Genetic and phenotypic response to selection in various traits of IWH and IWI strains of White Leghorn under long term selection

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ABSTRACT

A study was undertaken on male (IWH) and female (IWI) line of White leghorn completing 29th generation of selection. The average age at sexual maturity declined significantly in both the strains with the estimates of –1.404 and –1.28 days in IWH and IWI strains respectively on phenotypic scales. Corresponding estimates on genetic scales were –0.47 and –0.35 days per generation in IWH and IWI strains. The change in the average response per generation for egg weight at 28th and 40th wk of age in both the selected strains were mostly non-significant except for significant negative genetic association of 40 weeks egg production with egg weight at 40th week of age in IWI strain. Egg production (40th wk) improved significantly in the both the selected strains with the estimates of 0.880.15 and 0.690.15 eggs per generation in IWH and IWI strains on genetic scale. Average responses per generation for various economic traits observed at 64th wks of age revealed that body weight (BW-64) declined non-significantly in both the selected strains except for positive but non-significant response for 64th wk body weight on phenotypic scale.

Key words: Selection, genetic gains, White Leghorn

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INTRODUCTION

The commercial layer breeders are using specialized male and female lines for production of commercial layers. At present most of the high yielding pure line strains of layer stocks appear to be on the verge of approaching plateau, due to exhaustion of additive genetic variance and/ or other reasons (Bais *et al.* 2008). The IWH and IWI strains of White Leghorn are undergone family index selection for increased egg production to 64 weeks of age over more than 35 years. In any selection programme, the selection is practiced either for a single or a combination of traits and the individuals above a certain value for the criteria of selection are selected as parents, thus selection causes the variance among the parents to be reduced. Therefore, the present study was carried to evaluate phenotypic and genetic gains realized in various economic traits in two strains of White Leghorn selected for improved egg production.

MATERIALS AND METHODS

Two White Leghorn pure line populations viz. IWH & IWI and along with control (IWC) maintained at Experimental Layer Farm ICAR- Central Avian Research Institute, Izatnagar, Bareilly (U.P.) since early seventies and completing 29th generation as closed flock constituted the genetic stock for the present study. Having undergone family index selection over 28 generation, the IWH (male) and IWI (female) lines were hatched simultaneously along with the control line (IWC).

All the selected and control lines were maintained under standard and uniform management condition. In general chicks were obtained in 3-6 hatches in different generations. The chicks were identified individually and brooded on deep litter up to 8 weeks of age. After separation of sexes at 8 weeks of age, only 2 male chicks per dam in the selected lines and 1 male chick per dam in the control line and all the female chicks were retained for further study. The pullets were housed in 3 tier individual laying cages at about 18 weeks of age.

The hatch corrected data were utilized for estimating genetic parameters by full sib correlation method using mixed model Least squares and maximum likelihood (LSMLMW) computer programme (Harvey 1990). The phenotypic responses per

generation within line for economic traits were estimated as the regression of generation means (Y) on generation numbers (X). The realized genetic gains per generation in both selected and correlated traits were estimated by the regression of control deviated generation means of selected lines on generation numbers.

RESULTS AND DISCUSSION

Average response per generation for various economic traits up to 64 wks of age were estimated on genetic and phenotypic scales and presented in table 1 and 2. The average response per generation for initial body weight (16th wk) was found to be negative and non significant for both the selected strains, both on genetic and phenotypic scales; the estimates were –24.4523.01 g, -10.7918.88 g and –4.2920.13 g in IWH, IWI and IWC strains respectively. For 40th wk body weight, the average response per generation was negative and significant with the estimates of –4.051.61** g and –6.111.82** g on genetic and phenotypic scales respectively in IWH strain. The results agreed well with the report of Bais *et al.* (2008). The negative response may be attributing to negative genetic association of 40 weeks body weight with egg production for this line. In IWI strain the estimates were positive but non-significant with the estimates of 6.126.15 g and 4.066.15 g on genetic and phenotypic scales respectively.

