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Morphological characteristics of Şebap pigeons (*Columba Livia Domestica*)

Romedi Çelik

Department of Animal Husbandry, Faculty of Veterinary Medicine, Harran University, 63200 Şanlıurfa, TURKEY. Çelik R. ORCID: 0000-0002-6517-3688

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ABSTRACT

Şebap pigeon is unique to Şanlıurfa region, which has a deep pigeon breeding culture in Turkey. In this region pigeon breeding is a tradition. In Şanlıurfa there are 5 different colours varieties of Şebap, including Miski, Kürenk, Çakmaklı, Gök and Arap, which were determined by Şebap Pigeon Association and Federation. The objective of this study is to determine the phenotypic characteristics of the Şebap pigeon. Animal material (n=132) of the study consists of stated varieties, which were analyzed according to age and as well as gender (n=66 male, n=66 female). Age groups were formed on the basis of 4 development periods, including 06-12 months (Group 1, n=28), 13-24 months (Group 2, n=35), 25-36 months (Group 3, n=37) and >36 months (Group 4, n=32). The distribution of varieties was as follows: Miski (57.5%), Kürenk (16.7%), Çakmaklı (11.4%), Gök (11.4%) and Arap (3.0%). According to morphological characteristics analyzed in the study, the difference between the gender groups in terms of body length was found to be statistically significant ($p < 0.01$). The Şebap pigeon is represented by a federation of 28 associations in Turkey. Since the beginning of the 20th century. Şebap pigeon has a large head and thick neck. The beak is bluish grey in the Çakmaklı and Gök varieties and vibrant pink in the Miski, Kürenk and Arap varieties. The findings of this study support the view that Şebap pigeon is breed. However, it would be meaningful to support the results obtained for morphometric characterization with future genetic characterization studies.

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Introduction

As a member of Columba genus and Columbidae family, apart from few exceptions the rock pigeon constitutes of morphologically uniform family. The Columbidae family has 5 sub-families, including Columbinae, Otidiphabinae, Treroninae, Gourinae and Didunculinae. Among these sub-families Columba is the largest genus of this family. Columba genus is used to refer rock pigeons generally represented by the livia (Biray, 2019) The monogamous nature of pigeons provides convenience to breeders and makes it possible to develop the breed in the same dovecote and to obtain new breeds for enthusiasts (Darwin, 1976). The common pigeon and feral pigeon, that we see in our daily lives, were the members of the Columba. The domestication of the pigeon dates back around 10 000 years ago (Blasco et al., 2014; Çelik, 2022). Throughout human history pigeon fulfilled the needs of human beings as a food source. It was used for the purposes of communication and racing animal. More importantly, the pigeon satisfied the enthusiasts thanks to the aesthetic appearance of different breeds. They were accepted as a religious symbol, and today they are the symbol of peace (Atasoy et al., 2013). Mesopotamian figurines, mosaics, coins and tablets portraying pigeon's dates back 5000 years ago (Biray, 2019; Çelik, 2022).

In Şanlıurfa, the number of individual bird keepers referred as "curious fancier people" is high

*Corresponding Author: Romedi Çelik
E-mail: romedi@harran.edu.tr,

(Kürkçüoğlu, 2011). There are many special places where pigeon shows, and trades are held. As such, pigeon breeding stands out not only as a branch hobby breeding, but also as a common commercial activity.

The Şebap pigeon breed is represented by a federation of 28 associations in Turkey. Since the beginning of the 20th century (Şebap Güvercin Federasyonu, 2021), Şebap has widely been bred in the south of Turkey. Although it has similar color and physical characteristics of the Turkish tumbler pigeon (Taklacı), Şebap has been differentiated from the Tumbler breed and has preserved its current characteristics for a century. Today it is used as a costume bird. General appearance of Şebap can be described as medium in size, having fluffy and soft plumage, with a large head and thick neck, and plump legs. The color of chest fur and eye color varies according to body fur. The distinguishing feature of Şebap is that it has white middle tail feather (Şebap Güvercin Federasyonu, 2021).

