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ESTIMATION OF GROWTH PERFORMANCE COMBINING ABILITIES AMONG SOME STRAIGHT-BRED TURKEY STRAINS APPLYING DIALLEL CROSSING SCHEME

BY

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Abstract: *A full diallel crossing study involving Broad Breasted Bronze, (BB), White Holland (WH) and Mehallah 85 (M85) pure strains was conducted. Objectives of the experiment were to evaluate general and specific combing ability (GCA & SCA) and maternal ability (MA) effects on body weight and growth rate during growing period. The potential of using any of the studied strains as a sire or a dam breed was also studied.*

Significant differences ($P \leq 0.05$, $P \leq 0.01$ and $P \leq 0.001$) were found in body weight and growth rate at all studied ages among the 9 different genotypes, where the heaviest genotype at every age in each sex was recorded by a cross genotype. Significant differences were found in GCA where M85 strain recorded the highest positive value followed by BB breed; while the most distinct SCA was for BB X M85 crosses (significant positive effect). BB strain showed significant and positive maternal effect at most studied ages on its male progenies.

In conclusion, the results showed that M85 positive significant GCA for body weight at different ages, mean while, superiority for relative growth rate in most interval periods; crossing BB X M85 had superiority in SCA for body weight and relative growth rate except males of crossing WH X M85 which surpassed in relative growth rate; BB had the superiority of MA for body weight of males when WH had the superiority of MA for relative growth rate. These results suggest that crossing by using BB and M85 strains could be utilize additive and non-additive genetic effects. More genetic improving would be expected from these strains putting under reciprocal recurrent selection program.

INTRODUCTION

Crossing can provide additional information about the crossed strains, through partitioning variance between crosses (Falconer, 1991). Partitioning variance components of diallel crossing would allow the estimation of general and specific combining abilities, maternal ability and sex-linked effects (Henderson, 1948 and Griffing, 1956). By using a breeding program based on crossing, breeder can combine stocks that complete each other and in meat stocks can develop sire and dam lines (Fairfull, 1990).

The concept of combining abilities (general and specific), additive and non-additive genetic effects was first defined by Sprague and Tatum (1942). These terms have been used extensively with both plants and animals for evaluating the performance of lines in hybrid combinations and estimating maternal, reciprocal and sex-linkage effects from genetic studies of quantitative inheritance.

Recent study aimed to complete partitioning of variance to study general combing ability, specific combing ability, maternal and sex-linked effects (Sabra, 1990; Shebl et al., 1990 and Mandour et al., 1996).

The aims of the current study were to estimate some genetic parameters (GCA, SCA and MA) on growth performance (body weight and relative growth rate) in diallel crossing experiment involving three strains (BB, WH and M85). Moreover, to produce a suitable hybrid for local market under Egyptian conditions.

MATERIALES AND METHODS

Birds, management and measurements:

The experimental work carried out at the Mehallet Moussa Turkey Research Station, Kafr El-Sheikh Governorate, belonging to the Animal Production Research Institute, Ministry of Agriculture during the period from March, 2003 to October, 2003. The whole available flocks contents of three strains of turkey were used in the present investigation, Broad Breasted Bronze (BB), White Holland (WH) and Mehallah 85 (M85). Mehallah 85 strain has been maintained by Mehallet Moussa Turkey Research Station since 1985. The White Nicholas toms and White Holland hens were utilized for developing this strain through breeding and selection program (Abd-El-Gawad et. al., 1993). The BB and WH strains were classified to have an intermediate body weight, while the M85 was considered a heavy one.

The number of birds selected as a parent stock from the three strains in the base population of both breeds were 450 birds. The mating was planned in complete diallel crosses 3X3, to get pure bred and crossbred. Each breed contain 30 males and 120 females were taken when the birds of each breed aged 48 weeks old, in order to produce all males and females in the base papulation were wing and leg banded. Artificial Insemination (AI) was applied according to Lake and Stewart (1978) for getting day-old poults throughout the whole investigation. Feed and water were supplied *ad libitum* throughout the experimental period. The diet used cotained 26.76 and 21.37 % crude protein and 2931 and 3057 Kcal/ME/Kg, the layer 1 (0 to 8 wk), and layer 2 (9 to 24 wk), respectively.

Body weight was measured individually at hatch, 4, 8, 12, 16, 20 and 24 wks of age, relative growth rate was estimated according to the equation of Broody, (1945) at periods (hatch -4, 5-8, 9-12, 13-16, 17-20 and 21-24 wks of age). Growth rate (%) = (W2-W1) x 100/0.5 x (W1+W2)

Where, W1 = Body weight at the beginning

W2 = Body weight at the end of the period for which period was calculated.

Statistical analysis:

Data were analyzed by the application of the weighed least-squares means method in the procedure General Linear Model (GLM) of statistical software SAS 1999. Test of significance for the differences between genetic groups were done according to Duncan (1955). The least-squares means were used as input data for the program package CBE, program Version 4.0. (Wolf, 1996) that was used for estimating the crossbreeding genetic parameters for every group of crossbreds and all analyzed traits. The estimation was carried out by ordinary least-squares means.

