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VARIABILITY OF THE PRODUCTION CHARACTERISTICS OF THE ISOLATED TRAITS OF THE HONEY BEE IN THE AREA OF TREBINJE

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Abstract

To obtain high yield in beekeeping and to exploit potential of the honeybee pasture in the region of the Republic of Srpska it is necessary to use carefully chosen honeybee queens with a good biological potential. Protection of the local subpopulations of the honeybees in order to preserve biodiversity of this kind in the Republic of Srpska is the second important factor for the choice of the honeybees mother queens and their further selection. In the paper we have examined 4 bee traits situated in the selection centre nearby Trebinje. This area is on the border of BH, Montenegro and Croatia in the zone of Mediterranean climate and it is additionally interesting for the isolation of the honeybee traits in order to have new honeybee queens in the earlier phases of beekeeping seasons than in other areas of the RS. The amount of bees, brood, honey, pollen, brood quality and behaviour was investigated in two spring and one autumn survey. All data have been carefully collected, statistically processed and analysed. Trait V2 had the biggest amount of bees in the first and second spring examination (2.26 and 4.84 frames) and statistically it is importantly different from other traits by this characteristic ($P<0.01$). The same trait had the biggest amount of brood in spring examinations and it was importantly different from the other traits ($P<0.01$). The best brood quality (mark 3) in all 3 examinations during the year had traits V2 and G2. All examined traits showed variability that provides successful improvement of wanted characteristics and selection of suitable mother queens in order to get high productivity in beekeeping.
Keywords: honeybee, trait, production characteristics, selection

Introduction

Honeybee (*Apis mellifera* L.) is the most useful insect. Apart from the direct bee products, indirect benefit of the pollination in the world is estimated at more than 150 billions euros, which makes 9,5% of the world production value. (Gallai & assiss., 2009). In beekeeping, as well as in other branches of cattle raising, a lot of attention is paid on the selection of productive and vital parentism in the process of breeding and selection. These postulates are imposed by ambition for higher yield and more economic production. This task is difficult because quantitative characteristics, such as honey yield, are affected by a few genes, and apart from it the effect of the para-genetic factors are present (Hellmich et al., 1985; Page et al., 2002). Honey yields are also defined by the number of the working bees cells and by the number of the bees in the bee hive (Szabo & Lefkovitch, 1989). In order to have a normal spring development it is necessary to have enough brood of the different age in the bee hive (Jevtic, 2007). Quick development of the brood in spring is the race characteristics of the Carniolan bee, but it can also be affected by winter food reserve (Mladenovic et al., 2002). Quantity of pollen in the bee hive is very important for the nutrition and it is the source of

proteins, fats, vitamins and minerals for bees. Between the total surface of the brood and the number of the pollen bees there is a high positive correlation (Lebedev, 2001; Mladenovic et al., 2004). Separation and selection of bee traits with production characteristics which are above the average are the aim of the selection work. Therefore, the aim of this research was to study the most important productive traits of some bee traits from surrounding of Trebinje and give recommendations for breeding of the best traits of honey bees.

Materials and methods

This research was carried out on the apiary of the selection centre in Trebinje. Four bee traits of the *Apis mellifera carnica* race were included in the evaluation procedure. The first two traits V1 and V2 originates from Vucija, trait G1 from Golija and G2 from Grahovo. Traits were formed from the daughters and dominated queen mothers. The bee colonies were put into standard Langstrot-Rut beehives and at the start of the trial they were equalized in terms of strength (population of bees). The evaluation was performed in two spring examinations (I and II) before the beginning of S*alvia officinalis* pasture and in the autumn examination in the first 10 days of September. In order to do so, the individual frame was though to be divided in 10 horizontal parts (5 parts per side). The numbers represent the sum of values recorded for each trait from all frames of the colony. The following productive traits were examined using the above method: the surface of comb covered with bees, brood, honey and pollen. Brood quality was recorded using a system of points: 3 = excellent (without empty cells), 2 = good (present of few individual empty cells), 1 = spotty brood. Gentleness of bees was also evaluated using the point system: 4 = keep still, 3 = restless, 2 = runs from the combs, 1 = leaves the combs.

All measurements of examined characteristics for the bees were analysed by one way ANOVA analysis and comparisons between different traits were determined by LSD Test.

