Egypt. J. Vet. Sci. , pp.1-8

Egyptian Journal of Veterinary Sciences

https://ejvs.journals.ekb.eg/

Crossbreeding Effects on Some Egg Production and Reproductive Traits in Japanese Quail

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Abstract

A crossbreeding experiment was conducted utilizing two selected lines of Japanese quail: HBW4, developed for elevated body weight at 4 weeks, and HTEW10, created for increased total egg weight produced by females during the first 10 weeks of laying. A total of 1512 crossbreed quail were utilized in this study, derived from four mating groups throughout three hatches, to evaluate direct heterosis (H^i), direct additive effects (G^i), and maternal effects (G^m) on the subsequent traits: Egg production and reproductive characteristics: egg weight (EW), age at sexual maturity (ASM), body weight at sexual maturity (BWSM), total egg number (TEN10) and weight produced (TEW10) during the initial 10 wks of laying, daily egg mass (DEM), fertility rates (FRT%), and hatchability percentages (HAT%). Substantial heterosis was observed for TEW10 (7.6 %) and DEM (12.1%), while direct additive effects on most egg production and reproductive traits were significant (ranging from -141.0 for TEW10 to 31.37 for BWSM. Maternal contributions significantly impacted all measured egg production and reproductive traits, with effects ranging from -15.49 BWSM for EW to 27.9 for TEW10. Crossing HBW4 sires with HTEW10 dams yields superior egg production and reproductive traits due to beneficial direct heterosis and the advantageous maternal line effects of HTEW10 dams.

Keywords: Crossbreeding, Egg production, Quail, Reproductive traits.

Introduction

Research on poultry breeding employs quails as subjects due to their superior attributes compared to other poultry species, including accelerated growth rate, remarkable reproductive capacity, short life cycle, low feed requirements, superior meat flavor, increased egg-laying ability, and reduced hatching duration [1-3]. Quail breeding enhances trait performance by selection and crossover, resulting in diverse degrees of heterosis. This method influences both additive and non-additive genes, resulting in improved qualities such as growth and reproduction, while optimizing essential attributes in target populations [4, 5]. According to Ramadan et al. [6] crossbreeding is an effective method for obtaining diverse genetic combinations. This may enhance heterozygosity, obscure recessive alleles, diminish breeding integrity, and potentially eradicate entire lineages within a single generation. Crossbreeding methods generally result in enhanced economic performance owing to hybrid vigor [7].

The quail, possessing a mutant IGF-1 gene, demonstrated significant positive heterosis, with the hybrids growing faster than the parent types [8].

Previous studies Farahatet al., Marks et al. [9, 10] have revealed that the additive aspect of genetic variety has significantly enhanced body weight in Japanese quail. Moreover, non-additive genetic factors, like dominance and epistasis, are essential in improving meat and egg production by integrating complementary genetic characteristics. This facilitates the planned formulation of mating combinations intended to attain accelerated growth, elevated yield, and other critical economic traits [11, 12].

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(Received 03 May 2025, accepted 30 June 2025)
DOI: 10.21608/ejvs.2025.381489.2822

This study aims to assess the contributions of heterosis, maternal influences, and direct additive genetic effects resulting from the crossbreeding of two selected lines of Japanese quail, HBW4 and HTEW10.

Material and Methods

This study utilized data from a flock of four genetically distinct Japanese quail lines (HBW4 and HTEW10), selected for their great body weight at 4 wks and egg production at 10 wks. These lines were then crossed with each other to make new lines, which were named HBW4 x HTEW10 and HTEW10 x HBW4. The production was overseen by the Animal Production Department of Al-Azhar University in Cairo, Egypt. Table 1 presents the distribution of birds resulting from crossbreeding among various lines and hatches.

HBW4 and HTEW10 Japanese quail lines were selected based on their elevated body weight at 4 wks and egg output at 10 wks. Eggs were gathered for incubation at 10 to 12 weeks of age. Subsequent to incubation, the eggs were transferred to the hatcher. Upon hatching, each quail was permanently marked with wing bands and housed in quail battery brooders for four weeks.

