Genetic Evaluation of The Native Baladi Black Rabbits Under North Delta Weather of Egypt Using Animal Model Procedure. A: Doe Litter Traits

Hassan, N. S.*, A.M. Abdel-Ghany, Hanan H. Ghanem*, M. A. El-Shennawy*** and Mona M. Ghaly******

*Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt;

**Animal Production Dept., Faculty of Agriculture, Suez Canal University, Ismailia, Egypt.

***Sustainable Development Department, Environment Studies and Research Institute, Sadat Branch, Menofia Uni., Egypt.

****Animal Production Dept., Faculty of Agriculture, Cairo University Cairo Egypt,

***Received:** 19/6/2013*

Abstract: Litter traits, (litter size, LS and Litter weight, LW at birth; 21 days and weaning at 42 days post kindling of a total of 111 litters from 7 sires; 12 dams and 49 does, were evaluated using Multi-Trait Derivative-Free Restricted Maximum Likelihood Animal Model (DFREML). Data (LSB& LS21& LSW and LWB& LW21& LWW) were collected for two consecutive years on Baladi Black rabbits (an indigenous Egyptian breed, BB). The Mathematical model of the analysis comprised the effects of parity (P) and month of kindling (MOK) as fixed, as well as animal and common litter as random. Heritabilities of considered traits were relatively low being 0.03, 0.01, 0.01 for litter sizes and 0.01, 0.08 and 0.09 for litter weights at birth; 21 days and weaning; respectively. Furthermore, estimates of common litter effects were rather low (0.00002, 0.02 and 0.000045 for litter size and 0.00042, 0.0086 and 0.0006 for litter weight) at the three respective ages studied. The ranges of the top 25% BB does' transmitting ability (TA ± SE) for LSB, LS21 and LSW were 0.48 ± 0.03; 0.44 ± 0.02 and 0.43 ± 0.02 bunnies, with the accuracies being 0.09, 0.08 and 0.09%. While ranges of the top 25% BB does' transmitting ability (TA ± SE) for LWB, LW21 and LWW were (0.02± 0.03, 0.07 ± 0.02 and 0.11 ± 0.03 g.) with the accuracies being 0.09, 0.08 and 0.09. As for BB dams' transmitting ability (TA ± SE), the ranges of the top 25% for LSB, LS21 and LSW were 0.00 ± 0.03, 0.18 ± 0.03 and 0.33 ± 0.03 bunnies, with the accuracies being 0.09, 0.08 and 0.09%. While ranges of the top 25% BB dams' transmitting ability (TA ± SE) for LWB, LW21 and LWW were 0.01 ± 0.03, 0.03 ± 0.03 and 0.07 ± 0.03 g. with the accuracies being 0.09, 0.08 and 0.09; respectively. Similarly, the ranges of the top 25% BB sires' transmitting ability (TA ± SE) for LSB, LS21 and LSW were 0.0±0.0 , 0.11 ± 0.00 and 0.14 ±0.0 bunnies, with the accuracies being 0.09, 0.08 and 0.09%. While ranges of the top 25% BB sires' transmitting ability (TA ± SE) for LWB, LW21 and LWW were 0.0 ±0.0, 0.06 ±0.0 and 0.07± 0.0 g. with the accuracies being 0.28, 0.27 and 0.27%; respectively. Interestingly, and though of the larger numbers involved, ranges estimates of accuracies ($r_{a\hat{a}}$) of the predicted breeding value (TA) of BB rabbits were mostly higher in the data set of all animals (sires, dams and does) followed by those of sires. A high correlation among TA estimate traits were detected in does data. These estimates of correlation ,however, were age dependent and decreased as age advance, except that between LW21 and LWW (0.973) indicating correlated response to selection that should be considered in selection plans. Selection at early age of 21^{st} days post kindling may be associated with a correlated improvement at weaning at 42 days of age. Such conclusion can lead to a considerable reduction in costs of selection and generation intervals. LS and LW traits of the tested rabbit population have positive epigenetic trend in February, September and December for all litter traits, as well as at November for LSB, which may partially explain the good productive performance in Autumn and early winter.

Keywords: Baladi Black rabbits, litter size and weight, heritability, variance component, Epigenetic trend.

INTRODUCTION

Litter traits are of the most important traits for prolificacy of the rabbit doe. The Egyptian breeds of native animals, including rabbits, are considered a part of our nation genetic resources that must undergo more research and improvement, to compete with exotic ones. Baladi Black is one of our improved local rabbit breeds, derived 1950, with genetic pool and reservoir still have a huge variability. Accurate determination of these rabbits' breeding values for most economic traits is essential for planning and to achieve success in breeding programs. Best linear unbiased prediction values (BLUP) estimated by different procedures is an approach to predict transmitting abilities of animals and to adjust simultaneously for fixed effects of the model (Lukefahr, 1992).The genetic potential for improvement of a trait through selection depends to a great extent on the precise estimation of its genetic parameters. Animal Model Method is increasingly becoming one of the preferred methods of estimation, because among other reasons, it accounts for selection and downward bias in the data (Searle, 1989). Precise determination of reliable rabbits' individual breeding values, (*in this paper* BLUP or transmitting abilities which are in principle half that of the breeding values), for an economic trait is fundamental for planning and attaining progress in breeding programs (Nofal *et. al.*, 2003). Few reports on genetic analysis for doe litter traits using multi-trait animal model are available in the Egyptian literature.

Misztal (1990) pointed out that the accuracies of estimates of variance components is dependent on the choice of data, methods and models of analysis. Moreover, estimates of heritability and repeatability for litter traits have a broad range among reports, as reviewed by Iraqi and Youssef (2006).

Email: nagysaied@hotmail.com
nagysaied2003@yahoo.com

The aim of this experiment was: (1) evaluating the effects of non-genetic factors (parity, P; and month of kindling, MOK); and simultaneously (2) Estimating heritabilities, variance component and permanent environmental random effect using Derivative Free Multi-trait Restricted Maximum Likelihood Animal Model of Boldman (1995); (3) Estimating the genotypic expression during different environmental atmosphere and situation (Epigenetic trend) by regressing the breeding values on month of kindling (MOK) and parity (P) effects; and (4) Estimating the product moment correlation coefficients among breeding values of both litter size and weight traits at all studied ages (Birth; 21 days post-kindling and weaning at 6 wks. of age) for Baladi-Black; BB rabbits.

