GENETIC EVALUATION FOR EGG PRODUCTION TRAITS IN CROSSBREEDING EXPERIMENT OF SOME LOCAL STRAINS OF CHICKENS

By

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LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

5. SUMMARY

A crossbreeding experiment was carried out using four synthesized strains of chickens involving Matrouh (MT), Mandarah (MN), Inshas (IN) and Silver Montazah (SM). The experimental work was carried out in the Poultry Breeding Research Station at Inshas, Sharkia Governorate, Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Egypt. The main objectives of the present study were to estimate genetic parameters (additive genetic variance, heritability and predicted breeding values) and crossbreeding effects (i.e. direct additive effect, maternal additive effect, direct heterosis and maternal heterosis), as well as to evaluate the superiority of three-way crosses versus two-way crosses. A total number of 34 sires and 230 dams from MN strain and 32 sires and 194 dams from MT strain were used. Sires and dams of the two strains were chosen randomly from 250 cocks and 600 pullets to produce purebreds of MT and MN and first generation (F1) of crossbreds (½MN½MT and ½MT½MN). In second generation of crossbreds (F2), the crossbred hens of ½MN½MT were artificially inseminated from Inshas strain (IN), while the crossbred hens of ½MT½MN were artificially inseminated from cocks of Silver Montazah strain (SM) to produce three-way crossbreds (½IN¼MN¼MT and ½SM¼MT¼MN).

The studied traits were: (1) Growth traits: (body weight at 0, 4, 8, 12 and 16 weeks of age and daily gains during the intervals of 0-4, 4-8, 8-12 and 12-16 weeks); (2) Sexual maturity traits: age (ASM) and body weight (BWSM) at sexual maturity and weight of the first egg (WFE); (3) Egg production traits: egg number (EN90D), egg mass (EM90D) during the first 90-days and egg number (EN120D), egg mass (EM120D) during the first 120-days of laying and (4) partial egg recording traits such as period (in days) in which first ten eggs were laid (PF10E), egg mass for first ten eggs (EMF10E), egg number

(EN2DW) and egg mass (EM2DW) for two days per week, egg number (EN1WM) and egg mass (EM1WM) for one week per month, as well as clutch size (CS90D) and pause periods (PP90D) during 90 days and (CS120D) and (PP120D) during 120 days. The methods of single trait animal model and CBE software program were used.

Results of this study could be summarized as follows:

For growth traits:

- Heritability estimates were 0.57, 0.26, 0.24, 0.22, and 0.25 for BW0, BW4, BW8, BW12, BW16, respectively, and 0.26, 0.16, 0.13 and 0.08 for DG0-4, DG4-8, DG8-12 and DG12-16, respectively
- The ranges of predicted breeding values (PBV) for body weight and daily gains in MN strain were slightly higher than that in MT strain. For simple crossbreds, ranges in PBV recorded by ½MN½MT were slightly higher than those ranges recorded by ½MT½MN. For three-way crosses, the cross fathered by IN cocks and mothered by ½MN½MT had higher ranges in PBV for body weights than those cross fathered by SM cocks and mothered by ½MT½MN.
- The generalized least square means (GLM) of growth and daily gains showed superiority of MN strain over MT chickens. The GLM for body weights at 0, 4, 8, 12 and 16 weeks of age were 31.2, 208.1, 440.4, 754.3 and 1005.7g in MN and 33.2, 206.5, 430.7, 725.9 and 989 g in MT, respectively. The differences between simple cross (MN×MT) and its reciprocal (MT×MN) were insignificant for body weights and daily gains, while, the differences between ½IN¼MN¼MT and ½SM¼MT¼MN crosses were significant for only traits of BW0, BW8, BW12, BW16 and DG0-4.