Results and discussion

To obtain high yield in beekeeping it is necessary to have strong colonies and one of the aims in the beekeeping technology is to have a large/numerous colony. Because of that, quantity of bees per a colony is a very important economic characteristic of honey bees which are examined in the selection work.

Results of all examined characteristics are shown in the Table 1. The biggest quantity of bees in all three examinations appeared in colonies of V2 traits from Vucija (2,26, 4,84 and 2,55 frames).

During his examination of seven traits in Timok region, Serbia in the first spring examination Georgiev (2006) defined 2.93 frames of bees per a colony, while Nedic (2009) in the first spring examination for six bee traits defined 1.46 frames of bees per a colony in average. In the first two spring examinations the difference in the quantity of bees was importantly ($P<0.01$) different between examined traits (Table 2). In LSD trait examinations Trait V2 was statistically very different from the other traits ($P<0.01$) for the surface of bees on the frame.

In order to have a good spring development in colonies it is very important to have brood in all developing phases starting from eggs, then larvae to covered brood during orchard blossoming (Jevtic, 2007). In our examinations we defined statistically very significant difference regarding the surface of brood in four examined traits in the first two spring examinations (Table 2). The biggest surface of brood in spring examination had trait V2 (2.41 and 5.29 frames) and these values are statistically very different ($P<0.01$) from the other traits.

In spring, fresh flow of nectar and pollen cannot completely satisfy colonies needs for feeding brood. Because of that bees use food stored for wintering. The lack of honey in

spring leads to the reduction of the cared larvae and it reduces the colony strength for tha main pasture. (Taranov, 2001).

The quantity of honey among examined bee traits is significantly different in the first spring examination, while in the second spring examination and in autumn examination there was not statistical difference in the amount of honey among traits. For this characteristic also Trait V2 had the biggest average amount of honey (1.16 and 3.64 frames) in the first two spring examinations.

Table 1. Descriptive statistics for the examined traits of honeybee traits

Factor	I Spring exam			Factor	II Spring exam			Factor	Autumn exam		
Trait	n	$\bar{x}$	SD	Trait	n	$\bar{x}$	SD	Trait	n	$\bar{x}$	SD
Honeybee surface (1/10 frame)											
V1	8	1,09	0,39	V1	8	2,88	0,66	V1	8	1,73	0,55
V2	8	2,26	1,05	V2	8	4,84	1,13	V2	8	2,55	0,95
G1	4	0,88	0,30	G1	4	2,58	1,16	G1	4	1,60	0,58
G2	6	1,15	0,59	G2	6	2,83	2,08	G2	6	2,02	0,67
Average	26	1,43	0,87		26	3,42	1,56		26	2,03	0,78
Brood surface (1/10 frame)											
V1	8	0,99	0,27	V1	8	3,55	0,77	V1	8	3,43	0,57
V2	8	2,41	1,21	V2	8	5,29	0,96	V2	8	3,70	1,36
G1	4	0,83	0,51	G1	4	3,43	1,46	G1	4	3,45	0,84
G2	6	1,15	0,58	G2	6	2,65	1,54	G2	6	3,97	0,72
Average	26	1,44	0,99		26	3,86	1,49		26	3,64	0,92
Honey surface (1/10 frame)											
V1	8	1,03	0,37	V1	8	1,30	0,34	V1	8	0,99	0,35
V2	8	1,16	0,46	V2	8	3,64	2,74	V2	8	2,94	2,15
G1	4	0,80	0,35	G1	4	1,80	1,33	G1	4	1,43	1,72
G2	6	0,57	0,20	G2	6	1,92	2,11	G2	6	2,75	1,25
Average	26	0,93	0,42		26	2,24	2,05		26	2,06	1,67
Pollen surface (1/10 frame)											
V1	1	0,10	0,00	V1	8	0,28	0,15	V1	8	0,76	0,38
V2	4	0,13	0,05	V2	8	0,78	0,58	V2	8	0,78	0,31
G1	0	-	-	G1	2	0,60	0,71	G1	3	0,23	0,06
G2	1	0,30	0,00	G2	5	0,48	0,50	G2	5	0,52	0,24
Average	6	0,15	0,08		23	0,52	0,48		24	0,65	0,35
Brood quality (mark from 3 to 1)											
V1	8	2,75	0,46	V1	8	3,00	0,00	V1	8	3,00	0,00
V2	8	3,00	0,00	V2	8	3,00	0,00	V2	8	3,00	0,00
G1	4	2,75	0,50	G1	4	3,00	0,00	G1	4	3,00	0,00
G2	5	3,00	0,00	G2	6	3,00	0,00	G2	6	3,00	0,00
Average	25	2,88	0,33		26	3,00	0,00		26	3,00	0,00
Gentleness (mark from 4 to 1)											
V1	8	4,00	0,00	V1	8	4,00	0,00	V1	8	3,50	0,53
V2	8	3,88	0,35	V2	8	4,00	0,00	V2	8	3,63	0,52
G1	4	4,00	0,00	G1	4	4,00	0,00	G1	4	3,75	0,50
G2	5	3,80	0,45	G2	6	4,00	0,00	G2	6	3,67	0,52
Average	25	3,92	0,28		26	4,00	0,00		26	3,62	0,50

