GENETIC ANALYSIS OF BODY WEIGHTS IN RABBITS*

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Abstract

A complete 3 x 3 diallel cross was performed to study the growth performance of rabbits belonging to three different breeds namely White Giant (WG), Soviet Chinchilla (SC) and Grey Giant (GG) at the University Rabbit Farm, Centre for Advanced Studies in Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Mannuthy, Kerala. Growth records of F1 progeny were taken at fortnightly intervals up to fourteen weeks of age. Kits were weaned at four weeks. The data corrected for significant non-genetic effects were used for estimating genetic parameters. Heritability, genetic and phenotypic correlations were estimated by paternal half sib correlation method separately for different breeds and for pooled population. Heritability estimates of weight at fourth, twelfth and fourteenth weeks were 0.380±0.239, 0.657±0.379 and 0.727±0.407 respectively, indicating effectiveness of selection for body weight at weaning age. Genetic and phenotypic correlations of body weight between immediate age groups were greater than those widely separated. The genotypic correlation between second and eighth week body weight were high and positive.

Key words: *Rabbit, growth performance, diallel, heritability and phenotypic correlations*

In the recent years there has been a rise in global awareness on the virtues of rabbit meat, especially in developing countries, depicting it as an alternative means of alleviating world food shortages. In developing countries, there exist a tremendous potential for rabbits based on economic traits like high rate of reproduction, early maturity, rapid growth rate and efficient feed utilisation.

India faces enormous shortages in meat supply and has the greatest chance to tap the potentials of rabbit production. The population of valuable pure bred rabbits in the state of Kerala is facing a rapid decline due to adoption of indiscriminate breeding programme. In this context it is essential to study the performance of these breeds in our diversified environmental conditions. To provide quality breeding stock to farmers, a basic study on heritability, genetic, phenotypic and environmental correlations affecting growth traits is warranted.

Materials and Methods

The experiment was carried out at the University Rabbit Farm under the Centre for Advanced Studies in Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Mannuthy, Thrissur between March 2007 and July 2008. White Giant (WG), Soviet Chinchilla (SC) and Grey Giant (GG) breeds of rabbits formed the foundation stocks in this program. A complete three x three diallel cross was performed with a total of 44 does and nine bucks of three purebreds of WG, SC and GG in two different seasons. The data were generated from first filial generation (F1) kits produced by crossing in all possible combinations of the three parental groups with

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minimum of four full sib groups in each set of crosses. Weaning of bunnies was done at the age of four weeks and housed together in groups there after. Daily ration consisted of *ad libitum* green fodder and 50 to 200g of concentrates consisting of 15 to 20 percent crude protein depending on the age and size. The animals had access to drinking water round the clock. Body weight of each animal was recorded from birth to fourteenth week of age at fortnightly intervals. The litter size was recorded within 24 h of kindling. The experiment was scheduled in two seasons *viz.* cold and hot seasons. In the course of the experiment, the period from May to September was considered as cold season and the remaining period as hot season. Body weight of dam was recorded in kilograms within 24 h of kindling. The animals were divided into three groups based on their body weights as 2 to 2.5, 2.5 to 3 and above 3 kg. The age of dam at kindling was recorded and the animals were categorized into three groups as dam aged below 1000, 1000 to 2000 and above 2000 days.

Estimation of heritability, genetic and phenotypic correlations

The data on body weights were analysed by least squares technique (Harvey, 1960) using SPAB 2.0- Software Statistical package for animal breeding (Sethi, 2002) to study the influence of genetic and non-genetic factors. The data adjusted for non-genetic factors like sex, season of birth, litter size at birth, age and weight of dam at kindling, were used for genetic analysis. Heritability was estimated by paternal half sib correlation method (Sethi, 2002). The model used was

$Y_{ij} = \mu + S_i + e_{ij}$

Y_{ij} - Observation of j^{th} progeny of i^{th} sire

μ - Effect common to all individuals

S_i – Effect due to i^{th} sire with $E(S_i)= 0$ and $V(S_i)= ó^2_{si}$

e_{ij} – Random effect due to error with $E(e_i)= 0$ and $V(e_i)= ó^2_{ei}$

Genetic, phenotypic and environmental correlations were calculated by using paternal half sib method with help of SPAB 2.0 (Sethi, 2002).

