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# EFFECT OF SEX RATIO AND STRAINS ON FERTILITY AND HATCHABILITY AMONG THREE GENERATIONS IN QUAIL

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**ABSTRACT:** ***The experiment continued for three generations $G_1$, $G_2$ and $G_3$ through the hatching seasons 2006 – 2007 and 2007 – 2008. This experiment was aimed to study the effect of some environmental and genetical factors on hatchability and fertility percentages and growth rates in quail. Eighty nine quails (38 males and 51 females) were used as foundation stock from local quails from Kafer El-Sheikh (strain A) and the same number of birds were used as foundation stock from local quails from Shebin El-Kom (strain B). Mating system was applied in a ratio one male with one female (as ratio 1) and one male with two females (as ratio 2). In each generation 204 females and 150 males in both strains were tested and the total number overall generations were 612 females and 450 males.***

***The results can be summarized as follows :***

1. ***The fertility of generation (1) was lower than that of generation (2) and (3) which were similar. There are significant differences among generation.***
   ***The fertility of strain (A) was higher than that of strain (B). The differences in this concept were highly significant.***
2. ***The fertility of sex ratio (1) was higher than that of sex ratio (2). The differences in this respect were highly significantly ($P \leq 0.01$).***
   ***The hatchability of generation (1) was lower than that of generation 2 and 3 which were similar. The significant difference ($P \leq 0.01$) among generations.***
3. ***The hatchability of strain (A) was higher than that of strain (B). The differences between strains were highly significant ($P \leq 0.01$).***
   ***The hatchability of sex ratio (1) was significantly ($P \leq 0.01$) higher than sex ratio (2).***
4. ***The interaction between generation and strains, between generation and sex ratio, between strain and sex ratio and among generation, strain and sex ratio were not significant.***

**Key words:** **Sex ratio, Fertility, Hatchability, Quail.**

## INTRODUCTION

**The poultry industry in Egypt as well as in most of the developing countries is still undeveloped due to lack of capital investment, feed resources, improper health control and weak bargaining power in buying and selling. Countries having shortage in animal protein supply may consider using all available protein resources for human nutrition (Singh *et al.,* 1981).**

**Quail is a seasonal game bird because of its annual latitudinal migration; pass twice through Egypt, production of animal protein from commercial rearing of Japanese quail has been recently initiated in Egypt.**

**Fertility and hatchability percentages were affected by mating system including sex ratio (Soltan, 1984). In commercial production, low fertility and hatchability play an important and economical roll. Therefore the present study was conducted to study sex ratio and strain effects among three generations on fertility, hatchability percentages and growth rates in quail.**

## MATERIALS AND METHODS

**This study was carried out at the Poultry Farm, Faculty of Agriculture, Minufiya University, Shebin El-Kom, Egypt.**

**The experiment was continued for three generations $G_1$, $G_2$ and $G_3$ through the hatching seasons 2006 – 2007 and 2007 – 2008 this experiment was aimed to study the effect of some environmental and genetical factors on the percentages of fertility and hatchability as well as growth rates in quails. Eighty nine quails (38 males and 51 females) were used as foundation stock from local quails from Kafer El-Sheikh (strain A) and the same number of birds were used as foundation stock from local quails from Shebin El-Kom (strain B). Mating system was applied in a ratio one male with one female (as ratio 1) and one male with two females (as ratio 2). In each generation 204 females and 150 males in both strains were tested and the total number overall generations were 612 females and 450 males.**

**Mating system was applied in a ratio one male with one female and one male with two female. The fertile eggs were collected from each dam and stored in cold room at 16 - 18°C for 7 days or less, with 80 – 90 % relative humidity.**

**At hatching day quails were wing-banded according to their families for identification. All chicks were brooded in floor brooders with wheat chaff litter. The starting brooder temperature was 35°C during the first week, then the brooder temperature decreased gradually from 2 – 3 every week to reach 20 - 22°C at almost 42 days of age, and exposed to 24 hours of constant light during the first 6 weeks of age, then pullets were moved to individual cages in laying house, where the laying hens were kept under 16 hours light a day. All quails were kept under the same managerial hygienic and environmental conditions.**

**Water was available all time and all the experimental quails were fed *ad libitum* on a starter diet contained 25.02 % crude protein and 2826 ME / Kg. Kcal then at 6 weeks of age the diet was changed by a layer diet contained 21.12 % crude protein and 2844 Me / Kg. Kcal. Compositions o diet used are shown in Table (1).**

