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CROSSBREEDING EFFECTS OF PROGENY TRAITS DUE TO CROSSING OF BAUSCAT AND BALADI RED RABBITS

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ABSTRACT

A crossbreeding study was carried out at the Experimental Rabbit Farm, Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Nasr City Cairo, Egypt, for three consecutive years of production starting from September 1998, using Bauscat (exotic breed) and Baladi Red (local breed) in addition to their two reciprocal crosses to study direct heterosis, maternal additive and diret additive effects on progeny traits (body weight and daily gain). Breed group effects on body weight were non-significant at different stage of ages, while its effects on daily gain weight were found to be significant at age intervals of (8-10), (10-12), (12-14) and (4-14) weeks of age. Threr was a superiority of Bauscat rabbits over Baladi Red for body weight at studied all age except at 10 weeks, while for daily gain weight it was during all age intervals except at (8-10) weeks. however the differences between the two breeds were mostly non-significant for body weight and daily gain traits. Crossbreeding between Bauscat and Baladi Red rabbits was generally associated with improvement in all body weights and daily gain weight traits except body weights at 12, 14 weeks and daily gain during ages intervals of (8-10), (10-12) and (4 –14) weeks. Direct Sire additive effect on progeny traits were mostly in favour of Bauscat sired rabbits progeny traits except body weight at 14 weeks and during the age intervals of (8-10), (10-12), (12-14), (birth-14) and (4-14) weeks it was in favour of Baladi Red sires. Maternal additive effect on progeny traits was in favour of Baladi Red rabbits for most studied body weight traits. When crossbreeding was applied between these two rabbit breeds. Maternal additive effect on daily gain was in favour of BR dams during the age intervals of (birth-4), (4-6) and (6-8), while daily gain during intervals of (8-10), (10-12), (12-14), (birth-14) and (4-14) weeks were in favour of B dams.

Keywords: Egyptian Baladi Red rabbits, crossbreeding, Heterotic effect, maternal additive effect, direct additive effect.

INTRODUCTION

Crossbreeding has an advantage over the synthesis of breeds in utilizing the breed differences due to the expected segregation along with the recombination (Dickerson, 1969). Egyptian studies (e.g. Afifi, 1971; Afifi and Khalil, 1989; Oudha, 1990; El-Dessoki, 1991; Afifi *et al.*, 1994; Khalil *et al.*, 1995 and Abd El-Aziz, 1998) evidenced, in general, that crossing local breeds of rabbits (e.g. Baladi, Baladi Red, Baladi Black, Giza White, ..etc.) with exotic breeds (e.g. Bauscat, Californian, New Zealand White, ... etc.) was associated with improvement in progeny traits (e.g. body weight and daily gain weight). Several studies were carried out to investigate the productive potentialities of native and exotic breeds of rabbits under the Egyptian conditions, in spit of this results there is a need to obtain more information about the genetic, environmental and managerial aspects of rabbit production to create a profitable industry. In addition to estimate the present objectives direct heterosis (H^I), direct(G^I) and maternal (G^I) additive effects for progeny traits (body weight and daily gain) in crossbreeding experiment involving Bauscat (B) and Egyptian Baladi Red (BR) rabbits.

MATERIALS AND METHODS

The experimental work of this study was carried out in the Experimental Rabbit flock maintained by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University in Nasr City, Cairo, Egypt during three consecutive years of production starting in September 1998 till October 2001.

In this study one local Egyptian breed of rabbits (Baladi Red, BR) and one exotic breed (Bauscat, B) were used. Does were mated with bucks from both breeds. According to the breeding plan, bucks were assigned at random to breed the does but with a restriction to avoid full-sib, half-sib and parent offspring matings when mated does and bucks were from the same breed. Each buck was allowed to sire all litters given by 3-5 does throughout the three years of the study. The breeding plan permitted the simultaneous production of BB, BR, $^1/_2$B$^1/_2$BR and $^1/_2$BR$^1/_2$B litters. Distribution of breeding does and bucks as well as number of litters are presented in Table1. Culled or dead does and bucks during experimental period were replaced randomly by their substitutes from the same breed from the original stock.

Table 1. Mating groups and number of bucks, does and litters used in this crossbreeding experiment.

