FOLIA POMERANAE UNIVERSITATIS TECHNOLOGIAE STETINENSIS
Folia Pomer. Univ. Technol. Stetin., Agric., Aliment., Pisc., Zootech. 2014, 310(30), 27–34

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THE ASSESSMENT OF THE SIZE AND SELECTED TRAITS OF PHEASANT EGGS

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Streszczenie. Celem niniejszej pracy była ocena wielkości i wybranych cech zewnętrznych oraz wewnętrznych jaj bażantów różnych odmian. Materiał badawczy stanowiło po 15 jaj kur bażanta królewskiego *(Syrmaticusreevesii),* bażanta srebrzystego *(Lophuranyctemera)* i bażanta zwyczajnego *(Phasianus colchicus).* Łącznie poddano ocenie 45 jaj. Jaja uzyskano z sześciu stadek bażantów (po dwa dla każdej odmiany bażantów) liczących po pięć osobników (kogut i cztery kury). Ptaki utrzymywano w jednakowych warunkach środowiskowych i żywieniowych. Ocenę jaj przeprowadzono według metodyki podanej przez Mroczka (1997). Jaja znoszone przez kury bażantów srebrzystych, królewskich i zwyczajnych różnią się istotnie wielkością, barwą skorupy i, w niewielkim stopniu, jej grubością. Największy udział w jajach, niezależnie od pochodzenia bażantów, miało białko (48,46–54,77%) i żółtko (36,32–38,69%); najmniejszy udział miała skorupa (12,30–15,19%). U wszystkich badanych odmian bażanta stwierdzono istotne współczynniki korelacji między masą jaj a masą ich białka (0,666–0,721), jak również między masą białka a masą żółtka jaj (0,631–0,702). Uzyskane wyniki wskazują, że bażanty srebrzyste, królewskie i zwyczajne, użytkowane w chowie zamkniętym, osiągają stosunkowo dobre wyniki reprodukcji, określane na podstawie zapłodnienia jaj i wylęgu zdrowych piskląt z jaj nałożonych i z jaj zapłodnionych.

Key words: egg, pheasant, quality.
Słowa kluczowe: bażant, jaja, jakość.

INTRODUCTION

The research on aviculture are very numerous in recent years. The studies on reproduction of pheasants, bred in poultry farms and in amateur holdings, are great part of them (Torgowski et al. 1990, Krystianiak et al. 1999, Kruszewicz and Manelski 2002, Kuźniacka et al. 2005), especially those on eggs and their use in hatching (Krystianiak et al. 2000, Nowaczewski 2009, Nowaczewski and Kontecka 2002). The Common Pheasant eggs were in the most

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researched group, eggs of others strains like the Reeve's Pheasant and the Silver Pheasant were less common (Mróz 1998, Mróz et al. 2003). The previous own research (Biesiada--Drzazga 2009) revealed the substantial influence of the pheasants' origin on the majority of external traits and morphological composition of their eggs. Then, the research of Krystianiak et al. (2005) revealed the influence of the shell colour of the Common Pheasant on its traits. Besides, the research showed the issue of eliminating blue eggs from those destined to incubation.

The aim of the present paper was to assess the eggs size and to evaluate selected external and internal egg traits of different pheasant strains.

MATERIALS AND METHODS

The research material consisted of 45 eggs, 15 of each pheasant strain: the Common Pheasant, the Reeve's Pheasant and the Silver Pheasant. Reproduction of breeding pheasants elected in May. Selected to experience pheasants were around the age of 11–12 months. The eggs were taken from 6 flocks (2 for each strain) with 5 birds: 1 male and 4 females. The birds were reared under the same environmental and nutritional conditions. In the laying period the pheasants were fed according to the guidelines (Mróz 1998). The oilseeds and grain were the main feed but root and soilage were also accessible. The endeavour of the research was to hold the daily ration on the average level of 20% albumen, up to 5% of crude and around 11,5MJ of metabolic energy. The examined eggs were layed by pheasant hens between the end of April and the end of May and they had proper morphology and shape. The eggs were examined according to Mroczek's (1997) methodology which consists in the assessment of the whole eggs and then after breaking them up on the glass plate. The measurements were determined using electronic scales, micrometer bolt, tripod, electronic calliper, planimeter and Le Roche's scale. The whole eggs assessment was to determine the egg weight, the longitudinal and transversal axis'es length as well as the egg shell condition and colour.