All birds were housed in a singular chamber to guarantee that temperature, humidity, light intensity, and all environmental factors remained as consistent as possible. Nevertheless, environmental and management practices persisted at standard levels for the whole duration. At five weeks of age, the males were separated from the females, and at six weeks of age, the birds were classified into three groups. All birds were sexed according to plumage color and pattern concurrently; all chicks were gathered and placed in individual laying cages, with breeding occurring around two weeks later.

Feed and water were supplied ad libitum. The experimental diet consisted of 28% protein and 2920 Kcal (ME/Kg) until two weeks of age, followed by 25% protein and 2850 Kcal (ME/Kg) from three to six weeks of age. Throughout the egg production phase, the diet was modified to include a formulation of 20% protein and 2820 Kcal (ME/kg) [4].

The temperature began at 38°C during the initial week post-hatching and subsequently reduced by 2-3°C weekly, reaching 26-28°C by the fourth week of age, persisting until the end of the brooding period.

Traits studied:

Egg weight(EW), age at sexual maturity (ASM), body weight at sexual maturity(BWSM), total egg number produced during the initial 10 wks of laying (TEN10), total egg weight produced during the initial 10 wks of laying (TEW10), daily egg mass (DEM), fertility rates (FRT%), and hatchability percentages(HAT%).

Statistical analysis

The current study's data were analyzed utilizing the general linear model (GLM) process in SAS [13] based on the subsequent statistical model.

Yikpm = μ + Gi + Sk + Hm + eikpm

Where: Yikpm = the observation on the ikpmth trait; μ = overall mean, a common element across observations; Gi = fixed effect of the ith mating group; Sk = random effect of the kth sire; Hm = fixed effect of the mth hatch; eikpm = random residual error term.

The CBE computer package, version 4.0 Wolf [14], used estimated least-squares means as input data to evaluate the genetic factors related to crossbreeding (direct additive, maternal effects, and direct heterotic effect) for various traits.

Crossbreeding parameters for growth, egg production, and reproductive characteristics were assessed in accordance with Dickerson [15].

Purebred differences:

$[(G^i_{HBW4} + G^m_{HBW4}) - (G^i_{HTE10} + G^m_{HTE10})\} =$ (HBW4 x HBW4) – (HTE10 x HTE10).

Direct heterosis effect:

$H^i_{HBW} \text{ x }_{HTE}$ = [(HBW4 x THE10) + (HTE10 x HBW4)} – {(HBW4 x HBW4) + (HTE10 x HTE10)}.

$H^i\%$ = [H^i as unit / (average of HBW4 + HTE10)] x 100.

Direct additive effect:

$G^i_{HBW4} - G^i_{THE10}$ = {[(HBW4 x HBW4) + (HBW4 x THE10)] – [(HTE10 x HTE10) + (HTE10 x HBW4)]}.

Maternal additive effect (i.e., reciprocal cross difference):

$G^m_{HBW4} - G^m_{HTE10}$ = (HBW4 x THE10) – (HTE10 x HBW4).

Where:

G^I and G^M denote the direct and maternal additive effects of the specified breed (genetic) group.

Heritability (H2):

$H^2=V_G/V_{P,}$ where $V_{G=}V_A+V_D+V_I$ (genetic variance = additive, dominant, and epistatic variance) and phenotypic variance (V_P) = genetic (V_G) and environmental (V_E) components, and interaction component (V_{GE}).

Results and Discussion

Crossbreeding effects:

Egg production traits:

Table 2 presents the least-square means and standard errors (S.E.) for egg production traits, specifically EW, ASM, and BWSM.

The analysis of crossbreeding outcomes showed that the highest egg weight was achieved in crossbreds from HBW4 sires mated with HTEW10 dams (9.96), while the crossbreds produced from HTEW10 sires and HBW4 dams exhibited the lowest ASM. Moreover, the highest BWSM was recorded in crossbreds sired by HBW4 with HTEW10 dams. However, egg production traits varied significantly across the different mating groups (MG), highlighting the impact of genetic pairing on reproductive performance. The substantial impact of mating groups on the egg production characteristics of Japanese quail strains has been corroborated [16-18].

