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Phenotypic Time Trend in Performance Evaluation of Dahlem Red Chicken under Intensive Management in Himachal Pradesh

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ABSTRACT

A study was conducted to evaluate the production performance of Dahlem Red chicken over three consecutive generations maintained in intensive system. Dahlem Red birds were initially procured from CPDO Chandigarh and further produced through selective breeding. Performance traits evaluated were growth (day old chick weight, 4th week body weight (BW), 8th week BW, 12th week BW, 20th week BW and 40th week BW), age at sexual maturity, hen housed egg production (HHEP), hen day egg production (HDEP) and survivor egg production (SEP) at 40, 52 and 72 weeks of age and egg weight at 28, 40 and 52 weeks of age. Analysis revealed positive phenotypic trend in 4 week (17.58 g), 8 week (56.35 g), 12 week body weight (133.5 g), age at first egg (5.5 days) and age at 25% HHEP (2.0 days). The hen housed and hen day egg production at 40, 52 and 72 weeks revealed positive phenotypic trend of 4.79 and 1.93, 15.83 and 8.31, 31.6 and 13.98 eggs respectively. Further, survivor egg production also showed positive trend estimates at 40 and 52 weeks. Declining trends were observed in SEP at 72 week, day old chick weight (-0.89 g), 20 week BW (-37.99 g), 40 week BW (-141.2 g) and egg weight at 28 week (-1.7 g), 40 week (-3.3 g) and 52 week (-2.3 g). The results indicated the effectiveness of the selection along with improved management for bringing improvement in production traits in successive generations.

Keywords: Dahlem Red, Phenotypic trend, Growth trait, Egg production

Rural poultry farming is major farming system with immense potential in state of Himachal Pradesh. Chickens are playing an important role in rural economies especially for the poor and marginalized section of the people with respect to their subsidiary income and also provide them nutritious egg and meat for their own consumption (Padhi, 2016). The role of backyard poultry farming is now gaining recognition in augmenting local requirements of eggs and poultry meat in the state. But contrary to fast national growth, poultry production in HP had grown slowly due to sluggish growth of organized commercial poultry. The total poultry population in Himachal Pradesh is 13.41 lac birds (2019 census) having grown by 21.46% during 2012-19 period, most of this growth is contributed by backyard poultry farming. Backyard poultry serves as an inexpensive means for households to generate highly nutritious food items at minimal cost (Alders *et al*., 2009; Pica-ciamarra and Otte, 2010). The per capita egg availability of 14 eggs/annum has remained constant over last few years but it is far lesser than national per capita availability of 79 eggs/annum (BAHS, 2019). Apart from topographical and agro-climatic limitations, other major constraints associated with commercial poultry in hills are unavailability of quality chicks of high yielding strains, non-availability and high cost of feed and feed ingredients, poor managemental skill of ordinary farmer, lack of organized marketing and finances to operate large scale poultry enterprises.

The state has high and increasing local demands for eggs and poultry meat which is being largely fulfilled by supplies from adjoining states at comparatively high

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prices. To improve the socio-economic status of the farmers, backyard poultry production is a handy enterprise with low cost initial investment, but high economic return along with guarantee for improving protein deficiencies among the poor. Traditionally native chicken used for backyard poultry production are having low production potential around 60-80 eggs per year, thus making the backyard poultry less economical. To meet the growing demands of the population and to improve the per capita consumption among the rural people, aim is to increase the production performance of birds reared under backyard poultry production. 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). This breed is used to produce improved germplasm suitable for backyard rearing in India. The knowledge of performance of economic traits will help in designing the selection and breeding programme for further improvement. Growth and production traits of a bird indicate its genetic constitution and adaptation with respect to the specific environment (Ahmed and Singh, 2007). Since little information exists on production characteristics of Dahlem Red birds, so performance recording and selection of Dahlem Red birds are important for their subsequent use in cross breeding programme. Thus the present study is being carried out to evaluate the growth and production performance traits and to estimate the phenotypic time trend of Dahlem Red birds maintained under All India Coordinated Research Project on Poultry (Rural Poultry Unit, Palampur).

