

## MORPHOMETRIC PARAMETERS OF GRAY AND YELLOW HONEY BEE FROM SERBIA

M. Mladenović<sup>1</sup>, V. Pešev<sup>2</sup>, R. Radoš<sup>1</sup>, S. Rašić<sup>1</sup>

<sup>1</sup>Faculty of Agriculture, 11080, Belgrade-Zemun, Republic of Serbia

<sup>2</sup>Faculty of Agriculture, 38219, Lešak, Republic of Serbia

Corresponding author: valentinavh@neobee.net

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**Abstract:** In the study of the morphometric parameters of honey bees from 6 sites of southern Serbia (Panevlje, Bujanovac Lake, Vranje, Stubal, Repince and Devca), it was found that the average value in gray honey bees for the tongue length (*in vivo*) was 6.59 mm, length and width of the front wing were 8.96 and 3.09 mm, respectively, and the value of cubital index was 2.20. Length and width of basitarsus had an average value of 1.99 and 1.07 mm, while the average value of tarsal index was 1.82. Yellow honey bees from the area of Banat Arandjelovo, Uljma and Fruška Gora had an average value of the tongue length (*in vivo*) 6.40 mm. Average value of the front wing length was 9.05 mm; while the wing width had value of 3.08 mm. Determined value of cubital index was 2.33 and the average length and width of basitarsus were 2.04 and 1.16 mm, respectively. The value of tarsal index was 2.11. The total variability of the tested parameters was determined in this study.

**Key words:** gray and yellow honey bees, morphometric parameters, variability, Serbia

### Introduction

Morphometric traits are the main criteria in taxonomy and systematics of bees. In our country, the first study of different varieties dates from the nineteenth century *Živanović (1893)* to be continued in the twenties when *Grozdanić (1926)* made the step in separating the honey bee ecotypes, where he used the color of chitin of abdominal tergites and scutelli as morphological parameters in the differentiation of bees of Pannonian Plain. In one group of honey bees gray color of tergites is prevalent and these bees are classified as *Apis mellifera carnica* and in the other group, prevalent color of tergites is yellow and it was classified as a separate race designated *Apis mellifera panonica* which was researched. *Vlatković (1957)*, *Konstantinović (1965)* and *Kulinčević (1962)* have researched the existence of ecotypes that occurred when crossbreeding “gray” and Banat honey bees. Thirty

years later, *Georgijev (2001)* have studied the honey bee in the Timok region and found that it is a specific and under given environmental conditions, the best adapted ecotype for further exploitation. In the area of Serbia Carniolan honey bee, or otherwise known as domestic carnica, (*Apis mellifera carnica* Poll.) is represented. This honey bee originated from Slovenia. The aim of this study was to examine the following morphometric parameters: tongue length, front wing width, cubital (wing) index, basitarsus length, basitarsus width and tarsal index of yellow honey bees from three different localities in Vojvodina and gray bees obtained from hilly-mountainous areas of southern Serbia from six sites. Average, maximum and minimum values were obtained and total variability was determined.

## Material and methods

Samples of bees were taken from the territory of Vojvodina, bees colonies which were in good condition, satisfactory health status and had yellow queen bees with predominantly yellow worker bees. Samples were, also, taken from hilly-mountainous regions of southern Serbia where gray honey bees were represented. In Vojvodina, bee samples were taken from three locations: Banatsko Arandelovo Fruška Gora and Uljma, and samples from southern Serbia were from sites: Panevlje, Bujanovac Lake, Vranje, Stubal, Repince and Devča. Each sample was comprised of 10 bees. After sampling from hive, the bees were kept in 96% alcohol and kept at a temperature of +4 ° C, until the beginning of the measurement. For the measurements process, temporary anatomical preparations were made. Using tweezers, ceratin body parts of bees were removed, taped to the foil and than scanned with a resolution of 9600 dpi, and then measured using the computer program AutoCAD and Corel Draw 11. The measurements were performed according to standard methods.

## Results and discussion

By measuring certain body parts of yellow and gray honey bees (tongue length, front wing width, cubital (wing) index, basitarsus length, basitarsus width and tarsal index), the average, maximum and minimum values and variation coefficient of the tested parameters were determined. In Table 1, values for tested parameters for yellow honey bee from Vojvodina are given, and in the Table 2 are given values of morphometric traits of the tested gray honey bee from hilly-mountainous areas of southern Serbia.