The statistical models used were as follows:

First Model:

$$\mathbf{Y_{ijk} = \mu + BG_i + S_j + e_{ijk}}$$

Where:

$\mathbf{Y_{ijk}}$ = an observation, μ = overall means, $\mathbf{BG_i}$ = The effect of breed group (i=1, 2… and 9), $\mathbf{S_j}$ = The effect of j th sex, and $\mathbf{e_{ij}}$ = Random error

Second Model:

Combining ability model (Wolf, et al., 1991)

$$\mathbf{Y}_{iik}^{I} = \boldsymbol{\mu} + \mathbf{d}^{*} + 2\,\mathbf{g}_{i}^{I} + \mathbf{m}_{i}^{I} + \mathbf{S}_{ii}^{I} + \mathbf{e}_{iik}$$

$$\mathbf{Y}jjk^{II} = \boldsymbol{\mu} - \mathbf{d}^{*} + 2\,\mathbf{g}_{j}^{II} + \mathbf{m}_{j}^{I} + \mathbf{S}_{jj}^{II} + \mathbf{e}_{jjk}$$

$$\mathbf{Y}jjk^{C} = \boldsymbol{\mu} + \mathbf{g}_{i}^{I} + g_{j}^{II} + \mathbf{S}_{ij} + \mathbf{m} + \mathbf{m}_{j}^{II} + \mathbf{r}_{ij} + \mathbf{e}_{ijk}$$

$$\mathbf{Y}jjk^{R} = \boldsymbol{\mu} + \mathbf{g}_{i}^{I} + \mathbf{g}_{j}^{II} + \mathbf{S}_{ij} - \mathbf{m} + \mathbf{m}\,i^{I} + \mathbf{r}_{ij} + \mathbf{e}_{jjk}$$

where:

μ = general mean

$\mathbf{d}^{*}$= is identical to d for p = m, otherwise it contains a term dependent on average heterosis

$\mathbf{g}^{I}\mathbf{i}$ = general combining ability of the i^th purebred population from set I

$\mathbf{g}^{II}\mathbf{j}$ = general combining ability of the j^th purebred population from set II

$\mathbf{s}^{I}\mathbf{ii}$ = specific combining ability of the i^th purebred population from set I

$\mathbf{S}^{II}\mathbf{jj}$ = specific combining ability of the j^th purebred population from set II

Sij = specific combining ability of the combination i x j

The remaining effects have the same meaning as in general genetic model.

The same restrictions as in the general genetic model hold for the maternal and reciprocal effects.

RESULTS AND DISCUSSION

a- Body weight.

Means

Concerning the males, results of Table 1 illustrate that effect of mating group on body weights differed significantly ($P \leq 0.01$ and $P \leq 0.001$) at all ages studied. Mostafa and Nofal (2000) concluded that mating group were found to affect body weight of turkeys significantly. Means of BB and WH of the same authors were comparable to that of the present results of respective ages reported herein.

As regard to straightbreds, the heaviest body weight values were for M85 breed being 52.6, 556.2, 1632.8, 2884.9, 4283.0, 5813.4 and 7696.3 gm. at hatch, 4, 8, 12, 16, 20 and 24 wks of ages, respectively. Considering crossbreds, the cross BB X M85 attained the heaviest weight at hatch, 4, 8, and 12 wks of age being 50.3, 526.1, 1569.1 and 2758.6 gm. respectively, but for its reciprocal cross (i.e. M85 X BB) afterwords being 4419.4, 5982.0 and 8255.0g. at 16, 20 and 24 wks of age, respectively. Nevertheless, El–Nagar *et. al.* (1990*)*, Abd- El-Gawad *et al.*(1993), their scientific work was the initiator of the new strain M85. Nestor and Anderson (1998), Nestor *et al.* (2001a & b) and Nestor *et al.* (2004) concluded comparable results as regard to line differences, using different selected and commercial turkey lines.

According to the results concerning the females, the heaviest body weights values were of M85 being 52.6, 412.5, 1220.6, 2114.5, 3251.4, 4387.0 and 5392.0 gm. at hatch, 4, 8, 12, 16, 20 and 24 wks of age, respectively. Considering crossbreds, the crosses BB X M85 and WH X M85 attained the heaviest weight at all studied ages except at hatch being 427.5 and 426.0, 1218.5 and 122.16, 2096.3 and 2123.9, 3185.0 and 3282.7, 4194.8 and 4324.8 and 5881.0 and 5232.7 gm. respectively, but the cross (BB X WH) was recorded the lightest body weight at all studied ages. Nestor and Anderson (1998), Nestor *et al.* (2001a & b) and Nestor *et al.* (2004) reported comparable results as regard to line differences, using different selected and commercial turkey lines.

Generally,data of Table 1 revealed also that differences between straightbreds were much lower than those between crossbreds. At 4, 8, 12 and 16 wks of age the cross WH X M85 attained the heaviest body weight compare to straightbreds, while the cross BB X M85 gained the superiority for body weight than both straightbreds and crossbreds at 24 wks of age. Most of crosses had lighter body weight at hatch than those of their parental purebreds except the cross M85 X WH (52.1g.). However, crosses of BB X M85, WH X M85, M85 x BB and M85 X WH yielded heavier body weight than other crosses at 4, 8 and 12 wks of age. At 16 and 20 wks of age, body weight of crosses BB X M85, WH X M85 and M85 X WH recorded the heaviest values (3185.0, 3282.7 and 3167.0 gm “16 wk” and 4194.8, 4324.8 and 4145.0 g., “20 wk” respectively), Whatever, there were no significant differences among purebreds and their crosses at 24 weeks of age. Wolf and Knizetova (1994) with ducks sire and dam lines reported the same conclusion. Nestor *et al.* (1997) and Ye *et al.* (1997) reported reasonable differences in crosses when compared to those between straightbred lines.

