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SELECTION FOR IMPROVING EGG PRODUCTION IN MANDARAH CHICKENS TO MAXIMIZE THE NET INCOME.
1- CORRELATED RESPONSES, GENETIC PARAMETERS FOR EGG PRODUCTION AND GROWTH TRAITS

Abdel-Ghany, F.A. and A.I. Abdel-Ghany
Anim. Prod. Inst., Agric. Res. Center, Minist. Agric., Egypt.

ABSTRACT

The aim of the present study was conducted to estimate the correlated response, the genetic parameters (heritability, genetic and phenotypic correlations) of some egg number and growth traits in Mandarah chickens for improving egg number at the first 90 days of laying along three successive generations. Results showed significant differences between selected and control lines as well as among generations. The realized and expected response over two generations were increased body weight at hatch (BW0) 1.23 gm and body weight at four weeks (BW4) 20.27 gm, but decreased body weight at 12 weeks of age (BW12) -15.87, -75.62 gm for male and female. Growth rate was increased at different periods except female (Gr 4-8) decreased. Also, noticed that selection for increasing egg number during first 90 days of laying in Mandarah strain increased egg mass (232.7 g) and feed conversion (0.17 g) and reduced age at sexual maturity (- 8.06 days) and average egg weight (-0.47).

Estimates of heritability were (0.62 and 0.49) for ASM, and for BWSM (0.41 and 0.21), EN (0.35 and 0.38), EW (0.59 and 0.32), EM (0.39 and 0.36), feed conversion (0.37 and 0.22) for both the selected and control lines, BW0 (0.13 and 0.16), BW4 (0.32 and 0.31), BW8 (0.58 and 0.53) and BW12 (0.61 and 0.59) for both the selected and control lines, respectively. Genetic correlation in egg number in the selected line were positively associated with BW4 (0.21), BWSM (0.27) and EM (0.79), while, it with BW8 and BW12 weeks of age (-0.35 and -0.24), ASM (-0.39) and EW (-0.41) were negatively associated with egg number. There were low relationships between EN and the other traits studied. Genetic correlations between the other egg number and body weight traits showed a different genetic pattern in both selected and control lines. It could be concluded that selection for increased egg number during the first 90 days of laying in Mandarah strain decreased body weight and growth rate at different age. Heritability estimates based on sire component were higher for the selected line than the control one, which indicated that selection affected the heritability estimates.

INTRODUCTION

Intensive poultry production in Egypt depends not only on commercial hybrids but also on local strains of chickens. During the last four decades some efforts have been done to improve the performance of these local strains through continuous selection under different environmental condition, from these local strains, Mandarah strain. Selection for egg production redacted body weight, as well documented by Kinney (1969). He reported that egg production and body weight in chicken are genetically negatively correlated. The breed or strain variation in the association among the egg production traits was reported by El-Full *et al.*, (2001).

Egg production is the yield of overall performance of a bird concerning many variables such as egg number, egg weight, egg mass and age at sexual maturity. These variables are correlated with egg production and with each other in the positive or negative trends. Egg production traits are affected by age at sexual maturity. Tawfeek, (1988) , Kosba *et al*, (1997) and Younis and Abd El-Ghany (2004) found that selection for egg number of Silver Montazah chickens increased egg production in association with early sexual maturity, high egg mass and better feed conversion. Realized heritability for egg production traits was reported by Soltan (1991) in Sinai fowl and El-Waradany and Abdou (1993) in Norfa strain. Enab (1982) reported that the genetic correlations between egg number and egg weight were 0.21 and 0.42 in high egg number and high egg size line of White Leghorn, respectively.

Heritability (h^2) of egg production traits have been cited by many researches (Francesch *et al.* 1997; chen and Tixier-Boichard, 2003) working on exotic strains, in different local strain of chickens Abdou and Enab (1994); Abdou, (2006),Abd el-Ghany 2005,2006, Saleh *et al.* (2006) and Balat *et al.*(2008) on local strains. Weight at sexual maturity had different (h^2) estimates, Singh *et al.*(1986) for exotic strains and Abdel-Halim (1999) and Saleh *et al.*(2006) using local strains. Also, (h^2) estimates for body weight at different ages (Kosba *et al.*, 2002 and 2006; Abd el-Ghany 2005, 2006, Abdou, 2006 and Saleh *et al.*2006. Genetic and phenotypic correlations among production and reproduction traits have been studied by Francesch at al. (1997) and Hartmann *et al.* (2003) working on foreign strains of chickens and those using local strains were (El-Wardany and Abdou 1993; Younis and Abdel-ghany 2004; Abdella 2006 and Saleh *et al.* 2006).

