Egypt. J. Anim. Prod. **24**, No. 1-2 pp. 51-67 (1984)

On Estimating Genetic Parametrs of Partial Egg Production Records and Other Related Traits in Pullets of Dokki -4 chickens Produced from Triallel Matings

M.S. Hanafi and A.F.M. El - Labban

Fac. Agric. at Moshtohor, Zagazig Univ. and Anim. and Poult. Prod. Res. Inst., Min. Agric., Egypt.

DATA of 270 pullets produced from a triallel mating system were utilized to study the nature of egg production and to evaluate estimates of heritability and correlations for traits of comulative and periodical recordings of egg number in Dokki - 4 chickens. Related traits to egg production were studied and their genetic parameters were, also, estimated.

The obtained results are summarized as follows :

1. Egg number and egg weight increased gradually with the progressive comulative periods of egg production. While with periodical recording, egg number was shown to be slightly decreased with the successive periods.

2. The method of recording egg number on the basis of two days per week (50.4 eggs) was better and more reliable than that of one-week per month (42.2 eggs). The first method included a relatively longer period (81.2 days), while the second method included a relatively shorter period (71.0 days), for testing the pullets.

3. Components of variance due to sire (6.1 %) were lower than those due to dams (24.6 %) in all periods of comulative recording; indicating the importance of maternal effects (18.5 %) in determining egg production.

4. The non-additive genetic effects were not important in determining egg number either for comulative or periodical recordings. However, these effects were of significant importance when egg recording was on the basis of each of two - days per week (22.5 %) and one week per month (52.6 %). Indicating that non-additive genetic effects are important in determining egg number when part recored is for a long period of production.

5. The combined estimates of heritability for traits of comulative recording were higher (0.616) than those of periodical recording (0.393) ; likewise higher estimates were obtained for recording of two - days per week (0.332) and lower ones for one week per month (0.187). Indicating that testing the pullets for a longer period of time gave the genetic variabilities better chances to express themeselves distinctly additive.

6. The pullets reached sexual maturity at an early age (170.9 days) with a relatively heavier body weight (1530g), and layed at a rate of 62.9 % with an average clutch size of 2.62 eggs. Maternal effects were, also, found to be important for age at sexual maturity (22.1 %) and rate of laying (8.4 %). The combined estimates of heritability for age of sexual maturity (0.715), rate of laying (0.469) and clutch size (0.302) indicate that these traits are relatively highly heritable.

7. The genetic and phenotypic correlations among traits of egg number for comulative and periodical recordings were all positively high. The high positive genetic relationship between the first and the last period of recording indicate that the highest annual egg production could be attained by using for genetic selection the production of the pullet during the four-week period between 36 and 40 weeks. The negative genetic and phenotypic relationships between age at sexual maturity and each trait of egg recording indicate that early sexual maturity is associated with the ability of the pullet to produce eggs at a high rate during the course of egg production.

Information on both additive and non - additive genetic variances is of value in formulating effective breeding plans. An approach to estimating non-additive variance is to deliberately design a mating system such that non - additive variance can be estimated from the sire X dam interaction. Where diallel or triallel matings are used, sets of sire are usually rotated among pens of dams between hatches. Progeny from each set of matings are then produced in different hatches. This results in a confounding of hatch effects with sire X dam interaction.

Egg production in chickens is a complex matric trait showing variations during the period of production. There are several methods for partial recording to evaluate egg production. The aim of these methods is to shorten the generation interval and to improve egg performance by carrying out genetic selection in an early stage of egg production.

The present study was based on data collected on pullets Produced from triallel mating plan designed to obtain information on additive and non - additive genetic variances ; and to estimate heritabilities, genetic and phenotypic correlations among traits of partial recording of egg production as well as genetic parameters for some other related traits.

Material and Methods

This study was carried out at the Poultry Research Center at Anshas, Sharkia Governerate, Animal and Poultry Production Research Institute, Ministry of Agriculture.

3 series, 3 males and 3 groups of females per series of mating were introduced into a mating design constructed to obtain unbiased estimates of the additive and non-additive components of the hereditary variance for traits of egg number from a flock of non-inbred Dokki-4 chickens. Thirty

randomely chosen males were assigned to one of thirty breeding pens. Each male was mated to 10 randomely chosen females, with a total of 300 females. The females were assigned to the males at random except that sib mating was avoided to prevent inbreeding depression. Male pens were tripled and each triple of males constituted a unit or a triallel set with a total of 10 triallel sets. The second series of mating was made in such a way that males within each set were switched with females of each breeding pen of that set. The third series of mating was similarly carried out. The resultant shift of males constituted the second and the third series of mating with a restriction that females of a breeding pen within a set were mated only one time with a given male from that set. Pedigreed eggs from females of each series of mating were collected daily and individually weighed for a period of 15 days (to allow maximum number of chicks per mating) and then incubated. After each time of shifting males, eggs laid for a period of 10 days were discarded from the experiment so that pedigree of the produced chicks from the assigned males of each series of mating could be assured.

