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ESTIMATION OF SOME GENETIC EFFECTS IN CROSSBRED RABBITS

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ABSTRACT

Data were collected from 489 progeny. They represented purebred, F_1, backcross and F_2 inter se combinations of New Zealand White (NN) and Californian (CC) rabbits. They were used to estimate average individual, maternal genetic effects, individual & maternal heterosis and dominance & epistatic genetic effects. The rabbits were produced over 2-year period at Maryout Research Station. Three different genetic models, being Dickerson (1973), Kinghorn (1980) and Koch et al (1985) were used to estimate crossbreeding parameters.Coefficients of additive breed, heterosis, dominance maternal and recombination loss (epistatic) were discussed. The differences among eight genetic groups were significant for postweaning traits. F_{2N} had the highest weights (2009.2 g) and daily postweaning gain (32.9 g) when NC was the terminal sire and when reared by CN dam. Californian had significantly higher postweaning market weight (1957 g by 72 day of age) than (NN) purebred. Significant differences between generations in (F_1 vs. F_2) and (F_2 vs. $\bar{P}$) in weaning weight was found. No difference in postweaning weight could be observed between (NN) and (CC) purebreds. Sex linkage had negative effect for weaning weights. It also had positive effects for postweaning and weights gain. The individual breed effects (A^I) for W54, W72 and postweaning weights gain that were estimated by both genetic models of Dickerson and Kinghorn were positive, while weights from weaning to day 45 postweaning were negative. Average maternal effects (M^I) that were estimated by Dickerson and Kinghorn models had positive effect for early growth traits until weaning weight. However, the weights during postweaning period until 72 days of age or individual daily gain had been negatively effected. Individual dominance (d^I) had positive effect on weaning weight and negative effect on postweaning and weights gain. Additive x additive epistatic effects (gg^I) for the Koch model were significant. They were large and negative for postweaning weight. It was not significantly positive only for weaning weight. In contrast, the epistatic loss effects (e^I_x) that were estimated by Kinghorn model were significant and had positive effect on postweaning and weights gain. They had negative effect on weaning weight.

Keywords: Crossbreeding parameters, genetic effects, maternal, heterosis, epistasis, Recombination loss, rabbits

INTRODUCTION

In quantitative genetics, mathematical models are used rather than their biochemical or physiological mechanisms. Expected consequences of different models on observations from breeding experiments and their relationship to practical breeding decisions are analysed. Theoretical consideration of breed crosses and models for evaluating contribution of epistasis were described by Cockerham (1954), Kempthorne (1957), Dickerson (1969 and 1973), Kinghorn (1980 and 1982), Sheridan (1981) and Hill (1982). Heterosis among crosses and inbreeding are basically due to dominance of gene action at many loci (Hill, 1981). Heterosis (deviation from mid-parent) is proportional to heterozygosity when it is due to simple dominance with no interaction between loci. Mc Gloughlin (1980) found an almost perfect linear relationship between heterosis for reproductive performance and heterozygosity among various reciprocal crosses of two strains of mice. Dickerson (1972) defined recombination loss as a deviation from linear association with heterosis. It depends on interactions between diploid loci. It is more complex than dominance gain which depends on the singular interactions within loci. Sheridan (1981) proposed a “Parental epistasis” model to explain substantial reduction in heterosis from the F_1 to the F_2. Each parental line is homozygous for a different pair of complementary genes. The pairs act additively with other pairs, i.e. no 3-locus interactions. Mather and Jinks (1971) considered crosses between inbred lines. They used different definitions of the gene effects involving dominance in terms of the genotypic model rather than contrasts. In animal breeding the most commonly applied model was derived by Dickerson (1969 and 1973). Hill (1982) analyzed crossbred generation means. He used genotype values in terms of additive (average) effects, dominance effects, additive x additive, additive x dominance and dominance x dominance effects. Kinghorn (1980) presented that epistasis refers to all non-allelic gene interactions. He developed another genetic model. It accounts for the epistatic effects where heterosis effects are based on dominance effects. Epistatic interactions are covered by the epistatic loss (e_x). Literature reports providing evidence for separate dominance and epistatic effects in meat production of rabbits are few. The purpose of this study was to present and compare some equations for estimation of genetic effects when the crossbreeding experiments included two breeds.