The present study was conducted to estimate the heritability of egg production and some growth traits for selected and non-selected lines of Mandarah strain, beside estimating the genetic and phenotypic correlations among these traits and correlated response to selection program to developing egg number during four generations.

MATERIALS AND METHODS

The study was conducted at Sakha Research Station, Kafer El-Sheikh, Animal Production Research Institute, Agriculture Research Center. Two lines of Mandarah strain (Abdel-Gawad, 1981) were used in the present study. Selected line (a total of 3950) and control line (1030) pedigreed unsexed one day chicks hatched over four generations table 1. Selection was practiced from egg number up to 90 days of age using a family index that took into account the individual performance plus sire family average pullets, and for male were taken according to half-sib mean of egg number.

The chicks were wing banded, weighted at hatch, 4, 8and 12 weeks of age. Feed and water were allowed ad libitum throughout the experiment and the chicks were fed a layer 1 ration containing (19 % crud protein and 2800 K. cal) from hatch to 8 weeks of age, a layer 2 ration containing (15% CP and 2700 K. cal) from 9 to 20 weeks of age and fed a layer 3 ration containing (16.5% CP and 2750 Kcal) up to 54 weeks of age. All cocks vaccinated against diseases. Sexes were separated at 8 weeks of age. The pullets were housed in individual laying cages at 20 weeks of age. After 90 days of laying the pullets were housed in breeding been,

Studied traits

- Body weight at hatch, 4, 8, and 12 weeks of age in grams.
- Growth rate at different periods (0-4), (4-8), (8-12) and (0-8).
- Body weight at age sexual maturity in grams.
- Age at sexually maturity in days (age at first egg).
- Number of eggs in the first 90 days of laying.
- Egg weight, egg mass and feed conversion during the first at the first 90 days of laying.

Table (1): Number of sire, dams and progeny which used in the selected program which used in experimental work.

Generation	Selected line			Control line		
	Sires	Dams	Progeny	Sires	Dams	Progeny
0	20	200	960	9	80	240
1	22	200	1000	10	90	280
2	20	200	980	10	80	260
Total	62	600	2940	29	270	780

Statistical analysis:

Data collected were subjected to ANOVA applying the General Linear Models Procedure of SAS software (SAS, 1990). Duncan's multiple range test (1955) was used to detect the significance of the differences between means of the generations, lines and sexs.

Model: $Y_{ijkl} = u + G_i + L_j + S_k + (GL)_{ij} + (GS)_{ik} + (LS)_{jk} + (GLS)_{ijk} + e_{ijkl}$

Where:

Y_{ijkl} = an observation, u = overall mean, G_i = the fixed effect of i^{th} generation, L_j= the fixed effect of j^{th} line, S_k the effect of k^{th} sex, and $(GL)_{ij}$, $(GS)_{ik}$, $(LS)_{jk}$ and $(GLS)_{ijk}$ are the interaction between the main effects studied, and e_{ijkl} = random error.

The realized genetic gain per generation was estimated as a deviation of the selected line mean from the control line mean according to the numerator of the following equation after Guill and Washburn, (1974) for estimating realized response.

$$R_t = (S_t - S_{t-1}) - (C_t - C_{t-1})$$

Where: R_t realized gain due to selection in the t^{th} generation and S and C averages performance of the selected and the control populations.

Heritability from the sire variance component for the studied traits and the phenotypic and genetic correlations between them were estimated according to the equations given by Becker (1985).

RESULTS AND DISCUSSION

Least-Squares Means and Standard errors:

Least-square means for body weight at different ages as affected by sex, line and generation are presented in Table (2).The results indected that the generation had a significant effect on body weight at hatch, 4, 8 and 12 weeks of age. Where body weight at hatch was decreased significantly in the 3rd generation than the 1st and 2nd in selected line, Moreover, chicks for the selected line in the three generations were heavier (p<0.01) compared to the control ones at 4, 8, and 12 weeks of age Also male in the two lines had heavier weight than females at 8 weeks of age. Selection for high body weight at different ages result a positive change for males and females. These results of body weight are agreement with those obtained at different ages of local strains by Abdel-Halim (1999); El-Tahawy (2000); Kosba *et al.* (2002); Abdel-Ghany (2006) and Balat *et al.* (2008).

Table (2): Least squares and standard errors of body weight during growing period for the males and females over three generations of selection.