As regard to straightbreds modest and poor body weight figures, they were generally for WH at all studied ages in both sexes. However, there was no detectable trend as regard to the lightest body weight of turkey crosses in males and females.

Genenral combining ability (GCA):

General combining ability plays an important role in the inheritance of body weight at different ages. Accordingly, GCA effects in parental purebreds for body weight of males at hatch, 4, 8, 12, 16, 20 and 24 wks of age are presented in Table (2). Results revealed that M85 parental breed had the highest estimates of GCA at most studied ages of both sexes, followed by BB parental breed. However, the parental breed WH had the lowest GCA values at most ages studied in males and females. These findings suggested that the parental breed M85 had highest additive genetic effects on body weight which may be exploited in enhancement of this trait using those evaluated turkey strains if obtaining a broiler commercial line is required. These results were in agreement with those of Sabra (1990), Shebl *et. al.,* (1990), Hanafi *et. al.,* (1991), Mandour *et. al.*, (1992), Wolf and Knizetova (1994), Mandour *et. al.*, (1996) and Hanafi and Iraqi (2001) using other model birds. Abou El-Ghar (2003) reported that the general combining ability was significant effects for body weight at most studied ages.

These findings of crossbreeding analysis in both sexes (Tables 2) revealed that M85 and BB strains used in the present study had higher additive genetic variance of body weight than WH ones. In this respect when considering the preferance of the Egyptian consumers to use the local colorful turkey strains in their consumption instead of white colored WH strain may encourage the poultry breeders in Egypt to use M85 and BB strains in crossbreeding programe for producing commercial hybrid of turkey with heavy weights and with an acceptable coloration.

Specific combining ability (SCA):

Specific combining ability effects on body weight of both sexes at hatch, 4, 8, 12, 16, 20 and 24 wks of age are presented in Table (2). The cross BB X M85 gave the best SCA effect as regard to BW at most ages evaluated being 0.82, 18.52, 14.25, 17.30, 131.01, 234.67 and 339.90 in males at hatch, 4, 8, 12, 16, 20 and 24 wks of age, respectively, while, in females the cross WH X M85 had the highest values of SCA (i.e. 23.05, 37.00, 144.23, 232.47 and 207.37 at 4, 8, 12, 16 and 20 weeks of age, respectively). However, the cross BB X WH was ranked second after cross BBxM85 of males but the cross BB X M85 was ranked second after cross WH X M85 in females. On the other hand, the lowest SCA values at all ages studied were generally reflected by the cross WH X M85 except that at hatch in both sexes. This lead to conclud that the non- additive genetic effects (as measured by the sire x dam interaction component) appear to have considerable influence on body weight. Consequently, it refer to the possibility of utilizing such high commercial hybrids. Results of the present study are inagreement with Sabra (1990), Shebl *et. al.,* (1990), Hanafi *et. al.,* (1991), Mandour *et. al.,* (1992), Wolf and Knizetova (1994), Mandour *et. al.,* (1996), Hanafi and Iraqi (2001) and Abou El-Ghar (2003) showed that the specific combining ability, significant differences were observed for body weight at most studied ages.

It could be concluded that BB or WH strains can be crossed advantageously with M85 to utilize such high non-additive genetic effects for producing commercial turkey with heavy weight.

Maternal ability (MA):

Data obtained in Table 2 represent the MA in parental breeds for body weight of both sexes at hatch, 4, 8, 12, 16, 20 and 24 wks of age. It could be noticed that MA were highly significant for all studied ages, and it was highr and positive effects for BB breed of males and females except at hatch for males. However, negative MA were found for males of WH (except at 20 and 24 wk) and M85 (except at hatch and 4 wk) breeds and for females of WH (except at 24 wk) and M85 (except at htch) strains.

These results may lead to state that the range between strains in MA effects on body weight increased as the age of the offspring advanced from hatch up to 16 wks of age. In this respect, Vccaro and Vleck (1972) reported that MA was only important for early body weight and it could influence body weight by transmission of immunities or even diseases through the egg. Similar results were reported by Manglik *et. al.,* (1980), Jakubec *et. al.,* (1988), Sabra (1990), Hanafi *et. al.,* (1991), Khalil *et. al.,* (1999), Sabri *et. al,* (2000), Mostafa and Nofal (2000), Zaky (2005) and Aly and Abou El-Ella (2006) reported that the maternal ability was considerable effects ($P<0.01$) on body weight. Contrarly, Jakubec *et. al.,* (1988) reported that insignificant effect of MA on body weight of different either strains or lines of chickens.

Generally, BB strain ranked the first in MA for body weight which recorded high and positive estimates of MA for most studied ages, it is safely recommended to use BB as a dam-breed in crossbreeding programmes.

b-Relative growth rate :

Means:

Least squares means ± standard errors for relative growth rate of turkey males and females in both purebreds and crossbreds at the periods 0-

4, 5-8, 9-12, 13-16, 17-20 and 21-24 wks of age in addition to its statistical analysis are presented in Table (3).

