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Genetic study on the performance of Dahlem red Layers

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Abstract
A study was undertaken on a total of 328 Dahlem Red birds belonging to full sib mated (45), half sib mated (64) and non-inbred groups (219). The overall least squares means of body weight at 4, 8, 20, and 40 weeks of age, age at sexual maturity, egg production up to 40 weeks of age and egg weight at 32 and 40 weeks of age were 146.88, 374.28, 1150.70 and 1678.57 g, 181.02 days, 71.06 eggs and 52.81 and 56.25 g, respectively. The mean performance of non-inbred group was in general, superior to inbred groups in all the traits studied. The estimates of heritability estimates obtained for the full sib, half sib and non-inbred groups were ranged from low to high. The genetic and phenotypic correlations among different traits were estimated.

Keywords: Dahlem Red, Genetic correlations, Heritabilities, Inbred, Non-inbred

1. Introduction

India is a country with large human population and there is an ever increasing demand for poultry products. The eggs and meat of poultry are the cheaper and highly affordable source of protein for humans. Among the various economically important poultry species, the chicken represents a valuable agricultural commodity as a source of eggs and high protein meat. Dahlem Red is an egg-purpose breed of chickens, imported from Germany to India. It is a red-feathered breed laying tinted eggs with good egg weight and known for its high disease tolerance and immune competence (Kundu *et al.*, 1999) [8]. This breed is used to produce improved germplasm suitable for backyard rearing in India. Phenotypic characterization of this recently introduced germplasm will help in designing the selection and breeding for further improvement. Therefore, the present investigation is undertaken for the phenotypic characterization of Dahlem Red population.

Materials and Methods

The data utilized for the present study belonged to third, fourth and fifth generation inbred (half sib mated and full sib mated) and non-inbred groups of Dahlem Red population, maintained at the Project Directorate on Poultry (PDP), Hyderabad. A total of 45 full sib mated, 64 half sib mated and 219 non-inbred groups of birds were produced by mating 3, 7 and 20 sires to 9, 16 and 73 dams, respectively. The data on body weight (BW in g) at 4, 8, 20 and 40 weeks of age, age at sexual maturity (ASM, in days), egg production up to 40 weeks of age (EP 40, in number) and egg weight at 32 and 40 weeks of age (EW, in g) were analyzed by least squares technique (Harvey, 1979) [6], to study the effects of generations, groups (full sib mated, half sib mated and non-inbred) and hatches and the data adjusted for the effects of generations and hatches were utilized for the estimation of heritabilities and genetic and phenotypic correlations by half sib method (Becker, 1964) [1] within the groups. Standard errors of heritability estimates were calculated as per Dickerson (1960) [5].

Results and Discussion

Body weights

The least squares means obtained for various traits are presented in Table 1.The overall least squares mean body weights at 4, 8, 20 and 40 weeks of age were 146.88, 374.28, 1150.70 and 1678.57 g, respectively, which were similar to those reported by Singh *et al.* (2002a) [16] but slightly lower than those of Brah *et al.* (2002) [2]. The effect of generations was significant body weights at all ages studied, which might due to the variation in climatic and environmental factors. The highest means for body weights up to 20 weeks were obtained in third generation and at 40 weeks age in fifth generation.

The effect of the groups was significant (P<0.01) on body weights at all ages studied, with the mean body weights of birds belonging to non-inbred group attaining highest weights then those obtained in full sib mated and half sib mated groups, which indicated that inbreds would weigh lesser then non-inbreds. The lower body weights in inbred groups might be due to the effect of inbreeding depression. The effect of hatch on body weight was found to be significant at 4, 8 and 20at weeks of age, but not 40 weeks of age, which revealed that Dahlem Red birds in the present study were sensitive to the environmental conditions between different hatches Chaudhari *et al.* (1976) [4] also reported significant hatch effect on body weights of White Leghorns.

Age at sexual maturity

The overall least squares mean of age at sexual maturity was 181.02 days, which was almost similar to the mean reported by Singh *et al.* (2002a) [16] and lower than that found by Chatterjee *et al.* (2004) [3], which was probably due to breed variation. The age at sexual maturity was affected significantly (P<0.01) by the generations and groups but not by the hatches. The lowest mean was obtained in third generation and highest in fourth generation. The mean age at sexual maturity of non-in bred groups was lower than that of inbred groups, which could be due to effect of inbreeding. The significant variation in age at sexual maturity among the four hatches could be attributed to the environmental fluctuations.

