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The determination of some morphological characteristics of Bursa Oynarı pigeon breed

Faruk BALCI[1], Sena ARDIÇLI[1], Fazlı ALPAY[2], Deniz DİNÇEL[1], Bahadır SOYUDAL[1], Mehlika ER[1]

[1]Uludağ University, Faculty of Veterinary Medicine, Department of Genetics, Bursa, Turkey; [2]Uludağ University, Faculty of Veterinary Medicine, Department of Animal Science, Bursa, Turkey.

Summary: The aim of this study was to evaluate the morphological characteristics and to describe some quantitative traits of Bursa Oynarı native pigeon breed in Bursa province in Turkey. The study was carried out on a total of randomly selected 43 Bursa Oynarı pigeons (23 males, 20 females). The morphological characteristics (head type, eye colour, head and bib colour, neck blend colour, beak type and colour, head plumage, ventral abdomen colour and claw colour) and the quantitative traits (body weight and morphometric measurements) were determined from both male and female pigeons. The results indicated that the most frequent morphological characteristics of this pigeon breed were round shaped head (72.09%), dusty rose eye colour (67.44%), veiled head/bib colour (37.21%), purple neck blend colour (53.49%), flat-shaped type beak (67.44%), white beak (51.16%), markless head plumage (69.77%), white ventral abdomen colour (93.02%) and white claw colour (95.35%). Sex significantly ($P<0.01$) affected the quantitative traits such as the body length, leg length and tail length. Male pigeons had higher means of the mentioned traits than those of female pigeons. Over the past few decades, there has been an increased awareness for the conservation of native breeds for their importance to genetic diversity. Thus, studies conducted on native breeds in various species may provide a noteworthy contribution to this purpose.

Keywords: Bursa Oynarı, morphological characteristics, pigeon, Turkey.

Bursa Oynarı güvercini ırkına ait bazı morfolojik özelliklerin belirlenmesi

Özet: Bu çalışmanın amacı, Bursa ilinde yetiştirilen ve yerli bir güvercin ırkı olan Bursa Oynarı'na ait bazı morfolojik özelliklerin belirlenmesi ve bazı kantitatif karakterlerin ortaya konmasıdır. Çalışma, rastgele seçilen 23 erkek ve 20 dişi olmak üzere toplam 43 Bursa Oynarı ırkı güvercin üzerinde yürütülmüştür. Erkek ve dişi güvercinlerde bazı morfolojik özellikler (baş yapısı, göz rengi, baş ve ön göğüs rengi, şal rengi, gaga yapısı ve rengi, baş süsü, karın altı gövde rengi ve tırnak rengi) ve kantitatif karakterler (canlı ağırlık ve morfometrik ölçümler) belirlenmiştir. Sonuç olarak, Bursa Oynarı güvercin ırkında yuvarlak kafa yapısı (%72.09), gül kurusu göz rengi (%67.44), yaşmaklı baş ve ön göğüs rengi (%37.21) ile mor şal rengi (%53.49), düz tip gaga (%67.44), beyaz gaga (%51.16), süssüz baş (%69.77), beyaz karın altı (%93.02) ve beyaz tırnak rengi (%95.35)'nin yaygın olarak görüldüğü tespit edilmiştir. Bursa Oynarı güvercinlerinde, vücut uzunluğu, bacak uzunluğu ve kuyruk uzunluğu değerlerinde cinsiyetler arası farklılık önemli olmuştur ($P<0.01$). Bu özelliklerde, erkek güvercinler dişilere göre daha yüksek ortalamalara sahiptir. Son yıllarda, genetik çeşitlilik açısından önemli bir yere sahip olan yerli ırkların korunmasına yönelik ilgi giderek artmaktadır. Bu nedenle, farklı türlere ait yerli ırklarda yapılan çalışmalar, bu amaca kayda değer katkılar sağlayabilecektir.

Anahtar sözcükler: Bursa Oynarı, güvercin, morfolojik özellikler, Türkiye.

