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GENETIC DIFFERENCES OF SOME PRODUCTIVE AND REPRODUCTIVE TRAITS OF TWO LOCAL BREEDS UNDER DESERT CONDITIONS

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Abstract: *Two local breeds of Fayuomi and Sinai were selected to increase their body weight for two generations. They were reared under desert conditions. Egg number and egg weight were recorded daily from onset of lay to 25 weeks of production. An experiment was carried out to evaluate relationships between productive traits, environmental temperature and relative humidity. In second generation, egg weight of Fayoumi and Sinai breeds increased about 11.6 g and 9.8 g, respectively. Significant differences were found between the two breeds. Rate of lay egg was significantly higher in Fayoumi than in Sinai hens. It was 36.9% and 33.8% for Fayoumi and Sinai hens during the first generation. Egg production improved significantly about 22.4 eggs for Fayoumi and was 19.3 eggs for Sinai in the second generation. Low rate of egg production in first generation might be due to decrease the ambient temperature during the first few hours on winter days. Fertility and hatchability in the first generation were 86% and 76.7% for Fayoumi and 90% and 86.7% for Sinai breed, respectively. Sinai hens had fertility around 4% higher than Fayoumi in first generation and decreased about 12% in second generation. Depressive effect on hatchability might be due to selection for increased body weight. Significant negative linear regression was noted for egg weight (EW) on Maximum temperature (Max), average temperature and relative humidity (RH). The Fayoumi hens showed no significant change for all traits in second generation. A significant linear regression was observed for egg number (EN) and production rate (PR) on all environmental factors in Sinai hens. Phenotypic correlations between productive traits and environmental temperature and RH were estimated. Heritabilities for egg number, egg weight and percent of lay during experimental periods were 0.27, 0.33 and 0.17 for Fayoumi, 0.18, 0.52 and 0.11 for Sinai, respectively.*

INTRODUCTION

Climate is one of main environmental factors that affect poultry production. Genotype by environment interaction is usually described as a situation in which different genotypes (breed, lines, or strain) respond differently to different environments (Sheridan 1990) Reduced broiler performance due to high ambient temperature is well established (Leenstra and Cahaner 1992, Cahaner and Gutman 1993; Eberhart and Washburn 1993). To achive further improvements in the world poultry industry, breeding programs need to identify genotypes that perform better in hot climates (Cahaner, 1990). Genetic and environmental variations for some fitness traits, such as egg production and viability, have been studied in layers. Fertility and hatchability are important traits and were evaluated in parent and grand parent layer stocks, because of their economic value (Gowe *et al,* 1993). Yalcin et al. (1997) found that commercial broiler from three breeding companies differed significantly in their performance under hot summer climate, despite their similar growth rate in spring climate. They noticed effect of breeding under different climatic conditions. Production efficiency of poultry in tropics is still comparatively low. Although, local breeds are superior in adaptability. Complete gene transfer into high yielding populations proved superior to all other methods of genetic improvements of local populations, either by selection or crossbreeding.

In Egypt summer season is characterized by high ambient temperatures. The aim of the present study, to study the egg production of two different local breeds Fayoumi and Sinai under desert conditions. to determine the effect of high, low and normal temperature on the performance of chickens stocks that were bred in different temperature climates. Also to estimate the relation of several characters of the stocks to their respects and to evaluate of possibilities for maximizing genetic progress for the regions which are exposed to permanent environmental stresses.