**Table 1. Morphometric traits of yellow honey bee from Vojvodina**

Morphometric traits	Tongue length (mm)	Wings			Basitarsus		
		Length (mm)	Width (mm)	CI	Length (mm)	Width (mm)	Tarsal index
1. BANATSKO ARANĐELOVO							
average	6.43	9.23	3.14	2.40	2.03	1.16	1.76
max	6.59	9.54	3.29	2.83	2.07	1.21	1.87
min	6.09	8.85	2.20	1.72	1.99	1.11	1.67
CV (%)	1.95	2.70	4.58	17.73	1.46	2.67	2.59
2. ULJMA							
average	6.30	9.01	3.05	2.27	2.05	1.15	2.27
max	6.51	9.33	3.23	3.52	2.13	1.21	3.52
min	5.95	8.81	2.87	1.52	1.95	1.10	1.52
CV (%)	3.33	1.77	2.72	28.81	3.75	6.08	4.77
3. FRUŠKA GORA							
average	6.46	8.93	3.08	2.31	2.04	1.16	2.31
max	6.53	9.10	3.20	3.11	2.16	1.22	3.11
min	6.38	8.55	2.91	1.96	1.92	1.09	1.96
CV (%)	0.84	1.80	2.93	14.37	4.10	5.45	3.39
Average	6.40	9.05	3.08	2.33	2.04	1.16	2.11
Average CV (%)	2.04	2.09	3.41	19.37	3.10	4.73	3.58

Measurements of tongue length in the yellow honey bee from Vojvodina showed that the value ranged from 5.95 to 6.59 mm with an average value of 6.40 mm. The average value for this trait in gray honey bee from Southern Serbia was 6.59 mm. These values are similar to values obtained by *Билаш and Кривцов (1991)*, *Georgijev (2001)*, *Jevtić (2007)*. Data obtained using descriptive statistics show that there were variations from 0.84% to 3.33% for Vojvodina and 4.69% for Southern Serbia. Determined average value of yellow honey bee front wing length was 9.05 mm and 8.96 mm in gray honey bee. *Krivcov (1992)* stated that wing length in the Carniolan honey ranges from 9.00 to 9.40 mm. Determined variability for the wing length in yellow honey bee is average 2.09% and 5.10% for gray honey bee. Wing width in the studied samples ranged from 3.05 mm to 3.14 mm in bees from Vojvodina and honey bee samples from the area of Southern Serbia had the average value in the interval from 3.02 mm to 3.16 mm. *Krivcov (1992)* states that for carnica the average front wing width is 19.3 mm with the variation from 3.13 to 3.29 mm. Somewhat different values for this morphometric trait were obtained for the colonies from Timok region where it was found that the average wing length was 3.32 mm. The average value of the variation coefficient was 3.41% and 6.90% from two studied geographic areas of Serbia.

**Table 2. Morphometric traits of gray honey bee from South Serbia**

Morphometric traits	Tongue length (mm)	Wings			Basitarsus		
		Length (mm)	Width (mm)	CI	Length (mm)	Width (mm)	Tarsal index
1. PANEVLJE							
average	6.65	8.71	3.06	2.10	2.08	1.05	1.98
max	7.19	9.18	3.27	2.80	2.26	1.19	2.17
min	6.23	7.98	2.21	1.80	2.00	0.94	1.90
CV (%)	5.35	4.54	9.43	16.02	9.61	13.79	3.92
2. BUJANOVAČKO JEZERO							
average	6.59	8.96	3.02	2.30	2.13	1.06	1.86
max	6.16	9.15	3.23	3.10	2.26	1.19	12.10
min	7.52	8.49	2.21	1.80	2.00	0.94	1.72
CV (%)	6.04	9.20	7.92	20.06	6.48	6.28	8.89
3. VRANJE							
average	6.58	9.01	3.11	2.00	2.05	1.15	1.78
max	6.83	9.28	3.26	2.50	2.24	1.28	2.01
min	6.22	8.71	2.82	1.80	1.93	1.00	1.59
CV (%)	3.61	3.68	4.28	13.43	10.43	9.47	26.19
4. STUBAL							
average	6.51	8.79	3.07	2.20	1.75	1.03	1.70
max	6.87	9.33	3.28	2.90	2.13	1.16	1.84
min	6.02	8.13	2.62	1.70	1.17	0.92	1.27
CV (%)	2.95	6.01	7.81	18.28	14.84	4.63	3.72
5. REPINCE							
average	6.47	9.13	3.12	2.20	1.95	1.06	1.84
max	6.73	9.38	3.22	2.70	2.10	1.23	2.35
min	6.27	8.93	2.99	1.50	1.62	0.75	1.57
CV (%)	3.71	3.89	4.98	13.69	6.86	9.46	19.47
6. DEVČA							
average	6.78	9.16	3.16	2.30	2.00	1.11	1.80
max	7.22	9.40	3.49	3.20	2.34	1.20	1.98
min	6.23	8.92	3.00	1.70	1.63	0.87	1.68
CV (%)	6.49	3.28	6.99	24.19	1.21	11.51	6.57
Average	6.59	8.96	3.09	2.20	1.99	1.07	1.82
Average CV (%)	4.69	5.10	6.90	17.60	9.73	9.19	11.50