The following traits of egg production were studied on 324 pullets (daughters) from parents of the mating system which were chosen randomely at sexual maturity from a total number of 3587 one day old chicks :

1. Egg number produced from one-day old up to 36, 40, 44, 48, 52, 56 and 65 weeks of age (traits of comulative recording).

2. Egg number during the different periods of 36 - 40, 40 - 44, 44 - 48, 48 - 52, 52 - 56 and 56-60 weeks of egg production (traits of periodical recoreing).

3 Egg number during the first week per month of egg production.

4 Egg number during two days (Saturday and Sunday) per week throught the entire period of egg production.

5 Age and body weight at sexual maturity.

6 Rate of laying.

7. Clutch size.

Two types of adjustments were made to reduce the environmental variability and to simplify the statistical analysis.

a) To avoid missing cells, only data from dams which yielded surviving pullets in each series of mating (270 pullets) through end of egg pro - duction were utilized.

b) A correction for series effect was made within each set of mating system. A type of maternal effect resulting from changes in age of dams from one series to another must be considered.

The adjusted data of each set were statistically analysed by the application of factorial design with unequal number of subclasses described by Becker (1975). Componenents of variances and heritabilities for each trait as well as correlations among the studied traits were estimated.

Results and Discussion

Least square means

The least square means of traits of egg number for comulative and periodical recordings in Dokki-4 breed of chickens are presented in Table 1. The results show that egg number was comulatively increased with the successive periods of egg recording. The record of egg number per pullet reached the average of 45.1 eggs at the beginning period of egg production ; while it reached 178.0 eggs at the last period. Also, average egg weight was increased gradually with the progressive periods of egg production. Egg weight averaged 41.0g during the first period and 45.2g during the last period of production. Thus, egg weight increased gradually with advancing age of the pullet. The decreased egg weight during the early periods of egg production might be to the fact that the reproductive organ as well as the body weight of the pullet did not reach the optimal stage of maturity and, therefore, were not distinctly active to deposit more nutrient materials in the egg.

TABLE 1. Least square means (+standard errors) of traits of egg number for comulative and periodical recordings.

Comulative Recording			Periodical Recording		
Traits	Egg number	Ave. egg wt.	Traits	Egg number	Ave. egg wt.
0—36 weeks	45.1±1.92	41.0	36—40 weeks	19.3±0.54	43.9
0—40 weeks	64.4±2.18	41.1	40—44 weeks	19.2±0.53	44.4
0—44 weeks	83.6±2.40	42.4	44—48 weeks	18.7±0.66	46.0
0—48 weeks	102.3±2.54	43.1	48—52 weeks	18.7±0.36	46.0
0—52 weeks	121.0±2.72	43.5	52—56 weeks	17.7±0.57	47.0
0—56 weeks	138.6±2.93	44.0	56—60 weeks	17.1±0.55	48.6
0—65 weeks	178.0±3.34	45.2	2 days / weeks	50.4±1.38	45.3
			1 week/month	42.2±1.13	44.5

When the comulative records were devided into different periods of egg production, egg number per pullet was shown to be slightly decreased with the successive periods (Table 1). Early period of production (36 -44 weeks) was characterized with more egg number (38.5 eggs) of small size (44.2 g). Medium period (44 - 52 weeks) was characterized with medium egg number (37.4 eggs) of medium size (46.0 g). While the last period (52-60 weeks) was characterized with less egg number (34.8 eggs) of large size (47.8 g). Egg number during the early period of production was increased by only 1.1 eggs than the medium period. Thus one may, therefore, recommend that trapnesting for selection or culling can be carried out during the early period of 36 - 44 weeks starting from hatching date, *i.e.*, after about 12 weeks from sexual maturity (24.4 weeks). Mostageer *et al.* (1978) found that the average of egg number for 0-40, 0 - 44, 0 - 48, 0 - 52 and 0 - 70 weeks of age and full record were 6.12, 12.77, 21.92, 32.69, 82.01 and 119.77 eggs respectively in Fayoumi chickens ; indicating that the low of production resulting from delayed sexual maturity (38 weeks) and also, because the flock had not been subjected to any kind of genetic selection.

The average of egg number reached 50.4 and 42.2 eggs when perfo-rmance of egg production was recorded on the basis of two-days per week and one week per month, respectively (Table 1). Thus, the method of recording two - days per week gave more clear and accurate picture of egg production than the method of recording one week per month. This is true since the first method included 81.2 days for testing with an average of 0.62 egg per day ; while the second method included a shorter period of testing of about 71.0 days with an average of 0.59 egg per day. Part record of two days per week might be recommended for flocks of low or medium level of production, while one week per month might be preferable for high laying flocks. These results are inagreement with those of Obeidah *et al*, (1962) who reported that the method of two - days per week was better than the method of one week per month.