Although there are studies focusing on the characteristics of different native pigeon breeds, such as Bursa Oynarı (Balcı et al., 2018), Cakal, Mulakat (Özbaşer et al., 2020), Muradiye Dönek (Özbaşer et al., 2021), Edremit Kelebek Roller Pigeon (Erdem et al., 2018), Thrace roller (Soysal et al., 2011), Squadron flyer (Özbaşer et al., 2016), Scandaroon pigeons (Yıldırım et al., 2018), Klasik Manisa Hünkârisi (Türkeş and Gündüz 2021) and Alabadem (Erdem et al., 2021) of Turkey, the characteristic of Şebap pigeon have not been described in detail elsewhere. Considering the gap in the literature, this study was carried out to define the phenotypic characteristics of the Şebap pigeon. It aims to contribute existing literature by giving a direction to breed contradictions of Şebap pigeon native to Şanlıurfa and Turkey.

Material and Methods

Pigeon: This research was carried out on Şebap pigeons raised by Şanlıurfa Şebap Pigeon Association and local breeders of Şanlıurfa province. The animal material of the study consisted of a total of 132 Şebap pigeons from 5 different varieties, whose gender distributions as male (n=66) and female (n=66). The animal material was also taken from different age groups. The pigeons were classified according to their ages: 06-12 months (Group 1, n=28), 13-24 months (Group 2, n=35), 25-36 months (Group 3, n=37), and >36 months (Group 4, n=32).

Data of Şebap pigeons were collected from association and 5 independent breeders. In addition to measurements and observations to determine the distinctive features of the Şebap pigeon, such as plumage, markings, trotters, head structure, eye color, tail and wing feathers, specifications and local terms used by the federation and pigeon breeders were used.

Morphological characterization: Characteristics of beak type, beak tip color, nail color, head type and eye color were determined with the naked eyes qualitatively. Photographs were also taken (Canon EOS 650D and canon EF 50 mmF1.8 lens). Photographs of the pigeons were taken in 60×50 cm special boxes which are illuminated from the right, left and above, and covered with a black cloth of 500x300 cm in order to distract the pigeons from the outside stimuli. Measurements were taken by the same people throughout the study.

The number of wing and tail feathers was counted; The wing feathers were followed in the order of primary axial and secondary feathers (Table 1).

Body length, wingspan, wing length, tail length, chest circumference, chest width, head length, head width, beak length and beak depth were measured. The pigeons were weighed with the aid of a scale sensitive to 1 g (Gamry). Body length, wingspan, wing length, body length, tail length, and chest circumference were measured using a measuring tape, and chest width, head length and width, beak length and depth, and body diameter were measured with digital calipers (Atasoy et al., 2013; Özbaşer et al., 2016; Erdem et al., 2021; Çelik , 2021).

Table 1. Number of wing and tail feathers in Şebap pigeon.

Morphological characteristics	Ratio (%)
Number of wing feather	
10-1-10	80.3
10-1-11	13.6
10-1-9	6.1
Number of tail feather	
12 feathers	78.8
13 feathers	12.9
14 feathers	5.3
15 feathers	3.0

Statistical analysis: All statistical analyzes were carried out by using the IBM SPSS 22 program package. One-Way ANOVA procedure was used to analyze the difference between groups for measured characteristics. The methods of Independent-Samples T-tests analyzes were used between genders (Özdamar, 2001; Soysal, 2000). The conformity of the data to the normal distribution was examined using the homogeneity of variance test. The “Descriptive” method was adopted for explicative statistics subsequently. The factors that reveal significant effects were compared in Duncan test (Duncan, 1955).

