 29.91% and 49.51%respectively as compared to the L line bee clusters;
- by measuring the metrical morphology parameters, we have established that the S line bees have had longer forewing by 4.12% than the L line bees, linger rear wing by 3.05%, linger tongue by 3.64% and 4.20% more spikes at the rear wing than the L line bees. All noted differences are considered as statistically very significant;
- by measuring the cubital index, we have established presence of statistically very significant differences between the S line bees (index of 2.46) and the L line bees (index of 2.19);
- these researches have shown significant variations as of several features assessed, and also presence of two separate *Apis mellifera* groups accommodated to the relevant local environment conditions. Through meticulous selection one should preserve the authenticity of the species, and improve the selection of the domestic honey-bee.

BIOLOŠKO PROIZVODNE KARAKTERISTIKE NEKIH LINIJA MEDONOSNE PČELE U SRBIJI

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Rezime

Prirodne populacije medonosne pčele *Apis mellifera carnica* na području Republike Srbije su poslednjih decenija pod stalnim negativnim uticajem čoveka, pre svega primenom pesticida, herbicida i drugih hemijskih jedinjenja u poljoprivredi ali i zbog nekontrolisanog uvoza i mešanja sa drugim rasama ove pčele. U cilju očuvanja postojećih populacija i prirodne raznovrsnosti medonosne pčele i njihove dalje selekcije sprovode se ispitivanja morfometrijskih i produktivnih osobina pojedinih odabranih populacija sa teritorije Republike Srbije.

U radu je ispitivana količina legla, pčela i meda u prolećnom periodu kod dve linije (S i L) medonosne pčele Istočne Srbije. Linija S je pokazala bolji razvoj i više legla za 1,06 rama i pčela za 0,11u drugoj ispitivanoj

godini. U Szabo testu na mednu produktivnost, linija S je u obe godine ispitivanja imala za 29,91% i 49,51% više meda od linije L, respektivno po godinama.

Ispitivanjem morfometrijskih parametara utvrdili smo da su razlike u dužini prednjeg i zadnjeg krila, kubitalnom indeksu, dužini jezika i broju kukica na zadnjem krilu bile statistički vrlo značajne ($p<0,01$).

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