Least square analysis of variance

Results of Table 2 indicated that there were no significant differences between sires in all periods of egg number recording. The differences between groups of dams, however, were statistically highly significant in all periods of comulative recording. The respective differences of periodical recording were singificant only for the first (36-40 weeks) and the last (56-60 weeks) periods. These results indicated that the pullets differed in both age of sexual maturity and persistency. The differences between each of sires and groups of dams were stastistically significant for the performance of two-days per week and one week per months (Table 2). This means that the dams - were genetically hetorgenous and inhereted their daughters different genetic make up for egg number. In general, the sire X groups of dams interactions were not significant in all periods of egg recordings without fail.

TABLE 2. Mean squares of traits of egg number for comulative and periodical recordings.

Source of viariation	d.f.	0—36 weeks	0—40 weeks	0—44 weeks	0—48 weeks	0—52 weeks	0—56 weeks	0—65 weeks
				Comulative Recording				
Sire	20	966.4	1161.8	1344.8	1543.9	1683.8	3050.4*	2773.2
Group of dams	20	1826.8**	2159.6**	2404.6**	2738.5**	3173.7**	3849.5**	5442.5**
Sire X Group of dams	40	565.5	713.3	938.8	1101.0	1181.5	1188.7	1586.5
Residual	189	674.7	866.4	1064.3	1244.9	1476.6	1745.0	2519.6

Source of variation	d.f.	36—40 weeks	40—44 weeks	44—48 weeks	48—52 weeks	52—56 weeks	56—60 weeks	2days/ week	1week/ month
				Periodical Recording					
Sire	20	61.6	54.*	85.8	54.8	68.9	46.9	349.2	582.1
Group of dams	20	117.9**	54.6	69.6	60.7	79.4	102.6*	544.7	580.0**
Sire X Group of dams	40	53.1	51.2	43.9	33.2	27.3	33.4	285.4	513.2**
Residual	189	53.8	56.6	78.6	61.3	67.1	58.7	341.4	247.7

* Significant at $P \leq 0.05$

** Significant at $P \leq 0.01$

Components of variances

The estimates of components of variances of egg number for each period of comulative and periodical recording are presented in Tables 3 and 4, respectively. The percentages of variances due to sires were lower than those due to dams in all periods of comulative recording. The variances due to sire components averaged 6·1%, while those of dam components averaged 24·6% (Table 3). Thus 24·6%, of the total variance of egg number contains 18·5%, maternal effects and 6·1% additive genetic effects. The maternal effects in this study can, therefore, be considered as an important factor in determining egg production in this flock of Dokki-4. Similarly Jerome

et al. (1956) and Sato and Nordskog (1977) reported a relatively high proportion of maternal to additive genetic effects. Morcover, the component of variances due to dam and consequently the maternal effects decreased gradually and slightly with the successive periods of egg performance, *i.e.*, maternal effects decreased with advancing age of the pullet. On the other hand, the non-additive genetic effects was found to be not important in determining egg number in this study.

Considering the components of variances for traits of periodical recording (Table 4) ; it was found that the average percentages of variance components due to sire (9.6%) was near in magnitude to that of dam (10.0%). However, the percentages of variance components due to dam were higher than those of sire during the periods of 36 - 40 and 56- 60 weeks of age. The maternal effect in periodical recording was relatively lower than that of comulative recording which contributed only about 9.0%. Again, maternal effect was shown to be an important factor in determining egg number for the first and the last period of production ; which might be attributed to different age at sexual maturity and persistency of the pullets.

TABLE 3. Estimates of the components of variance for comulative recording of egg number

Components of variance	0—36 weeks	0—40 weeks	0—44 weeks	0—48 weeks	0—52 weeks	0—56 weeks	0—65 weeks
O_s^2	64.7	73.5	80.1	107.7	118.5	172.9	242.5
O_d^2	275.2	343.3	376.4	427.5	495.6	593.7	805.1
O_{sd}^2	000.0	000.0	000.0	000.0	000.0	000.0	55.3
O_w^2	674.7	866.4	1064.3	1244.9	1476.5	1745.0	2519.6
O_p^2	1014.6	1283.2	1520.8	1780.1	2090.6	2511.6	3622.5
Components as percent of the phenotypic variance							
O_s^2	6.4	5.7	5.3	6.1	5.7	6.9	6.7
O_d^2	27.1	26.8	24.8	24.0	23.7	23.6	22.2
O_{sd}^2	00.0	00.0	00.0	00.0	0.00	00.0	1.5
O_w^2	66.5	67.5	69.9	69.9	70.6	69.5	69.6