The assessment of eggs after breaking them up on the glass plate embraced the following traits: the weight of egg shell, albumen and yolk as well as the egg shell thickness and the colour of yolk.

On the basis of collected data it was possible to determine the egg shape index (I_k) and the yolk index ($I_ż$) according to the following pattern:

$$I_k = \text{egg length / egg width}$$

$$I_ż = \text{yolk height / yolk diameter}$$

The received results were statistically measured by average values and coefficients of variation. The importance of statistic differences between the average values was examined with the Tukey test (StatSoft Inc. 2001). The correlation coefficients were determined for the analyzed traits. The results of different pheasant strains individual hatches were also collated.

RESULTS AND DISCUSSION

Table 1 shows the results for an average egg weight and selected external traits for the Reeve's Pheasant, Common Pheasant and Silver Pheasant, from which the Silver Pheasant females layed the heaviest eggs.

Table 1. Mean values of egg weigths and external traits
Tabela 1. Wartości średnie masy i wybranych cech zewnętrznych jaj bażancich

Specification Wyszczególnienie	Strain of pheasant Odmiana bażanta		
	Lophura nyctemera srebrzysty	*Syrmaticus reevesii* królewski	*Phasianus colchicus* zwyczajny
Egg weight Masa jaja (g)	39.95^{A}	32.11^{B}	31.04^{B}
Egg length Długość jaja (mm)	47.73^{a}	45.37^{b}	44.93^{b}
Egg width Szerokość jaja (mm)	39.82^{a}	37.40^{b}	35.88^{b}
Shape index Indeks kształtu jaja	1.20^{a}	1.21^{a}	1.25^{a}
Shell colour Barwa skorupy	bright pink jasny róż	grey-olive szaro-oliwkowa	olive oliwkowa
Shell thickness Grubość skorupy (mm)	0.293^{a}	0.291	0.244^{a}

Explanatory notes: values marked with small different letters a and b differ significantly at P ≤ 0.05, values marked with large different letters A and B differ significantly at P ≤ 0.01.
Objaśnienia oznaczeń: a, b – średnie oznaczone małymi literami różnią się istotnie przy P ≤ 0,05, A, B – średnie oznaczone dużymi literami różnią się istotnie przy P ≤ 0,01.

The eggs of other strains had similar weight. The Common Pheasant egg weight was close to Mróz et al. (2003), Kuźniacka et al. (2004) and lower than Wilson's (1991) results. The Silver Pheasant eggs, much heavier, also had significantly longer the longitudinal and transversal axis in comparison with other examined eggs. Beyond all of the examined eggs, the Silver Pheasant eggs' length of the longitudinal and transversal axises was greater in comparison with the eggs of the other strains. The length of the longitudinal and transversal axises fluctuated respectively around 44.93–47.73 and 35.88–39.82mm in all of the researched eggs. The size assessment of the hatching eggs is extremely important because, as it was confirmed in many papers (Michalak and Mróz 2003), the eggs of non-standard sizes mark worse hatching results. The egg shape index was approximate and fluctuated between 1.2 and 1.25 in all researched eggs. The mentioned results allow to conclude that all of the eggs were of standard shape and size. This, according to many authors (Pakulska et al. 2003), is a crucial aspect in hatchability. The shell colour is determined by genetic factors. In Mróz et al. (2003) view the Common Pheasants' eggs differ from those of other strains on the diversity of shell colours, which is caused by its organic compounds. The basic colours of them are: dark brown, olive, light brown and blue (Mróz et al. 2003).

The egg shell colours diversity was different for each strain: the Silver Pheasant – light pink, the Reeve's Pheasant – grey and olive, the Common Pheasant – olive. The shells of all pheasants' eggs were clean and slick. The egg shell thickness was the geatest in the taglion of the Silver Pheasant eggs (0.293 mm), then the Reeve's Pheasant (0.291 mm), and eventually the Common Pheasant (0.244 mm). Though, the differenses are statistically insignificant.

In Malec's view (2005) the research on the egg shell quality may give some valuable information in the field of eventual hatchability problems. The egg shell plays an important role in the correct gas exchange during the embryogenesis, that is why it should be clean, slick, without any scratches, deformation or roughness. Furthermore, the quality of egg shell depends in a large measure on its thickness (Mróz et al. 2003, Świątkiewicz and Koreleski 2004) determined by the genetic and environmental factors, the age of hens, the length of laying period and feeding (Mróz et al. 2003, Pakulska et al. 2003, Czaja and Gornowicz 2005).