MATERIALS AND METHODS

Field records Data of Baladi Black (BB), an improved native rabbit breed, collected through two consecutive years (2010 – 2011) on doe litter size and weight traits at birth; 21 days and weaning at 42 days post-kindling, were used in this study. Rabbits were raised at the Experimental Rabbitery, Animal Production Research Institute, Sakha, Kafr El-Sheikh Governorate, Egypt. The city is situated 140 Km north of Cairo and 90 Km east of Alexandria. Kafr El-Sheikh Governorate is located in the middle east of the Nile Delta, where it overlooks the Mediterranean Sea Shore in the north and the River Nile (Rashid Branch) in the west. The International Coastal Road (which joins all the Mediterranean Sea countries) passes in the north of it. The road will play a role in the movement of international commerce and tourism. The total area of the Governorate is 3748 km2 and it divided into 10 cities, 44 local units, 205 villages, and 1695 sub-villages (http://www.kafrtp.gov.eg/kafrinfo.aspx-29 June 2013).

Breeding does and bucks were lodged separately in individual collective galvanized wire cages arranged back to back in single-tier batteries provided with feeders and automatic nipple drinkers. Rabbit does houses were provided with feeders, automatic drinkers and nest boxes at 25 days after fertile mating. All rabbits were fed on the same commercial pelleted diet containing approximately 18% protein, 2.39% crude fat and 12.8% crude fiber. Feed and water were provided all the day long *ad libitum*. Weaning of litter was done six weeks after kindling. Cages of all animals were cleaned and disinfected regularly and before each kindling. All through the experimental period, animals were medicated likewise and subjected to harmonious managerial and environmental conditions.

Breeding plan started in October 2010 and terminated at the end of spring 2011. Litter size (LSB, LS21 and LSW) and weight (LWB, LW21 and LWW) at birth, 21 and weaning at 42 days post-kindling, were recorded. For Breeding, each doe was transferred to the cage of its assigned buck to be bred, and palpated 10 days later, for successful pregnancy testing. Does that failed to conceive were returned to the same assigned buck to be rebred. Nest boxes were prepared for parturition with saw-dust in the 25^{th} day of the pregnancy.

Numbers of sires, does and dams along with number of litters are listed in table 1.

Statistical and genetic analysis:

Data collected on 111 litters produced from 49 does fathered by 7 sires and mothered by 12 dams of BB breed (Table 1). Starting mixed model procedure (Co-) variance matrix, for every studied age (birth, 21 days post kindling and at weaning) of the litter size and weight traits, were obtained applying REML method of VARCOMP procedure of SAS, 2000. These starting values were used for the estimation of the more precise and reliable estimates of multi-trait animal model variance and covariance components.

Data of does litter size and weight traits were analyzed using Derivative Free Restricted Maximum Likelihood Animal Model (DFREML) of Boldman *et al.* (1995). The model adopted for analyzing the data comprised the effects of month of kindling and parity (as fixed effects) in addition to additive genetic and permanent environmental (as random effects).

The following animal model (in matrix notation) was used:

$$Y = Xb + ZaUa + ZcUc + e$$

Where: Y = column vector of observation on animal; X; Za and Zc = are incidence matrices relating records of i^{th} trait to the fixed, random additive and random permanent environmental effects, respectively. b; U_a and U_c = are vector of fixed effects peculiar to month of kindling and parity; animal random additive and permanent environmental effects, respectively; e = is the column vector of random errors.

Where: $r_{A\hat{A}}$= the accuracies of the prediction of the i^{th} animal's breeding value; F_j= inbreeding coefficient of animals (assumed to be zero in case of unknown values); d_j= the j^{th} the diagonal elements of the inverse of the appropriate block coefficient matrix; and α_a (Starting Value) = (σ^2_e/σ^2_a). It is then why this value should be estimated as precisely as possible before going into the final analysis.Standard errors of the predicted breeding values $(s.e._p)$ were estimated for each individual as: $s.e._p = \; d_j \sigma^2_e$ where d_j the diagonal element of the inverse of the appropriate block coefficient matrix that respond to this animal and σ^2_e were error variance.

Table (1): Structure of the data analyzed for Baladi Black (BB) rabbits

Numbers of				Bunnies		
Litters	**Sires**	**Dams**	**Does**	**Born**	**Weaned**	**Livability (%)**
111	7	12	49	642	322	49.84

The relationship coefficient matrix (A^{-1}) among animals was considered (Korhonen, 1996). MTDFREML program of Boldman *et al.* (1995) applying the sparse matrix package, SPARSPAK (George and Ng 1984), was adopted for the analysis. A convergence criterion was assumed when the variance of the log-likelihood values in the simplex reached $<10^{-6}$

Occurrence of local maxima was checked by repeatedly restarting the analyses until the log-likelihood did not change beyond the first 6 decimal digits. The MTDFREML evaluates also the proportions of additive genetic effects (heritability; h^2_a), permanent environmental effects (c^2), and error (e^2). Heritabilities in the narrow sense (h^2_a) are computed as: $\mathbf{h^2_a = \sigma^2_a / (\sigma^2_a + \sigma^2_c + \sigma^2_e)}$ Where: σ^2_a = additive genetic variance, σ^2_c = permanent environmental variance, and σ^2_e = error variance.

Predicted breeding values (TA):

The (co)variances matrix estimated using MTDFREML analysis is used by the same software for the prediction of breeding values, their accuracies ($r_{a\hat{a}}$) and standard errors. The accuracies of **BLUP** for each individual was estimated according to the equation suggested by Henderson (1973) as:

$$r_{A\hat{A}} = \sqrt{1 + F_j - d_j\alpha}_{\,a}$$

A: Correlation study:

The transmitting abilities **(BLUP)** estimated by MTDFREML and their estimated ranks are used to estimate the Product moment, (for BLUP's), and Spearman, (for BLUP ranks), correlation coefficients among the studied litter traits of all animals; sires; dams and does representatives.

B: Epigenetic Trend:

The study of changes in genotypic appearance of the involved genes' expression caused by mechanisms other than changes in the underlying DNA sequence endorsing parity (4 classes) and month of kindling (7 classes) using the methods mentioned by Legates and Myers (1988) and Hassan *et. al.* (2010), were estimated as genotype by environment interaction.

C: Environmental Trend (ENV):

Estimated as the result of subtracting TA's of LS and LW values of an animal from its observed phenotypic values of the same traits, all as deviations from the overall-means of the whole tested rabbit population. The resultant Litter size (***ENV***_LS) and litter weight (***ENV***_WT) values as are regressed parallel matching their respective month of kindling (MOK) or parity (P).

RESULTS AND DISCUSSION

Means and coefficients of variation of uncorrected records, and Least Square means:

Overall actual means of LS and LW traits in BB rabbits, their standard deviations and coefficients of variation (CV %) during the suckling period are presented in table 2 for data comparing purposes. Coefficients of variability (CV %) ranged from 36.52 to 41.20% for litter size and from 29.40 to 34.19% for litter weight traits. The later variability data may reveal that BB rabbits is still have a relatively massive variability and may possibly constitute a rich genetic resource ready to be given more care and improvement.