MATERIALS AND METHODS

Dahlem Red birds in the present study were procured from Central Poultry Development Organization, Chandigarh. These birds were then reared under farm conditions and further produced through selective breeding. Farm performance data of three consecutive generations had been evaluated on farm for various growth performance traits. The birds were maintained in floor pens on deep litter system for a period of 72 weeks. The birds were provided starter feed up to 0-6 week, grower feed 7-18 week and layer feed 18 week onward.

Growth performance data for the present study is being collected from the performance records maintained at Poultry Farm, Palampur under AICRP on Poultry Breeding. Birds were kept in deep litter system for a period of 72 week in ratio of 1 male to 8 females. The performance traits evaluated were growth traits (Chick weight at day old stage, 4th week BW, 8th week BW, 12th week BW, 20th week BW and 40th week BW), age at sexual maturity (ASM), hen housed egg production (HHEP), hen day egg production (HDEP) and survivor egg production (SEP) at 40 weeks, 52 weeks and 72 weeks of age and egg weight at 28 weeks, 40 weeks, 52 weeks of age. The phenotypic means and variability for different traits was estimated generation wise and the phenotypic time trends over the generations was estimated for various growth and performance traits.

Phenotypic trend per year was estimated as the linear regression of the population performance (P) on time (year).

$$\Delta P = b_{P.T} = \frac{\Sigma Pt}{\Sigma t^2}$$

Where,

b_{PT} = is regression of population performance (P) on time (t)

$\sum Pt$ = corrected sum of product for performance and time

$$= \Sigma Pt - \frac{\Sigma P \Sigma t}{N}$$

$\sum P^2$ = corrected sum of square of performance (trait)

$$= \Sigma P^2 - \frac{(\Sigma P)^2}{N}$$

$\sum t^2$ = corrected sum of square for time taken as deviation from its means

$$= \Sigma t^2 - \frac{(\Sigma t)^2}{N}$$

N = Total number of records

RESULTS AND DISCUSSION

The phenotypic mean estimated for growth performance traits viz. growth (Chick weight, 4th week BW, 8th week

BW, 12th week BW, 20th week BW and 40th week BW), age at sexual maturity (ASM), hen housed egg production (HHEP), hen day egg production (HDEP) and survivor egg production (SEP) at 40 weeks, 52 weeks and 72 weeks of age and egg weight at 28 weeks, 40 weeks, 52 weeks and of age are presented in Table 1. In growth traits, day old chick weight, 20th week BW and 40th week BW was higher in Generation 1(G1), whereas 4th week BW, 8th week BW, 12th week BW was higher in Generation 2 (G2). Age at sexual maturity (age at first egg) is observed least in G1, whereas age at 25% HHEP and age at 50% HHEP is similar in G1 and G2. Hen housed egg production, hen day egg production and survivor egg production up to 40, 52 and 72 weeks was more in G3 whereas egg weight at 28, 40 and 52 weeks was higher in G1 in comparison to G2 and G3 which might be due to negative correlation with egg production.

Shivaprasad *et al*. (2017) reported least squares means of body weight at 4, 8, 20, and 40 weeks in Dahlem red bird were 146.88, 374.28, 1150.70 and 1678.57 g, which is lower than the present study. He also reported age at sexual maturity (181.02 days), higher than the present study, egg production up to 40 weeks of age 71.06 eggs and egg weight at 32 and 40 weeks of age 52.81 and 56.25 g respectively. Jha *et al*. (2013) in comparison to present study reported lower body weight of day old chick (33.24), 4 week (145.82), 8 week (495.46), 12 week (812.75), 16 week (1243.46), 20 week (1546.31) and 40 week (1795.17) in Dahlem Red bird. However, age at sexual maturity (143.65) is similar to present finding. Niranjan *et al*. (2008) compared the growth and production performance of 4 chicken varieties developed for backyard farming. The body weights were significantly ($P<0.05$) varied in 4 chicken varieties. The body weights were significantly

Table 1: Performance evaluation of Dahlem Red birds for growth traits over different generations under farm conditions

