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RESEARCH ARTICLE

Comparison of Swarming Tendency and Defensive Behavior of Yığılca Local and Other Commonly Used Honeybee Genotypes in Turkey [1]

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Summary

In this study, swarming tendency and defensive behavior of Yığılca local honeybee were determined and compared with other commonly used honeybee genotypes in Turkey. Colonies were headed by naturally mated queens and 10 colonies of Yığılca local honeybee, 12 colonies of *of Apis mellifera caucasica* cross and 12 colonies of *of Apis mellifera anatoliaca* cross were used in the experiment. In swarming season, Yığılca honeybee colonies constructed more queen cells (49.86±18.00) than both *A.m. anatoliaca* cross (13.00±7.00) and *A.m. caucasica* (8.00±1.15) cross colonies. Similarly, according to results of sting test, the highest number of stings was determined in Yığılca honeybee colonies (18.38±4.24), followed by *A.m. anatoliaca* (5.50±2.15) and *A.m. caucasica* (3.75±0.62) crosses. Results showed that Yığılca local honeybee genotype has a more swarming tendency and is more defensive than *A.m. anatoliaca* and *A.m. caucasica* crosses.

Keywords: *Yığılca honeybee, Swarming, Defensive behavior, Genetic conservation*

Yığılca Yerel Bal Arısının Oğul Verme Eğilimi ve Savunma Davranışı Bakımından Türkiye'de Yaygın Olarak Kullanılan Diğer Genotipler ile Karşılaştırılması

Özet

Bu çalışmada, Yığılca yerel bal arısının oğul verme eğilimi ve savunma davranışının belirlenmesi ve Türkiye'de yaygın olarak kullanılan diğer bal arısı genotipleri ile karşılaştırılması amaçlanmıştır. Araştırmada, doğal çiftleşmiş ana arılar ile oluşturulan Yığılca bal arısı genotipinden 10 koloni, Anadolu ve Kafkas ırkı melezlerinden ise 12'şer koloni olmak üzere toplam 34 adet bal arısı kolonisi kullanılmıştır. Oğul verme mevsimi süresince Yığılca bal arısı kolonilerinin (49.86±18.00) hem Anadolu ırkı melezi kolonilerinden (13.00±7.00) hem de Kafkas ırkı melezi kolonilerinden (8.00±1.15) daha fazla ana arı yüksüğü yaptıkları belirlenmiştir. Benzer şekilde sokma testi sonuçlarına göre, en yüksek iğne sayısı Yığılca bal arısı kolonilerinde (18.38±4.24) belirlenirken, bu grubu Anadolu ırkı melezi (5.50±2.15) ve Kafkas ırkı melezi (3.75±0.62) koloniler takip etmiştir. Araştırma sonuçları Yığılca yerel bal arısı genotipinin Anadolu ve Kafkas ırkı melezlerine göre daha fazla oğul verme eğilimi gösterdiği ve daha hırçın olduğunu ortaya koymuştur.

Anahtar sözcükler: *Yığılca bal arısı, Oğul, Savunma davranışı, Genetik koruma*

INTRODUCTION

The honeybee (*Apis mellifera* L.), the most economically important beneficial insect, has proven to be highly adaptive to a wide variety of ecosystems in its native range of Africa, Europe, and Central and Western Asia. Across this range, numerous subspecies and ecotypes of *A. mellifera* have been described based upon behavior, morphology and molecular evidence. While some subspecies inhabit large geographic areas, some subspecies and all ecotypes

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inhabit relatively small geographic areas with smaller population size [1-5]. Specific behavioral and phenological adaptations to local environment conditions are known for some honeybee populations [1,6,7]. The survival of these locally adapted populations or ecotypes results from a number of traits conferred selective advantage to the population within an ecologically distinct area [8]. Each honeybee genotypes that genetically different have their own peculiar behavior traits. Within the endemic range of the honeybee, the variation between the behavioral traits, such as swarming and defensive, provides the basis for subspecific classification [9,10].