Direct heterosis(Hi):

Table 2 presents estimates of direct heterosis for egg production, expressed in grams (g) and percentages (%). Nonetheless, these characteristics exhibited non-significant ($P < 0.01$ or $P < 0.001$) positive direct heterosis, calculated at 0.37, -0.12, and 1.21 for EW, ASM, and BWSM, respectively. Bahie-El-Deen et al. [16] noticed a similar pattern, with positive heterosis for BWSM at 18.2% and negative heterosis for egg weight, egg number (EN), and age at sexual maturity at -1.95%, -3.4%, and -1.4%, respectively. Gerken et al.[19] observed a negative heterosis of 5.5% for the age at which 50% output is achieved. Moritsu et al. [20] showed negative heterosis for ASM ranging from 9% to 23% in several quail crosses. Aboul-Hassanet [17] indicated that the superior dark quail (B) strain excelled in TEW10, DEM, and BWSM, whereas the white quail (W) strain shown superiority in ASM and TEN10. The same author identified substantial impacts ($P < 0.05$ or $P < 0.001$) of direct heterosis on all egg production and reproductive characteristics. Nofal [18]identified an uneven tendency in the superiority rating of meat line (M) or egg line (E) females for sexual maturity features. The M line exhibited a substantial superiority for ASM ($P < 0.05$). The E line marginally exceeded the M line in EP20.

Direct additive effect(Gi):

This study determined that direct additive effects on egg production features were significant ($P < 0.05$ or $P < 0.001$), with values computed at -18.13 for ASM and 31.37 for BWSM. The impact on EW was negligible, quantified at -0.98 Table 2. The eggs of quail sired by HBW4 were much superior than those sired by the HTEW10 line. Bahie-El-Deen et al. [16] and [18]discovered substantial differences between M- and E-sired quails in EN ($P < 0.05$), EW ($P < 0.01$), feed conversion ratio (FCR) ($P < 0.001$), and BWSM ($P < 0.01$). This indicated that sire-line effects were significant in the variance of most egg production variables. E-sired quails outperformed in EN and BWSM, but M-sired quails excelled in EW and FCR. This beneficial result indicates that M quails may function as a sire line to improve egg weight and feed conversion efficiency. Conversely, we may utilize an E-line as a sire line to augment egg production and body weight during sexual maturity.

In 2001, Aboul-Hassan discovered that the egg production characteristics of B- and W-sired quails exhibited substantial differences in ASM, BWSM, TEN10 ($P < 0.01$), and TEW10 and DEM ($P < 0.001$). This indicated that sire line effects significantly influenced the variations in most egg production variables. ASM, TEN10, and BWSM supported W-sired quails, whereas sired quails excelled in TEW10 and DEM. This beneficial result indicates that employing B quails as a sire line may improve their ASM and augment the overall TEW10. Conversely, we may utilize the W-line as a sire line to augment overall EW and DEM.

Maternal additive effect(Gm):

The maternal effects, as seen by the disparities across reciprocal crossings, on all assessed egg production were statistically significant ($P < 0.001$). The egg weight of quails dam by the HTEW10 line was significantly higher than that of quails dam by the HBW4 line (Table 2). Continuous trend, demonstrating significant reciprocal effects between BWSM and ASM [16, 20, 21].

According to Bahie-El-Deen et al. and Aboul-Hassan [16, 17] indicated that maternal line effects on TEW10 and BWSM were insignificant, suggesting that both strains examined might function as dams, with the W strain deriving the most advantage. Conversely, employing B quails as a dam line has led to a substantial rise ($P < 0.01$) in BWSM. Nofal [18] noted that maternal influences on sexual maturity characteristics were insignificant, except for ASM, which was significant ($P < 0.01$). The author observed that the least-squares means of his investigation indicated a benefit in earlier ASM when employing the E line as a dam line.