Results

Şebap pigeons are divided into varieties according to the color of the feathers covering the body. In the Arap Variety, all the feathers covering the body are black. In other varieties, the main color covering the body is light shiny cream or bluish white. However, they are separated according to black or brown markings in the chest and wing regions. These marks in the wing area are called stamps. Accordingly, in the Miski variety, patterns on wings are dark vibrant brown in color, the shapes are clear, coarse-grained, and cover the wing symmetrically. in the Çakmaklı variety, patterns on wings are black. In the Kürenk and Gök varieties, the patterns on the wing are not in the form of scales, but rather in the form of columns. The color of these columns is brown in the Kürenk variety and black in the Gök variety. (Figure 1, Figure 2).

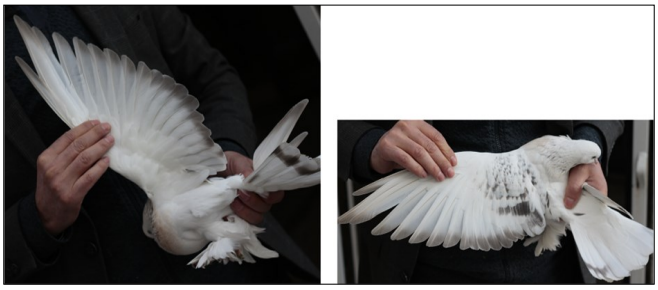

Figure 1. Examples of Wings in Şebap pigeons.

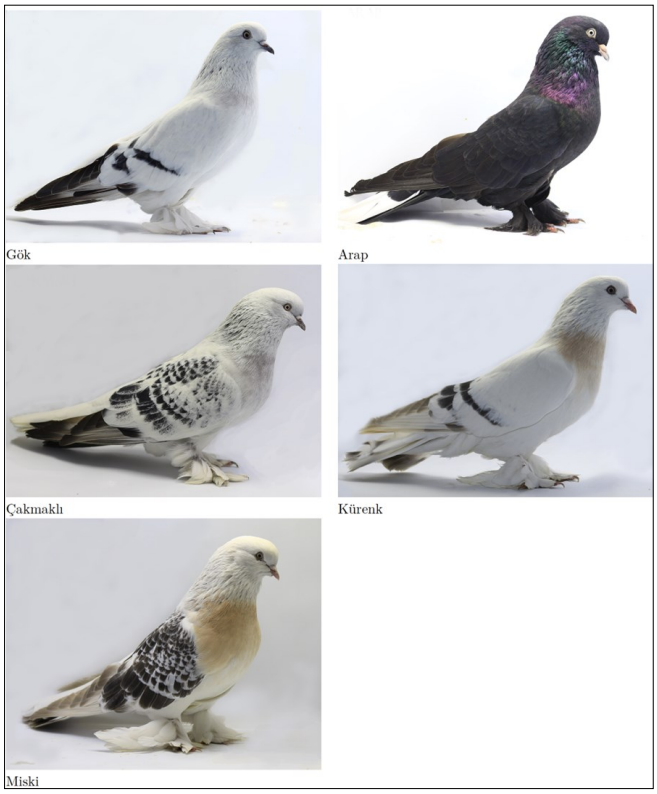

Figure 2. Color variants of Şebap pigeons; Gök, Arap, Çakmaklı, Kürenk, Miski

Taking into consideration the measurements, observations and evaluations previously determined by the breeders and Şanlıurfa Şebap Pigeon Federation it was found that 5 different color variations were determined among the 132 pigeon samples, which are Miski 57.5 % (n=76), Kürenk 16.7 % (n=22), Çakmaklı 11.4 % (n=15), Gök 11.3 % (n=15) and Arap 3.0 % (n=4) (Figure 2).

Statistical analyzis displayed significant variations between different age groups in terms of wing length and tail length characteristics ($P<0.05$). Significant differences in wingspan, chest circumference and chest width ($P<0.01$) were also determined. Mean values for body weight, body length, head length, head width, beak depth, and beak length in different groups were found as statistically significant ($P<0.001$).Comparative differences of these measurements in terms of genders; body weight, head length, beak depth and shank length ($P<0.001$); body length, wingspan, head width, beak length and tail length ($P<0.01$) and wing length ($P<0.05$) (Table 2) were significant.