Generations	Generation 1	Generation 2	Generation 3
Body Weight (g)			
Day old	38.47 ± 0.50^{a}	36.81 ± 0.30^{b}	36.70 ± 0.29^{b}
4 week	210.76 ± 2.24^{a}	257.35 ± 5.14^{b}	245.92 ± 3.24^{b}
8 week	504.39 ± 5.37^{a}	668.68 ± 8.81^{b}	617.09 ± 13.75^{c}
12 week	809.37 ± 14.93^{a}	1090.67 ± 8.81^{b}	1076.39 ± 11.22^{b}
20 week	1637.48 ± 15.48^{a}	1600.34 ± 11.60^{ab}	1561.50 ± 14.17^{b}
40 week	1910.26 ± 20.26^{a}	1662.96 ± 11.94^{b}	1627.76 ± 12.20^{b}
Egg weight (g)			
28 week	52.77 ± 0.39^{a}	50.45 ± 0.28^{b}	49.25 ± 0.15^{c}
40 week	58.95 ± 0.43^{a}	53.72 ± 0.41^{b}	52.35 ± 0.26^{c}
52 week	59.36 ± 0.11^{a}	56.55 ± 0.47^{b}	54.71 ± 0.20^{c}

Means with different superscript in rows differ significantly.

Table 2: Performance evaluation of Dahlem Red birds for production traits over different generations under farm conditions

Generations	Generation 1	Generation 2	Generation 3
ASM (days)			
Age at 1st Egg	140	133	151
Age at 25% HHEP	163	162	167
Age at 50% HHEP	176	183	176
Egg production up to 40 weeks			
Hen housed	66.90	67.93	76.49
Hen day	74.46	72.48	78.32
Survivor	83.47	79.30	80.35
Egg production up to 52 weeks			
Hen housed	102.35	103.90	134.01
Hen day	121.83	115.62	138.45
Survivor	146.63	132.79	142.50
Egg production up to 72 weeks			
Hen housed	145.15	141.94	208.35
Hen day	191.88	175.04	219.84
Survivor	267.18	215.99	232.43

Table 3: Phenotypic time trend estimates of Dahlem Red birds

Traits	Phenotypic Trend	Traits	Phenotypic Trend
Body weight		HHEP	
Day old	-0.89	40 week	4.79
4 week	17.58	52 week	15.83
8 week	56.35	72 week	31.6
12 week	133.5	**HDEP**	
20 week	-37.99	40 week	1.93
40 week	-141.2	52 week	8.31
		72 week	13.98
Egg Weight			
28 week	-1.7	**SEP**	
40 week	-3.3	40 week	1.56
52 week	-2.3	52 week	2.06
Age at first egg	5.5	72 week	-17.37
Age at 25% HHEP	2.0		

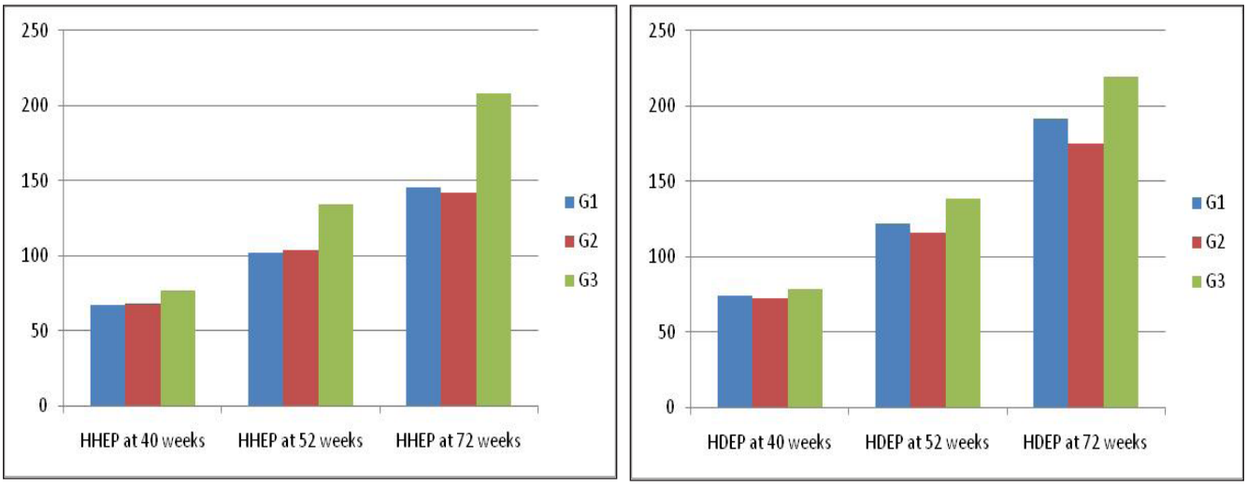

Fig. 1: HDEP and HHEP at 40, 52 and 72 weeks of age over the last three generations

