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MATROUH AS A COMMON PARENT IN CROSSING WITH SOME LOCAL STRAINS OF CHICKENS

BY

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Abstract: *An experiment was conducted to investigate the effect of crossing Matrouh as a common sire parent with Inshas, Mandarah and Silver Montazah as appendage dame parents, on the inheritance of some productive traits. Regarding the parental strains, Mandarah strain had the highest body weight at 4 and 8 wk of age and weight at sexual maturity (BW_{SM}) 329, 651 and 1435 g., respectively, while Matrouh being the highest weight at 12 wk of age (941 g). Also The desirable significant age at sexual maturity mean (SM) was achieved by Matrouh parental strain (187 d.), while the highest mean of egg number in the first 90 d. of production ($EN_{90d.}$) was given by Inshas strain (48 egg). Both Matrouh and Inshas had the heaviest early egg in the first 90 d. of production (EW.) being 47 g. Heterosis % on the basis of mid-parent ranged from 1.5 to 3.8 for (BW_{SM}), from -12 to -8.7 for (SM), from -24.4 to -16.1 for ($EN_{90\ d.}$) and from -3.2 to 1.1 for ($EW_{90\ d.}$). Estimates of additive genetic variability for body weight at 4,8 and 12 wk of age, (BW_{SM}), (SM), ($EN_{90\ d.}$) and (EW.) were 0.443, 0.662, 0.189, 0.003, 0.006, 0.024 and 0.001, respectively, while estimates of dominance genetic variability were 0.282, 0.103, 0.154, 0.003, 0.005, 0.005 and 0.002 in the same trend. The results of the degree of dominance ($\hat{h}$) indicated that dominance was partial to over dominance for the loci of the studied traits. These results indicate that using Matrouh as a common parent in crossing with Inshas, Mandarah and Silver Montazah local strains of chickens can be benefit to egg production by increasing body weight at 12 wk of age, body weight at sexual maturity, early egg weight and reducing age at sexual maturity.*

INTRODUCTION

Commercial poultry industries have gone through establishing the gene-pool, which contains different types of poultry genetic stocks. Variations in genetic stocks can provide fundamental information's regarding gene function, genetic interactions and genetic pathways. These information's were important to develop foundation stocks, which utilized for producing commercial poultry breeds. One of the attempts to produce the Egyptian commercial egg-type breed of chicken utilized Matrouh as a common genetic resource of local gene-pool, to perform the actual initial foundation stocks. The stander breed White Leghorn performs about 3/4 of Matrouh genetic make-up (Mahmoud et al., 1974). Constant parent regression method (Griffing, 1950) was used to analyze the data of crossing Matrouh with three local strains of chickens (Inshas, Mandarah and Silver Montazah). Such method will give information regarding both direction and magnitude of dominance, furthermore partitioning the variations F1 crosses. A significant attention has been focused upon crossing effects on improving indigenous chickens. Several reports evidenced with the existence of heterotic effects (Hanafi et al., 1991; Mohammed, 1997; Nawar and Abdou, 1999; Sabri et al., 2000; Afifi et al., 2002 and Iraqi et al., 2005). The purpose of the present study was to investigate the effect of crossing of Matrouh sire strain with Inshas, Mandarah and Silver Montazah dam strains on some growth and egg production traits and estimates the components of genetic variability of these traits.

MATERIALS AND METHODS

The present experiment had been carried out at El-Sabahia Research Station, Animal Production Research Institute, Agricultural Research Center, during 2005-2006.

Experimental stocks: Four local strains of chickens Matrouh, Inshas, Mandarah and Silver Montazah were used in the present study. Matrouh has been used as a sire parent, while Inshas, Mandarah and Silver Montazah were used as variable dame parents. The produced strain-crosses were Matrouh x Inshas (1x2), Matrouh x Mandarah (1x3) and Matrouh x Silver Montazah (1x4). A total of 10 Matrouh males and 40 females from each of dame parents were used to produce each strain-cross. Artificial insemination had been applied by assigning 4 females to each male.

Management procedures: Management conditions were similar as possible as throughout the experiment. Eggs were collected throughout 7 days and incubated in full-automatic draft machine. All chicks were pedigreed and wing-banded at day-old. The chicks were fed *ad libitum* a commercial ration throughout the experiment.

The studied traits:

1- Body weight: body weight 4, 8, 12 weeks of age and body weight at sexual maturity (W4, W8, W12 and BW_{SM}, respectively).

2- Age at sexual maturity (SM).

3- Egg number in the first 90 d. of production ($EN_{90\ d.}$).