MATERIALS AND METHODS

Data were collected from the crossbreeding experiment carried out at Maryout Research Station, Desert Research Center. The records contained postweaning traits: weaning weight from birth to 28 days (WW), body weight from birth to 45 days (W45), body weight from birth to 54 days (W54), body weight from birth to 72 days of age (W72) and average daily weight gain from total 489 progeny.

Figure (1) illustrates relationships along various studied groups. Whereas Table (1) gives the number of rabbits used in this study.

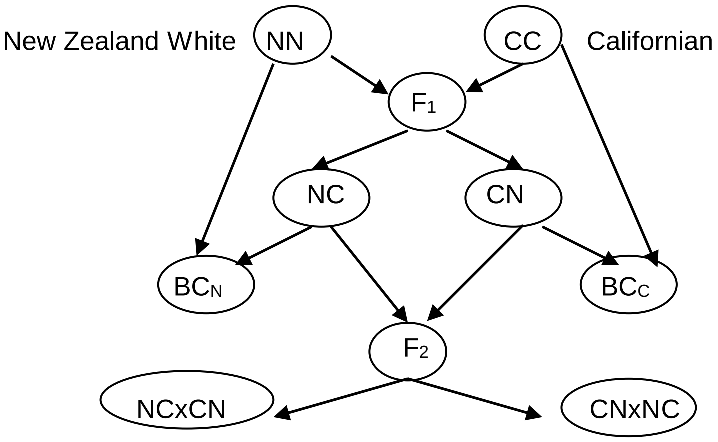

Figure 1. A schematic diagram of the crossbreeding scheme
NN& CC = New Zealand White and Californian pure-breds rabbits.
CN& NC = reciprocal crosses,
BC_N & BC_C = backcrosses to NN and CC sires, respectivly.
NC x CN& CN x NC = F_2 generation.

Table 1. Number of rabbits in genetic groups.

Genetic groups		Number of rabbits
Parental		
	NN	103
	CC	35
F_1	NC	48
F_1	CN	91
Backcrosses		
	BC_N	50
	BC_C	37
F_{2c}	(CNxNC)	74
F_{2N}	(NCxCN)	51

NN = New Zealand White, NC, CN F_1 crossbreds, BC_N = backcrosses with NN sire, BC_C=backcrosses with CC sire, F_{2C} (CNxNC) and F_{2N} (NCxCN)

All animals were kept under the same environmental conditions. Rabbits were fed commercial pelleted ration and drank fresh water *ad libitum.* Growing kids were seperated from their dams after weaning (usually at 28 days of age). Young rabbits were regularly weighed.

Methods of estimation:

I- Linear model:

The following linear model was used to analyse the data:

$y_{ijk} = \mu + G_i + S_j + GS_{ij} + e_{ijk}$

where:

y_{ijk} is individual observation

μ is general mean,

G_i is fixed effect of the the i^{th} genetic groups representing purebred, F_1 crossbred compinations, backcrosses and F_2 crossbreds.

S_j is fixed effect of the jth sex,

GS_{ij} is interaction between genetic groups and sex and,

e_{ijk} is random error.

Estimates of genetic components were calculated from linear contrasts Table 2).

Table 2. Contrasts for estimating genetic components from first generation

Genotype	Additive	Dominance	Maternal	Sex linked	Heterosis
NN	1	-.5	1	1	-1
CC	-1	-.5	-1	-1	-1
NC	0	.5	-1	1	1
CN	0	.5	1	-1	1

(NN=New Zealand White, CC=Californian; NC and CN=reciprocal crossbreds F_1).