The Table 2 shows average values of the pheasant eggs' internal traits. The Silver Pheasant's eggs were the heaviest, they had also the highest weight of each morphological compound like shell, albumen and yolk. The weight of the Silver Pheasant's eggs was approximately 6.07 g, the Reeve's Pheasant's – 3.95 g, the Common Pheasant's – 4.03 g. The weight of yolk respectively 14.50 g, 11.77 g and 12.01 g, the albumen 19.36 g, 16.40 g, 15.00 g. The weight of all morphological compounds of the Common and Reeve's Pheasants was usually lower than of the Silver Pheasants'. The differences were confirmed for $P \leq 0.01$.

Table 2. Mean values of egg internal traits
Tabela 2. Wartości średnie wybranych cech wewnętrznych jaj

Specification Wyszczególnienie		Strain of pheasant Odmiana bażanta		
		Lophura nyctemera srebrzysty	*Syrmaticus reevesii* królewski	*Phasianus colchicus* zwyczajny
Egg weight Masa jaja	g %	$39{,}95^{A}$ 100,00	$32{,}11^{B}$ 100,00	$31{,}04^{B}$ 100,00
Stell weight Masa skorupy	g %	$6{,}07^{A}$ $15{,}19^{A}$	$3{,}95^{B}$ $12{,}30^{B}$	$4{,}03^{B}$ $12{,}98^{B}$
Yolk weight Masa żółtka	g %	$14{,}51^{a}$ $36{,}32^{b}$	$11{,}77^{b}$ $36{,}66^{b}$	$12{,}01^{b}$ $38{,}69^{a}$
White weight Masa białka	g %	$19{,}36^{A}$ $48{,}46^{b}$	$16{,}40^{a}$ $51{,}07^{a}$	$15{,}00^{bB}$ $48{,}32^{b}$
Yolk colour Barwa żółtka		$6{,}97^{a}$	$7{,}03^{a}$	$6{,}11^{a}$
Index yolk Indeks żółtka		$0{,}23^{a}$	$0{,}22^{a}$	$0{,}29^{a}$

Explanatory notes: values marked with small different letters a and b differ significantly at $P \leq 0.05$, values marked with large different letters A and B differ significantly at $P \leq 0.01$.
Objaśnienia oznaczeń: a, b – średnie oznaczone małymi literami różnią się istotnie przy $P \leq 0{,}05$, A, B – średnie oznaczone dużymi literami różnią się istotnie przy $P \leq 0{,}01$.

Table 2 also illustrates the share of morphological compounds in the eggs weight. Notwithstanding the birds' origin, albumen had the biggest share in the egg weight: the Common Pheasant 48.32%, the Reeve's Pheasant 51.07% and the Silver Pheasant 48.46%. The second major compound was yolk. The biggest share of it was in the Common Pheasants' eggs (38.69%), then the Reeve's Pheasant (36.66%) and the Silver Pheasant (36.32%). The differences confirmed with $P \leq 0.05$. Shell had the lowest share in the egg weight: the Silver Pheasant – 15.19%, the Common Pheasant – 12.98%, the Reeve's Pheasant – 12.30% of egg weight. Its share was diversified in all researched strains.

By contrast, the yolk index of researched eggs and their colouring were similar regardless of the birds' origin.

Table 3 collates the average values of correlation coefficients between selected internal and external traits of pheasant eggs. They were essential between the weight of egg and albumen (0.666–0.721) as well as between the weight of albumen and yolk (0.631–0.702). No significant relationships between other traits.