Variance component (σ^2):

Trend observed in BB rabbits, for the additive genetic variance (σ^2_A; diagonal elements) as a proportion of the total variance though Inconsistent, seemed generally to be age dependent and curvilinear, decreased as the age of does increased till 21 days of age, and increased thereafter (Table 3). Meanwhile, the percentage of the additive genetic variance (σ^2_A) of BB litter weights, increased as the age of does increased (Table 3). However; litter traits as fitness and transitional traits are expected to have faded and consumed additive genetic variance due to that they are being continually subjected to natural selection. In this respect, the phenotypic variance, (diagonal elements) of litter sizes decreased as age advanced, while it show inconsistent trend as to litter weight traits (Table 3). Permanent environment of LS and LW traits, was found to be very low in their magnitude.

Conversely, Youssef *et al.* (2003) reported that litter size and weight traits are greatly affected by the additive genetic and maternal effects. In this respect, Khalil *et al.* (1987) reported that the low percentages of sire variance component reflect the large environmental component of variance associated with the doe during kindling and raising its litters to weaning. They also added that since milk production and subsequently litter gain are of the fitness traits and are influenced by litter size, it is supposed that the additive variance has been diminished through long term natural selection. El-Raffa, *et.al.* (1997) reported similar trend for percentages of sire variance components for litter sizes of line N rabbits.

Heritability estimates:

Heritability estimates using REML method for LS and LW traits in BB rabbits, were relatively very low (from 0.01 - 0.03) for LS and (0.01 - 0.09) for LW, table 3. These estimates were within the ranges of El-Raffa (2000), Baselga and Garcia (2002), Youssef *et al.* (2003), Nofal *et al.* (2002), Iraqi *et al.* (2006), Gad (2007), Gharib *et al.* (2008) and Iraqi (2008). This may be attributed to the consumption of the additive genetic variance due to natural selection which consequently led to inflated non-additive genetic and environmental factors (i.e. constitute the major source of variation reported herein for those traits). In this respect, Khalil *et al.* (1987) concluded that environmental conditions and non-additive genetic effects play a large role in doe litter traits in rabbits. Therefore, such diminished estimates for heritability for these traits reveal higher non-additive genetic effects for all studied litter traits. Such low heritaility traits do not support individual selection and therefore, family and within family selection could play a role especially with the presence of genetic evaluation for each animal (i.e. BLUP). Crossbreeding is another tool, whereas it predominantly the leading breeding system in most meat-type production rabbit production. Marker assisted selection would be the preferred technique but on the other hand it is still very expensive and not veritably available under the Egyptian condition.

Indirect selection for litter traits from its component traits; (and)from their nature as composite traits; could be an alternative solution key. However, Blasco *et al.* (1993) reported that moderate estimates of h^2 ($0.2 < h^2 < 0.3$) for the components of litter size (i.e. Ovulation rate and number of embryos are encouraging and can be used for indirect selection. However, using actual transmitting ability of animals from reliable models of estimation would enhance more the genetic response.

Genetic correlation:

Estimates of genetic correlations among litter size and weight traits are presented in table 3. Estimates of genetic correlations were generally negative and ranged from low to high. Values of genetic correlations extracted from animal model procedures are of limit practical usefulness and to some extent hard to elucidate and unreliable. The covariance yielded by multi-trait animal model is in most cases doubtful and debatable and did not clearly differ from zero especially when the number of traits involved in the analysis exceeds two. A comparable conclusion has been reached at by Luiting and Urf, 1991 who determined that an alternative method is acceptable in a breeding program if no reliable estimates of genetic correlations are available. This is why an alternative study of the correlations among the resultant transmitting ability, values and ranks, is from one point of view indisputable and undeniable. However, when such study is to be done (i.e. estimating correlations among the resultant transmitting ability), it is foreseeably better to be a resultant from single trait animal models analysis (a paradigm not used in this paper).

Animal Evaluation:

Breeding Values (TA's); Accuracies (a_i) and Standard error (SE):

Estimates of BB rabbits breeding values, their accuracies (a_i) and Standard errors for litter sizes and weight traits, are presented in table 4. In general a logical trend in the estimates of the ranges of TA's of litter size and weight traits, was observed. BLUP values ranges beside its accuracies revealed a high expected level of response at all ages

studied. These expected level of response are age dependent and get smaller in LS traits as age advanced. In contrast and on the whole the opposite trend was true in case of LW. Same trend was also observed in the superior 25 % animals, dam and doe data.

El-Raffa *et.al.* (1997) reported that differences between minimum and maximum values of the top 25 % sire breeding value estimates are the backbone for any planned selection strategy.

In case of litter weight traits, the ranges and confidence level (accuracies estimates) of the upper 25 % of the data of all animals were the best, followed by sire data. Does TA and a_i estimates surpassed that of their dams for LS and LW traits specially that for the upper 25%, also sires revealed a high TA in LS traits' estimates of than that of LW.

However, the superior sires TA estimates are advantageous, since the replacement rate of sires do not exceed 20-25% of the rabbit populations. Therefore an elevated selection intensity pressure can be exerted which in turn is expected to yield a greater selection response.

Correlation estimates among breeding value traits and its Rank correlations:

Estimates of between LS or LW traits Breeding Values correlation studies (Product Moment for BLUP values and Spearman for BLUP ranks) for all-, doe, dam and sire data are presented in table 5. Ranges of Product Moment inter-association coefficients' were generally high in magnitude, positive in direction and highly significant. Product Moment Estimates ranged from 0.801 – 0.981 for LS and from 0.724 – 0.969 for LW. Consistent conclusion in magnitude and direction were also detected for Spearman's correlation coefficients between transmitting ability ranks and they ranged from 0.829 – 0.976 for LS and from 0.740 – 0.957 for LW. In general, Steady conclusion for magnitude and direction for both correlation coefficients was detected in case of doe, dam and sire transmitting ability. Using any of correlation coefficients can do the job and they can substitute each other especially in large sized populations. Values of both correlation parameters are age dependent and may reveal that correlated response for selection from one trait to the other is quite feasible. The same conclusion and results were ascertained in case of doe-, dam- and sire-data (Table 5).

Epigenetic Trend (EGT):

Epigenetic trends estimated as a deviation from the overall-BLUP values' means of the whole tested rabbit population for Litter size (EGT_LS) and weight (EGT_WT) traits as affected by month of kindling (MOK) and parity (P) were illustrated through figures (1, 2, 3 and 4).

