

Morphological and morphometric characterization of Bulgarian local chicken breed - Southwest Bulgarian dzinka

H. Lukanov^{1*}, I. Pavlova²

¹Department of Animal Husbandry - Monogastric and other animals, Faculty of Agriculture, Trakia University, Student's campus, 6000 Stara Zagora, Bulgaria

²Department of General Livestock Breeding, Faculty of Veterinary Medicine, Trakia University, Student's campus, 6000 Stara Zagora, Bulgaria

(Manuscript received 24 January 2021; accepted for publication 7 June 2021)

Abstract. The poultry genetic resources of the Republic of Bulgaria cover mostly the domestic chicken and domestic pigeon species. A number of introduced breeds of chickens are bred in the country, but also some local primitive and decorative breeds. Southwest Bulgarian dzinka is one of the three bantam chicken breeds that originated in Bulgaria. The aim of the study is to make a complete exterior characteristic of the Southwest Bulgarian dzinka breed. A phenotypic evaluation of a total of 29 roosters and 61 hens was performed. The mean body weight of roosters was 620.7 ± 18.9 g and 492.7 ± 8.42 g of hens. The birds are characterized by the presence of a small rose comb, beard and well feathered legs. The most common color of the plumage is spangled. The legs and beak are light in color, except for the black color of the plumage. The eyes are orange-red. The calculated Index for massiveness, Index of compactness and Index of long-leggedness for roosters were 5.35 ± 0.13 , 218.57 ± 4.15 and 46.36 ± 1.83 , respectively, and 4.62 ± 0.09 , 214.62 ± 3.60 , 41.03 ± 1.25 for hens.

Keywords: Bulgarian local breed, genetic diversity, poultry, true bantam

Introduction

There are 1437 local chicken breeds in existence throughout the world, with more than half of them being from Europe, including the Caucasus (CGRFA, 2019). The Balkans are not an exception to the breed variety of domestic chickens (Lukanov, 2012), including the largest variety of long-crowing breeds (Lukanov, 2017a). Hobby poultry breeders have a primary role in the preservation of this breed diversity and the maintaining of the poultry farming genetic resources, alongside the national genetic pools (Teneva et al., 2015).

Several chicken breeds have been created in Bulgaria, the oldest of which was the Black Shumen chicken (Lukanov et al., 2018). Beside this breed in the National Genetic Pool (the Institute of Agriculture – Stara Zagora, and the Institute of Animal Sciences – Kostinbrod), several other breeds and productive chicken lines are bred and maintained there by hobby breeders as well (Lukanov, 2011a,b; Teneva et al., 2015). Alongside the Bulgarian chicken breeds and breed groups described thus far (Shumen chicken, Stara Zagora Red chicken, Katunitsa chicken, Struma chicken, Bregovska dzinka, and Struma bantam), a few more breed groups have come into the spotlight in recent years, possessing a typical consolidated exterior and created by Bulgarian Muslims in various regions of the Rhodopes mountain. These are the Southwest-Bulgarian chicken, the Bulgarian longcrower, the Rhodope black mottled chicken, and the Southwest Bulgarian dzinka. The last breed is one of three miniature Bulgarian chicken breeds bred by

the local populace of the West Rhodopes and the Razlog Hollow for decades (Figure 1).



Figure 1. Southwest Bulgarian dzinka (left - rooster; right - hen)

Similar small chickens have been bred for centuries for decorative purposes and as brooders in all of Europe (Lukanov, 2017b). In Bulgaria, they are known under the summary name of “zhinki”/singular – “zhinka” (Anonymous, 1903), “dzinki”/singular – “dzinka” (Kumanov, 1943) or true bantams (Lukanov, 2017b). It is interesting to note the similarity between the Southwest Bulgarian dzinka and the Turkish Ispenc (TR İspenç) breed (Özdemir, 2019a), which can be explained through the historical connections between the two countries. Unlike the Southwest Bulgarian dzinka, the Ispenc breed has been subjected to a detailed analysis of its morphological characteristics (Özdemir, 2019b).