Reproductive traits:

Table 3 provides the least-square means and standard errors (S.E.) for reproductive traits, specifically FRT% and HAT%. The crossbreds originating from sired HBW4 and HTEW10 dams exhibited the highest levels of egg production and reproductive traits, with the exception of ASM. However, we observed significant differences in egg production and reproductive traits due to the mating groups (MG). According to Bahie-El-Deen et al., Aboul-Hassan, Nofal and Abdel-Moutalib [16-18, 21] also confirmed the significant effect of MG on egg production and reproductive traits of Japanese quail strains.

Direct heterosis:

Estimates of direct heterosis, expressed in grams (g) and percentages (%), for the reproductive traits examined are displayed in Table 3. These variables exhibited significant positive direct heterosis ($P < 0.01$), with values of 1.64, 39.15,1.15,-4.3 and -5.7 for TEN10, TEW10, DEM, FR%, and HA%, respectively. According to Bahie-El-Deen, et al. [16], a similar tendency documents negative heterosis for egg weight, with estimations of -1.95% and -3.4%, respectively.

Gerken et al. [19] documented a negative heterosis of 5.5% for the age at which 50% output is achieved. Moritsu et al. [20] showed negative heterosis for ASM ranging from 9 to 23% in several quail crosses. Aboul-Hassan [17] indicated that the B strain excelled in TEW10, DEM, and BWSM, whereas the W strain excelled in ASM and TEN10. The same author identified significant impacts ($P < 0.05$ or $P < 0.001$) of direct heterosis on all egg production and reproductive parameters. Also, Nofal [18] identified an uneven tendency in the superiority rating of M or E females for sexual maturity features. The M line exhibited a substantial superiority for ASM ($P < 0.05$). In EP20, the E line somewhat surpassed the M lines.

Direct additive effect (Gi):

The direct additive effects on the examined reproductive traits were substantial ($P < 0.05$ or $P < 0.001$), with computed values of -9.3, -141.0, -1.25, 1.4, and -2.7 for TEN10, TEW10, DEM, FR%, and HA%, respectively Table 3. The reproductive characteristics of quails sired by HBW4 were significantly superior than those sired by the HTEW10 line. A study conducted by Bahie-El-Deen et al. [16], Nofal [18] and Aboul-Hassan[22] revealed that quails sired by M and E exhibited substantial differences in EN ($P < 0.05$), EW ($P < 0.01$), FCR ($P < 0.001$), and BWSM ($P < 0.01$). This indicated that sire-line influences were significant in the variance of most egg production characteristics. E-sired quails outperformed in EN and BWSM, but M-sired quails excelled in EW and FCR. This beneficial result indicates that M quails may function as a sire line to improve egg weight and feed conversion efficiency. Conversely, we may utilize an E-line as a sire line to augment egg production and body weight during sexual maturity. Aboul-Hassan[17] indicated that the egg production characteristics of B and W sired quails exhibited significant differences in ASM, BWSM, and TEN10 ($P < 0.01$), as well as TEW10 and DEM ($P < 0.001$), demonstrating that sire line effects were substantially influential in the variance of most egg production parameters. ASM, TEN10, and BWSM favored W-sired quails, whereas sired quails excelled in TEW10 and DEM. This beneficial result indicates that employing B quails as a sire line may improve their age at sexual maturity and augment the overall egg production during the initial ten weeks of laying. Conversely, we may utilize the W-line as a sire line to augment overall egg weight and daily egg mass during the initial ten weeks of laying.

Maternal additive effect (Gi):

Maternal line effects (expressed as the differences between reciprocal crosses) on all reproductive traits studied were statistically significant ($P<0.001$). The reproductive traits of quails mothered by the HTEW10 line were significantly superior to those of quails mothered by the HBW4 line (Table 3). The same trend was observed by Bahie-El-Deen et al.,Moritsu et al. and Abdel-Moutalib[16, 20, and 21]who reported that reciprocal effects were significant for BWSM and ASM.