Gen.	Line	Body weight at different ages					
		BW0	BW4	BW8		BW12	
		Comb.sex	Comb.sex	Male	Female	Male	Female
G1	S.	34.39 ±0.29	222.19±1.15	569.64±4.20	435.00±4.70	921.33±6.56	750.82±4.93
	C.	34.11±0.19	218.89±1.36	573.88±7.39	471.68±6.72	918.95±11.21	740.00±7.09
	Av.	34.24±0.10	221.35±0.92	570.72±3.69	444.03±4.09	920.72±5.65	748.16±4.47
G2	S.	34.76±0.11	248.44±1.33	547.59±3.76	443.47±3.30	880.36±5.80	739.82±6.42
	C.	33.73±0.14	230.16±0.75	579.82±7.80	479.82±7.80	893.85±9.86	759.56±10.52
	Av.	34.65±0.09	243.87±0.99	554.22±3.47	453.71±3.36	883.14±5.04	745.69±4.60
G3	S.	35.15±0.11	260.14±4.65	551.91±4.59	425.75±2.74	868.53±4.00	736.49±3.88
	C.	33.83±0.17	236.07±2.72	577.39±5.34	483.76±4.07	926.02±7.04	801.29±5.65
	Av.	34.89±0.13	254.12±3.58	558.28±3.74	445.25±2.70	882.91±3.77	752.69±3.61
Significances							
Generation		*	*	*		*	*
Line		*	*	**	**	**	**
Sex				**	**	**	**
G*L		*	*	*	*	*	*

G1= First generation G2= Second generation G3=third generation *= significant at 0.05
****= significant at 0.01 S=selected line C = control line Av.= Average**
BW0= Body weight at hatch BW4= Body weight at 4 weeks of age
BW8=Body weight at 8 weeks of age BW12= Body weight at 12 weeks of age.

Concerning growth rate at the different periods of age, the differences between generations and lines (Table 3). It was observed that there were significant differences between growth rates during the early period of growth (0-4), (0-8) and (8-12) in two lines, but was decreased significantly (0,01) in the 3thgeneration than 1 and 2 generations in both lines, chicks for the selected line in three generations were heavier (p<0.01) compared to the control at different ages and males in the two lines had heavier growth rate than females at (4-8), (8-12), Table 3. The realized correlated response for growth rate was positive at different ages except at (4-8) Table (4).These results of growth rate are agreement with those obtained at different ages by Rizkalla and El-Hossari (2002); Ghanem (2003) and Balat *et al.*(2008).Which indicated that selection for egg number decreased body weight at 8 weeks of age and growth rate at (4-8).

Table (3): Least squares and standard errors of growth rate during (0-12) weeks intervals for the males and females over three generations of selection.

Gen.	Line	Body weight at different ages						
		Gr(0-4)	Gr(4-8)		Gr(8-12)		Gr(0-8)	
		Comb.sex	Male	Female	Male	Female	Male	Female
G1	S.	146.01±0.31	84.33±0.91	65.78±1.25	47.19±0.58	53.94±0.90	180.68±0.17	178.26±0.15
	C.	145.85±0.39	96.29±1.23	90.21±1.13	46.17±0.96	44.48±1.48	177.36±0.32	172.64±0.39
	Av.	145.97±0.25	93.18±0.77	91.65±0.55	46.93±0.48	51.61±0.79	177.17±0.40	170.63±0. 28
G2	S.	150.25±0.26	71.07±0.61	60.06±0.75	46.56±0.49	50.13±0.63	183.22±0.13	180.75±0.15
	C.	148.83±0.22	98.88±1.08	90.56±0.92	42.69±1.33	45.56±0.78	177.53±0.30	173.37±0.40
	Av.	149.89±0.20	85.88±1.01	85.94±0.88	45.79±0.48	48.81±0.51	176.17±0.17	171.27±0.20
G3	S.	151.13±0.29	68.55±0.84	53.99±1.14	44.96±0.68	53.48±0.60	182.62±0.17	181.54±0.15
	C.	149.29±0.45	99.02±1.22	96.98±2.10	46.42±0.88	49.48±0.63	177.71±0.26	173.76±0.25
	Av.	150.67±0.25	77.65±1.34	80.73±1.53	45.32±0.55	52.48±0.48	176.20±0.17	170.45±0.19
Significances								
Generation		*	*	*		*	*	*
Line		*	*	**	**	**	**	**
Sex			*	**	**	**	**	**
G*L		*	*	*	*	*	*	*

G1= First generation G2= Second generation G3=third generation
***= significant at 0.05 **= significant at 0.01 S=selected line**
C = control line Av.= Average Gr(0-4)= growth rate during (hatch - 4weeks)
Gr(4-8)= growth rate during (4 – 8 weeks) Gr(8-12)= growth rate during (8-12weeks)
Gr(0-8)= growth rate during (hatch - 8weeks)

The means of age at sexual maturity (days) for different generations, are presented in Table (4). Were 170.19, 167.77 and 161.63 days for the selected line and 175.93, 174.45 and 175.43 for the control line, respectively. The selected line pullets matured earlier than of the control line. Decreasing sexual maturity of selected line during the 2, 3 generations reflected the effect of selection for high egg number. El-Wardany *et al.*(1992);Abdel-Halim (1999); Younis and Abdel-Ghany (2004), Abdel-Ghany(2006) and Aly *et al.* (2010).