Three different eye colors were determined in the varieties of Şebap. In the Miski and Çakmaklı variety, pearl eye color, in which the iris turns a yellow straw color from the pupila to the outer rim, has been observed. In the Kürenk and Gök varieties, the iris turns into slightly orange (amber) colour from the pupil to the outer rim and lastly in the Arap variety, iris is pearly white (Figure 3).

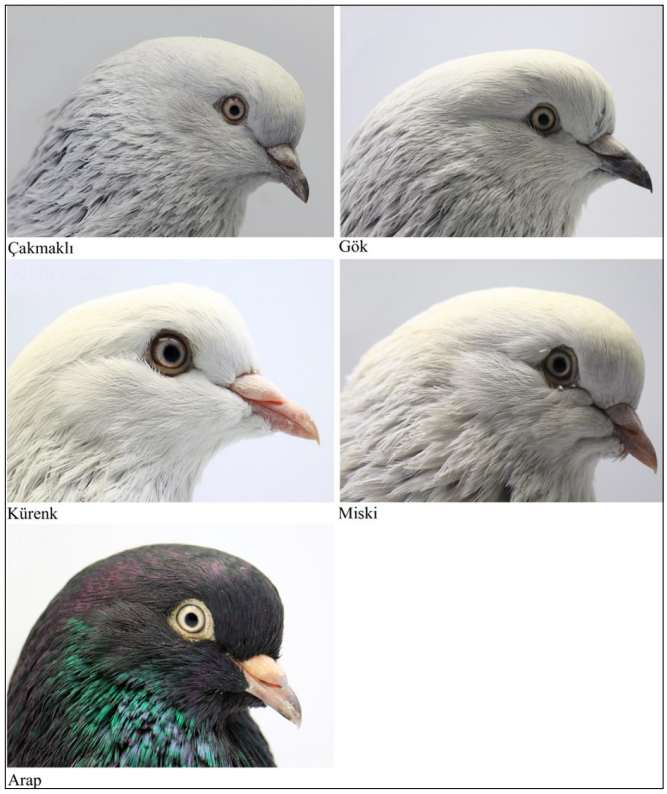

Figure 3. Head structure, eye colors and beak types of Şebap pigeons. Çakmaklı, Gök, Kürenk, Miski and Arap

Table 2. The statistical values of the morphometric characteristics (X±Sx) in Şebap pigeon

Şebap Age Group	n	Body Weight (g)	Beak length (mm)	Beak depth (mm)	Head length (mm)	Head width (mm)	Shank length (mm)
1	28	339.82±3.38^{a}	17.58±0.05^{a}	8.18±0.05^{a}	34.55± 0.11^{a}	23.19± 0.11^{a}	42.57±0.28
2	35	354.86±2.64^{b}	17.73±0.06^{a}	8.35±0.05^{b}	34.83±0.11^{ab}	23.37± 0.11^{a}	42.90±0.26
3	37	359.59±2.60^{bc}	17.92±0.06^{b}	8.40±0.04^{bc}	34.91±0.10^{b}	23.88±0.11^{b}	43.11±0.24
4	32	365.16±2.51^{c}	17.93±0.06^{b}	8.52±0.05^{c}	35.24±0.09^{c}	24.28±0.11^{c}	43.53±0.25
Total	132	355.49±1.57	17.80±0.03	8.37±0.03	34.89±0.05	23.70±0.07	43.04±0.13
Age		***	***	***	***	***	-
Female		350.00±2.33	17.72±0.05	8.26±0.04	34.63±0.07	23.51±0.08	42.36±0.17
Male		360.98±1.90	17.88± 0.04	8.47± 0.03	35.15±0.07	23.88±0.10	43.73±0.16
Gender		***	**	***	***	**	***
Şebap Age Group	n	Wing length (cm)	Wingspan (cm)	Tail length (cm)	Body length (cm)	Chest perimeter (cm)	Chest Width (cm)
1	28	32.04±0.29^{a}	71.71±0.46^{a}	14.88±0.13^{a}	36.27±0.23^{a}	21.64±0.17^{a}	5.41±0.04^{a}
2	35	32.74±0.22^{b}	73.47±0.44^{b}	15.11±0.12^{ab}	37.00±0.16^{b}	22.18±0.14^{b}	5.54±0.03^{b}
3	37	32.80± 0.19^{b}	73.49±0.34^{b}	15.28±0.11^{b}	37.11±0.16^{b}	22.19±0.13^{b}	5.55±0.03^{b}
4	32	33.03± 0.18^{b}	73.84±0.39^{b}	15.33±0.10^{b}	37.47±0.17^{b}	22.41±0.14^{b}	5.60±0.03^{b}
Total	132	32.68±0.11	73.19±0.21	15.16±0.06	36.99±0.09	22.12±0.07	5.53±0.02
Age		*	**	*	***	**	**
Female		32.40±0.16	72.52±0.29	14.99±0.07	36.70±0.13	22.04±0.11	5.51±0.03
Male		32.95±0.15	73.87±0.29	15.33±0.09	37.28±0.13	22.21±0.10	5.55±0.03
Gender		***	***	***	***	-	-