Litter sizes and weight estimated epigenetic trends, of the whole tested rabbit population as regressed against month *EGT*_LS and *EGT*_LW, are shown in Fig. 1 &2. Data revealed that all LS and LW traits respond comparatively when regressed against MOK; which possibly means similar genotype-environment interaction. Positive epigenetic trends were usually recognized during February, September and December for all LS and LW, beside November for LSB. The maximum LS and LW values were generally at September, December and February (autumn through winter). A transient negative for all LS trend emerged in April till June (Spring-beginning of summer) and at November for LS21 and LSW. However, the lowest LS epigenetic values were exchanged between summer months for all LS and LSW traits and November for (LS21 &LSW). The expected explanation is that this performance is in conformity with the high loss due to hot stress in summer months. The positive (*i.e.* high) LS and LW epigenetic trend during winter is evidently comprehensible as the animals are exploiting the favorable proximate conditions and have the favorable fodder diets like clover and/or alphalpha fresh hay.

Litter sizes and weight estimated epigenetic trends, of the whole tested rabbit population as regressed against Parity, *EGT*_LS and *EGT*_LW, are shown in Fig. 3 &4.

Data revealed that All LS and LW traits responds comparatively when regressed against P; which possibly means similar genotype-state of production interaction. However, data in Fig. 3 &4 shows that LS and LW of the tested rabbit population reveal the classical view of the law of diminishing returns. Though have crucial fluctuating and expose dissimilar trends; positive epigenetic trend seems to concentrate in second and third parity. The high epigenetic trend at the second and the third parities is clearly due to that the animals reach their premium physiological reproductive maturity and development. However, the lowering trends following these premium parities may coincide with ideal production curves in which after a period of constant production (persistency), animals reveal gradual diminishing production. The high epigenetic trend is seemingly due to that these Animals are initiating their first season with their reservoirs unexhausted.

Table (2): Overall Means, standard deviations (SD) and coefficients of variability (CV %) on litter sizes (LSB, LS21 and LSW) and weight traits (LWB, LW21 and LWW) at birth; 21 days and weaning at 6 wks. of age for Baladi Black (BB) rabbits.

Traits	Mean	SD	CV (%)
	litter Size (LS)		
At Birth (LSB)	5.78378	2.11232	36.52
At 21 days (LS21)	4.52326	1.81968	40.23
At weaning (LSW)	4.29333	1.7689	41.2
	Litter Weight (LW)		
At Birth (LWB)	0.275766	0.091827	33.3
At 21 days (LW21)	1.23808	0.363954	29.4
At weaning (LWW)	1.67287	0.571922	34.19

No. of records =111; No. of animals in A^{-1} = 49

Table (3): Genetic and phenotypic variance co-variance matrices; as well as percentages contribution for permanent environment and error of litter size (LS) and litter weight (LW) traits in Baladi Black (BB) rabbits.

	LSB	LS21	LSW		LWB	LW21	LWW
Additive genetic (CO-)variance							
LSB	**0.147**	**-0.04**	**-0.005**	**LWB**	**0.068**	**-0.071**	**-0.151**
%	**3.33%**			**%**	**0.74%**		
LS21	**-0.04**	**0.013**	**0.007**	**LW21**	**-0.071**	**0.875**	**-0.492**
%		**0.53%**		**%**		**7.57%**	
LSW	**-0.005**	**0.007**	**0.019**	**LWW**	**-0.151**	**-0.492**	**0.856**
%			**0.94%**	**%**			**9.08%**
Phenotypic (CO-)variance							
	LSB	**LS21**	**LSW**		**LWB**	**LW21**	**LWW**
LSB	**4.415**	**1.59**	**0.766**	**LWB**	**9.221**	**-6.277**	**-4.36**
LS21	**1.59**	**2.437**	**1.729**	**LW21**	**-6.277**	**11.561**	**5.222**
LSW	**0.766**	**1.729**	**2.028**	**LWW**	**-4.36**	**5.222**	**9.427**
Environmental proportion of total (CO-)variance							
	LSB	**LS21**	**LSW**		**LWB**	**LW21**	**LWW**
LSB	**4.268**			**LWB**	**9.153**		
%	**96.67%**			**%**	**99.26%**		
LS21	**0.510**	**2.424**		**LW21**	**-0.630**	**10.686**	
%		**99.47%**		**%**		**92.43%**	
LSW	**0.260**	**0.79**	**2.009**	**LWW**	**-0.480**	**0.600**	**8.571**
%			**99.06%**	**%**			**90.92%**
Uncorrelated random effects as a proportion of phenotypic variance.							
	LSB	**LS21**	**LSW**		**LWB**	**LW21**	**LWW**
LSB	**0.00002**			**LWB**	**0.00042**		
LS21	**0.17**	**0.020**		**LW21**	**-0.015**	**0.0086**	
LSW	**1**	**0.16**	**0.000045**	**LWW**	**-0.092**	**-0.920**	**0.0006**
Heritability and genetic correlation							
	LSB	**LS21**	**LSW**		**LWB**	**LW21**	**LWW**
LSB	**0.03**			**LWB**	**0.01**		
LS21	**-0.92**	**0.01**		**LW21**	**-0.29**	**0.08**	
LSW	**-0.1**	**0.47**	**0.01**	**LWW**	**-0.62**	**-0.57**	**0.09**

Table (4): Animal breeding values (BLUP) and its SE and Accuracies ranges belonging to litter size (LS) and weight (LW) traits for Baladi Black (BB) rabbits at birth, 21 days and at weaning.

