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Coturniculture in Algeria Physical Characteristics and Incubation Parameters of Eggs of Three Dominant Strains

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Abstract.

The objective of the present study is to determine the physical characteristics and incubation parameters of eggs of three strains of quail (*Coturnix Japonica*, *Coturnix Coturnix* and their crossing (*Japonica* X *Coturnix*) of white color. Five hundred eggs (500) of each strain were divided into five blocks of one hundred (100) eggs randomly and were the subject of our experimentation. The weight of the egg and the shape index of the three strains are similar ($p > 0.1$). The thickness of the cross *Japonica* X *Coturnix* is important ($p < 0.04$) than that of the other two strains. The Haugh unit is dominant ($p < 0.03$) for the *Japonica* strain. The *Coturnix* strain outclasses the other strains for the height of the yolk (8.30mm, $p < 0.01$) and for the weight of the white (5.26g $p < 0.04$). The weight of the yolk with 4.26 g and a yellow / white ratio of 0.96, marks a dominance of the cross strain *Japonica* X *Coturnix*. The shell / live weight ratio is similar for the three strains. The fertility of the *coturnix* strain is dominant (91%) ($p < 0.02$) and the cross strain ensures an optimal hatching rate of (63%) ($p < 0.01$). The embryonic mortality rate is minimal (18%) for the *coturnix* strain while it remains high for the other strains (approximately 36%).

Keywords: *Algeria, Eggs, Quail, Strains.*

1. Introduction

In Algeria, the breeding of quail or cotulticultor, has attracted the attention of poultry farmers as a new avenue for diversification of breeding and a means of producing meat and eggs in a short period of time. In fact, quails are characterized by rapid growth, early sexual maturity and a low demand for food and space compared to other poultry species **(Nanda et**

al., 2015; Sarabmeet & **Mandal, 2015).** Its strong egg slope (250 to 300 eggs per female per year) seen by the poorest rural families as a financial source capable of raising their living standards (**Dahouda et al., 2013**) all the more since they require very little financial means (**Mondry, 2016**). Thus, according to the objectives (meat or eggs), the rural population has

developed strains with their own characteristics, thus explaining the great heterogeneity of the populations used and the zootechnical performances. (**Berrama et al., 2011**). In Algeria, studies carried out by among others by **Moula et al., (2014)** and **Ferrouk et al., (2015)** on Japanese quail must be supplemented by other studies relating to the main strains used in rural areas, namely, strains *Coturnix Japonica, Coturnix Coturnix* and their cross J*aponica* X *Coturnix,* whose physicochemical characteristics and incubation parameters for eggs need to be better defined. This is the object of this work.

2. Materials and methods

One hundred and fifty (150) eggs from each quail population (*Coturnix Japonica, Coturnix Coturnix* and their cross *Japonica* X *Coturnix,*) were collected from 10 farms in the **Sétif** region, in farms where male and female quail live together in semi freedom. The average duration of egg storage was 10 days at a temperature of 6°C. A total of 50 eggs from each population were used to determine their physical characteristics. They were numbered and weighed individually (to the nearest 0.1g). The length and width of the eggs were measured to the nearest 0.01mm, using a digital caliper. After breaking the eggs, the constituents were placed on a flat surface. The height of the blank was determined using a graduated ruler placed halfway around the outline of the yolk. The height of the yolk was determined by placing a ruler vertically and its diameter with a caliper according to the method of **Angrand, (1986**). After separation, the weights of the albumen, the yolk and the shell were weighed with an electronic balance (0.01g accuracy). The thickness of the shell was determined using the caliper in three places: at the pointed end; at the rounded end and in the middle. The thickness value is determined by the average of these three measurements (**Çağlayan et al., 2009; Moula et al., 2010; Menezes et al., 2012; Hanusová et al., 2015).** The color of yellow was appreciated using the DSM scale according to the method of **Mertens et al., (2010**). The Haugh unit allowing the appreciation of the freshness of eggs (**Buffet, 2010**) was calculated using the formula for **Silversides, (1994**). The yellow / white ratio was calculated using the formula **Çağlayan et al., (2009**). The following variables were also calculated:

Shape index: Egg width / egg length X 100

Percent of albumen (%): Albumen weight / Egg weight X 100

Percentage of shell (%) = shell weight / egg weight × 100

Percentage of yolk (%) = yolk weight / egg weight × 100

Vitellus index: Vitellus height / vitellus diameter X 100

Incubation parameters were determined on 50 eggs from each population

The eggs were incubated for 28 days (37.5 ° C and 60% RH) with an inversion every 8 hours before being transferred to the hatchers (38 ° C, 70% RH).

Statistical analysis

Descriptive statistics and analysis of variance of the general uni-varied linear model (ANOVA), were carried out with the statistical software SPSS version 2.5. The general linear model was used to test the effects of factors on the variables. The differences were considered significant with a risk of error of 5 %.

Table 1: External physical characteristics of eggs

	Strain			ESM	p
	Japonica	*coturnix*	*japonica* X *coturnix*		
Egg weight (g)	11.04	11.53	11.21	0.21	0,214
Length (mm)	32.67	32.80	33.17	0.30	0,623
Width (mm)	26.00	25.90	25.50	0.29	0,410
Shape index	79	80	77	0.005	0,125

3. Results and discussions

External physical characteristics of eggs

The weight of the eggs incubated is similar for the three strains (p>0,05) (**Table 1**) and remains lower than those of **Sangilimadan et al., (2012**) (12,4g), **Moula et al., (2014**) (12,3g) and **Berrama et al., (2011**) (11,8g). The length, width and shape index are identical for the three strains (p>0,05).

