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COMPARATIVE STUDY OF SELECTED PRODUCTION TRAITS OF DIFFERENT ORAVKA HEN LINES

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ABSTRACT

The aim of our study was to compare laying characteristics and egg weight of three different Oravka hen lines (OR 1, OR 2, OR 3) during two years. Hens were kept outdoor in a heatless hen-house with a covered yard. Feeding and watering were *ad libitum*. They were fed with a standard feed mixture with 11.7 MJ ME and 200.0 g NL. Basic statistics for average laying per hen and laying intensity (%) was done for each Oravka line indicating that these characteristics tended to be higher in year 2017 than in year 2018. The statistical model for egg weight included effects of line, month of laying and interaction line x month of laying. Data were analysed separately for each year. Only line (genotype) had significant effect on egg weight, the remaining effects were not significant. In year 2017 the highest egg weight had line OR 3 (58.61 ± 0.30 g), the lowest egg weight had line OR 1 (57.32 ± 0.31 g), (P = 0.010). In year 2018 the highest egg weight had line OR 1 (60.64 ± 0.33 g), the lowest egg weight had line OR 3 (58.72 ± 0.37 g), (P = 0.005).

Key words: Oravka breed; egg weight; laying traits

INTRODUCTION

Egg production is affected by both genetic and environmental factors, and many interactions between them have been determined. The mean laying in a flock of hens of a particular age is determined by the individual patterns of sequential laying at that time (Johnston and Gous, 2003).

Oravka is a dual-purpose breed kept for egg and meat production. The yellow- brownish Oravka has, according to breed standard, a hard rectangular frame; comb is rosette, medium size, the mandrel follows the header line, legs are medium length, without feather, yellow; red tinted strip (lampas) on the sides of the bows is wanted; fingers are straight; well stretched; feather is rich; well-fitting; solid structure. Body weight of males is between 2.8 and 3.3 kg, body weight of females is between 2.2 and 2.7 kg, egg laying ranges from 180 to 200 pcs per year; eggs have a brownish shell and their average weight is about 55 g (Weis and Hrnčár, 2009; Hrnčár *et al*., 2010; Hanusová *et al.*, 2017).

Egg weight has great economic importance mainly in poultry breeding and is considered one of the major breeding objectives and research goals in different countries (Shalev and Pasternak, 1993; Jones *et al.*, 2001; Johnston and Gous, 2007; Islam and Dutta, 2010; Savegnago *et al.*, 2011). Van den Brand *et al.* (2004) demonstrated that the weight of eggs from outdoor layers was lower at an early age, but increased more with age. The age of hens is an important factor affecting the weight of eggs. Tůmová and Gous (2012) found that the significant interaction between the hen type and age was apparent in laying ($P \leq 0.001$), sequence length ($P \leq 0.001$) and the time of oviposition ($P \leq 0.001$). A significant

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interaction between production type and age ($P \leq 0.015$) was evident in egg weight, but egg component proportions were dependent only on the hen type. Zita *et al.* (2009) compared the effect of genotype and age on egg weight and egg quality characteristics: egg weight, yolk and eggshell percentage increased with the hen's age in all genetypes. Yi *et al.* (2014) estimated genetic parameters of these increment traits in 2 pure lines of chickens. Egg weights at different ages were highly heritable in 2 lines ($h^2 \geq 0.35$), and had strong genetic and phenotypic correlations among different ages.

The aim of this study was to analyse an egg production and egg weight of three different lines (genotypes) of Oravka population reared at NPPC – RIAP Nitra in years 2017 and 2018 (each year was analysed separately). Egg weight was also analysed in dependence on month of laying and interaction line x month.