Body weight at sexual maturity for selected line had negative correlation with egg number at first 90 days of laying, Table 4. Significant differences were found between selected line and control lines as well as between generations. El-Wardany *et al.*(1992);Abdel-Halim (1999); Younis and Abdel-Ghany (2004), Abdel-Ghany(2006), Average egg weight during 90 days of laying for selected line had negative correlation with egg number at first 90 days of lying. Significant differences were found between selected line and control lines as well as between generations. Egg mass during 90 days of laying for selected line had positive correlation with egg number at first 90 days of laying. Significant differences were found between selected line and control lines as well as between generations. These results are in agreed with those obtained by El-Wardany *et al.*(1992);Abdel-Halim (1999); Younis and Abdel-Ghany (2004), Abdel-Ghany(2006) and Aly *et al.* (2010). Feed conversion (feed intake, kg / Egg mass, kg) at first 90 days of lying affected by line and generation are presented in Table (4).

During first 90 days of lying in Table (4). Significant differences were found between selected line and control lines as well as between generations. These results were closely in agreement to those reported by Saleh *et al.* (1994), Younis and Abdel-Ghany (2004), Abdel-Ghany (2006) and Aly *et al.* (2010). Negative genetic and phenotypic correlations were found between egg number and age at sexual maturity and feed conversion while positive correlations were found between egg number and egg weight and egg mass

Table (4): Least squares means and standard errors of body weight at sexual maturity, age at sexual maturity,(egg number, egg weight, egg mass and feed conversion) at 90 days of laying in Mandarah strain selected and control over 4 generations.

Generations	Line	ASM	BWSM	EN	EW	EM	F.conv.
G1	Selected	170.19±0.89	1500.65±4.65	45.59±0.59	48.59±0.09	2219.21±14.89	5.02±0.07
	Control	175.93±1.56	1528.25±7.35	37.45±0.54	49.63±0.13	1861.64±16.45	6.85±0.13
Overall mean		171.96±0.99	1510.78±4.35	43.50±0.64	48.98±0.16	2109.42±18.66	5.78±0.29
G2	Selected	167.77±0.97	1490.56±4.33	47.12±0.75	48.93±0.07	2380.19±12.32	4.49±0.06
	Control	174.45±0.95	1560.23±7.32	38.89±0.84	50.31±0.06	1979.62±14.55	5.99±0.12
Overall mean		170.05±0.87	1512.90±4.38	45.14±0.77	49.99±0.08	2219.90±11.36	5.01±0.19
G3	Selected	161.63±0.93	1493.80±4.68	50.44±0.59	49.38±0.09	2586.65±22.31	4.19±0.06
	Control	175.43±1.64	1579.50±7.42	39.11±0.78	50.89±0.14	1996.38±19.24	5.88±0.11
Overall mean		166.65±1.12	1521.15±4.35	46.75±0.68	50.01±0.13	2389.51±16.25	4.99±0.08
Significances							
Generation (g)		***	*	***	**	***	**
Line(L)		***	**	***	***	***	***
G*L		*	*	*	**	*	*

G1= First generation G2= Second generation G3=third generation *= significant at 0.05 **= significant at 0.01 ASM=Age at sexual maturity, BWSM=body weight at sexual maturity, EN=egg number during the first 90 days of laying, EW=average egg weight during the first 90 days of laying, EM=egg mass (first 90 days of laying) F.conv.= Feed conversion (first 90 days of laying)

Genetic parameter:

Heritability:

The estimated h^2 for body weight at different ages for the selected and control lines are presented in Table (5). H^2 for selected line and control line for most subsequent body weight at (0, 4, 8 and 12 weeks of age) were moderate (0. 29, 0.35, 0.48 and 0.21), respectively for selected line and (0.26, 0.37, 0.53 and 0.37), respectively for control line. Generally, one can concluded that genetic selection at early ages may gave rapid improvement in growth of these local strain Abdel-Latif and El-Hammady (1992), Enab (2000), Kosba *et al.* (2002), Ghanem (2003), Abdel–Ghany (2006) and Balat *et al.*,(2008), who reported that heritability values of body weight at 4 weeks in local strains of chicken ranged from (0.13 to 0.66).