MATERIAL AND METHODS

The study was carried out in South Sinai Research Station located at Ras Suder. Average annual temperature is 29.7 °C with a range from 19.6 in February to 37.6 °C in August. Temperatures and relative humidity were recorded continuously during the experimental periods. Minimum (Min) and maximum (Max) temperatures were averaged at each month. The experiments were used two local-breeds Fayoumi and Sinai chickens. Data were used from two generations that were carried out with different climates data. A total of 3800 eggs were collected from the two breeds during two generations. Seven hundred and twenty laying hens were selected for body weight at 8 weeks of age. Selection for body weight was made through independent culling levels, where the progeny of males or female below 700 grams was discarded. Individual selection was based mainly on selection in that individual hens that failed to lay were of course never selected and selected females that had very low production records did not contribute to the next generation. In each selection line 40 cockerels were mated to 360 hens, each male being mated to five females. In first the generation, 1470 chicks produced from 1800 eggs and 1322 chicks produced from 2000 eggs in second generation. At hatch, pedigreed chicks were wing banded and housed on deep litter in an open house from 1 to 112 days of age at a housing density of $10/m^2$. At the age of four weeks chicks were classified by sex (male, female) and by genotype. Chicks were vaccinated against Marek's and Newcastle diseases. All birds were kept under same managerial and hygienic conditions from hatch up to end of laying period. Water and feed were *ad Libitum* to all birds. Adult birds were allocated in family cages in an open house and were fed a commercial diet of 18% CP, 2900 kcal ME/kg. Some dams either did not lay or had no chicks at hatching and records from chicks that lost their wing-bands before sexing were not included.

The Following Traits Were Studied:

Egg number (EN) and egg weight (EW) were recoded daily from onset of lay to 25 weeks of production. Sexual maturity (ASM) was considered as the age when the first egg was laid. Production rate (PR), hatchability (H), fertility (F) are computed. Body weight at sexual maturity (BW) is measured.

Statistical analysis: The statistical analysis was based on the following:

Model I:

$$Y_{ijkl} = \mu + B_i + G_j + M_k + (B*G)_{ij} + (G*M)_{jk} + e_{ijkl}$$

Where Y_{ijkl} = individual observation of the trait, μ= overall mean of the trait,

B_i= fixed effect of the i[th] breed, G_j = fixed effect of generation,
M_k = fixed effect of Month of production,
$(B*G)_{ij}$= interaction between breeds and generation,
(G*M) interaction between generation and month of production and,
e_{ijkl} = random error.

Model II: $$Y_{ijkl} = \mu + G_i + S_j + S(G)_{ij} + e_{ijkl}$$

Where Y_{ijkl} = individual observation of the trait,
μ= overall mean of the trait,
G_i= fixed effect of the i[th] generation, S_j = random effect of sire,
$S(G)_{ij}$= sire within generation. and
e_{ijkl} = random error.

General linear model procedure of SAS software was used (SAS Institute, 1996). Heritability estimates for productive and reproductive traits were calculated as:

$$h_2\, S = 4(\sigma^2\, S)/ (\sigma^2\, S + \sigma^2\, e)$$

RESULTS AND DISCUSSION

Monthly fluctuations of the min, max, average temperatures and RH during the experiment period are presented in Table 1. The difference between summer and winter months temperature increased to 15 °C. High differences between max and min temperatures during May averaged 15 °C, but the low differences were found in December. They were about 9°C. The RH averaged between 46% and 62 % during the experiment period.

Least square means for monthly egg number, egg weight and production rates were corrected for variations between breeds, generations, month of production and interaction between them. They are given in Table 2. Major changes in the rearing environment for the breeds that were involved in the present study were done in the first generation. The change in each trait might be due to decrease in ambient temperatures in winter months (Jan. – Feb.) during first year production.

Egg Weight:

Table 2 presents the average monthly egg weight in the laying season from sexual maturity till the end of the experimental period. Sinai was higher significantly than Fayoumi by about 5.1 and 3.3 g in the first and second generation, respectively. Soltan (1991) found that Sinai fowl laid heavier eggs 43.3 g than both Fayoumi 37.3 g and Baladi 39.2 g. The differences were statistically significant. Yoo *et al* (1983) and Merat *et al* (1994) reported considerable differences between layer strains in egg weight. They agreed with the results of the present study that imposes a considerable genetic effect on egg size. The genetic influence on egg weight has been reported by Washburn and Marks 1983 and Poggen Poel and Duckitt 1988. It is interested to notice that the egg weight for Fayoumi increased about 11.6 g. However, it was also increased about 9.8 g in Sinai in the second generation. Nordskog and Festing (1962) in Whit Leghorn and Fayoumi showed that selection in egg weight cited 4 and 10 gm increase in egg weight for Fayoumi and Leghorn, respectively.