Egg production

The overall least squares mean of egg production up to 40 weeks of age was 71.06, which was in agreement with the earlier reports Sharma *et al.*(2003) [13] and higher than that of Sharma and Krishna (1998) [11]. The mean egg production of 76.79 in third generation declined to 60.76 in fourth generation but increased to 75.63 in fifth generation and the differences between generations were significant (Table 1). The mean egg production of half sib (65.71) and full sib (70.56) groups was lower than that of non-inbred group (76.89) and the differences.

Table 1: Least squares means (g) of body weights (BW in g), age at sexual maturity (ASM, days), egg production up to 40 weeks of age (EP40) and egg weight at 32 (EW 32, g) and 40 weeks of age (EW 40, g) of Dahlem Red.

	n	BW 4		BW 8		BW 20		BW 40		ASM (days)		EP-40 Weeks		EW-32 Weeks (g)		EW-40 Weeks (g)	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Overall	328	146.88	3.5	374.28	8.15	1150.7	17.35	1678.57	19.89	181.02	1.55	71.06	1.79	52.81	0.43	56.25	0.46
Generations:																	
3	98	174.44^{a}	5.81	386.90^{a}	13.55	1202.42^{a}	28.82	1630.41^{b}	33.05	171.91^{c}	2.57	76.79^{a}	2.97	52.42	0.71	55.94^{b}	0.77
4	78	150.65^{b}	4.93	382.72^{a}	11.5	1071.36^{c}	24.48	1699.78^{a}	28.06	191.28^{a}	2.18	60.76^{b}	2.53	55.5	0.6	58.75^{a}	0.65
5	152	115.56^{c}	3.58	353.22^{b}	8.34	1178.33^{b}	17.74	1705.50^{a}	20.34	179.86^{b}	1.58	75.63^{a}	1.83	50.52	0.44	54.05^{b}	0.47
Groups:																	
Full sib	45	139.37^{b}	5.24	358.54^{b}	12.22	1185.09^{a}	26.01	1694.90^{a}	29.82	178.42^{b}	2.32	70.58^{b}	2.68	54.32^{a}	0.64	58.53^{a}	0.69
Half sib	64	144.05^{b}	5.07	343.56^{b}	11.79	1098.74^{b}	25.09	1584.71^{b}	28.77	185.63^{a}	2.24	65.71^{b}	2.59	49.92^{b}	0.62	53.33^{c}	0.67
Non-inbred	219	157.22^{a}	4.13	420.74^{a}	9.62	1168.28^{a}	20.47	1756.10^{a}	23.48	179.01^{b}	1.83	76.89^{a}	2.11	54.19^{a}	0.51	56.88^{b}	0.55
Hatches:																	
1	170	148.75^{b}	3.32	413.03^{a}	7.75	1194.18^{a}	16.49	1639.65	18.9	180.3	1.47	69.57^{b}	1.7	52.95	0.41	55.43	0.44
2	123	140.16^{bc}	4.49	384.52^{ab}	10.47	1085.57^{c}	22.27	1641.75	25.54	179.93	1.99	64.00^{b}	2.3	52.18	0.55	56.14	0.59
3	14	128.16^{c}	9.22	399.69^{ab}	21.52	1138.98^{abc}	45.78	1742.89	52.49	186.99	4.09	70.69^{ab}	4.72	51.76	1.13	55.21	1.22
4	21	170.45^{a}	7.97	358.89^{b}	18.59	1184.08^{b}	39.56	1689.97	45.38	176.85	3.53	79.97^{a}	4.08	54.37	0.98	58.21	1.05

Means followed by superscript do not differ significantly ($p \leq 0.05$)

were significant, which might be due to the influence of inbreeding depression. The effect of hatch was significant on egg production, which was in agreement with the report of Vasu *et al.* (2004) [19].