Mating group		Number of		
Buck	Doe	Buck	Doe	Litters
B	B	14	47	203
BR	BR	13	44	171
B	BR	13	44	174
BR	B	14	52	142
Total		54	187	690

B = Bauscat; BR = Baladi Red rabbits.

Rabbits were raised in a semi-closed rabbitry. Breeding does and bucks were housed separately in individual wired-cages with standard dimensions arranged in double-tier batteries. Cage of each doe was provided with a matal nest box for kindling. Each doe was palpated 10 days after breeding to determine pregnancy. Those which failed to conceive were returned to the same mating buck at the day of test. At weaning (28 days after birth), young rabbits were sexed, tattooed and transferred to another batteries to be housed in groups of 3 to 4 individuals in standard progeny wire cages equipped by feeding hoppers and drinking nipples. The rabbits were fed ad-libitum on commercial pelleted ration, which provide 16.3% crude protein, 13.2% crude fibers and 2.5% fat. All Rabbits were kept under the same mangerial, hiegynic and inveromental conditions.

Data for progeny traits (body and daily gain in weight) were analyzed using the following mixed model:

$Y_{iklmnopq} = \mu+M_i+S_{ik}+Y_l+Se_m+P_n+ Ls_o+Sx_p+(SeY)_{ml}+(PY)_{nl} +e_{iklmnopq}$

Where:

$Y_{iklmnopq}$ = The observation on the iklmnpth growth traits;

μ = Overall mean, common element to all observations;

M_i = fixed effect of the ith breed group;

Y_l = fixed effect of the lth year of kindling

Se_m = fixed effect of the mth season of kindling;

P_n = fixed effect of the nth parity;

Ls_o = fixed effect of the oth litter size at birth;

Sx_p = fixed effect of the pth sex;

$(SeY)_{ml}$ = fixed effect of interaction between the mth season of kindlinfand lth year of kindling;

$(PY)_{nl}$ = fixed effect of interaction between the nth parity and lth year of kindling and

$e_{iklmnopq}$ = random deviation of the qth individual of the ith breed group assumed to be independently randomly distributed, i.e. N.D (0, σ^2e).

Genetic model and estimation of crossbreeding effects:

Cossbreeding effects (additive maternal, additive direct and heterosis direct) on different traits were estimated according to the genetic model such genetic model permit to derive a selected set of linear contrasts. (Harvey, 1990).

The following linear contrasts of mating type least-squares means were computed to quantify differences attributable to sire breed, dam breed and direct heterotic effect as:

Purebred differences:

$\{(G^I{}_B + G^m{}_B) - (G^I{}_{BR} + G^m{}_{BR})\} = (B \times B) - (BR \times BR)$.

Direct heterosis effect:

$H^I{}_{B \times BR} = \{(B \times BR + BR \times B) - (B \times B + BR \times BR)\}$.

Direct additive effect:

$(G^i{}_B - G^i{}_{BR}) = \{[(B \times B)+(B \times BR)]-[(BR \times BR)+(BR \times B)]\}$.

Maternal additive effect:

$(G^m{}_B - G^m{}_{BR}) = [(B \times BR) - (BR \times B)]$.

Where:-

G^i and G^m represent direct additive and maternal additive effects, respectively, of the subscript breed (genetic) group. Each single degree of freedom contrast was tested for significance with the Student's t-test.

RESULTS AND DISCUSSION

Mating. groups:

Breed group effect on progeny traits (body weight and daily gain in weight) are presented in tables (2&3). Breed group effect on body weight was found to be non-significant at different age stages. The same trend was observed by Abd El-Aziz (1998) and Khalil and Afifi (2000) with different breed groups and their crosses, they found that breed group effect on body weight recorded at different ages were non-significant.

Table 2. Estimates of breed group, means ± SE, purebred difference, heterosis (H^i), maternal additive effect (G^m) and direct additive effect (G^i) on body weight recorded at different ages.