Egg Number:

Use of part-time record for estimate of the first laying year is a popular practice by poultry breeders. They are interested to record number and average length of pauses in the first 24 weeks of laying. It was found that the two breeds have almost the same averages for the two characters. The average lengths of pauses were 18 days in Fayoumi and 16 days in Sinai females, respectively. Abdel- Gawad and El-Ibiary (1971) reported that the average length of pauses were 10.8, 10.4 and 12.1 days in Fayoumi, Rhoude Island Red and Leghorn breeds, respectively. The average number of eggs in first ninety days of age was 35.1 eggs for Fayoumi. Abdou and Kolstad (1984) cited that the egg number till first 90 days of egg production were 54, 44 and 41 eggs in White Leghorn, Fayoumi and White Baladi, respectively.

Egg Production:

The rate of lay egg was significantly higher in Fayoumi than Sinai hens. The average rate of production for first generation was 36.9% compared to 33.8% for Sinai hens during the laying period. The mean egg production was improved significantly in second generation. They were about 22.4 and 19.3 eggs in Fayoumi and Sinai breeds, respectively. Fayoumi laid highest number of eggs with highest rate. Statistically, there were significant differences in EN, EW and EP. El-Wardany (1987) recorded an increase of 2 g in egg weight of Norfa strain over control during developing egg weight strain of Norfa chicks through 2 generations. The egg number till 60 weeks of age decreased. High adaptablity efficiency of the Fayoumi and Sinai chickens was recorded. It was apparently due to their low egg production during cold stress with the change from normal to low ambient temperatures. After the first generation decrease of the egg production during the winter months was apparently managed due to low temperatures. The birds returned to their level of production under normal temperatures after adaptation to the cold temperatures. High variation in egg production was found in Fayoumi and Sinai hens when pullets were reared under the same conditions. Ensminger *et al.* (1990); Spinu and Degen 1993 and Sari (1993) reported that low ambient temperature causes some adverse effects. Low ambient temperature causes some adverse effects including increased feed intake, and decreased egg production, feed efficiency in poultry (Arad and Marder 1982). At temperatures above or below thermo neutral zone, corticosteroid secretion increases in response to stress (Brown and Nestor 1973). By effects of stress such as cold as cold stress-related depression in poultry performance (Mc Dowell, 1989).

Age at Sexual Maturity

Age at sexual maturity (SM) was found lowest in Fayoumi than Sinai breeds in both generations. The age at first egg was earlier by about 29 days in Fayoumi hens as compared to the second generation. Mean value for Fayoumi hens was early by about 10 days as compared to Sinai hens in the second generation. Fayoumi had early sexual maturity, more egg production and low mortality (Hossori et al 1992 and Barua et al 1998). The age at sexual maturity was similar between the strains. The average was 131 days in the first generation. Significant differences were noticed between Fayoumi and Sinai in the second generation. Abou El-Ghar and Abdou (2004) found that the average of age at sexual maturity was 159.2 days in Norfa chicken. Brody *et al.* (1984) suggested that there is a body weight of threshold for the onset of sexual maturity. Delay in SM for Sinai birds appear to fit the threshold concept. Small birds reached body weight similar to that of the Fayoumi breed by sexual maturity. Bakir *et al,* (1988) who reported that age at sexual maturity ranged from 166 to 184 days in parental breeds (W.P. Rock, Sinai and W. Cornish), while these means ranged from 172 to 196 days in crossbreds. Hossari et al, (1992) found that the Fayoumi strain was early in maturity. It was 172 days for Fayoumi, 199 days for Gold Montazah, 172.9 days for Gimmizah, and as 163 days for Silver Montazah strains. In the current study, the Fayoumi birds are more responsive to light than the Sinai counterparts. Alternatively hypothalamic maturity of the Fayoumi birds may be early allowing them to respond to increasing photoperiod more quickly. However, other factors such as small population size, inbreeding, natural selection, change in fitness and/or approach to genetic physiological limits may also influence the rate of response.

