Egypt. Poult. Sci. Vol (30) (IV): (1151-1170)

IMPROVING THE PRODUCTIVITY AND REPRODUCTIVITY OF BAHEIJ CHICKENS THROUGH CROSSING

Effect of Upgrading on:

B. Egg Production, Egg Quality and Hatch Traits

By

Osama M Aly; Nema A. Mosaad; Nazla Y. Abou El-Ella and Yousria K. M. Afifi

Anim. Prod. Res. Inst., Agric. Res. Center, Ministry of Agric., Dokki, Egypt

Osmali2002@yahoo.com

Received: **30/10/2010** Accepted:**30/11/2010**

Abstract: *rossing trials were carried out to evaluate the effect of upgrading (increasing blood of Silver Montazah, SM in Baheij chicken breed, Bj) on egg production traits [age and body weight at sexual maturity (ASM and BWSM), moreover, egg number (EN), egg weight (EW), rate of laying (RL) and egg mass production (EM) at 90 and 180 days from 50% of lay. Also, some of external and internal egg quality traits were detected. In addition, hatch traits [fertility percentage (F%), hatchability percentages of fertile eggs (HFE%) and of total eggs set (HTE%) and embryonic mortality] were calculated throughout crossing selected SM males for mature body weight as a parent line with Bj dams producing three generations progenies [(the 1st generation (½ SM + ½ Bj), the 2nd generation (¾ SM + ¼ Bj) and the 3rd generation (7/8 SM + 1/8 Bj)]. Moreover, simple correlation was estimated depending on cumulative data of the three generations for both the upgraded group and Bj breed to evaluate the effect of upgrading on egg production traits.*

Results were as follows:

- *The 3rd generation had the most highest values (P<0.05) of egg productive studied traits.*
- *Pullets of the 2nd generation sexually matured earlier (P<0.05) by 3.0 to 3.6 days than both of the 1st and the 3rd generations, respectively.*

- *Significant differences ($P<0.01$) were found between the two genotypes with respect to BWSM and each of EN, RL, EW and EM at 90 and 180 days where the upgraded group surpassed Bj breed.*
- *The 3rd generation had the highest values ($P<0.05$) of HFE% and HTE% and the lowest value of weak chicks percentage (91.53%, 84.48% and 0.76%, respectively).*
- *Upgrading had no significant effects on any of the studied hatch traits.*
- *The upgraded group surpassed ($P<0.05$) Bj breed concerning egg weight, and both of albumin and yolk weights.*
- *Upgrading increased ASM in different rates of change percentages (Δ%) where the 3rd generation had the higher value than that of the 1st and 2nd ones.*
- *The 3rd generation had the highest Δ% values of EW at 90 and 180 days.*
- *Rate of change percentages of BWSM, EN at 90 and 180 days and egg mass at the same periods recorded the highest values in the 2nd generation.*
- *Rate of change indicated that F% of Bj eggs in the third generation was better than that of its cross. However, both of HFE% and HTE% for upgraded group were improved through the same generation, also Δ% values indicate that upgrading improved most of egg quality traits.*
- *Negative and significant correlation coefficients ($P<0.01$) were found between BWSM and each of ASM (-0.595) and EW90 days (-0.503) for the upgraded group, while it was positive and significant among most of the production traits for the same group.*
- *Positive and significant ($P<0.05$) correlation coefficients were found among most of egg production traits concerning Bj breed, however, only negative and significant correlation coefficients were found between ASM and each of EW 90 and EW180 days and EM 180 days for the same breed.*

It could be concluded that upgrading through crossing Silver Montazah sires to Baheij dams improved all studied productive traits and some of egg quality traits.

INTRODUCTION

The major challenge for extending poultry production of local or developed Egyptian strains is improving its capabilities to produce more quantity and quality of eggs.

Many investigators confirmed the superiority of crossbreds over the purebreds regarding reproductive and some economic traits (Abd El-Gawad and El-Ibiary, 1972; Farghaly and Saleh, 1988; Abdou, 1992; Fairfull, 1990; Nawar and Abdou, 1999; Khalil *et al.*, 2004; Aly *et al.*, 2005).

Amin (2008) reported that crossing between chicken strains improved the following production traits (Body weight at sexual maturity, egg number, egg weight and egg mass) compared with those for pure strains. Moreover, other researchers confirmed this trend of improvement with respect of rate of laying. (Amin, 2008; Wang and Pirchner, 1992; Nawar and Abdou, 1999; Nawar and Bahie El-Deen, 2000). Amin (2008) noticed that some crosses had slight increase in fertility and hatchability over purebred parent.

Results of most crossbreeding experiments carried out in Egypt (El-Srwy, 1980; Ezz Eldin and El-Labban, 1989; Nawar and Bahie El-Deen, 2000) reported that crossing between local breeds or strains of chickens with other local strains was generally associated with an existence of considerable heterotic effects on egg quality. Conversely, Kosba (1978) stated that crossbreeding had no advantageous heterotic effects on egg quality. Many investigators reported that crossbreeding tended to increase shell quality (Khalifah *et al.*, 1978; El-Turky *et al.*, 1981).

The present study was carried out to evaluate the effect of crossbreeding program (upgrading) on egg production traits, some of external and internal egg quality and hatch traits.

MATRIALS AND METHODS

This study was conducted at El-Sabahia Poultry Research Station, Alexandria, Animal Production Research Institute, Agriculture Research Center, Egypt.