*e-mail: drlukanov@gmail.com

The goal of the current study was to perform a detailed exterior profile of the Southwest Bulgarian dzinka – a local bantam chicken breed.

Material and methods

The study was conducted during the period from 10.11.2020 to 20.11.2020 in Banya village, Blagoevgrad Province, Bulgaria, situated in the West Rhodopes. A total of 29 roosters and 61 hens of the local true bantam breed, also known as the Southwest Bulgarian dzinka were subjected to morphological and morphometric analysis. The average age of the tested roosters was 1.8 years with minimal/maximal variations of 1.5 to 3. The average age of the tested hens was 2.2 years, encompassing birds with ages from 1.6 to 6 years. Birds of three colour varieties were included: red-spangled, black mottled and black.

The following morphological characteristics were monitored:

- Phenotypic assessment of comb type, beard/muffs development and footing foot feathering extent, feather colour, shank and beak colour, eye colour.

- Live body weight (kg). The study was conducted on male and female birds through individual measuring of live weight. For this purpose, a technical scale EU-6000CE with precision of 0.1 g was used.

- Body dimensions. They were measured once during the live weight control, in the following order: straight body length (cm) – with measuring tape; diagonal body length (cm) – with compass; breast size (cm) – with measuring tape; breast width (cm) – with compass; breast circumference (cm) – with compass; sternum length (cm) - with measuring tape; tibia length (cm) – with measuring tape; tarsometatarsus length (cm) – with measuring tape; tarsometatarsus circumference (cm) – with measuring tape; wing length (cm) – with measuring tape; wingspan (cm) – with measuring tape; head length (cm) – with digital caliper; head width (cm) – with digital caliper; comb length (cm) – with digital caliper; comb height (cm) – with digital caliper; beak length (cm) – with digital caliper; beak height (cm) – with digital caliper; wattles height (cm) – with digital caliper; wattles width (cm) – with digital caliper; eye diameter (cm) – with digital caliper.

- On the grounds of the conducted morphometric analysis, the following body conformation indices were calculated:

$$\text{Massiveness index (MI)} = (\text{live weight} / \text{body length}) * 100 \quad (1)$$

$$\text{Compactness index (CI)} = (\text{breast circumference} / \text{body length}) * 100 \quad (2)$$

$$\text{Long-leggedness index (LI)} = (\text{leg length} / \text{body length}) * 100 \quad (3)$$

The statistical analysis was performed via statistical software IBM® SPSS® Statistics (V26). Due to the study specifics, data for mean (m), standard error of mean (SEM) and coefficient of variation (CV, %) values were included as well. The male/female differences were considered statistically significant at $p < 0.05$, using Student's t-test, if the data were normally distributed.

Results

The examined birds had three feather colour patterns: red-spangled, black mottled and black, with the highest share belonging to the red-spangled variety (♂68.97% and ♀54.1%), followed by the black mottled birds (♂27.6% and ♀24.59%), with blacks being the fewest. An exterior assessment determined that the birds only had rose-shaped combs, with well-developed “pearls” and clearly formed spike. With regard to beard and muffs development, greater variation was observed in the roosters - from individuals with moderately developed beards (86.21%) to ones with slightly developed beards (13.79%). Visible wattles were observed in all roosters, inversely correlated with beard development. Unlike the roosters, the hens exhibited excellently formed beards in 68.85% of the examined birds, with wattles being absent or barely visible in such individuals. In the other 31.15% of the hens, beards were moderately developed, with visible small wattles. The earlobes were not visible in the hens, concealed by the muffings. In some of the roosters with lower beard development, the earlobes were visible and coloured red. Iris colour varied from orange to red, without any noticeable correlation to feather colouring. Among the males, the orange-red iris colour had the greatest share (44.83%), and among the females - orange iris (78.69%). The presence of foot feathering was very well-pronounced in all roosters, whereas hens exhibited variations in this parameter. In 65.57% of the examined hens, the ptilopody was determined as excellent, very good in 19.67%, and moderate in 14.76%. Shank colour was directly related to feather colour, being predominantly white coloured in red-speckled and black-white coloured birds, and black in the black-feathered birds. In 20.69% of the roosters, the shanks were yellow, whereas there were no such individuals among the hens. The number of toes on each leg for all examined birds was 4.