4- Early egg weight (in the first 90 d. of production EW.).

Statistical analysis: All data were first converted to logarithmic transformation prior to statistical analysis to avoid the effects of epistasis. The data analyzed by using SAS computation program (SAS Institute, 1997). Duncan's new multiple range test was used to compare every two means of the different traits studied (Steel and Torrie, 1960). Partitioning of variance of F1 within a constant parent group was done by using constant parent regression method (Griffing, 1950). Heterosis percentages (H) based on the mid-parents (MP) was determined according to equations given by (Sinha and Khanna, 1975) as follows:

$$(\mathbf{H})\ \% = \frac{F_1 - MP}{MP} \times 100$$

Where: (H) % = heterosis percentage

F_1 = mean of crosses

MP = mid-parents

The genotypic constant parent regression (c.p.r.) coefficients, potency ratio ($\mathbf{h_p}$) and dominance value ($\hat{\mathbf{h}}$) were estimated according to equations given by (Griffing, 1950).

$$b = \frac{(½)\,\sigma^2 A + p\sigma A\sigma d}{\sigma^2 A}$$

$\sigma^2 A$ = additive mean square

$p\sigma A\sigma d$ = correlation between σA and σd

σd = the root square of dominance mean square

$$(h_p) = \frac{F_1 - MP}{|\,P - MP\,|}$$

P = constant parent

$$(\hat{\mathbf{h}}) = \sqrt{\sigma^2 d / \sigma^2 A}$$

$\sigma^2 d$ = dominance mean square

$\sigma^2 A$ = additive mean square

RESULTS AND DISCUTION

Means: As seen in Table, 1: Mandarah parental strain being heavier than other parental strains at 4 wk of age (W4) 329 g. The corresponding weights of Matrouh, Inshas and S. Montazah at the same age were 216, 240 and 307 g., respectively. The same trend was found in body weight at 8 wk of age (W8) 651 vs. 506, 444 and 593 g., respectively. At 12 wk of age (W12) both Matrouh and Mandarah pure strains had significantly heaviest weights 941 and 919 g., respectively, flowed by S. Montazah 849 g., while Inshas had the lowest weight 749 g. No significant differences were found between pure strains concerning body weight at sexual maturity (BW_{SM}), which were in range of 1435 to 1481 g. The most desirable age at sexual maturity (SM) 187 d. was achieved by Matrouh flowed by S. Montazah 188 d. then Inshas 194 d., while Mandarah was the last pure strains matured sexually (202 d.). Regarding egg number at the first 90 d. of production ($EN_{90\ d.}$), Inshas was superior (48 egg) than other pure strains i.e. S. Montazah (47 egg), Matrouh (42 egg) and Mandarah (39 egg). Significant differences among pure strains were shown for egg weight at the first 90 d. of production (EW), where Matrouh and Inshas were significantly heavier (EW) 47 g. than both Mandarah and S. Montazah 46 g. The same results were reported by (Zatter, 1994, Nawar, 1995, Shebl et al., 1995, Mandour et al., 1996 and Iraqi et al., 2007)

Heterosis and potency ratio: It appears from Table, 2 that the cross Matrouh x Inshas (1 x 2) showed positive heterosis percentages 23.7, 34.7, 21.2 and 3.6 for W4, W8, W12 and BW_{SM} traits. This means that dominance tended to the higher parent of these traits. While, it showed negative heterotic values -8.7, -24.4 and -2.1 % for the traits SM, $EN_{90\ d.}$ and EW, respectively. Therefore, it could be concluded that dominance toward the lower parent was found. Also the potency ratio values (h_p) were 4.5, 5.3, 1.9, 4.3, -4.7, -3.7 and 0.0 for W4, W8, W12, BW_{SM}, SM, $EN_{90\ d.}$ and EW, respectively. These results indicate that over dominance for variable parent (Inshas) was found in the traits W4 and BW_{SM}, while over dominance for common parent (Matrouh) was found in the traits W8, W12, SM and $EN_{90\ d.}$, respectively. On the other hand, no dominance in EW trait was observed in the cross 1 x 2, the means of both common (C.P) and variable (V.P) parents did not differ significantly.

