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ESTIMATION OF GENETIC PARAMETERS FOR SOME EGG PRODUCTION TRAITS IN THREE GENERATIONS OF CROSSING SOME LOCAL STRAINS WITH TWO COMMERCIAL LINES OF LAYING HENS

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ABSTRACT: The current investigation was undertaken to study the effects of generation, hatch and genotype; to estimate the components of genetic variance and heritability and to determine the best cross within each generation based on multiple egg production traits. This information helps breeders to employ suitable breeding methodology for obtaining the parental groups for producing a commercial egg-type breed of chicken characterized by good productivity. Animal model analyses under both additive and dominance models were used to estimate the additive and dominance components of genetic variance. Best linear unbiased prediction (BLUP) was used for predicting the best cross for egg production traits. The local sire strains were (Silver Montazah, Baheij, Matrouh, Mandarah and Golden Montazah) together with two commercial dame lines (Lohman Brown and Lohman Selected Leghorn) were used in this experiment. The results showed clearly that all egg production traits in this study showed statistically insignificant differences under fixed effects of generations, hatches and genotypes. Contrarily, egg production traits were largely affected by the interactions generations x genotypes and generation x hatch x genotype. Moreover, the egg production traits in the first and second generations were genetically controlled by additive and dominance genetic variations, while in the third generation only dominance genetic variance was accounted a major part of the total genetic variance for all egg production traits studied. Consequently, heritability estimates in this study were low to moderate for egg production traits. Generally, results of crossing Silver Montazah, Baheij and Golden Montazah local strains with Lohman Sleeted Leghorn was promising to obtain

Key Words: Animal model, additive, dominance, local chicken & commercial dame lines.

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the parental dame foundation stocks and Silver Montazah, Baheij, Mandarah and Golden Montazah crossed with Lohman Brown was promising to obtain the parental sire foundation stocks, for producing the commercial egg-type breed of chicken.

INTRODUCTION

The implementation of breeding programmes led to considerable advances in production and genetics. As instant, over the last 50 years, egg production increased by 28 % with the annual production progress of 1.8 eggs per hen on average. At the same time, the total weight of eggs laid during the first year of production increased by 42.7 % and mean egg weight by 11.7 %, with 32 % lower feed intake and the age at first egg was greatly advanced in around the world (Fairfull et al., 1998). In Egypt, the characteristics of the Egyptian local chicken were ranged from 190 to 215 eggs per hen for annual egg number, while the average egg weight ranged from 50 to 58 g and the total egg mass ranged from 9.5 to 12.5 Kg. In the same time, hatchability percentage ranged from 83 to 86 % from the total egg set and from 90 to 93 % from fertile eggs and the mortality rates ranged from 2.9 to 4.4 %, 2.6 to 4.1 % and 0.7 to 1.5 % from day old to 10 weeks of age, from 11 to 21 weeks of age and from 22 to 52 weeks of age, respectively. Moreover, the average body weights were ranged from 540 to 750 g at 8 weeks of age, from 1340 to 1590 g at sexual maturity and from 1600 to 1950 g of mature body weight (Annual book of Egyptian strains of chicken, 2009). This information would serve decision making for both conservation and improving the local strains to different production systems and environments. One of the approaches for genetic improvement of local strains was to crossbreed the local strains with two foreign commercial lines of chicken in three successive generations to obtain the parental groups for producing the commercial egg-type breed of chicken characterized by good productivity.

The principal objective of crossbreeding is genetic improvement of economically important traits. Many studies have discussed the factors affecting the economic traits of chicken; such genetic factors include breed effects, genotype effects, maternal effects, sire effects and effects of systems of breeding etc. The different breeds perform differently within the same environment, and the genetic make-up of the animal is permanent and cannot be modified in subsequent generations except through breeding and selection. Therefore, breed type has a marked effect on performance and productivity than all other factors considered (Okon, 2008). Also many investigators found that there were wide variations in egg production traits between different breeds and/ or strains of chickens (Khalil et al., 2004; Nurgiartiningsih et al., 2004; Chih- Feng Chen et al., 2007; Iraqi et al., 2007). Several reports have been discussed the relative importance of additive and non additive variations upon productive traits (Khalil et al., 1999; Iraqi et al., 2000; Nawar and Bahie El-Deen, 2000 and Iraqi, 2002) reported that the Egyptian strains of chicken were not subjected to intensive selection program and consequently, high additive and non-additive genetic variations appeared among them. Also, Fairfull and Gowe, 1990; Wei et al., 1991a,b; Gengler et al., 1997; Palucci et al., 2007 and Norris et al., 2010 reported that non additive effects have a substantial contribution to variation of economic traits. Mixed model equation was used for estimation genetic parameters and genetic evaluation including matrices for additive genetic and dominance animal relationships (Henderson, 1976; Boldman et al., 1993; Gilmour et al., 2000). The BLUP is an effective way of ranking and selecting animals given measurements on multiple traits of their own performance and information of their relatives (Xie and Xu, 1996). The aims of this study were to estimate the effects of generation, hatch and genotype on egg production traits, to estimate the components of genetic variance and heritability for egg production traits within each generation and to determine the best cross within each generation based on multiple egg production traits. This information helps breeders to employ suitable breeding methodology for their improvement.