Body Weight at Sexual Maturity

The body weight of Sinai strain was significantly higher than that of the Fayoumi breed. The relationship was reversed because of increased time to the sexual maturity in Sinai birds. The Fayoumi bird weighed 1420 g as an average compared to 1740 g for Sinai bird ($P \leq .01$) at sexual maturity in the second generation. Horst (1981) found that negative relationship between body size and productivity under hot environment conditions. The body weight related depressive effect of heat produced not only differences between populations but also systematic genotype x environment interactions in growth, laying intensity, feed consumption and egg weight.

Fertility And Hatchability:

Least square means for reproductive traits during two generations in Fayoumi and Sinai breeds are presented in Table 3. Observed general means for F and H in the first year production under desert condition were 86% and 76.7 % for Fayoumi and 90% and 86.7% for Sinai, respectively. Gowe et al (1993) reported means of 95% for F and 88% for H in the first laying cycle of White Leghorn. Their results are similar to the obtained results in this study. The Sinai hens had F around 4% higher than Fayoumi in the first generation. It was decreased about 12% in the second generation. The effect of generation was also highly significant for fertility and hatchability. It had a strong influence on genetic group performance. Depressive effect on hatchability might be due to selection for body weight. Hossari et al (1992) reported that the fertility means for RIR, WL, Fayoumi and average of developed strains were 40.5, 88.6, 45.4, and 92.3% respectively.

Regression Coefficients:

Linear regressions coefficients of means for productive traits on environmental temperature and RH are presented in Table 4. Overall environment fluctuation trend was not significant for incidence of egg number and production rate as estimated by linear regression. Negative regression coefficients were observed for RH on productive traits in both generations. Significant negative linear coefficient was noted for egg weight on max, average temp. and RH. The Fayoumi hens showed no significant changes for all traits in the second generation. Positive significant regression coefficient was observed for egg number on average temp. and for egg weight on min temp. Significant linear regression coefficient was observed for egg number and egg production on all environmental factors in Sinai hens. No changes were noted for egg weight in both generations.

Phenotypic Correlation

Phenotypic correlations between productive traits, the environmental temperature and the relative humidity are given in Table 5 a and b. There was no correlation between average temp. And productive traits in Fayoumi during first generation. The Fayoumi had significant relationship between productive traits and max, min and average temperatures in the second generation. Negative correlation was recorded for RH in both generations. The phenotypic correlation between egg number and egg weight was negative and significant. This result is in agreement with the result reported by Sewalem, (1998). He found negative genetic correlation between egg number and egg weight. The phenotypic correlation was also negative and very low between min, max temp., the EW and EPR in the first generation. The relationships were positively significant in the second generation. The results of the present study indicate that the phenotypic relationship between environment temperature and many correlated traits changed with selection particularly in magnitude.

Heritability:

It seems that genetic differences between the breeds for egg production traits as well as for the genetic parameters of the traits are not well known for Sinai strain. There are extensive literature concerning genetic parameters of egg number and egg weight in poultry. The heritabililties for EN and EW were very similar according to Besbes et al 1992; Hagger 1994; Jeyarubau and Gibson 1996. They were low according to Wei and Van der Werf 1993; Hagger 1994; and Mielenz et al 1994. The estimates of the heritability of the traits were affected by breed difference. Some reports were in agreement with the results that are shown in Table 5 a and b. The Sinai was the heaviest body weight than Fayoumi breed. It had the highest estimates (0.52). The Fayoumi had (0.27) for egg weight. The estimates of heritability for EN were 0.33 in Fayoumi and 0.18 in Sinai. Selection for increased body weight determined depressive effects in fertility and hatchability, which were not eliminated through management practices. Gowe *et al,* (1983) reported that the effects of selecting for body weight which is negatively correlated to the traits that determine fertility and hatchability.

