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Diallel Experiment Involving Three Genetic Groups of Rabbit in Respect of Body Weight at Weaning and 60 Days of Age

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ABSTRACT

Complete diallel experiment provides a means for estimating the general combining abilities (GCA) of different lines (i.e. genetic groups under consideration) and specific combining abilities (SCA) of different crosses, besides testing for the presence of reciprocal effect (RE), if any. The investigation under report deals with the study of combining ability effects as well as RE in respect of body weights at weaning and 60 days of age in a complete diallel experiment involving three genetic groups of rabbits under the agro-climatic conditions of the north eastern hilly state of Meghalaya.

Key Words : body weight, Diallel experiment, general combining ability, specific combining ability, reciprocal effect.

INTRODUCTION

Rabbit farming is gaining its momentum in State like Assam, India. Rabbit, compared to other livestock species requires low investment at the same time are highly prolific, attains maturity at an early age, grows rapidly and efficient in conversion of feed into meat. In addition, the rabbit meat is white in color, easily digestible, low in cholesterol and sodium content. These potential of rabbits can be well utilized at a commercial or small scale level to address the problems of food scarcity of the country. Only limited studies have been conducted on the performance of rabbits in tropical countries, where climate, diet, management and stock resources can differ markedly from those in temperate countries. It is evident that the body weight and growth rate of weaned rabbits depend on various factors viz., age and weight of dam at kindling, litter size at birth, season of kindling, sex of litters etc. (Rojan *et al.*, 2013, Kabir *et al.*, 2014). The present investigation under report deals with the study of combining ability effects as well as of reciprocal effect (RE) in respect of body weights at weaning and 60 days of age in a complete diallel experiment involving three genetic groups of rabbits under the agro-climatic conditions of the north eastern hilly state of Meghalaya.

MATERIALS AND METHODS

Records of body weight at weaning and at 60 days of age that were generated in a complete diallel experiment involving three ge-

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netic groups of rabbit viz., indigenous rabbit of Meghalaya(I), Soviet Chinchilla (SC) and New Zealand White (NZW) breeds were used in the study. The animals were maintained at the Rabbit Research Farm, Indian Council of Agricultural Research (ICAR) complex for North Eastern Hill Region, Barapani, Meghalaya, and were housed in cages under uniform managemental practices. Weaning was done at 42 days of age. Records of body weights were subjected to the diallel analysis in order to partition the between cross variance into GCA, SCA and reciprocal effect components. Eisenhart's Model I (fixed effect) as described by Griffings (1956) and as explained by Singh and Kumar (1994) was utilised for this analysis. Prior to diallel analysis of data, the records were corrected for significant effects of season of birth and sex of the animal by use of least squares constants (Harvey, 1975).

RESULTS AND DISCUSSION

Prior to diallel analysis data were corrected for effect of season of birth on 60 day's body weight, which was found significant. The effect of sex on body weight at weaning and 60 days and season effect on weaning weight were not observed to be significant.

Body weight at weaning: Analysis of variance revealed that genetic group variation in body weight at weaning was highly significant ($P<0.01$). The average body weight at weaning for the 3 pure lines SC, NZW and I were 608.22, 629.17 and 522.48 g respectively The average weaning weight of various cross combinations including direct and reciprocal crosses also showed considerable variations. In general, the performance of the crosses involving New Zealand White appeared to be relatively better (Table 1).

Table 1. The mean of crosses involving Diallel Experiment in respect of Body Weight at Weaning and at 60 days,

Sire Breed	Dam breed	Body weight(g) at	
		Weaning	60 day
SC	SC	608.22	1013.59
NZW	NZW	629.17	1008.86
I	I	522.48	787.89
SC	NZW	636.61	1037.50
SC	I	540.03	894.45
NZW	I	376.45	1012.23
NZW	SC	652.35	1053.07
I	SC	583.53	968.94
I	NZW	648.04	1007.06

SC = Soviet Chinchilla NZW = New Zealand White I =Indigenous

Table 2. Results of analysis of variance for Combining Abilities in respect of Body Weight at Weaning and at 60 days

Sources of variation	Body weight at			
	Weaning		60 days	
	D.F.	M.S.S.	D.F.	M.S.S.
GCA	2	6099.00**	2	19430.00**
SCA	3	635.83**	3	7143.00**
RE	3	1210.98**	3	1665.59**
Error	1585	95.87	1576	376.44

**P<0.01

Table 3. GCA of different lines, SCA of different Crosses and RE in respect of body weight at Weaning and 60 days