Results of Table 3 illustrate that effect of mating group (MG) on relative growth rate differed significantly ($P \leq 0.05$ and $P \leq 0.001$) at all periods ages studied. Mostafa and Nofal (2000) concluded that MG were found to affect relative growth rate of turkey significantly. Means of BB and WH of the same authors were comparable to that of the present results of respective ages reported herein.

As regard to straightbreds, the fastest relative growth rate values were for M85 in both sexes at early ages meanwhile, WH was the slowest one. Considering crossbreds, the cross WH X M85 attained the fastest at period 0-4 wks of age 164.9, but for its reciprocal cross (i.e. M85 X WH) afterwords being 57.7, 47.2, 37.2 and 32.5, at periods 9-12, 13-16, 17-20 and 21-24 wks of ages, respectively in males while the cross M85 X BB recorded the fastest values at period 5-8 wks of age. However, there was no detectable trend as regard to the slowest relative growth rate of turkey crosses.

Considering crossbreds, the cross M85 X BB attained the fastest at periods 0-4 and 5-8 wks of age being 156.0 and 96.0, but, the cross WH X BB had the fastest values 54.0, 31.4 and 23.8 at periods 9-12, 17-20 and 21-24 weks of age, respectively in females. These results are in agreement with those reported by EL–Nagar *et. al.,* (1990*)* who reported that relative growth rate during the studied periods differed significantly.

On the other hand, the growth rate were no significant differences between the pure strains and their crosses or the reciprocal at different ages were found by Nawar *et. al.,* (2004).

Genenral combining ability (GCA):

Data obtained in Table (4) showed the GCA of males at different periods found to have significant effects. The BB strain had the positive values for GCA of relative growth rate (1.35, 3.69, 5.29 and 4.83 % at the periods 0-4, 5-8, 17-20 and 21-24 wks of age, followed by the WH strain was reliazed positive estimates for GCA of relative growth rate (3.39, 1.75 and 1.62 % at the periods 9-12, 13-16, and 21-24 wks of age. While M85 strain had the lowest percentage for GCA at most studied ages except at the period 0-4 wks of age. The BB strain ranked the first in GCA for relative growth rate and the WH strain ranked second after BB strain, while the M85 was the least one.

Concerning, GCA effects for relative growth rate of females at all periods differed significantly among the three strains involved in this study (Table 4). The M85 strain recorded positive estimates in early ages 2.88 and 3.14 % at periods 0-4 and 5-8 wks of age. At periods 9-12, 13-16 and 21-24 wks of age, BB strain had estimates 0.90, 1.18 and 3.71%, while WH strain recorded 1.35 and 3.52 % for GCA of relative growth rate at periods 13-16 and 17-20 wks of age. The BB strain ranked the first in GCA for relative growth rate and the M85 strain ranked second after BB strain, while WH strain was the least one. However, Mandour *et. al.,* (1992) reported that the general combining ability effects for relative growth rate were not significant for all strains (Alexandria chicks, Nicholas and Cobb commercial brioler strins) at different periods.

Specific combining ability (SCA):

Specific combining ability (SCA) effects on relative growth rate of males and females at the periods 0-4, 5-8, 9-12, 13-16, 17-20 and 21-24 wks of age, in the crosses BB X WH, BB X M85 and WH X M85 are presented in Table (4). The effects of SCA on relative growth rate were shown to be the highest and the best estimates in cross WH X M85 at most studied ages of males. The cross BB X WH was ranked second after cross BB X M85, which it was recorded. 4.11 and 3.30 % for SCA at the periods 5-8 and 13-16 wks of age in males while the cross BB X M85 higher were 3.11, 4.97 and 1.84 % for SCA at 5-8, 9-12 and 13-16 wks of age in females. These results in agreement with obtained by Mandour *et. al.,* (1992) found that estimates of SCA effects were highly significant for relative growth rate from hatch to 7 wks of age. Estimates of SCA effects for relative growth rate for Cobb and Nicholes cross were negative at 1, 2, 3, and 5 wks of age and being negative at 6 and 7 wks of age for Alexandria X Nicholes cross.

Generally, differences between the crosses BB X M85 and WH X M85 crosses for SCA were 9.50, 4.57, 8.65 4.76, 4.56 and 6.91 % at the periods 0-4, 5-8, 9-12, 13-16, 17-20 and 21-24 wks of age. This wide range in SCA would give good chance for poultry breeders to select for SCA of relative growth rate in different strains of turkey. Furthermore, it could be concluded that non-additive gene effects appear to have considerable influences on relative growth rate in the crosses BB X M85 and WH X M85.

