Phenotypic and genetic parameters of economic traits in IWH and IWI strains of White Leghorn under selection

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ABSTRACT

Genetic and Phenotypic parameters were studied in various economic traits in IWH and IWI strains of White Leghorn. The heritability of average age at sexual maturity and egg production up to 40 and 64 weeks of age was observed to be of low to moderate in magnitude, while no definite trend of gene effects was observed for age at sexual maturity and egg production up to 64 weeks of age in both the strains. For egg production up to 40 weeks of age additive and sex-linked gene effects were found to be important in IWI strain. Most of the estimates of genetic correlation estimated from sire component of co-variance were higher than the dam component of covariance, which were also inconsistent in direction in various strains. The egg production up to 64 weeks of age has got positive genetic association with body weight at various ages (16, 40 and 64 week) in both the strains and negative genetic association with age at sexual maturity in IWI. Association of egg production up to 64 weeks of age with egg weight at various ages varies from very low to very high in magnitude, which were positive in IWH strain, while no definite trend regarding direction of association was observed in IWI strain. General trend of association of egg production up to 64 weeks of age with egg production up to 40 week was positive and high in both the strains under study.

Key words: Egg production, genetic parameters, White Leghorn, IWH, IWI
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INTRODUCTION

White leghorn (WLH) is the breed having more than 90% contribution to layer industry and the genetic improvement in WLH is highly advantageous for exploiting the production potential of this breed (Anees *et al*. 2010). After many generations of selection, breeders have now developed layers which mature at a young age. There have been desirable improvements in other economically important traits also viz. initial egg weight and body weight at housing, mature mean egg weight and body weights and finally production during residual period of lay. In selection programme the estimates of phenotypic and genotypic parameters and association of economic traits of each generation is necessary for targeted traits. Keeping this in view the present study was undertaken to study the heritability, genetic and phenotypic correlations among different traits and to compare male (IWH) and female (IWI) strains of White Leghorn up to 64 weeks of age selected for egg production.

MATERIALS AND METHODS

The present study was conducted at Layer farm of ICAR- Central Avian Research Institute, Izatnagar, Bareilly (UP). Data were collected from S_{29} generation of IWH (male) and IWI (female) strains of White leghorn, which is under selection for increasing egg production. The chicks and growers were reared on deep litter. Thereafter, they were housed in the individual laying cages (California cage house) after completion of 16th wk of age. Standard and uniform managemental conditions were provided during brooding, growing & adult stages. The data on individual birds were collected for 2037 birds of IWH (progeny of 49 sires and 297 dams) and 1693 of IWI (progeny of 49 sires and 298 dams) of 29th generation. The traits studied were age at sexual maturity (ASM); body weight at 16 (BW-16), 40 (BW-40) & 64 weeks of age (BW-64); egg weight at 28 (EW-28) & 40 weeks of age (EW-40) and hen housed egg production up to 40 (EP-40) & 64 weeks of age (EP 64). The hatch corrected data were utilized for

Table 1. Least square means of various economic traits of IWH and IWI strain

Traits	IWH	IWI
BW-16 (g)	873.31±2.36	918.32±3.25
BW- 40 (g)	1446.78±3.71	1510.09±5.04
BW- 64 (g)	1558.72±4.29	1635.35 ±5.87
ASM (days)	140.14±0.25	145.32±0.31
EW-28 (g)	45.98±0.06	49.39±0.08
EW- 40 (g)	53.12±0.06	54.54± 0.07
EW-64 (g)	55.85 ±0.06	55.26 ±0.09
EP-40	110.71±0.77	100.77±0.92
EP-64	242.76 ±1.13	227.15 ±1.38

estimating least squares mean and genetic parameters by full sib correlation method using mixed model Least squares and maximum likelihood (LSMLMW) computer programme (Harvey 1990).

RESULTS AND DISCUSSION

The least squares mean along with standard errors of different economic traits of IWH and IWI strains are given in table 1. The estimates of body weight were 873.31 and 918.32 g at 16 week of age in IWH and IWI, respectively. Corresponding body weight were 1446.78 g & 1510.09 g at 40 weeks of age and 1558.72 g & 1635.35 g, at 64 week of age in both the strains. The body weights at 16 weeks of age and age at sexual maturity were lower than estimates reported by Anees et al. (2010). The estimates of initial egg weight at 28th weeks of age were 45.98 g and 49.39 g in IWH and IWI strain, respectively, while corresponding estimates of egg weight at 40th weeks of age were 53.12g and 54.54g, respectively. Hen housed EP-40 were 110.71 and 100.77 and EP-64

Table 2. Heritability estimates of various economic traits of IWH and IWI strains