Table 3. Coefficients of correlation of egg internal traits
Tabela 3. Współczynniki korelacji między wybranymi cechami wewnętrznymi jaj

Specification Wyszczególnienie	*Lophura nyctemera* bażant srebrzysty	*Syrmaticus reevesii* bażant królewski	*Phasianus colchicus* bażant zwyczajny
		Egg weight Masa jaja	
Shell weight Masa skorupy	0.425	0.311	0.303
White weight Masa białka	0.675*	0.666*	0.721*
Yolk weihgt Masa żółtka	0.523	0.385	0.711*
Shell thickness Grubość skorupy	0.031	0.211	0.030
		White weight Masa białka	
Shell weight Masa skorupy	0.433	0.285	0.314
Yolk weihgt Masa żółtka	0.671*	0.702*	0.631*
		Yolk weihgt Masa żółtka	
Shell weight Masa skorupy	0.301	0.071	0.066
		Shell thickness Grubość skorupy	
Shell weight Masa skorupy	0.185	0.244	0.292

Coefficients of correlation of egg internal traits *P ≤ 0.05.
Korelacje pomiędzy wybranymi cechami wewnętrznymi jaj *P ≤ 0,05.

Table 4 shows selected rates of pheasant females' reproduction.

Table 4. Mean values of egg hatching
Tabela 4. Wartości średnie inkubacji jaj

Specification Wyszczególnienie	Strain of pheasant Odmiana bażanta		
	Lophura nyctemera bażant srebrzysty	*Syrmaticus reevesii* bażant królewski	*Phasianus colchicus* bażant zwyczajny
Egg fertility Zapłodnienie jaj (%)	83.0^{a}	80.2^{b}	85.7^{a}
Hatch of poults from eggs incubate Wyląg piskląt z jaj nałożonych (%)	74.5^{a}	71.3^{b}	76.9^{a}
Hatch of poults from eggs fertilized Wyląg piskląt z jaj zapłodnionych (%)	85.4^{A}	77.6^{B}	87.3^{A}

Explanatory notes: values marked with small different letters a and b differ significantly at P ≤ 0.05, values marked with large different letters A and B differ significantly at P ≤ 0.01.
Objaśnienia oznaczeń: a, b – średnie oznaczone małymi literami różnią się istotnie przy P ≤ 0,05, A, B – średnie oznaczone dużymi literami różnią się istotnie przy P ≤ 0,01.

The egg fertilization and hatching data show that the Silver Pheasant eggs were fertilized in 83.00%, the Reeve's Pheasant – 80.20% and the Common Pheasant – 85.70% together with the best results in the numer of healthy pheasant chicks hatched of the fertilized and incubated eggs, respectively 87.30% and 76.90% (differences statistically confirmed). The data analysis proves that the percentage of fertilized eggs was the highest in the Common Pheasant eggs, on the other hand the highest percentage of healthy pheasant chicks hatched from the incubated and fertilized eggs was in the Common Pheasant.

CONCLUSIONS

The Silver, Reeve's and Common Pheasant eggs differ between each other by size, shell colour and shell thickness. The greatest share in the egg composition, independently from birds' origin, had albumen, then yolk and shell. In all of the researched pheasant strains the significant correlation coefficients were verified between the weight of eggs and the weight of albumen, then between the weight of albumen and yolk. The results show, that the Silver Pheasant, the Reeve's Pheasant and the Common Pheasant bred in barns, point out good levels of fertilization and hatching healthy chicks from the hatched and fertilized eggs.

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Abstract. The objective of the present work was to assess egg size and evaluate selected external and internal egg traits of selected pheasant strains. Fifteen eggs of each of the following strain were examined: the Reeves's Pheasant *(Syrmaticus reevesii)*, the Silver Pheasant *(Lophura nyctemera)* and the Common Pheasant *(Phasianus colchicus)*. A total of 45 eggs were studied. The eggs were obtained from 6 groups (2 for each variety) of 5 pheasants (1 male and 4 females). The birds were reared under the same environmental conditions and fed the same diets. Eggs were assessed following the methodology described by Mroczek (1997). The eggs laid by Reeves's Pheasant, Silver Pheasant and Common Pheasant females had significantly different shell sizes, colour and, to some extent, thickness. Regardless of the variety, eggs contained significantly most albumen (48.46–54.77%), less yolk (36.32–38.69%), and shell (12.30–15.19%). Common Pheasant eggs had significantly more yolk and albumen than the remaining eggs. For all the varieties studied, significant correlation coefficients were obtained between egg weight and albumen weight (0.666–0.721) and, in the case of Common Pheasant, between egg weight and yolk weight (0.711). The findings of this study indicate that Reeves's Pheasants, Silver Pheasant and Common Pheasants reared in captivity achieve good breeding results in the form of egg fertilisation and hatching of healthy chicks from eggs hatched and fertilised.