Several honeybee races and native ecotypes have been adapted to different ecological regions of Turkey. They have some differences in their morphology, behavior and physiology according to the environmental conditions. Based on multivariate analysis of morphometric data, Ruttner [1] suggested that three subspecies exist in Turkey: *A.m. caucasica* in the northeast, *A.m. meda* in the southeast and *A.m. anatoliaca* throughout the rest of the country including Thrace (European part of Turkey). Also some researches studied the honeybee populations using different approach and reported that there are another *A. mellifera* subspecies in Turkey: *A.m. carnica* in Thrace and *A.m. syriaca* in the southeast [11-14].

A.m. anatoliaca and *A.m. caucasica* are used intensively for commercial queen bee rearing in Turkey. For this reason, it is presumed that these two honeybee genotypes and their crosses constitute the majority of honeybee population in the country. Gentle and productive *A.m. caucasica* also has been used in beekeeping in many places around the world especially in higher elevations [15,16]. The Anatolian honeybees, *A.m. anatoliaca*, have many ecotypes and local populations that differ from each other morphologically, physiologically and behaviorally [17]. One of the local populations inhabits in Yığılca, a small geographic area in Western Black Sea Region in Turkey. Morphometric and genetic studies reported that Yığılca local honeybee population differed from other populations of *A.m. anatoliaca* [18-20]. Despite the wide spread efforts for genetic conservation of this population and great demand for queen and colony from beekeepers, there is no data about its behavioral, colony development and production characteristics. Therefore, the aim of the present study was to determine the swarming tendency and defensive behavior of Yığılca honeybee and compare with *A.m. caucasica* and *A.m. anatoliaca* crosses which are the most common genotypes in honeybee population of Turkey.

MATERIAL and METHODS

The experiment was carried out in Düzce, Turkey. Thirty four colonies headed by naturally mated queens were used in the experiment; 10 colonies of Yığılca local honeybee, 12 colonies of *A.m. caucasica* and 12 colonies of *A.m. anatoliaca*. Queens of *A.m. caucasica* and *A.m. anatoliaca* were reared in apiaries where queens are reared commercially at Central Anatolia Region. Yığılca honeybee queens were reared from original breeder colonies of this genotype in Yığılca (Düzce), according to Laidlaw [21]. In all groups, queens were reared from different breeder colonies selected by randomly for representation of the population. Each mated queen was introduced into 6-frame colonies. These colonies were managed the same way for a period of 60 days prior to the beginning of the experiments to allow time for workers in the colony to be replaced by daughters of the new queens [22]. The experimental colonies were equalized with regard to adult bee, brood and food stocks. They were kept in Langstroth hives in the same apiary and evaluated for swarming tendency and defensive behavior for a reproduction season.

In swarming season from April to July, all colonies in the genotype groups were controlled every week under normal colony management conditions. During the observation period, the numbers of colony had a swarming tendency and the numbers of queen cell in these colonies were recorded to assay the swarming tendency of genotypes. All sealed and unsealed queen cells were counted and destroyed in queenright colonies [6]. To quantify defensive behavior, black coloured suede target attached to the end of a one meter stick was waved for one minute by hand in a rhythmic way approximately 10 cm from the entrance of the hive to stimulate the defensive response of colonies. The numbers of the stings in the target were recorded in order to measure the defensive trait of each colony. This process was repeated 8 times at different dates and two colonies which were equal with regard to worker population from each genotype were tested simultaneously in each repetition [6,23]. For statistical analysis, SPSS statistical program was used. Chi-square test was performed to analyze the data of swarming tendency. Swarming tendency of genotype groups was also compared by t-test. Defensive behavior trait data of the three genotype groups were analyzed by ANOVA and the means were compared using the Duncan multiple comparison test.

RESULTS

The swarming tendency and the number of queen cells constructed in groups were given in *Table 1*. Results of χ^2 analyses showed that there was significant difference in the swarming tendency between the genotype groups. According to the results, Yığılca local honeybee colonies constructed more queen cells than other genotypes ($P<0.05$). In swarming season from April to July, 2 of 11 colonies (18.18%) in Anatolian group, 3 of 10 colonies (30.00%) in Caucasican group and 7 of 9 colonies (77.77%) in Yığılca group constructed queen cells known as swarm marker.