Table 1: Meteorological data of Ras Sudr experimental station Minimum (min), maximum (max), average temp. (average) and Relative humidity (RH) during 2001 and 2002 .

Month	2001				2002			
	Min	Max	Average	RH	Min	Max	Average	RH
January	8.4	20.6	14.5	61	8	20.1	14	60
February	8.5	20.3	14.4	56.5	7.2	19	13.1	60
March	10.2	22.7	16.5	52	9.5	21	15.3	52
April	13.6	28.0	20.6	46.5	13.0	25.9	19.5	48
May	18.1	33.1	25.6	48	18	33	25.5	49
June	21.4	34.1	27.8	49.5	21	34.8	27.9	50
July	22.5	36.7	27.6	50	22	37.2	29.6	50
August	23.5	37.8	30.7	54	23	37.5	30.3	52
September	20.7	34.1	27.1	56.5	21	35.1	28.1	58
October	17.6	29.8	23.7	57	17.5	29.3	23.4	58
November	14.1	26.1	20.1	62.5	15.1	26	20.6	61
December	10.0	21.6	15.8	59	12	21.5	16.8	60

Table 2: Least square means of monthly egg number, egg weight and rate of production effects of genotype, generation and month of production.

Traits	Month	Genotype			
		Fayoumi		Sinai	
		1st Generation	2nd generation	1st Generation	2nd generation
Egg Number egg – (EN)	Oct.	42.3±20.3	58.7±22.5	20.6±8.1	41.6±19.7
	Nov.	68.6±16.6	55.6±8.5	35.8±14.0	52.4±17.4
	Dec.	8.8±7.9	61.4±12.9	2.7±3.1	57.4±19.5
	Jan.	9.5±11.1	91.8±6.9	17.1±11.3	59.2±6.9
	Feb.	103.3±32.9	86.8±14.7	75.4±22.4	56.6±14
	Mar.	93.0±6.6	73.1±29.0	78.2±5.1	51.8±6.5
Average		48.9±41.4	71.3±22.3	34.1±30.1	53.4±16.6
Egg weight g (EW)	Oct.	34.4±4.2	44.3±1.4	42.1±7.8	48.1±2.3
	Nov.	38.4±3.1	47.4±3.8	44.1±9.5	52.7±4.1
	Dec.	36.9±14.9	46.2±25.0	30.1±18.9	51.9±2.2
	Jan.	34.0±18.9	51.2±1.5	48.1±5.2	53.9±2.5
	Feb.	41.1±4.9	51.2±.5	44.6±5.4	53.1±1.9
	Mar.	45.4±5.8	51.5±1.5	45.9±6.9	51.4±1.5
Average		37.0±11.7	48.6±3.5	42.1±11.5	51.9±3.2
Production rate (PR) %	Oct.	30.2±14.8	50.1±19.2	20.6±8.1	43.5±21.9
	Nov.	51.4±11.8	51.5±7.7	35.8±14.0	61.9±17.1
	Dec.	7.1±6.3	61.3±12.9	2.6±3.1	74.1±23.7
	Jan.	7.6±8.9	91.8±6.9	17.1±11.3	78.8±9.1
	Feb.	77.4±21.7	86.8±14.7	74.3±20.7	74.6±14.8
	Mar.	74.4±5.3	72.2±28.8	78.2±5.1	71.4±8.8
Average		36.9±30.9	69.2±23.0	33.8±29.7	67.2±21.3