Breeding Program:

Upgrading line:

In the first generation, females of the Baheij (Bj) breed were crossed to selected Silver Montazah (SM) males as a parent line according to their individual mature BW (average), thus, the females produced (1/2SM +

1/2Bj) were backcrossed to the same parent line throughout two additional generations [produced (3/4SM + 1/4Bj) and (7/8SM + 1/8Bj), respectively].

Control line:

Pullets of Bj breed were randomly chosen to establish a pedigreed control population.

Studied Traits:

Egg production traits:

At 20 weeks of age, a total of 330 pullets of upgraded group and Bj breed were kept on floor pens (11-12 pullets + 1 sire, each). The pullets were fed a laying diet (17% crude protein and 2600 Kcal/kg of diet). Feed and water were provided *ad-libitum* throughout the experimental period. The pullets were subjected to natural lightning, which was received about 14 hr light per day. When birds reached 50% egg production, eggs were recorded daily for 90 days (EN90) and 180 days (EN180). Egg weight, g was recorded weekly for all eggs produced through two consecutive days per week for the two periods (EW90) and (EW180). Rate of laying percentages (RL90 and RL180) and egg mass production, g were calculated by multiplying the average number of eggs for each pen and the average weight of eggs during the same period (EM90 or EM180). Age at sexual maturity (ASM) was calculated as the number of days from hatch until 50 % of laying for each pen, also averages of body weight of pullets per pen were recorded at the same time (BWSM).

Egg quality traits:

At 50 weeks of pullets age, 100 eggs produced from both the upgraded and Bj groups, in the 3rd generation, were examined for external and internal egg quality traits. Measurements were taken within four hours after collection including egg weights in grams and egg shape index (width to length x 100) according to Potts and Washburn (1983). After that, eggs were broken out on a flat surface and the heights of the albumen and yolk in millimeter were measured using Ames Triple Micrometer. Yolk was separated from the albumen and weighed. The weight of albumen was calculated as the difference between the egg weight and the weight of the shell and yolk. Shell plus membranes were weighed. Yolk index (height of yolk/ yolk diameter) was calculated according to Wisely and Stadelman (1959). Yolk, albumen and shell were expressed as percentages of total egg weight. Shell thickness without membrane was also, measured at different three places of shell at broad end, equator and pointed end using a micrometer (mm) and yolk/albumin ratio was estimated.

Hatch traits:

At 44 weeks of age, a total of 3108 eggs were collected from both the upgraded and Bj pullets (1219, 881 and 1008 eggs in the three generations, respectively). Eggs were stored for seven days in room temperature supplied with fans. Three egg hatches were put in forced draft-type incubator (Egyptian-made). Temperature (37.5°C) and relative humidity (55%) were automatically monitored during the setting phase and during the hatching phase were 37°C and 65%, respectively. Hatch traits [Fertility percentage, F% and hatchability (expressed as a percent of hatch chicks of both of fertile, HFE% and total, HTE% eggs set)] were estimated. Also, the non-hatched embryos (all dead embryos throughout the incubation period), the pipped embryos, PE%, and weak chicks, WC% were recorded and calculated as a percentage of fertile eggs at the end of incubation.

Statistical analysis:

All percentages of the hatch traits were transferred to arc sine values before analysis.

Data of egg production and hatch traits were analyzed using the following fixed model (SAS institute, 1988):

$$Y_{ijk} = U + Gn_i + Gt_j + (GnGt)_{ij} + e_{ijk}$$

Where: Y_{ijk}= an observation, U = overall mean, Gn_i= the fixed effect of i^{th} generation, Gt_j= the fixed effect of j^{th} genotype, $(GnGt)_{ij}$= effect of the interaction between the two main factors, and e_{ijk}= random error.

Egg quality traits data were analyzed using the following fixed model (SAS institute, 1988):

$$Y_{ij} = U + Gt_i + e_{ij}$$

Where: Y_{ij}= an observation, U = overall mean, Gt_i= the fixed effect of i^{th} genotype, and e_{ij}= random error.

Significant differences among means were tested by Duncan Test (1955).

Rate of change (Δ %) for character between both the crossbred and the pure

Baheij were estimated using the following equation:

$$\Delta \% = \left[\frac{\text{Mean of the character for crossbred}}{\text{Mean of the character for pure Baheij}} - 1 \right] \times 100$$

Correlations among egg production traits (ASM, BWSM, EN90, EN180, RL90%, RL180%, EW90, EW180, EM90 and EM180) were determined depending on cumulative data of the three generations for both upgraded group and Bj breed.

RESULTS AND DISCUSSION

The results presented in Table 1 showed that generation had significant effect (P<0.05) on body weight at sexual maturity (BWSM) and egg production traits. The 3rd generation had the highest values for BWSM, EN180, RL180, EW90, EW180 and EM180 days (1565.66g, 63.45egg, 35.25%, 52.48g, 51.86g and 3206.8g, respectively), while the 1st generation had the highest values for EN90 and RL90 days (28.32egg and 31.47%, respectively).

Concerning the age at sexual maturity (ASM), the pullets of the 2nd generation matured sexually earlier (P<0.05) by 2.98 to 3.56 days than those of the 1st and 3rd generations, respectively.