- The GLM solutions of the direct additive effects (G^I) for body weights and daily gains were highly significant ($P \leq 0.01$) and in favour of MT strain, being 4.0, -62.1, -38.5, -20.2 and -27.2% for BW0, BW4, BW8, BW12 and BW16, respectively and -74.6, -12.7, -9.3 and -37.8% for DG0-4, DG4-8, DG8-12 and DG12-16, respectively.
- The GLM solutions of the maternal additive effect (G^M) for body weights and daily gains in this study were highly significant ($P \leq 0.01$) and in favour of MN strain, being -10.2, 70.5, 49.1, 29.7 and 29.9% for BW0, BW4, BW8, BW12 and BW16, respectively, and 83.7, 17.7, 13.8 and 26.4% for DG0-4, DG4-8, DG8-12 and DG12-16, respectively. Results showed that effects of G^M on body weights at early ages were higher than those at later ones.
- The GLM solutions of direct heterosis (H^I) were highly significant ($P \leq 0.01$) for all growth traits, the percentages of H^I were -4.9, 53.0, 25.7, 12.3, 23.0, 64.0, 27.7, 29.1 and 49.8% for BW0, BW4, BW8, BW12, BW16, DG0-4, DG4-8, DG8-12 and DG12-16, respectively.
- Most estimates of the maternal heterosis (H^M) for body weights and daily gains were highly significant ($P \leq 0.01$). The percentages of H^M were 0.9, 15.9, 11.3, 8.1 and 10.6% for BW0, BW4, BW8, BW12 and BW16, respectively, and 21.8, 7.2, 5.8 and 6.5% for DG0-4, DG4-8, DG8-12 and DG12-16, respectively.

Egg production and partial egg recording traits:

- The heritabilities of sexual maturity traits were moderate, being 0.23 for ASM, and high (0.69) for BWSM. While the estimates of heretability were low for egg production traits, being 0.08, 0.07, 0.07, 0.04 and 0.05 for WFE, EN90D, EM90D, EN120D and EM120D, respectively.

- The ranges in predicted breeding values (PBV) for MT strain were slightly higher than those for MN strain ranging from 1.4 to 416 for sexual maturity traits, 6.5 to 306 for egg production traits and 1.1 to 88.4 for partial egg recording traits.
- The ranges in PBV recorded by ½MN½MT were slightly higher than those ranges recorded by ½MT½MN. The cross fathered by IN cocks and mothered by ½MN½MT had higher ranges in PBV for sexual maturity and egg production traits than those cross fathered by SM cocks and mothered by ½MT½MN.
- The GLM in MN strain was slightly earlier in ASM (157 days) than MT strain (158 days). The differences between simple cross of MN×MT and its reciprocal MT×MN were insignificant for ASM, BWSM and WFE. The differences between ½IN¼MN¼MT and ½SM¼MT¼MN crosses were insignificant for ASM. The crossbred of ½SM¼MT¼MN had significantly heavier BWSM (1626 g) than ½IN¼MN¼MT cross (1381 g).
- The three-way crossbreds were found to start laying at an earlier ASM by 5 days than the F1 crosses (½MN½MT and its reciprocal ½MT½MN), as well as by 8 days than the two foundations. The three-way crosses were recorded the heaviest BWSM ($P \leq 0.01$).
- The GLM in MN strain were slightly higher in EN90D and EN120D compared to MT strain and consequently recorded the heaviest EM90D and EM120D, respectively.
- For partial egg recording, estimates of GLM showed that MN pullets laid the first 10 eggs in 15.7 days vs. 15.8 days for MT strain and has insignificantly heavier EMF10E (421 g) than MT strain (419 g). Also, MN pullets recorded egg number and egg

mass for two days per week and for one week per month higher than those of MT pullets.

- In crossbreds, ½MT½MN cross have shorter period in which first 10 eggs were laid than ½MN½MT cross. In addition, the ½MN½MT cross hens recorded egg number and egg mass for two days per week and for one week per month higher than those of ½MT½MN cross hens.
- In three-way crosses, means of PF10E is the same for ½IN¼MN¼MT and ½SM¼MT¼MN crosses. The cross of ½IN¼MN¼MT has slightly higher EN2DW and EN1WM and heavier EM2DW and EM1WM than ½SM¼MT¼MN cross hens.
- Clutch size which contains one and three eggs was the highest in purebreds compared to in crossbreds, average of clutch size that contains more than five eggs was higher in three-way cross than those in both simple cross and purebreds.
- Three-way cross have the higher number of pause that equal one day than those in both simple crossbreds and purebreds, while purebreds have slightly higher number of pause that equal more than five days than simple crossbreds and three-way cross.
- The generalized least square solutions of the direct additive effects (G^I) on all traits of sexual maturity, egg production and partial egg recording were highly significant ($P \leq 0.01$) and in favour of MN strain, being -4.0, 9.1, 0.8, 5.4, 4.4, 3.6, 2.5, -11.1, 1.2, 3.9, 0.1, 6.3 and 1.9% for ASM, BWSM, WFE, EN90D, EM90D, EN120D, EM120D, PF10E, EMF10E, EN2DW, EM2DW, EN1WM and EM1WM, respectively.
- Effects of G^I on clutch size were in favour of MT strain except for clutch contains more than five eggs. The effect of G^I was associated with a decrease in the pause periods for more than five days in favour of MT strain.

