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ASPECTS REGARDING SOME MORPHOLOGICAL VALUES OF THE DOMESTIC QUAIL EGGS (COTURNIX COTURNIX JAPONICA)

ASPECTE PRIVIND UNII INDICI MORFOLOGICI AI OUĂLOR DE PREPELIȚĂ DOMESTICĂ (COTURNIX COTURNIX JAPONICA)

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The domestic quail (Coturnix coturnix japonica) is the smallest bird subspecies that is breed in farms, for its meat and eggs production. Quail eggs are precious aliments and also have important drug value. It is a natural source of vitamins and mineral substances. However, in the speciality literature there is little information regarding the quality indexes (morphological, physical and chemical) of quail eggs. After measuring the egg shape index, the eggs volume, the specific egg weight and after also analysing the longitudinal and transversal diameter ratio we reached a series of conclusion: the average weight was of 10.44 ± 0.13 grams, the eggs volume was of 9.675 – 10.472 cm ^{3} and a specific weight of 0.996 ± 0.01 g/cm^3. Likewise the dimensions of these eggs were: 32.34 mm – longitudinal diameter and 24.92 – 24.97 mm for transversal diameter; the egg shape index had a value of 1.30/1, respective of 77.04 %. The quail eggs have albumen (egg white) that represents 58.37 % from the egg total weight, a yolk that represents 33.37 % and a mineral shell that represents 8.28 %

Key words: morphological data, eggs, domestic quail, quail breeding

Introduction

Bird breeding (Poultry rising) is one of the ancient occupations of man. During time, he tried to domesticate, to breed and to improve different birds species, creating races, lines, varieties and highly performing hybrids.

The domestic quail (*Coturnix coturnix japonica*) is the smallest bird subspecies that is breed in farms, for its meat and eggs production. According to international standards, this subspecies includes 6 races and 60 lines. Today, in Japanese poultry, quail breeding offers 50% of the eggs production. The commercial quail exploitation is encouraged in the main Asiatic and European countries and also in USA, ensuring the dietetically, rich in nutritive substances and relatively inexpensive products.

Quail breeding is a relative new poultry branch, in Romania being practiced in family system of 100 to 2500 individuals. Domestic quails (*Coturnix coturnix japonica*) are small birds which can attain highly technical, biological and economical performances, better than other birds species.

Quail eggs (fig. 1) are precious aliments and also have important drug value. These eggs are used in many therapeutically purposes: digestive disturbances, anaemia, tuberculosis, ulcer, high blood pressure, diabetes, arteriosclerosis, asthma, etc. Also, quail egg consumption has good results in memory improvement and in heart problems, gastric activities improvement, children growing stimulation.

Figure 1. Domestic quail eggs

On the other hand, the quail egg consumption has no negative effects. It is a natural source of vitamins and mineral substances. It contains just 1,4 % cholesterol compared to hen eggs which has 4 %; about 3 times less fats; 23 % yolk proteins compared to 16-17 % in hen eggs yolk. Regarding the vitamins and minerals content, the quail egg has 6 times more aneurin, 5 times more phosphorus and iron, 15 times more lactoflavin, and antialergical agents than hen eggs content.

However, in the speciality literature there is little information regarding the quality indexes (morphological, physical and chemical) of quail eggs. The purpose of our research is to add a contribution to some problems regarding the morphological indexes of domestic quail eggs (*Coturnix coturnix japonica*).

Materials and Methods

The biological material used in this study was represented by 60 eggs of 8 weeks old domestic quails weighting about 160-170 grams.

The 60 domestic quail eggs have been cleaned of dust and other impurities using small brushes in order not to damage the egg shell. Then the eggs have been inscriptionated with a marker.

The next step was to establish the eggs weight using an analytical Shimadzu type balance. The obtained values (in grams) have been centralized in tables.

Next, we made a series of measurements for establishing the eggs shape (profile index). We measured the eggs longitudinal diameter (from the rounded to the sharp limit of the egg) and the transversal diameter measured in the median area. The measurements were made using a caliper – 0.05 mm (50µ) of precision.

The next stage was to determine the eggs volume. We used two methods: first was to use a graded cylinder filled with 200 ml water. The eggs were introduced in the cylinder, being measured the displaced water volume. The values have been introduced in tables. The second method was the mathematical using the relation:

$V = 0.519 \times D \times d_1 \times d_2$, where: V = egg volume, in cm^3;

D = longitudinal egg diameter, in cm .;

d_1 and d_2 = transversal egg diameter, in cm;

0.519 = specifically calculation coefficient.

In order to determine the weight and components proportions, we carefully broke the mineral egg shell, then we separated the white egg, yolk, mineral shell and the shell membranes (fig. 2).

Figure 2. Aspects regarding the studying of quail eggs components

The components were weighted with a analytical Shimatzu type balance (fig. 2) The obtained data were used to determine morphological indexes as:

- egg shape index
- the longitudinal and transversal diameter ratio
- egg volume (using the two methods)
- the specific eggs weight.