The estimated of heritability (h^2) were obtained according to sire variance component of egg production traits for selected and control lines are presented in Table (6), and they were in good agreement with that estimated by Abdou and Kolestad (1979), Enab (1991) and El-Wardany and Abdou (1993).

Table (5): Heritability (diagonal), genetic correlation (above diagonal) and phenotypic correlation (below diagonal) between body weight traits for selected and control lines.

trait	Bw0	Bw4	Bw8	Bw12
	Selected line			
Bw0	0.136±0.12	0.297	0.168	0.226
Bw4	0.453	0.323±0.09	0.895	0.713
Bw8	0.511	0.143	0.582±0.16	0.337
Bw12	0.387	0.498	0.469	0.614±0.14
	Control line			
Bw0	0.161±0.08	0.192	0.242	0.187
Bw4	0.481	0.316±0.19	0.811	0.697
Bw8	0.411	0.521	0.532±0.17	0.371
Bw12	0.334	0.402	0.293	0.598±0.12

Table (6): Heritability (diagonal), genetic correlation (above diagonal) and phenotypic correlation (below diagonal) between egg production traits for selected and control lines.

Traits	ASM	BWSM	EN	EW	EM	F.Conv.
Selected line						
ASM	0.621±0.224	0.364	-0.392	0.079	0.331	0.211
BWSM	0.311	0.415±0.223	0.279	0.292	0.397	0.374
Egg number	0.367	0.412	0.353±0.264	-0.315	0.798	-0.241
Egg weight	0.324	0.34	-0.412	0.592±0.182	0.297	0.312
Egg mass	0.362	0.432	0.178	0.323	0.393±0.233	0.185
Feed conversion	0.019	0.386	0.137	0.351	0.295	0.372±0.320
Control line						
ASM	0.492±0.214	0.487	-0.598	0.457	-0.612	0.126
BWSM	0.413	0.213±0.114	-0.079	0.574	-0.112	0.345
Egg number	0.289	0.493	0.382±0.119	-0.446	0.897	-0.114
Egg weight	0.398	0.678	0.712	0.321±0.114	-0.076	0.378
Egg mass	0.312	0.546	0.234	0.298	0.365±0.191	0.326
Feed conversion	0.175	0.297	0.314	0.126	0.179	0.223±0.171

The h^2 estimates of age at sexual maturity (ASM) were high (0.62) and moderate (0.49) for selected and control lines, respectively. Result in the present study is higher than those reported by El-Full(2001),and Ghanem (2003)and agreement with those reported by Balat *et al*, (2008).The heritability estimates of age at sexual maturity (ASM)over two generations in Mandarh. The results reflect the possibility of improving egg production through selection for early sexually maturity birds. The h^2 estimates of body weight at sexual maturity (BWSM) was moderate (0.41) for selected line and low (0.21) for the control line. The results agreement with those reported by Kosba *et al*,(2006). The h^2 estimates of egg number was moderate (0.35 and 0.38) in both lines, respectively. Similar estimates were found with Kosba *et al*, (2002), Younis and Abdel-Ghany (2004), Abdel-Ghany (2005), and Balat *et al*, (2008).While, Singh and Singh (1985) found high heritability values. The h^2 estimates of egg weight were high for the selected line (0.59), while it was moderate for the control line (0.32). The results agreement with those reported by Kosba *et al.*(1997), Enab *et al.*(2000), and Balat *et al.*(2008). The

h^2 estimates of egg mass were moderate (0.39 and 0.36) for both the selected line and the control lines, respectively. These values were agreement with those reported by Abdella (2006) and Balat *et al.* (2008). Concerning, feed conversion was moderate for the selected line (0.37), while it was low for control line. Generally, heritability estimates based on sire component were higher for the selected line than the control line. This result indicated that selection affected the heritability estimates as found by Kosba *et al.*(2002) and Balat *et al.* (2008) who reported that heritability increased by selection.

The heritability estimates and other parameters of population over many generations for body weight at the different ages studied, egg production traits and feed conversion of selective breeding are necessary for an understanding of the problems involved in the formulation of efficient breeding plans partial improved flocks Balat *et al.*, 2008.

Genetic correlations:

Genetic correlation among body weight at the different ages for both selected and control lines were positive (Table 7). Moreover, low between BW at hatch and both BW4, BW8 and BW12, while that between BW4 and BW8 and BW12 weeks were high (0.89 and 0.71) for selected line and (0.81 and 0.69) for control line. Kosba *et al.*, 2006 and Balat *et al.*, 2008 found very low estimates of genetic correlation between BW at hatch and BW8.