MATERIALS AND METHODS

The current experiment had been carried out at El-Sabahiah Poultry Research Station, Animal Production Research Institute, Agriculture Research Center, Egypt.

Experiment Stock and Design: The progenies of the first generation (G1) developed by crossing four local developed strains used as male, including: Silver Montazah (SM), Baheij (BJ), Matrouh (MT), and Golden Montazah (GM) chickens together with females of two commercial lines of laying hens Lohman Brown (LB) and Lohman Selected Leghorn (LSL). In the second generation (G2), the progenies were produced by backcrossing the first generation males (½ SM x ½ LB, ½ BJ x ½ LB, ½ MN x ½ LB, ½ GM x ½ LB, ½ SM x ½ LSL, ½ BJ x ½ LSL, ½ MT x ½ LSL and ½ GM x ½ LSL again with the commercial female (LB and LSL) to produce two-way crosses contributing 75 % LB x 25 % developed local strains and (75 % LSL x 25 % developed local strains. Ongoing to the third generation (G3), the males of the second generation were backcrossed to the commercial female (LB and LSL) to produce progenies contributed 87.5 % LB x 12.5 % developed local strains and 87.5 % LSL x 12.5 % developed local strains. Table 1 reflects the stock designation of the local strains as 90, 80 and 80 cock for local strains and 200, 155 and 150 hens for Lohman Brown (LB), and 200, 140 and 120 hens of Lohman Selected Leghorn (LSL) over the three generations, respectively. The available data recorded were 400, 134 and 284 observations at the three generations, respectively.

Table (1): The stock designation and the crossing plan obtained

Generations	Local Strains	♂	Commercial Lines	
			LB (♀)	LSL (♀)
G1	SM	20	40	50
	BJ	20	40	50
	MN	10	40	-
	MT	20	40	50
	GM	20	40	50
	Total	90	200	200
G2	(½ SM x ½ LB)	10	35	-
	(½ BJ x ½ LB)	10	45	-
	(½ MN x ½ LB)	10	35	-
	(½ GM x ½ LB)	10	40	-
	(½ SM x ½ LSL)	10	-	30
	(½ BJ x ½ LSL)	10	-	35
	(½ MT x ½ LSL)	10	-	45
	(½ GM x ½ LSL)	10	-	30
	Total	80	155	140
G3	(¼ SM x ¾ LB)	10	35	-
	(¼ BJ x ¾ LB)	10	45	-
	(¼ MN x ¾ LB)	10	35	-
	(¼ GM x ¾ LB)	10	35	-
	(¼ SM x ¾ LSL)	10	-	30
	(¼ BJ x ¾ LSL)	10	-	30
	(¼ MT x ¾ LSL)	10	-	30
	(¼ GM x ¾ LSL)	10	-	30
	Total	80	150	120

SM = Silver Montazah, BJ= Baheij, MN = Mandarah, MT= Matrouh, GM = Golden Montazah, LB = Lohman Brown and LSL = Lohman Selected Leghorn.

Management Conditions: All managerial practices were similar as possible as throughout the experiment for all generations. Artificial insemination was applied by pooling semen from cocks per each genetic group and inseminates the LB and LSL hens twice a week separately. Two hatches in each mating combination per generation were used. For each hatch eggs were collected throughout 7 d and incubated in full-automatic draft machine. At hatch, all chicks were wing-banded and weighed to the nearest gram. The chicks were fed ad libitum commercial a starter ration (19 % CP and 2800 KCal) up to 8 weeks of age, then the ration was changed by commercial grower ration (15 % CP and 2700 KCal) up to 20 weeks of age, then during the production period the pullets were fed a commercial layer ration (16.5 % CP and 2750 KCal) and they were housed in individual cages and received 16 hr day light. At the onset of lay, eggs were recorded and weighed daily during the first

90 d of production, then twice a week till the end of experiment.

The Studied Traits: 12 egg production traits were studied,

Egg Number T different ages:

- Number of eggs at 1st 90 d of laying (EN1),
- Number of eggs at 180 d of laying (EN2),
- Number of eggs at 240 d of laying (EN3),
- Number of eggs at 52 wks of laying (EN4),

Egg Weights at different ages:

- Average egg weight through the 1st 90 d. of laying (EW1),
- Average egg weight at 180 d of laying (EW2),
- Average egg weight at 240 d of laying (EW3),
- Average egg weight at 52 wks of laying (EW4),

Egg Mass at different ages:

- Egg mass throughout the 1st 90 d of laying (EM1),
- Egg mass throughout 180 d of laying (EM2),
- Egg mass throughout 240 d of laying (EM3) and
- Egg mass throughout 52 wks of laying (EM4).

