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A Comparison on Some Features of Queens Reared from Different Honeybee (*Apis mellifera* L.) Genotypes

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Abstract: In this research, four groups of queens were reared from the pure breed Caucasian and Anatolian honeybees and their crossbreds using artificial insemination technique and Doolittle method. Then, the yield of grafting, the period up to the pre-oviposition and queen weights in the pre-oviposition and post-oviposition periods were analyzed and compared depending upon genotype of reared queens. While 80 % of the inseminated larvae in the Caucasian group was accepted and properly fed by the bees, this rate was 83.33 % in the Anatolian group. It was concluded that the queens from the pure-breed and hybrid Anatolian genotypes began oviposition later than Caucasian queens and differences among the groups in terms of pre-oviposition and post-oviposition weights of the queens were not significant.

Key words: Honeybee (*Apis mellifera* L.) genotypes, queen and queen features

Introduction

Honeybees are social insects living in colonies. A honeybee colony reveals three types of individuals grouped as queen-bee, worker bee and drone types having different features with regard to anatomical and physiological aspects. The queen holds the most important position in a colony in hive. To put it in more explicit terms, the yield of performance of a colony is associated with the combined effect of the climate, vegetation and queen and her breeding value to large extent (Genc, 1992).

There are 4.322.000 hives with bees in Turkey according to the 2000 statistics (Anonymous, 2000). There is a need of approximately 2.100.000 queens per year in Turkey. The production of queens under the controlled conditions have been made by a few state institutions and some private producers for the last 15 years, but the amount of this production can only meet 5 % of queens required. The apiarists who can not afford to buy queens or can not produce them tend to use queens for a long time or meet their need by dividing or by using the natural cells taken from the colonies preparing for swarming. Even though they manage to secure an increase in yield through the renewal process of the queen, they also cause an increase in the number of colonies having aggressiveness, low honey yield and high swarming tendency.

To rear a high quality of queen depends upon the inner and outer conditions of the bee-hive. The time the colony is prepared to swarm the most available period to rearer a good quality of queen. The queens to be reared in the colonies which are about to swarm are possessed of better features (Weiss, 1983).

In a research carried out around Erzurum, larvaes were grafted with an additional royal-jelly, dry and with an additional water; the percentages of grafting were found to be 88.89 %, 72.22% and 65.56%, respectively. In addition, the average pre-oviposition periods of the queens in different groups were 15.07±0.88, 14.03±0.83 and 15.07±1.12 days, respectively (Genc, 1996).

In a study including different rearing and grafting methods (Dodologlu and Genc, 1997), the pre-oviposition periods of the queens reared under control by using natural cells were determined as 11.00±0.33 and 11.23±0.44 days, respectively. However, these periods for artificially insemination group were 13.88±0.30 and 14.00±0.44 days.

Donald and Norman, (1983) reported that closed brood and weight of the queen after removed from the mating box were directly associated with the yield of honey, the average weight of queen was 214.4 mg at 18th hours after removing from the mating box. In addition, the weight of the same queens were reduced to 207.9 mg after 8th days.

In this study, the various features of queens in four different groups reared under control and artificially inseminated from the Caucasian, pure-breed Anatolian honeybee and their crossbreds were investigated and it was aimed to guide the apiarists on the basis of these features examined above.

Materials and Methods

The research was carried out at Apicultural Application and Research Unit at Agricultural Faculty of Ataturk University. A colony from each genotype was chosen for the production of larvae

from the Anatolian and Caucasian genotypes having superior features from the aspects of various criteria. One colony of beginning and one of finishing colony were utilized for the each of Caucasia X Caucasia (C X C), Caucasia X Anatolia (C X A), Anatolia X Caucasia (A X C) and Anatolia X Anatolia (A X A) genotypes. 80 mating colonies were formed for the reared queens. Artificial insemination instrument, microscope, drone's cage, queen's cage, sensitive balance, transfer spoon, grafting frame, cross-bars and queen grill were also used in present study. Artificial insemination method was used for the queens reared under control by Doolittle method from June to August in 1998.

In this research, 0-24 hours old larvae taken from the colonies belonging pure-breed genotypes were used. 30 larvae was given to each one of the beginning colonies. The larvae accepted by the bees in these colonies were counted the following day to see the rate of grafting and the cells were transferred to the prepared finishing colonies.

The queen cells were transferred to the mating colonies after they were reaped at the end of the 9^{th} day following grafting. 80 queens randomly selected (20 queens from each group) and given to the mating colonies were assigned for artificial insemination. 8 µl spermatozoid from 8-10 drones was used for each of the queens during the artificial insemination.

Daily controls of the queens in each insemination group were made in the mating colonies to determine the pre-oviposition periods. The queens whose pre-oviposition periods have been determined have been given by cage from the colonies of mating to the colonies of production. The weight of 15 queens from each group, 18 hours after they were removed from the colonies of mating, was sensitively (0.001 mg) determined as well as their weight 8 days after they were admitted into production colonies. Also, the queens which were admitted into the production colonies were counted to determine the rates of the acceptance of queens.

The pre-oviposition periods of the queens in each group and their pre-oviposition and post-acceptance weights were statistically analyzed by Completely Randomized Experiment Design. Least Significant Difference (LSD) test was also applied to compare means having significant effect. The acceptance rates of queens and grafting yield were analyzed with the rate test (Duncan, 1954).