-: P>0.05; *: P<0.05; **: P<0.01; ***: P<0.001, a-c means within a column with different letters are significantly different (P<0.05).

The feathers growing sideways covering the tarsal area are called trotter. In Şebap breed the trotters are sword type and all the Şebap pigeons have trotters. The color of the trotter feathers is the same color as the body feathers, it is black in Arap variety and white in other varieties. These feathers are soft, curved and overlapping. They give the foot a thick appearance. The leg pads above the heel are curved in and out, not very hard and long feathers are arranged under the heel in a symmetrical form that supports each other (Figure 4).

In the Şebap pigeon breed, the dark part near the ends of the light-colored tail feathers is called Toka (Clip) The tail clip was determined to be vibrant dark brown in the Miski variety, light brown in the Kürenk variety, and black in the Çakmaklı and Gök variety. The total number of tails in the Şebap pigeon is between 12 and 14. In the Miski, Çakmaklı, Kürenk and Gök variety, two to four long tail feathers are not white symmetrically on the sides, the side feathers are equal on the right and left, and up to four tail feathers in the middle are white. The entire or part of the tail cannot consist of only white tail feathers. In the Arap variety the tail is completely black. (Fig. 5).

Figure 4. Examples of trotters in Şebap pigeons.

Figure 5. Example of tails feather in Şebap pigeon.

Discussion

The topic of domestication mainly focuses on the mammals and oversees the importance of other species like birds (Blasco et al., 2014). Domestic pigeon is derived from wild rock dove, and it is the oldest domesticated bird species (Cobo-Simón et al., 2020; Price, 2002; Rose et al., 2006). As being a small prey, domestication process of birds can't be proved by the bone evidence, therefore cuneiform tablets can be considered as tell-tale physical evidence which were found in Mesopotamia.

Adult Rock pigeon is at 29-37 cm body length. It has 62 to 72 cm wingspan. According to the standard measurements, the wing is usually ranges from 22.3 cm, whereas the tail 9.5 to 11 cm, the beak is around 1.8 cm, and the shank length of 2.6 to 3.5 cm (Rock dove, 2022). In comparison with their wild ancestors and common feral pigeon, domestic pigeons show great differences in morphological structure, especially in the color, length and distribution of the feathers, as well as the anatomy of the head, differences in the beak and claws. These features significantly affect the appearance (Özbaşer et al., 2021; Parés-Casanova and Kabir, 2019; Shapiro et al., 2013; Vickrey et al., 2018). The intense selective breeding lead by enthusiasts resulted in the emergence of many breeds and varieties around the world (Johnston, 1990; Murton et al., 1972; Price, 2002; Stringham et al., 2012). This is the reason why breeders take utmost care to preserve the pedigree of pigeons and to breed birds selectively (Balcı et al., 2018; Baptista et al., 2019; Bartels, 2003).
Si et al (2021) claimed that the domestic pigeon basically displays three main iris colors, including yellow to orange "pebble", white "pearl" and black "bull's" eyes. The Bull's eye is due to the complete absence of stromal pigment cells, whereas pebble and pearl irises in pigeons contain bright pigment cells with birefringent crystals in the anterior stromal tissue. Although the bull's eyes feature was associated with white feathers in some studies (Bond, 1919; Hollander and Owen, 1939), it was not observed in Şebap varieties.