Egg weight

The overall mean egg weight at 32 and 40 weeks of age for Dahlem Red birds were 52.42 and 55.94 g, respectively and they were similar to the report of Singh *et al.* (2000) [14]. The mean for egg weight in fourth generation was highest (55.50 and 58.75 g), while in fifth generation, the means were the lowest. The birds in fourth generation matured late (191.28 days) and produced the lowest number of eggs (60.76) with highest mean egg weights at both 32 (55.50 g) and 40 weeks of age (58.75 g). The effect of groups was significant on the egg weight at the both ages. The non-in bred group had the mean age at sexual maturity intermediate to those of full sib and half sib groups, but attained the highest egg production (76.89 eggs) and egg weight at 32 weeks of age (54.19 g). The birds of half sib group matured late (185.63 days), produced the lowest number of eggs (65.71) and recorded the lowest mean egg weights at 32(49.92 g) and 40 weeks of age (53.33 g). Thus, the half sib mated group was the most disadvantaged one. The effect of hatch was significant on egg production but not on the egg weight.

Heritabilities

Estimates of habitability, genetic and phenotypic correlations among various traits of Dahlem Red birds are presented in Table 2. The heritability estimates of body weight were 0.02, 0.61 and 0.49 in full sib, half sib and non-inbred groups at 4 weeks of age, while the estimates in these groups at 40 weeks of age were 0.19, 0.20 and 0.53, respectively. The results revealed the moderate genetic variability for the body weights in half sib and non-inbred groups, when compared to the full sib group. The estimates of heritabilities reported by Kalita and Das (1986) [7] were similar to those obtained in the present study, whereas they were higher than those of Singh *et al.* (2002b) [17] and lower than those of Brah *et al.* (2002) [2]. The heritability that could be obtained for age at sexual maturity in non-inbred group only was 0.48, which was in agreement with the report of Sharma *et al.* (1996) [10], while this estimate was higher than that reported by Sharma and Verma (2001) [12].

The heritabilities of egg production up to 40 weeks of age in full sib, half sib and non-inbred groups were 0.24, 0.86 and

0.59 respectively, which were in agreement with the report made by Sharma *et al.* (2003) [13].
The egg weight at 32 and 40 weeks of age had the heritabilities of 0.91 and 0.89, respectively in half sib group and 0.77 and 0.70 in non-inbred group respectively, which were similar to those observed by Sharma

Table 2: Estimates of heritability (on diagonal) and genetic (above diagonal) phenotypic correlations (below diagonal) of body weights (BW), age at sexual maturity (ASM), egg production (EP) and egg weight (EW) of different Dahlem Red groups.

	Group	BW 4	BW 8	BW 20	BW 40	ASM	EP 40	EW 32	EW 40
BW 4	Full sib	0.02 ± 0.38	@	-	@	@	@	-	-
	Half sib	0.61 ± 0.59	0.71± 0.30	-	-0.16± 1.33	-	0.85± 0.16	-0.11± 0.56	-0.02± 0.58
	Non-inbred	0.49± 0.27	-	@	-0.31± 0.18	0.27± 0.20	-0.40± 0.16	0.49± 0.13	0.52± 0.13
BW 8	Full sib	0.23	0.06± 0.42		-0.39± 0.11	@	0.07± 0.11	-	-
	Half sib	0.24	0.85± 0.72	-	0.72± 0.57	-	0.57± 0.34	0.39± 0.42	0.21± 0.47
	Non-inbred	0.22	@	-	-	-	-	-	-
BW 20	Full sib	0.10	-0.01	@	-	-	-	-	-
	Half sib	-0.08	-0.03	@	-	-	-	-	-
	Non-inbred	-0.07	0.20	0.6 ± 0.17	1.25-0.22	-0.64± 0.25	0.35± 0.34	0.38± 0.30	0.32± 0.32
BW 40	Full sib	-0.18	-0.04	0.01	0.19± 0.53	@	@	-	-
	Half sib	0.02	0.24	0.24	0.20± 0.39	-	0.39 ± 0.99	0.76± 0.49	1.03-0.06
	Non-inbred	-0.05	0.10	0.30	0.53± 0.28	-0.51± 0.15	0.17± 0.18	0.56± 0.12	0.57± 0.12
ASM	Full sib	-0.31	-0.22	-0.02	0.35	@	@	-	-
	Half sib	-020	-0.23	0.16	0.02	@	-	-	-
	Non-inbred	0.00	-0.20	-0.19	- 0.09	0.48± 0.27	-0.85± 0.06	-0.15± 0.17	-0.10± 0.18
EP 40	Full sib	0.25	0.34	-0.03	-0.35	-0.41	0.24± 0.58	-	-
	Half sib	0.26	0.22	-0.10	0.01	-0.33	0.86± 0.72	-0.28± 0.45	-0.62± 0.30
	Non-inbred	-0.05	0.54	0.14	0.60	-0.30	0.59± 0.30	-0.31± 0.15	-0.19± 0.16
EW 32	Full sib	-0.07	-0.17	-0.18	0.16	0.17	-0.07	@	-
	Half sib	-0.01	0.09	0.16	0.17	0.15	-0.13	0.91± 0.75	0.88± 0.11
	Non-inbred	0.16	0.07	0.09	0.21	-0.06	-0.09	0.77± 0.35	@
EW 40	Full sib	0.21	0.16	-0.04	-0.10	-0.18	0.18	0.13	@
	Half sib	0.02	0.09	0.26	0.24	0.14	-0.18	0.34	0.89± 0.74
	Non-inbred	0.15	0.05	0.08	0.22	-0.02	-0.08	0.40	0.70± 0.33