Table 3: Least square means for reproductive traits during two generations in Fayoumi and Sinai breeds

Traits	Genotype			
	Fayoumi		Sinai	
	1St Generation	2nd Generation	1St Generation	2nd Generation
Age at sexual maturity days (ASM)	132	161	131	171
Body weight at sexual maturity g (BW)	1216	1420	1398	1740
Fertility % (F)	86	88	90	78
Hatchability % (H)	76.7	64	86.7	68.2

Table 4: Linear regressions coefficients± SE of means for productive traits on environmental temperature and Relative humidity.

Regression X/y	Genotype			
	Fayoumi		Sinai	
	1st Generation	2nd generation	1st Generation	2nd generation
EN /Max	.33±7.9 n.s	-14.1±10.9 n.s	35.5±9.9 ***	33.5±9.8 ***
EN/Min	-15.0±11.3 n.s	17.6±10.5 n.s	35.1±9.9 ***	34.1±9.9 ***
EN/average	13.9±7.4 n.s	2.0±18.9 n.s	65.6±17.1 ***	-62.6±17.1 ***
EN/RH	-.75±1.1 n.s	-.72±1.7 n.s	4.4±1.3 ***	3.8±1.3 ***
EW/Max	-22.9±4.4 ***	1.78±1.5 n.s	2.27±1.7 n.s	2.6±1.7 n.s
EW/Min	33.5±6.2 ***	1.92±1.4 n.s	1.75±1.7 n.s	1.9±1.7 n.s
EW/average	-10.1±4.1 **	-3.7±2.6 n.s	-3.6±2.9 n.s	-3.9±2.9 n.s
EW/RH	-1.67±.6 **	-.17±.24 n.s	-.20±.23 n.s	-.21±.24 n.s
EP/Max	-1.7±5.5 n.s	-11.9±10.2 n.s	41.4±10.9 ***	43.4±10.9 ***
EP/Min	-8.6±7.8 n.s	19.7±9.9 *	42.3±11.1 ***	42.0±11.1 ***
EP/average	9.5±5.1 n.s	-2.2±17.7 n.s	-77.6±19.1***	-78.0±9.1 ***
EP/RH	-.78±.75 n.s	-.82±1.7 n.s	4.8±1.5 ***	5.0±1.5 ***

N.S = non-significant * = P<0.05, ** = P< 0.01 , *** = P< 0.001

Table 5 a: Heritability (diagonal) and Phenotypic correlations between productive traits and environmental temperature and relative humidity in Fayoumi breed during 1st generation (below diagonal) and 2nd generation (above diagonal).

2nd / 1st	EN	EW	EP	Min	Max	average	RH
EN	0.27±.08	-.38 ***	.98 ***	.43 ***	.47 ***	.44 ***	-.53 ***
EW	-.31 ***	.33±.02	.45 ***	.65 ***	.69 ***	.66 ***	-.64 ***
EP	.99 ***	.32 ***	.17±.o4	.49 ***	.54 ***	.51 ***	-.63 ***
Min	.11 n.s	.007 n.s	.08 n.s		.98 ***	.99 ***	-.74 ***
Max	.13 n.s	-.01 n.s	-.11 n.s	.99 ***		.99 ***	-.81 ***
Average	.08 n.s	-.01 n.s	.06 n.s	.99 ***	.98 ***		-.76 ***
RH	-.52 ***	-.21 **	-.54 ***	.04 n.s	-.03 n.s	.08 n.s	

NS = non-significant * = P<0.05, ** = P< 0.01 , *** = P< 0.001
Pooled heritability estimates for EN, EW and EP

Table 5 b: Heritability (diagonal) and Phenotypic correlations between productive traits and environmental temperature and relative humidity in Sinai breed during 1st generation (below diagonal) and 2nd generation (above diagonal).