The average of body length, which was determined as 36.99 cm in Şebap pigeons, is similar to Squadron flyer pigeons (Özbaşer et al., 2016). It was found as 36.48 cm. This was higher than the values obtained from Klasik Manisa Hünkârisi (Türkeş and Gündüz, 2021) which is 31.40 cm, Alabadem pigeons (Erdem et al., 2021) which is 31.56 cm, Tumbler pigeons (Atasoy et al., 2013) in the province of Ankara, which is 34.95 cm, and Trakya Makaracısı pigeons (Soysal et al., 2011) which is 34.42 cm. The results confirm the reports of the federation of the Şebap pigeon as a medium-sized breed.

Soysal, et al. (2011) determined the morphological characteristics of the Trakya Makaracı pigeon breed and reported that the chest width was higher in females than males. However, in Sebap pigeons, the overall mean chest width was found to be higher in males. Similar findings were reported by Atasoy et al. (2013), Özbaşer et al. (2021) and Yıldırım, et al. (2018) The overall mean chest width was found to be 55.30 mm in Şebap pigeons. This finding is similar to Bursa Oynarı 56.00 mm (Balcı et al., 2018), Scandaroon Pigeon 55.75 mm (Yıldırım et al., 2018) and Alabadem 56.86 mm pigeons (Erdem et al., 2021). However, higher numbers were reported in Tumbler pigeons (Atasoy et al., 2013) which are found in the city of Ankara and Squadron flyer pigeons (Özbaşer et al. 2016). They are 62.98 mm and 65.03 mm respectively. Moreover, in terms of chest width, the difference between age groups was significant ($p < 0.01$), but the difference between genders was not statistically significant.

When compared with different breeds in Turkey in terms of body weight. The average body weight of Şebap pigeons was determined as 355.49 g. This body weight was close to the average values of Bursa Oynarı pigeons 341.95 g (Balcı et al., 2018). Şebap pigeons determined to be lighter than Squadron flyer pigeons, which is 428.85 g (Özbaşer et al., 2016) and Cakal pigeon which is 374.02 g (Özbaşer et al., 2020); heavier than Alabadem which is 321.17g (Erdem et al., 2021), Tumbler pigeons (Atasoy et al. 2013) in province of Ankara which is 321.62 g, Mülekat pigeon (Özbaşer et al., 2020) which is 328.96 g and Trakya Makaracısı (Soysay et al., 2011) which is 335.58 g. Body weight values of Şebap pigeon were found to be higher in males than females in the gender groups. These findings are similar to the results reported in the studies above (Atasoy et al., 2013; Özbaşer et al. 2020, Yıldırım et al., 2018).

When the body weight, wingspan and length values of the Şebap pigeons are considered together, it is seen that they generally have heavier and longer wings than the game bird pigeon breeds and genotypes. In fact, it has a wingspan value close to the size of a large Scandaroon pigeon. It is possible to say that the medium size of the Şebap pigeons restricts its game behavior and maneuvering movements and therefore it is more often bred as costume pigeons.

Although it requires knowledge, expense and organizational skills, there are economic, scientific, cultural and ecological benefits for the protection of local genetic resources of a country. Animals, as a local genetic resources and an element of biodiversity, are frequently investigated in terms of genetics and various morphological characteristics for not only to shed light on phylogenetic studies, but also to develop more efficient production systems and the studies of genetic improvement (Casanova, 2013). For this reason, studies started to recognize Şebap pigeon breed as a local genetic resource. On this basis, morphological measurements followed by the genetic association and characterization studies are important for breed description.