Introduction

Domestic pigeon (*Columba livia domestica*), is a member of the *Columbidae* family, which includes pigeons and doves. There are approximately 310 species in the *Columbiformes* order. Domestic pigeon originates from the wild rock pigeon (8) and shows great variation in morphology when compared to its wild ancestors. Variations in structure, colour, length and distribution of feathers, anatomical structure of head, beak and claws significantly affect the appearance. Thus, breeders and pigeon fanciers apply utmost attention to protect pigeons' pureness and breed the birds selectively (4, 22). Among the most striking characteristics selected in breeding are colour variations, alterations of body size and structure, distribution and arrangement of feathers (4).

Various breeds of domestic pigeons have been identified in Turkey; Bursa Oynarı pigeon (also known as Bursa Roller/Tumbler) being one of the most famous of those. The bird has also been named as 'Bursa Pigeon', 'Bursa Bird', 'White Wing-White Tail' by the breeders and fanciers. Bursa Oynarı lives in the South Marmara Region in Turkey (23). There is a history of 600 years from Ottoman Empire to the present day about this native pigeon breed. Centuries of special breeding has resulted in

dramatic variations in morphological and behavioral traits of the bird. Black pied colour, shiny black feathers, wide and remarkable chest, long and wide shaped white beak, big eyes, proportional body structure and the featherless mid-tarsal region are the general physical characteristics of this breed. Although, breeders tend to select black pied variants including black wing - white tail and white wing - white tail (Figures 1 and 2: white wing - white tail variant) birds; pure breed also exists as straight black or white variations (Figure 3: straight white variant). A spiral descent and solo flying of long distance are the major flying characteristics of this native pigeon breed (23). Bursa Oynarı pigeons always tend to fly individually and dispersed, even if they are forced to fly as groups. Thus, it is difficult to observe their flying pattern with bare eyes.

Native breeds have a crucial role in preserving the genetic diversity. In this respect, registration procedures of Bursa Oynarı pigeon were completed in 2010, based on the present study conducted by Balcı et al. (3). In the literature, there is limited information about Bursa Oynarı breed. Comprehensive studies may be needed to perform an adequate evaluation, and therefore, the aim of this study was to determine the morphological characteristics and to describe some quantitative traits of Bursa Oynarı pigeon breed in the South Marmara Region of Turkey.

Materials and Methods

A total of 43 purebred Bursa Oynarı pigeons (23 males and 20 females; age of 17-26 months), randomly selected from seven different flocks in Bursa province, were used in this study. All animals were belonged to the Turkish Pigeon Breeders Association. Head shape, beak type, head plumage, head and bib colour, beak colour, eye colour, neck blend colour, ventral abdomen colour and claw colour were determined. Morphological variations are presented in Figure 4.

Measurement of the body weight was carried out by using an electronic micro-balance device (Shimadzu AUX320, Kyoto, Japan). Measurements of the body length, wingspan, leg length, tarsal length and tail length were carried out by using a ruler, while the measurements of the beak length and chest depth were carried out by using a caliper according to the following anatomic regions:

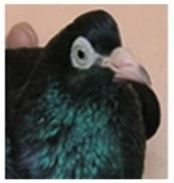
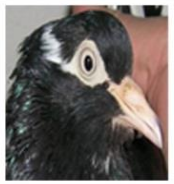
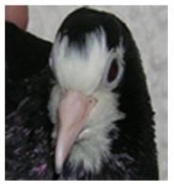
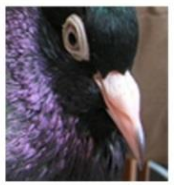
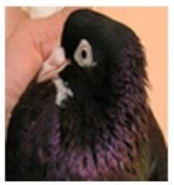
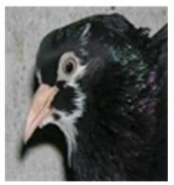
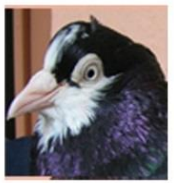
Body length was the distance from the first thoracic vertebra to the end of the pygostyle; chest depth was the distance between two glenoid fossa; beak length was the distance from the tip of the upper beak to the starting point of the beak; wingspan was the distance between the tips of the eighth primaries (length of two wing with body width); leg length was the distance from median point of the os pubis to starting point of os metatarsi; tarsal length was the longitudinal line through os metatarsi; and tail length was measured from the base of the tail to the tip of the central retrix (12, 21).