Trait	No. Rec.		Max			Min			Range (TA)			Records		Upper 25% (TA)				
			TA	SE	RI	TA	SE	RI	Range	SE	ACC	Positive	%	Max	Min	Range	SE	ACC
		All data																
LSB	131		0.66	0.41	0.71	-0.88	0.31	0.16	1.54	0.10	0.55	45.00	34.35	0.66	0.18	0.48	0.04	0.10
LS21	131		0.49	0.36	0.64	-0.64	0.29	0.10	1.13	0.07	0.54	40.00	30.53	0.49	0.05	0.44	0.02	0.10
LSW	131		0.47	0.37	0.64	-0.63	0.30	0.07	1.09	0.07	0.57	38.00	29.01	0.47	0.04	0.43	0.02	0.09
LWB	131		0.03	0.41	0.71	-0.05	0.31	0.16	0.07	0.10	0.55	50.00	38.17	0.03	0.01	0.01	0.04	0.61
LW21	131		0.08	0.36	0.64	-0.14	0.29	0.10	0.22	0.07	0.54	41.00	31.30	0.08	0.01	0.01	0.02	0.54
LWW	131		0.13	0.37	0.64	-0.20	0.30	0.07	0.33	0.07	0.57	34.00	25.95	0.13	0.01	0.11	0.02	0.55
		Doe data																
LSB	111		0.657	0.39	0.71	-0.88	0.31	0.32	1.537	0.080	0.390	34.00	30.63	0.657	0.182	0.475	0.04	0.10
LS21	111		0.487	0.35	0.64	-0.641	0.29	0.26	1.128	0.060	0.350	33.00	29.73	0.487	0.047	0.44	0.02	0.10
LSW	111		0.466	0.37	0.64	-0.626	0.3	0.19	1.092	0.060	0.340	32.00	28.83	0.466	0.038	0.428	0.02	0.09
LWB	111		0.026	0.39	0.71	-0.045	0.31	0.32	0.071	0.080	0.390	40.00	36.04	0.026	0.005	0.021	0.04	0.10
LW21	111		0.082	0.35	0.64	-0.142	0.29	0.26	0.224	0.060	0.350	33.00	29.73	0.082	0.012	0.07	0.02	0.10
LWW	111		0.125	0.37	0.64	-0.204	0.3	0.19	0.329	0.060	0.340	29.00	26.13	0.125	0.015	0.11	0.02	0.09
		dam data																
LSB	12		0.66	0.39	0.71	-0.85	0.31	0.32	1.51	0.08	0.39	6.00	50.00	0.66	0.66	0.00	0.03	0.06
LS21	12		0.36	0.35	0.64	-0.57	0.29	0.29	0.93	0.06	0.35	5.00	41.67	0.36	0.18	0.18	0.03	0.06
LSW	12		0.37	0.36	0.64	-0.56	0.30	0.30	0.93	0.06	0.34	4.00	33.33	0.37	0.04	0.33	0.03	0.06
LWB	12		0.02	0.39	0.71	-0.05	0.31	0.32	0.06	0.08	0.39	6.00	50.00	0.02	0.01	0.01	0.03	0.06
LW21	12		0.04	0.35	0.64	-0.14	0.29	0.29	0.18	0.06	0.35	4.00	33.33	0.04	0.01	0.03	0.03	0.06
LWW	12		0.08	0.36	0.64	-0.20	0.30	0.30	0.29	0.06	0.34	3.00	25.00	0.08	0.02	0.07	0.03	0.06
		Sire data																
LSB	7		0.12	0.41	0.64	-0.74	0.32	0.16	0.86	0.09	0.48	4.00	57.14	0.12	0.12	0.00	0.00	0.28
LS21	7		0.09	0.36	0.58	-0.51	0.29	0.10	0.60	0.07	0.48	5.00	71.43	0.09	-0.02	0.11	0.00	0.27
LSW	7		0.12	0.37	0.58	-0.49	0.31	0.07	0.60	0.06	0.51	6.00	85.71	0.12	-0.02	0.14	0.00	0.27
LWB	7		0.01	0.41	0.64	-0.03	0.32	0.16	0.04	0.09	0.48	3.00	42.86	0.01	0.01	0.00	0.00	0.28
LW21	7		0.06	0.36	0.58	-0.11	0.29	0.10	0.17	0.07	0.48	6.00	85.71	0.06	-0.01	0.06	0.00	0.27
LWW	7		0.07	0.37	0.58	-0.14	0.31	0.07	0.21	0.06	0.51	6.00	85.71	0.07	0.00	0.07	0.00	0.27

Table (5): Product Moment among BLUP values and Spearman correlation coefficient among BLUP ranks in BB rabbits for all data traits.

Trait	Product Moment Correlation Coefficient					Spearman Correlation Coefficient				
All data	**LSBTA**	**LS21TA**	**LSWTA**	**LWBTA**	**LW21TA**	**LSB_R**	**LS21_R**	**LSW_R**	**LWB_R**	**LW21_R**
LS21TA	0.851	1				0.865	1			
LSWTA	0.801	0.981	1			0.829	0.976	1		
LWBTA	0.813	0.81	0.847	1		0.84	0.797	0.84	1	
LW21TA	0.61	0.747	0.819	0.764	1	0.685	0.787	0.87	0.791	1
LWWTA	0.463	0.63	0.738	0.724	0.969	0.556	0.664	0.788	0.74	0.958
Doe data										
LS21TA	0.846	1				0.853	1			
LSWTA	0.805	0.983	1			0.823	0.976	1		
LWBTA	0.817	0.81	0.85	1		0.842	0.795	0.844	1	
LW21TA	0.621	0.749	0.818	0.771	1	0.686	0.788	0.871	0.8	1
LWWTA	0.493	0.647	0.748	0.741	0.973	0.579	0.682	0.803	0.762	0.963
Dam data										
LS21TA	0.902	1				0.931	1			
LSWTA	0.799	0.972	1			0.879	0.979	1		
LWBTA	0.777	0.814	0.835	1		0.809	0.8	0.842	1	
LW21TA	0.556	0.706	0.8	0.76	1	0.672	0.737	0.832	0.787	1
LWWTA	0.239	0.433	0.591	0.606	0.931	0.358	0.45	0.607	0.628	0.907

Environment Trend (ENV):

Environment trends estimated as a subtraction of TA's of LS and LW traits from the phenotypic values of the same traits. And then make the deviation from the overall-environmental value means of the whole tested rabbit population, for Litter size (*ENV* _LS) and litter weight (*ENV*_WT) traits as affected by month of kindling (MOK) and parity (P) were illustrated through figures (5, 6, 7 and 8).

Litter sizes estimated environmental trends, as a deviation from the overall-environmental-values' mean of the whole tested rabbit population as (instead of as put two commas) regressed against month *ENV*_LS, are shown in Fig. 7, which shows, that litter size traits of the tested rabbit population have positive environmental trend from February till June and during December for all litter size traits, meaning that the effects of environment was high during these months, decrease sharply during September and November and increase thereafter during December, this may be due to the miscellaneous factors that cannot be accounted for in the model, thus these animals –perhaps- did not express themselves as a result of inadequate rearing environment especially feeding and slight infections around the year. During September and November a low environment effect (negative trend) was detected, this may be due to the high performance of does during the starting of production season in winter.

As regard to Litter weights environmental trends, Fig. 8 shows that litter weight traits of the tested rabbit population have crucial fluctuating and exposed dissimilar trends. The negative environmental trend in April, June, September and November (Figure 8). These low environment trends are evidently comprehensible as the animals are exploiting the favorable proximate conditions and also the favorable abundant fodder diets like alphalpha.

However, the curve in Fig. 5 shows that litter sizes of the tested rabbit population have positive environmental trend that seems to be concentrated in second, third and fourth parity, The same trend was noticed also for LS21 and LSW at the third parity, meanwhile the positive trend is concentrated in the second and fourth parities only in all litter sizes.

In general, this trend is however, opposite to that of epigenetic. The low effect of the environment was for all litter size traits at the 1st. parity; which may be due to that these animals have already reached their premium physiological reproductive maturity and development. An explanation for the high environmental effect is that does producing in the 2nd, 3rd and 4th parities may be due that animals at their highest production stages are more sensitive to environmental variations or they receiving inadequate situations as mentioned above. Therefore, the environmental trend can be used to detect unfavorable situation on herds during the production season.