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References

Atasoy, F., Erdem, E. & Hacan, Ö. G. (2013). Determination of morphological characteristics of tumbler pigeons in province of Ankara (Columba livia domestica). *Ankara Üniversitesi Veteriner Fakültesi Dergisi 60*, 135-143.

Balcı, F., Ardıçlı, S., Alpay, F., Dinçel, D., Soyudal, B. & Mehlika, E. R. (2018). The determination of some morphological characteristics of Bursa Oynarı pigeon breed. *Ankara Üniversitesi Veteriner Fakültesi* Dergisi *65*, 349-355.

Baptista, L. F., Martínez Gómez, J. E. & Horblit, H. M. (2009). Darwin's pigeons and the evolution of the columb-iforms: recapitulation of ancient genes. *Acta Zoológica Mexicana 25*(3), 719-741.

Bartels, T. (2003). Variations in the morphology, distribution, and arrangement of feathers in domesticated birds. *Journal of Experimental Zoology Part B: Molecular and Developmental Evolution, 298,* 91-108.

Biray, B. (2019). Mitochondrial DNA analyses of domestic pigeon breeds (columba livia domestica) in Turkey. *Master of Science*, Biology. Middle East Technical University.

Blasco, R., Finlayson, C., Rosell, J., Marco, A. S., Finlayson, S., Finlayson, G. & Vidal, J. R. (2014). The earliest pigeon fanciers. *Scientific Reports, 4*(1), 1-7.

Bond, C. J. (1919). On certain factors concerned in the production of eye colour in birds. *Journal of Genetics, 9*(1), 69-81.

Casanova, P. M. P. I. (2013). Morphological similarities between Spanish pigeon breeds. *Turkish Journal of Veterinary and Animal Sciences 37*(3), 346-351.

Çelik, R. (2022). Morphological Characteristics of Şanlıurfa Yapışan (Tumbler) Pigeons (Columba livia domestica). *Harran Üniversitesi Veteriner Fakültesi Dergisi, 11*, 106-112.

Çelik, R. (2021). *Diyarbakır'a özgü güvercin ırkları*. Medipres Matbaacılık Ltd. Şti. Malatya.

Cobo-Simón, I., Márquez-Rodríguez, J., Méndez-Cea, B., Gallego, F. J. & Pérez-Fernández, M. (2020). Understanding the morphological and genetic distinctiveness of the Spanish pouter pigeons. *The Marchenero Pouter as a case study Ibis 162*(3), 766-777.

Darwin, C. (1976). *Türlerin Kökeni*. İkinci Baskı. Onur Yayınları, Özyurt matbaası. Ankara.

Duncan, D. B. (1955). Multiple range and multiple F tests. *Biometrics 11*, 1-42.

Erdem, E., Özbaşer, F. T., Gürcan, E. K. & Soysal, M. I. (2021). The morphological and morphometric characteristics of Alabadem pigeons. *Turkish Journal of Veterinary and Animal Sciences, 45*(2), 372-379.

Erdem, H., Konyalı, C. & Savaş T. (2018). Morphol ogical characterization of Edremit Kelebek Roller Pigeons. *Çanakkale Onsekiz Mart Üniversitesi Dergisi, 6*, 93-100.

Hollander, W. F. & Owen, R. D. (1939). Iris pigmentation in domestic pigeons. *Genetica, 21*(5-6), 408-419.

Johnston, R.F. (1990). Variation in size and shape in pigeons, Columba livia. *Wilson Bull, 102*, 213-225.

Kürkçüoğlu, S.S. (2011). Şanlıurfa Geleneksel Mimarisinde Kuş Takaları (Kuş Evleri). Şanlıurfa Kültür Sanat Tarih ve Turizm Dergisi 11: 41-43.

Murton, R.K. & Thearle, R.J.P. (1972). Thompson: Ecological studies of the Feral pigeon, Columba livia var. 1. Population, breeding biology and methods of control. *Journal of Applied Ecology,* 9, 835-874.