On the contrary, Aboul-Hassan [17] reported that maternal line effects on TEW10, and BWSM were not significant, i.e. both strains studied could be used as a line of dam, but they were mainly in favour of the W strain. In contrast, using B quails as a dam line has resulted in a significant increase ($P<0.01$) in BWSM. Also, Nofal [18] observed that maternal effects on sexual maturity traits were not significant except for ASM ($P< 0.01$). The same author added that the least-squares means of his study showed that using the E line as a dam-line gave an advantage expressed in earlier ASM.

Heritability estimates:

The ratio of the response to selection to the selection differential (R/S) in Table 4 indicates the estimated realized heritability for reproductive variables. The estimated realized heritability for reproductive traits (EW, ASM, BWSM, TEN10, TEW10, DEM, FRT%, and HAT%) are 0.12, 0.08, 0.17, 0.18, 0.19, 0.20, 0.07, and 0.08, respectively. Nonetheless, Aboul-Hassan[22] presented a spectrum of estimates (0.12–0.18) for the realized heritability of BW6. Moreover, El-Fiky [23] indicated that realized heritabilities varied between 0.12 and 0.21 throughout four generations of selection for BW6.

Conclusion

In summary, crossing HBW4 sires with HTEW10 dams significantly improves Japanese quail reproductive performance due to positive heterosis and additive effects, along with favorable maternal line influence. This specific crossbreeding strategy offers a valuable approach for enhancing productivity in the poultry industry.

Acknowledgment

We like to convey our profound gratitude and appreciation to the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Egypt, for their financial support.

Ethical Considerations

The current study was done in accordance with the criteria of the Ethics Committee, the Institutional Animal Care and Use Committee (ARC-IACUC), and the Agricultural Research Center, approval number ARC-ABRI-11-24.

Conflicts of interest

The authors declare that there is no conflict of interest.

Funding statement

There is no funding.

Author`s contributions

All authors collaborate equally.

TABLE 1. Distribution of quail progeny resulting from crossbreeding across diverse lines and hatches

Mating groups	HBW4 X HBW4		HTEW10 X HTEW10		HBW4 X HTEW10		HTEW10 X HBW4		Total	
Hatch	M	F	M	F	M	F	M	F	M	F
1	84	80	75	78	85	87	52	50	296	295
2	76	66	72	68	52	50	50	48	250	232
3	72	75	56	52	48	45	45	46	221	218
Total	232	221	203	198	185	182	147	144	767	745

M: Males, F: Females.

TABLE 2. Estimates of mating group, means ± SE, purebred difference, heterosis (H^i), maternal additive effect (G^m) and direct additive effect (G^i) on egg production traits

	EW	ASM	BWSM
Mating groups			
HBW4 X HBW4	8.75±0.42	60.6±7.8	176.8±14.5
HTE10 X HTE10	9.85±0.42	52.7±7.1	160.9±12.1
HBW4 X HTE10	9.96±0.42	61.6±7.6	177.8±13.3
HTE10 X HBW4	9.62±0.52	51.4±7.9	162.3±13.2
Purebred difference			
	-1.21	7.94	15.87
Sig.	*	*	*
Additive effect			
G^i	-0.98±0.6	18.13±1.2	31.37±2.2
Sig.	NS	**	**
Heterosis			
H^i unit	0.37±0.3	-0.12±0.6	1.21±1.1
H^i %	3.95	-0.21	0.72
Sig.	NS	NS	NS
Additive maternal			
G^m	-0.22±.4	-10.19±0.8	-15.49±1.6
Sig.	NS	**	**

* =P< 0.05, ** = P< 0.01, *** = P< 0.001 and ^{ns} = Non- significant, EW= egg weight, ASM= age at sexual maturity, BWSM= body weight at sexual maturity.

TABLE 3. Estimates of mating group, means ± SE, purebred difference, heterosis (H^i), maternal additive effect (G^m) and direct additive effect (G^i) on reproductive traits.