As for environment X parity interaction, data of environment trends presented in Fig. 6, revealed that litter weights of the tested rabbit population have an obvious trend across evaluated ages, disparate that revealed in litter sizes. The effects of environment was low and not clear for LWB in the 1st, 2nd and 3rd parities, otherwise, it started to have negative trends especially in the 1st and 4th ones. In case of LW21 and LWW, Positive environment trend seems to concentrate in the 2nd and 3rd parities, seemingly because at the 1st parity Animals are in their first production season with their reservoirs unexhausted; or because does may have an adequate rearing and managerial conditions.

Epigenetic trends for litter size and weight traits as affected by month of kindling and parity

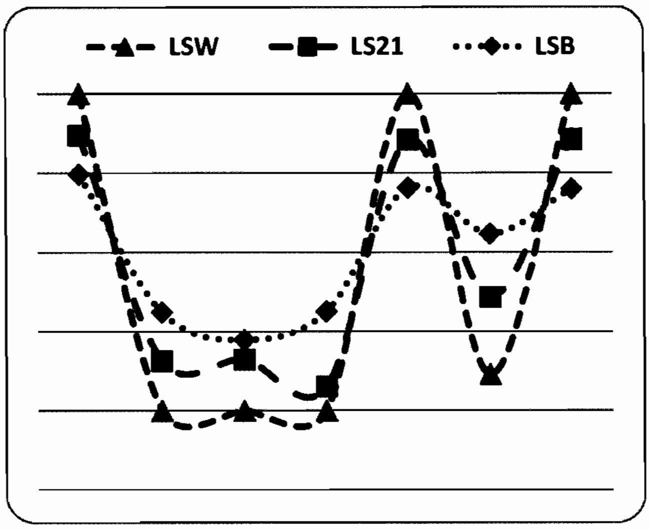

Figure (1): *EGT*_LS traits, as affected by month.

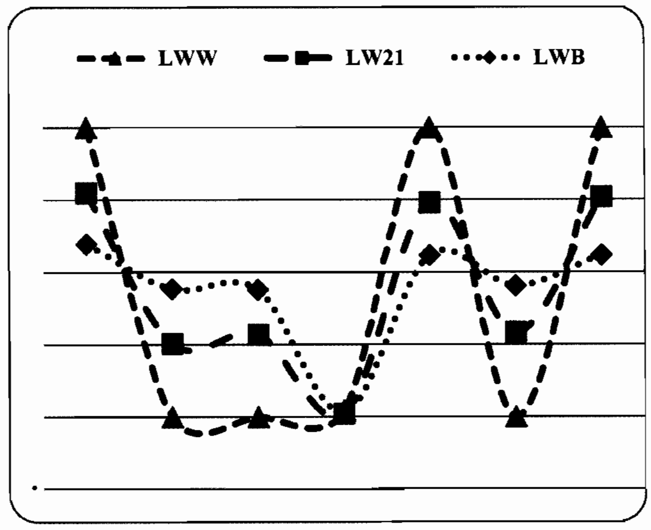

Figure (2): *EGT*_LW traits, as affected by month.

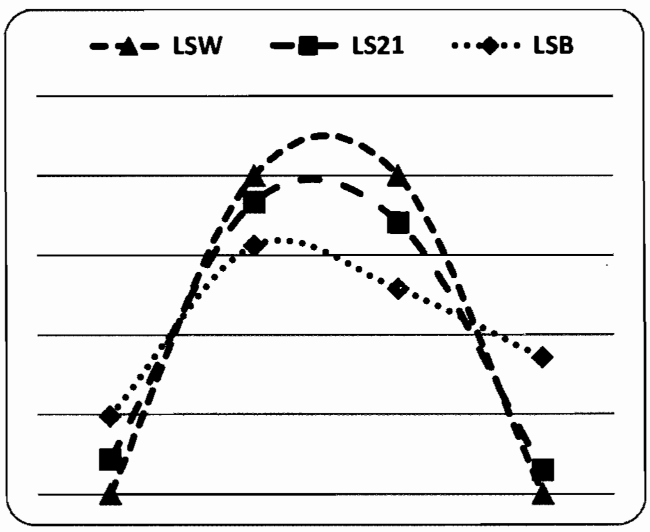

Figure (3): *EGT*_LS traits, as affected by parity.

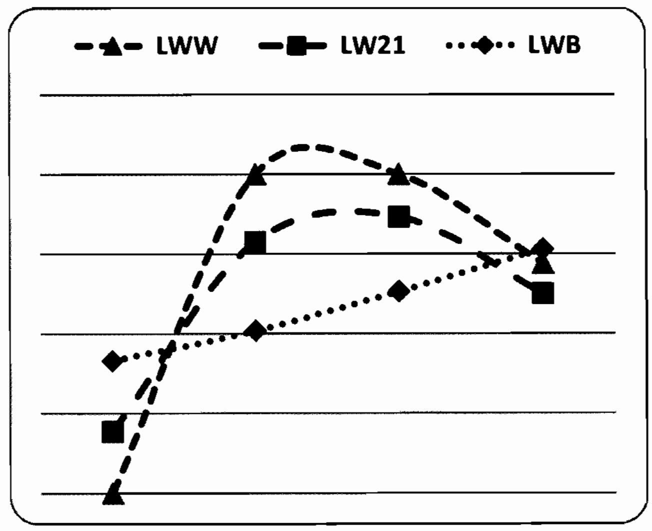

Figure (4): *EGT*_LW traits, as affected by parity

Environmental trends for litter size and weight traits as affected by month of kindling and parity:

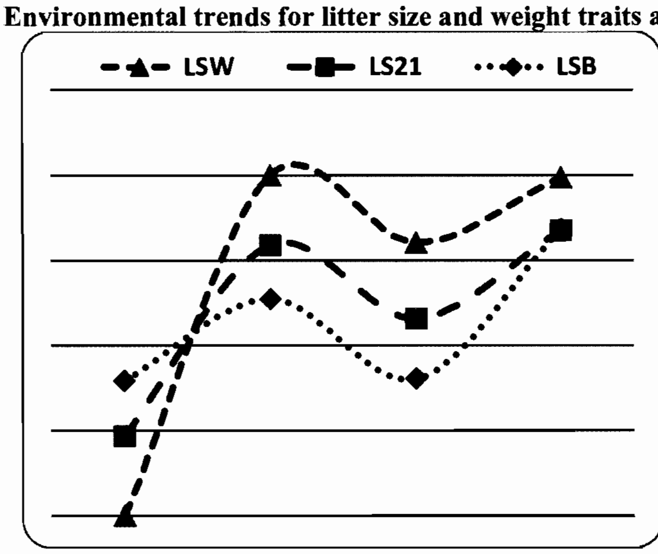

Figure (5): *ENV*_LS traits, as affected by parity.