**Table (1) : Composition of the experimental diets**

| Ingredients | Starter diet | Layer diet |
|---|---|---|
| Ground yellow corn | 53.05 | 61.50 |
| Soybean meal | 44.00 | 35.00 |
| Dicalcium phosphate | 2.00 | 02.55 |
| Salt (Na cl) | 0.50 | 00.50 |
| Vitamin premix* | 0.30 | 00.30 |
| Methonine | 0.10 | 00.10 |
| Dl-Lysine | 0.05 | 00.05 |
| Total Kg | 100 | 100 |
| Crude protein | 24.30 | 21.07 |
| ME / Kg. Kcal | 2826 | 2844 |

* Each 2.5 kg. of vitamins and minerals mixture contain :
12000.000 IU Vitamin A acetate; 2000.000 IU Vitamin $D_3$; 10.000 mg Vitamin E acetate; 2000 mg Vitamin K3; 100 mg Vitamin $B_1$; 4000 mg Vitamin $B_2$; 1500 mg Vitamin $B_6$; 10 mg Vitamin $B_{12}$; 10.000 mg Pantothenic acid; 20.000 mg Nicotinic acid; 1000 mg folic acid; 50 mg Biotin; 500.000 mg choline; 10.000 copper; 1000 mg Idone; 300.000 mg Manganese; 55.000 mg Zinc, and 100 mg Selenium.

## Fertility and hatchability percentage:-

**Fertility percentage can be evaluated as :**
**Total number of fertile eggs/total number of incubated eggs X 100**
**Also, hatchability percentage can be calculated as:**
**Number of released chicks/number of fertile eggs X 100**

**Recorded data were subjected to statistical analysis using SPSS (Statistical Package for Social Science) program version 10, (1999). Duncan's new multiple range test was used to compare every two means of the different traits studied (Steel and Torries, 1980). Data as percentages were converted to angles using arcsin transformation prior to statistical analysis.**

**The following model was used :**

$$Y_{ijkl} = \mu + G_i + L_j + S_k + (G\times L)_{ij} + (G\times S)_{ik} + (L\times S)_{jk} + (G\times L\times S)_{ijk} + e_{kjkl}$$

**Where :**

- $Y_{ijkl}$ = The observation of $i^{th}$ bird.
- $\mu$ = The overall mean.
- $G_i$ = The fixed effect of $i^{th}$ generation.
- $L_j$ = The fixed effect of $j^{h}$ strain within the $i^{th}$ generation
- $S_k$ = The fixed effect of the $k^{th}$ sex ratio.
- $(G\times L)_{ij}$ = The interaction between $i^{th}$ generation and $j^{th}$ strain
- $(G\times S)_{ik}$ = The interaction between $i^{th}$ generation and $k^{th}$ sex ratio.
- $(G\times L\times S)_{ijk}$= The interaction between $i^{th}$ generation ank $j^{th}$ strainand $k^{th}$ sex ratio
- eijkl = The random error assumed to be normally distributed with zero mean and variances $\square^2 e$

## RESULTS AND DISCUSSION

### 1. Fertility percentage:-

**Data in Table (2) showed the fertility percentages as affected by generations, strains and sex ratio. It was observed that the lowest value of fertility percentages were recorded by generation 1 ($G_1$) compared to either generation 2 or 3 which were similar (Table 2). They were 67.5, 71.0 and 71.1% in G1, G2 and G3, respectively. The differences in this respect, were significant ($P \leq 0.01$) as shown Table (3).**

**Table (2) : Means of fertility and hatchability percentages of two different strains of quail with different sex ratio among three generation**