The average age at sexual maturity declined significantly in both the strains with the estimates of –1.4040.16** days and –1.280.13** days in IWH and IWI strains respectively on phenotypic scales. Corresponding estimates on genetic scales were –0.470.16** days and –0.350.11 days per generation in IWH and IWI strains. The egg production was the criterian of selection hence, reduction in age of sexual maturity might have contributed to the principal trait i.e. egg production upto 64 weeks of age. Similar findings/arguments have also been reported by Bais *et al.* (2008). Kumar and Singh (2009) also reported reduction in age at sexual maturity for broiler dam and sire lines. The reduction in ASM is expected when the criterion of selection is egg production at fixed age. In such cases the selection for increased number of eggs favors the early maturity on account of their negative genetic association (Bais *et al.* 2008).

The change in the average response generation for egg weight at 28th and 40th wk of age in both the selected strains (H & I) were mostly non-significant except for significant negative genetic association of EP (40th wk) with egg weight at 40th week of age in IWI strain. At 64 weeks of age body weight (BW-64) and egg weight (EW-64) declined non-significantly in both the selected strains except for positive but non-significant response for 64th wk body weight on phenotypic scale and for 64th wk egg weight on

Table 1. Phenotypic response in various production traits in

Traits	Strain	
	IWH	**IWI**
BW at 16thwk	-24.45±23.012	-10.79±18.88
BW at 40thwk	-6.11±1.826**	4.06±6.15
BW at 64thwk	-5.81±19.58	8.26±20.48
ASM	-1.404±0.16**	-1.28±0.13**
EW at 28th wk	-0.324±0.29	-0.16±0.28
EW at 40th wk	0.019±0.047	-0.03±0.04
EW at 64thwk	-0.45±0.32	-0.15±0.48
EP up to 40th wk	1.452±0.14**	1.253±0.15**
EP up to 64thwk	1.55±0.37**	1.65±0.36**

** Significant at P<0.01; BW= Body weight, ASM = age at sexual maturity,
EW= egg weight, EP= egg production.

Table 2. Genetic response in selected strains and time trend in control population for various production traits.

Traits	Strain		
	IWH	IWI	IWC
BW at 16thwk	-20.15±10.59	-6.49±11.60	-4.29±20.13
BW at 40thwk	-4.05±1.61**	6.12±6.15	-2.06±1.48
BW at 64thwk	-32.87±17.36	-18.60±16.90	26.87±14.38
ASM	-0.47±0.16**	-0.35±0.11**	-0.93±0.15**
EW at 28th wk	0.14±0.22	0.297±0.17	-0.46±0.31
EW at 40th wk	0.06±0.04	-0.11±0.03**	0.076±0.04
EW at 64thwk	-0.08±0.32	0.22±0.25	-0.37±0.36
EP up to 40th wk	0.88±0.15**	0.69±0.15**	0.56±0.17**
EP up to 64thwk	1.22±0.29**	1.32±0.68	0.33±0.38

** Significant at P<0.01; BW= Body weight, ASM = age at sexual maturity,
EW= egg weight, EP= egg production.

genetic scale in IWI strain. The negative genetic gains in egg weight indicated a declining trend for egg weight across the generation and agreed full with the findings of Pattanayak and Patro (1995) and Bais *et al.* (2008).

Egg production (40th and 64 wk) improved significantly in the both the selected strains with the estimates of 1.22 0.29** and 1.320.68** at 64 weeks of age in IWH and IWI strains on genetic scale. Corresponding estimates on phenotypic scales were observed to be 1.55 0.37** and 1.650.36** in IWH and IWI strains. In contrast to present study Shrivastava *et al.* (1989) could not find any significant response in spite of improvement in the selected trait. However, John *et al.* (2000), Chatterjee and Mishra (2002) and Devi and Reddy (2004) reported positive and significant phenotypic response in egg production up to 280 days of age.

Average response per generation for various economic traits up to 64th wk of age in the control population revealed non-significant changes in body weight at 16th and 40th wk of age and egg weight at 28th and 40th weeks of age. However, for ASM and 40th wk egg number, the changes were significant which might be due significant changes due to overall improved managemental conditions provided to the control population along with the selected strains in the preceding few generations and also natural selection of birds of 64 wks of age. It is quite natural that the birds reproduce next generation after 64 wks of age will good egg producers. It will be important to mention here that for 64th wk production traits, IWC showed non-significant changes in the preceding generations.

The genetic gains realized in both the strains were indicative of successful application of selection programme for improving egg production.

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