Traits		Body weight at							
			Birth		4 weeks		6 weeks		8 weeks
Breed group		No.	means ± SE	No.	means ± SE	No.	means ± SE	No.	means ± SE
B x B		1267	54.3 ± 1.06	823	382.6 ± 7.49	725	642.5 ± 12.12	657	940.5 ± 24.86
BR x BR		932	54.1 ± 1.14	561	378.8 ± 8.16	506	622.6 ± 13.31	433	891.2 ± 28.46
B x BR		1003	56.2± 1.23	629	388.9 ± 9.36	556	653.8± 15.14	488	946.3 ± 30.90
BR x B		1125	54.5 ± 1.07	691	381.8± 7.75	618	642.0 ± 12.57	516	914.5 ± 26.91
Significant			ns		ns		ns		ns
Purebred difference									
$\{(G^i B + G^m B) - (G^i BR + G^m BR)\}$			0.23 ± 0.39		3.86 ± 4.18		19.92 ± 6.76		49.33 ± 21.67
Significant			ns		ns		**		*
Heterosis (H^i)									
H^i B x BR	Unit		1.13 ± .28		4.68 ± 30.2 ^{ns}		15.41 ± 4.87		14.53 ± 15.74
Significant			***				**		ns
	Percent		2.1%		1.2%		2.4%		1.6%
Maternal additive effect									
$(G^m B - G^m BR)$			-1.74 ± 0.40		-7.10 ± 4.31 ns		-11.79 ± 6.94 ^{ns}		-31.76 ± 22.51
Significant			***						ns
Direct additive effect									
$(G^i B - G^i BR)$			1.97 ± 0.56		10.97 ± 5.97		31.71 ± 9.61		81.09 ± 31.04
Significant			***		ns		***		**

Table 2. cont.

Traits	Body weight at					
	10 weeks		12 weeks		14 weeks	
Breed group	No.	means ± SE	No.	means ± SE	No.	means ± SE
B x B	593	1219.4 ± 15.00	555	1493.0 ± 17.46	551	1768.4 ± 15.78
BR x BR	389	1225.4 ± 17.27	381	1483.3 ± 20.07	362	1768.6 ± 18.38
B x BR	425	1243.1 ± 18.31	403	1479.1 ± 21.11	396	1749.7 ± 19.19
BR x B	462	1222.9 ± 16.00	443	1478.4 ± 18.00	440	1757.9 ± 16.74
Significant		ns		ns		ns
Purebred difference		-5.65 ± 11.50		-9.62 ± 13.46		-0.21 ± 11.87
Significant		ns		ns		ns
$\{(G^i B + G^m B) - (G^i BR + G^m BR)\}$						
Heterosis (H^i)						
H^i B x BR		10.79 ± 08.34		-9.41 ± 9.77		-14.72 ± 8.55
Significant		ns		ns		ns
		0.9%		-0.6%		-0.8%
$(G^m B - G^m BR)$		-20.23 ± 11.98		-0.76 ±v 14.05		8.23 ± 12.25
Significant		ns		ns		ns
$(G^i B - G^i BR)$		14.57± 16.51		10.38 ± 19.34		-8.44 ± 16.93
Significant		ns		ns		ns

B = Bauscat rabbits, BR = Baladi Red rabbits.

H^i % = [H^i in unit / (average of B + BR)] x 100. * = P<0.05, ** = P<0.01, *** = P<0.001, ns = non-significant.

Table 3. Estimates of breed group, means ± SE, purebred difference, heterosis (H^i), maternal additive effect (G^m) and direct additive effect (G^i) on daily gain weight calculated at different growth intervals.