+ Negative estimates considered zero

TABLE 4. Estimates of the components of variance for periodical recording of egg number

Components of variance	36—40 weeks	40—44 weeks	44—48 weeks	48—52 weeks	52—56 weeks	56—60 weeks	2 days/ week	1 week/ month
O_s^2	4.1	6.0	9.8	11.7	8.4	5.9	20.8	20.1
O_d^2	13.8	3.1	7.1	5.6	8.2	9.5	68.7	40.7
O_{sd}^2	2.3	3.2	0.0	0.0	0.0	0.0	124.9	342.0
O_w^2	53.8	56.6	78.6	61.3	67.1	58.7	341.4	247.7
O_p^2	74.0	68.9	95.5	78.6	83.7	74.1	555.8	650.5
Components as percent of the phenotypic variance								
O_s^2	5.5	8.7	10.3	14.9	10.0	8.0	3.7	3.1
O_d^2	18.6	4.5	7.4	7.1	9.8	12.8	12.4	6.3
O_{sd}^2	3.1	4.6	0.0	0.0	0.0	0.0	22.5	52.6
O_w^2	72.7	82.1	82.3	78.0	80.2	79.2	61.4	38.0

+ negative estimates considered zero.

Similarly, the dam components of variance for part recording of two days per week and one week per month were higher than those of sire components (Table 4); indicating the influence of maternal effect. The sire X dam interaction was again not significant in most traits except for part record of egg number for two - days per week (22.5%) and one week per month (52.6%). This suggests that non-additive genetic effects may have a significant importance in determining egg number when part recording is for a long period of production than for a short period. Jerome *et al.* (1956) reported that the magnitude of non-additive variance was larger for production of 365 days as compared with shorter period up to four months.

Heritabilities

The heritability estimates along with their standard errors for traits of comulative and periodical recordings are presented in Table 5. With respect to traits of comulative recording, higher estimates of heritability from the dam components were obtained (averaged 0.984) than those derived from the sire components (averaged 0.244) for all traits which might be attributed to maternal effects. Similar results were found by Ezz-Din (1977) in Fayoumi

chickens. In addition, the combined estimates of heritability averaged 0.616 which can be considered as a relatively high value. Thus, rabid improvement of egg production in Dokki-4 breed could be attained by genetic selection utilizing the additive genetic effects.

TABLE 5. **Estimates of heritability (± standard errors) due to sire, dam and sire + dam for traits of comulative and periodical recordings of egg number.**

Components	0+36 weeks	0—40 weeks	0—44 weeks	0—48 weeks	0—52 weeks	0—56 weeks	0—65 weeks
			Comulative Recording				
Sire	0.255 ±0.020	0.229 ±0.019	0.211 ±0.019	0.242 ±0.019	0.227 ±0.017	0.275 ±0.024	0.268 ±0.016
dam	1.085 ±0.031	1.070 ±0.030	0.990 ±0.028	0.961 ±0.027	0.948 ±0.023	0.946 ±0.028	0.889 ±0.026
Sire+dam	0.670 ±0.005	0.560 ±0.005	0.601 ±0.005	0.611 ±0.005	0.588 ±0.005	0.611 ±0.002	0.579 ±0.004

Component	36—40 weeks	40—44 weeks	44—48 weeks	48—52 weeks	52—56 weeks	56—60 2 weeks	days/ weeks	1 week/ month
				Periodical Recording				
Sire	0.222 ±0.019	0.348 ±0.018	0.410 ±0.018	0.595 ±0.015	0.401 ±0.039	0.318 ±0.014	0.150 ±0.014	0.142 ±0.020
dam	0.746 ±0.029	0.180 ±0.016	0.297 ±0.014	0.285 ±0.014	0.392 ±0.017	0.513 ±0.024	0.494 ±0.018	0.250 ±0.018
Sire+dam	0.484 +0.006	0.264 ±0.006	0.354 ±0.005	0.440 ±0.004	0.397 ±0.004	0.416 ±0.004	0.322 ±0.004	0.187 ±0.006

Consedering the traits of periodical recording, nearly similar values of heritability were obtained for each of sire (0.382), dam (0.402) and combined (0.393) components (Table 5). It is clear then, that the heritability estimates derived from comulative recording were higher than those dervied from periodical recording. This might be due to the fact that pullets were tested in

a long period of time with comulative recording which gave the genetic variabilities a better chance to express themselves among the pullets than with periodcal recording. This point of view might also hold true for part recording of egg number on the basis of two - days per week since it estimated a relatively higher combined value of heritability (0.332) than that on the basis of one week per month (0.187).

TABLE 6. Least square means (±standard errors.) of age and body weight at sexual maturity, rate of laying and clutch size.