	TEN10	TEW10	DEM	FRT%	HAT%
Mating group					
HBW4 X HBW4	52.6±4.6	455.3±19.1	9.13±5.9	81.2	69.8
HTE10 X HTE10	57.8±3.9	568.4±14.4	9.83±4.9	84.2	76.4
HBW4 X HTE10	54.8±6.6	537.0±15.2	10.72±5.2	80.5	69.2
HTE10 X HBW4	58.9±5.3	565.0±15.1	11.27±5.5	76.3	65.6
Purebred difference					
	-5.24	-113.0	-0.7	-3.0	-6.6
Sig.	*	**	NS	*	**
Additive effect					
Gi	-9.3±**0.7**	-141.0±2.3	-1.25±0.6	1.4	-2.7
Sig.	**	**	*	**	**
Heterosis					
Hi unit	1.64±0.3	39.15±1.3	1.15±0.30	-4.3	-5.7
Hi %	3	7.6	12.1	-5.1	-7.8
Sig.	**	**	**	**	**
Additive maternal					
Gm	4.1±0.5	27.9±1.6	0.55±0.4	-4.3	-3.6
Sig.	**	**	NS	**	**

TEN10= total egg number at first ten week, TEW10= total Egg Weight at first 10 weeks, DEM= daily egg mass, FRT%= fertility rates percentages and HAT%= hatchability percentages.

TABLE 4. Realized heritability estimates computed from reproductive traits.

Trait	Realized h^2 ± S.E
EW	0.12± 0.10
ASM	0.08±0.09
BWSM	0.17±0.10
TEN10	0.18±0.15
TEW10	0.19±0.11
DEM	0.2±0.09
FRT%	0.07
HAT%	0.08

EW= egg weight, ASM= age at sexual maturity, BWSM= egg weight at sexual maturity, TEN10= Total Egg Number at 10 wk, TEW10= Total Egg Weight at 10 wk

