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The Significance of Egg Shell Color on the Pheasant Hatching Production Results

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Abstract.- Based on studies carried out in 2011, on the impact of genetic factors on hatching and vitality of pheasant chicks and young, a strong causal relation has been confirmed between the egg shell color and certain production parameters, such as the embryonic death rate. A model was based on determining egg shell color for 420 eggs. Shell color of eggs obtained in aviaries is very versatile and can be expressed in almost 25 color tones. All these nuances are embedded in the seven basic tones. The result shows that embryonic death rate is 85% for lime skim eggs, 50% for lime spots eggs, 50% for green eggs, 30% for blue-green eggs, 25% for dark grey eggs, 25% for brown eggs and 20% for light brown eggs. Results of this study were applied to one of the biggest pheasant farm in Serbia, "Ristovača" in Bač. The total number of examined eggs was 216,188 of which 191,240 were fertilized, and 24,948 had dead embryos. Thus the total number of hatched pheasant chicks was 155,690. The eggs were classified by their color and related to their hatchability status. When total number of eggs (216,188) was used with above mentioned parameters, almost the same results (155,763) were obtained, confirming the correctness of the obtained results.
Keywords: Pheasant, egg shell color, fertility, embryonic death rate.

INTRODUCTION

Farm production of pheasants in Serbia was poorly developed until 1960, when the number of partridges had reduced considerably across the Central, Eastern and Southern Europe. Since 1960 tens of millions pheasants of different ages have been released in various biotopes, and the pheasant has become the main hunting game in most of the European countries. Today, pheasant is still widely produced in Serbia - over 200,000 chicks annually. However, thirty years ago (1980s) during "golden period" of hunting tourism, the average was about 800,000 annually. Compared to this number the production in Serbia has decreased.

In order to start pheasant production and to pre-determine the capacity, it is imperative to know the needs of the region for hunting the artificially produced pheasant game, limits of profitability of the pheasant farm and specific age structure (category) of the product.

Among other factors the color and egg shell quality have also been reported to have significant effect on the viability of newly hatched chicks of "hunting" pheasants (Uščebrka *et al.,* 2011; Krystaniak *et al.,* 2005). Jović (1964) noticed that most of the observed eggs were fawn-colored (up to 43%), green-brown (about 24%) and brown (about 19%), followed by dark brown (up to 4%), white (5%), green blue (up to 4%) and very light green (up to 1%). It was noticed that eggs with irregular lime shells, which are not coated with a layer of wax, almost never hatch in chicks. Such eggs on the average are 2.5% only but their number increases to 5.47% (lime eggs) by the end of the hatching period. The eggs with stronger lime as white spots are only 0.58% (Uščebrka *et al*., 2011). The role of these characteristics of the egg shell is not yet sufficiently understood in the incubation process (Marinković and Kekić, 2007).

According to this study hatching ranged from 70 to 75%. The largest number of unhatched eggs was with irregular lime of the shell (95%) followed by green (50%) and had lime spots on the shell (50%). The percentage of unfertilized eggs varied during the laying period and generally ranged 10-17%. Ristić *et al.* (2009) reported 259,342 (13.27%) unfertilized eggs out of a total of 1,954,056 eggs in the period 1993 - 2002. They also reported that embryonic death rate was 18.73% of total eggs. The percentage dead from fertilized eggs was 21.60%. In some pheasant farms the second eggs candling is

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practiced (usually after 14 days), with a purpose to reject eggs in which the embryo died due to various reasons. In large pheasant farms this process is not usual. Number of pheasant chicks hatched from planted eggs depends on the number of fertilized eggs and the quality of incubation. In relation to time of planting, the number of hatched eggs is within the following range: up to 60% for the eggs hatched up to the 20th of April, followed by 60% to 70% for those hatched until 20th of June, and after this period hatching decreased below 60% (Jović, 1964, Ristić *et al.*, 2010). According to Ivanović and Ristić (2006), out of a total of 1,954,056 eggs, 1,330,351 (68.08%) pheasant chicks hatched and out of 1,694,714 fertilized eggs, 1,330,351 pheasant chicks hatched (78.50%).

The object of this study was to study the impact of genetic factors on hatching and vitality of pheasant chicks and young ones. The aim was to suggest realistic parameters that will primarily serve to establish the indicators of the number of fertilized eggs, as well as number of dead embryos. These two parameters are preconditions for accurate determination of egg numbers needed for production in each particular year, and planning the optimal size of the parent flock in late February and early March.

MATERIALS AND METHODS

None of the three main subspecies of pheasants: plain (*Phasianus colchicus* L, 1758); Mongolian (*P. mongolicus* Brandt, 1845); and Chinese (*P. torquatus* Gmelin, 1789) are kept as pure subspecies nowadays in Serbia, since the last extensive research of basic biological parameters for these pheasant subspecies has been undertaken more than 50 years ago.