Results and Discussion

Heritability estimates of body weights at different ages

The heritability estimates of body weights at different ages of rabbits from the pooled data are presented in Table. Heritability estimates for body weights at birth, two, four, six, eight, ten, twelve and fourteen weeks of age were 0.193±0.165, 0.355±0.229, 0.380±0.239, 0.499±0.287, 0.089±0.141, 0.644±0.358, 0.657±0.379 and 0.727±0.407, respectively in rabbits under study. Heritability estimates for body weights of WG at birth, second, fourth, sixth, eighth, twelfth and fourteenth weeks stood at 0.2235±0.3942, 0.3381 ± 0.4837, 0.3489 ± 0.4918, 0.0701 ± 0.2696, 0.0769 ± 0.2944, 0.0479 ± 0.3112 and 0.4774 ± 0.6386 respectively. Value for tenth week was below zero. For SC, high estimates of heritability were obtained for tenth (0.8017±0.7859), twelfth (0.6558±0.7673) and fourteenth (0.7138±0.7993) week's body weight. Corresponding values for other age groups were medium and a few were negative. Heritability estimates for body weights for GG at fourth, sixth and fourteenth weeks were 0.2211 ± 0.3490, 0.4227 ± 0.5307 and 0.2571 ± 0.5876, respectively. In rabbits, heritability estimate component showed an increasing trend from birth to fourteenth week of age except for eighth week. This might be a reflection of the fact that as age advanced the genetic make up or the additive genetic effects became more pronounced than environmental effects. Heritability estimates were higher for ten, twelve and fourteen week age groups. For high values of heritability, trait's phenotype is good indicator of underlying breeding values (Farghaly and El-Mahdy, 1999). So phenotypic selection will be effective for higher age body weights. At fourteenth week of age heritability estimate was 0.7138 ±0.7993 in SC similar to the reported heritability estimates in SC by Bhushan *et al*. (1998) and Kasiviswanathan (2000). Some heritability estimates arrived at was found to be above one which may be due to low sample size. Discrepancies between the estimates, heritability values depend on the genetic make up of the stocks, management and climatic conditions and period of study as well as differences in data size, models of data correction and method of analysis (Khalil *et al*., 1986).

Genetic and phenotypic correlation among body weights at different ages

The genetic correlation estimates among body weights for the pooled data are presented above the diagonal in Table and phenotypic correlation estimates below the diagonal. High genetic correlation between

body weights indicates the synergestic control of the same additive gene. Genetic correlation observed between second and eighth week weight was high, indicating that selection of body weight at second week also improves the eighth week body weight. Phenotypic correlation ranged from 0.140±0.074 (between birth and eighth weeks of age) to 0.885±0.042 (between twelfth and fourteenth weeks of age). Phenotypic correlations values with respect to body weight between age groups of minimal separation was found to be higher than those the widely separated. Similar observations were made by Bhushan and Ahlawat (1999). Singh *et al.* (2007) reported positive correlation (0.68) between sixth and twelfth weeks body weight.

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Table. Heritability, genetic and phenotypic correlations of body weights from pooled data

	Birth weight	2nd week weight	4th week weight	6th week weight	8th week weight	10th week weight	12th week weight	14th week weight
Birth weight	**0.193±0.165**	1.015±0.180	0.736±0.329	0.556±0.375	0.464±0.689	0.296±0.468	-0.008±0.548	-0.139±0.550
2nd week weight	0.437±0.059	**0.355±0.229**	0.886±0.114	0.687±0.254	0.892±0.393	0.707±0.288	1.068±0.431	2.241±6.354
4th week weight	0.350±0.062	0.828±0.037	**0.380±0.239**	0.826±0.138	0.894±0.152	0.483±0.352	0.466±0.424	1.122±0.176
6th week weight	0.158±0.068	0.690±0.050	0.830±0.038	**0.499±0.287**	0.855±0.221	0.910±0.091	0.916±0.179	0.622±0.464
8th week weight	0.140±0.074	0.589±0.060	0.655±0.056	0.814±0.043	**0.089±0.141**	0.807±0.235	1.133±5.529	/
10th week weight	0.220±0.078	0.491±0.070	0.490±0.070	0.668±0.059	0.795±0.049	**0.644±0.358**	1.017±0.085	0.083±0.187
12th week weight	0.172±0.086	0.414±0.079	0.388±0.080	0.512±0.075	0.667±0.065	0.853±0.045	**0.657±0.379**	1.00±0.033
14th week weight	0.216±0.088	0.44±0.081	0.410±0.083	0.424±0.082	0.549±0.076	0.668±0.067	0.885±0.042	**0.727±0.407**

/ cannot be estimated

Diagonal values are heritability, above diagonal genetic correlations and below diagonal phenotypic correlations

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