II- Genetic models:

It is the first model used recombination loss as defined by Dickerson (1973). The genetic model is as follows:

$$y = \mu + A^I + D^I + M^I + r^I_{73} + Sex + e$$

where:

y = indvidual observation, μ = overall mean, A^I =Individual additive effect; D^I=Individual dominance effect; M^I = Individual maternal effect; r^I_{73} =recombination loss effect; e = random error.

The Coefficient r^I (Table 3) describes average fraction of dependently segregating pairs of loci. They are in gametes from both parents, which are expected to be nonparental combinations.

Table 3. Coefficients for expected genetic effects recombination loss defined by Dickerson (1973).

Mating type	A^I	D^I	M^I	r^I_{73}
Parental				
NN	1	0	1	0
CC	-1	0	-1	0
F1				
NC	0	1	-1	0
CN	0	1	1	0
Backcrosses				
BC_N	.5	.375	.5	.25
BC_C	-.5	.375	-.5	.25
F2				
F_{2C} (CN x NC)	0	.5	0	.5
F_{2N} (NC x CN)	0	.5	0	.5

The means genetic model accounts for the epistatic effects according Koch *et al.* (1985). It is represented as:

$y = \mu + g^{I}_{A} + g^{M}_{A} + g^{MG}_{A} + d^{I} + d^{M} + gg^{I} + e$

where:

y = indvidual observation, μ = overall mean, g^{I}_{A} =Individual additive effect; g^{M}_{A} = maternal effect; g^{MG}_{A} = grandmaternal effect; d^{I} & d^{M} =Individual and maternal dominance effect; gg^{I} =(additive x additive) Individual epistatic effect and e= random error.

Coefficients of genetic parameters for the genetic groups are shown in Table 4.

Table 4. Coefficients for expected genetic effects as defined by Koch *et al.* (1985).

Mating type	g^{I}_{A}	G^{M}_{A}	g^{MG}_{A}	d^{I}	d^{M}	gg^{I}
Parental						
NN	1	1	1	0	0	1
CC	-1	-1	-1	0	0	1
F_1						
NC	0	1	1	1	0	.5
CN	0	-1	-1	1	0	.5
Backcrosses						
BC_N	.5	0	1	.5	1	.625
BC_C	-.5	0	-1	.5	1	.625
F_2						
F_{2C} (CN x NC)	0	0	1	.5	1	.5
F_{2N} (NC x CN)	0	0	-1	.5	1	.5

III- The model of Kinghorn (1980):

It shows dominance and two-locus interactions, using the term “epistatic loss (e)” to describe effect from break down of parental combinations (Table 5)..

The model is:

$y = \mu + A^{I} + D^{I} + M^{I} + e^{I}_{x} + e^{M}_{x} + e$

where:

y = indvidual observation, μ = overall mean, A^{I} =Individual additive effect; D^{I}= Individual dominance effect; M^{I} = Individual maternal effect; e^{I}_{x} & e^{M}_{x} =Individual and maternal epistatic effect and e= random error.

Modified generalized least square procedure SAS (1990) was applied to estimate the effects in the model. Preliminary analyses indicated that two-factor (year & age) of dam and interactions with genetic groups were not significant.

Table 5. Coefficients for expected genetic effects (epistatic loss) defined by Kinghorn (1980).

Mating type	A^I	D^I	M^I	e^I_x	e^M_x
Parental					
NN	1	0	1	0	0
CC	-1	0	-1	0	0
F_1					
NC	0	1	-1	.5	0
CN	0	1	1	.5	0
Backcrosses					
BC_N	.5	.5	.375	.375	.5
BC_C	-.5	.5	.375	.375	.5
F_2					
F_{2C} (CN x NC)	0	.5	0	.5	.5
F_{2N} (NC x CN)	0	.5	0	.5	.5