The recorded data pertaining to live body weight and the body conformation indices for representatives of the breed are presented in Table 1. The average mass of the roosters was 620.7 ± 18.9 g, and of the hens – 492.7 ± 8.42 g ($p < 0.001$). The difference in the mean weights of the males and females was 20.61%. Variation (CV) in this parameter was greater in roosters, by 4% compared to hens. The minimum-maximum measured values for live body weight in roosters were 540.2 g and 740.5 g, and in hens – 410.6 g and 555.8 g. The massiveness index, which is related to live body weight, logically exhibited higher values in roosters, compared to the hens, $5.35 \pm 0.13\%$ and $4.62 \pm 0.09\%$, respectively, ($p < 0.001$). Variations in this parameter were lower for both genders, with wider minimum-maximum range observed in roosters. The lowest values for roosters and hens were 4.74% and 3.73%, respectively, and the highest ones – 6.64% and 5.21%. The other two body conformation indices - compactness index and long-leggedness index - also exhibited higher mean values in roosters, compared to hens, with significant differences only for the second index ($p < 0.05$). The compactness index exhibited

the lowest variation, compared to the other two indices used. Unlike the former, the extent of variation was the highest for the long-leggedness index, CV=14.75% and CV=13.32% for

roosters and hens, respectively. The differences between minimum and maximum values were significant, 24.17% in roosters and 22.24% in hens, respectively.

Table 1. Live body weight and body conformation indices in Southwest Bulgarian dzinka

Parameter	Live body weight, kg		Massiveness index, %		Compactness index, %		Long-leggedness index, %	
	male	female	male	female	male	female	male	female
x	620.7	492.7	5.35	4.62	218.57	214.62	46.36	41.03
SEM	18.9	8.4	0.13	0.09	4.15	3.60	1.83	1.25
CV, %	11.4	7.4	9.03	8.26	7.10	7.31	14.75	13.32
p-value	<0.001		<0.001		>0.05		<0.05	

Table 2 presents the results from the body measurements of representatives of both genders from the breed. In all examined parameters, significantly higher values were recorded for the roosters ($p < 0.05$), except for breast depth, where a similar trend

was observed ($p > 0.05$). The highest variation was observed with regard to tarsometatarsus length (13.94% and 13.67%) and tibia length (11.50% and 13.02%), while the variation was the lowest for wingspan (3.90% and 3.15%).

Table 2. Body measurements in Southwest Bulgarian dzinka

Parameter	Gender	x	SEM	CV, %	p-value
Straight body length, cm	male	9.87	0.21	7.79	<0.001
	female	8.89	0.14	6.75	
Diagonal body length, cm	male	11.59	0.18	5.79	<0.001
	female	10.68	0.12	4.91	
Breast width, cm	male	6.45	0.17	10.14	<0.001
	female	5.74	0.11	8.02	
Breast depth, cm	male	7.91	0.17	8.12	>0.05
	female	7.61	0.09	4.90	
Breast circumference, cm	male	25.27	0.39	5.74	<0.001
	female	22.85	0.24	4.55	
Sternum length, cm	male	8.28	0.17	7.60	<0.05
	female	7.49	0.20	11.90	
Tibia length, cm	male	8.04	0.25	11.50	<0.001
	female	6.88	0.21	13.02	
Tarsometatarsus length, cm	male	5.36	0.20	13.94	<0.001
	female	4.38	0.14	13.67	
Tarsometatarsus circumference, cm	male	4.54	0.10	8.36	<0.001
	female	3.87	0.07	7.55	
Wing length, cm	male	24.37	0.48	7.29	<0.001
	female	21.65	0.20	3.97	
Wingspan, cm	male	57.73	0.60	3.90	<0.001
	female	50.25	0.36	3.15	