Combining ability effect			Body weight at	
			Weaning	60 days
μ			599.65	983.73
GCA :	g_1		5.17	13.12
		g_2	28.98	49.19
		g_3	-34.15	-62.32
SCA :	s_{12}		10.67	-0.77
		s_{13}	-8.89	-2.84
		s_{23}	17.77	74.04
RE :	r_{12}		-7.87	-7.78
		r_{13}	-21.75	-37.25
		r_{23}	-35.79	-32.41

N.B. Suffixes 1, 2 and 3 means SC, NZW and I respectively

Results of analysis of variance for combining abilities also showed that the effect of GCA was highly significant on body weight at weaning. The GCA (Table 3) was found to be highest in NZW (28.98) followed by SC (5.17) and indigenous (-34. 15). The results suggest that in respect of weaning weight, NZW ought to perform better when crossed with other lines including itself. The variances of body weight at weaning due to SCA and reciprocal effect were also highly significant. In regards to this trait, in the crosses of SC and NZW (S_{12}), and in NZW and I (S_{23}), the SCA was found to be relatively high and positive while in the crosses of SC x I (S_{13}), the SCA was found to be negative. Thus, favourable non-additive gene action is evident in the cross of NZW with the other two pure lines. The reciprocal effects were found to be negative in all the three reciprocal crosses viz. SC x NZW (r_{12}), SC x I (r_{13}), NZW x I (r_{23}), the estimated effects were substantially high in the later two crosses.

The highly significant reciprocal effect as observed in the present study in respect of body weight at weaning indicates presence of maternal effect. In order to exploit the non-additive gene action as well as the maternal effects to the maximum it would be better to

cross females of the superior exotic breeds viz. SC and NZW with the males of indigenous breed. The fact that the GCA effect of NZW was found to be the highest and that SCA of crosses involving NZW were all positive and high, it may be opined that NZW will be a better choice compared to SC when crossing with indigenous rabbits. However, as already indicated, male of Indigenous will have to be crossed with the female of NZW to take advantage of the reciprocal effect.

Comparable to the present findings Sakaguti *et al*.(1998) also reported significant effect of GCA, SCA as well as reciprocal effect in respect of body weight at weaning in a 3 x 3 diallel experiment involving NZW, Californian and SC breeds of rabbit.

Body weight at 60 days: The effect of genetic group on body weight at 60 days was also found to be highly significant justifying diallel analysis for this trait. The averages for body weight at 60 days as observed in the three pure lines SC, NZW and I were 1013.59, 1008.86 and 787.89 g respectively. Variances due to GCA, SCA as well as reciprocal effects were all found to be highly significant on 60 days body weight.

Significant variation in body weight at 70 days of age due to GCA was reported earlier by Carregal *et al.* (1984) in a crossbreeding experiment involving Dutch, NZW, Californian and Buscat Giant rabbits. In the present study, similar to the body weight at weaning, the GCA effect was found maximum in the body weight at 60 days also for NZW(49.19), followed by SC (13.12) and Indigenous (-62.32). The results show that the two pure breeds viz. NZW and SC would perform better in crosses when compared to Indigenous. The SCA effect also shows similar trend to that of body weight at weaning, with highest SCA in NZW x I (74.04) followed by SC x NZW (-0.77) and SC x I (-2.84). The reciprocal effects were found to be profound in crosses of SC with I (-37.25) and NZW with Indigenous(-32.41). An overall appraisal of the GCA, SCA and reciprocal effect would show that in respect of 60 days body weight crosses of Indigenous male with NZW females would result in best cross performance.

The present findings showed that combining ability effects as well as reciprocal effects on body weight at weaning and at 60 days of age were significant. The significant RE was thought to be due to maternal effect – which may not be carried over to adulthood.

CONCLUSION

Records of body weight at weaning(42 day) and at 60 days of age generated from a 3 X 3 complete diallel experiment involving three genetic groups of rabbit viz., indigenous rabbit of Megahalaya(I), Soviet Chinchilla (SC) and New Zealand White (NZW) breeds were used to estimate GCA, SCA and RE (reciprocal effect). The animals were maintained at the Rabbit Research Farm, Indian Council of Agricultural Research (ICAR) complex for North Eastern Hill Region, Barapani, Meghalaya, and were housed in cages under uniform managemental practices. Eisenhart's Model I (fixed effect) as described by Griffings(1956) and as explained by Singh and Kumar (1994) was utilised for this analysis. Effects of GCA, SCA and RE were all found to be highly significant ($P<0.01$) on both the body weights. NZW had the highest GCA followed by SC and I. The fact that the GCA effect of NZW was the highest and that SCA of crosses involving NZW were all positive and high, it was opined that NZW will be a better choice compared to SC when crossing with indigenous rabbits. Further, it was observed that the males of Indigenous will have to be crossed with the females of NZW to take advantage of reciprocal effect.

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