Traits	Least square means
Age at sexual maturity (days)	170.90±2.41
Body weight at sexual maturity (g)	1530.10±0.03
Rate of laying (percentage)	62.90±1.13
Clutch size (number)	2.62±0.10

Related traits to egg production

Results presented in Table 6 indicate that the pullets reached sexual maturity at a relatively early age of 170.9 days (about 24.4 weeks of age) with a relatively heavier body weight of 1530 grams. Previous studies of Tawefeek (1981) reported nearly similar age at sexual maturity (24.8 weeks) but lighter body weight (1340 grams) in the same breed of chickens However, very late of sexual maturity (38 weeks) and lower body weight (1077 grams) were reported by Ezz EL-Din (1977) in Fayoumi chickens. Obidah (1969) found that the average of age and body weight at sexual maturity were 329 days and 1466 grams, respectively in Rhode Island Reds.

In additon, the pullets layed at a rate of 62.9% and had an average clutch size of 2.62 eggs all over the period of production (Table 6). The comulative rate of laying within each period starting from sexual maturity to 36, 40, 44, 48, 52, 56, and 65 weeks of age was 59.1, 61.6, 63.9, 64.2, 65.1 and 62.7 percentages, respectively. While that respective clutch size was 2.46, 2.59, 2.68 , 2.70, 2.70, 2.67 and 2.52 eggs. It is clear that the pullets started in laying with relatively lower rate and small clutch size, then both of them increased gradually till they reached a plateau level during the period of 44 to 56 weeks of age (64.2% and 2.69 eggs) ; after which each of rate

of laying and clutch size started to be decreased during the last period of production. The pullets of this study can be considered to lay at a relatively high rate and to have a relatively large clutch size compared to other pure breeds used in previous studies. Mahmound *et al.* (1974) reported rate of laying of 63.4% in Silver Montazah and 59.6% in Golden Montazah. However, lower rate of laying (56.6%) was reported by Yamada *et al.* (1958) in White Leghorn. Assem and Ragab (1955) reported an average clutch size of 1.94 for Baladi and 1.87 eggs for Fayoumi chickens. Also, kheir El-Din *et al.* (1976) found that the average clutch size was 2.0 eggs in Fayoumi and 1.7 in Plymouth Rock.

Results of Table 7 indicate that therewere significant differences between groups of dams for age at sexual maturity and rate of laying; which means that the dams were genetically heterogenous since this flock of Dokki-4 had not been subjected to genetic selection. There were no significant differences between sires and between sires X groups of dams interaction in all traits ; indicating that the non-additive genetic effects were, also, not important in determining age and body weight at sexual maturity, rate of laying and clutch size.

TABLE 7. Least square analysis of variance for age and body weight at sexual maturity, rate of laying and clutch size

Source of variation	d.f.	Age at sexual maturity	Body weight at sexual maturity	Rate of laying	Clutch size
Sire	20	1411.6	0.1355	227.4	2.2
Group of dams	20	3201.7**	0.0830	465.7*	2.7
Sire X Group of dam	40	839.3	0.0662	118.6	1.4
Residual	189	1015.1	0.1511	270.3	2.5

* significont at $p \leq 0.05$

** significant at $p \leq 0.01$

Results presented in Table 8 show, in general, that the percentages of dam components of variance are higher than sire components; indicating the presence of maternal effects which were 22.1 %, 8.4% and 1.4% for each of age at sexual maturity, rate of laying and clutch size respectively. Similar results were reported by King and Henderson (1954) and Van Vleck and Doolittle (1964) who reported that maternal effects were important for age at sexual maturity and persistency of production. However, Sato and Nordskog (1977) failed to show such effect in their studies.

TABLE 8. Estimates of the compoenents of variance for age and body weight at sexual maturity , rate of laying and clutch size.

Components of variance	Age at sexual maturity	Body weight at seuxal maturity	Rate of laying	Clutch size
O_s^2	107.6	0.0148	26.26	0.20
O_d^2	457.3	0.0044	55.77	0.24
O_{sd}^2	000.0	0.0000	00.00	0.00
O_w^2	1015.1	0.1511	268.22	2.48
O_p^2	1580.0	0.1703	350.25	2.92
Components as percent of the phenotypic variance				
O_s^2	6.8	8.7	7.5	6.8
O_d^2	28.9	2.6	15.9	8.2
O_{sd}^2	0.00	0.0	00.0	0.0
O_w^2	64.2	88.7	76.6	84.9

+ Negative eetimates considered zero.

In general, the sire heritability estimates were less than those of the dam (Table 9) due to maternal effects. The combined estimates of heritability were high for age at sexual maturity (0·715), rate of laying (0·469) and clutch size (0·302) ; indicating that these traits are relatively highly heritable and, therefore, must be considered in selection programs. Similar results were reported by Abd EL-Gawad (1975).