For EN, RL, EW and EM at 90, 180 days, significant differences (P<0.01) were found between the two genotypes (Bj and upgraded group) where the upgraded group surpassed significantly (P<0.01) the control one (Bj) (27.83 eggs vs. 23.21 eggs, 62.07eggs vs. 50.04 eggs, 30.92% vs. 25.79 %, 34.48% vs. 27.80%, 50.40 g vs. 48.86 g, 50.55 vs. 49.25 g, 1402.6g vs. 1131.4 g and 3114.9g vs. 2451.5 g, respectively), for all mentioned traits, respectively.

These results were in agreement with those reported by Nawar and Abdou (1999) and Zaman *et al.* (2004) who showed that some crosses were recommended to improve some of egg production traits. Contrarily, the purebred hens had higher values concerning some egg production traits compared to crossbreds (El-Soudany *et al.*, 2003). On the other hand, Saadey *et al.* (2008) recorded positive and high heterotic effect for egg weight. The significant differences between the two genotypes for egg production traits are in agreement with those found by Abdou (1985), Nawar and Abdou (1999), El-Tahawy (2000), Nawar and Bahie El-Deen (2000) and Amin (2008).

The BWSM of upgraded group surpassed (P<0.01) that of the Bj breed (1589.79g vs 1345.50g). The superiority of crosses over the pure strain in BWSM was confirmed by several reports (Ali, 1979; Kosba *et al.*, 1981; Farghaly, 1989; Zatter, 1994; Mandour *et al.*, 1996; Mohamed, 2003; El-Soudany *et al.*, 2003). Moreover, Amin (2008) found that reciprocal crosses surpassed both their parents and strain crosses concerning BWSM, EN and EM during 90 days.

No significant effects of interaction for any of the mentioned traits were observed. However, the upgraded group recorded the highest values of EN at 90 days (29.11eggs) in the 1st generation and EN180 days (65.84 eggs) in the 3rd generation. Khalil *et al.* (2004) reported that backcrosses of Saudi chickens (S) with White Leghorn (L) (L X ¾L ¼S) recorded higher egg production than other crossbred groups.

Results of hatch traits are presented in Table 2. It was cleared that generation affected (P<0.05) HFE%, HTE% and WC%. The 3rd generation had the highest significant values of HFE% and HTE% (91.53%, 84.48%, respectively) and the lowest value of WC% (0.76%), while the other hatch traits were not affected by generation. On the other hand, it was clear that upgrading had no significant effects on any of the mentioned hatch traits.

These results are disagreement with that reported by Amin (2008) who found significant differences between the purebred and the crossbred concerning F% and HTE%. Also, the same author found that the reciprocal crosses had significantly the highest F%, HFE% and HTE% compared to the other genotypes. Moreover, Nawar and Abdou (1999) reported that some crosses were recommended to improve some of the hatch traits.

There were significant effects (P<0.05) as a result of the interaction between the generation and genotype for both of the pipped embryos (PE%) and the WC%, where the genotype (⅞SM + ⅛Bj) at the 3rd generation had the lowest least squares mean (P<0.05) PE% (0.10%) while, Bj had the lowest (P<0.05) value of WC% at the 2nd generation (0.66%).

Results in Table 3 revealed that significant differences were found between the two genotypes (7/8 SM + 1/8 Bj and the pure Bj) where the averages of egg weight, albumin and yolk weights of the upgraded group were higher (P<0.05) than those of the control (Bj) (53.68g vs 50.08g, 28.60g vs 26.58g and 17.57g vs 16.42g, respectively). No significant differences were found between the two genotypes concerning all other egg quality traits.

Results reported herein are in agreement with those reported by El-Soudany *et al.* (2003) who showed that there were no significant differences between crossbreds and purebred concerning shell weight, shell percentage and shell thickness and egg shape index.

Ezz Eldin and El-Labban (1989); Nawar and Abdou (1999); Nawar and Bahie El-Deen (2000) and Iraqi (2002), reported that crossing between some strains is associated with existence of heterotic effects on most egg quality traits. Also, Zaman *et al.* (2004) cited that cross of RIR X Fayoumi recorded the best quality of eggs compared to the purebred Fayoumi or the other crosses.

Rate of change (Δ %) as shown in Table 4 showed that the upgraded group surpassed the pure Bj in certain egg production traits. The mean of ASM in the 1st generation was higher in Bj compared to its cross (Δ % = -0.12). However, upgrading increased ASM in different rates from generation to another and Δ % of ASM during the third generation was higher than that in the second generation.

Comparing BWSM, it was found that Δ % for this trait was higher in the second generation (22.06%) followed by that of the third and the first generations (19.51% and 13.06%), respectively.

Rate of change for egg number at 90 and 180 days was higher during the second generation (34.41% and 30.60%) compared to those of the 1st and 3rd generations (14.74%, 22.87% and 17.65%, 20.85%, respectively) showing that upgrading improved egg number.

Concerning EW90 and EW180 days, rate of change for these traits was the highest during the third generation (5.24% and 3.73%) showing that upgrading improved egg weight. With the same token, rate of change for egg mass recorded the highest values in the 2nd generation (36.88% and 33.40%) and the lowest values in the 1st generation (17.12% and 24.17%) for 90 and 180 days, respectively.

Table 5 showed that as it was expected, F% for Bj was better than that of its cross (Δ % = -3.05) in the 3rd generation. However, hatchability was improved through upgrading at the same generation, where Δ % were 7.65% and 5.37% for HFE% and HTE% , respectively.