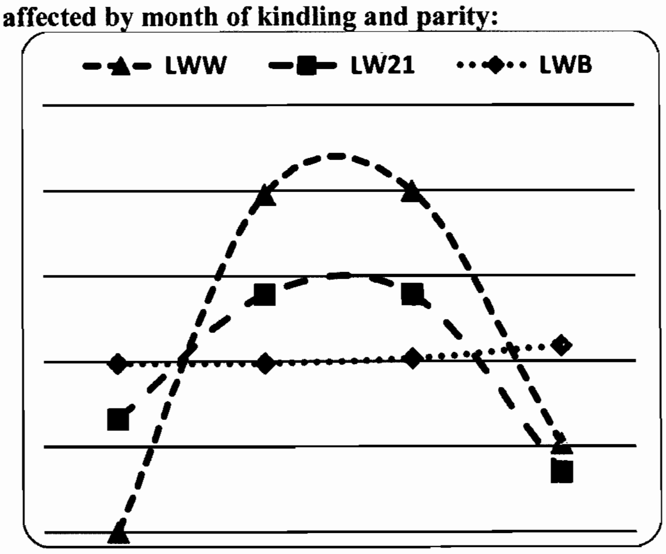

Figure (6): *ENV* _LW traits, as affected by parity.

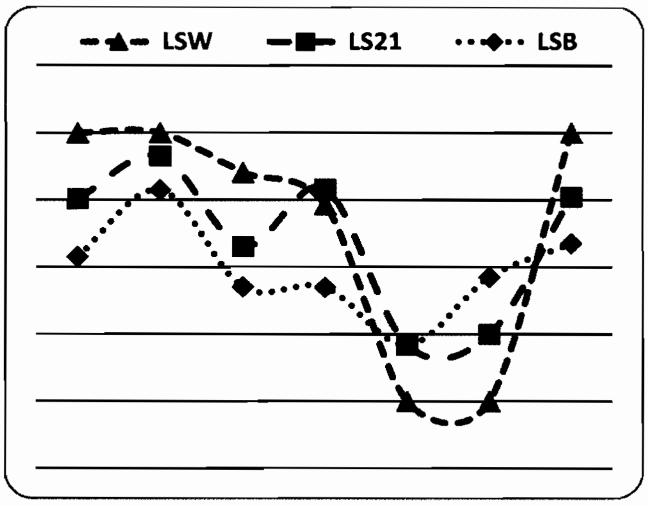

Figure (7): *ENV* _LS traits, as affected by month.

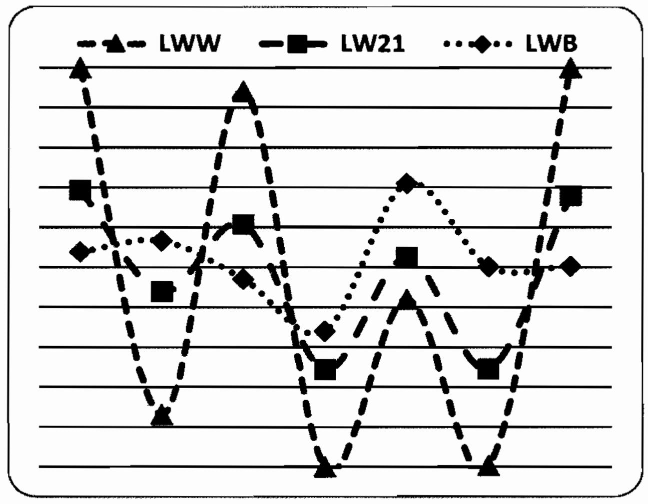

Figure (8): *ENV* _LW traits, as affected by month

REFFERENCES

Baselga, M. and M. L. Garcia (2002). Evaluating the Response to Selection in Meat Rabbit Programs. 3rd Science Congress on Rabbit Production in hot climates, 8-11 Oct: 1-10-2002

Boldman, K. G., L. A. Kriese, L. D. Van Vleck, C. P. Van Tassell and S. D. Kachman (1995). A Manual for Use of MTDFREML. A Set of Programs to Obtain Estimates of Variances and Covariances [DRAFT]. U.S. Department of Agriculture, Agricultural Research Service, USA.

Blasco A., J. Ouhayoun and G. Masoero (1993). Harmonization of criteria and terminology in rabbit meat research. World Rabbit Science 1(1): 3-10.

El-Raffa, A. M. (2000). Animal Model Evaluation of V-Line Rabbits Raised Under Egyptian Condition. Egyption Journal of Rabbit Science, 10 (I): 75-82.

El-Raffa, A. M., M. K. Shebl, M. A. Kosba and M. H. Khalil (1997). Sire and Dam Transmitting Abilities for Litter Size Traits in Three Lines Of Rabbits Raised In High Intensive System Of Production. Egyptian J. of Rabbit Science, 7 (2): 67-79.

Gad, S.O.A. (2007). Genetic Analysis for Productivity of Gabali Rabbits Raised in The North-Western Coast of Egypt. Ph.D. Thesis, Faculty of Agriculture, Moshtohor, Zagazig Univ., Banaha, Egypt.

George, A. and E. Ng (1984). A New Release of SPARSPAK: The Waterloo Sparse Matrix Package. Mimeo, Department of Computer Science, University of Waterloo, Waterloo, Ontario, Canada (Agricultural Research Service, USA.

Gharib, M. G., G. E. Y. Attalah, A. Farid, M. A. Aboul-Hassan and M. M. S. Mabrouk (2008). Evaluation of Some Genetic Parameters and Permanent Environmental Effects for Some Maternal Traits in Two Breeds of Rabbits. Egyptian J. of Rabbit Science, 18 (2): 145-156.

Hassan, N. S., A. Farid, A. M. Abdel-Ghany, H. M. Sabri, E. G. Ahmed and Mona M. Ghali (2010). Epigenetic Trend of Milk Yield and Litter Gain Traits in Californian Rabbits. The 6th International Conference on Rabbit Production in Hot Climates, 1-4 Feb. Assiut. Egypt.

Henderson, C. R. (1973). Sire Evaluation and Genetic Trends. In: Proc. Anita. and Genet. Syrup. In Honor of J. L. Lush. pp 10 - 41. Amer. Soe. Anim. Sci., Champaign, IL.

Iraqi, M. M. (2008). Estimation of Heritability and Repeatability for Maternal and Milk Production Traits in New Zealand White Rabbits Raised in Hot Climate Conditions, Livestock Research for Rural Development 20 (8) 2008.

Iraqi, M. M. and Y. M. K. Youssef (2006). Genetic Analysis for Milk Production Traits in New Zealand White Rabbits Raised in Egypt. Egyptian Journal of Rabbit Science 16:1-13.