et al. (1996) [10]. The heritabilities estimated reported by Saini *et al.* (1991) [9] was lower than those obtained in the present study. The heritabilities for some of the traits could not be obtained, which might be due to small sample size.

Genetic correlations

The genetic correlations of body weights at 20 and 40 weeks of age with age at sexual maturity were -0.64 and -0.51 (both in non-inbred group) respectively, which implied that the birds heavier at 20 and 40 weeks of age would start laying the eggs early. The genetic correlations obtained in the present study were similar to those reported by Singh *et al.* (2001) [15].
The genetic correlations between body weights and egg production up to 40 weeks of age as observed in the present study were, in general, positive and ranged from 0.17 to 0.85. In the present study, majority of the genetic correlations between the body weights and egg weights were positive and ranged between 0.38 and 0.76 at 32 weeks age and from 0.21 to 0.57 at 40 weeks age, which indicated that body weight and egg weight were influenced by the same set of genes and selection for higher body weights would automatically improve the egg weight as a correlated response to selection.
The genetic correlation of age at sexual maturity with egg production and egg weight were negative and ranged from -0.85 to -0.10. The results indicated that Dahlem Red birds with lower age at sexual maturity would produce more number of eggs with large egg size. The present findings were in agreement with the reports made by Singh *et al.* (2004) [18].
The genetic correlations of egg production up to 40 weeks of age with egg weight at 32 and 40 weeks of age were negative and varied from -0.62 to -0.19, which revealed that the birds with high egg production tend to lay smaller sized eggs. Similar relationship between egg number and egg weight was reported by Sharma *et al.* (2003) [13]. The genetic correlations for some of the traits could not be obtained because the heritabilities were outside the normal range, probably due to less number of sires and less number of progeny per sire. The genetic correlations between some of the traits were also beyond the normal range.

Phenotypic correlations

Majority of the phenotypic correlations among the body weights at 4, 8, 20 and 40 weeks of age were positive and ranged from 0.18 to 0.23 in full sib group, from -0.08 to 0.24 in half sib group and from -0.07 to 0.30 in non-inbred group. Majority of the phenotypic correlations between the body weights and age at sexual maturity were negative in all the three groups and ranged from -0.31 to 0.35. The results have indicated that body weights at various ages and age at sexual maturity were influenced by the same set of genes and selection of birds for higher early body weights would lead to birds with heaver body weights at later ages and earlier sexual maturity.
The phenotypic correlations between body weights and egg production up to 40 weeks of age were low and ranged from -0.35 to 0.60, whereas the phenotypic correlations of age at sexual maturity with egg production up to 40 weeks age were all negative with the magnitudes of -0.41, -0.33 and -0.30, in full sib, half sib and non-inbred groups, respectively.
Majority of the phenotypic correlations between the body weights and egg weight at 32 and 40 weeks age were positive indicating the possibility of increasing the egg weight through selection of birds for high body weights. The phenotypic correlations of age at sexual maturity varied from -0.06 to 0.17 with egg weight at 32 weeks and from -0.18 to 0.14 with egg weight at 40 weeks age.

The phenotypic correlations between egg production and egg weight were negative in half sib (-0.18) and non-inbred groups (-0.08) while this estimate was positive (0.18) in full sib group. The phenotypic correlations obtained between the egg weight at 32 and 40 weeks age were 0.13, 0.34 and 0.40 in full sib, half sib and non-inbred groups, respectively.