RESULTS AND DISCUSSION

Least squares means and standard errors for postweaning traits are presented in Table (6). The differences among eight genetic groups were significant for postweaning traits. Least squares means for individual weaning weight varied from 455.2 in F_2 to 614.3 g in Californian rabbits. The mean value of the F_{2N} was high at 72 days of age for postweaning when compared with other genetic groups. Weight at 45 days of age for (NC) rabbit was similar to that of (CN). Weaning weight of (F_{2N}) rabbit was similar to that of (NN) New Zealand White purebred rabbit. Average individual effect indicates that Californian rabbit had heavier weaning weights and postweaning gains than New Zealand White. Californian strain had higher gain during postweaning period than other genetic groups. Lukefahr *et al*. (1983) found that weight at 54 d and weight gain were improved and weight at weaning was increased in Californian sired on an individual rabbits basis. Similar postweaning gain for New Zealand White and Californian have been reported by Carregal (1980). The 72- day body weight was highest in (CN) vs. (NC) and (BC_C) vs. (BC_N) genetic groups when Californian terminal sire breed. Martins *et al.* (1988) reported that crossbreds included Californian breed had the best postweaning growth rate. At 72- days of age body weight of the F_{2N} rabbits averaged 2009.2 g. They had superiority over the two pure breeds. F_{2N} had high weights and daily postweaning gain when (NC) was the terminal sire and reared by (CN) dam. Maximum body weight gain was (32.9 g/day) for group F_{2N}.Californian (CC) had significantly higher postweaning market weight (1957.0 g) by day 72 than (NN) purebred.

Table (7) Presents estimation results of crossbreeding parameter for postweaning traits. They were calculated from linear contrasts. The genetic effects from linear contrasts were evaluated between Californian and New Zealand White rabbit.

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The analysis of the traits of Californian showed possible existence of heterotic effect in the first generation due to genetically heterogeneous origin of the breed. The differences between the two breeds were not significant. Mc Gloughlin (1980) observed a positive linear relationship in mice between expected heterozygsity, heterosis in litter size, weight at birth and at weaning. The sex linkage had negative effect for weaning weight. It had positive effect for postweaning and gain weights.

Table 7. Estimates of genetic components and crossbreeding parameters for postweaning and weight gain traits.

Genetic effects	WW	Gain wt.	W45	W54	W72
Additive	-53.2	3.5	6.3	38.0	101.2
Maternal	-15.7	4.3	57.2	96.1	173.5
Dominance	13.3	2.5	56.4	79.2	125.0
Sex linkage	-90.6	2.7	-44.6	-20.0	28.8
Heterosis	26.7	5.1	122.9	158.5	250.0
(F_2- $\bar{P}$)	-77.1 *	.55	-67.6	-62.9	-52.9
($\bar{BC}$- $\bar{P}$)	-51.9 †	-3.9 *	-117.6	-152.5	-222.2
(F_1- F_2)	84.9**	-2.7 *	64	14.7	-33.95
(NC-CN)	31.9	-3.9	15.9	-69.2	-139.5

***=P<0.05, ** = P<0.01, †= P < .05 to .10.**

Significant differences were found between generations of (F_1 vs. F_2) and (F_2 vs. $\bar{P}$) in weaning weight. No difference in postweaning weight could be observed between the two breeds. Cifrte *et al*. (1998) found that no differences between the generations in weaning weight were apparent, which implies the absence of the heterotic effect. The values of heterosis that were found in the literature for growth traits in rabbits are always low. They range between 0 and 5% in accordance with Brun *et al*. (1992) and Jensen et al. (1996). It can be concluded that Californian breed is superior in individual weaning weight to NN breed, but there were no differences in postweaning traits and daily gain between the two breeds.