Genetic and phenotypic correlations

The genetic correlations among traits of egg number for comulative and periodical recordings based on ful l- sib components as well as the phenotypic correlations are presented in Tables 10 and 11, respectively. The genetic and phenotypic correlation coefficients among comulative traits of egg number (Table 10) were all positivcly high with over all averages of 0.965 and 0.918,

TABLE 9. Estimates of heritability due to sire, dam and sire + dam for age and body weigh at sexual maturity, rate of laying and clutch size.

Components	Age at sexual maturity	Body weight at sexual maturity	Rate of laying	Clutch size
Sire	0.272 ±0.019	0.348 ±0.016	0.300 ±0.013	0.274 ±0.016
Dam	1.158 ±0.035	0.103 ±0.004	0.637 ±0.023	0.329 ±0.017
Sire + dam	0.715 ±0.00	0.225 ±0.005	0.469 ±0.004	0.302 ±0.005

respectively. In addition, highly positive estimates of genetic relationships between each comulative trait and each trait of two-days per week (0·722), one week per month (0·913) rate of laying (0·894) and clutch size (0·652) were obtained. The over all respective averages of phenotypic associations are 0·651, 0·715, 0·847 and 0·615. It should be pointed, out here, that these correlations are in part automatic. One would expect that genes which affect egg number at a given period of recording would also affect egg number at another period during the course of egg production., and since egg number at the last period was genetically positively highly correlated with any other period ; thus, one may suggest that genetic selection for improving egg production would be carried out during the early period of about 12 weeks after sexual maturity; which in consequent would decrease the generation interval. However, relatively high negtaive genetic (-0·594) and phenotypic (-0·590) correlations were obtained between age at sexual maturity and each trait of egg recording (Table 10). This means that when a pullet reached sexual maturity at an early age, one would expect that this pullet would have the ability to produce eggs at a high rate over all periods of egg production. Similar results were reported by Obeidah *et al.* (1962), Acharya *et al.* (1969) and Ezz EL-Din (1977).

The genetic and phenotypic correlations between rate of laying and each trait of two - days per week (0·917 vs. 0·749), one week per month (0·980 vs. 0·825) and clutch size (0·795 vs. 0·781) were all positively high ; this is true since rate of laying can be considered as a relaible representative of egg production.

With respect to the associations between traits of egg number for periodical recording (Table 11) ; the genetic correlations were in general highly positive (0·795), while those based on phenotype were moderately positive (0·333).

TABLE 10. Genetic correlations among traits of comulative recording of egg number based on full-sib components (above diagonal) and phenotypic correlations (below diagonal).

	0-36 wks.	0-40 wks.	0-44 wks.	0-48 wks.	0-52 wks.	0-56 wks.	0—65 wks.	2days /wk.	wk. 1mon.	ASM	BWSM	RL	ACS
0—36 wks.		0.988	0.990	0.970	0.948	0.920	0.821	0.769	0.750	—0.836	0.146	0.801	0.459
0—40 wks.	0.975		0.999	0.990	0.969	0.944	0.856	0.856	0.680	—0.751	0.171	0.840	0.538
0—44 wks.	0.945	0.977		0.995	0.974	0.953	0.900	0.865	0.716	—0.756	0.227	0.875	0.607
0—48 wks.	0.900	0.941	0.976		0.993	0.981	0.941	0.928	0.704	—0.688	0.228	0.903	0.670
0-52 wks.	0.858	0.906	0.947	0.983		0.995	0.972	0.962	0.734	—0.621	0.096	0.935	0.732
0—56 wks.	0.820	0.873	0.913	0.956	0.984		0.983	0.986	0.746	—0.555	0.121	0.943	0.748
0—65 wks.	0.737	0.789	0.826	0.870	0.906	0.941		1.024	0.725	0.408	0.120	0.961	0.808
2 days/wk.	0.625	0.669	0.689	0.724	0.736	0.759	0.802		0.599	0.306	—0.050	0.980	0.713
1wk./mon.	0.568	0.609	0.625	0.643	0.670	0.700	0.744	0.550		—0.428	1.041	0.917	0.865
ASM	—0.798	—0.742	—0.714	—0.671	0.611	—0.560	—0.456	—0.366	—0.390		—0.053	—0.408	—0.021
BWSM	—0.093	—0.074	—0.091	—0.086	—0.099	—0.112	—0.060	—0.095	—0.003	0.089		0.091	0.101
RL	0.725	0.778	0.811	0.847	0.882	0.914	0.971	0.825	0.749	—0.443	—0.069		0.795
ACS	0.401	0.487	0.551	0.630	0.696	0.746	0.791	0.660	0.624	—0.091	—0.073	0.781	

ASM = Age at sexual maturity.
BWSM = Body weight at sexual maturity.
RL = Rate of laying.
ACS = Average clutch size.