Table (7): Genetic correlation between body weights, egg production traits for selected and control lines.

Traits	**Selected line**			**Control line**		
Line	**BW4**	**BW8**	**BW12**	**BW4**	**BW8**	**BW12**
Age at sexual maturity	-0.361	-0.312	-0.232	0.063	0.031	0.124
Body weight at sexual maturity	0.593	0.298	0.236	0.687	0.836	0.546
Egg number	0.211	-0.354	-0.246	0.261	-0.313	-0.215
Egg weight	0.235	0.087	0.014	-0.316	-0.567	-0.412
Egg mass	-0.163	-0.021	0.039	0.084	0.184	0.034
Feed conversion	0.124	-0.106	-0.169	0.144	-0.111	-0.107

The genetic correlations estimates among egg production traits are presented in (Table 7). Genetic correlation estimates for age at sexual maturity were positive with all egg production traits studied except with egg number it was negative the selected line. There were positive and relatively low estimates of genetic correlation between ASM and egg weight and feed conversion, also there were positive and relative low estimates of genetic correlation between BWSM and EN and EW, and moderate with EM and Feed conversion. Estimates of genetic correlation was negative and moderate between egg number and egg weight (-0.31), while it was high with egg mass (0.79). There results agreement with those reported by Balat *et al.*, (2008).

The control line, the genetic correlation of ASM were positive with BWSM (0.48) and (0.45) with EW, while they were negative and high (-0.59) with EN and EM (-0.61), there were positive and relatively low estimates of genetic correlation between ASM with feed conversion (0.12). Estimates of rg between BWSM with both EN and EM traits were negative and low, while it was positive and high with EW and moderate with feed conversion. The rg was negative and moderate between EN with EW (-0.44), high with EM and negative and low with feed conversion (-0.24). The rg was negative and low between EW with EM (-0.076) and positive and moderate with feed conversion (0.37).Generally, the highly genetic correlation between any two traits, indicated that selection in trait improve the other trait indirect.

Phenotypic correlations:

The phenotypic correlation among body weight traits for selected and control lines for Mandarah strain are presented in Table (8). The rp estimates of both the selected and control lines were positive and moderate among BW traits studied except rp between BW4 and BW8 for the selected line which had low estimated (0.14).

Table (8): phenotypic correlation between body weights, egg production traits for selected and control lines.

Traits	**Selected line**			**Control line**		
Line	**BW4**	**BW8**	**BW12**	**BW4**	**BW8**	**BW12**
Age at sexual maturity	0.261	0.492	0.298	0.374	0.414	0.325
Body weight at sexual maturity	0.211	0.346	0.313	0.276	0.373	0.336
Egg number	0.312	0.497	0.342	0.283	0.397	0.213
Egg weight	0.389	0.501	0.376	0.489	0.549	0.514
Egg mass	0.343	0.456	0.298	0.302	0.346	0.312
Feed conversion	0.114	0.291	0.178	0.110	0.261	0.231

The phenotypic correlation rp among all egg production traits were positive and the range is between low and moderate estimates (0.019-0.432) for the selected line, Table (8). Concerning the control line, result showed positive and moderate rp between ASM with BWSM, EN, EW and EM (0.413, 0.289, 0.398 and 0.312), respectively, while it was low between ASM with feed conversion (0.175), Table (8). Estimates of rp were positive and moderate between BWSM and both of EN, EW, and EM and feed conversion (0.493, 0.678, 0.546 and 0.297), respectively, Egg number had positive and high rp (0.712) with EW, while it was moderate with EM and feed conversion. In addition, rp was positive and moderate between EW with EM (0.298), and low with feed conversion. These results are in agreement with those reported by Enab *et al.*, (2001), Abdel-Ghany (2005) and Balat *et al.*,(2008).and different results were found by Sheble *et al.*, (1991), Francesch *et al.*, (1997), Enab *et al.*,(2001), Abdel-Ghany (2005), Abdella (2006), Enayat, (2006), Saleh *et al.*, (2006)and Balat *et al.*,(2008).