To determine the egg shape index we used the formula:

$I_{F.O.} = \frac{d}{D} x100$, where: $I_{F.O.}$ = egg shape index (%);

d = transversal diameter (the two determination media) (cm);

D = longitudinal diameter (cm).

We calculated the longitudinal and transversal diameter ratio, using the formula $R_{D/d} = \frac{D}{d}$, where D and d have the same signification as above.

The specific egg weight (density) was mathematical determined, using the formula:

$G_S = \frac{G}{V}$, where: G_S = specific egg weight (g/cm^3);

G = egg weight (g);
V = egg volume (cm^3).

The total amount of data obtained from the measurements, were centralized and statistical analysed. We determined: the statistical mean, standard error of mean, standard deviation, variance and the variability coefficient.

Results and Discussions

Regarding the quail eggs weight, it oscillated between 7.75 and 12.10 grams, the 60 established values been of 10.44 ± 0.13 grams, and the variability coefficient had a reduced value of 9.8% (table 1). The founded and calculated specific weight values were found to be alike to the data found in the speciality literature. Therefore, according to Van, I. and col., 2003; Polen, T.; Herman, V., 2007, the quail eggs weight varies between 9 and 14 grams, depending on the birds age, variety or race.

Table 1.

The main statistical indices regarding some morphological quail egg values (*Coturnix coturnix japonica*)

Specification		UM	n	Calculated statistical indicators					Variation limits	
				$\bar{X} \pm$	$s_{\bar{X}}$	s	s^2	V%	min.	max.
Egg weight		g	60	10.44	0.13	1.023	1.048	9.80	7.75	12.10
Egg volume	calculated*	cm^3	60	10.472	0.11	0.847	0.717	8.09	8.54	12.52
	established **	cm^3	60	9.675	0.13	0.980	0.961	10.13	7.80	12.00
Differences between the two volumetric values		cm^3	60	0.837	0.09	0.704	0.495	84.11	0.04	2.99
		%	60	7.91	0.84	6.491	42.137	82.16	0.40	27.71
Specific egg weight		g/cm^3	60	0.996	0.01	0.059	0.004	5.92	0.72	1.05
Longitudinal diameter (D)		cm l	60	32.34	0.169	1.307	1.708	4.04	29.30	34.65
Transversal diameter (d_1)		cm l	60	24.97	0.09	0.682	0.465	2.73	23.40	26.25
Transversal diameter (d_2)		cm l	60	24.92	0.08	0.659	0.435	2.64	23.30	26.20
Egg shape index (I_{FO})	D and d ratio	x/1	60	1.30/1	0.01	0.059	0.004	4.54	1.12/1	1.54/1
	$\frac{dx100}{D}$	%	60	77.04	0.45	3.520	12.392	4.57	64.80	89.50

* calculated using the formula: $V=0,519 \times D \times d_1 \times d_2$

** established using water filled graded cylinder

D = longitudinal diameter

d = the two transversal diameters mean

The quail egg longitudinal diameter varied between 29.30 mm and 34.65 mm with a mean of 32.34 ± 0.169 mm and a reduced variability (v = 4.04 %) (table 1). The transversal diameter was measured in both directions therefore d_1 has a mean value of 24.97 ± 0.09 mm and for d_2 the mean value is 24.92 ± 0.08 mm (table 1). The variation limits for the 60+60 measured values were 23.40 and 26.25 mm, 23.30 and 26.20 mm. The variability coefficient were very small (v = 2.64 – 2.73 %) (table 1). The mean difference between the two values of the transversal diameter was of 0.05 mm (50µ).

Based on the two measured diameters (transversal and longitudinal), we determined the ratio between these values and the egg shape index.

The ratio between the longitudinal and transversal quail egg diameter was between, 12/1 and 1.54/1, and the mean of the 60 specifically data was of 1.30 ± 0.01/1 (v = 4.54 %) (table 1).

For the egg format index we found values from 64.80% to 89.50%, and the average mean was 77.04 ± 0.45 % (v = 4.57 %) (tabel 1). These values show us how much represents the transversal diameter from the longitudinal diameter.

The values we obtained regarding the egg shape index are close to the ones that exist in the speciality literature (1.32/1; 76 %) (Bălăşescu, M. and col., 1980, cit. by Vacaru-Opriş, I., 2002).

The quail egg volume values oscillate between 8,54 cm^3 and 12,52 cm^3 with a statistical mean of 10.472 ± 0.11 cm^3 and a low variability of 8.09% (table 1). The volumetric values determined with the graded cylinder variated between 7.80 cm^3 and 12.00 cm^3, the statistic mean being of 9.675 ± 0.13 cm^3 (v = 10.13 %) (table 1). The differences between the calculated volume values and the determined volume values were of 0.837 ± 0.09 cm^3 or of 7.91 ± 0.84 % (v = 82.16 – 84.11%) (table 1). We consider these values above average, and we think that the volumetric values obtained by calculations more accurate and closer to reality.

Regarding the specific quail egg weight, it oscillate between 0.72 g/cm^3 and 1.05 g/cm^3, with a statistic mean of 0.996 ± 0.01 g/cm^3 and a low variability (v =5.92 %) (table 1). The eggs that we studied were 3-4 days old and they were produced by young quails at the beginning of their egg laying period.