Iraqi M. M., M. K. Ibrahim, N. S. H. Hassan and A. S. El-Deghadi (2006). Evaluation of Titter Traits in Purebred and Crossbred Rabbits Raised Under Egyptian Conditions. Livestock Research for Rural Development, 18(6) 2006.

Khalil, M .H. J. B. Owen and E. A. Afifi (1987). A Genetic Analysis of Litter Traits in Bauscat and Giza-White Rabbits. Anim. Prod., 45:123-134.

Korhonen, T. (1996). The Dairy Cattle Evaluation of 1996.http://www.mloy.fi/faba/blup/blup1.htmlblup1.html.

Legates, J. E. and R. M. Myer (1988). Measuring Genetic Change in A Dairy Herd Using A Control Population. J. Dairy Scince, 71(4):1025-1033.

Lukefahr, S. D. (1992). Animal Models for Quantitative Genetic Analysis in Rabbit Breeding Programs. J. Appl. Rabbit Res., 15: 104-130.

Luiting P. and E. M. Urf (1991). Residual feed consumption in laying hens. 1. Quantification of Phenotypic Variation and Repeatabilities. Poultry Science, 70: 1655-1662.

Misztal, I. (1990). Restricted Maximum Likelihood Estimation of Variance Components in Animal

Model Using Sparse Matrix Inversion And A Supercomputer. J. Dairy Sci., 73:163-172.

Nofal, R.Y., A. M. Abdel-Ghany and K. Saleh (2002). Best Linear Unbiased Prediction (BLUP) on Some Litter Traits and Masculinity Rate of New Zealand White Rabbits Under Egyptian Conditions. The 3rd Scientific Conference on Rabbit Production in Hot Climates, Hurghada, Egypt 8-11 October, 127-137;

Nofal, R. Y, A. M. Abdel-Ghany and M. Y. Mstafa (2003). Best linear unbiased prediction of White Holland Turkey Toms Regarding Body Weight and Conformation Measures. Book of Abstracts of the 5th Annual Meeting of the European Association for Animal Production Roma, Italy. 31 August-3 September. Poster G3. Page 67.

SAS® Institute (2000). SAS/STAT User's Guide: Statistics. Version 8, SAS Inst. Inc., Cary Nc, USA.

Searle, S. R. (1989). Variance Component-Some History and a Summary Account of Estimation Methods. J. Anim. Breed. Genetics. 106: 1-29.

Youssef, Y. M. K., M. M. Iraqi and N. S. Hassan (2003). Heritability, Repeatability and Permanent Environmental Effect for Litter Traits in New Zealand White and Baladi Red Rabbits. Annals of Agriculture Science, Moshtohor, 41(4):1459-1469.

التقييم الوراثى للأرانب البلدي ألأسود المحلية تحت ظروف شمال الدلتا فى مصر باستخدام طريقة النموذج الحيوانى. ١. صفات خلفة البطن

ناجى سعيد حسن*- أحمد محمود عبد الغنى- حنان حسن غانم*- محمد عبد الحميد الشناوى ***- منى محمد عبد الرحمن غالى******

*معهد بحوث الإنتاج الحيوانى – مركز البحوث الزراعيه- وزاره الزراعة-مصر.
**قسم الإنتاج الحيوانى- كلية الزراعة بالإسماعيلية- جامعه قناة السويس- مصر
***قسم التنمية المستدامة- معهد بحوث الدراسات البيئيه- فرع السادات- جامعه المنوفيه- مصر
**** قسم الإنتاج الحيوانى- كلية الزراعة بالجيزة- جامعه القاهرة- مصر

تم تجميع بيانات أرانب البلدي ألأسود المحلية في محطة بحوث التربية بسخا – كفر الشيخ (بمنطقة شمال دلتا مصر) معهد بحوث الانتاج الحيوانى في الفترة ما بين أكتوبر ٢٠١٠ – مايو ٢٠١١ حيث أستخدم نموذج الحيوان في التحليل و التقييم الأحصائي علي ٤٩ بنت و ١٢ أم و سبعة ذكور بإجمالى ١١١ بطن لتقييم بعض الصفات ألأمية (حجم ووزن خلفة البطن عند أعمار الميلاد – ٢١ يوم – و عند الفطام) هدا و قد كان النمودج الأحصائي يحتوي علي الحيوان نفسه بالأضافة (الي التأثير العام لخلفة بطن الأم) كتأير عشوائي و تأثير كلا من ترتيب خلفة البطن و شهر الميلاد كتأثير عوامل ثابتة. وقد أظهرت النتائج التالية :-

١ - الحصول علي عمق وراثي منخفض و يتراوح ما بين (٠,٠١ – ٠,٠٣), (٠,٠١- ٠,٠٨), (٠,٠٩) لصفات الخلفة (حجم ووزن) عند نفس الأعمار.

٢ - الحصول علي تأثير العام لخلفة البطن متناهي في الدقة (ضعيف جدا) حيث تراوح بين (٠,٠٠٠٠٢ – ٠,٠٢), (٠,٠٠٠٤٢ – ٠,٠٠٠٠٤٥), (٠,٠٠٦٠ - ٠,٠٠٨٦) عند نفس ألأعمار السابقة.

٣ - كانت القيم الوراثية في الترتيب المنطقي لها لأعلي ٢٥ % من الحيوانات (كبنات أرانب) كمدي لحجم البطن عند الأعمار الثلاثة كالتالي (٠,٤٨±٠,٠٣) و (٠,٤٤±٠,٠٣) و (٠,٣٣ ± ٠,٠٣) أرنب لكل خلفة و دلك بدرجة دقة (٠,٠٩, ٠,٠٨, ٠,٠٩ %) لنفس ألأعمار السابقة.

٤ - بينما سجلت أمهات الأرانب قيما وراثية لأعلي ٢٥ % بنفس الترتيب المنطقي السابق و تراوحت بين (٠,٠١±٠,٠٣) (٠,٠٨±٠,٠٣) (٠,٠٧±٠,٠٣) و بدرجة دقة (٠,٠٦ %) لكل من الحجم و الوزن.

٥ - لوحظ أن قياس درجة الدقة سجلت قيما أعلي لأوزان خلفة البطن عن أحجامها في حالة نسبة الحيوانات ألأعلي (٢٥%) لجميع الحيوانات (بنات – أمهات – دكور) .

٦ - الحصول علي معاملات تلازم عالية ما بين القيم الوراثية لصفات الخلفة جميعها الا أنها لوحظ أنها تقل بتقدم العمر من الميلاد و حتي الفطام, الا في حالة وزن الخلفة عند ٢١ و عند الفطام حيث سجلت أعلي تقدير (٠,٩٧٣) .

٧ - الحصول علي تعبير جيني موجب خلال شهور فبراير – سبتمبر – ديسمبر لجميع صفات الخلفة المدروسة.