Results and Discussion

The Yield of Grafting: 83.33 % (50) in the Anatolian group and 80.00 % (48) in the Caucasian group from total 120 larvae belonging to four different insemination groups were accepted by the bees for feeding and all of these cells completed their incubation period and the queens made a normal emergence (Table 1). In present study, values of grafting yield were determined to be 83.33 % and 80.00 % respectively, but grafting yield was found as 64.8 % in a study conducted by Gul and Kaftanoglu (1990). Kaftanoglu and Kumova (1992) reported that grafting yield values were 91.4 % for April, 83.33 % for May, 91.7 % for June, 85.0 % for July, 60.0 % for August and 58.3 % for September; In a previous study, 95.0 % of grafting yield was reported by Dodologlu and Genc (1996). That the findings of the present research are different from the reports of literature is guessed to have arisen from the condition of care rearing colonies and the difference of race and climate. In addition, difference in terms of grafting yield values between groups was not significant.

Table 1: The results of larvae transfer and grafting yield

Features	Anatolian	Caucasian	General
The number of grafted larvae	60	60	120
The number of accepted cells	50	48	98
Grafting yield (%)	83.33	80.00	81.66
The number of emergence queens	50	48	98
Emergence rate (%)	100.00	100.00	100.00

Pre-oviposition Period: The mean pre-oviposition periods in the queens were found to be 14.667±0.349 days in A X A group, 14.067±0.343 days in A X K group, 13.200±0.261 days in K X K group and 13.733±0.330 days in K X A group (Table 2). According to the results of the variance analysis applied to the values of pre-oviposition, differences among genotypes were found to be significant ($P<0.05$).

According to the LSD test applied to the averages of the pre-oviposition period, while the mean value of the A X A group was not different from that of the A X C group, it was found significantly higher than those of the C X C and C X A groups ($P<0.01$). On the other hand, there was not significant difference in the mean values of pre-oviposition among the A X C, C X C and C X A groups. The mean pre-oviposition periods for the four groups in the present research were in agreement with the results (14.00 and 13.88 days) reported by Dodologlu and Genc (1997)

Table 2: Mean values for various features of queens

Groups	n	$\bar{x} \pm S_{\bar{x}}$	Max.	Min.
Pre-oviposition Period (Day)				
AxA	15	14.667±0.349A	17	13
AxC	15	14.067±0.343AB	16	12
CxC	15	13.200±0.261B	15	12
CxA	15	13.733±.330AB	16	11
General	60	13.920±.172	17	11
Pre-oviposition Weight of the Queens (mg)				
AxA	15	228.60±2.466	242	211
AxC	15	227.20±2.688	250	210
CxC	15	227.07±2.492	241	207
CxA	15	224.20±2.091	235	210
General	60	226.77±2.417	250	207
Post-oviposition Weight of the Queens (mg)				
AxA	15	214.80±1.343	223	205
AxC	15	216.13±1.482	227	209
CxC	15	217.80±1.763	230	205
CxA	15	212.73±1.562	224	203
General	60	215.37±1.580	230	203

A,B: The difference between the mean values carrying different letters (P<0.01), LSD

for the queens reared from the natural cells under the controlled method and insemination artificially, but they have been found higher than pre-oviposition periods for the queens reared from the natural cells by Doolittle method and mating naturally (10.9 and 11.1 days)(Dodologlu and Genc, 1996).

Pre-oviposition Weight of the Queens: The mean pre-oviposition weights of the queens in different genotypes were 228.60±2.466 mg for A X A group, 227.20±2.688 mg for the A X C group, 227.07±2.492 mg for the C X C group and 224.20±2.091 for the C X A group (Table 2). According to the results of variance analysis applied to the weights of the queens, the pre-oviposition weights of the queens in the genotypes were not different from each other. The obtained values were found higher (214.4 mg) than the pre-oviposition weight of the queens reported in literature (Donald and Norman, 1983).

Post-oviposition Weights of the Queens: The post-oviposition weights of the queens were 214.80±1.343 mg for A X A group, 216.13±1.482 mg for the A X C group, 217.80±1.763 mg for the C X C group and 212.73±1.562 for the C X A group (Table 2). According to the results of variance analysis applied to the post-oviposition weights of the queens reared from the different genotypes, the effect of genotype on the post-ovipoisition periods of the queens was not significant. The values obtained from the study were higher than the 8th day weights of the ovipoisition queens (207.9 mg) reported in literature (Donal and Norman, 1983). This difference may be due to climate conditions, colony condition and the difference in breed.

The Acceptance Rate of the Queens: A total of 80 queens, 20 queens for each group of 4 groups, were given to be caged to production colonies. They were accepted 100 % in the A X A group, 85 % in the A X C group, 90 % in the C X C group and 90 % in the C X A group. In other words, all of the queens in the A X A and A X C were accepted by the colony to which they were given and 17 of the 20 queens were accepted in the C X C group while 18 of the 20 queens were accepted in the C X A group. The rates were analyzed by the rate test, but there was not difference in this aspect among the groups.

Conclusions

The present study revealed that the pre-oviposition periods vary depending upon genotypes of the queens reared from different breeds and pre-and post-oviposition weights and the rates of acceptance are not different among genotype groups. In other words, the queens reared from the pure-breed and hybrid Anatolian groups in pre-oviposition periods were later time than the ones from the Caucasian groups did. In addition, C X C and C X A genotypes showed better

performance than AxA and AxC genotypes for the purpose of making better use of the colonies of mating in the queen rearing.

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