Table 6 showed that upgrading improved most of egg quality traits except egg shape index (-0.91%), yolk percentage (-0.33) and yolk index (-2.38%). Since weight of eggs produced from Bj pullets was smaller than that of its cross, yolk index for the former was expected to be higher than that of the later. Generally, upgrading improved some of egg quality traits.

Table 7 showed the estimates of correlation coefficients among several productive traits for the upgraded group. Negative and highly significant correlation coefficients were found between BWSM and each of ASM (-0.595) and EW90 (-0.503), while it was positive and highly significant between that former trait and EW180 (0.576). No significant correlation coefficients were found between ASM and any of the other egg production traits.

Positive and significant ($P<0.05$) correlation coefficients were found between EN90 and each of RL90 (1.00), EM90 (0.940) and EM180 (0.317). Also, the same sign was found concerning correlation between EN180 and each of RL180 (1.00), EW90 (0.359) and EW180 (0.380), EM90 (0.306) and EM180 (0.943).

Equal values of correlation coefficients were found between RL90 and each of EM90 and EM180 (0.940 and 0.317, respectively) also, between RL180 and each of EW90 (0.359), EW180 (0.380), EM90 (0.306) and EM180 (0.943). Moreover, significant correlation coefficients were found between EW90 and each of EW180, EM90 and EM180 (0.914, 0.345 and 0.476, respectively). EW180 and each of EM90 and EM180 (0.394 and 0.523, respectively), also between EM90 and EM180 (0.460). Results of the present study are in-agreement with that reported by Khalil *et al.* (2004) who found negative and non significant correlation between age at sexual maturity and egg production at 90 day of lay (0.31). These results indicate that upgrading for improving body weight was associated with improvement of most of egg production traits.

Table 8 showed the estimates of correlation coefficients among several productive traits for the Bj group. Results revealed that negative and significant correlation coefficients were found between ASM and each of EW90, EW180 and EM180 (-0.646, -0.683 and -0.654, respectively). Contrarily of these results, values of correlation coefficients reported by Balat *et al.* (1995) and El-Sayed *et al.* (2001) were positive. Positive and highly significant correlation coefficients were found between EN90 and each of RL90 (1.00) and EM90 (0.975). Approximately equal values were found by Balat *et al.* (1995) for the correlation coefficients among the same traits. Same signs and values of correlation coefficients were found between EN180 and both of RL180 (1.00) and EM180 (0.927). Estimates of the correlation coefficients were significant between RL90 and EM90 (0.975) and between RL180 and EM180 (0.927) also, between EW90 and EW180 (0.701). Balat *et al.* (1995) reported positive and moderate value (0.57) of correlation coefficients between the same traits, while estimates which reported by Francesch *et al.* (1997) and El-Sayed *et al.* (2001) were small and negative and ranged from -0.05 to -0.22. The other relationships among the rest traits studied had correlation coefficients ranged between negative and positive but not significant values.

Table (1): Effect of upgrading on least squares means of age (ASM) and body weight at sexual maturity (BWSM) and egg production traits at different studied generations

Generation	Genotype	ASM, d	BWSM, g	Egg number, egg		Rate of laying %		Egg weight, g		Egg mass, g	
				90 d	180 d	90 d	180 d	90 d	180 d	90 d	180 d
1	½ SM+1/2 Bj	216.6±1.40	1518.2±25.39	29.11±0.60	58.54±1.65	32.34±0.67	32.52±0.92	47.66±0.92	49.64±0.47	1388.8±37.3	2849.0±85.39
	BjBj	216.8±1.85	1342.7±13.64	25.37±1.55	47.64±3.04	28.18±1.72	26.46±1.69	46.82±0.78	48.09±0.83	1185.7±65.6	2294.3±185.9
Overall mean		216.6±1.15^{A}	1481.2±26.20^{B}	28.32±0.66^{A}	56.24±1.76^{B}	31.47±0.73^{A}	31.24±0.98^{B}	47.48±0.45^{C}	48.52±0.40^{C}	1346.0±37.3	2732.2±92.4^{B}
2	3/4SM+1/4Bj	213.8±0.57	1629.7±14.70	26.52±1.27	61.83±1.80	29.47±1.41	34.35±1.00	50.50±0.32	50.79±0.31	1341.91±70.0	3147.9±109.39
	BjBj	212.5±0.99	1335.1±64.84	19.73±3.61	47.34±2.46	21.92±4.01	26.30±1.37	49.55±0.50	49.17±0.61	980.3±188.4	2359.7±104.8
Overall mean		213.6±0.50^{B}	1580.6±30.66^{A}	25.39±1.32^{B}	59.41±2.01^{AB}	28.21±1.47^{B}	33.01±1.12^{AB}	50.35±0.29^{B}	50.52±0.30^{B}	1281.6±71.6	3016.5±116.3^{AB}
3	7/8SM+1/8Bj	218.2±1.09	1621.6±21.64	27.86±1.10	65.84±2.74	30.96±1.22	36.57±1.52	53.03±0.30	52.22±0.62	1477.1±58.6	3347.9±154.6
	BjBj	213.3±1.11	1356.8±43.26	23.68±2.72	54.48±1.96	26.31±3.02	30.27±1.09	50.39±1.09	503.48±1.23	1190.5±131.8	2677.6±106.7
Overall mean		217.2±1.00^{A}	1565.7±31.68^{A}	26.98±1.08^{AB}	63.45±2.44^{A}	29.98±1.20^{AB}	35.25±1.35^{A}	52.48±0.40^{A}	51.86±0.35^{A}	1416.8±59.0	3206.8±138.7^{A}
Crossbred overall mean		216.2±0.67	1589.8±14.12	27.83±0.60	62.07±1.28	30.92±0.67	34.48±0.71	50.40±0.40	50.55±0.30	1402.6±33.2	3114.9±74.4
Baheij overall mean		214.4±0.94	1345.5±21.47	23.21±1.51	50.04±1.70	25.79±1.68	27.80±0.94	48.86±0.68	49.25±0.61	1131.4±71.9	2451.5±92.7
Overall mean		215.9±0.57	1541.8±17.78	26.92±0.61	59.71±1.25	25.72±0.68	33.17±0.70	50.10±0.36	50.30±0.27	1349.3±33.2	2984.6±71.6
Significance of:											
Generation (Gn)		*	*	*	*	*	*	**	**	NS	*
Genotype (Gt)		NS	**	**	**	**	**	**	**	**	**