Statistical Analysis: All percentages were first converted to arcsine transformation prior to statistical analysis. Data were analyzed for variation between different genetic groups using (Proc GLM) of SAS software (SAS, 2000) using the following model:

$Y_{ijkl} = \mu + G_i + R_{ij} + H_{ijk} + (GH)_{ik} + (GR)_{ij} + (GRH)_{ijk} + e_{ijkl}$

Where: Y_{ijkl} is the $ijkl^{th}$ observation, μ is the overall mean, G_j is the fixed effect of i^{th} generation, R_{ij} is the fixed effect of ij^{th} genotype within generation, H_{ijk} the fixed effects of ijk^{th} hatch within genotypes and generation, (GH) the interaction effects between i^{th} generation and k^{th} hatch, (GR) the interaction effects between i^{th} generation and j^{th} genotype, (GRH) the interaction effects among i^{th} generation, j^{th} genotype and k^{th} hatch and e_{ijkl} is the random error. While the estimates of The (Co) variance and variance components estimates were obtained using REML individual animal model analyses under both additive and dominance models based on the DFREML program of Meyer (1989). The model is expressed in matrix notation as follows:

$$y = Xb + Za + Zd + e$$

Where: y is the vector of observations, b is the vector of fixed effects, a is the vector of random additive animal effects, d refers to the vector of random dominance effects and X and Z are the incidence matrices relating the observations to the respective fixed and random effects. Z is partitioned into a null matrix for base animals without records and an identity matrix for animals with records. Under this model the means and variances matrices re assumed to be as follows:

$$E\begin{vmatrix} Y \\ a \\ d \\ e \end{vmatrix} = \begin{vmatrix} Xb \\ 0 \\ 0 \\ 0 \end{vmatrix}$$

$$V\begin{vmatrix} Y \\ a \\ d \\ e \end{vmatrix} = \begin{vmatrix} V_{dom} & Z'A_{\sigma^2 a} & Z'D_{\sigma^2 d} & I_{\sigma^2 e} \\ AZ'_{\sigma^2 a} & A_{\sigma^2 a} & 0 & 0 \\ DZ'_{\sigma^2 d} & 0 & D_{\sigma^2 d} & 0 \\ I_{\sigma^2 e} & 0 & 0 & I\sigma^2 e \end{vmatrix}$$

Where: $V_{dom} = z\,(A\sigma^2 a + D\sigma^2 d)\,z' + I\sigma^2 e$, $\sigma^2 d$ is the dominance genetic variance; A and D are the additive and dominance animal relationship matrices, $\sigma^2 e$ is the random environmental variance and I is an identity matrix.

Heritability was computed according to Boldman et al. (1995)

$$h^2 = \sigma^2 A / (\sigma^2 A + \sigma^2 e)$$

Where: h^2 is the heritability, $\sigma^2 A$ is the additive genetic variance, $\sigma^2 e$ is the random environmental variance.

Prediction the best cross within generation was obtained using the best linear unbiased prediction (BLUP) solutions for fixed and random effects by solving the usual Mixed Model Equations given by (Henderson, 1975&1984).

$$\begin{vmatrix} X`X & X`Z \\ Z`X & Z`ZA^{-1} \end{vmatrix} \begin{vmatrix} \hat{b} \\ \hat{u} \end{vmatrix} = \begin{vmatrix} X`Y \\ Z`Y \end{vmatrix}$$

Where: λ is the ratio $\sigma^2 e / \sigma^2 u$

RESULTS AND DISCUTIONS

Factors Affecting Some Egg Production Traits: The differences among generations, hatches, genotypes and the interactions between them (Table 2) revealed that all egg production traits studied were statistically insignificantly differ (P<0.05) in between generations, hatches, genotypes and the interaction between generations and genotypes. In addition, the interaction between generation and hatch was insignificant (P<0.05) for egg number till 180 d of laying (EN2), egg mass at the first 90 d., of laying (EM1), egg mass at 180 d., of laying (EM2) and egg mass till 240 d. of laying (EM3), respectively. Unlike, the interactions between generation and hatch and the triple interaction among generation x hatch x genotype were highly significant differences (P<0.01) with respect to the other traits i.e. egg number at the first 90 d., of laying (EN1), egg number till 240 d. of laying, (EN3), egg number till 52 wk. of age (EN4), early egg weight at the first 90 d., of laying (EW1), average egg weight at 180 d., of laying (EW2), average egg weight till 240 d. of laying (EW3), average egg weight till 52 wk. of age (EW4), and egg mass till 52 wk. of age (EM4). These findings of variations for egg production traits may be attributed to physiological adaptability to the environment and genetic variations among and within breeds (Cole, 1972; Fredeen, 1972 and Okon, 2008).

