Aspects of the Genotype-Environment Interaction at the Japanese Quail (*Coturnix-Coturnix Japonica*)

Teofil Oroian[1], Rareş Oroian[1], Simona Paşcalău[1], Elvira Oroian[1], Dorel Dronca[2]

[1]*University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Mănăştur str. no.3-5, 400372, Romania*
[2]*University of Agricultural Sciences and Veterinary Medicine Timişoara, Calea Aradului, no.119, Romania*

Abstract
We analyzed the problems of genotype-environment interaction at three *Coturnix Coturnix Japonica* varieties. The environment where the experiment took place is perfect identically for all the activities, to ensure that the observed differences at the followed traits to be strictly attributed to the genotype differences. We analyzed the body weight, eggs weight, eggs large and small diameter, yolk and egg white weight, egg-shell weight. The data were statistically interpreted using the average and dispersal indices estimation, and the significance testing using Student test.

Keywords: *Coturnix Coturnix Japonica*, Genotype-Environment Interaction, Body Weight.

1. Introduction

In 1974, Bell confirms the fact that the results extrapolation from one trait to another, at the same population, or from a breed, species to another, have a reliable safety of extrapolation, as well as a repeatability degree.
Many authors are showing the fact that the use of different genotypes, which are belonging to the same breed or species, in identical environmental conditions can give a measure of the genotype-environment interaction. The use of similar genotypes in different environmental conditions is another possibility of estimating the interaction size and degree between traits and traits and environment. Because of the fact that the Japanese quail has a high precocity and a small interval between generations, it is the most adapted between birds to the study of genotype-environment problems.

* Corresponding author: Teofil Oroian, *teoroian@yahoo.com*

The research hypothesis started from a premise that similar genotypes, in the same environmental conditions are giving similar performances, and in different environmental conditions, if there is a genotype-environment interaction, the performances should be different

2. Materials and methods

The experimental disposal were organized using Japanese quails (*Coturnix Coturnix Japonica*), observed in their evolution from the hatching period until the age of 8 months.
The experiment included an initial number of 105 females, belonging to the 3 color varieties (figure 1, 2 and 3).

Figure 1. 35 females from standard variety (Aguti)

Figure 2. 35 females from white variety (Giant White)

Figure 3. 35 females from brown variety (Tuxedo)

There was applied the same light schedule, in the observed period, from 5 to 8 months, for all the lots, of 17 hours/day, at the youth period, and from 1 day to 35 days there was a non-stop schedule.

The average temperature in the experimental room where were laid the cages, was between 16 and 22ºC. On the experimental period we gave concentrated forage for laying hens, with the following structure: 18.10% B.P.; 2835 kcal/kg M.E.; 4.08% fats; 0.31% salt; 0.14% sodium; 0.39% calcium; 0.66% phosphorus; 0.89% lysine; 0.68% methionine + cystine.

We analyzed in the experimental period, the numerical egg production, to be able to observe the possible differences between the color varieties, considered as different genotypes.

At 6 months of age, we weighted the individuals, to establish the body weight depending on the color variety. In the period of 5-6 months of age we gathered randomly, from the 3 color varieties, about 100 eggs, were analyzed using classical measurements: the eggs weight, eggs height and diameter.

To be able to make a qualitative evaluation, and eventually to observe the differences caused by the color varieties and different genetic structure, we analyzed the yolk weight, egg white and egg-shell weight. The results interpretation was made using „Student" test.

3. Results and discussion

The aspects regarding the average, dispersal indices and signification for the birds body weight, at 6 months of age, at the 3 varieties are presented in table 1.

The standard variety realizes an average of 166±1.01 g, being inferior as performance with 28 g to the Giant white variety, and with 12 g to the Tuxedo variety. The Giant white variety is superior with 16 g to the Tuxedo variety. Those differences are statistically very significant and are confirming the fact that due to the selection, they have different genotypes, because those performances were realized in perfect identical conditions.

The eggs were randomly gathered for 30 days, between the months 5 and 6, from the 3 varieties involved in the experiment, 100 eggs per each variety. At standard Aguti variety, wild, the eggs average weight is between 9 and 11 g, and at the 3 varieties included in the experiment the results are the following: the standard variety realizes an average weight of 11.43±0.17 g, statistical significant inferior with 0.74 g to the Giant white variety and statistical very significant inferior with 1.78 g to the Tuxedo variety (table 2). This fact confirms the speciality literature data, which are showing that Tuxedo variety was selected and ameliorated for eggs greater weight. Tuxedo variety is superior with 1.04 g to the Giant white variety, the difference being statistical very significant. At the 3 lots, either between them, or within them, we observed a very good uniformity, with values of V% between 8.55 (Tuxedo) and 9.18 (standard).

