Egypt. J. Anim. Prod. **16**, No. 2, pp. 69-76 (1976)

The Genetic of Non-productive Days (Pause Duration) in a Fayoumi Flock of Chickens

M. A. El-Hossari

Animal Production Department, Ministry of Agriculture, Dokki, Cairo, Egypt.

DATA from three generations of a pedigree flock of Fayoumi chicken were analysed using variance and covariance technic in order to study pause duration.

The results showed that the pooled heritability (h^2) estimate of the three generations of pause duration in five months from December to April (winter pause) was $.254 \pm .082$ and of pause duration during the laying season to 17 months of age had almost the same value $(.251 + .082)$. The sire heritability estimates were larger than the dam estimates which suggest sex-linked effects.

The phenotypic and environmental correlations between the pause measurements and the rate of egg production measurements were significantly negative. The average value were —.604 and —.613 respectively. The average estimate of the genetic correlation was similar in sign and magnitude $(-.624 \pm .094)$.

The genetic correlation between pause duration and body weight at sexual maturity was also negative $(-.321 \pm .126)$, but positive between pause duration and age at sexual maturity $(.401 \pm .179)$.

Pausing in poultry is a complicated problem. More investigations are needed to identify its genetic nature.

Most workers reported that this character is governed by both gentic and environmental factors, although some have suggested that it may be controlled solely by environmental factors.

Lerner and Taylor (1936) concluded that if any gentic interpretation of winter pause could be accepted, the spring pause condition might be governed by factors other than those controlled by winter pause. The same workers (1947) reported that they were able with selection to reduce the incidence of winter pause in white leghorn chickens from 54% to 27% in nine generations, while a control line showed 63% winter pause at the end.

Hays (1951) indicated that winter pause incidence and duration were regulated both by environmental and heredity factors: The heritability (h^2) estimate was 0.34 for pause duration. Season and outside temperature had a great effect on pause duration than length of days, hours of sunshine or inside temperature. Krueger *et al.* (1952) obtained anestimate, of h^2 for duration of long pause (greater than six days), of 0.20 using the correlation between full side and 0.23 using the regression of progeny on rams. The h^2 values for duration of short pause (less than six days) were smaller, 0.16 and 0.21 respectively.

It is generally assumed that a negative correlation usually exists between egg number and pause duration. However, Krueger *et al.* (1962) found positive genetic correlation between total egg production and short pause (0.59).

Long annual pause in the Fayoumi chickens under the Egyptian environmental conditions has been reported by Assem and Ragab (1955) and Issawi and Amer (1958). It will be worthwhile then to study the genetic parameters involving this trait to find out to what extent the genetics and environment are affecting and to indicate its association with other economic traits. It should be possible eventually to determine the criteria of pause which shows the highest inheritance and contributes most to the variation in egg production to be used in selection schemes.

Material and Methods

Data from three generations of a pedigree Fayoumi flocks were collected to study non-productive days. It was suggested to calculate the total pause periods during the laying year till 17 month of every pullet age. Winter pause was also investigated as non-prductive days during five months period from December to April. This period would eliminate hot summer effect as well as long fall pause due to inadequate diet or moulting season. A pause in this study was defined as a period of 10 or more consecutive days of non-production.

Date of hatch for the three generations was as follows :

1. Seven hatches from January to April in the first generation.
2. Seven hatches from January to March in the second generation.
3. Seven hatches from January to March in the third generation.

The two measurements used are :

(*a*) Pause 5 : Pauses duing 5 months from the beginning of December to the beginnisg of May.

(*b*) Pause tot. : Total pauses during the laying season from first egg to 17 months of age.

The genetic, environmental and phenotypic correlation coefficients between the two measurements of pauses and age at sexual maturity (S.M.), body weight at sexual maturity (M.B.W.), and percentage of egg production ($P_1\%$, $P_2\%$, $P_3\%$ and $P_4\%$) were estimated. These traits were measured as follows :

S.M. = Age at sexual maturity was the age when the bird laid its first egg.

M.B.W. = Body weight at first egg laid.

$P_1\%$ = Percentage of egg production to 250 days from the first egg.

$P_2\%$ = Percentage of egg production to 17 months of age.

$P_3\%$ = Percentage of egg production to January the first.

$P_4\%$ = Percentage of egg production to June the first.

The purpose of measuring egg production on a percentage basis is to reduce hatch effect (Lerner and Cruden 1948, Oliver *et al.,* 1957). The advantage of this method is to reduce generation interval and also to reduce but not to eliminate the variance due to the so-called systematic effects (defined as those which can be examined by regression techniques).

In order to remove some of the environmental effects particularly the effect of date of hatch, the values were adjusted, before analysis to their hatch mean as described by Hossari (1966).