References

1. Arunrao, K.V., Kannan, D., Amutha, R., Thiruvenkadan, A.K. and Yakubu, A., Production Performance of Four Lines of Japanese Quail Reared under Tropical Climatic Conditions of Tamil Nadu, India. *Frontiers in Genetics*, **14,** 1128944 (2023).
2. Abdel-Halim ، A., El-Komy, E., Abdelsalam, A. and Ramadan, G., Evaluating Body Weight and Carcass Traits in Six Hybrid Quail Varieties over a Five Week Period. *Adv. Anim. Vet. Sci.*, **12**(8) 1474-1482. (2024)
3. Hatab, M.H., Chen, W., Abouelezz, K., Elaroussi, M., Badran ،A., Zoheir, K., El-Komy, E., Li, S. and Elokil, A., Effects of Exposing Japanese Quail Eggs to a Low Dose of Gamma Radiation and in Ovo Feeding by Two Sources of Trace Elements on Embryonic Development Activities. *Poultry Science*, **103**(3) 103364 (2024).
4. Elkhaiat, I., El-Kassas, S., Eid, Y., Ghobish, M., El-Komy, E., Alagawany, M. and Ragab, M., Assessment of Variations in Productive Performance of Two Different Plumage Color Varieties of Japanese Quail and Their Reciprocal Crosses. *Tropical Animal Health and Production*, **55**(3), 195 (2023).
5. Faraji-Arough, H., Maghsoudi, A. and Rokouei, M., Study of Genetic and Non-Genetic Effects on Cumulative Survival in a Crossbred Population of Quail. *Tropical Animal Health and Production*, **55**(1) 5 (2023).
6. Ramadan, G.S., El-Komy, E.M., Abdelsalam, A.M., Abd ElRahman, H.H., Nassar, F.S. and Abdel-Halim, A.A., The Impact of Different Plumage Color Selected Quail Lines on Egg Quality and Eggshell Properties. *Egyptian Journal of Chemistry*, **68**(1) 487-501(2025).
7. Volkova, N.A., Romanov, M.N., Abdelmanova, A.S., Larionova, P.V., German, N.Y., Vetokh, A.N., Shakhin, A.V., Volkova, L.A., Anshakov, D.V. and Fisinin, V.I., Genotyping-by-Sequencing Strategy for Integrating Genomic Structure, Diversity and Performance of Various Japanese Quail (Coturnix Japonica) Breeds. *Animals*, **13**(22) 3439 (2023).
8. **K**halil, M.H., Elattar, E.A., Ayman, S.E. and Shebl, M.K., Detection of Single-Nucleotide Polymorphisms in Growth Hormone and Insulin-Like Growth Factor-1 Genes Related to Growth Traits in Purebred and Crossbred Quails. *Veterinary World*, **17**(7) 1482 (2024).
9. Farahat, G., Mahmoud, B., El-Komy, E. and El-Full, E., Alterations in Plasma Constituents, Growth and Egg Production Traits Due to Selection in Three Genotypes of Japanese Quail. *The Journal of Agricultural Science*, **156**(1) 118-126 (2018).
10. Marks, H., Abdominal Fat and Testes Weights in Diverse Genetic Lines of Japanese Quail. *Poultry Science*, **69**(10) 1627-1633 (1990).
11. Marks, H., Heterosis and Overdominance Following Long-Term Selection for Body Weight in Japanese Quail. *Poultry science*, **74**(11) 1730-1744 (1995).
12. Mahmoud, B.Y., Semida, D.A., El-Full, E.A. and Emam, A.M., Genetic Evaluation for Survival Traits in Japanese Quail Line Selected for Fast Growth Rate. *Animal Biotechnology*, **34**(7) 2414-2419 (2023).
13. SAS, I., Sas/Stat® 9.2. *Users Guide* (2008).
14. Wolf, J., User's Manual for the Software Package Cbe, Version 4.0 (a Universal Program for Estimating Crossbreeding Effects). *Research Institute of Animal Production, Prague-Uhrineves, Czech Republic* (1996).
15. Dickerson, G., Manual for Evaluation of Breeds and Crosses of Domestic Animals. *Food and Agriculture Organization of the United Nations, Rome*, **47,** (1992).
16. Bahie-El-Deen, M., Shebl, M. and El-Raffa, A., Heterosis, Maternal and Direct Genetic Effects for Growth and Egg Production Traits in Quail Crosses. *Egyptian Poultry Science Journal (Egypt)*, **19**(III)491-507 (1998).
17. Aboul-Hassan, M., Crossbreeding Effects on Some Growth and Egg Production Traits among Two Strains of Japanese Quail. *Al-Azhar J. Agric. Res*, **34** 41-57 (2001).
18. Nofal, R.Y., Crossbreeding Parameters of Females in Two Lines of Japanese Quail for Some Growth and Sexual Maturity Traits . *Egypt.Poultry. Sci.*, **26**(1), 69-85(2006).
19. Gerken, M., Zimmer, S. and Petersen, J., Juvenile Body Weight and Gonad Development in a Diallel Cross among Lines of Japanese Quail (Coturnix Coturnix Japonica). *Theoretical and Applied Genetics*, **76** 775-780 (1988).
20. Moritsu, Y., Nestor, K., Noble, D., Anthony, N. and Bacon, W., Divergent Selection for Body Weight and Yolk Precursor in Coturnix Coturnix Japonica. 12. Heterosis in Reciprocal Crosses between Divergently Selected Lines. *Poultry Science*, **76**(3) 437-444 (1997).
21. Abdel-Moutalib, A. A., Aboul-Seoud, D.I. and Aboul-Hassan, M.A**.**, Effect of Crossing on Some Productive and Reproductive Traits between Two Varieties of Japanese Quail. *Journal of Animal and Poultry Production*, **14**(1) 1-5 (2023).
22. Aboul-Hassan, M., Selection for Growth Traits in Japanese Quail. 1-Early Responses. *Mansoura J. Agric. Sci.*, **22** 101-109 (1997).
23. El-Fiky, F., Selection for High Body Weight at Six Weeks of Age in Japanese Quail. Direct and Correlated Responses. *Al-Azhar. J. Agr. Res*, **41**, 15-27 (2005).