Performance of The Crosses within Generations: Results of the first generation of crossing Silver Montazah (SM), Baheij (BJ), Matrouh (MT) and Golden Montazah (GM) local sire strains with two commercial dame lines Lohman Brown (LB) and Lohman Selected Leghorn (LSL) are given in Table 3. The general means of some egg production traits were 39, 111, 147 and 196 eggs for number of eggs at 90 d of laying (EN1), number of eggs at 180 d of laying (EN2), number of eggs at 240 d of laying (EN3) and number of eggs till 52 wks of laying (EN4), respectively; and 53, 53, 55 and 55 g for average egg weight at 90 d of laying (EW1), average egg weight at 180 d of laying (EW2), average egg weight till 240 d of laying (EW3) and average egg weight till 52 wk of age (EW4), respectively, while egg mass were 2072, 5811, 8024 and 10839 g for egg mass at the first 90 d of laying (EM1), egg mass at 180 d of laying (EM2), egg mass till 240 d of laying (EM3) and egg mass till 52 wk of age (EM4), respectively. The coefficient of variability (CVs) was fewer than 25 % reflected the low levels of dispersion in these variables. Also as seen in Table 3, that of the 8 crosses the cross SM x LSL had better means of EN2, EN4, EW1, EW3, EW4 and EM4 (119, 210 egg, 53, 56, 56 g and 11830 g, respectively). Moreover, the cross SM x LB was ranked second, since it showed superiority in EN1 (42 egg), EN3 (153 egg), EW2 (54 g), EW4 (56 g), EM1 (2182 g), EM2 (6265 g) and EM4 (8435 g). Furthermore, the results of Table 3, shows the cross GM x LSL was ranked third, it was superior in EN3 (153 egg), EW1 (54 g) and EW2 (54 g), while the cross GM x LB was ranked fourth, since it had better means of EW2, EW3, and EW4 (54, 56 and 57 g, respectively). The results of foreign commercial dame performance revealed that Lohman Brown (LB) and Lohman Selected Leghorn (LSL) were gained either high or low egg production yield, respectively. Because of, they may have a high or low frequency of favorable alleles for these traits. The same conclusion was reported by Lopez-Perez (1979). The former results showed clearly that Silver Montazah and Golden Montazah local sire strains of chicken are considered to be fitting parental strains that play an important role in improving egg production traits. This finding agreed with those reported by (Kosba and Abd El-Halim, 2008 for egg number and egg mass at 90 d of production, Abou El-Ghar et al., 2009&2010 for egg weight and most of egg production traits and Iraqi et al., 2012).

Regarding the second generation, Table 4, presents the general means of some egg production traits and the CVs that fewer than 25 % which associated with low levels of variations among genetic groups. Egg number traits had 47, 93, 140 and 202 eggs for EN1, EN2, EN3 and EN4, respectively; and egg weights reached 51, 53, 56 and 57 g for EW1, EW2, EW3 and EW4, respectively, and egg mass till 52 wk of age (EM4) had 11037 g. On the other hand, some egg mass traits like EM1, EM2 and EM3 estimated 2271, 4741and 7233 g, respectively, the CVs that exceed 20 % reflects dispersion of the genetic groups within the generation. These results demonstrate that means of egg mass at different laying periods were affected mainly by the large proportion of variations in egg number. This finding was confirmed by Omeje and Nwosu (1986) who reported that backcrossing of Gold link with Nigerian chickens produced highest hen day egg number. The performance of the crosses in Table 4 revealed that the cross BJ x LSL showed superiority means of EN1, EN2, EN3, EW3, EN4, EM1, EM2, EM3 and EM4 (50, 115, 151, 230 egg, 2557, 6274, 8482 and 13147 g, respectively. While, the cross GM x LSL was ranked second since, it had the same egg number at 240 d of laying (EN3 151 egg). Moreover, the cross BJ x LB was ranked third it achieved higher estimates of EN2 (91 egg), EW2 (55 g), EW4 (58 g), EM1 (2544 g) and EM3 (7334 g). The corresponding cross SM x LB was ranked fourth, since it gained a higher estimates of EN1 (50 egg), EN3 (147 egg), EN4 (211 egg), EW1 (53 g), EW3 (56 g), EM2 (5260 g) and EM4 (11375 g). The former results showed clearly that there was a correlation between egg number and egg mass at the different periods of production, so egg mass could be affected mainly by the large proportion of variations in egg number trait. The same finding was reported by Abou El-Ghar et al., (2010). Contrarily, Garwood and Lowe (1978) reported that egg mass was increased solely through change in egg weight.