The hunting pheasant was created by crossing the three above-mentioned "basic" sub-species, and it is the only pheasant grown and hunted today in Serbia. The present study was carried out in the Laboratory for Anatomy and Histology of the Agricultural Faculty in Novi Sad, with three repeats of each of 100 eggs (total 400 eggs) sorted according to egg coloration (dark brown, light brown, brown-green and blue green) into four different groups - which represent most common color of pheasant egg shell. In order to obtain larger sample of selected eggs, a similar methodology was applied in monitoring egg hatching at the pheasant farm "Ristovača" in Bač during the period 1st March to 31st May 2011. Shell color was determined for 420 pheasant eggs. Shell color of eggs obtained in aviaries is very versatile and can be expressed in almost 25 tones of colors. All these nuances are embedded in the seven (7) basic tones.

Four groups, separated in four aviaries from which each had 80 hens and 8 cocks were used in this study.

Nest-site selection as an important factor influencing the survival and reproductive success of pheasant (Wu and Liu, 2011) was excluded, since in our study we focused only on artificial pheasant production.

RESULTS AND DISCUSSION

A strong causal link between the color and quality of egg shell and certain production parameters such as hatching and vitality of chicks and vitality and capacity of the parent flock has been established.

Table I shows the data on number of eggs/ pheasant, total number of fertilized eggs, number of chicks hatched in four different aviaries grouped on the basis of color of egg shell. The birds of group A produced 53.4 eggs with dark picking per pheasant, whereas the group D of aviaries produced 48.1 eggs with blue green shell per pheasant. Group B with brown egg shells had 92.1% fertilized eggs, whereas group D had 80.19% fertilized eggs. In Group B 84.67% of the fertilized eggs with brown shell hatched whereas group D had the least hatching *i.e.* 78.65%.

Egg shell color

Figure 1 shows relationship between egg shell color and fertilization for the first, second and third monitoring of the pheasant eggs.

The blue green eggs with an average weight of 31.1 g, were the heaviest whereas the eggs with dark picking were 29.6 g. It appears the egg shell color may indirectly affect the quality of eggs, fertilization at certain rate, and consequently total result of hatching, but there is little effect on the egg weight and number of eggs laid by pheasant hens.

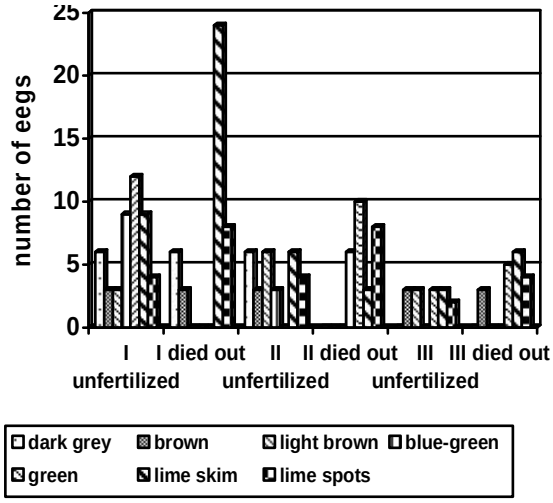

Fig. 1. Relationship between egg shell color and fertilization

Among the four experimental groups of pheasant hens, only group D had a lower capacity (48.1 eggs), while the laying of eggs was above 50 eggs in all other groups (Table I). The average egg weight among four groups was 30.48 g. Above average weight was found in groups B and D (30.9 g and 31.1 g), while the weight below the average was found in groups A (29.6 g) and C (30.3 g). Fertilization rate of pheasant eggs was the highest *i.e.* 92.1% in group B (brown colored eggs) and lowest (80.2%) in group D (blue-green colored).

Figure 2 shows relationship between embryonic death rate and egg shell color. The result shows that embryonic death rate is 85% for lime skim eggs, 50% for lime spots eggs, 50% for green eggs, 30% for blue-green eggs, 25% for dark grey eggs, 25% for brown eggs and 20% for light brown eggs.

The analysis showed that there is statistically significant difference in number of dead embryos and embryonic death rate related to the egg shell color (Table II, Figs. 3, 4). Other variables didn't have statistically significant relationship with egg shell color.

Application of obtained results

In one of the largest pheasant farms in Serbia "Ristovača" in Bač, 216,188 eggs were examined; classified on the basis of color. Out of total number 191,240 were fertilized and 24,948 contained dead

Table I.- Data on Hatching of eggs of Ring-necked pheasants from four different aviaries grouped on the basis of color of egg shells and production parameters.

Egg color groups at four aviaries	Total No. of eggs	Fertilized eggs		Eggs with dead embryo		No. of hatched chicks	From total number of eggs	From fertilized eggs	No. of eggs/ pheasant	Average egg weight (g)
		No.	%	No.	%		%	%		
A (Dark-picking)	4,272	3,806	89.1	637	14.92	3,169	74.18	78.8	53.4	29.6
B (Brown)	4,144	3,817	92.1	585	14.11	3,232	77.99	82.8	51.8	30.9
C (Green)	4,064	3,649	89.8	628	15.45	3,021	74.33	83.9	50.8	30.3
D (Blue-green)	3,848	3,086	80.2	628	16.32	2,458	63.87	91.0	48.1	31.1
Total:	16,328	14,358	87.93	2.478	15.18	11,880	72.76	82.74	51.03	30.5

embryos; resulting in 155,690 hatched pheasant chicks (Table III).