Also it could be seen from Table, 2 that the cross Matrouh x Mandarah (1 x 3) showed positive heterotic effects on W8, W12 and BW_{SM} traits 9.2, 7.2 and 1.5 %, respectively. In contrast the traits W4, SM, $EN_{90\ d.}$ and EW had negative heterotic effects -2.2, -12.0, -16.1 and -3.2 %, respectively. These results mean that dominance toward high parent was found in W8, W12 and BW_{SM} traits, while dominance tended to the lower parent in the traits W4, SM, $EN_{90\ d.}$ and EW. The estimated potency ratio (h_p) was 0.1, 0.7, 6.1, 2.0, -3.1, -4.3 and -3.0 for the studied traits, respectively. Otherwise, no dominance effect was found in the inheritance of W4, while partial dominance to Mandarah was exist in the inheritance of W8. Over dominance to Matrouh was controlling the inheritance of W12, BW_{SM} and SM traits, contrarily over dominance to Mandarah was found in the inheritance of $EN_{90\ d.}$ and EW traits.

The remaining cross Matrouh x S. Montazah (1 x 4) showed heterotic effect 2.7, 16.7, 10.6, 3.8, -11.5, -19.1 and 1.1 % for W4, W8, W12, BW_{SM}, SM, $EN_{90\ d.}$ and EW traits, respectively. This means that dominance for high parent was found for W4, W8, W12, BW_{SM}, and EW traits, while dominance tended to low parent for both SM and $EN_{90\ d.}$ traits. These findings supported by the values of potency ratio (h_p) 0.15, 2.1, 2.1, 55, -43, -3.4 and 1.0 for W4, W8, W12, BW_{SM}, SM, $EN_{90\ d.}$ and EW traits, respectively. Such values indicated that no dominance was found in the inheritance of W4 and complete dominance for Matrouh was found in the inheritance of EW. Also over dominance for Matrouh was present in the inheritance of both W12 and $EN_{90\ d.}$ traits. In the contrast, over dominance for S. Montazah was found in W8 trait. Although both BW_{SM} and SM traits showed over dominance for S. Montazah and Matrouh, respectively, but there were no significant differences between the parental strains Matrouh and S. Montazah for these traits, so the values of (h_p) 55 and -43 were untrue. Generally, most of economic traits were affected significantly by crosses, Sheridan (1980), Gavora et al. (1996) and Mohammed (1997) found positive heterotic effects ranged from 9.2 to 32.8 % for egg production traits, while Horn (1985) and Wang and Pirchner (1992) observed negative and positive heterotic effects on the same traits.

Genetic variance components: Results presented in Table, 3 reflected that additive genetic variations ($\sigma^2 A$) accounted for a major part of the total genetic variance for W4, W8, W12, SM and $EN_{90\ d}$ traits 0.443, 0.662, 0.189, 0.006 and 0.024, respectively, since, the estimates of dominance variations ($\sigma^2 d$) in these traits were relatively low (0.282, 0.103, 0.154, 0.005 and 0.005) in the same trend. These results were in agreement with those of (Amrit, 1980 and Abou El-Ghar, 2007). While, the low estimate of $\sigma^2 A$ for EW 0.001 compared with the $\sigma^2 d$ 0.002 suggested that non-additive genetic variation or the environmental effects were large and masked the variation due to additive genes. Estimated $\sigma^2 d$ 0.003 was equal that of $\sigma^2 A$ 0.003 for BW_{SM}. Moreover, negative genetic correlations between additive and dominance ($P\sigma A\sigma d$) were found for all the studied traits -0.377, -0.268, -0.196, -0.0004, -0.002, -0.006 and -0.001, respectively. These findings dealt with those cited by (Fairfull and Gowe, 1990, Besbes et al., 1992, Hagger, 1994 and Zaky, 2007). The estimated dominance values ($\hat{\mathbf{h}}$) were 0.8, 0.4, 0.9, 0.9, 0.9, 0.5 and 1.4 for W4, W8, W12, BW_{SM}, SM, $EN_{90\ d.}$ and EW, respectively. These estimates show that complete dominance is present in the majority of the loci of W4, W12, BW_{SM}, and SM, while partial dominance is important in both W8 and $EN_{90\ d}$. and over dominance is controlling the inheritance of EW. The same findings were found by Abou El-Ghar, (2007).