Concerning the third generation, the results obtained in Table 5 revealed that the coefficient of variability (CVs) was fewer than 25 % reflected the low levels of dispersion of the genetic groups within the generation in all egg production traits. Such traits estimated, 51, 100, 139 and 204 eggs for EN1, EN2, EN3 and EN4, respectively; and 50, 53, 55 and 56 g for EW1, EW2, EW3 and EW4, respectively, and 2579, 5315, 7581 and 11450 g for EM1, EM2, EM3 and EM4, respectively. Furthermore, results of crossing of Silver Montazah (SM), Baheij (BJ), Mandarah (MN), Matrouh (MT) and Golden Montazah (GM) local sire strains with two commercial dame lines Lohman Brown (LB) and Lohman Selected Leghorn (LSL) are given in Table 5. It was clear that the cross SM x LSL was the best hybrid gained a higher means of EM1, EM3 and EM4 (3154, 8815 and 13420 g, respectively). Moreover, the cross SM x LB showed superiority in EW1 (55 g) and EM2 (6897 g). As well as, the hybrid BJ x LB had a higher means of EN4 (225 egg) and egg weight at all periods studied EW1, EW2, EW3 and EW4 (55, 55, 58 and 60 g, respectively). While, the cross MN x LB was ranked fourth. The former results showed clearly that Silver Montazah local sire strain of chicken was considered to be fitting parental lines that play an important role in improving both egg number and egg weight traits, respectively. These findings agreed with those reported by (Kosba and Abd El-Halim, 2008 for egg number and egg mass at 90 d., of production, Abou El-Ghar et al., 2009&2010 and Iraqi et al., 2012 for egg weight and most of egg production traits). From the previous results it was clear that the direction of the genetic correlation between partial and full egg record could change in the course of selection. The same conclusion was found by Bohren, 1970. Also, Garwood and Lowe (1978) reported that egg mass was increased solely through change in egg weight and in despite of the low phenotypic correlation between egg weight and egg mass, and the antagonism between egg number and egg weight, it is desirable to improve egg mass and its component traits egg number and egg weight.

Genetic Variance Components and Heritability Estimates: The estimates of additive σ^2A, dominance σ^2D, random environmental σ^2e variations and heritability estimates h^2 for some egg production traits in the first generation were presented in Table 6. These data pointed out that additive genetic variance (σ^2A) accounted a major part of the total genetic variance for EN4 (1456), EW2 (35), EW3 (32), EW4 (24), EM1 (3935628), EM3 (5713532) and EM4 (4811971), since the estimates of dominance genetic variance (σ^2D) in these traits was relatively low. Obvious results indicate that additive genetic variance may be a common in the inheritance of this trait. These results were in agreement with the findings of (Fairfull et al., 1983). Contrarily, the estimates of σ^2D were larger than those of additive for EN1, EN2, EN3, EW1 and EM2 (317, 1009, 1449, 30 and 1600479, respectively). These findings dealt with those cited by Wei et al. (1991a,b), they reported that dominance influences all genetic parameters related to crossbreeding. Also, these findings dealt with those cited by (Abou El-Ghar and Abdou, 2004 and Abou El-Ghar, 2005). The observed estimates of random environmental variation (σ^2e) for these traits were 11, -12, 27, 10 and 149372 suggested that non-additive genetic variation or the environmental effects may be masked the effects of additive genes. The same conclusion was cited by (Shebl et al., 1990 and Zaky, 2005). Heritability estimates for egg production traits were presented in Table 6, showed that h^2 in the first generation were estimated were ranged 0.2 to 0.3 among all egg production traits studied. These results were agreed with findings reported by (Quadeer et al., 1977; Venktramaiah et al., 1986; Wei et al., 1991a,b and Sang et al., 2005). Moreover, the results of heritability estimates for egg number and egg weight were lower than those reported by (Enab et al., 1992; Abdou and Enab, 1994 and El Wardany, 1999).

According to the genetic variations in the second generation for egg production traits, it was noticed from Table 6, that additive genetic variations (σ^2A) in the second generation were estimated to be 817, 1800, 2215498, 29812557, 7177365 and 26920016 for EN1, EN2, EM1, EM2, EM3 and EM4 traits, respectively. The corresponding mean squares due to dominance genetic variance (σ^2D) for the previous traits were -361, -491, -703025, -9369812, 1847347 and -3573789 indicating that additive genetic variation may control the inheritance of the majority of the loci for these traits. On the other hand, the estimated dominance genetic variance (σ^2D) for EN3, EN4, EW1, EW2, EW3 and EW4 (8388, 8243, 531, 479, 630 and 599, respectively), reflects the controlling of non-additive genetic variation of the inheritance of these traits. The same conclusion was reported by (Wei and van der Werf, 1993; Abou El-Ghar and Abdou, 2004 and Abou El-Ghar, 2005). In the same order, environmental variations σ^2e were estimated to be 37, 6, 168, 195, 5, 3, 5, 5, 67435, -971353, -803933 and -713967 for EN1, EN2, EN3, EN4, EW1, EW2, EW3, EW4, EM1, EM2, EM3 and EM4 traits, respectively. The estimates of heritability in the second generation were ranged from 0.2 to 0.3 among all egg production traits studied. These results were agreed with findings reported by (Wei et al., 1991a,b and Sang et al., 2005).