Özbaşer, F.T., Atasoy, F., Erdem, E. & Güngör, İ. (2016). Some morphological characteristics of squadron flyer pigeons (Columba livia domestica). *Ankara Üniversitesi Veteriner Fakültesi Dergisi 63,* 171-177.

Özbaser, F.T., Erdem, E., Gurcan, E.K. & Soysal, M.I . (2020). Morphological characteristics of the cakal, Mulakat and oriental pigeon breeds raised in the Marmara Region of Turkey. *Agricultural Science Digest-A Research Journal 40*, 303-310.

Özbaşer, F.T., Erdem, E., Gürcan, E.K. & Soysal, M.İ. (2021). The morphological characteristics of the Muradiye Dönek pigeon, a native Turkish genetic resource. *Ankara Üniversitesi Veteriner Fakültesi Dergisi 68*(2), 107-112.

Özdamar, K. (2001). *SPSS İle Biyoistatistik*, Kaan Kitapevi. 4.Baskı. Eskişehir.

Parés-Casanova, PM. & Kabir, A. (2019). Morphological diversification among pigeon breeds of different aptitudes.WSEAS *Transactions on Biology and Biomedicine 1*6, 1-9.

Price, T.D. (2002). Domesticated birds as a model for the genetics of speciation by sexual selection. Genetics of Mate Choice: From Sexual Selection to Sexual Isolation. *Genetica 116*, 311-327.

Rock Dove (2022). http://en.wikipedia.org/wiki/Rock_Dove/

Rose, E., Nagel, P. & Haag-Wackernagel, D. (2006). Spatio-temporal use of the urban habitat by feral pigeons (Columba livia). Behavioral *Ecology and Sociobiology 60*, 242-254.

Şebap Güvercin Federasyonu (2021). https://www.sebapguvercinfederasyonu.org.tr/index.php

Shapiro, M.D., Kronenberg, Z., Li C., Domyan, E.T., Pan, H., Campbell, M. & Wang, J. (2013). Genomic diversity and evolution of the head crest in the rock pigeon. *Science, 339*(6123): 1063-1067.

Si, S., Xu, X., Zhuang, Y., Gao, X., Zhang, H., Zou, Z. & Luo, S.J. (2021). The genetics and evolution of eye color in domestic pigeons (Columba livia). *PLoS genetics 17*(8): e1009770.

Soysal, M.İ., Gürcan, E.K., Akar, T., Alter, K. & Genç, S. (2011). The determination of several morphological features of Thrace Roller Breeds in raised Thrace Region. *Tekirdağ Ziraat Fakültesi Dergisi, 8,* 61-68.

Soysal, M.İ. (2000). *Biyometrinin Prensipleri (İstatistik I ve II ders notları),* Trakya Üniversitesi Tekirdağ Ziraat Fakültesi, Tekirdağ.

Stringham, S. A., Mulroy, E. E., Xing, J., Record, D., Guernsey, M.W., Aldenhoven, J. T. & Shapiro, M. D. (2012). Divergence, convergence, and the ancestry of feral populations in the domestic rock pigeon. *Current Biology, 22*(4): 302-308.

Türkeş, M. & Gündüz, S. (2021). Klasik Manisa Hünkârisi Güvercinleri: Tarihçe ve Sınıflandırması. Kebikec: İnsan Bilimleri İçin Kaynak Araştırmaları Dergisi (51):

Vickrey, A.I, Bruders, R., Kronenberg, Z., Mackey, E., Bohlender, R.J., Maclary, E.T. & Shapiro, M.D. (2018). Introgression of regulatory alleles and a missense coding mutation drive plumage pattern diversity in the rock pigeon. *ELife, 7*, e34803.

Yıldırım, H., Doğan, U. & Cimrin, T. (2018). Determination of the morphological characteristics of Scandaroon pigeon grown in the central of Hatay province (Columba livia domestica). *The Eurasia Proceedings of Science, Technology, Engineering & Mathematics, 2*, 368-375.