To satisfy feeding needs of honey bees in proteins it is necessary to have pollen of the adequate quality and quantity in bee colonies (Mladenovic et al., 1999). In the examined traits we noticed the lack of pollen in the first spring examination, where pollen was found only in six colonies. This lack bees try to overcome in spring, what is seen in the second spring examination. Low values of the marked pollen in all traits in the second spring examination are the result of the high consumption of pollen in the nutrition of the bee brood. Brood quality is the characteristic of high importance during selection work. Loose and spotty brood can be a sign of mating in relationship, or it can also be a sign of an old bee queen or not quality bee queen. Based on the results of examination of brood quality it is established that only traits V2 and G2 had brood marked with best marks (3.00), while traits V1 and G1 in the first spring examination had brood of less quality which was marked with 2.75.

Table 2. Results of analysis of one way ANOVA for examined traits

Factor	I Spring exam		II Spring exam		Autumn exam	
	$F_{exp.}$	p	$F_{exp.}$	p	$F_{exp.}$	p
	Honeybee surface					
Traits	5,52	0,01**	4,54	0,01**	2,294	0,106
	Brood surface					
Traits	6,23	0,00**	6,75	0,00**	0,436	0,730
	Honey surface					
Traits	3,35	0,04*	2,18	0,12	2,906	0,057
	Pollen surface					
Traits	5,50	0,10	1,59	0,22	2,905	0,060
	Brood quality					
Traits	1,21	0,33	-	-	-	-
	Gentleness					
Traits	0,69	0,57	-	-	0,241	0,867

* - P<0,05; ** - <0,01;

Behaviour of the Carniolan bees is very nice and it is known as a tranquil bee which does not show aggression. During selection work the aim is to choose bees that area tranquil and that do not sting during examinations of colonies. This characteristic can be influenced not only by genetis predisposition, but also by environment temperature, different smells that can irritate bees etc. Because of that it is important to have the same criteria for the whole apiary where are colonies are situated from traits. The average behaviour mark for all examined traits was the best during the second spring examination (4.00), while in the first spring and autumn examination there were differences in behaviour of examined traits that influenced the average behaviour mark (3.92 and 3.62). The best behaviour mark was given to the trait G1 (4.00, 4.00 and 3.75), and the worst behaviour mark was given to the trait V2 (3.88, 4.00 and 3.63). Defined differences between examined traits were not statistically important (P>0.01). The similar results were also got by Georgieva (2006) while examining bees from the area of East Serbia and she marked behaviour in her selection examinations with 3.47, 3.76 and 3.78.

Conclusion

Based on the results of the examined productive characteristics: bee surface, brood surface, honey surface, pollen surface, brood quality and bee behaviour in four honey bee traits in the selection centre in Trebinje we can make the following conclusions:

Examined traits showed the characteristic productive characteristics for the Carniolan bee race. The best results were found in trait V2 (Vucija 2) especially for the characteristics of bee surface and brood in the first two spring examinations and statistically very significant ($P<0.01$) it differed from the rest of examined traits. Trait V2 had also a good honey surface during examinations and an excellent mark for brood quality.

Only behaviour of trait V2 was worse comparing to the other traits, but this characteristic can be improved in the selection work by choosing mothers with tranquil temperament. Results of trait V2 can be explained by the fact that locally adapted organisms, such as honey bees, have better productive results than the organisms bred in other ecological conditions.

Shown variability of the examined characteristics gives enough space to improve the most important productive characteristics by careful selection of bee queens mothers from traits with results that are above average. By extension of the high-quality breeding mothers we can expect positive effects of the application of selection in the beekeeping in the Republic of Srpska.

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