Constant parent regression coefficients: From Table, 4 it is valuable to discuss the values of constant parent regression coefficient (c.p.r). The negative estimates of c.p.r of F1 on the constant parent for W4 and W12 (-0.351 and -0.532) indicate that dominance was the major source of variation in F1 crosses (0.282 and 0.154 comparing with ½ σ^2A 0.221 and 0.095, respectively Table, 3). Also, the expected fractions of F1 attribute to c.p.r were 0.055 and 0.054, while the expected deviations from c.p.r were 0.715 and 0.344, in the same trend. The c.p.r coefficients trend for SM and EW is decreasing 0.081 and 0.051. These results together with the values of $\hat{\mathbf{h}}$ 0.9 and 1.4 Table, 3 suggested that dominance was more important in the inheritance of these traits. The expected fractions of F1 attribute to c.p.r were 0.00003 and 0.000004, while the expected deviations from c.p.r were 0.009 and 0.003, respectively. Moreover, estimates of c.p.r for W8, BW_{SM} and $EN_{90\ d.}$ 0.096, 0.376 and 0.267 indicate that additive portion of genetic variance was controlling the inheritance of these traits. The expected fractions of F1 belong to c.p.r were 0.006, 0.001 and 0.002, while the expected deviations from c.p.r were 0.530, 0.003 and 0.015, in the same trend. These results are dealing with findings reported by (Griffing, 1950).

CONCLUSION

These results indicate that using Matrouh as a common parent in crossing with Inshas, Mandarah and Silver Montazah local strains of chickens can benefit some egg production traits by increasing body weight at 12 wk of age, body weight at sexual maturity, early egg weight and reducing age at sexual maturity. Further experiments should be made to investigate the effect of crossing with a constant parent (Matrouh) on annual egg production, mature body weight and mature egg weight.

Table (1) Means ± S.D of parental strains

Traits	Matrouh	Inshas	Mandarah	S. Montazah
W4	**216 ^{d} ± 4.5**	**240 ^{c} ± 4.5**	**329 ^{a} ± 6.4**	**307 ^{b} ± 6.6**
W8	**506 ^{c} ± 12.2**	**444 ^{d} ± 11.7**	**651 ^{a} ± 17.8**	**593 ^{b} ± 16.0**
W12	**941 ^{a} ± 19.3**	**749 ^{c} ± 16.1**	**919 ^{a} ± 16.9**	**849 ^{b} ± 16.3**
BW_{SM}	**1456 ± 183.8**	**1481 ± 305.7**	**1435 ± 146.9**	**1458 ± 174.8**
SM	**187 ^{c} ± 3.9**	**194 ^{b} ± 6.3**	**202 ^{a} ± 8.6**	**188 ^{c} ± 8.4**
$EN_{90\ d.}$	**42 ^{bc} ± 9.8**	**48 ^{a} ± 7.6**	**39 ^{c} ± 11.3**	**47 ^{ab} ± 13.8**
EW	**47 ^{a} ± 2.3**	**47 ^{ab} ± 2.5**	**46 ^{b} ± 2.1**	**46 ^{b} ± 2.9**

W4 = body weight at 4 weeks of age, W8 = body weight at 8 weeks of age,
W12 = body weight at 12 weeks of age, BW_{SM} = body weight at sexual maturity,
SM = age at sexual maturity, $EN_{90\ d.}$ = egg number in the first 90 days of production,
EW. = average early egg weight at the first 90 d. of production,
Means in each row with different litters differ significantly at .05 level.

Table (2): F1 crosses, common parent (CP), variable parent (VP) means and Heterosis percentages (H %) and potency ratio (h_p)

Crosses	Traits	W4	W8	W12	BW_{SM}	SM	$EN_{90\ d.}$	EW
1x2	**F1**	282	640	1024	1522	174	34	46
	C.P	216	506	941	1456	187	42	47
	V.P	240	444	749	1481	194	48	47
	H%	23.7	34.7	21.2	3.6	-8.7	-24.4	-2.1
	h_p	4.5	5.3	1.9	4.3	-4.7	-3.7	0.0
1x3	**F1**	266	632	997	1467	171	34	45
	C.P	216	506	941	1456	187	42	47
	V.P	329	651	919	1435	202	39	46
	H%	-2.2	9.2	7.2	1.5	-12.0	-16.1	-3.2
	h_p	0.1	0.7	6.1	2.0	-3.1	-4.3	-3.0
1x4	**F1**	269	642	990	1512	166	36	47
	C.P	216	506	941	1456	187	42	47
	V.P	307	593	849	1458	188	47	46
	H%	2.7	16.7	10.6	3.8	-11.5	-19.1	1.1
	h_p	0.15	2.1	2.1	55	-43	-3.4	1.0

1x2 = Matrouh x Inshas, 1x3 = Matrouh x Mandarah, 1x4 = Matrouh x S.Montazah,
F1 = F1 crosses, CP = constant parent (Matrouh), V.P = variable parent, H% = Heterosis percentage, h_p = potency ratio.