Some of the main morphometric dimensions pertaining to the head and its caruncles are presented in Table 3. Significantly higher values for roosters, compared to hens, were observed here as well ($p < 0.05$), except for head width, for which the variations were not statistically significant. For some parameters related to caruncles (comb and wattles), we observed very high variation, especially in the females. In hens with excellent beard development, the wattles were absent altogether, and in those with moderate beards, the wattles had

varying sizes, with maximum values reaching 0.90 cm and 1.40 cm for length and height, respectively. Unlike hens, all roosters exhibited visible wattles in various stages of development with lengths from 1.00 cm up to 2.40 cm, and heights from 0.70 cm up to 2.30 cm, respectively. Different stages of development, positively correlated to the wattles' size, were observed with regard to the comb's length and height in both genders. The lowest variations were observed in the parameters related to the head length and width.

Table 3. Head measurements in Southwest Bulgarian dzinka

Parameter	Gender	x	SEM	CV, %	p-value
Head length, cm	male	4.51	0.07	5.40	<0.05
	female	4.24	0.07	6.69	
Head width, cm	male	2.63	0.03	3.66	>0.05
	female	2.57	0.03	5.66	
Comb length, cm	male	4.50	0.18	15.00	<0.001
	female	2.59	0.11	19.09	
Comb height, cm	male	1.49	0.10	23.81	<0.001
	female	0.71	0.05	29.58	
Beak length, cm	male	1.51	0.05	12.20	<0.05
	female	1.38	0.03	10.14	
Beak height, cm	male	1.01	0.02	7.33	<0.001
	female	0.81	0.02	11.95	
Wattle length, cm	male	1.29	0.12	34.76	<0.001
	female	0.19	0.07	161.91	
Wattle height, cm	male	1.50	0.12	30.65	<0.001
	female	0.30	0.11	164.01	
Eye diameter, cm	male	1.15	0.03	9.19	<0.001
	female	0.96	0.02	7.09	

Discussion

The recorded mean live weight in the birds of the Southwest Bulgarian dzinka breed was within the normal limits for most true bantams, per the European standard (EE, 2008, 2010, 2012, 2013). Another Bulgarian breed of small chickens also had comparable values of live body weight - the Bregovska dzinka (Mihaylov, 2018). The miniature Bulgarian breed Struma bantam exhibited greater live weight, being, per the standard, in the range of 750-950 g for roosters, and 650-850 g for the hens (Mihaylov, 2018). Comparing our data with those for another similar breed, the Ispenc, greater live body weight was observed in the Turkish breed, 0.733 ± 0.01 g versus 620.7 ± 18.9 g for the roosters, and 0.582 ± 0.01 g versus 492.7 ± 8.42 g for the hens, respectively (Özdemir, 2019b). In another report on the Ispenc breed, the same author reported a lower mean body weight, bringing it even closer to our results, 649 g for the roosters and 513 g for the hens, respectively (Özdemir, 2019a).

With regard to the body conformation indices, comparison with other similar breeds would be difficult because such studies are rarely conducted with non-commercial birds. An interesting comparison could be drawn with the calculation of the three indices in broiler chickens and egg-laying hens. Kokoszyński et al. (2017) determined higher values for the massiveness index and lower values for the compactness and long-leggedness indices in the three broiler chicken hybrids, compared to what was measured for the Southwest Bulgarian dzinka. Similar variations in the body conformation indices were also observed with regard to egg-laying chickens, such as the Shumen chicken (Lukanov et al., 2018). The explanation for these differences with standard chickens could be found in the lower weight, considerably more developed breasts, and the breed's shorter legs.