Table (8, 9 and 10) present results for the estimation of genetic components and crossbreeding parameters of postweaning and gain traits. The individual breed effects (A^I) for W54, W72 and postweaning weight gain estimated by both genetic models of Dickerson and Kinghorn were positive. Weights from weaning to W45 postweaning weight were negative. In contrast, for these breed effects, there were negative and significant effects estimated from the Koch model. Brun and Rouvier (1988) found that the New Zealand White strain had favorable direct additive effect on litter size and weight at weaning. Californian strain was better for maternal effects on litter size at birth and for grandmaternal effects on growth from birth to weaning. The maternal breed effect ($g^M{}_A$) estimated by Koch et al. (1985) model had negative effect for all postweaning weights, except for postweaning gain. Average maternal effects (M^I) estimated by Dickerson and Kinghorn model had positive effect for early growth traits until weaning weight. However, the weights during postweaning period until 72 day of age or individual daily gain had negative effect. Youssef (1992) reported that postweaning growth performance of rabbits mothered by New Zealand White dams were almost similar to those mothered by Baladi Red dams. Additive and non-additive maternal breed effects were low and of little importance. Brun (1993) reported that the different expression of genetic gain in purebred and crossbred dam might be due to an effect of the genetic background (homozygous vs. heterozygous) on the expression of genetic variability.

Table 8. Genetic effects for postweaning and weight gain traits by Dickerson (1973)

Genetic effects	WW	Gain wt.	W45	W54	W72
A^I	-42.4	1.8	-11.1	5.5	38.7
M^I	14.1	-2.0	-19.9	-37.9	-74.1
.d^I	11.3	-1.3	-11.1	-22.9	-46.6
R^I_{73}	-146.5	3.8	-81.8	-47.6	20.7
Sex	4.5	.87	19.3	27.1	42.7

Table 9. Genetic effects for postweaning and weight gain traits by Koch *et al.* (1985)

Genetic effects	WW	Gain wt.	W45	W54	W72
.g^I_A	-36.3	-2.8 †	-83.9 *	-109.2 *	-159.8 *
G^M_A	-34.2	.65	-23.0	-17.0	-5.1
.g^{Mg}_A	30.0	1.61	57.1 **	71.6 **	100.4 *
.d^I	62.2	-19.9**	-275.8	-454.9 *	-812.7 *
.d^M	-46.1	-6.8 *	-162.1*	-233.5 *	-346.3 *
.gg^I	125.4	-35.6 **	-480.5	-801.4 †	-1442.7 *
Sex	7.8	1.1	26.4	36.3	56.0

***=P<0.05, ** = P<0.01, †= P < .05 to .10..**

Table 10. Genetic effects for postweaning and weight gain traits by Kinghorn (1980)

Genetic effects	WW	Gain wt.	W45	W54	W72
A^I	-43.1	1.7	-12.6	3.6	36.0
.M^I	11.5	-1.8	-20.1	-36.8	-70.5
.d^I	60.2	-20.0**	-279.5	-459.6 *	-819.3 *
.e^I_X	-107.7	36.6 **	514.2	-843.7 †	1501.9*
.e^M_X	-87.7	-13.4 *	-315.3*	-436.0 *	-677.0*

***=P<0.05, ** = P<0.01, †= P < .05 to .10.**

Individual dominance effects (d^I) for postweaning and gain weights estimated by Kinghorn model were relatively large and significant. The maternal dominance effects (d^M) for postweaning and gain traits estimated by Koch model, were negative and had significant effects. Individual dominance (d^I) had positive effect on weaning weight and negative effect on postweaning and gain weights. Krogmeier *et al.* (1994) reported that the additive genetic contributions to variation in litter traits were higher at birth and during the postweaning period than during the perweaning period. Dickerson (1969 and 1973) defined the heterosis effects as deviation from parental averages due to increased average heterozygosity of F_1 crossbreds. They include epistatic effects, However, Kinghorn (1980) modeled dominance and two-locus interactions. He used the term ‘epistatic loss (e)’ to describe effects from breakdown of parental combinations. He considered “heterosis “ synonymous with dominance and not as the deviation of reciprocal F_1 crosses from mid-parent as used by Dickerson (1973). The small heterosis effects estimated by the Dickerson model might be resulted from combination of dominance effects and epistatic effects included in the heterosis effects. Maternal granddam effects ($g^{MG}{}_A$) as estimated by Koch model were significant for increased postweaning weights.