Figure 1. Bursa Oynarı pigeon (White wing-White tail).
Şekil 1. Bursa Oynarı güvercini (Ak kanat-Ak kuyruk).

Figure 2. Bursa Oynarı pigeon (White wing-White tail).
Şekil 2. Bursa Oynarı güvercini (Ak kanat-Ak kuyruk).

Figure 3. Bursa Oynarı pigeon (straight white).
Şekil 3. Bursa Oynarı güvercini (beyaz).

Figure 4. Morphological variation in Bursa Oynarı pigeon.
Şekil 4. Bursa Oynarında morfolojik varyasyon.

Morphological Variation									
Beak Type	**Beak Colour**	**Eye Colour**	**Head and Bib Colour**	**Neck Blend Colour**	**Head Shape**	**Head Plumage**		**Ventral Abdomen Colour**	**Claw Colour**
 Flat-shaped	 White	 White	 Black	 Green	 Round	 Markless	 Browed	 White	 White
 Collapsed	 Low-black Pied	 Dusty Rose	 Veiled	 Purple	 Chestnut	 Piebald	 Mottled	 Black	 Black
	 Black Pied	 Dark Dusty Rose	 Periapted	 Green-Purple	 Pelite	 Scarfed	 Speckling		 Smokey
			 Heaped		 Snake				

Statistical analysis: Levene's test was used to test for homogeneity of the variances. In addition, the variables were examined by normality test. Afterwards, all measurements were analyzed with Student's *t* test (MINITAB 15, Pennsylvania, USA). Differences were considered significant at a probability level of $P<0.05$ in all analyses.

Results

Morphological characteristics and alternative variants of each corresponding category are shown in Table 1. The results indicated that round shaped head (72.09%), flat-shaped type beak (67.44%), markless head plumage (69.77%), veiled head and bib colour (37.21%), white beak (51.16%), dusty rose eye colour (67.44%), purple neck blend colour (53.49%), white ventral abdomen colour (93.02%) and white claw colour (95.35%) are the most frequent morphological characteristics of this pigeon breed compared to alternative variants.

Morphometric characteristics of Bursa Oynarı pigeon are shown in Table 2. The results revealed that body length, leg length and tail length of male pigeons were significantly ($P<0.01$) higher than those of female pigeons. There were no significant differences between male and female pigeons in terms of body weight, chest depth, beak length, wingspan and tarsal length.

Table 1. Morphological characteristics in Bursa Oynarı pigeons (n=43).
Tablo 1. Bursa Oynarı güvercinlerine ait morfolojik özellikler (n=43).

Morphological Characteristics	Variations	Male (n)	Female (n)	General (n)	Male (%)	Female (%)	General (%)
Head Shape	Round	15	16	31	65.22	80	72.09
	Chestnut	6	0	6	26.09	0	13.95
	Pelite	1	3	4	4.35	15	4.65
	Snake	1	1	2	4.35	5	9.3
Beak Type	Flat-shaped	19	10	29	82.61	50	67.44
	Collapsed	4	10	14	17.39	50	32.56
Head Plumage	Markless	18	12	30	78.26	60	69.77
	Scarfed	3	3	6	13.04	15	13.95
	Speckling	2	3	5	8.70	15	11.63
	Browed	0	1	1	0	5	2.33
	Mottled	0	1	1	0	5	2.33
Head and Bib Colour	Black	8	4	12	34.78	20	27.91
	Veiled	5	11	16	21.74	15	37.21
	Periapted	8	3	11	34.78	55	25.58
	Heaped	2	2	4	8.7	10	9.3
Beak Colour	White	8	14	22	34.78	70	51.16
	Low-black Pied	3	2	5	13.04	10	11.63
	Black Pied	12	4	16	52.17	20	37.21
Eye Colour	White	4	6	10	17.39	30	23.26
	Dusty Rose	17	12	29	70.91	60	67.44
	Dark Dusty Rose	2	2	4	8.7	10	9.3
Neck Blend Colour	Green	9	3	12	39.13	15	27.91
	Purple	11	12	23	47.83	60	53.49
	Green-Purple	3	5	8	13.04	25	18.60
Ventral Abdomen Colour	White	21	19	40	91.3	95	93.02
	Black	2	1	3	8.7	5	6.98
Claw Colour	White	23	18	41	100	90	95.35
	Black	0	1	1	0	5	2.33
	Smokey	0	1	1	0	5	2.33

Table 2. Morphometric characteristics in Bursa Oynarı pigeons (n=43).
Tablo 2. Bursa Oynarı güvercinlerine ait morfometrik özellikler (n=43).