Similar to the other small Bulgarian hen breeds, the most

common feather colour pattern was the red-spangled one. Individuals with such feather colours are encountered with the Ispenc breed as well, yet the breed exhibits a significantly greater feather colour variety (Özdemir, 2019b), with 13 recognized colourations (Özdemir, 2019a). The black mottled colouration is also observed relatively often in the Southwest-Bulgarian dzinka, being more consolidated among the females, whereas the males relatively often exhibited red mixes in the neck and waist areas. The situation with this colour was similar for two other Bulgarian small chicken breeds - the Bregovska dzinka and the Struma bantam (Lukanov, 2017b). Their comb was similar to that of the Ispenc breed, with noticeable comparability of our comb measuring results with the data reported by Özdemir (2019b). The beard of the Ispenc breed was also clearly expressed, with small wattles being observable in both the males and the females (Özdemir, 2019b). With regard to head size (width and length), there was a similarity between our results and the data reported for the Ispenc breed as well (Özdemir, 2019b). The beak's length and height for both genders of the Bulgarian breed exhibited lower mean values compared to the Ispenc (Özdemir, 2019b). With regard to iris colour, the primary eye colour for the Ispenc is also orange to orange-red (personal observations). Comparability was found in the eye diameter of both breeds, 10.55 ± 0.10 mm in roosters and 9.29 ± 0.10 mm in Ispenc hens (Özdemir, 2019b), versus 11.5 ± 0.30 mm in roosters and 9.6 ± 0.20 mm in the hens of the Bulgarian breed, respectively. The legs were well-feathered in both breeds, with the Ispenc exhibiting larger shank feathers, similar to some Dutch and Belgian foot-feathered bantam breeds (EE, 2008). Polydactyly was not observed in the Southwest Bulgarian dzinkas, similar to most chicken breeds. By contrast, the Ispenc exhibited the presence of a 5th toe, which was one of their main breed characteristics (TSHF, 2016; Özdemir, 2019a,b). Another true bantam with polydactyly is the Javanese Bantam (Lukanov, 2015), all other small five-toed breeds were smaller copies of standard breeds, such as Dorking,

Silkie, Houdan, Faverolles, and Meusienne (EE, 2008; Lukanov, 2017b). Differences between the two breeds were found with regard to shank length, with the Ispenc's length being 60.09 ± 0.15 mm for the roosters and 56.60 ± 0.21 mm for the hens (Özdemir, 2019b), with the difference between the two breeds per this parameter being more notable in the hens. Results comparable to ours, with regard to shank length in roosters and hens were reported by Cozzi et al. (2017) for the Italian small hen breed of Mericanel della Brianza.

With regard to body size, the comparison between the straight body length for both breeds – Ispenc and Southwest Bulgarian dzinka was in favour of the Turkish breed, 11.58 ± 0.04 cm versus 9.87 ± 0.21 cm for roosters, and 10.98 ± 0.05 cm versus 8.89 ± 0.14 cm for hens, respectively (Özdemir, 2019b). Concerning breast width, comparable data were reported for both breeds. Özdemir (2019b) reported data on the wingspan of the Ispenc, which indicate higher mean values, compared to the Southwest Bulgarian dzinka for both genders, 60.00 ± 0.27 cm as opposed to 57.73 ± 0.6 cm for the roosters, and 54.46 ± 0.17 cm compared to 50.25 ± 0.36 cm for the hens, respectively.

Conclusion

All presented results were in line with the sexual dimorphism of the domestic chicken, indicated clear and well-expressed inter-gender differences with regard to the morphometric dimensions and body conformation indices of the Southwest Bulgarian dzinka – a local chicken breed. This breed possessed all characteristics of primitive chickens, which had not been strictly selected per exterior features, thus the greater observed variety. It was evident from the conducted comparison with the Turkish breed of Ispenc that there were a number of differences related to the birds' type, as well as the feather colours, the number of toes, and a number of morphometric dimensions, which had lower mean values in the Bulgarian breed. The results of the study could be used as a basis for the preparation of an exterior standard of the breed on a European model, as well as to show the current state of these attractive chickens.

Acknowledgements

We would like to express our gratitude for the assistance provided by the breeders of this interesting breed, without which this study could have never been possible.