Traits	Daily gain weight							
	Birth- 4 weeks		4- 6 weeks		6- 8 weeks		8- 10 weeks	
Breed group	No.	means ± SE	No.	means ± SE	No.	means ± SE	No.	means ± SE
B x B	823	11.7 ± 0.26	720	18.4 ± 0.55	642	20.1 ± 0.46	575	20.0 ± 0.43
BR x BR	561	11.6 ± 0.29	500	17.8 ± 0.61	424	20.0 ± 0.52	383	21.5 ± 0.50
B x BR	629	11.8 ± 0.33	552	19.2 ± 0.69	479	20.7 ± 0.57	418	19.6 ± 0.53
BR x B	691	11.7 ± 0.27	613	18.6 ± 0.58	496	20.2 ± 0.49	448	20.0 ± 0.47
Significant		ns		ns		ns		**
Purebred difference								
$\{(G^i B + G^m B) - (G^i BR + G^m BR)\}$		0.16 ± 0.15		0.66 ± 0.35		0.04 ± 0.38		-1.5 ± 0.39
Significant		ns		ns		ns		***
Heterosis (H^i)								
H^i B x BR	Unit	0.09 ± 0.11		0.80 ± 0.25		0.40 ± 0.28		-0.97 ± 0.28
Significant		ns		**		ns		***
	Percent	0.8%		4.4%		5.0%		4.7%
Maternal additive effect								
$(G^m B - G^m BR)$		-0.16 ± 0.15		-0.63 ± 0.36		-0.50 ± 0.40		0.40 ± 0.40
Significant		ns		ns		ns		***
Direct additive effect								
$(G^i B - G^i BR)$		0.32 ± 0.21		1.30 ± 0.50		0.54 ± 0.54		-1.90 ± 0.06
Significant		ns		**		ns		***

Table 3. cont.

Traits	Daily gain weight							
	10-12 weeks		12-14 weeks		Birth-14 weeks		4-14 weeks	
Breed group	No.	means ± SE	No.	means ± SE	No.	means ± SE	No.	means ± SE
B x B	539	18.6 ± 0.34	531	19.2 ± 0.41	531	17.6 ± 0.15	531	19.8 ± 0.19
BR x BR	376	18.9 ± 0.40	360	18.9 ± 0.48	360	17.5 ± 0.17	360	19.8 ± 0.21
B x BR	396	17.5 ± 0.42	387	17.3 ± 0.50	387	17.3 ± 0.18	387	19.3 ± 0.22
BR x B	432	17.9 ± 0.38	425	18.3 ± 0.45	425	17.4 ± 0.16	425	19.6 ± 0.20
Significant		**		***		ns		*
Purebred difference								
$\{(G^i B + G^m B) - (G^i BR + G^m BR)\}$		-0.22 ± 0.35		0.21 ± 0.43 ns		0.07 ± 0.11		-0.10 ± 0.15
Significant		ns				ns		ns
Heterosis (H^i)								
H^i B x BR		-1.03 ± 0.25		-1.22 ± 0.31		-0.22 ± 0.08		-0.43 ± 0.11
Significant		***		***		**		***
Maternal additive effect		5.5%		6.4%		1.3%		2.2%
$(G^m B - G^m BR)$		0.34 ± 0.37		1.02 ± 0.45		0.15 ± 0.12		0.29 ± 0.16
Significant		ns		*		ns		ns
Direct additive effect								
$(G^i B - G^i BR)$		-0.56 ± 0.50		-0.81 ± 0.62		-0.09 ± 0.16		-0.39 ± 0.22
Significant		ns		ns		ns		ns

B = Bauscat rabbits, BR = Baladi Red rabbits.
H^i % = [H^i in unit / (average of B + BR)] x 100. * = P<0.05, ** = P<0.01, *** =P<0.001, ns = non- significant.

Breed group effect on daily gain in weight were found to be significant at the age intervals (8-10), (10-12), (12-14) and (4-14) weeks of age. In this respect, Tosson et al (1999) and Abd El-Ghany (2000a& b) with different local and exotic breed groups of rabbits and their crosses proved that breed group effect on daily gain in weight at different ages were significant (P <0.05, P <0.01 or P <0.001), while it was non-significant at the age intervals of 8-10, 10-12, 12-14 and 4-14 weeks. In agreement with the present results, Youssef (1992) and Abd El-Aziz (1998) found that breed group effect on daily gain in weight at most age intervals was non-significant.