Maternal ability (MA):

Table (4) showed that MA effects in parental purebreds for relative growth rate of males and females at the periods 0-4, 5-8, 9-12, 13-16, 17-20 and 21-24 wks of age. It could be seen that WH strain ranked the first in

MA for reltive growth rate at all ages except at 9-12 wk of age, followed by BB strain, while M85 strain had the lowest and negative estimates for all ages except at 9-12 and 13-16 wks of age. This result recommened to use WH strain a dam-breed in crosing programmes. The maternal ability found to have significant effects on relative growth rate at all periods studied. Also, BB strain ranked the best estimate of MA and it had positive estimates at 0-4 and 5-8 wks of age, followed by M85 strain at periods13-16 and 17-20 wk of age. Moreover, WH strain had positive and high estimates at period 21-24 wk of age. These results are in agreement with those found by Mostafa and Nofal (2000), who reported that the maternal effects on growth performance (expressed as the differences between reciprocal crosses) at various age stages traits were not significant at all cases. The offspring of the WH X BB mating had better performance growth rate than those from its reciprocal. This means also that using BB hens as dam-breed with WH toms as a sire-breed gives an advantage in shank length and breast width. These results lead to confirm that dams of BB turkey are better concerning their mothering ability versus turkeys. MA could be considered as a characteristic of a given strain of turkey or chicken.

Consequently a breed with high MA should be considered in crossbreeding programme as a breed of dam. Accordingly, it is recommended to use BB as a dam-breed in crossbreeding programmers.

Table (1):L.S.M ± S.E. for body weight of males and females (gm) in purebred and their crosses of Turkey at different ages.

Genotype	Hatch	4 wk	8 wk	12 wk	16 wk	20 wk	24 wk
Purebred				**Males**			
BB x BB	48.7 ± 1.3^{cd}	468.0 ± 28.7^{bcd}	1402.9 ± 78.5^{bc}	2375.7± 135.5^{cd}	3677.1 ± 175.3^{de}	5362.2 ± 295.8^{abcd}	7012.0 ± 555.2^{ab}
WH x WH	51.9 ± 1.0ab	408.0 ± 21.8d	1258.3 ± 60.0c	2214.2 ± 103.4d	3489.6 ± 136.8e	4784.4 ± 209.2d	6098.3 ± 358.4b
M85 x M85	52.6 ± 0.6^{a}	556.2 ± 11.8^{a}	1632.8 ± 31.9^{a}	2884.9 ± 55.3^{a}	4283.0 ± 76.3^{ab}	5813.4 ± 121.9^{ab}	7696.3 ± 201.4^{a}
Crossbreds							
BB x WH	48.8 ± 1.1^{bcd}	456.5 ± 22.7^{cd}	1413.5 ± 61.3^{bc}	2537.0 ± 105.7^{bc}	3944.8 ± 136.8^{bcd}	5519.4 ± 215.2^{abc}	7266.7 ± 413.8^{ab}
BB x M85	50.3 ± 0.6bcd	526.1 ± 11.7ab	1569.1 ± 32.4ab	2758.6 ± 57.4ab	4301.3 ± 75.4ab	5783.6 ± 109.2ab	7730.8 ± 170.5a
WH x BB	48.3 ± 1.0c	459.3 ± 20.2bcd	1396.6 ± 54.6bc	2486.6 ± 94.1bc	3838.3 ± 121.8cde	5072.1 ± 203.6bcd	7090.0 ± 331.8a
WH x M85	48.8 ± 0.7bcd	525.4 ± 14.4ab	1509.5 ± 39.6ab	2721.5 ± 68.3ab	4202.3 ± 93.7abc	5632.8 ± 142.1abc	7208.6 ± 234.6ab
M85 x BB	46.8 ± 1.2^{d}	490.0 ± 24.4^{bc}	1532.2 ± 69.3^{ab}	2668.9 ± 119.5^{abc}	4419.4 ± 159.1^{a}	5982.0 ± 280.7^{a}	8255.0 ± 620.7^{a}
M85 x WH	52.6 ± 1.4^{a}	473.9 ± 30.2^{bcd}	1413.9 ± 81.5^{bc}	2504.6 ± 140.6^{bcd}	4024.6 ± 181.9^{abcd}	5000.0 ± 396.9^{cd}	7020.0 ± 620.7^{ab}
Purebreds				**Females**			
BB x BB	50.4 ± 0.8^{abc}	373.8 ± 16.8^{bc}	1029.2 ± 49.5^{b}	1813.3 ± 81.7^{b}	2885.8 ±104.9^{c}	3911.6± 99.2^{bc}	4982.0 ± 541.6
WH x WH	49.7 ± 0.7^{bcd}	367.0 ± 14.3^{c}	980.0 ± 41.3^{b}	1727.8 ± 69.2^{b}	2735.0 ± 97.8^{c}	3918.7±100.8^{bc}	4901.9±580.4
M85 x M85	52.0 ± 0.4^{ab}	412.5 ± 8.8^{ab}	1220.6 ± 26.4^{a}	2114.5 ± 43.0^{a}	3251.4 ± 60.0^{a}	4387.0 ± 63.1^{a}	5392.0 ± 63.4
Crossbreds							
BB x WH	49.4 ± 0.7cd	353.0 ± 14.8c	1005.0 ± 43.4b	1727.7 ± 70.8b	2746.8 ± 70.2c	3686.5 ± 92.2c	4793.2 ± 541.6
BB x M85	50.0 ± 0.4abc	427.5 ± 8.7a	1218.5 ± 27.1a	2096.3 ± 45.2a	3185.0 ± 60.9a	4194.8 ± 58.8ab	5881.0 ± 329.0
WH x BB	49.9 ± 0.7ab	352.1 ± 15.3c	1033.3 ± 46.4b	1818.5 ± 73.3b	2796.4 ± 96.5c	3823.8 ± 92.2c	4856.6 ± 533.1
WH x M85	49.3 ± 0.7ab	426.0 ± 10.3c	1221.6 ± 31.7b	2123.9 ± 52.8b	3282.7 ± 73.6c	432408 ± 70.7c	5232.7 ± 403.0
M85 x BB	48.0 ± 0.8d	415.4 ± 16.8ab	1191.5 ± 51.6a	1926.9 ± 83.0ab	2920.7 ±110.0bc	3966.1 ±106.0bc	5051.1 ± 580.4
M85 x WH	52.1 ± 0.7a	371.6 ± 20.6bc	1094.4 ± 60.2ab	2060.0± 104.9a	3167.0±110.4a	4145.0 ±125.4ab	5052.2 ± 710.8
Significant							
Bet. males	***	***	***	***	***	***	**
Bet. femals	***	***	***	***	***	***	NS