2nd / 1st	EN	EW	EP	Min	Max	average	RH
EN	0.18±.11	.01 n.s	.94 ***	.14 *	.16 *	-.14 *	-.25 ***
EW	-.33 ***	.52±.07	.13 n.s	.27 ***	.31 ***	.27 ***	-.44 ***
EP	.99 ***	.33 ***	.11±.08	.33 ***	.36 ***	.33 ***	-.48 ***
Min	-.11 n.s	-.05 n.s	-.11 n.s		.98 ***	.99 ***	-.75 ***
Max	-.06 n.s	-.018 n.s	-.06 n.s	.99 ***		.99 ***	-.81 ***
Average	-.16 *	-.09 n.s	-.16 *	.99 ***	.98 ***		-.76 ***
RH	-.65 ***	-.08 n.s	-.66 ***	-.03 n.s	-.04 n.s	.06 n.s	

NS = non-significant * = P<0.05, ** = P< 0.01 , *** = P< 0.001
Pooled heritability estimates for EN, EW and EP

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الملخص العربي

الفروق الوراثية فى بعض الصفات الإنتاجية والتناسلية فى نوعين من الدجاج المحلى تحت ظروف الصحراء

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أجريت الدراسة بمحطة جنوب سيناء (راس سدر) على نوعين من الدجاج المحلى الفيومي وسينا حيث تم تربيتهم تحت ظروف الصحراء لمدة جيلين متتالين لتقييم الأداء الإنتاجي وعلاقة التغيرات المناخية من درجة حرارة ورطوبة ببعض الصفات الإنتاجية والتناسلية. وكانت أهم النتائج :

وجد أن وزن البيض فى الجيل الثاني للدجاج الفيومي يزيد بحوالي 11.6 جرام فى حين انه يزيد بمقدار 9.8 جرام فى دجاج سينا.كما وجد أن الاختلافات بين النوعين تحت الدراسة كانت معنوية. فكان معدل الإنتاج فى الجيل الأول 36.9% فى الفيومي و 33.8% فى دجاج سينا. كذلك وجد أن إنتاجية البيض تحسنت معنويا بعد الجيل الأول بحوالي 22.4 بيضة فى الفيومي و 19.3 بيضة فى دجاج سينا. أما بالنسبة لمعدل الخصوبة و نسبة الفقس فى أول جيل كانت 86% و76.7 % فى الفيومي وكانت 90% و86.7% فى دجاج سينا. وكانت نسبة الخصوبة فى دجاج سينا أعلى بحوالي 4% من الدجاج الفيومي ووصل الفرق الى 12% فى الجيل الثاني لصالح الفيومي.وقد لوحظ أخفاض نسبة الفقس فى الجيل الثاني والتى ربما ترجع الى الانتخاب لزيادة وزن الجسم الذى له علاقة سالبة مع نسبة الفقس. كذلك تم تقدير قيمة انحدار الصفات الإنتاجية على التغيرات فى درجة الحرارة والرطوبة خلال اشهر الإنتاج وسجلت علاقة انحدار معنوية وسالبة بين وزن البيض و درجة الحرارة القصوى والمتوسط الشهري لدرجة الحرارة والرطوبة النسبية فى الدجاج الفيومي. كما وجد أن التغيرات كانت معنوية فى الجيل الثاني . كذلك سجلت علاقة انحدار معنوية بين عدد البيض ومعدل إنتاج البيض وكل التغيرات البيئية فى دجاج سينا. وتم تقدير درجة الارتباط بين الصفات الإنتاجية ودرجة الحرارة والرطوبة النسبية. كذلك تم تقدير المكافئ الوراثي لكل من عدد البيض ووزن البيض ومعدل الإنتاج البيض وكان المكافئ الوراثي لعدد البيض ووزن البيض ومعدل إنتاج البيض 27, و33, 17, فى الفيومي و 18, 52, 11, فى دجاج سينا على التوالى.