تأثيرات الخلط على بعض صفات إنتاج البيض والصفات التناسلية فى السمان اليابانى

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[2] قسم اإلنتاج الحيواني، معهد البحوث الزراعية والبيولوجية، المركز القومى للبحوث، الجيزة، مصر.

الملخص

تم إجراء تجربة خلط بإستخدام أربع خطوط من السمان اليابانى: الخط الأول منتخب لصفة وزن الجسم العالى عند عمر 4أسابيع(HBW4) ، الخط الثانى منتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ10 أسابيع الأولى من الإنتاج.(HTEW10)

حيث تم خلط ذكور الخط (HBW4) مع إناث الخط (HTEW10) والتلقيح بين ذكور الخط (HTEW10) مع إناث الخط (HBW4) مع المقارنة مع أبناء كلا من الخط HBW4 و الخط.HTEW10

إستخدم في هذه الدراسة عدد 1512 طائر خليط تم إنتاجها خلال ثلاث فقسات متتالية وذلك لتقييم الأداء الإنتاجى والتناسلى فى الطيور الخليطة وقياس تأثير كل من الخلط والتأثيرات المضيفة المباشرة والأمية على الخلطان للصفات الآتية:

أ - صفات إنتاج البيض وتشمل : وزن البيضة - العمر عند النضج الجنسى - الوزن عند النضج الجنسى - عدد ووزن البيض الكلى الناتج خلال الـ10 أسابيع الأولى من الإنتاج - كتلة البيض اليومية المنتجة خلال الـ10 أسابيع الأولى من الإنتاج .

ب- الصفات التناسلية وتشمل: النسبة المئوية للخصوبة - النسبة المئوية للفقس.

وقد أوضحت الدراسة النتائج الآتية:

صاحب الخلط بين ذكور الخط المنتخب لصفة وزن الجسم العالى عند عمر 4 أسابيع وإناث الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ10 أسابيع الأولى من الإنتاج تفوق فى كل صفات إنتاج البيض والصفات التناسلية المدروسة تلاها الخلط العكسى بين ذكور الخط المنتخب لصفة وزن البيض الكلى العالى المنتج خلال الـ10 أسابيع الأولى من الإنتاج وإناث الخط المنتخب لصفة وزن الجسم العالى عند عمر 4 أسابيع.

كانت قوة الخلط المباشرة عالية المعنوية فى صفات إنتاج البيض والصفات التناسلية المدروسة وكانت نسبة الخلط لهذه الصفات مرتفعة بالنسبة لصفة كتلة البيض المنتجة يوميا (12.1%) وإنخفضت إلى (7.6%) بالنسبة لصفة وزن البيض الكلى المنتج خلال الـ 10 أسابيع الأولى من الإنتاج.

كان للتأثير المضيف المباشر تأثيرا معنويا على معظم صفات إنتاج البيض والصفات التناسلية المدروسة تراوح من (-141) بالنسبة لصفة وزن البيض المنتج خلال الـ 10 أسابيع الأولى من الإنتاج إلى (31.37) بالنسبة لصفة وزن الجسم عند النضج الجنسى. كان لتأثير الأم المضيف تأثيرا معنويا على كل صفات إنتاج البيض والصفات التناسلية المدروسة وتراوح هذا التأثير من(-15.49) بالنسبة لصفة وزن البيضة إلى (27.9) بالنسبة لصفة وزن البيض المنتج خلال الـ 10 أسابيع الأولى من الإنتاج .

يؤدي تهجين آباء سلالة HBW4 مع أمهات خط HTEW10 إلى تفوق فى إنتاجوخصائص البيض بسبب قوة الهجين المفيدة والتأثيرات الأمية الإيجابية لخط.HTEW10 .

كلمات مفتاحية: الخلط، إنتاج البيض، السمان، الصفات التناسلية.