Concerning the third generation, the results obtained in Table 6 revealed that the estimates of additive σ^2A, dominance σ^2D, random environmental σ^2e variations and heritability estimates h^2 for some egg production traits the dominance genetic variance (σ^2D) accounted a major part of the total genetic variance for all egg production traits studied, while the estimates of additive genetic variance (σ^2A) in these traits was relatively lower than dominance genetic variations. Obvious results indicate that non-additive genetic variance may be a common in the inheritance of this trait. These findings dealt with those cited by Wei et al. (1991a,b), they reported that dominance influences all genetic parameters related to crossbreeding. Also, these findings agreed with those cited by (Wei and van der Werf, 1993; Abou El-Ghar and Abdou, 2004 and Abou El-Ghar, 2005). The observed estimates of random environmental variation (σ^2e) for these traits support the suggestion that non-additive genetic variations or the environmental effects may be masked the effects of additive genes. The same conclusion was cited by (Shebl et al., 1990 and Zaky, 2005). Moreover, heritability estimates for egg production traits in Table 6, showed that h^2 estimated in the third generation ranged 0.3 to 1.0 among all egg production traits studied. This was because of heritability depends on the range of typical environments in the population studied, so in the third generation the negative environmental variation estimate was the only reason for reducing the phenotypic variance, consequently, high estimates of heritability were obtained for egg weight traits. These results agreed with findings reported by (Shebl et al., 1990 and Zaky, 2005).

CONCLUSION

The former results showed clearly that all egg production traits in this study showed statistically insignificant differences under fixed effects of generations, hatches and genotypes. Unlike, egg production traits were largely affected by the interactions generations x genotypes and generation x hatch x genotype. Moreover, the egg production traits in the first and the second generations were genetically controlled by additive and dominance genetic variations, while in the third generation only dominance genetic variance was accounted for a major part of the total genetic variance for all egg production traits studied. Consequently, heritability estimates in this study were moderate to low for egg production traits. Generally, crossing Silver Montazah, Baheij and Golden Montazah local strains with Lohman Sleeted Leghorn to obtain the parental dame groups, and crossing Silver Montazah, Baheij, Mandarah and Golden Montazah with Lohman Brown to obtain the parental sire groups for producing the commercial egg-type breed of chicken characterized by good productivity.

Table (2): Significance of variations for some egg production traits

		S.O.V					
		Bet. Generation (G)	**Bet. Hatches (H)**	**Bet. Genotypes (Gtyp)**	**G x H**	**G x Gtyp**	**G x Gtyp x H**
d.f	**675**	**2**	**1**	**7**	**2**	**14**	**14**
Traits	M.S Error						
EN1	8.2	NS	NS	NS	**	NS	**
EN2	-26.4	NS	NS	NS	NS	NS	NS
EN3	35.2	NS	NS	NS	**	NS	**
EN4	112.6	NS	NS	NS	**	NS	**
EW1	6.6	NS	NS	NS	**	NS	**
EW2	2.8	NS	NS	NS	**	NS	**
EW3	3.1	NS	NS	NS	**	NS	**
EW4	3.4	NS	NS	NS	**	NS	**
EM1	-379836	NS	NS	NS	NS	NS	NS
EM2	-128392	NS	NS	NS	NS	NS	NS
EM3	-11156	NS	NS	NS	NS	NS	NS
EM4	223256	NS	NS	NS	**	NS	**

EN1= egg number at the first 90 d., of laying, EN2 = egg number at 180 d., of laying, EN3 = egg number till 240 d. of laying, EN4 = egg number till 52 wk. of age, EW1 = early egg weight at the first 90 d., of laying, , EW2 = average egg weight at 180 d., of laying, EW3 = average egg weight till 240 d. of laying, EW4 = average egg weight till 52 wk. of age, EM1 = egg mass at the first 90 d., of laying, EM2 = egg mass at 180 d., of laying, EM3 = egg mass till 240 d. of laying, EM4 = egg mass till 52 wk. of age.

Table (3): Means of egg production traits and ranking the crosses performance in the first generation

	Traits											
	EN1	**EN2**	**EN3**	**EN4**	**EW1**	**EW2**	**EW3**	**EW4**	**EM1**	**EM2**	**EM3**	**EM4**
General Mean	39	111	147	196	53	53	55	55	2072	5811	8024	10839
C.V	12.7	10.4	9.3	10.8	6.4	5.6	5.5	5.5	14.3	11.8	11.3	12.5
Crosses												
SMxLSL	41	119	151	210	53	53	56	56	2149	6253	8432	11830
SMxLB	42	117	153	209	52	54	55	56	2182	6265	8435	11664
GMxLSL	39	114	153	204	54	54	55	55	2113	6146	8313	11199
GMxLB	40	110	149	196	53	54	56	57	2125	5929	8290	11189
MTxLSL	38	111	145	198	53	52	55	56	1992	5824	8039	11109
BJxLSL	38	111	145	190	52	49	57	57	1958	5466	8199	10897
MTxLB	38	101	138	185	52	52	53	53	2016	5257	7281	9792
BJxLB	39	102	138	173	52	52	52	52	2041	5346	7203	9030