Genetic correlation among egg production and body weight trait:

The genetic correlation among egg production and body weight traits for selected and control lines are presented in (Table 8). In the selected line, genetic correlation between BW4 and body weight at sexual maturity was positive and high (0.59), while estimates were moderate with EN (0.21) and EW (0.23) and positive and low between BW4 with feed conversion. The rg estimates were negative and moderate with age at sexual maturity (-0.36) and low with egg mass (-0.16). Concerning rg between BW8 and egg production traits, all estimates were low and moderate, genetic correlation between BW8 and body weight at sexual maturity was positive and moderate

(0.29), positive and low with egg weight and feed conversion (0.087, 0.106). The rg estimates were negative and moderate with age at sexual maturity and egg number (-0.31 and -0.35), genetic correlation between BW12 and body weight at sexual maturity was positive and moderate (0.23), and positive and low with egg weight, egg mass and feed conversion (0.014, 0.039 and 0.169), respectively, and

the rg were negative and moderate with age at sexual maturity and egg number (-0.23 and -0.24). Concerning for control line, genetic correlation between BW4 and body weight at sexual maturity was positive and high (0.68), while estimates were moderate with EN (0.26) and positive and low between BW4 with age at sexual maturity, egg mass and feed conversion (0.063, 0.084 and 0.144), while estimates were negative and moderate with EW(-0.316). Concerning rg between BW8 and BW12 with body weight at sexual maturity was positive and high (0.83 and 0.54), while with age at sexual maturity, egg mass and feed conversion and negative with egg number and egg weight. Balat *et al.*, (2008) found the genetic correlation between egg production and body weight traits showed a different genetic pattern in both selected and control lines. It could be concluded that selection for increased egg number during the first 90 days of laying in Mandarah strain decreased body weight and growth rate at different age.

Phenotypic correlations among egg production and body weight traits:

The estimates of phenotypic correlation rP among egg production and body weight traits are presented in Table 8. Results showed positive and moderate rP values between BW4 and all egg production traits studied for both the selected and control lines except that with feed conversion for two lines which had low values (0.11). Concerning rP between BW8 and BW12 with egg production there were positive and moderate with all egg production traits studied for both the selected and control lines. In general, positive genetic and phenotypic correlations were found between body weight at 12 weeks of age with body weight at sexual maturity, egg weight and egg mass, while was negative value with age at sexual maturity, egg number and feed conversion for egg production.

Realized correlated response:

Table (9) shows the cumulative realized correlated response for body weight was negative at BW8 for male (-21.24) and positive for female (76.24), and body weight was negative at BW12 for two sex(-59.87, -75.62), but at BW0 and BW4 was positive (1.23, 20.27).These results of body weight are agreement with those obtained at different ages by Abdel-Halim (1999); El-Tahawy (2000); Kosba *et al.* (2002); abdel-Ghany (2006) and Balat *et al.* (2008).

Table (10) shows the realized correlated responses of age at sexual maturity, body weight and egg production traits as result of selection for increase egg number during the first 90 days of laying. Negative correlated responses with age at sexual maturity were noticed (-8.06days), body weight at sexual maturity (-58.10 g), average egg weight in the first 90 days of age (-0.47g). Similar results were reported by Enab (1982) , El Wardany *et al.*, (1992) and Yonis and Abd El Ghany (2004) . Selection for increase egg number during the first 90 days of laying casued improving egg mass and feed conversion ,while realized correlated responses of egg mass during the first 90 days of laying , (232.7) , Realized correlated responses of feed conversion were (0.17).El- Tahawy (2000) reports similar values for more of the previous relationships.

Table (9): Realized correlated response for growth traits in selected line by sex after two generations.

Traits	Realized response								
	Male			Female			Comb.Sex		
	G1	G2	Cumulative	G1	G2	Cumulative	G1	G2	Cumulative
BW0							1.05	0.18	1.23
BW4							14.48	5.79	20.27
BW8	-27.99	6.75	-21.24	0.33	75.91	76.24			
BW12	-15.87	-44.00	-59.87	-30.56	-45.06	-75.62			
Gr (0-4)							1.26	0.42	1.68
Gr (4-8)	-15.85	-2.66	-18.51	-6.07	-12.49	-18.56			
Gr (0-8)	2.37	0.75	3.12	1.76	0.40	2.16			
Gr (8-12)	2.88	5.36	8.24	4.89	-0.57	4.32			

G1= First generation G2= Second generation Gr(0-4)= growth rate during (hatch – 4 weeks) Gr(4-8)= growth rate during (4 – 8 weeks) Gr(8-12)= growth rate during (8-12weeks) Gr(0-8)= growth rate during (hatch - 8weeks) BW0= body weight at hatch BW4= body weight at 4 weeks of age BW8 = body weight at 8 weeks of age BW12 = body weight at 12 weeks of age.

Table (10): Realized response for unselected traits in selected line by generation in egg production.