Table 1. The average, dispersal indices and statistical signification at body weight trait, at the age of 6 months (g)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	35	166±1.01	10	6.02	-	-28***	-12***
White	35	194±1.85	11	5.67	-	-	+16***
Brown	35	178±2.19	13	7.30	-	-	-

Table 2. The average, dispersal indices and statistical signification at the eggs weight trait, at Japanese quail (g)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	11.43±0.17	1.05	9.18	-	-0.74*	-1.78***
White	100	12.17±0.18	1.09	8.95	-	-	-1.04***
Brown	100	13.21±0.19	1.13	8.55	-	-	-

The large diameter is one of the traits which is used at the bird egg format estimation. In table 3, the data are showing an average of the standard variety of 3.13±0.04 cm, value inferior with 0.12 cm regarding the Giant white variety and 0.18 regarding the Tuxedo variety. At this trait there are no statistical significant differences between the varieties. The values of the variation coefficient are indicating a very good uniformity either within, or between the varieties.

Table 3. The average, dispersal indices and statistical signification at the egg large diameter trait, at Japanese quail (cm)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	3.13±0.04	0.25	7.98	-	-0.12 ns	-0.18 ns
White	100	3.25±0.04	0.28	8.61	-	-	-0.06 ns
Brown	100	3.31±0.05	0.30	9.06	-	-	-

The small diameter is the second component of the estimation formula of egg format index and has an average of 2.76±0.30 cm at the standard variety, and of 2.80±0.30 cm at Tuxedo variety. The differences for this trait between the 3 varieties are statistical insignificant (table 4).

Analyzing the format index, based on the 2 diameters, we observed that the egg format index at standard variety is 1.13; 1.25 at Giant white variety and 1.18 at Tuxedo variety.

The yolk weight is either genetic influenced, or food proteic level influenced. The standard variety has a yolk average weight of 4.40±0.04 g, value statistical insignificant inferior, with 0.13 g regarding the Giant white variety, but statistical significant with -0.43 g regarding the Tuxedo variety. The statistical significant difference in behalf of Tuxedo variety was observed at this trait regarding the other two varieties. For this trait, the variation coefficient values are indicating a good uniformity, with values of 8.60 at the Giant white variety and 9.54 at standard variety (table 5).

Table 4. The average, dispersal indices and statistical signification at the egg small diameter, at Japanese quail (cm)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	2.76±0.30	0.30	10.86	-	+0.16 ns	-0.04 ns
White	100	2.60±0.25	0.25	9.61	-	-	-0.20 ns
Brown	100	2.80±0.30	0.30	10.71	-	-	-

Table 5. The average, dispersal indices and statistical signification at the yolk weight trait, at Japanese quail eggs (g)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	4.40±0.04	0.42	9.54	-	-0.13 ns	-0.43*
White	100	4.53±0.03	0.39	8.60	-	-	-0.30*
Brown	100	4.83±0.04	0.43	8.90	-	-	-

The egg white is an eatable component, with a high protein content, having at the hens values between 9.5 and 11.5%, after Sauveur B., 1998, being well represented the egg albumins,

conalbumins, egg mucoids, egg globulins G1 and G2, lysosimes, egg mucin, flavoproteins, egg mucoproteins, egg glycoproteins, avidin and other proteins. Because of this composition, there is not recommended uncooked in the human or animal consume, being an inhibator by the avidin and B complex vitamins contained.

The egg white average is superior to the yolk, being of 5.73±0.06 g at standard variety, 6.28±0.07 g at Giant white variety and 6.98±0.07 g at Tuxedo variety. Between the 3 varieties there are distinct and very distinct statistical differences, gave by the egg size differences (table 6).

Table 6. The average, dispersal indices and statistical signification at the egg white weight trait, at Japanese quail eggs (g)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	5.73±0.06	0.64	11.16	-	-0.55**	-1.25***
White	100	6.28±0.07	0.73	11.62	-	-	-0.70**
Brown	100	6.98±0.07	0.75	10.83	-	-	-

The bird egg-shell is composed in a proportion of more than 95% of mineral substances, having in addition organic substances and some water. At the Japanese quail, two organic substances, egg porphyrin and egg xanthine, are well represented, those having a coloration role at the eggs.

At the analyzed varieties we observed averages of 1.30±0.01 g at the standard variety and of 1.40±0.02 at Tuxedo variety. Statistical significant differences are appearing between standard variety and Tuxedo (table 7).

Table 7. The average, dispersal indices and statistical signification at the egg-shell weight trait at Japanese quail (g)

Genetic variety	n	X ±sx	s	V%	Differences and statistical significations		
					Standard variety	White variety	Brown variety
Standard	100	1.30±0.01	0.15	11.53	-	-0.06 ns	-0.10*
White	100	1.36±0.01	0.17	12.50	-	-	-0.04 ns
Brown	100	1.40±0.02	0.20	14.28	-	-	-

4. Conclusions

1. Between the 3 quail varieties there are very significant statistical differences regarding the body weight, at 6 months of age, which confirms their membership to different genetic structures.
2. The eggs weight differs from one variety to another, in the same environmental conditions and at the same age, with the averages between 11.43 g at the standard variety and 13.21 g at Tuxedo variety.
3. There were no significant differences regarding the egg format index, from one variety to another, analyzing the 2 diameters.
4. There are differences from one variety to another regarding the yolk and egg white weight, because of the eggs total weight differences.

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