SM: Silver Montazah strain and Bj: Baheij breed, BWSM: body weight at sexual maturity, ASM: age at sexual maturity,
* significant at P<0.05, ** significant at P<0.01, and NS: not significant,
Means having different letters in every column are significantly different (P<0.05).
The interactions between the main two factors concerning all traits studied were not significant.

Table (2): Effect of upgrading on least squares means of hatch traits at different generations

Traits		Percentages of					
Generation	Genotype	Fertility	Hatchability of fertile eggs	Hatchability of total set eggs	Non-hatched embryos	Pipped embryos	Weak chicks
1	½ SM+1/2Bj	90.43±1.41	87.77±1.16	79.37±0.97	8.30±1.46	1.13±0.84	2.80±1.13
	BjBj	92.39±2.62	85.82±2.87	79.14±2.04	10.70±2.74	0.93±1.62	2.55±2.18
Overall mean		90.84±1.24	87.36±1.09 [B]	79.30±0.87 [B]	8.80±1.29	1.09±0.74	2.75±1.00 [A]
2	3/4SM+1/4Bj	90.51±2.08	88.07±2.28	80.12±2.51	8.60±1.96	1.96±1.20	1.36±1.05
	BjBj	89.88±4.27	91.29±3.87	82.07±4.88	5.74±3.11	2.36±2.53	0.66±1.39
Overall mean		90.39±1.85	88.68±1.97 [B]	80.49±2.22 [B]	8.05±1.68	2.04±1.08	1.23±0.88 [B]
3	7/8SM+1/8Bj	91.84±1.94	92.92±1.52	85.35±1.82	6.61±1.46	0.10±0.32	0.87±0.65
	BjBj	94.73±4.03	86.31±5.82	81.22±4.59	7.47±3.93	4.10±3.63	2.21±2.83
Overall mean		92.44±1.76	91.53±1.68 [A]	84.48±1.71 [A]	6.79±1.39	0.92±0.88	0.76±0.80 [B]
Crossbred overall mean		90.82±1.05	89.20±1.03	81.16±1.10	7.97±0.97	1.17±0.55	1.66±0.69
Baheij overall mean		92.18±2.05	87.76±2.30	80.67±2.16	8.18±1.85	2.234±1.44	1.83±1.23
Overall mean		91.10±0.90	88.91±0.94	81.91±0.97	8.02±0.85	1.38±0.52	1.69±0.56
Significance of:							
Generation (Gn)		NS	*	*	NS	NS	*
Genotype (Gt)		NS	NS	NS	NS	NS	NS
GnxGt		NS	NS	NS	NS	*	*

SM: Silver Montazah strain and Bj: Baheij breed.

* significant at $P<0.05$, and NS: non significant.

Means having different letters in every column and within every main factor of treatments are significantly different ($P<0.05$).

Table (3): Effect of upgrading on least square means of egg quality traits

Traits \ Genotype	7/8 SM+1/8Bj	BjBj	Overall mean	Significance of genotype
Egg weight (g)	53.68+0.50	50.08+1.16	53.12+0.48	*
Egg shape index	77.15+0.50	77.86+1.30	77.26+0.47	NS
Albumin weight (g)	28.60+ 0.38	26.58+0.92	28.29+0.36	*
Albumin %	53.21+0.38	52.97+0.90	53.19+0.35	NS
Albumin height	7.73+0.29	6.70+0.58	7.57+0.27	NS
Haugh unit	87.67+1.65	82.95+3.94	86.93+1.53	NS
Yolk weight (g)	17.57+0.23	16.42+0.29	17.39+0.21	*
Yolk %	32.75+0.33	32.86+0.48	32.76+0.29	NS
Yolk index	0.41+0.00	0.42+0.01	0.42+0.00	NS
Yolk/Albumin ratio	0.62+0.01	0.62+0.02	0.62+0.01	NS
Shell weight (g)	7.51+0.11	7.08+0.34	7.44+0.11	NS
Shell %	14.21+0.33	14.17+0.62	14.06+0.21	NS
Shell Thickness (mm)	38.58+0.59	36.78+1.56	38.30+0.56	NS

- SM: Silver Montazah strain and Bj: Baheij breed.