The average value of the cubital index for yellow honey bee was 2.33 and 2.20 for gray honey. In the research by *Vlatković (1957)*, cubital index value for bees of Pešter Sjenica plateau ranged from 2.3 to 3.6. *Ruttner (1952)* stated that the cubital index value was 2.74. In the research by *Georgijev (2006)* interval of cubital index ranges from 2.45 to 2.65. Basitarsus length ranged from 2.03 to 2.05 mm in honey bees from Vojvodina. Average value for this trait in bees from southern Serbia was 1.99 mm and is similar to results obtained by *Jevtic (2007)* who analyzed honey bees from the six regions of Serbia, and found an average value of 2.07 mm. Basitarsus width had an average value of 1.16 mm in samples from Vojvodina and variation coefficient 4.73% (Table 1). Honey bees from

Southern Serbia had an average value of 1.07 mm and variability 9.19% (Table 2). These results are consistent with results obtained in studies by *Jevtić (2007)* where the basitarsus width ranged from 1.05 to 1.16 mm and in research by *Nedić (2009)* where the average basitarsus width of six studied lines from Serbia was 1.18 mm. Tarsal index had an average value of 2.11, with the variation coefficient of 3.58 (Table 1) and 1.82 with a coefficient of variation 11.50% (Table 2). Somewhat different results were obtained in research by *Georgijev (2001)* where the tarsal index was 1.79, while the average variation coefficient 14.16%.

## Conclusion

By measuring certain anatomical parts of yellow honey bees from Vojvodina and the gray honey bee from Southern Serbia, the following conclusions can be made:

Average value of tongue length is higher in the samples of gray honey bees in relation to the average value of yellow honey bee samples. Wing and basitarsus had slightly higher average value in the samples of yellow honey bees from Vojvodina in relation to the samples of gray bees from Southern Serbia. Variation coefficients for the tested areas are very different. It is notable that the coefficients for samples from Southern Serbia are higher than the variation coefficient for samples from Vojvodina except the variation coefficients for cubital index. The results of this research will be incorporated in the further studies and further selection of yellow and gray honey bee, as well as the conservation of indigenous material of *Apis mellifera carnica* Poll from Southern Serbia and Vojvodina.

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## MORFOMETRIJSKI PARAMETRI SIVE I ŽUTE MEDONOSNE PČELE IZ SRBIJE

*M. Mladenović, V. Pešev, R. Radoš, S. Rašić*

## Rezime

U ovom radu je vršeno istraživanje morfometrijskih parametara sa 6 lokaliteta južne Srbije (Panevlje, Bujanovačko jezero, Vranje, Stubal, Repince i Devča). Utvrđene su slede prosečne vrednosti morfometrijskih parametara kod sive medonosne pčele: dužina jezika (in vivo) 6.59 mm, dužina i žirina prednjeg

krila 8.96 mm i 3.09 mm, vrednost kubitalnog indeksa 2.20, dužina i širina bazitarzusa 1.99 mm i 1.07 mm, dok je prosečna vrednost tarzalnog indeksa bila 1.82. Uzorci žute pčele sakupljeni su sa lokaliteta Banatsko Arandelevo. Uljma i Fruška Gora. Prosečna vrednost za dužinu jezika (in vivo) je bila 6.4 mm. Prosečna vrednost za dužinu prednjeg krila je bila 9.05 mm, dok je širina krila iznosila 3.08 mm. Dobijena vrednost za kubitalni indeks iznosila je 2.33, a prosečna dužina i širina bazitarzusa su bile 2.04 mm i 1.16 mm. Vrednost tarzalnog indeksa iznosila je 2.11. U ovom istraživanju određena je i ukupna varijabilnost testiranih parametara.

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