| Generation | Strains | Sex ratio | Means of fertility | Means of Hatchability |
|---|---|---|---|---|
| 1 | A | 1 | 72.2 ± 1.14 | 70.2 ± 1. 4 |
| | | 2 | 67.2 ± 1.14 | 65.0 ± 1.3 |
| | B | 1 | 67.2 ± 1.14 | 65.3 ± 1. 4 |
| | | 2 | 63.5 ± 1.1 | 61.7 ± 1.4 |
| Average of generation | | | 67.5 ± 0.6 | 65.7 ± 0.6 |
| 2 | A | 1 | 74.7 ± 1.1 | 73.3 ± 1. 4 |
| | | 2 | 71.5 ± 1.14 | 71.0 ± 1.4 |
| | B | 1 | 70.5 ± 1.14 | 68.7 ± 1. 4 |
| | | 2 | 67.3 ± 1.1 | 66.0 ± 1.4 |
| Average generation | | | 71.0 ± 0.6 | 69.7 ± 0.6 |
| 3 | A | 1 | 75.3 ± 1.1 | 74.0 ± 1. 4 |
| | | 2 | 71.5 ± 1.14 | 70.3 ± 1.4 |
| | B | 1 | 70.8 ± 1.14 | 68.7 ± 1. 4 |
| | | 2 | 67.0 ± 1.1 | 65.3 ± 1.4 |
| | | | 71.1 ± 0.6 | 69.5 ± 0.6 |
| Overall means of strain | A | | 72.0 | 70.0 |
| | B | | 67.7 | 65.9 |
| Overall means of sex ratio | | 1 | 71.7 | 70.0 |
| | | 2 | 68.5 | 66.5 |

**A = Local strain obtained from Kafer El-Shikh**
**B = Local strain obtained from Shebin El-Kom**
**1 = sex ratio 1 (one male : one female)**
**2 = sex ratio 2 (one male : two females)**

**Table (3) : Analysis of variance of fertility and hatchability pre centage of two Different strains of quail with different sex ratio among three generation.**

| Sources of variation (S.O.V.) | Degrees of freedom d.f | M.S. | |
|---|---|---|---|
| | | Fertility | Hatchability |
| Between generation (G) | 2 | 65.3** | 84.1** |
| Between strains (B) | 1 | 229.6** | 270.7** |
| Between sex ratio (S) | 1 | 172.5** | 140.0** |
| G * B | 2 | 0.63 | 0.56 |
| G * S | 2 | 1.27 | 2.7 |
| G * S | 1 | 0.52 | 0.33 |
| G * B * S | 2 | 0.52 | 0.77 |
| Error | 36 | 2.2 | 7.5 |

G = generation B = Strains S = Sex ratio
(G*B), (G*S), (B*S) and (G*B*S) = interaction between sources of variance
M.S. = Means of square for traits from ANOVA table
* significant at P ≤ 0.05
** significant at P ≤ 0.01

Either G2 or G3 had the highest value of fertility % comparing with G1 which gave the lowest value in both strains (A and B).

The fertility percentage of strain (A) was higher than that of strain (B), it were 72.0 and 67.7 % of strain (A) and (B), respectively (Table 2). The differences in this concept, were highly significant (P ≤ 0.01) as shown in Table (3). This finding may be due to inbreeding effect in strain (B) from past years. This effect of inbreeding was observed by Sato *et al*. (1989).

The fertility % of sex ratio (1) was higher than that of sex ratio (2) in both strains (A and B) during different generations studied.

Generally, the fertility % of sex ratio (1) was higher than that of sex ratio (2). They were 71.7 and 68.0 %, respectively. The differences in this respect, were highly significantly (P ≤ 0.01) as shown Table (3).

As obtained before, Sex ratio (1) (one male : one female) had better fertility percentage than that of sex ratio (2) (one male : two females). These results illustrate the effectiveness of both males and females in mating. And leads to use sex ratio 1 (1 male : 1 female) in commercial mating system in order to realize higher fertility percentages.

Lower fertility percentages in sex ratio 2 may be caused by lower sexual mating rates between males (33.3 % from the total flock numbers) and females (66.6 % from the total flock numbers). Similar finding was observed by Soltan (1991).

## 2. Hatchability percentage :

**The hatchability % of generation (1) was lower than that of either G2 or G3 which were nearly similar (Table 2). The hatchability of $G_1$ , $G_2$ and $G_3$ were 65.7, 69.7 and 69.5 %, respectively. The differences in this respect, were highly significantly ($P \leq 0.01$) as shown Table (3).**

**The hatchability % of G1 for strain (A) was lower than other generations as well as that for strain (B).**

**The hatchability % of strain (A) was higher than that of strain (B) at different generations. The hatchability of strain (A) and (B) were 70.6 and 65.96%, respectively. The differences between strains were highly significant ($P \leq 0.01$) Table (3).**

**The hatchability % of strains (A and B) of sex ratio (1) was higher than that of sex ratio (2) at all generations studied.**