TABLE II. Genetic correlations among traits of periodical recording of egg number based on full sib components (above diagonal) and phenotypic correlations (below diagonal).

	36—40 weeks	40—44 weeks	44—48 weeks	48—52 weeks	52—56 weeks	56—60 weeks	Rate of laying
36—40 weeks		0.140	0.789	0.237	0.419	0.524	0.696
40—44 weeks	0.291		1.786	0.154	1.445	2.404	1.756
44—48 weeks	0.280	0.364		1.044	1.044	0.826	1.027
48—52 weeks	0.304	0.295	0.402		0.669	0.646	0.799
52—56 weeks	0.270	0.148	0.333	0.438		0.467	0.869
56—60 weeks	0.287	0.089	0.249	0.288	0.462		0.815
Rate of laying	0.569	0.463	0.530	0.624	0.639	0.596	

The same logic of explanation for the correlated traits of comulative recording, also hold true here. High positive genetic relationship (0.524) was also estimated between the early period of 36-40 weeks and the last period of 56-60 weeks of production. Thus, genetic selection and/or culling for improving traits of egg performance could be carried out during the four - weeks period between 36 and 40 weeks. Mostageer *et al.* (1978) reported that the highest annual relative efficiency could be obtained by using for selection the production of the pullet during the four -week period between 40 and 44 weeks in Fayoumi chickens.

References

Abd-El-Gawad, E. M. (1975) Heritability estimates and genetic relationship among economic traits in Dokki-4. III. Body weight and age at sexual maturity, egg weight and egg production traits. *Agric. Res. Rev.* Cairo, 53,105.

Acharya, R. M., Dhillon, J. S. and Tiwana, M. S. (1969) Age at first egg and egg production, their inheritance and expected response to different methods of selection. *Br. Poult. Sci.* 10,175.

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

Becker, W. A. (1975) *"Manual of Quantitative Genetic"*,. 3 rd. ed, Washington State University Press, Pullman, Washington 99163.

Ezz El - Din, Z. A. (1977) The inheritance of egg production in the Fayoumi fowl. *Ph. D. Thesis*, Cairo University.

Jerome, F. N., Henderson, C. R. and King, S. C. (1956) Heritabilities, gene interaction and correlation associated with certain traits in the domestic fowl. *Poult. Sci.* 35,995.

Khair El - Din, M. A., Kamar, G. A. R., Darwish, A. and Ali, M. M. (1976) Mode of laying in Fayoumi and White Plymouth in subtropic at different seasons. *Egypt. J. Anim. Prod.* 16,119.

King, S. C. and Henderson, . R. (1954) Heritability studies of egg production in the domestic fowl. *Poult. Sci.* 33, 155.

Mahmoud, T. H. , Abdel Salam, F. E., Aboul Seoud, A. A., Madkour, F. H. and Abdel Salam, N. (1974) Dietary effect on the performance of the Siliver Montazah and the Golden Montazah pullets. I. Rate of lay. *Agric. Res' Rev.*, Cairo, 52,77.

Mostageer, A., Eza El-Din, Z. A., Kamar, G. A. R. and Obeidah, A. (1978) A genetic study of partial egg production records in a randombred Fayoumi flock. *Ann. Genet Anim.* 10,569.

Obeidah, A. M. A. (1969) The inheritance of egg weight in the fowl. *Ph. D. Thesis*, Cairo University.

Obeidah, A. M. A., Badr El-Din, A. A. and Ghany, M. A. (1962) The application of some partial recording systems in egg production. *J. Anim. Prod. U. A. R.* 2,133.

Sato, M. and Nordskog, A. W. (1977) On estimating components of genetic variance in diallel matings. *Br. Poult. Sci.* 18,699.

Tawfeek, M. I. (1981) Dokki - 4 as a layer and chick producer. *M. Sc. Thesis*, Zagazig University.

Van Vleck, L. D. and Doolittle, D. P. (1964) Genetic parameters of monthly egg production in the Cornell Control. *Poult. Sci.* 43,560.

Yamada, Y., Bohrem, B. B. and Crittenden, L. B. (1958) Genetic analysis of White Leghorn closed flock apparently plateaued for egg production. *Poult. Sci.* 37,565.

تقدير بعض المعايير الوراثية للتسجيل الجزئى لانتاج البيض ولصفات أخرى ذات علاقة فى أناث الدجاج دقى ـ ٤ والتى نتجت من التزاوج التبادلى الثلاثى

محمد حنفى سيد وعبد الفتاح محمد اللبان

كلية الزراعة ـ جامعة الزقازيق ووزارة الزراعة ، مصر

استخدمت بيانات ٢٧٠ دجاجة من نوع دقى ـ ٤ ، والتى نتجت من التزاوج التبادل ـ الثلاثى وذلك لدراسة طبيعة انتاج البيض فى هذا النوع من الدجاج، ولتقدير قيم المكافئ الوراثى ومعاملات التلازم لصفات تسجيل البيض الجزئى التراكمى والتزامنى ، كما قدرت المعايير الوراثية لبعض صفات ذات علاقة بانتاج البيض .