Strain	Traits	Sire	Dam	Sire + Dam
IWH	BW-16	0.16±0.05	0.14±0.07	0.15±0.04
	BW- 40	0.18±0.06	0.18±0.07	0.18±0.04
	BW-64	0.22±0.07	0.23±0.07	0.22±0.04
	ASM	0.06±0.04	0.16±0.07	0.11±0.03
	EW-28	0.31±0.08	0.09±0.06	0.20±0.05
	EW-40	0.19±0.06	0.08±0.06	0.14±0.04
	EW-64	0.05±0.03	< 0	-0.0009
	EP-40	0.13±0.03	0.14±0.07	0.07±0.03
	EP-64	<0	0.23±0.08	0.11±0.03
IWI	BW-16	0.31±0.10	0.25±0.09	0.27±0.06
	BW- 40	0.43±0.12	0.29±0.09	0.36±0.07
	BW-64	0.27±0.09	0.019±0.09	0.23±0.05
	ASM	0.19±0.07	0.18±0.09	0.19±0.05
	EW-28	0.33±0.10	0.17±0.09	0.25±0.06
	EW-40	0.39±0.11	0.12±0.08	0.25±0.06
	EW-64	0.03±0.04	0.03±0.08	0.03±0.03
	EP-40	0.14±0.06	0.01±0.08	0.07±0.04
	EP-64	0.09±0.04	<0	0.02±0.03

Table 3. Genetic and phenotypic correlation for egg production up to 64 weeks with other production traits of IWH and IWI strains

Strain	Traits	Sire (rGS)	Dam (rGd)	Sire± Dam(rGsd)	Phenotypic (rp)
IWH	ASM	0.91±0.22	-0.26±0.27	-0.15±0.23	-0.19±0.02
	BW-16	>1	0.031±0.26	0.42±0.17	0.09±0.02
	BW-40	0.95±0.09	0.17±0.25	0.25±0.18	0.06±0.02
	BW-64	0.53±0.61	0.35±0.22	0.33±0.17	-.05±0.02
	EW-28	0.09±0.75	0.05±0.35	0.04±0.19	0.01±0.02
	EW-40	-0.67±0.46	0.14±0.31	-0.35±1.95	-0.38±0.02
	EW-64	>-1	0.49±0.34	>1	-0.03±0.02
	EP-40	-0.23±0.36	0.83±0.08	0.84±0.06	0.72±0.02
IWI	ASM	>-1	0.08±0.60	>-1	0.43±0.03
	BW-16	0.52±0.19	-0.51±0.39	0.26±0.43	0.04±0.03
	BW-40	0.31±0.25	-0.57±0.32	-0.05±0.43	0.002±0.03
	BW-64	0.53±0.30	0.43±0.50	0.37±0.42	-.21±0.03
	EW-28	-0.002±0.29	-0.43±0.53	-0.28±0.45	-0.03±0.03
	EW-40	0.02±0.28	-0.29±0.68	-0.13±0.49	-0.07±0.03
	EW-64	0.01±0.58	0.93±0.19	0.74±0.49	0.32±0.02
	EP-40	>1	>-1	0.38±0.75	0.71±0.02

242.76 and 227.15 in IWH and IWI strains, respectively. The estimates of egg weight and egg production for both the strains were within normal range and comparable to Anees et al. (2010) and Qadari et al. (2013).

The heritability's for economic traits up to 64 wks of age were estimated and presented in table-2. A perusal of result indicates that in various strain body weight and egg weight at various age interval were low to moderately heritable. The importance of additive and or sex-linked gene effects was visible in the inheritance of BW-16 in both the strains and for BW-40 and BW-64 in IWI strains only. An additive or sex-linked gene effect in influencing egg weight at various intervals was also observed at 28th and 40th wk of age in both the selected strains. The heritability of ASM, EP-40 and EP-64 was observed to be of low to moderate in magnitude, while no definite trend of additive or non-additive gene effects was observed for ASM and EP-64 in both the strains. For EP-40 additive and sex-linked gene effects were found to be important in IWI strain. It is in comparison with Bais *et al.* (1997). In contrast to present study high heritability estimates for body weight at various ages were reported by Qadri et al. (2013)

Genetic and phenotypic correlation of EP-64 with other economic traits (body weights, egg weights and ASM) up to 64 weeks of age were estimated and presented in table 3. A perusal of table revealed that EP-64 has got positive genetic association (r_{GS}) with body weights at various ages (16, 40 and 64 week) in IWH and IWI strains. Association of EP-64 with egg weight at various ages varied from very low to very high in magnitude, which were positive in direction in IWH strain, while no definite trend regarding direction of association was observed in IWI strain. Kumar *et al.* (2004) reported negative genetic correlation of age at first egg with egg production up to 40 and 64 weeks of age. The positive genetic and phenotypic correlations of EP-64 with BW-16 and BW-40 indicate the importance of body weight for higher egg production. Crawford (1990) also reported that body weights are positively correlated with egg production. General trend of association of EP-64 with EP-40 was positive and high in both the strains under study.

The body weight and egg weight at various ages were higher in IWI strain as compared to IWH strain while

egg production at various ages was higher in IWH strain. In general the heritability of average age at sexual maturity and egg production up to 40 and 64 weeks of age was observed to be of low to moderate in magnitude. The genetic associations of egg production up to 64 weeks of age with egg weight at various ages were positive in IWH strain, while no definite trend was observed in IWI strain.

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