Oetting *et al*. (1989) reported that maternal breed (mothered additive) had effect on body weight at weaning (4 weeks) and up to nine weeks of age was significant. Additive x additive epistatic effects (gg^I) for the Koch model were significant. They were large and negative for postweaning weight. Their effects were not significantly positive only for weaning weight. In contrast, the epistatic loss effects ($e^I{}_x$) estimated by Kinghorn model were significant and had a positive effect on postweaning and gain weights. They had negative effect on weaning weight. Komender and Hoeschele (1989) reported that estimates of crossbreeding parameters were very close, regardless of the different used procedures.

Khalil (1980) and El-Qen (1988) showed that crossbreeding was important in improving weight and weight gain of rabbits.

Hill (1982) discussed dominance and epistasis as components of heterosis. He presented partitioning of additive $g^I{}_h$, dominance $d^I{}_h$ and interactions ggIh $d^I{}_h$ and gdIh for crosses of two breeds. He used the F_2 population as a base instead of the parental generation. His formulation did not include maternal or grandmaternal effects. The use of models with gg^I , r_{73} and e_x resulted in identical analyses of variance because all are coded values of each other.

CONCLUSION

The genetic components estimates indicate possibility of improving growth traits in rabbits. Also, it is often used one or more of different genetic models to explain the level of heterosis observed in a particular crossbred population. For example, the absence of hertrosis in F_2 population can be explained in terms of either parental or epistasis.

REFERENCES

Brun, J. M. (1993). Crossbreeding parameters between 3 rabbits strains and analysis of the response to selection for litter size: litter traits at birth and weaning. Genetics, Selection, Evolution. 25: 5, 459-474.

Brun, J. M.; G. Bolet and J. Ouhayoun (1992). The effects of crossbreeding and selection on productive and reproductive traits in a triall experiment between three strains of rabbits. J. Appl. Rabbit. Res., 15: 181-114.

Brun, J. M. and R. Rouvier (1988). Genetic effects on litter traits and dam weight in crosses of two selected rabbits strains. Genetics, Selection, Evolution, 20(3): 367-378.

Carregal, R. D. (1980).Evaluation of heterosis, combing ability and maternal and reciprocal mating effects in rabbits. Proc. 2nd World Rabbit Congress, April 1980. Barcelona, Spain, Revista de sociedade Barsileira de zootecnia, 10 (4): 594-603.

Cifrte, M.; Baselga F. Garcia-Ximenez and J. S. Vicente (1998). Performance of a hyperprolific rabbit line II. Maternal and growth performances. J. Anim.Breed. Genet., 115: 139-147

Cockerham, C. C. (1954). An extension of the concept of partitioning hereditary variance for analysis of covariances among relatives when epistasis is present. Genetics, 39: 859.

Dickerson, G. E. (1969). Experimental and approaches in utilizing breed responses. Anim. Breed. Abstr., 37: 191.

Dickerson, G. E.(1972). Inbreeding and heterosis in animals .Proc. An, Br.and Gen. Symp. In honour of J.L. Lush. Virginia Polytech. Ins. PP 54-76.

Dickerson, G. E. (1973).Inbreeding and heterosis in animals. In Honor of Dr. Jay L. Lush .pp 54-77. Amer. Soc. Anim. Sci. Champaign, IL.

El- Qen. R. Y. N. (1988). Genetical and enviornmental studies on rabbits M.Sci. Thesis, Fac. Agric., Tanta Univ., Egypt.

Hill, W. G. (1981). The genetic basis of heterosis. 32nd Annual Meeting, EAAP, Zagreb, 31. Aug./3. Sep. 1981. Paper III-1.

Hill, W. G. (1982). Dominance and epistasis as components of heterosis. Z. Tiezucht. Züchtungsbiol., 99: 161.

Jensen, N. E.; J. F.Jensen ;Z. Szendro and P.Sorensen (1996). Diallel crossbreeding experiment in Danish and Hungarian meat rabbit 1. Reproductive performance, growth and feed conversion. World Rabbit Sci., 4: 109-114.