ودلت النتائج على ما يلى :

١ ـ ارتفع بالتدريج كل من عدد البيض ووزن البيضة وذلك بتقدم فترات تسجيل البيض الجزئى التراكمى ، أما بالنسبة لتسجيل البيض الجزئى التزامنى فقد لوحظ انخفاض قليل فى عدد البيض المنتج .

٢ ـ كانت طريقة تسجيل البيض على أساس يومين من كل أسبوع (٥٠ر٤ بيضة) أفضل من التسجيل على أساس أسبوع من كل شهر (٤٢ر٢ بيضة) اذ كانت فترة الاختبار فى الطريقة الأولى (٨١ر٢ يوم) أطول من الطريقة الثانية (٧١ر٠ يوم) .

٣ ـ كانت نسبة التباين التجمعى للذكور (١ر٦٪) منخفضة بالنسبة للتباين التجمعى فى الأمهات (٦ر٢٤٪) ، مما يدل على أهمية تأثير الأمومة (٥ر١٨٪) فى تحديد انتاج البيض ٠

٤ ـ لم يظهر تأثير هام للتباينات الوراثية غير التجمعية فى تحديد انتاج البيض سواء للتسجيل الجزئى التراكمى أو التزامنى ، الا أنه كان لهذه التباينات تأثير واضح بالنسبة لتسجيل البيض على أساس يومين من كل أسبوع (٥ر٢٢٪) أو أسبوع من كل شهر (٦ر٥٢٪) ، مما يدل على أن تسجيل انتاج البيض لأطول فترة من الانتاج يعطى فرصة أكبر للتباينات الوراثية غير التجمعية فى أن تظهر أثرها وبوضوح فى تحديد انتاج البيض٠

٥ ـ كانت قيم المكافىء الوراثى لصفات التسجيل الجزئى التراكمى (٦١٦ر٠) أعلى من تلك لصفات التسجيل الجزئى التزامنى (٣٩٣ر٠) ، كما كانت قيم المكافىء الوراثى لتسجيل البيض يومين من كل أسبوع (٣٣٢ر٠) أعلى من مثيلتها لتسجيل البيض أسبوع من كل شهر (١٨٧ر٠) مما يدل على أن اختبار الاناث لفترة أطول أعطت فرصة كبيرة للتباينات الوراثية التجمعية فى أن تظهر أثرها ٠

٦ ـ بلغت اناث الدقى ـ ٤ النضج الجنسى فى عمر مبكر (٩ر١٧٠ يوم) ووزن جسم ثقيل (١٥٣٠ جرام) نسبيا ، ووضعت بيض بمعدل ٩ر٦٢٪ وحجم عنقود بيض متوسطة ٢ر٦٢ بيضة ٠ كما كان للأمومة تأثير واضح فى تحديد كل من العمر عند النضج الجنسى (١ر٢٢٪) بمعدل انتاج البيض (٤ر٨٪)، كما دلت قيم المكافىء الوراثى لكل من العمر عند النضج الجنسى (٧١٥ر٠) ومعدل انتاج البيض (٤٦٩ر٠) وحجم عنقود البيض (٣٠٢ر٠) على أن هذه الصفات مرتفعة وراثيا ويجب أخذها فى الاعتبار فى برامج الانتخاب لانتاج البيض ٠

٧ ـ كانت قيم معاملات التلازم الوراثية والمظهرية بين صفات عدد البيض للتسجيل الجزئى التراكمى ، وكذلك بين تلك للتسجيل الجزئى التزامنى موجبة ومرتفعة ٠

كما كانت قيمة معاملات التلازم الوراثى والمظهرى بين عدد البيض الموضوع خلال أول وآخر فترة انتاج موجبة ومرتفعة ، مما يدل على أن التحسين السنوى لانتاج البيض يمكن الحصول عليه وذلك باجراء الانتخاب خلال الأربع أسابيع الأولى لفترة الانتاج المحصورة بين ٣٦ ـ ٤٠ أسبوع ٠

كما دلت معاملات التلازم الوراثى والمظهرى السالبة بين العمر عند النضج الجنسى وكل من صفات انتاج البيض للتسجيل الجزئى على أن الدجاجة التى تنضج جنسيا عند عمر مبكر يكون لديها القدرة والقابلية لانتاج البيض بمعدل مرتفع خلال أى فترة من فترات انتاج البيض ٠