[1]BB = Broad Breasted Bronze, WH = White Holland, and M85 = Mehallah 85.

NS Non significant. ** significant at 1 % level of probability.

*** Significant at 0.1 % level of probability.

a, b, c ,…. Means within the same column within the same sex different superscripts are significantly different ($P<0.05$).

Table (2) : General (GCA) and Specific (SCA) combining abilities and Maternal ability (MA) of purebreds and their crosses for body weight (gm) of males an females at different ages.

Sex	Genotype	Body weight at						
		Hatch	4 wk	8 wk	12 wk	16 wk	20 wk	24 wk
Males	μ	50.68	481.0	1447.7	2450.0	3938.53	5391.58	7310.96
	GCA							
	BB	-2.92	11.24	- 21.28	- 99.45	-117.52	87.61	150.02
	WH	3.00	-65.0	-170.66	-266.65	-384.17	-568.32	-873.48
	M85	- 0.08	76.30	191.94	366.01	465.69	480.71	723.50
	SCA							
	BB X WH	- 1.54	20.53	35.74	114.52	- 60.20	-59.24	20.66
	BB X M85	0.82	18.52	14.25	17.30	131.01	234.67	339.90
	WH X M85	0.72	-2.01	- 49.99	-131.82	- 70.81	-195.43	-360.56
	MA							
	BB	-0.23	35.43	180.23	351.20	472.53	483.47	772.27
	WH	-4.13	-52.76	-49.66	-158.00	-133.37	32.26	87.95
	M85	4.36	17.33	-130.57	-193.20	-339.16	-515.73	-860.22
Females								
	μ	50.33	387.03	1096.9	1914.6	2981.00	4052.86	5124.7
	GCA							
	BB	-0.51	-11.36	- 49.36	-99.60	-120.24	-198.25	- 85.58
	WH	-.63	-23.65	-104.94	-150.05	-201.06	-148.05	- 246.0
	M85	1.14	35.02	154.30	249.66	321.00	346.30	231.58
	SCA							
	BB X WH	1.53	-39.55	-56.19	-38.62	-19.75	-78.11	-260.22
	BB X M85	-1.76	16.50	19.19	-105.61	-212.72	-129.26	246.34
	WH X M85	0.23	23.05	37.0	144.23	232.47	207.37	13.88
	MA							
	BB	0.63	33.0	143.3	223.23	271.86	250.50	463.00
	WH	-0.96	-5.61	-48.10	-77.96	-93.73	-224.90	53.00
	M85	0.33	-27.40	95.20	-145.27	-178.13	-25.60	-516.00

BB = Broad Breasted Bronze, WH = White Holland and M 85 = Mehallah 85

Table (3): L.S.M ± S.E. for relative growth rate of males and females (%) in purebred and their crosses of Turkeyat different ages.