MATERIAL AND METHODS

Oravka is a dual-purpose breed kept for egg and meat production. Laying traits (average lay and laying intensity) and egg weight of Oravka breed were measured in three lines (OR 1, OR 2 and OR 3). In each line, the rooster was from a different breeder. The *ex situ* conservation flock kept at the National Agricultural and Food Centre – Research Institute for Animal Production Nitra (NPPC – RIAP Nitra) during two years was included in the experiment. NPPC – RIAP Nitra is located in the temperate climate zone, GPS coordinates of the location are 48° 32' N and 18° 03' E. The breeding females originated from mating between females raised in the RIAP Nitra flock and roosters from breeders. Each season the roosters from breeders were registered in the Slovak breeders' register (Hanusová *et al*., 2017).

The hens were kept in a heatless hen-house with a covered yard. Feeding and watering was *ad libitum*. They were fed with a standard feed mixture with 11.7 MJ ME and 200.0 g NL. The hens were exposed to the natural light with the addition of artificial light (14 hours light + 10 hours dark).

The laying per line was recorded daily. The eggs were weighed individually; each egg from each line separately every first seven days of the month (Hanusová *et al*., 2017). The eggs were weighted on scales KERN 572 with the accuracy of 0.001 g. The weight of the eggs in a certain month actually reflects the age of the hens. The experiments started in early March, when hens were over 40 weeks of age.

Statistical analysis was done using the SAS9.2 statistical software (2009). The GLM model was applied to study the influence of effects causing variation of egg weight in Oravka hens for each year separately. The following model was applied:

$$Y_{ijk} = \mu + L_i + M_j + L_iM_j + e_{ijk}$$

where:
Y_{ijk} – individual egg weights
μ – intercept
L_i – fixed effect of line (OR 1,OR 2, OR 3); $\sum_i S = 0$
M_j – fixed effect of month (March, April, May); $\sum_j A = 0$
L_iM_j – interaction of line x month; $\sum_{ij} LM = 0$
e_{ijk} – random error; $e_{ijk} = N\,(0, I\sigma^2_e)$

RESULTS AND DISCUSSION

National Agricultural and Food Centre – Research Institute for Animal Production in Nitra (NPPC – RIAP Nitra) deals with the conservation of poultry genetic resources not only on a methodology basis but also contributes to the maintaining of the local Oravka breed. The average laying per hen and laying intensity (%) in each Oravka line (OR 1, OR 2, OR 3) were recorded or calculated. The results are given in Table 1. Although the animals received the same feed in both experimental years, we found differences in average laying per hen and also in laying intensity (%). Average laying per hen and laying intensity (%) in each Oravka line (OR 1, OR 2, OR 3) tended to be higher in 2017 compared to 2018. The different laying characteristics between the years within the line could be caused both by the effect of external environmental conditions (animals were kept in a heatless hen-house with a covered yard) and also by hereditary factors of animals.

The weight of the eggs in a certain month actually expresses the age of hens. The experiments started in early March, when hens were 40 weeks of age.

Results from the analysis of variance of fixed effects affecting egg weight in 2017 are given in Table 2. Only the line had highly significant effect on

Table 1. Laying characteristics of Oravka breed

Month/year	Line OR 1		Line OR 2		Line OR 3	
	Average laying (piece/hen)	Laying intensity (%)	Average laying (piece/hen)	Laying intensity (%)	Average laying (piece/hen)	Laying intensity (%)
III/2017	19.42	62.63	23.93	77.20	21.60	69.68
IV/2017	26.92	89.72	27.33	91.11	28.47	94.89
V/2017	29.33	94.62	26.07	84.08	27.60	89.03
Total (92 days)	75.67	82.25	77.33	84.05	77.67	84.12
III/2018	17.00	54.84	16.07	51.84	19.36	62.44
IV/2018	22.47	74.89	20.86	69.52	19.86	66.19
V/2018	16.67	53.76	17.93	57.83	19.21	61.98
Total (92 days)	56.13	61.01	54.86	59.63	58.43	63.51

egg weight. Table 3 shows the means and standard errors of egg weights in dependence on line and month of laying (year 2017). The highest weight of eggs was recorded in OR 3 line (58.61 ± 0.30 g), the lowest egg weight was in OR 1 line (57.32 ± 0.31 g; $P = 0.010$). No significant effect of month and line x month on egg weight was found in year 2017. When we evaluated the effect of line x month, the egg weight was ranged from 56.88 g to 58.93 g. The number of eggs in each group ranged from 40 to 100 pieces (results not shown).