Purebred differences:

Linear contrasts between Bauscat and Baladi Red rabbits for body weight and daily gain in weight are given in tables (2&3). These contrasts indicated the superiority of Bauscat rabbits over Baladi Red ones in body weight at all ages except at 10 weeks and for daily gain weight during all age intervals studied except that during the interval (8-10) weeks. The differences were mostly non-significant for body weight and daily gain traits except that for body weight (P<0.05, P<0.01or P<0.001) at 6, 8 weeks and daily gain during interval of (8-10) weeks. In this respect, Youssef (1992) and Afifi et al (1994) reported that rabbits of purebred New Zealand White and Baladi Red rabbits were not significantly different in most body weight at different ages and post-weaning daily gain during most age intervals studied and the differences were mostly in favour of New Zealand White rabbits. Also, Gad (1998) and Khalil and Afifi (2000) found that purebred differences were generally not significant for body weight and daily gain traits. However, Abd El-Aziz (1998) with New Zealand White and All-Gabli rabbits and Abdel-Ghany et al, (2000b) with New Zealand White and Baladi Black rabbits observed significant (P <0.05, P <0.01 or P<0.001) purebred differences in body weight but non- significant in all daily gain traits studied.

Heterotic effect:

Estimates of heterosis percentages for progeny traits (body weight and daily gain weight) are given in tables (2&3). These estimates indicated that crossing between B and BR rabbits was generally associated with improvement in all body weight and daily gain in weight traits except body weight at 12, 14 weeks and gain in weight during age intervals (8-10), (10-12) and (4-14) weeks. The heterotic effect was significant (P <0.01 or P <0.001) on body weight at birth and at 6 weeks of age and non-significant at 4, 8, 10, 12 and 14 weeks. For daily gain weight hetcrotic effect was significant (P<0.01 or P<0.001) during all age intervals studied except during age intervals from birth-4 and 6-8 weeks. Different crossbreeding experiments carried out on rabbits in Egypt (Abdel-Aziz, 1998; Gad, 1998; Tosson et al, 1999; Abdel-Ghany et al, 2000 a&b; Khalil and Afifi, 2000) revealed that heterotic effects for body weights and daily gain at different ages and age stages were evidenced.

Direct additive effect:

Linear contrasts of direct additive (sire breed) effect on progeny traits were mostly, non-significant except body weight at birth, 6, 8 and during the age interval (8-10) weeks, in favour of Bauscat sired rabbits for most growth traits except body weight at 14 weeks. However during the age intervals (8-10), (10-12), (12-14), (birth-14) and (4-14) weeks it were in favour of Baladi Red sired tables (2&3). This means that in general patemity of B rabbits is better than that of BR ones. Youssef, (1992) observed that growth performance at post-weaning ages (5 and 6 weeks) of New Zealand White sired rabbits were not significantly different in their weights and gains from those of rabbits sired by Baladi Red breed, in the other side significant differences in favour of New Zealand White-sired rabbits were evidenced during the later ages of 10 and 12 weeks. Afifi et al (1994) with New Zealand White, Baladi Red and their two reciprocal crosses, showed that growth performance (body weight and daily gain) at early ages (5 and 6 weeks) of New Zealand White-sired crossbred rabbits was not significantly differ from those sired by Baladi Red bucks. However, they observed significant differences in favour of New Zealand White-sired rabbits during later ages at 10 and 12 weeks.

Abdel-Ghany et al (2000a) with New Zealand White (NZW), Baladi Black (BB) and Baladi Red (BR) observed significant differences in favour of BB bucks except daily gain from (14-16) weeks of age, contrasts were consistently the highest for BB bucks and the lowest for NZW buck breed effect ($P<0.05$, $P<0.01$, $P<0.001$) on post-weaning daily gain. They indicated that patemity of BB rabbits is better compared to NZW ones. The superiority of BB rabbits as sires suggest the use of breed as a sire breed in crossbreeding programs including NZW would be beneficial in improving post-weaning daily gain traits. These results confirm the use of (BB) as a terminal sire-breed for engendering of broiler rabbits.

Maternal additive effect:

Linear contrast of maternal additive effect on progeny traits were non-significant effect except body weight at birth and daily gain during the age interval (12-14) weeks it were significant ($P <0.05$ or $P <0.001$) tables (2&3). Youssef (1992), Afifi et al (1994) and Khalil and afifi (2000) indicated that maternal additive effect on most body weights and daily gains were not significant. However, Abd El-Aziz (1998) and Hassan et al (1999) indicated that maternal additive effect on most body weights and gains were significant ($P <0.05$, $P <0.01$ or $P <0.001$). However contrast, also showed that differences were in favour of Baladi Red rabbits for most body weight traits. This means that BR damed rabbits were heavier than those of B damed ones at most ages studied. Maternal additive effect on daily gain was in favour of BR dams during the age intervals (birth-4), (4-6) and (6-8) weeks, while at (8-10), (10-12), (12-14), (birth-14) and (4-14) weeks intervals it were in favour of B dams. These results might refer to the exchanged maternity of local BR dams with those exotic B ones for daily gain. Oudah (1990) and El-Dessoki (1991) with New Zealand White and Baladi Red rabbits indicated that all crossbred groups mothered by New Zealand White and Californian dams recorded heavier weights at 4, 8 and 10 weeks of age, while those mothered by Baladi Red dams showed lower weights. The same author found that rabbits mothered by Baladi Red dams had obvious lesser post-weaning daily weight gain than that mothered by New Zealand White does. Abd El-Aziz (1998) with New Zealand White (NZW) and Gabli rabbits indicated that maternal additive effect on body weight was positive in favour of Gabli while it was not significant for daily gain.

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تأثير الخلط على صفات نتاج الأرانب الناتجة من خلط سلالة البوسكات مع البلدي الأحمر

جمال الدين يوسف عطاالله
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أجريت هذه الدراسة في مزرعة الأرانب البحثية بكلية الزراعة- جامعة الأزهر بمدينة نصر- مصر خلال ثلاثة سنوات إنتاجية متتالية بدأت في سبتمبر ١٩٩٨م حتى أكتوبر ٢٠٠١م استخدم في هذه الدراسة نوعين من الأرانب هي البوسكات (سلالة أجنبية) و البلدي الأحمر(سلالة محلية) وذلك لدراسة بعض التأثيرات الوراثية لصفات النمو للأبناء و تقييم الأداء الإنتاجي في خلطانيما و قياس تأثير كل من الخلط و التأثيرات المضافة المباشرة و الأمية على بعض الصفات الإنتاجية.

- اظهر اختبار التضادات المستقيمة تفوق الأرانب البوسكات على الأرانب البلدي الحمراء في صفات وزن الجسم و على معظم صفات الزيادة اليومية في الفترات المختلفة من العمر.
- أدى الخلط بين البوسكات و البلدي الاحمرإلي وجود قوة هجين موجبة و غير معنوية لمعظم صفات وزن الجسم فيما عدا أوزان الجسم عند ١٢، ١٤ أسبوع وصفات معدل الزيادة اليومية في فترات النمو من ٨-١٠، ١٠-١٢، ٤-١٤ أسبوع . كان تأثير الخلط معنويا على صفة وزن الميلاد ووزن الجسم عند ٦ أسابيع بينما لم يكن معنويا على صفات ا وزان الجسم عند اعمار ٤، ٨، ١٠، ١٢، ١٤ أسبوع سن العمر بينما كان تأثير الخلط معنويا على جميع صفات مقدار الزيادة اليومية فى فترات النمو المختلفة. كما أدى الخلط إلي وجود قوة هجين سالبة ومعنوية لمعظم صفات الزيادة اليومية.
- لم يكن التأثير التجمعي المباشر معنويا فيما عدا صفات أوزان الجسم عند الميلاد وعمر ٦، ٨ اسبوع و صفات معدل الزيادة اليومية في فترات النمو من ٨-١٠ أسبوع وفى صالح ذكور الأرانب البوسكات و صفة وزن الجسم عند ١٤ أسبوع صفة معدل الزيادة اليومية في فترات النمو من ١٠-١٢، ١٢-١٤، الميلاد-١٤، ٤-١٤ أسبوع وفى صالح ذكور الأرانب البلدي الحمراء.

كان التأثيرالأمي المضيف غير معنوي على صفات أوزان الجسم المقاسة عند الأعمار المختلفة و على معظم صفات الزيادة اليومية ماعدا الوزن عند الميلاد و الفترة من ١٢-١٤ أسبوع وكان التأثيرالأمي المضيف في صالح إناث الأرانب البلدي الحمراء في معظم صفات وزن الجسم، بينما كان في صالح الأرانب البوسكات بالنسبة لصفات معدل الزيادة اليومية خلال الفترات من ٨-١٢، ١٠-١٢، ١٢-١٤، الميلاد -١٤، ٤-١٤ أسبوع.