Genotype	0 – 4 wk	5 - 8 wk	9 - 12 wk	13 – 16 wk	17 - 20 wk	21 - 24 wk
Purebred			**Males**			
BB x BB	160.6 ± 3.2^{b}	102.2 ± 3.9^{ab}	49.7 ± 3.9^{c}	43.8 ± 3.4^{b}	40.1 ± 2.7^{a}	32.0 ± 4.4^{a}
WH x WH	151.3 ± 2.5^{c}	99.5 ± 3.0^{b}	55.4 ± 3.0^{ab}	46.8 ± 2.7^{a}	32.3 ± 1.9	28.0 ± 2.8^{c}
M85 x M85	164.4 ± 1.3a	95.8 ± 1.3^{b}	51.0 ± 1.3^{bc}	41.6 ± 1.3^{c}	38.6 ± 0.9^{a}	29.0 ± 1.2^{c}
Crossbreds						
BB x WH	160.2 ± 2.6	102.2 ± 3.0^{ab}	56.2 ± 3.0^{a}	44.5 ± 2.7^{ab}	33.4 ± 2.0^{b}	31.6 ± 3.3^{a}
BB x M85	163.7 ± 1.3^{a}	100.5 ± 1.6^{ab}	55.5 ± 1.6^{ab}	43.8 ± 1.5^{b}	30.1 ± 1.0^{c}	29.5 ± 1.4^{ab}
WH x BB	159.6 ± 2.3^{b}	100.8 ± 2.7^{ab}	55.9 ± 2.7^{ab}	43.2 ± 2.4^{b}	33.1 ± 2.6^{b}	29.9 ± 1.9^{ab}
WH x M85	164.9 ± 1.6^{a}	96.3 ± 2.0^{c}	57.4 ± 2.0^{a}	43.5 ± 1.8^{b}	28.5 ± 1.3^{d}	27.9 ± 1.9^{c}
M85 x BB	163.5 ± 2.8^{a}	104.1 ± 3.4^{a}	52.7 ± 3.4^{b}	41.6 ± 3.1^{c}	30.7 ± 4.9^{c}	29.3 ± 1.6^{a}
M85 x WH	158.5 ± 3.4^{b}	96.0 ± 2.5^{c}	57.7 ± 4.0^{a}	47.2 ± 3.5^{a}	37.4 ± 4.9^{a}	32.5 ± 3.7^{a}
Purebreds			**Females**			
BB x BB	149.9 ± 2.0^{b}	90.1 ± 2.4^{ab}	52.1 ± 2.5^{ab}	45.7 ± 2.2^{a}	30.9 ± 1.5^{bc}	24.9 ± 1.8^{ab}
WH x WH	150.1 ± 1.7^{b}	89.6 ± 2.0^{b}	49.6 ± 2.1$^{ab\ b}$	44.9 ± 2.1^{a}	35.7 ± 1.5$^{a\ c}$	20.5 ± 1.9^{bc}
M85 x M85	153.0 ± 1.0^{a}	95.8 ± 1.3^{a}	51.0 ± 1.3^{ab}	41.6 ± 1.3^{bc}	28.6 ± 0.9^{c}	19.0 ± 1.2^{b}
Crossbreds						
BB x WH	147.8 ± 1.7	92.8 ± 2.1^{ab}	50.2 ± 2.2^{a}	44.6 ± 2.0^{a}	29.4 ± 2.0^{b}	26.4 ± 1.8 ^{a}
BB x M85	155.2 ± 1.0^{a}	91.6 ± 1.6^{ab}	49.6 ± 1.4^{a}	39.1 ± 1.3^{c}	26.7 ± 0.9^{c}	23.7 ± 1.1^{ab}
WH x BB	146.8 ± 1.8^{b}	95.4 ± 2.3^{a}	54.0 ± 2.3^{a}	43.2 ± 2.0^{ab}	31.4 ± 1.4^{bc}	23.8 ± 1.7^{ab}
WH x M85	155.6 ± 1.2^{a}	92.3 ± 1.5^{ab}	49.4 ± 1.6^{ab}	43.0 ± 1.6^{ab}	26.7 ± 1.0^{c}	18.2 ± 1.3^{c} 2c
M85 x BB	156.0 ± 2.0^{a}	96.0 ± 2.5^{a}	44.8 ± 2.6^{b}	41.1 ± 2.3^{b}	29.3 ± 1.6^{bc}	24.3 ± 1.9^{ab}
M85 x WH	147.3 ± 2.4^{b}	92.6 ± 2.9^{a}	51.1 ± 3.3^{ab}	43.2 ± 2.8^{a}	27.2 ± 1.8^{c}	18.4 ± 2.3^{c}
Significant						
Bet. males	***	*	*	*	***	***
Bet. femals	***	*	*	*	***	***

[1]BB = Broad Breasted Bronze, WH = White Holland and M85 = Mehallah 85and.

* significant at 5 % level of probability.

*** significant at 0.1 % level of probability.

a, b, c ,…. Means within the same column within the same sex with different superscripts are significantly different (P<0.05).

Table (4): General (GCA) and Specific (SCA) combining abilities and Maternal ability (MA) of purebreds and their crosses for relative growth rate of males and females (%) at different ages.

Sex	Genotype	Periods					
		0 – 4 wk	5 - 8 wk	9 12 wk	13- 16 wk	17-20 wk	21–24wk
Males	µ	159.87	99.49	53.58	44.69	33.08	27.85
	GCA						
	BB	1.35	3.69	- 2.46	- 0.14	5.29	4.83
	WH	- 6.82	- 0.37	3.39	1.75	- 0.66	1.62
	M85	5.47	- 3.32	- 0.93	- 1.61	- 4.63	- 6.45
	SCA						
	BB X WH	2.44	- 2.27	- 0.21	- 5.52	0.86	- 2.69
	BB X M85	- 2.18	4.11	- 0.50	3.30	- 5.52	- 2.40
	WH X M85	- 0.26	- 1.84	0.71	2.22	4.66	5.09
	MA						
	BB	5.53	-1.80	0.47	-1.73	-4.56	-3.83
	WH	1.33	4.60	-0.83	0.47	6.93	9.16
	M85	-6.88	-2.80	0.39	1.26	-2.37	-5.33
Females							
	µ	151.18	92.48	50.48	43.38	30.42	22.16
	GCA						
	BB	- 0.93	- 1.2	0.9	1.18	- 0.28	3.71
	WH	- 1.95	- 1.94	- 0.34	1.35	3.52	- 0.42
	M85	2.88	3.14	- 056	- 2.53	- 3.24	- 3.29
	SCA						
	BB X WH	- 5.86	3.11	4.97	1.84	- 0.98	- 0.33
	BB X M85	3.64	0.73	- 3.68	- 2.92	2.77	3.62
	WH X M85	2.26	- 3.84	- 1.29	1.08	- 1.79	- 3.29
	MA						
	BB	2.73	2.56	-0.36	-3.30	-3.76	-0.90
	WH	-0.37	-3.13	0.73	0.80	-1.47	5.00
	M85	-2.36	0.57	-0.37	2.50	5.23	-4.10