C.V = coefficient of variability, EN1= egg number at the first 90 d., of laying, EN2 = egg number at 180 d., of laying, EN3 = egg number till 240 d. of laying, EN4 = egg number till 52 wk. of age, EW1 = early egg weight at the first 90 d., of laying, , EW2 = average egg weight at 180 d., of laying, EW3 = average egg weight till 240 d. of laying, EW4 = average egg weight till 52 wk. of age, EM1 = egg mass at the first 90 d., of laying, , EM2 = egg mass at 180 d., of laying, EM3 = egg mass till 240 d. of laying, EM4 = egg mass till 52 wk. of age, SM = Silver Montazah, BJ = Baheij, MT = Matrouh, MN = Mandarah, GM = Golden Montazah, LB = Lohman Brown, LSL = Lohman Selected Leghorn.

Table (4): Means of egg production traits and ranking crosses performance in the second generation

	Traits											
	EN1	**EN2**	**EN3**	**EN4**	**EW1**	**EW2**	**EW3**	**EW4**	**EM1**	**EM2**	**EM3**	**EM4**
General Mean	47	93	140	202	51	53	56	57	2271	4741	7233	11037
C.V	15.6	17.0	13.4	13.0	5.7	5.4	4.4	4.4	21.4	27.5	22.0	18.5
Crosses												
BJxLSL	50	115	151	230	51	54	55	57	2557	6274	8482	13147
GMxLSL	47	94	151	209	50	52	56	56	2331	4920	8216	11697
BJxLB	49	91	128	188	52	55	55	58	2544	5040	7334	10884
SMxLB	50	90	147	211	53	54	56	57	1719	5260	7128	11375
MNxLB	48	93	125	194	48	53	55	57	2332	4916	7011	11126
SMxLSL	44	89	142	183	50	52	57	57	2212	4659	7952	10421
GMxLB	40	77	138	190	52	53	53	55	2102	2102	4111	7500

C.V = coefficient of variability, EN1= egg number at the first 90 d., of laying, EN2 = egg number at 180 d., of laying, EN3 = egg number till 240 d. of laying, EN4 = egg number till 52 wk. of age, EW1 = early egg weight at the first 90 d., of laying, , EW2 = average egg weight at 180 d., of laying, EW3 = average egg weight till 240 d. of laying, EW4 = average egg weight till 52 wk. of age, EM1 = egg mass at the first 90 d., of laying, , EM2 = egg mass at 180 d., of laying, EM3 = egg mass till 240 d. of laying, EM4 = egg mass till 52 wk. of age, SM = Silver Montazah, BJ = Baheij, MT = Matrouh, MN = Mandarah, GM = Golden Montazah, LB = Lohman Brown, LSL = Lohman Selected Leghorn.

Table (5): Means of egg production traits and ranking the crosses performance in the third generation

	Traits											
	EN1	**EN2**	**EN3**	**EN4**	**EW1**	**EW2**	**EW3**	**EW4**	**EM1**	**EM2**	**EM3**	**EM4**
General Mean	51	100	139	204	50	53	55	56	2578	5315	7581	11450
C.V	18.4	15.1	13.7	10.6	8.2	5.0	5.7	6.0	20.3	15.9	14.1	11.8
Crosses												
SMxLSL	45	88	114	176	53	53	54	57	3154	5768	8815	13420
SMxLB	49	89	146	201	49	55	56	55	2280	6897	6895	11373
BJxLB	57	104	153	225	55	55	58	60	2376	4867	8212	10983
MNxLB	46	92	132	197	49	51	55	57	2992	5829	5829	11692
MTxLSL	60	111	155	218	50	52	53	54	2250	4715	7290	11271
GMxLSL	50	95	127	197	50	53	53	54	2521	4987	6688	10706
GMxLB	44	130	130	198	52	53	53	58	2315	5135	5135	11372
BJxLSL	47	95	133	201	50	54	55	57	2383	4652	4652	10100

C.V = coefficient of variability, EN1= egg number at the first 90 d., of laying, EN2 = egg number at 180 d., of laying, EN3 = egg number till 240 d. of laying, EN4 = egg number till 52 wk. of age, EW1 = early egg weight at the first 90 d., of laying, , EW2 = average egg weight at 180 d., of laying, EW3 = average egg weight till 240 d. of laying, EW4 = average egg weight till 52 wk. of age, EM1 = egg mass at the first 90 d., of laying, , EM2 = egg mass at 180 d., of laying, EM3 = egg mass till 240 d. of laying, EM4 = egg mass till 52 wk. of age, SM = Silver Montazah, BJ = Baheij, MT = Matrouh, MN = Mandarah, GM = Golden Montazah, LB = Lohman Brown, LSL = Lohman Selected Leghorn.