* significant at P<0.05. NS: not significant

Table (4): Rate of change (Δ %) for certain production traits

Generation	Age at sexual maturity	Body weight at sexual maturity	Egg number		Egg weight		Egg mass	
			90 days	180 days	90 days	180 days	90 days	180 days
1	-0.12	13.06	14.74	22.87	1.79	3.22	17.12	24.17
2	0.61	22.06	34.41	30.60	1.92	3.29	36.88	33.40
3	2.33	19.51	17.65	20.85	5.24	3.73	24.07	25.04
Average	0.82	18.15	19.90	24.04	3.15	3.15	6.95	27.06

Table (5): Rate of change (Δ %) for egg fertility and hatchability percentages

Generation	Fertility%	Hatchability of fertile eggs %	Hatchability of total set eggs%
1	-2.12	2.27	0.29
2	0.70	-3.52	-2.37
3	-3.05	7.65	5.37
Average	-1.47	1.64	0.61

Table (6): Rate of change (Δ %) for egg quality traits

Traits	Δ %
Egg weight	7.18
Egg shape index	-0.91
Albumin weight	7.59
Albumin %	0.45
Albumin height	15.37
Haugh units	5.69
Yolk weight	7.00
Yolk %	-0.33
Yolk index	-2.38
Yolk/Albumin ratio	0.00
Shell weight	6.07
Shell %	0.28
Shell Thickness	4.89

Table (7): Correlation between egg production traits of upgraded group

Trait	BWSM	ASM	EN90	EN180	RL90	RL180	EW90	EW180	EM90	EM180
BWSM	1	-0.595**	-0.140	-0.025	-0.140	-0.025	-0.503**	0.576**	0.044	0.105
ASM		1	-0.043	0.113	-0.043	0.113	-0.089	-0.253	-0.077	-0.025
EN90			1	0.201	1.000**	0.201	0.005	0.089	0.940**	0.317*
EN180				1	0.201	1.000**	0.359*	0.380*	0.306*	0.943**
RL90					1	0.201	0.005	0.089	0.940**	0.317*
RL180						1	0.359*	0.380*	0.306*	0.943**
EW90							1	0.914**	0.345*	0.476**
EW180								1	0.394**	0.523**
EM90									1	0.460**
EM180										1

-BWSM: body weight at sexual maturity, ASM: age at sexual maturity, EN90 and EN180: egg number at 90 and 180 days, RL90 and RL180: rate of laying at 90 and 180 days, EW90 and EW180: egg weight at 90 and 180 days and EM90 and EM180: egg mass production at 90 and 180 days.

* significant at $P<0.05$, ** significant at $P<0.01$.

Table (8): Simple correlation between egg production traits of Baheij breed

Trait	BWSM	ASM.	EN90	EN180	RL90 egg	RL180	EW90	EW180	EM90	EM180
BWSM	1	0.458	-0.134	0.233	-0.134	0. 233	-0.233	-0.462	-0.187	0.096
ASM		1	-0.038	-0.447	-0.038	-0.447	-0.646*	-0.683*	-0.189	-0.654*
EN90			1	0.405	1.000**	0.405	-0.284	-0.335	0.975**	0.451
EN180				1	0.405	1.000**	0.156	0.327	0.453	0.927**
RL90					1	0.405	-0.284	-0.335	0.975**	0.451
RL180						1	0.156	0.327	0.453	0.927**
EW90							1	0.701*	-0.065	0.268
EW180								1	-0.199	0.344
EM90									1	0.529
EM180										1

-BWSM: body weight at sexual maturity. ASM: age at sexual maturity. EN90 and EN180: egg number at 90 and 180 days. RL90 and RL180: rate of laying at 90 and 180 days. EW90 and EW180: egg weight at 90 and 180 days and EM90 and EM180: egg mass production at 90 and 180 days.

* significant at P<0.05. ** significant at P<0.01.

REFERENCES

Abdel- Gawad, E.M..; and H.M. El- Ibiary (1972). *Heterosis estimates for some economic traits in the Fayoumi and RIR. Crosses. Agric. Res. Rev. Egypt. 50: 79-84.*

Abdou, F.H. (1985). *Improving indigenous chickens in developing countries; experience from Egypt. Proc. 12th Annual Scientific Conference of Tanzania Society of Animal Production, Arusha, Tanzania.*

Abdou, F.H. (1992). *A working panel to improve Menofyia chickens through developing the new strain of (Norfa). Menofyia. Agric. Res. 17 (2): 980-982.*

Ali, M.A. (1979). *Genetic studies in poultry. Comparative study of Dandarawy, Rhode Island Red, S.C.W. leghorn and Dokki-4 breeds of chicken and their crosses. M.Sc. thesis, Alex. of Agric. Univ. of Alexandria, Egypt.*

Aly, O.M.; R. Sh. Abou El-Ghar; Nazla Y. Abou El-Ella; and W.Z. Aly (2005). *Using potency ratio to interpret hybrid vigor in crossing between two local strains of chickens. Egypt. Poult. Sci. 25: 413-428.*

Amin, E. M. (2008). *Effect of crossing between native and a commercial chicken strain on egg production traits. Egypt. Poult. Sci. 28 (1): 27-349.*

Balat, Magda M.; Nadia A. El-Sayed; F.N. Soliman; and M.A. Kosba (1995). *The Effect of introducing dwarf gene to Mandarah strain on economically important traits. Egypt. Poult. Sci. 15:43-71.*

Duncan, D.B. (1955). *Multiple range and multiple F test. Biometrics 1:1-42.*

El- Sayed, Nadia A.; R.E. Rizk; M. Bahie El- Deen; and Hedaia M. Shalan (2001). *Effect of strain and dietary regimen on the performance of local chickens. Egypt. Poult. Sci. 21:1021-1038.*