BB = Broad Breasted Bronze, WH = White Holland, and M 85 = Mehallah 85

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الملخص العربى

تقدير قدرات التوافق لكفاءة النمو بين بعض سلالات الرومى النقية باستخدام الخلط المتبادل

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أجريت هذه التجربة بمحطة بحوث الرومى بمحلة موسى– محافظة كفرالشيخ والتابعة لمعهد بحوث الانتاج الحيوانى – وزارة الزراعة واستصلاح الاراضى خلال الفترة من مارس حتى أكتوبر 2003م.

ولقد استخدم فى هذه الدراسة ثلاث سلالات من الطيور الرومية النقية وهى سلالة البرونز عريض الصدر، سلالة الهولندى الابيض وهما كسلالات متوسطة الوزن وسلالة محلة 85 وهى ثقيلة الوزن وقد استخدم الخلط المتبادل 3×3 للحصول على 9 تراكيب وراثية وتم أخذ 150 طائر من كل سلالة (120 أنثى ، 30 ذكر) وتم أخذ مقاييس وزن الجسم على عدد 2446 كتكوت فاقس من التسعة مجاميع وراثية وأستمر الوزن كل أربعة أسابيع حتى عمر التسويق (24 أسبوع) بالأضافة الى حساب معدل النمو النسبى خلال هذه الفترة كل 4 أسابيع فى كلا الجنسين من الذكور والاناث ويهدف البحث الى تقدير قدرات التوافق العامة والخاصة والتأثير الامى .

ويمكن تلخيص أهم النتائج كالآتى :–

يوجد فروق عالية المعنوية فى وزن الجسم بين السلالات النقية عند كل الاعمار المدروسة حيث تفوق ذكور وأناث سلالة محلة 85 عن سلالاتى البرونز عريض الصدر

والهولندى الابيض. بينما كان الخليط والخليط العكسى بين سلالاتى البرونز عريض الصدر ومحله 85 أثقل فى وزن الجسم بالمقارنة بالخلطان الأخرى سواء فى الذكور أو الاناث عند معظم الأعمار المدروسة.

سجلت ذكور وأناث السلالة محلة 85 أحسن التقديرات فى قدرة التوافق العامة لوزن الجسم عند معظم الأعمار المدروسة بينما كانت ذكور واناث سلالة الهولندى الابيض هى الاقل فى قدرة التوافق العامة لوزن الجسم عند معظم الأعمار المدروسة.

أظهر الخليط بين البرونز عريض الصدر × محله 85 أحسن التقدير فى قدرة التوافق الخاصة فى وزن جسم الذكور عند عمر 16 ، 20 ، 24 أسبوع بينما كانت اناث الخليط الهولندى الابيض × محله 85 هى الاعلى فى قيم قدرة التوافق الخاصة فى وزن الجسم عند كل الأعمار عدا وزن الفقس.

حققت ذكور واناث سلالة البرونز عريض الصدر التأثيرات الأعلى والموجبة معنويا فى المقدرة الامية فى وزن الجسم عند جميع الاعمار المدروسة عدا وزن فقس الذكور.

اختلف معدل النمو فى الذكور والآناث معنويا بين المجاميع الوراثية التسعة عند جميع الأعمار المدروسة حيث سجلت سلالة محلة 85 أعلى قيم لمعدل النمو النسبي فى المراحل العمرية الأولى حتى عمر 12 أسبوع.

اختلفت تأثيرات قدرة التوافق العامة لمعدل النمو النسبي في الذكور والإناث معنويا فى السلالات الثلاثة عند جميع الاعمار المدروسة وسجلت ذكور وإناث سلالة البرونز عريض الصدر أعلى قدرة توافق عامة تلتها سلالة محلة 85 .

أظهر الخليط الهولندي الأبيض × محلة 85 أعلى قدرة توافق خاصة لمعدل النمو النسبي فى الذكور عند معظم الفترات المدروسة وكانت اناث الخليط البرونز عريض الصدر × محله 85 هى الأعلى فى قدرة التوافق الخاصة لمعدل النمو النسبى عند معظم الفترات البينية المدروسة.

رتبت ذكور سلالة الهولندي الأبيض الأولى فى المقدرة الأمية لمعدل النمو النسبي عند كل الفترات المدروسة عدا من 9–12 أسبوع بينما كانت ذكور سلالة محله 85 هى الاقل عند كل الفترات المدروسة عدا من 9–12 ، 13–16 أسبوع.

من هذه النتائج يمكن ان نستخلص ان الخلط بين البرونز عريض الصدر ومحله 85 يعطى أفضل خليط يناسب المستهلك ملون الريش ذو وزن جسم أثقل ومعدل نمو نسبى أعلى وذلك بتحقيق أقصى استفادة من الوراثة التجميعية والغير تجمعيه ويحتمل الحصول على تحسن وراثى أفضل عند وضع هذه السلالات تحت نظام التزاوج الدوري المتبادل.