Variance and covariance analysis were worked out according to the model shown by Lerner (1958) and by Hossari (1966). The standard errors of the h^2 and genetic correlation estimates were calculated as the method showed by Falconer (1960) and Robertson (1959) respectively.

Table 1 shows the structure of the samples analysed in the three different generations.

TABLE 1. **The structure of the samples analysed.**

	1st generation	*2nd* generation	*3rd* generation	Pooled data
No. of sires	11	20	23	54
No. of dams	92	73	117	282
No. of progeny	413	254	447	1114
Sire family size	37.55	12.70	19.43	20.63
Dam family size	4.49	3.48	3.82	3.95
Dams per sire	8.36	3.65	5.09	6.27

Results and Discussion

Table 2 indicates the means and the standard deviations of the measurements studied in different experiments.

TABLE 2. **Means (M) and standard deviations (S.D) of the traits studies.**

		Pause 5	Pause tot.	S.M.	M.B.W.	P_1%	P_2%	P_3%	P_4%
1st generation	M	48.89	88.83	222.90	1497.00	34.39	32.95	38.52	36.22
	S.D	38.25	53.19	40.82	205.00	11.45	11.49	17.63	11.66
2nd generation . . .	M	34.74	96.32	225.50	1448.00	35.61	32.94	22.95	31.20
	S.D	31.01	49.83	33.00	204.70	10.01	10.24	9.14	9.01
3rd generation	M	43.08	90.36	—	—	—	—	—	—
	S.D	35.31	46.83	—	—	—	—	—	—

Heritability estimates

Table 3 shows the variance components and the heritability h^2 estimates calculated from the samples taken from the three different generations. It can be seen that in the first generation no values were obtained for h^2 estimates for pause during the first five months production (winter pause) and also for total pauses during the laying season till 17 months of age. This indicates that pause duration for this flock in this season were caused by environmental effects. This agrees with (Gawad 1961) on the Fayoumi chicken who calculated also zero value for h^2 of winter pause. But, in the second generation considerable h^2 values were obtained for pausing during the five months, and for pausing in the laying season. The results of the third generation proved that the genetic variation in this character should not be ignored and contributes considerably to the variance of pauses in the first five months (17% of the total variance).

TABLE 3. Variance components and heritability (h^2) estimaes of pause duration.

	Sire comp.	Dam comp.	Individual	h^2_s	h^2_d	h^2 comb.
1*st* gen. pause 5 . .	2.20	28.34	1334.07	0.000	0.000	0.000
Pause tot	11.78	58.62	2604.70	0.000	0.000	0.000
2*nd* gen. pause 5 . .	99.93	4.53	844.42	0.421	0.019	0.220
Pause tot	213.62	129.47	1925.37	0.372	0.226	0.299
3*rd* gen. pause 5 . .	11.62	84.50	1151.76	0.037	0.311	0.170
Pause tot	120.16	160.40	1875.32	0.223	0.297	0.260

TABLE 4. Pooled heritability estimates of pause duration.

Trait	Sire estimate (± S.E.)	Dame estimate (± S.E.)	Combined est. (± S.E.)
Pause 5	0.343 ± 0.085	0.162 ± 0.078	0.254 ± 0.082
Pause tot	0.268 ± 0.082	0.233 ± 0.084	0.251 ± 0.082

Table 4 shows the pooled h^2 estimates of the two measurements of pause duration in the three generations. The pooled h^2 estimate for the two measurements studied is .25 ± .08. This indicates that hereditary factors played a considerable part in determining pause duration. The estimates obtained agree in magnitude with those obtained by Hay (1951) and Krueger *et al.* (1952) whose estimates for h^2 of pause duration were 0.34 and 0.20 respectively. The results indicate that more uniform environment was provided in the

TABLE 5. Phenotypic (r_P), environmental (r_E) and genetic (r_G) corelation between pause duration and other traits studied.

Traits	Correlation	S.M.	M.B.W.₁	P1%	P_2%	P_3%	P_4%
Pause 5 . .	r_P	—	—	—.674	—.736	—.133	—.751
	r_E	—	—	—.680	—.719	—.187	—.729
	r_G ± S.E	—	—	—.976±.018	—.799±.086	—.320±.168	—.544±.184
Pause tot.	r_P	—.272	—.068	—.674	—.784	—.318	—.765
	r_E	—.436	—.145	—.680	—.773	—.385	—.749
	r_G ± S.E	+.401±.179	—.321±.126	—	—.911±.043	—.445±.175	—1.0 ±.000

second and the third generations than in the first generation. The possibility of the effect of drift should not be entirely excluded in this respect.

There is some evidence suggesting sex inked effect in the inheritance of the duration of pauses particularly during the five month pausing (winter pause) where the sire h^2 estimate is significantly larger than the dam h^2 estimate (Table 4).