- Most of solutions for maternal additive effect (G^M) for traits of sexual maturity, egg production and partial egg recording were non-significant and ranged from low to moderate in favour of MT strain relative to MN strain being 2.9, 8.6, -3.8, -5.8, -6.8, -2.3 and -3.3% for ASM, BWSM, WFE, EN90D, EM90D, EN120D and EM120D, respectively and -10.8, 1.8, 1.9, 3.0, -2.8 and -2.4% for PF10E, EMF10E, EN2DW EM2DW, EN1WM and EM1WM, respectively.
- The G^M estimates for clutch size and pause periods were in favor of pullets mothered by MT. The percentages of G^M ranged from -12.5% to 35.9% for clutch size, -28.5 to 17.6% for pause periods during the first 90 days, -40.2% to 39.4% for clutch size and -32.2% to 25.6% for pause periods during the first 120-days of egg production.
- The generalized least square solutions of H^I were highly significant for all egg production traits. The percentages of H^I were -3.8, 28.5, 29.3, 28.8, 24.9, 19.7, 17.4, 17.9, 10.6 and 8.8% for ASM, BWSM, EN90D, EM90D, EN120D, EM120D, EN2DW, EM2DW, EN1WM and EM1WM, respectively.
- The estimable solutions of H^I and their percentages for clutch size traits were negative and significant for clutches containing one and three eggs (-13.1 and -6.6%) during the first 90 days and (-16.5 and -23.9%) during the period of 120-days of egg production, while they were positive and significant for clutches containing more than five eggs (14.2% during first 90 days and 57.4% during 120-days).
- The percentages of H^I were positive and highly significant for pauses periods of one day (21.4 and 38.4%) during first 90 days and 120-days of egg production, respectively, while they were negative and highly significant for pause periods of more than five days (-20.95 and -34.38%), respectively.

- Most of the generalized least square solutions of H^M were highly significant for egg production traits except for only BWSM and WFE. The percentages of H^M were -2.6, 1.2, 0.03, 7.8, 8.2, 7.8 and 8.1% for ASM, BWSM, WFE, EN90D, EM90D, EN120D and EM120D, respectively.
- Estimates of H^M on most partial recording traits were highly significant and in favor of hens-mothered by crossbred dams. The percentages of H^M were -10.5, 0.2, 7.2, 0.7, 3.2 and -10.5% PF10E, EMF10E, EN2DW, EM2DW, EN1WM and EM1WM, respectively
- The estimates of H^M for clutch size traits were negative and significant for clutches containing one egg (-11.2 and -15.5%) during first 90 days and 120-days of egg production, respectively, while they were positive for clutches containing five eggs (24.0 and 29.4%), respectively.
- Estimates of H^M were positive and significant for pause periods of one day during the first 90 days (17.3%) and during the period of 120-days of egg production (31.8%), while they were negative for pause periods for five days and for more than five days (-22.7 and -5.7%) during the first 90 days, respectively, (-21.7 and -6.9%) during the period of 120-days of egg production.
- Finally, from this study it is recommended that: applying genetic selection at early ages may gave rapid improvement in growth of local strains, this may be encourage the poultry breeders to using it to be short the generation intervals and consequently save money, time and effort.
- Based on superiority of the three-way versus two-way crosses for all the studied traits, one can recommend that the Animal Production Research Institution (APRI) can continue in

production of three-way crosses to improve growth and egg production traits of local chickens.