Traits	Realized response		
	Generation 2	Generation 3	Cumulative
Age at sexual maturity (day)	-0.94	-7.12	-8.06
Body weight at sexual maturity (g)	-42.07	-16.03	-58.10
Egg number at the first 90 days (egg)	0.09	3.10	3.19
Average egg weight at the first 90 days (g)	-0.34	-0.13	-0.47
Egg mass the first 90 days (g)	43.0	189.7	232.7
Feed conversation the first 90 days (g/g)	0.33	-0.19	0.17

In general, the results of the present selection experiment that selection for increased egg number during the first 90 days of laying in Mandarah strain decreased body weight and growth rate at different age. Heritability estimates based on sire component were higher for the selected line than the control one, which indicated that selection affected the heritability estimates.

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الأنتخاب لتحسين إ نتاج البيض فى دجاج المندرة لتعظيم صافى العائد :
1 - الأستجابة المرتبطة ، القيم الوراثية لصفات إنتاج البيض والنمو

فوزي على عبد الغنى و عبد الغنى إبراهيم عبد الغنى
معهد بحوث الإنتاج الحيوانى – مركز البحوث الزراعية – وزارة الزراعة – الدقى

اجريت هذه الدراسة بهدف قياس الاستجابة المرتبطة والمعايير الوراثية (المكافىء الوراثى، والإرتباط الوراثى والظاهرى لقطيع من سلالة المندرة تم انتخابه بهدف تحسين عدد البيض الناتج خلال ال 90 يوم الاولى من الإنتاج خلال ثلاث أجيال متعاقبة . أوضحت النتائج أن الأنتخاب لتحسين عدد البيض أدى إلى زيادة وزن الجسم عند الفقس 1.23 جرام ووزن الجسم عند عمر 4 اسبوع 20.27 جرام بينما نقص وزن الجسم عند عمر 8 أسبوع (-21.24 جرام) للذكور وزيادة 76.24 جرام للاناث . عند عمر 12 أسبوع نقص الوزن (-15.87جرام ،- 75.62 جرام) للذكور والاناث وكذلك معدل النمو يتزايد زيادة ضئيلة فى كل الفترات ماعدا الاناث فى الفترة (4-8). و وجد ان الأستجابة المحققة والمتوقعة بعد جيلين من الأنتخاب لصفة تبكير عمر البلوغ الجنسى بمقدار (-8.06 يوم) وتحسنت كتلة البيض (232.7 جرام)و الكفاءة التحولية لتلك الفترة (0.17). ونقص وزن الجسم عند عمر النضج الجنسى (-58.10 جرام) ومتوسط وزن خلال ال 90 يوم الأولى من الإنتاج (-0.47جرام) وكانت قيم المكافىء الوراثى 0.62 ، 0.49 للعمر عند النضج الجنسى و 0.41،0.21 لوزن الجسم عند النضج الجنسى و 0.35 ، 0.38 لعدد البيض و 0.59 ، 0.32 لوزن البيضة و 0.39، 0.36 لكتلة البيض و 0.37 ،0.22 للكفاءة التحولية و 0.13، 0.16 لوزن الجسم عند الفقس و 0.32 ، 0.31 لوزن الجسم عند 4 أسبوع و 0.58 ،0.53 لوزن الجسم عند 8 أسبوع و0.61 ،0.59 لوزن الجسم عند 12 أسبوع لكل من الخطين المنتخب والمقارن على التوالى . التحسين الوراثى فى صفة عدد البيض ارتبطت إيجابياً بكل من وزن الجسم عند 4 أسبوع (0.21) و وزن الجسم عند النضج الجنسى (0.27) وكتلة البيض (0.79) ، بينما كان التحسين الوراثى لصفة عدد البيض ارتبطت ارتباط سالب بكل من وزن الجسم عند عمر 8 أسبوع (-0.35) ووزن الجسم عند عمر 12 أسبوع (-0.24) و عمر النضج الجنسى (- 0.39) و(-0.41)لوزن البيضة . وكانت قيم الإرتباط الوراثى بين عدد البيض وباقى الصفات التى تم دراستها منخفضة .وأظهرت الدراسة ايضاً تبايناً فى قيم الإرتباط الوراثى بين صفات البيض ووزن الجسم عند الأعمار المختلفة. لما سبق يمكن بالأنتخاب لزيادة عدد البيض خلال ال90 يوم الأولى من الإنتاج فى سلالة المندرة أدى لنقص وزن الجسم ومعدل النمو فى بعض الأعمار المختلفة كما ان ارتفاع قيمة المكافىء الوراثى على اساس الأب فى الخط المنتخب عن الخط المقارن يشير الى تأثر المكافىء الوراثى بالأنتخاب .

قام بتحكيم البحث

أ.د / السمره حسن علي أبوعجلة	**كلية الزراعة – جامعة المنصورة**
أ.د / حسن حسن يونس	**كلية الزراعة – جامعة كفر الشيخ**