Regarding the Coturnix coturnix japonica egg composition and structure, the data shown in table number 2 are self – evident, and are referring at the weight as well as at the proportion of the three avian egg components.

Table 2.

The main statistical indices regarding the weight and proportion of the 3 quail egg compounds

Specification		n	Calculated statistical indicators					Variation limits	
			$\bar{x} \pm$	$s_{\bar{x}}$	s	s^2	V (%)	min.	max.
Mineral egg shell weight	grams	60	0.857	0.01	0.111	0.012	12.90	0.61	1.14
	% from TEW*	60	8.288	0.159	1.231	1.516	14.85	6.14	14.58
Albumen weight	grams	60	6.107	0.10	0.809	0.654	13.24	3.00	7.37
	% from TEW*	60	58.37	0.53	4.113	16.910	7.05	38.70	63.07
Yolk weight	grams	60	3.470	0.05	0.390	0.152	11.25	2.50	4.24
	% from TEW*	60	33.37	0.45	3.522	12.402	10.55	38.70	63.07

*TEW=Total egg weight

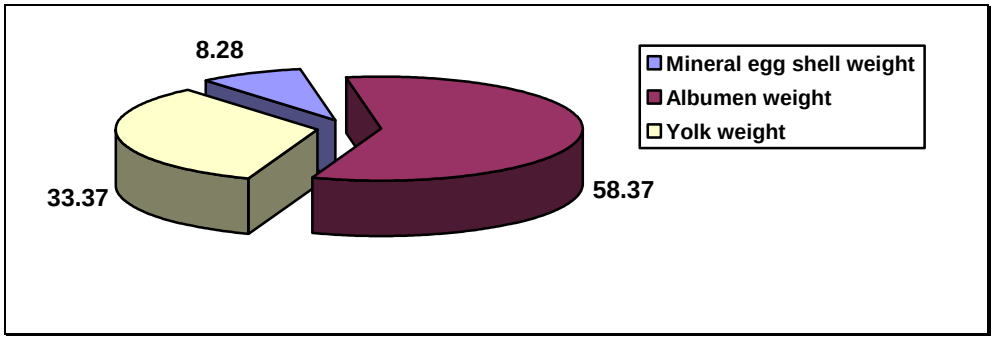

Figure 3. The proportions of quail egg compounds

Thereby, concerning the mineral egg shell, the values determined by weighting varied between 0.61 and 1.14 grams, and the statistic average was of 0.857 ± 0.014 grams, their variability being medium (v = 12.90 %) (table 2).

The mineral egg shell is reported to the total egg weight and has a medium proportion of 8.288 ± 0.159 % (fig. 3), with limits like 6.14 % and 14.58 % (v = 14.85 %). The quail egg albumen (egg white) has a average weight of 6.107 ± 0.10 grams, but at the 60 eggs that we studied we found values between.3.0 gram and 7.37 grams, while their variability coefficient was of 13.24 % (table 2).

The proportion that the albumen has from the total egg weight has a average value of 58.37 ± 0.53 % (v = 7.05 %) (table 2) (fig. 3). The variability limits of the 60 calculated values had a minimum of 38.70 % and maximum of 63.07 (table 2). The quail egg yolk has an average value of 3.47 ± 0.05 grams, with limits between 2.50 and 4.24 grams and a variability of 11.25 % (tabelul 2).

The proportion of the yolk from the total egg weight represents a mean of 33.37±0.45 % (fig. 3). The 60 values studied have limits: 29.01 % and 46.70 % (v = 10.55 %) (table 2). Comparatively with similar data that can be found in the scientific literature (*Vacaru-Opriş, I., 2002; Van, I. and col., 2003*) (table 3), the obtained data are relatively close. Thereby, the cited authors found a quail egg average weight of 13.24 grams from which: 1.28 grams (9.67 %) are represented by egg mineral shell; 4.07 grams (30.74 %) are represented by egg yolk and 7.89 grams (59.59 %) are represented by albumen (egg white) (table 3).

Table 3.

The weight and proportion of quail egg components

Specification	Weight(grams)	% from total egg weight
Egg yolk	4.07	30.74
Egg white	7.89	59.59
Egg shell	1.28	9.67
Total egg weight	13.24	100.00

Source: Vacaru-Opriş, I., 2002; Van, I. and col., 2003.

Conclusions

1. The domestic quail eggs (Coturnix coturnix japonica) studied by us have been characterised by an average weight of 10.44 ± 0.13 grams, a volume of 9.675 – 10.472 cm^3 and a specific weight of 0.996 ± 0.01 g/cm^3.

2. The dimensions of these eggs were: 32.34 mm – longitudinal diameter and 24.92 – 24.97 mm for transversal diameter; the egg shape index had a value of 1.30/1, respective of 77.04 %.

3. The domestic quail eggs (Coturnix coturnix japonica) have a mineral shell that represents, in average, 8.28 % from total egg weight; a yolk that represents 33.37 % and albumen (egg white) that represents 58.37 % from the egg total weight.

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