Table (6): Additive σ²A, dominance σ²d, random environmental σ²e mean squares and heritability estimates h² for some egg production traits

Traits	Generations											
	G1				G2				G3			
	σ²A	**σ²d**	**σ²e**	**h²**	**σ²A**	**σ²d**	**σ²e**	**h²**	**σ²A**	**σ²d**	**σ²e**	**h²**
EN1	190	317	11	0.2	817	-361	37	0.2	817	5089	-435	0.3
EN2	802	1009	-12	0.3	1800	-491	6	0.2	2159	20648	-1792	0.3
EN3	1062	1449	27	0.2	-16282	8388	168	0.3	3415	41614	-3594	0.3
EN4	1456	1251	137	0.2	-14481	8243	195	0.3	4603	92511	-7995	0.4
EW1	27	30	10	0.2	-1047	531	5	0.3	154	5599	-484	1.0
EW2	35	5	3	0.2	-926	479	3	0.3	176	6150	-541	1.0
EW3	32	2	4	0.2	-1253	630	5	0.3	212	7232	-637	1.0
EW4	24	14	4	0.2	-1191	599	5	0.3	225	7689	-677	1.0
EM1	3935628	3787926	-359121	0.3	2215498	-703025	67435	0.2	5725007	14928802	-1412874	0.3
EM2	1246698	1600479	149372	0.2	29812557	-9369812	-971353	0.3	5702455	52086319	-4467628	0.3
EM3	5713532	2823518	351699	0.2	7177365	1847347	-803933	0.3	9885061	12758441	-10758993	0.3
EM4	4811971	3376317	654527	0.2	26920016	-3573789	-713967	0.3	11908357	302902180	-25896052	0.5

σ²A = additive genetic variance, σ²d = dominance genetic variance, σ²e = random environmental variance, h²= heritability estimates,

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الملخص العربي

تقدير المعايير الوراثية لبعض صفات إنتاج البيض فى ثلاث أجيال من الخلط بين بعض سلالات الدجاج المحلية مع خطان من خطوط دجاج البيض التجاري

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أجريت التجربة الحالية لدراسة تأثير كل من الأجيال، موسم التفريخ والتركيب الوراثى ولتقدير مكونات التباين الوراثي والمكافئ الوراثي ولتحديد أفضل خلطات فى كل جيل وذلك بالنسبة لإجمالى صفات إنتاج البيض المختلفة. هذة المعلومات تساعد المربين فى عمل برنامج تربية مناسب للحصول على الأباء اللازمة لإنتاج سلالة إنتاج بيض تجارية تتميز بإنتناجيتها العالية. ولقد استخدمت تحليلات النموذج الحيوانى بالنماذج الفرعية للتباين الوراثى المضيف وتباين السيادة بهدف حساب التباين الوراثى المضيف والتباين الوراثى الراجع لتأثير السيادة والمكافئ الوراثى لصفات إنتاج البيض واستخدمت طريقة أفضل متنبئ خطي غير متحيز للتنبؤ بافضل الخلطات فى كل جيل بالنسبة لصفات إنتاج البيض. ولقد تم تزاوج السلالات المحلية من الدجاج هى المنتزة الفضى ، بهيج، مطروح، المندرة والمنتزة الذهبى مع سلالتين تجاريتين من سلالات دجاج البيض هما لوهمان البنية Lohman Brown (LB) و لوهمان لجهورن المنتخبة Lohman Selected Leghorn (LSL). أظهرت النتائج بوضوح أن صفات إنتاج البيض المدروسة لم تتاثر معنويا بتأثير كل من الأجيال وموسم الفقس والتركيب الجيني على العكس تأثرت تلك الصفات تأثرا معنويا كبيرا بالتداخل بين الجيل والتركيب الجينى وكذا التداخل بين الجيل وموسم الفقس والتركيب الجيني. وأيضا أظهرت نتائج الجيلين الأول والثانى أهمية التباين الوراثى المضيف إلى جانب التباين الوراثي الراجع الى تأثير السيادة بالنسبة لصفات إنتاج البيض فى حين صفات إنتاج البيض فى الجيل الثالث قدر فيها التباين السيادى بانه معظم التباين الوراثى مما يدل على أن الجينات ذات التأثير الغير مضيف هى من تتحكم فى وراثة تلك الصفات. علاوة على أن تقديرات المكافئ الوراثي عبرالثلاث أجيال بالنسبة لصفات إنتاج البيض كانت متوسطة الى منخفضة. وعموما فإن نتائج خلط سلالات المنتزة الفضي، بهيج والنتزة الذهبي مع سلالة لوهمان للجهورن المنتخبة لها الأفضلية فى تكوين القطعان التأسيسية الأمية كما أن خلط المنتزة الفضي، بهيج، المندرة والمنتزة الذهبي مع سلالة لوهمان البنية لها الأفضلية فى تكوين القطعان التأسيسية الأبوية الذين يشتركون فى أنتاج سلالة البيض التجارية.