higher in C_1 variety and Vanaraja and lower in Gramapriya. Similarly the egg weights were significantly (P<0.05) higher in C_1 cross throughout the laying period. The egg production in C_1 cross was better than Vanaraja and C_2 cross at all ages; however the egg production was on par with Gramapriya at 64 and 72 weeks of age. Yadav *et al*. (2017) reported annual egg production (81), average age at first laying (181 days) average egg weight (34.3 gms) body weight 542 gms at 8 weeks in male and 450 gms in female, 885 gms at 12 weeks in males and 772 gm in females and at 72 weeks 1800 gms in males and 1578 gms in females in Ankaleshwar breed of poultry. Haunshi *et al*. (2011) compared the Assel and Kadaknath breed of poultry and observed that the Aseel breed showed ($P < 0.001$) higher BW at different ages; greater egg weights at 28, 32, and 40 wk of age than the Kadaknath breed. Whereas the Kadaknath breed reached sexual maturity at an early age and it had higher 40 wk egg production ($P < 0.001$). Alireza *et al*. (2015) observed the average weight of native hen and rooster pullets in Isfahan Province at ages of 8, 12 and 24 week that were respectively 671±109 and 853 ±125, 929 ±177 and 1199 ± 237, 1765 ±363 and 2167±335 g which is higher than the present findings.

Kalita *et al*. (2017) compared the performance evaluation of PB2X indigenous and Dahlem red birds under intensive

system of rearing and reported delayed age at sexual maturity (ASM) 172.36 ± 5.26 days in PB-2 × indigenous and 158.23±2.75 days in Dahlem Red bird in comparison to present study. Egg production up to 40 and 52 weeks and egg weight at 40 weeks and 52 weeks of age were recorded as 39.20 and 70.23, 39.64±2.53 g and 49.20±1.25 g, respectively in PB-2 × Indigenous bird and 82.56 and 124.76, 48.60±3.55 g and 54.62±2.73 g in Dahlem Red bird, respectively.

The phenotypic means and variability for different traits was estimated generation wise and the phenotypic time trends over the generations was estimated for various growth performance traits. The analysis revealed positive phenotypic trend in 4 week body weight (17.58 g), 8 week body weight (56.35 g), 12 week body weight (133.5 g), age at first egg (5.5 days) and age at 25% HHEP (2.0 days). The hen housed and hen day egg production at 40, 52 and 72 weeks of age showed positive phenotypic trend of 4.79 and 1.93, 15.83 and 8.31, 31.6 and 13.98 eggs, respectively. Further, survivor egg production also showed positive trend estimates at 40 and 52 weeks. Negative trends were observed in survivor egg production at 72 week, growth traits *viz*. day old chick weight (-0.89 g),20 week BW (-37.99 g), 40 week BW (-141.2 g) and egg weight at 28 week (-1.7 g), 40 week (-3.3 g) and 52 week (-2.3 g).

The result of present study were consistent with earlier finding of Dinesh *et al*. (2018) in native birds and observed positive phenotypic trends in day old chick weight, 8 weeks BW, 20th week body weight, egg weight at 28, 40 and 52 weeks, HDEP at 40, 52 & 72 weeks of age. However negative or declining trends were observed in growth traits *viz*. 4 weeks BW (-16.4 g) and 40 weeks BW (-102.9 g). The results of present analysis indicated the effectiveness of the selection along with improved management for bringing improvement in egg production traits of the population in successive generations.

CONCLUSION

Positive phenotypic trends were observed for body weight (4, 8 and 12 weeks), age at first egg and age at 25% HHEP. Further, hen housed and hen day egg production also revealed positive phenotypic trend. Negative trends were observed in survivor egg production at 72 week, growth traits (day old chick weight, 20 week, 40 week BW) and egg weight. The positive phenotypic trends indicated the effectiveness of the selection along with improved management for bringing improvement in egg production traits of the population in successive generations. The improvement in Dahlem Red population would also result in subsequent improvement of crosses developed for rural poultry. The information generated from the present investigation could be considered as a progressive step for effective propagation of germplasm developed for rural poultry.

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