**The hatchability % of sex ratio (1) was significantly ($P \leq 0.01$) higher than sex ratio (2). They were 70.0 and 66.5 % of sex ratio (1) and (2), respectively.**

**The interaction between generation and strains, between generation and sex ratio, between strain and sex ratio and among generation, strain and sex ratio on hatchability % were not significant as shown in (Table 3).**

**These results as shown before proved that the use of sex ratio 1 (one male : one female) in commercial farming could be realized higher hatchability percentages as well as higher fertility percentages and leads to an economical efficiency with great gain.**

**In this respect, Inal *et al.* (1996) who showed that egg hatchability ranged from 51.35 to 55.03, 51.22 to 61.98 and 48.00 to 53.48 % for control, low and high lines over 5 generations of selection, respectively. The corresponding averages of egg fertility were 82.94, 87.39 and 86.79 %, in the same lines. Also, Debes (2004) stated that fertility after 1, 2, 3, 4 generations of selection were 86.03, 72.50, 82.09 and 80.72 % and hatchability were 75.85, 88.14, 76.71 and 74.81 % for selected quail lines, respectively. However, Panait *et al*. (1992) indicated that egg fertility was 83.3 or 77.3 % for quail selected for egg production or body weight at 5 wk, respectively. They added that egg hatchability percentage was 67.3 quail selected for egg production compared with 56.7 for quail were selected for 5-wk body weight over 20 generation. Study of Mandour and Sharaf (1993) showed that the average mean of fertility percentage obtained was (64.6). Marks (1995 b) noted that low hatchability of total eggs in high 4-wk body weight and control lines (25 and 27 %, respectively). Moreover, El-Hadad (1996) stated that fertility after one generation of selection were 75.6, 60.8 and 76.1 % and hatchability of fertile eggs were 69.1, 61.1 and 81.1 % for high body weight, high egg number and control quail lines, respectively. Tawefeuk (2001) showed that the effect of line on fertility percent was not significant and highly significant on hatchability of fertile eggs.**

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# تأثير النسبة الجنسبة والسلالات علي نسبتي الخصوبة والفقس عبر ثلاثة أجيال في السمان

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**الملخص العربي**

**تم إجراء هذا العمل على ثلاث أجيال من السمان خلال الموسمين الانتاجيين ٢٠٠٦-٢٠٠٧ و ٢٠٠٧-٢٠٠٨ بمزرعة أبحاث الدواجن- قسم إنتاج الدواجن - كلية الزراعة بشبين الكوم – جامعة المنوفية.**

**والهدف من هذه التجربة هو دراسة بعض العوامل البيئية والوراثية المؤثرة على بعض النسبة المئوية لكل من الخصوبة والفقس، ومعدلات النمو ، فى سلالتين محليتين من السمان وهما السلالة الأولى (A) تم الحصول عليها من كفر الشيخ أما السلالة الثانية (B) من مزرعة كلية الزراعة-جامعة المنوفية وذلك خلال ثلاثة أجيال (G1, G2 and G3) وذلك تحت نظامين من أنظمة التزاوج المنسب والخاص بالنسبة الجنسية وهما النسبة الجنسية (1) وهى ١ ذكر : ١ أنثى ، أما النسبة الجنسية (2) فهي عبارة عن تزاوج ١ ذكر : ٢ أنثى.**

**وفيما يلى ملخص لأهم النتائج :**

**الخصوبة والفقس**

**١- وجد أن النسبة المئوية لكل من الخصوبة والفقس في البيض الناتج من الجيل الأول كان منخفض معنويا عن تلك الناتج من الجيلين الآخرين.**

**٢- أوضحت النتائج أن البيض الناتج من السلالة الأولى أعطى نسبتى خصوبة وفقس أعلى معنويا عن تلك الناتج من السلالة الثانية.**

**٣- وجد أن البيض الناتج من الطيور المرباة بنظام التزاوج الأول كان عالى معنويا (باحتمال ٠.٠١) فى نسبتى الخصوبة والفقس عن تلك الناتج من الطيور المرباة بنظام التزاوج الثانى.**

**٤- وجد أن التداخل بين الجيل والسلالة ، بين الجيل ونظام التزاوج وبين الجيل والسلالة ونظام التزاوج على نسبتى الخصوبة والفقس كان غير معنويا .**