Internal physical characteristics of eggs

The weight of the shell, its thickness, its percentage and its shape index, remains similar for all the strains (**Table 2**). Although the heights of the yolk and albumin did not vary for all the strains, the diameter of the yolk of the *japonica* strain was the least expressive (6.78 mm) with respect to the two other *coturnix* and cross strains (*japonica* x *coturnix*) with 8.30 and 7.75 mm respectively.

However, it remains obvious to several authors that this parameter is linked to the age of individuals. (**Nagarajan et al., 1991; Gonzalez, 1995; Altan et al., 1998; Danilov, 2000, Nazligul et al., 2001; Orhan et al., 200**1) but according to **Zita et al., (2013**), the diameter of the yolk has irregular fluctuations, especially between 9 and 49 weeks of age. The yolk index was dominant for the *Japonica* (38) strain over the *Coturnix* (32) and crossed strains (34). According to **Zita et al., (2013)**, the index of yellow tends to decrease with the age of the quail, these results are however in contradiction with those of **Nagarajan et al., (1991**) and **Gonzalez (1995**) who report an increase in the index of yellow with the age of quail. Moreover, **Moula et al., (2014); González Sánchez, (2009); Tilki** & **Saatci, (2004)** report that this parameter tends to decrease with the duration of egg storage.

The yolk color was identical for the three strains (p>0,05). Although the value of the color of yellow is similar to the results put forward by **Moula et al., (2014)**, it remains lower than the results of **Zita et al 2013**. It should be noted that the color of the yolk is related to food (**Nys, 2000; Blum** & **Sauveur, 1996; Naraharid** & **Rajinir, 1999**) and in particular the presence of xanthophyll carotenoid pigments (**Zongo et al., 1997**) including lutein which contributes to 70% of the coloring of the yellow (**Bourre, 2003**). The Haugh units were the most expressive for the *Japonica* strain (72.30) and remained below the values advanced by **Moula et al, (2014)** (85,99). This parameter which represents the freshness of the egg.

Table 2: Internal physical characteristics of eggs

	Strain			ESM	p
	Japonica	*Coturnix*	*Japonica* X *Coturnix*		
Weight of the shell (g)	1.77	1.63	1.59	0.5	0,724
Shell thickness (µm)	0.25	0.25	0.26	0.06	0.052
Percentage of the shell (%)	16	14	14	0.004	0,084
Vitellus height (mm)	2.60	2.67	2.68	0.03	0,653
Albumin height (mm)	2.78	3.40	3.17	0.11	0,564
Vitellus diameter (mm)	6.78^{b}	8.30^{a}	7.75^{a}	0.19	0.015
Vitellus index	38^{a}	32^{c}	34^{b}	0.03	0.001
Haugh units	72.30^{a}	70.19^{b}	70.16^{b}	0.34	0.029
Albumin weight (g)	4.79^{ab}	5.26^{a}	4.50^{b}	0.12	0.038
Yolk weight (g)	3.46^{b}	4.01^{ab}	4.26^{a}	0.12	0.043
Percentage of albumen	43^{ab}	46^{a}	40^{b}	0.009	0.040
Percentage of yolk (%)	31^{b}	35^{ab}	38^{a}	0.009	0.023
Yolk color	5.44	4.60	5.08	0.19	0,321

Table 3: Egg incubation settings

	Strain			ESM	p
	Japonica	*Coturnix*	*Japonica* X *Coturnix*		
Fertility (%)	70^{b}	81^{ab}	91^{a}	0.03	0.017
Hatching (%)	35^{b}	63^{a}	53^{ab}	0.04	0.010
Early mortality	16^{ab}	11^{b}	28^{a}	0.03	0.040
Late mortality	19^{a}	7^{b}	10^{ab}	0.03	0.012

fluctuate with the age after **Nazligul et al., (2001), Orhan et al., (2001)** & **Zita et al., (2013**). The weight of albumin was higher for the coturnix strain (5.26g) and the weight of the yolk of the crossed strain (*Japonica* x *Coturix*) (4.26g) was dominant compared to the other two strains.

According to **Fletcher et al., (1983)**, the proportion of white tends to decrease with age while the weight of the yolk would show irregular fluctuations with age which is confirmed by **Zita et al., (2013).**

Egg incubation settings

The hatching rate was predominant for the *Coturnix* strain with 63%, lower for the *Japonica* strain (35%) and intermediate for the crossed strain (*Japonica* x *Coturnix*) (53%) with a common sex ratio of 1: 1 (**Table 3**). It remains in the range advanced by **Islam et al., (2014**) between 31% and 71%. However, by sex ratio (1 :2 and 1 :3) **Karousa et al., (2015**) advanced hatch rates of 49% and 52% respectively. However, incubation techniques and egg positions are factors influencing the hatching rate as reported **Moraes et al., (2008**). In general, according to **Roriz et al., (2016**) to maintain good quality of the hatching egg, a maximum 5-day shelf life is highly recommended.

The fertility rate was dominant in the cross strain (*Japonica x Coturnix*) (91%), intermediate for the *Coturnix* strain (81%) and minimum for the *Japonica* strain (70%) with a higher early embryonic mortality rate for the cross strain (28%), intermediate for the *Japonica* strain (16%) and intermediate for the strain *Coturnix* (11%).

4. Conclusion

Cross strains (*Japonica x Coturnix*) and *Coturnix* are from the economic point of view more profitable for the rural populations with a good fertility rate for which, it is necessary to associate a better hatching rate by determining the constraining factors and the causes of embryonic mortality

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