El-Soudany, S.M.; E.F. Abde-Hamid; M.M. Fathi; and M.F. Amer (2003). *Effect of crossbreeding between two developed local strains of chickens on laying performance. Egypt. Poult.Sci. 23 (II): 409-419.*

El-Srwy, A.A. (1980). *Studies in poultry production. Effect of crossing on fertility, hatchability and egg quality of Dandarawy chickens. M.Sc. Thesis. Fac. of Agric. Univ. of Mansoura, Egypt.*

El-Tahawy, W.S. (2000). *Genetically improvement of some productive and reproductive traits in local chicken. M. Sc. Thesis. Fac. of Agric., Alex. Univ., Egypt.*

El-Turky, A.I.; Y.M. Kader; N.Z. Mohanna; L. Goher; and I.F. Sayed (1981). *Certain factors affecting rate of weight loss in incubated eggs. Agric. Res. Rev., Cairo 59:29-44.*

Ezz Eldin, Z.A.; and A.F. El-Labban (1989). *Egg weight and egg characteristics of purebred and crossbred chickens, Third Egypt. British Conference on Animal, fish and poultry production. Alexandria, 7-10 October: 983-992.*

Fairfull, R. W. (1990). *Heterosis (cited by POULTRY BREEDING AND GENETICS, Crawford, R.D., 1990). Elsevier Science Publishers B.V., Amsterdam the Netherlands. Pp. 913-933.*

Farghaly, M. (1989). *Combining ability analysis in a diallel cross involving four lines of Alexandria chicken. J. Agric. Sci. Mansoura Univ. 14: 161-168.*

Farghaly, M.; and K. Saleh (1988). *The effect of crossbreeding on egg traits in laying hens. Egypt. Poult. Sci. 8: 376-391.*

Francesch, A; J. Estany; L. Alfonso; and M. Iglesias (1997). *Genetic parameters for egg number, egg weight, and eggshell color in three Catalan poultry breeds. Poult Sci. 76:1627-31.*

Iraqi, M.M. (2002). *Genetic evaluation for egg quality traits in crossbreeding experiment involving Mandarah and Matrouh chickens using animal model. Egypt. Poult. Sci. 22: 711-726.*

Khalifah, M.M.; M.F. Shawer; M.A. Kosba.; and A.Z. Khalil (1978). *Genetic and seasonal effects on interior egg quality in Alexandria cross line, Fayoumi and Dokki-4 chickens. Redaktion, Beitrage Zur Tropischen Land Wirtchaft and Veterinarmedizin 16: 321- 328.*

Khalil, M.K; A.H.Al-Homidan and I.H Hermes (2004). *Crossbreeding components in age at first egg and egg production for crossing Saudi chickens with White Leghorn. Livestock Research for Rural Development 16(1) 2004. Online Journal http://www. cipav.org.co/ lrrd15/ khaliltmp.htm, Latin America.*

Kosba, M. A. (1978). *Heterosis and phenotypic correlation for shank length, body weight and egg production traits in Alexandria strains and their crosses with the Fayoumi chickens. Alex. J. Agric. Res. 26: 29-41.*

Kosba, M.A.; T.H. Mahmoud; A.Z. Kalil; and, G.M. Abd-Alla (1981). *A comparative study of four breeds of chickens and their F1 crosses. Agric. Res. Rev., Cairo 59: 93-103.*

Mandour, M.A.; G.A. Abd-Allah; and M.M. Sharaf (1996). *Effect of crossbreeding in some carcass traits of native and standard breeds of chickens. Egypt. Poult.Sci. 16: 171-185.*

Mohamed, A.A. (2003); *Effect of diallel crosses on poultry performance. M. .Sci. Thesis. Fac. of Agric. Alexandria University, Egypt.*

Nawar, M.E.; and F.H. Abdou (1999). *Analysis of heterotic gene action and maternal effects in crossbred Fayoumi chickens. Egypt. Poult. Sci. 10: 671-689.*

Nawar, M.E.; and M. Bahie El-Deen (2000). *A comparative study of some economic traits on seven genotypes of chicken under intensive production system. Egypt. Poult. Sci. 20: 1031-1045.*

Potts, P.L.S.; and K.W. Washburn (1983). *The relationship of age, methods of measuring and strain on variation in shell strength. Poult. Sci. 62: 239-246.*

Saadey, S. Mekky; A. Galal; H.I. Zaky and A. Zein El-Dein (2008). *Diallel crossing and egg production traits of two native Egyptian and two exotic chicken breeds. International J. of Poult. Sci. 7: 64-71.*

SAS Institute (1988). *User s Guide Statistics. SAS Institute INC., Cary, NC, USA.*

Wang, A.G.F. and F.Pirchner (1992). *Heterosis of feed efficiency and reproductive traits in reciprocal crosses of laying hens. A.B.A., 60: 1284.*

Wisely, R.L.; and W.J. Stadelman (1959). *Measurements of the interior egg quality. Poult. Sci. 38: 474-481.*

Zaman, M. A.; P. Sørensen; and M.A.R. Howlider (2004). *Egg production performances of a breed and three crossbreeds under semi-scavenging system of management.* Livestock Research for Rural Development. Vol. 16, Art. #60. *Retrieved October 3, 110, from http://www.lrrd.org/lrrd16/8/zama16060.htm*

Zatter, O.M.M. (1994). *Genetic studies in poultry. Effect of crossbreeding between local strains of chicken on some productive traits .M.Sc. Thesis. Fac. of Agric., Alex. Univ. Egypt.*