Table II.- The effect of egg shell color on the number of dead embryos and embryonic death rate

	t	df	Sig. (2-tailed)
Number of dead embryos	3,414	6	,014
Embryonic death rate	4,685	6	,003

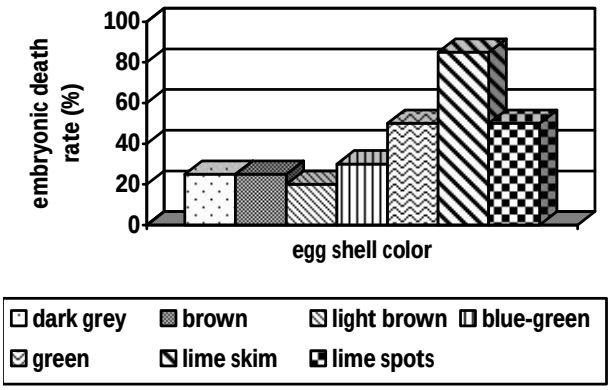

Fig. 2. Relationship between embryonic death rate and egg shell color

Table III.- Embryonic death rate at the pheasant farm "Ristovača" in Bač

Egg shell color	No. of eggs	No. of chicks	Number of embryos died	Embryonic death rate (%)
Dark gray	8,648	6,486	2,162	25
Brown	41,076	30,807	10,269	25
Light brown	92,961	74,369	18,592	20
Blue-green	51,885	36,319	15,566	30
Green	2,162	1,081	1,081	50
Lime skim	8,648	1,297	7,351	85
Lime spots	10,808	5,404	5,404	50
Total:	216,188	155,763	60,425	28

CONCLUSIONS

In artificial breeding of pheasant, selection of eggs according to characteristics of shell color is a very important step. Practice of placing all sets of unsorted eggs in the incubator is incorrect because all eggs differing from typical colors (brown, dark-picking, green, and blue-green), or eggs with lime scum and lime spots on the shell, have smaller percentage of hatching thus they may be discarded in the initial stages. Obtained data confirmed that the maximum embryonic death rate (85%) was in shell lime skim eggs followed by eggs with green coloration with lime spots on shell (50%).

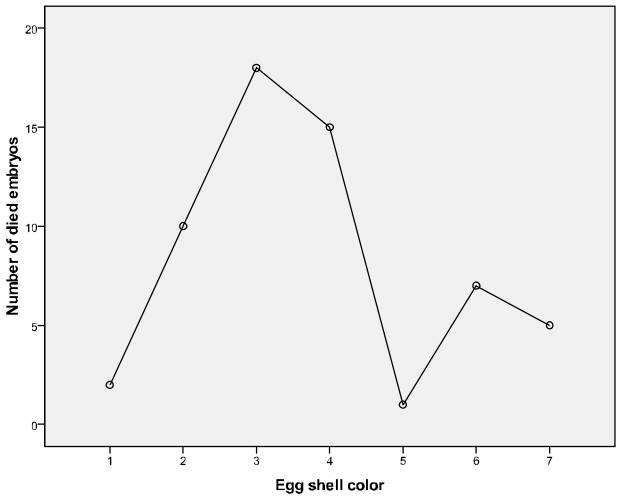

Fig. 3. Relationship between number of dead embryos and egg shell color

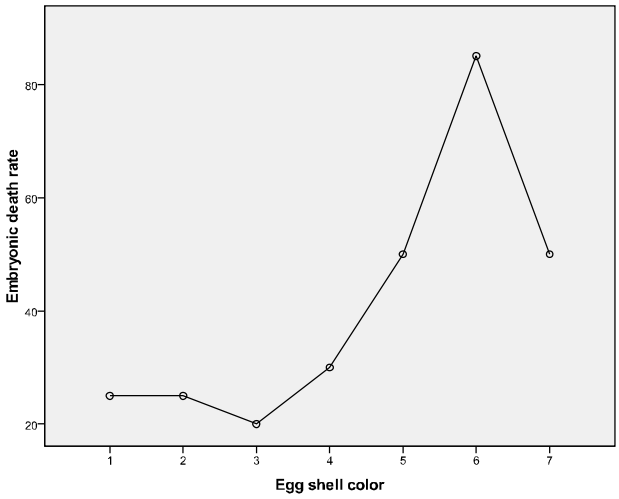

Fig. 4. Relationship between embryonic death rate and egg shell color

Taking care of proper selection of the pheasant eggs prior to incubation, can indirectly contribute to the success of production. Also, in the production cycle, nutrition is likely to affect color

and shell quality, fertilization and consequently total result of hatching, but effects on the egg weight and number of eggs laid by pheasant hens was very low in the period of holding the parent flock (1st March – 31st May). Further researches are needed in order to analyze diet, physiology and genetics, so that more accurate results can improve the quality and quantity of pheasant production in Serbia.

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