References

- Anonimous**, 1903. First Bulgarian exhibition of poultry in Sofia. *Oralo (Plow)*, 15, pp. 225-228 (Bg).
- CGRFA**, 2019. Status and trends of animal genetic resources - 2018. Commission on Genetic Resources for Food and Agriculture, CGRFA-17/19/11.2/Inf.4.
- Cozzi MC, Colombo E, Zaniboni L, Madeddu M, Mosca F, Strillacci MG, Longeri M, Bagnato A and Cerolini S**, 2017. Phenotypic and genetic characterization of the Italian bantam chicken breed Mericanel della Brianza. *Livestock Science*, 205, 56-63. <https://doi.org/10.1016/j.livsci.2017.09.013>
- EE**, 2008. Rassegeflügel - Standard für Europa in Farbe. Ergänzungslieferungen der Jahre 2008. Bund Deutscher Rassegeflügelzüchter e.V.Germany. Berchem/Luxembourg (Ge).
- EE**, 2010. Rassegeflügel - Standard für Europa in Farbe. Ergänzungslieferungen der Jahre 2010. Bund Deutscher Rassegeflügelzüchter e.V.Germany. Berchem/Luxembourg (Ge).
- EE**, 2012. Rassegeflügel-Standard für Europa in Farbe. Bund Deutscher Rassegeflügelzüchter e.V.Germany. Berchem/Luxembourg (Ge).
- EE**, 2013. Rassegeflügel-Standard für Europa in Farbe. Ergänzungslieferungen der Jahre 2013. Bund Deutscher Rassegeflügelzüchter e.V.Germany. Berchem/Luxembourg (Ge).
- Kokoszyński D, Bernacki Z, Saleh M, Stęczny K and Binkowska M**, 2017. Body conformation and internal organs characteristics of different commercial broiler lines. *Brazilian Journal of Poultry Science*, 19, 47-52. <http://dx.doi.org/10.1590/1806-9061-2016-0262>
- Kumanov S**, 1943. Full course in poultry farming. Svetlina Publ. house, Stara Zagora, Bulgaria (Bg).
- Lukanov H**, 2011a. Bulgarian poultry breeds, Part I. *Aviculture Europe*, 7, 1-9. From: <http://www.aviculture-europe.nl/nummers/11E02A03.pdf>
- Lukanov H**, 2011b. Bulgarian poultry breeds, Part II. *Aviculture Europe*, 7, 1-6. From <http://www.aviculture-europe.nl/nummers/11E03A03.pdf>
- Lukanov H**, 2012. Balkan chicken breeds and breed groups, Part I and II. *Aviculture Europe*, 8, 1-16. From <http://www.aviculture-europe.nl/nummers/12E06A07.pdf>
- Lukanov H**, 2015. Javanese bantam the breed that combines wild fowl temperament with perfection of exhibition poultry. *Aviculture Europe*, 5, 1-8. From <http://www.aviculture-europe.nl/nummers/15E05A05.pdf>
- Lukanov H**, 2017a. Balkan longcrowing chicken breeds. *Aviculture Europe*, 13, 1-7. From <http://www.aviculture-europe.nl/nummers/17E03A11.pdf>
- Lukanov H**, 2017b. Exhibition and ornamental poultry breeding. Kota Publ. house, Stara Zagora, Bulgaria (Bg).
- Lukanov H, Genchev A and Petrov P**, 2018. Phenotypic characterization of Shumen chicken breed. *Bulgarian Journal of Animal Husbandry*, LV (1), 50-58 (Bg, with abstract in English).
- Mihaylov M**, 2018. Bulgarian pigeon and chicken breeds. *Tsian EOOD*, Sofia, Bulgaria, (Bg).
- Özdemir D**, 2019a. Miniature fancy chicken breed of Turkey: Ispenc. In: *Proceeding of the 1st International Congress of Alternative Poultry and Ornamental Birds-2019*, Antalya, Turkey, 28 (Tr).
- Özdemir D**, 2019b. Some morphological characteristics of Ispenc roosters and chickens. *Journal of Natural and Applied Sciences*, 23 (Special Issue), 155-162 (Tr).
- Teneva A, Gerzilov V, Lalev M, Lukanov H, Mincheva N, Oblakova M, Petrov P, Hristakieva P, Dimitrova I and Periasamy K**, 2015. Current status and phenotypic characteristics of Bulgarian poultry genetic resources. *Animal Genetic Resources*, 56, 19-27.
- TSHF**, 2016. Turkey Ornamental Chickens and Garden Animals Federation. TSHF brochure for EE Meeting 24th to 28th of May, 2017 in Eger/Hungary.