Kempthorne, O. (1957). An introduction to genetic statistics. John Wiley and Sons, Inc., New York.

Khalil,M. H. (1980). Genetic and environmental studies on some productive traits in rabbits. M. Sci. Thesis, Fac. Agric. Sci .Moshtohor Zagazig Univ. Egypt.

Kinghorn, B. (1980).The expression of" recombination loss" in quantitive traits. Z. Tierzücht. Züchtungsbiol., 97: 138.

Kinghorn, B. (1982). Genetic effects in crossbreeding.I. Models of merit .Z. Tierzücht. Züchtungsbiol., 99: 59.

Koch, R. M.; G. E.Dickerson; L. V. Cundiff and K. E.Gregory (1985). Heterosis retained in advanced generations of crosses among Angus and Herford cattel. J. of Anim. Sci., 60 (5): 1117-1132

Komender, P. and I. Hoeschele (1989). Use of mixed model methodology to improve estimation of crossbreeding parameters. Livestock. Prod. Sci., 21: 101-113.

Krogmeier, D.; V. Dzapo and I. L. Mao (1994). Additive genetic and maternal effects on litter traits in rabbits. J. of Anim. Breeding and Genetics, 111 (5-6): 420-431.

Lukefahr, S. ; W. D. Hohenboken ; P. R. Cheeke and N. M. Patton (1983). Breed heterotic and diet effects on postweaning litter growth and mortality in rabbits. J. of Anim. Sci., 57(5): 1108-1116.

Martins, E. N.; C. Scapinello and A. C. Furlan (1988). Genetic improvement of rabbits for meat production. Inform Agropecusno 14 (159): 30-33, Brazil. (ABA, 58, No. 4751).

Mather, K. and J. L. Jinks (1971). Biometrical genetics. Chapman and Hall, London, 377 PP. Mc Gloughlin, P. 1980: The relationship between heterozygosity and heterosis in reproductive traits of mice. Anim. Prod., 30:69.

Oetting ,B. C.; J. M. Rabes and Z. B. Johonson (1989). Growth rate and body weight of crossbred rabbits. J. Appl. Rabbit Res., 12: (5) 855-865.

SAS, (1990). SAS User’s Guide: Statistics. SAS. Cary, NC.

Sheridan, A. K. (1981). Crossbreeding and heterosis. Anim. Breed. Abstr., 49:131

Youssef, M. K. (1992). The production performance of purebred and crossbred rabbits. M. Sc., Thesis, Fac. Agric. Sci., Moshtohor Zagazig Univ. Egypt.

تقدير بعض التأثيرات الوراثية فى الأرانب الخليطة

حسن إسماعيل زكى

مركز بحوث الصحراء- المطرية القاهرةقسم تربية الحيوان والدواجن شعبة الإنتاج الحيواني و الدواجن

فى دراسة استخدم فيها عدد ٤٨٩ نتاج من الأرانب لتراكيب وراثية مكونة من النيوزيلندي الأبيضNN و الكالفورنيا CC كخطوط آباء و الجيل الأول بخطيه NC, CN و الخليط العكسي مع الآباء BCN , BCC و الجيل الثاني F_{2C} , F_{2N} . استخدمت هذه البيانات فى تقدير بعض القيم الوراثية و منها الثاثير التجمعى و السيادى و قوة الهجين كما استخدمت فى محاولة تقدير الجزء الوراثي الناتج عن التداخل الجميطى بين الأنواع في الجيل الثاني. و استخدمت ثلاثة موديلات إحصائية لتقدير هذه التأثيرات الوراثية (Dickerson 1973 Kinghorn 1980and Koch *et al.* 1985) وكانت أهم النتائج ما يلي:

وجد اختلافات وراثية واضحة بين التراكيب الوراثية لصفات الوزن و معدل الزيادة الوزنية اليومي من الفطام و حتى وزن التسويق. كما وجد أن الجيل الثاني باستخدام الأب NC و إلام CN حققت أعلى معدل زيادة وزنية عند عمر ٧٢ يوما (٢٠٠٩,٢ جرام) بمعدل زيادة وزنية يومي ٣٢,٩ جراما . كما أن نوع الكالفورنيا حقق أعلى وزن تسويقي عند ٧٢ يوما بالمقارنة بالجيل الأول و النيوزيلندي النقي ١٩٥٧ جراما. ووجد اختلافات معنوية بين الجيل الأول و الجيل الثاني و الجيل الثاني و جيل الأباء فى وزن الفطام. كما لوحظ أن تأثير كروموسوم الجنس كان سالبا على وزن الفطام .فى حين انه كان إيجابيا على الأوزان بعد الفطام. اما التأثير التجمعى كان إيجابيا عند الوزن عند ٥٤ و ٧٢ يوما عندما قدر باستخدام موديل Dickerson , Kinghorn . بينما

كان تأثيره سالبا على الوزن من الفطام حتى عمر ٤٥ يوما. و كان التأثير الأمي فى كلا من الموديلين السابقين إيجابي فى الأوزان الأولى حتى وزن الفطام أما بعد ذلك فان هذا التأثير يضعف و يكون سلبيا حتى عمر ٧٢ يوما من العمر. اما التأثير السيادى فكان إيجابيا على وزن الفطام و سلبي على الوزن بعد الفطام .و كان تأثير التداخل التجمعى (ggI) المقدر بواسطة موديل Koch et al معنوي و القيمة المقدرة عالية و كان تأثيرها سلبى على الوزن بعد الفطام و لكن هذه القيم كانت غير معنوية وإيجابية فقط عند وزن الفطام. على العكس من ذلك فالقيمة المقدرة بواسطة موديل Kinghorn فكانت معنوية و إيجابية التأثير على الوزن بعد الفطام و سالبة على وزن الفطام. و التقديرات الوراثية باستخدام موديل (1973) Dickerson وجد أن تأثير r^{I}_{73} ايجابى على كل صفات الوزن بعد الفطام حتى عمر ٧٢ يوما. و كان هذا الموديل اقرب الى التفسير المنطقي للقيمة الوراثية. أما التقدير الخاصة بالتأثيرات الوراثية باستخدام مود يل (1985) Koch et al فوجد تأثير سالب لقوة الهجين على الوزن عند ٤٥ , ٥٤ و ٧٢ يوما من العمر. و هذا يرجع الى تأثير قوة الهجين على وزن الفطام. ووجد أن التأثير السيادى و التداخل في التأثير التجمعي كان إيجابيا فقط عند وزن الفطام. ويتضح من هذه النتائج انه يمن اختيار الطريقة المناسبة للتحسين باستخدام الخلط .

Table 6. Least square means for postweaning and weight gain

Genetic groups	Weaning weight (WW)	Daily Wt. gain	Weight at 45 day (W45)	Weight at 54 day (W54)	Weight at 72 day (W72)
Parental					
NN	555.5±29.5	29.3±1.3	1054.3±30.5	1318.4±40.5	1846.5±62.6
CC	614.3±35.3	30.5±2.4	1133.1±55.1	1407.7±73.1	1957.0±113.1
F$_1$					
NC	608.7±28.7	25.8±1.9	1098.0±44.8	1280.4±59.5	1745.2±92.0
CN	576.8±20.8	29.7±1.4	1082.1±32.4	1349.6±43.0	1884.7±66.6
Backcroses					
BC$_N$	512.7±28.1	25.6±1.9	949.6±43.9	1180.9±58.2	1643.5±90.1
BC$_C$	553.4±33.6	26.4±2.2	1002.5±52.5	1240.2±69.6	1715.7±107.6
F$_2$					
F$_{2N}$	560.5±23.1	32.9±1.5	1120.1±36.0	1416.4±47.8	2009.0±73.9
F$_{2C}$	455.2± 28.2	28.0±1.9	932.0±44.0	1184.1±58.4	1688.8±90.3