According to results of sting test, defensive behavior of genotypes (the numbers of sting) were significantly

Table 1. *Swarming tendency and number of queen cells in genotype groups (n = number of colonies had a swarming tendency)*
Tablo 1. *Genotip gruplarında oğul verme eğilimi ve ana arı yüksük sayıları (n= oğul verme eğilimi gösteren koloni sayısı)*

Genoypes	Number of Queen Cells				Swarming Tendency (%)
	n	X±Sx	Min	Max	
A.m. anatoliaca	2	13.00±7.00	6	20	18.18**b**
A.m. caucasica	3	8.00±1.15	6	10	30.00**b**
Yığılca Local Honeybee	7	49.86±18.00	2	136	77.77**a**

Means followed by different letters (a,b) in the same column are different (P<0.05)

Table 2. *Number of stings (results of sting test) in genotype groups (n = number of colonies)*
Tablo 2. *Genotip gruplarında belirlenen iğne sayıları (n = koloni sayısı)*

Genotypes	n	X±Sx	Min	Max
A.m. anatoliaca	6	5.50±2.15**b**	1	18
A.m. caucasica	5	3.75±0.62**b**	2	6
Yığılca Local Honeybee	4	18.38±4.24**a**	6	40

Means followed by different letters (a,b) in the same column are different (P<0.01)

different eachother (P<0.01). In the present study, *A.m. caucasica* was the gentlest genotype and Yığılca local honeybee was the most defensive genotype. Although Yığılca local honeybee was significantly different from *A.m. caucasica* and *A.m. anatoliaca* in terms of defensive behavior, there was no significant difference between the *A.m. caucasica* and *A.m. anatoliaca (Table 2)*.

DISCUSSION

The honeybee population show a great genetic variation and this variation provide some advantages to improve the honeybee culture in Turkey [24]. Several honeybee subspecies and ecotypes have been adapted to different ecological regions [1,12,14,17]. *A.m. anatoliaca* and *A.m. caucasica* subspecies, and their reciprocal crosses constitute the majority of honeybee population in the country. There are several local populations of the *A.m. anatoliaca,* such as Muğla bees, Yığılca bees and Giresun bees. However, these local genotypes were not isolated in their geographical range, less well defined and need further investigation [5].

The survival of local or native honeybee populations results from a number of traits commonly perceived as adaptive, many of which are related to reproductive swarming and defensive behavior [6,10,25]. This present study clearly showed that Yığılca genotype is more inclined to swarm and is more defensive than *A.m. anatoliaca* and *A.m. caucasica* crosses. Yığılca honeybee colonies constructed more queen cells (49.86±18.00) than both *A.m. anatoliaca* (13.00±7.00) and *A.m. caucasica* (8.00±1.15) crosses. Genç et al.[6] reported that Erzurum honeybee genotype had more defensive behavior but had not more swarming tendency than *A.m. anatoliaca* and *A.m. caucasica*. Similarly, Yücel and Kösoğlu [25] found that Muğla ecotype showed better performance for adaptation to environmental conditions and had more defensive behavior than Italian cross. The variation in swarming tendency and defensive behavior can be used for classification of honeybee population [9,10]. Morphometric and genetic studies also suggested that endemic honeybee in Yığılca provience of Düzce distinct from the other population and the conservation of this genotype in its native range may be worthwhile [18-20].

The importation of foreign queens and the practice of moving hives several times in a year are factors that can affect the genetic structure of a local honeybee population through genetic introgression [26]. It is known that the migratory beekeeping is practiced extensively in Turkey. However, local beekeepers claimed that neither foreign honeybee colonies nor queens were introduced into Yığılca location and colonies have been managed traditionally. Therefore, it should be considered that endemic honeybee population may exist in Yığılca location. In many countries of Europe, there is a kind of "certification" for local honeybee populations and official conservation programme have been managed [5]. Although conservation of Yığılca local honeybee is also proposed, its adaptive characteristics have not been studied making it difficult to rapidly implement conservation efforts. Identify the other characteristics of this local genotype in both their native location and other region, for this reason, need to be examined in future studies.

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