الملخص العربى

تحسين الصفات الإنتاجية والتكاثرية لدجاج بهيج بواسطة الخلط

تأثير التزاوج القمى على:

ب. صفات إنتاج البيض وجودة البيض والفقس

أسامة محمود على – نعمة أحمد محمد مسعد -

نظلة يوسف أبو العلا - يسرية كمال محمد عفيفى

معهد بحوث الإنتاج الحيوانى – مركز البحوث الزراعية- وزارة الزراعة – الدقى- مصر

تم اجراء دراسة لتقييم تأثير الخلط الرجعي (زيادة دم سلالة المنتزه الفضى فى دجاج بهيج) على بعض صفات إنتاج البيض (العمر والوزن عند النضج الجنسى– عدد البيض ، معدل إنتاج البيض ، وزن البيض وكتلة إنتاج البيض خلال ٩٠ يوم و١٨٠ يوم (عند الوصول ٥٠ % انتاج) وكذلك بعض صفات جودة البيض الخارجية والداخلية، وذلك من خلال خلط ديوك المنتزه الفضى المنتخبة لوزن الجسم الناضج كخط اباء مع اناث البهيج لإنتاج ثلاث أجيال متتابعة من الأبناء كما يلى: الجيل الأول (٢/١ منتزة فضى + ٢/١ بهيج) ، الجيل الثانى (٤/٣ منتزة فضى + ٤/١ بهيج) ، الجيل الثالث (٨/٧ منتزة فضى + ٨/١ بهيج). أيضا تم دراسة بعض صفات الفقس، كما تم حساب معاملات الارتباط بين صفات انتاج البيض المختلفة إعتمادا على البيانات الخاصة بكل من مجموعة الخلط الرجعى وبهيج وكانت النتائج كما يلى :-

- إختلفت متوسطات جميع الصفات الإنتاجية معنويا بين الأجيال حيث كانت متوسطات الجيل الثالث الأعلى باستثناء كتلة البيض عند ٩٠ يوم.
- نضجت دجاجات الجيل الثانى جنسيا مبكرا بقيمة ٢.٩٨ ، ٣.٥٦ يوما مقارنة بكل من الجيلين الأول والثالث على التوالى.
- تفوقت مجموعة الخليط على سلالة بهيج معنويا بالنسبة لوزن الجسم عند النضج الجنسى وأيضا عدد البيض ومعدل وضع البيض ووزن البيض وكذلك كتلة البيض الناتج عند ٩٠ و١٨٠ يوما.
- كانت نسبة الفقس فى كل من البيض المخصب أو البيض الكلى للجيل الثالث هى الأعلى معنويا كما حقق أقل نسبة للكتاكيت الضعيفة مقارنة بالجيلين الأول والثانى.
- لم تتأثر أ ى من صفات الفقس بالتزاو ج الرجعى.
- أثر الخلط الرجعى معنويا على أوزان كل من البيضة ، الصفار والبياض.
- تأخر عمر النضج الجنسى لدجاجات مجموعة الخلط الرجعى عن دجاجات البهيج فى الجيل الثالث بحوالى ٥ أيام (معدل التغير = ٢.٣٣%).
- تحقق بالجيل الثالث أعلى نسبة فى معدل التغير بالنسبة لوزن البيضة عند ٩٠ يوم و١٨٠ يوم (٥.٢٤ % ، ٣.٧٣% على التوالى).

- سجلت نسبة معدل التغير أعلى القيم فى الجيل الثانى بالنسبة لوزن الجسم عند النضج الجنسى (٢٢.٠٦%) وكل من عدد البيض وكتلة البيض الناتج عند ٩٠ و١٨٠ يوم (٣٤.٤١% ، ٣٠.٦٠% ، ٣٦.٨٨% و٣٣.٤٠% على التوالى).
- أشارت نسبة التغيرأن نسبة الخصوبة فى البيض الناتج من دجاجات البهيج كانت أفضل منها فى البيض الناتج من الخليط فى الجيل الثالث ، ومع ذلك كانت نسبتى الفقس لمجموعة الخلط الرجعى أفضل فى نفس الجيل و أيضاً أشارت نسبة معدل التغير أن الخلط الرجعى يحسن من صفات جودة البيض.
- كانت قيم معامل الارتباط سالبة ومعنوية بين وزن الجسم عند النضج الجنسي وكل من العمر عند النضج الجنسي (- ٠.٥٩٥) و وزن البيضة عند ٩٠ يوما (-٠.٥٠٣) بالنسبة لمجموعة الخلط الرجعي بينما كانت القيم موجبة ومعنوية بين معظم صفات إنتاج البيض لنفس المجموعة.
- كان معامل الارتباط موجبا ومعنويا بين معظم صفات إنتاج البيض لدجاجات بهيج بينما كانت القيم سالبة فقط بالنسبة لمعامل الارتباط بين العمر عند النضج الجنسي وكل من وزن البيضة عند٩٠ ، ١٨٠ يوما ، وكذلك كتلة البيض الناتج عند ١٨٠ يوما.

نستنتج من النتائج السابقة أن الخلط الرجعى لدجاجات بهيج مع ذكور سلالة المنتزه الفضى لثلاث أجيال متعاقبة أدى إلى تحسين معظم صفات إنتاج البيض، وصفات الخصوبة والفقس ، وكذلك معظم صفات جودة البيض التى تم دراستها.