Conclusion

The mean performance of non-inbred group was in general, superior to inbred groups in all the traits studied. The estimates of heritability estimates obtained for the full sib, half sib and non-inbred groups were ranged from low to high. The genetic and phenotypic correlations among different traits were varied

References

1. Becker WA. Manual of Procedures in Quantitatives Genetics. Washington State University, Pullman, Washington, 1964.
2. Brah GS, Chaudhary ML, Sandhu JS. Inheritance of changes in body weights over the laying cycle and their interrelationships with economic traits in White Leghorns. Indian Journal of Poultry Science. 2002; 37:215-220.
3. Chatterjee RN, Yadav SP, Rai RB, Kundu A. Evaluation of Nicobari fowls under backyard island milieu. Indian Journal of Animal Sciences. 2004; 74:992-993.
4. Chaudhari D, Mohapatra SC, Venkataramaiah A, Ayyagari V, Ahuja SD. Genetic varitation and covaritation for some of the economic traits in four White Leghorn strains. Indian journal of Poultry Science. 1976; 11:189-197.
5. Dickerson GE. Techniques for Research in Quantitative Animal Genetics. Techniques and procedures in Animal Production Research. Americian Society of Animal Production, Monogram. 1960, 56-105.
6. Harvey WR. Least squares analysis of data with unequal sub-class numbers. Agricultural Research Service United States Department of Agriculture, 1979.
7. Kalita D, Das D. Genetic studies on some of the economic traits of White Leghorn breed of poultry. Indian Journal of Poultry Science. 1986; 21:231-233.
8. Kundu A, Singh DP, Mohapatra SC, Dash BB, Moudgal RP, Bisht GS *et al.* Antibody response to sheep erythrocytes in Indian native vis-à-vis imported breeds of chickens. British of Poultry Science. 1999; 40:40-43.
9. Saini RS, Jitendra Kumaran, Singh RP. Genetic studies on economic traits in a flock of Rhode Island Red chicken under selection. Indian Journal of Poultry Science. 1991; 26:6-11.
10. Sharma D, Johari DC, Kataria MC, Singh BP, Singh BP, Hazary RC *et al.* Effect of long term selection on genetic parameters of economic traits in White Leghorn. Asian Australian Journal of Animal Sciences. 1996; 9:455-459.
11. Sharma AK, Krishna ST. Genotypic and phenotypic parameters of economic traits in 'V' strain of White Leghorns under selection. Indian Journal of Poultry Science. 1998; 33:198-201.
12. Sharma PK, Verma SK. Genetic characterization of half-sib mating on growth and production traits in White Leghorn population. Indian Journal of Poultry Science. 2001; 36:87-88.
13. Sharma L, Harpal Singh, Sharma RK, Singh CV. Performance evaluation and construction of multi-trait selection indices in a randombred population of White Leghorn. Indian Journal of Poultry Science. 2003; 38:145-148.
14. Singh B, Harpal Singh, Singh CV, Brijesh Singh. Genetic parameters of growth, egg production and egg quality traits in White Leghorn. Indian Journal of Poultry Science. 2000; 35:13-16.
15. Singh S, Chhikara BS, Dalal DS, Malik CP. Estimation of Genetic and Phenotypic parameters of economic traits of White Leghorn. Indian Journal of Poultry Science. 2001; 36:163-168.
16. Singh UB, Chhikara BS, Raheja KL. Evaluation of average performance of some economic traits under long-term selection programme over various generations in a closed flock of White Leghorn. Indian Journal of Poultry Science. 2002a; 37:130-134.
17. Singh UB, Chhikara BS, Raheja KL. Estimation of genetic parameters of various economic traits over different generations of selection in a closed population of White Leghorn. Indian Journal of Poultry Science. 2002b; 37:135-138.
18. Singh SK, Sharma RK, Harpal Singh, Kumar D. Performance evaluation and construction of multi-trait selection indices in a commercial strain of White Leghorn. Indian Journal of Poultry Science 2004; 39:120-124.
19. Vasu Y, Narasimha Rao G, Sharma RP, Hazary RC, Ramesh Gupta B, Satyanarayana A *et al.* Genetic study on egg production traits in IWI and control strains of White Leghorn. Indian Journal of Animal Sciences 2004; 74:994-996.