The significant results obtained of h^2 estimates in Table 4 indicate that selection against non-productive days is useful. Since (pause 5) measurement is earlier than (pause tot.) and the h^2 estimatels, for the two measuements are about the same in magnitude, it is suggested to use the former measurement as criterion of selection to reduce pause duration in this flock and consequently to increase egg number.

Correlation estimates

Table 5 indicates the phenotypic (r_P) the environmental (r_E) and genetic (r_G) correlation coefficients between the two pause measurements and the other traits studied. The standard errors (S.E.) of the genetic correlations are also shown.

It can be seen that the different estimates of correlation coefficients are significantly negative between the two pause measurements and the percentage of production measurements. Similar trend can be observed for the correlations between (pause tot) and body weight at sexual maturity. This means that birds which had short pause were those of higher rate of egg production and were those of heavier body weights of sexual maturity. However, the genetic correlation between pause and age at sexual maturity is positive. This indicates that birds which matured earlier had the ability to pause fewer days.

Acknowledgement

The author offers his thanks to Prof. A.A. El-Itriby and Prof. M.T. Ragab for the help they offered.

Refernces

Assem, M.A. and Ragab, M.T. (1955) Rate of persistency and pausing in Baladi and Fayoumi fowl. *Poul. Sci.*, **34**, 1027.

Falconer, D.S. (1960) "*Introduction to Quantitative Genetics*". Oliver and Boyd Ltd. Great Britain.

Gawad, E.M. (1961) *Genetic and Phonoytipic parameters in the Fayoumi breed and their relation to its improvement through breeding*. Ph. D. Thesis, Univ. of Alexandria, 1961.

Hays, F.A. (1951) Further studies in environmental and hereditary factors affecting winter pause incidence and duration. *Poul. Sci.* **30**, 100.

Hosari, M.A. (1966) The Fayoumi Domestic fowl. (c) Heritability of some of the economic traits. *Agric. Res. Rev., Cairo*, **44**, 141.

Issawi, H.F., and Amer, M.F. (1958) Variation in egg production in a Fayoumi flock. *Annals of Agric. Res. Ein Shams Univ.*

Krueger, W.F., Dickerson, G.,E., Kinder, G.B. and Kempster, H.L. (1952) The genetic and environmental relationships of total egg production to its components and to body weight in the domestic fowl. *Poul. Sci.* **31**, 922.

Lerner. I.M. (1958) "*The Genetic Basis of Selection*" John Wiley and Sons, Inc., New York.

——— **and Cruden, D.M.** (1948) The heritability of accumulative monthly and annual eggproduction. *Poul. Sci.* **27**, 67.

——— **and Taylor, L.W.** (1936) The relation of pause to the rate of egg production. *J. Agric. Res.* **52**, 39.

——— **and** ——— (1947) Further observation on winter pause in S.C. White Leghorn pullet. *Poul. Sci.* **26** 515.

Oliver, M.M., Bohren, B.B and Anderson, V.L. (1957) Heritability and selection efficiency of several measures of egg production. *Poul. Sci.*, **36**,395.

Robertson, A. (1959) The sampling variance of the genetic correlation coefficient. *Biometric* **15**, 219.

وراثة صفة الانقطاع عن البيض فى قطيع من الدجاج الفيومى

محمد فتح الباب الحصرى
قسم الانتاج الحيوانى – وزارة الزراعة

أجريت تجارب على قطيع منسب من الدجاج الفيومى لمدة ثلاث اجيال لدراسة صفة الانقطاع عن البيض . وقد قيست هذه الصفة من ديسمبر الى أبريل ، كما قيست أثناء موسم انتاج البيض الى عمر ١٧ شهر وحللت النتائج تحليلا وراثيا واحصائيا .

وأوضحت النتائج أن العمق الوراثى للمقياس الأول مقداره ٢٥٤ر ± ٨٢ ر وللمقياس الثانى مقداره ٢٥١ر٠ + ٠٨٢ر٠ وظهر أن العمق الوراثى للآباء أكبر من العمق الوراثى للأمهات مما يدل على وجود ارتباط بالجنس ، كما أوضحت النتائج أن الارتباط الظاهرى والبيئى والوراثى بين صفتى الانقطاع عن البيض ونسبة انتاج البيض هى – ٦٠٤ر٠ ، – ٦١٣ر ، – ٦٢١ر± ٠٩٦ر على التوالى وأن الارتباط الوراثى سليما – ٣٢١ ± ١٠٦ر) بين صفة الانقطاع عن البيض وصفة وزن الجسم عن البلوغ ولكن هذا الارتباط الوراثى موجبا (٤٠١ر ± ١٧٩ر) بين صفتى الانقطاع عن البيض والنضج الجنسى (العمر عند وضع اول بيضة) .