Table (3): Genetic variance components

Traits	$\sigma^2 A$	$\sigma^2 d$	$P\sigma A\sigma d$	$\sigma^2 e$	$\hat{h}$
W4	0.443	0.282	-0.377	.00003	0.8
W8	0.662	0.103	-0.268	.00003	0.4
W12	0.189	0.154	-0.196	.00002	0.9
BW_{SM}	0.003	0.003	-0.0004	.00002	0.9
SM	0.006	0.005	-0.002	.00001	0.9
$EN_{90\ d.}$	0.024	0.005	-0.006	.00008	0.5
EW	0.001	0.002	-0.001	.00001	1.4

$\sigma^2 A$ = additive genetic variance, $\sigma^2 d$ = dominance variance,
$P\sigma A\sigma d$ = interaction between additive and dominance effects,
$\sigma^2 e$ = error variance, $\hat{h}$ = the dominance value.

Table (4): Constant parent regression coefficients b, expected fraction of F1 attribute to constant parent regression E (F1→b) and expected fraction of F1 due to deviation from regression E (1-b)

Traits	b	E (F1→b)	E (1-b)
W4	-0.351	0.055	0.715
W8	0.096	0.006	0.530
W12	-0.532	0.054	0.344
BW_{SM}	0.376	0.001	0.003
SM	0.081	0.00003	0.009
$EN_{90\ d.}$	0.267	0.002	0.015
EW	0.051	0.000004	0.003

W4 = body weight at 4 weeks of age, W8 = body weight at 8 weeks of age,
W12 = body weight at 12 weeks of age, BW_{SM} = body weight at sexual maturity,
SM = age at sexual maturity, $EN_{90\ d.}$ = egg number in the first 90 days of production,
EW = average early egg weight at the first 90 days of production.

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Crossing, Matrouh, Local strains.

الملخص العربي

استخدام مطروح كأب ثابت في الخلط مع بعض السلالات المحلية من الدجاج

رضا شعبان أبوالغار و هداية محمد شعلان و حنان حسن غانم

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أجريت هذه التجربة لدراسة تأثير خلط سلالة مطروح كسلالة أبوية ثابتة مع بعض السلالات الأمية مثل إنشاص، المندرة و المنتزه الفضي وذلك علي بعض الصفات الإنتاجية. وبالنظر إلي متوسطات السلالات الأبوية نجد أن سلالة المندرة قد حققت أعلي وزن جسم عند عمر 4 و8 أسابيع وعند النضج الجنسي 329 ، 651 و 1435 جرام علي التوالي. في حين حققت سلالة مطروح أعلي وزن جسم عند عمر 12 أسبوع 941 جرام وكان اقل عمر للوصول للنضج الجنسي 187 يوم قد تحقق بواسطة سلالة مطروح في حين أن أكثر عدد للبيض خلال الـ 90 يوم الأولي من الإنتاج 48 بيضة قد تحقق بواسطة سلالة إنشاص. في حين تساوت السلالتان مطروح و إنشاص في أعلي وزن للبيضة خلال ألـ 90 يوم الأولي من الإنتاج 47 جرام. ولقد تراوحت قوة الهجين من 1.5 إلي 3.8 % بالنسبة لصفة وزن الجسم عند عمر النضج الجنسي ومن - 12 إلي - 8.7 بالنسبة لصفة العمر عند النضج الجنسي ومن - 24.4 إلي - 16.1 بالنسبة لصفة عدد البيض خلال الـ 90 يوم الأولي من الإنتاج ومن - 3.2 إلي 1.1 بالنسبة لصفة وز ن البيضة خلال الـ 90 يوم الأولي من الإنتاج. وبلغت قيم التباين الوراثي المضيف 0.443 ، 0.662 ، 0.189 ، 0.003 ، 0.006 ، 0.024 و 0.001 للصفات المدروسة علي التوالي. كما قدرت قيم التباين الراجع لتأثير السيادة ب 0.282 ، 0.103 ، 0.154 ، 0.003 ، 0.005 ، 0.005 و 0.002 علي نفس المنوال. كما دلت نتائج درجة السيادة علي أن السيادة تراوحت من سيادة جزئية إلي سيادة فائقة لمعظم المواقع المتحكمة في الصفات المدروسة. وهذه النتائج تدلل علي أن خلط سلالة مطروح كسلالة أبوية ثابتة مع بعض السلالات الأمية مثل إنشاص، المندرة و المنتزه الفضي كان مفيدا لزيادة إنتاج البيض عن طريق زيادة وزن الجسم عند عمر 12 أسبوع و عند النضج الجنسي وكذا زيادة وزن البيضة عند النضج الجنسي وتقليل العمر اللازم للوصول للنضج الجنسي.