Trait	Sex	Mean	Standart Deviation	Variation Coefficient	Minimum	Maximum
Body weight (g)	Male	344.95	29.95	8.68	290.00	400.00
	Female	338.41	22.71	6.71	300.00	386.00
	Total	341.95	26.71	7.81	290.00	400.00
Beak length (cm)	Male	2.57	0.25	9.92	2.00	3.00
	Female	2.62	0.19	7.51	2.40	3.00
	Total	2.60	0.22	8.80	2.00	3.00
Body length (cm)	Male	27.19[a]	1.268	4.66	24.00	29.00
	Female	26.15[b]	1.113	4.26	24.50	28.00
	Total	26.70	1.297	4.85	24.00	29.00
Chest depth (cm)	Male	5.65	0.61	10.81	5.50	7.00
	Female	5.55	0.48	8.72	5.40	6.50
	Total	5.60	0.55	9.84	5.50	7.00
Wingspan (cm)	Male	59.21	2.61	4.41	54.00	68.00
	Female	58.90	1.77	3.01	56.00	62.00
	Total	59.07	2.24	3.79	54.00	68.00
Leg length (cm)	Male	8.66[a]	0.54	6.28	7.00	9.50
	Female	8.14[b]	0.56	6.99	6.50	8.50
	Total	8.42	0.61	7.24	6.50	9.50
Tarsal length (cm)	Male	2.50	0.13	5.23	2.30	3.00
	Female	2.46	0.20	8.35	2.00	3.00
	Total	2.48	0.16	6.80	2.00	3.00
Tail length (cm)	Male	13.97[a]	0.57	4.10	13.50	15.00
	Female	13.45[b]	0.58	4.33	12.50	14.50
	Total	13.73	0.63	4.59	12.50	15.00

[a,b] Different superscripts within a column indicate significant difference (P<0.01).
[a,b] Aynı sütunda farklı harfleri taşıyan ortalamalar arası farklılık önemlidir (P<0.01).

Discussion and Conclusion

Domesticated animals show an enormous variety in hereditary features because they live in limited environment that is much less challenging, complex, and diverse than the natural environment compared to their wild ancestors. In the wild, phenotypic variations are usually determined by the natural selection by environmental changes of the individuals. However, desirable characteristics of the animals are selected by breeders according to the economically important traits or habitual appearance (4). Selective breeding for certain visual characteristics decreases the variations and leads to formation of pigeons with similar morphologic characteristics favoured by pigeon fanciers. Breeds show dramatic variation in craniofacial structures, colour and pattern of plumage pigmentation, feather placement and structure and flight behaviours (15, 20). Among the factors mentioned, centuries of selective breeding have been associated with predictable morphological variation of Bursa Oynarı pigeon. In the present study, Bursa Oynarı pigeon was categorized under nine headings depending on her physical appearance and special marks. Results indicated that white coloured abdomen and white coloured claw are substantially common for both male and female groups in Bursa Oynarı (93.02 % and 95.35 %, respectively). In addition, round shaped head, flat-shaped beak, markless head plumage and dusty rose eye colour are rather common physical appearances (ranged from 67.44 % to 72.09 %). Attention has been applied to this morphology and therefore birds have been bred selectively by the breeders to protect their pureness. In the literature, there is limited information about the characteristics of this native pigeon breed. To the best of our knowledge, this is the first study evaluating morphological variants of

the Bursa Oynarı. Thus, studies performed with larger populations may be needed in order to constitute a trustworthy data.