Yi *et al.* (2014) found a similar weight of eggs at the age of 50 – 60 weeks as we observed at the same age in Oravka hens in 2017. Zita *et al.* (2009) followed the changes in egg weight by age in various hen genotypes. The egg weight increased with the layer's age in all genotypes. The egg weight increase with the age of hens is in agreement with Peebles *et al.* (2000), Silversides and Scott (2001), Van den Brand *et al.* (2004), Rizzi and Chiericato (2005) and Johnston and Gous (2007).

Analysis of variance of fixed effects affecting egg weight in 2018 is given in Table 4. The significant effect of line (genotype) on egg weight (2018) was found. In Table 5 are given the means and standard errors of egg weights by line and month (year 2018). The highest weight of eggs had line OR 1 (60.64 ± 0.33 g), the lowest egg weight had line OR 3 (58.72 ± 0.37 g). No significant effect of month (least squares means were estimated between 59.37 ± 0.33 and 59.72 ± 0.36 g) and line x month was not found on egg weight. When we evaluated the effect of line x month, the egg weight was ranged from 58.52 g to 61.15 g. The number of eggs in each group ranged from 50 to 73 pieces (results not shown).

Table 2. Analysis of variance of fixed effect on egg weight (year 2017)

Source of variance	Weight (g)		
	DF	Mean Squares	*P*
Line	2	80.96	0.005
Month	2	16.99	0.372
Line *month	4	1.64	0.984

Table 3. Least squares means ± standard errors of egg weights (year 2017)

Effect	Line		
	OR1	OR2	OR3
N	191	265	236
Egg weight	57.32 ± 0.31	57.91 ± 0.26	58.61 ± 0.30
Scheffe's test		OR 1 : OR 3*	
Effect	Month of laying		
	March	April	May
N	160	265	267
Egg weight	57.59 ± 0.34	58.16 ± 0.26	58.09 ± 26
Scheffe's test		No significant differences	

* $P = 0.010$

The line (genotype) of Oravka hen had a significant effect on egg weight both in 2017 and 2018. The significant effect of line on the egg weight was also found by Hanusová *et. al.* (2014). The egg weight was lower (55.07 g and 56.80 g) compared to this work. Similarly, the effect of genotype on the egg weight was found by Tůmová *et al.* (2009).

Yi *et al.* (2014) also confirmed the increase in the egg weights with increasing the hen's age. Tůmová and Gous (2012) monitored the weight and quality of eggs depending on the type and age of hens. A significant two-way interaction between type and age ($P \leq 0.015$) was evident. On the other hand, the proportions of egg components were dependent only on type of hen. In the present work, the weight of the eggs were weighted from 40 weeks (March) to the age of 52 weeks (May). Over this period, the egg weight ranged from 57.32 g to 58.61 g.

CONCLUSION

Our results show that the line (genotype) of the Oravka breed has a significant effect on the egg weight. The factor of month and interaction of line x month did not influence egg weight i.e. no differences were found.

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Table 4. Analysis of variance of fixed effect on egg weight (year 2018)

Source of variance	Weight (g)		
	DF	Mean Squares	*P*
Line	2	102.63	0.0099
Month	2	5.64	0.7746
Line *month	4	29.65	0.2524

Table 5. Least squares means ± standard errors of egg weights (year 2018)

Effect	Line		
	OR1	OR2	OR3
N	201	178	163
Egg weight	60.24 ± 0.33	59.67 ± 0.35	58.72 ± 0.37
Scheffe's test		OR 1 : OR 3**	
Effect	Month of laying		
	March	April	May
N	171	199	172
Egg weight	59.37 ± 0.33	59.72 ± 0.36	59.55 ± 0.55
Scheffe's test		No significant differences	

** $P = 0.005$

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