The means for body weights for male and female pigeons were found to be 344.95 g and 338.41 g, respectively in the current study. Rose et al. (16) and Bartyzel et al. (5) have reported higher body weight means of 356-344 g and 484-474 g for male and female pigeons in *Columba livia* and *Columba palumbus*, respectively. Furthermore, body weight means ranging from 328-432 g for male and 314-425 g for female have been reported in Turkish native pigeon breeds (1, 12, 19). Among the evaluated morphometric measurements, body length and wingspan were lower compared to other squadron flyer pigeon breeds raised in Turkey as reported by Atasoy et al. (1), Özbaser et al. (12) and Soysal et al. (19). Our results indicated that Bursa Oynarı is smaller in body size among the native pigeon breeds. Tobalske et al. (21) and Bachmann (2) reported higher wingspan means in *Columba livia* (62.2 cm and 68 cm, respectively). Pigeons are fast and persistent flying birds, and therefore, their wings should be smaller in size to reduce drag at high velocities. This allows the birds to beat their wings at high frequencies to reach the fastest flight speed (6, 7, 13). Bursa Oynarı pigeons are known as rather fast and unrelenting (3-4 hours) flyers. It is worth noting that, body size and wing structure characteristics seemed to be compatible with flight kinematics.

The diversity of feeding characteristics and adaptations in birds may be the initiator of their structurally differing beaks (17). Hence, variation in beak type and length can be evaluated as a common circumstance (1). In the current study, the means for beak length for male and female pigeons were found to be 2.57 cm and 2.62 cm, respectively, and this result indicated that Bursa Oynarı possesses longer beak compared to other Turkish native pigeon breeds (1, 12, 19). Apart from feeding and adaptive properties, the phenotypical selection employed by the pigeon breeders for long beak characteristic may be another explanation for this difference.

The means (total) of 8.42 cm for leg length and 2.50 cm of tarsal length were observed in the present study. Soysal et al. (19) reported lower means of leg length (7.85 cm) and higher means of tarsal length (3.18 cm) in Thrace roller pigeon breeds. The environmental factors and breeds with different genomic backgrounds may influence the quantitative traits of the pigeons. However, there is limited information about these phenotypical traits to perform an adequate comparison.

Tail structure stands out as a remarkable characteristic of the flying birds to provide maximum drag and velocity (6, 21). Hence, tail length should be evaluated to understand flight characteristics and kinematics. The mean of 13.73 cm (total) for tail length in Bursa Oynarı pigeon was observed in the current study. The previous studies conducted on various pigeon breeds indicated lower means of tail length (1, 12, 21). Conversely, Soysal et al. (19) reported a higher mean (14 cm) of this trait in Thrace roller pigeon breeds. Flight characteristics of the pigeons emphasize the wide variation of speeds and types of flight within breeds. Pigeons have been bred selectively not only for physical appearance, but also for their flying pattern (tumbler, thrace roller, etc.). Hence, length and structure of tail may vary among breeds and even between different populations of the same breed.

Sexual dimorphism (SD), phenotypic means of many traits differing between sexes in dioecious species, is generally conceived to be adaptive (14). Our results suggested that the means of body length, leg length and tail length were significantly ($P<0.01$) affected by sex in Bursa Oynarı pigeon. The phenotypic means of mentioned traits were higher in male pigeons. In this respect, SD may be considered as responding to these traits. The existence of SD was reported in various avian species including doves and pigeons (12, 18). Body weight and other morphometric measurements were not affected by sex in the current study. In the literature, the means for body weight of male pigeons have been reported to be higher compared to females (9, 10, 11, 16). Moreover, similar sex-effect was observed in the studies conducted in native Turkish pigeon breeds (1, 12, 19). One possible explanation about the lack of significant effect of sex on body weight may be the peculiar characteristic of Bursa Oynarı pigeon. However, studies performed with higher number of animals would be desirable to confirm this condition.

Unconscious crossbreeding and importation of native breeds may result in decrease or loss of diversity on animal genetic resources without characterisation. Hence, studies conducted on native breeds should be performed to classify and conserve sustainable development of animal genetic resources.

This study focused on the morphological characteristics of Bursa Oynarı pigeon to evaluate its breed specifications. The present results confirm that Bursa Oynarı has specific breed characteristics that can be conserved by selective breeding programme. However, next studies in larger populations, especially DNA based studies, should be conducted to reveal a more adequate characterization.

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Correspondence Author:
Prof.Dr. Faruk BALCI
Uludag University,
Faculty of Veterinary Medicine,
Department of Genetics,1659, Bursa, Turkey.
e-mail:fbalci@uludag.edu.tr