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RESEARCH ARTICLE

Estimates of Heritability and Correlations of Economic Traits in Two Strains of White Leghorn

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ABSTRACT

Indian White Leghorn N strain (IWN) and Indian White Leghorn P strain IWP are the two strains of White Leghorn maintained at All India Co-ordinated Research Project (AICRP) on Poultry, Kerala Agricultural University (KAU), Mannuthy centre. The data of 20th generation on age at first egg or Age at Sexual Maturity (ASM), 16 and 40 week body weight (Bw16, Bw40), 28 and 40 week egg weight (Ew 28, Ew40) and egg production up to 40 weeks age (En40) pertaining to 2120 and 2112 of IWN and IWP strains of White Leghorn progeny belonging to 50 sires and 300 dam formed the basis of this study. The mean values of IWN strain for average Age at Sexual Maturity (ASM), 16 & 40 week body weight (Bw 16, Bw40), 28 & 40 week egg weight (Ew28 & Ew40) and En40 & En64 were 143.85 days, 1.116 kg & 1.584 kg, 50.63 g & 54.26 g and 115.99 & 237.13 respectively. The mean values of IWP strain for average age at first egg (ASM), 16 & 40 week body weight (Bw 16, Bw40), 28 & 40 week egg weight (Ew 28 & Ew 40) and En40 & En64 were 137.55 days, 1.131 kg & 1.651 kg, 50.42 g & 54.01g and 121.21 & 246.40, respectively. The production performance of IWP strain is numerically more than IWN strain in-terms of egg production but the egg weight of IWN is higher than IWP, indicates that the egg production and egg weight are negatively correlated. For both the strains, heritability of ASM, egg weight and egg production was low to moderate. Higher heritability was recorded for body weight characters. Positive correlation was observed between both egg weight characters on genetic and phenotypic scale as well as between body weight characters. Negative correlation was noticed between ASM and En40 as well as Egg weight and Egg production traits on both genetic and phenotypic scale.

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INTRODUCTION

White Leghorn is the main promising breed of layer industry with more than 90 per cent population for egg production. The overall genetic improvement in economic traits of White Leghorn is inevitable for sustainable breeding programs and to exploit the production potential of this breed. The analysis of the genetic parameters is highly necessary for genetic improvement of these traits. The estimates of genetic and phenotypic parameters of each generation should be studied for desired improvement in economic traits. Therefore, the present study was undertaken with IWN and IWP strains of White Leghorn selected for improved egg production at All India Co-ordinated Research Project (AICRP) on poultry, Mannuthy centre.

MATERIALS AND METHODS

The Indian White Leghorn N strain (IWN) and Indian White Leghorn P strain (IWP) are major White Leghorns maintained at AICRP on poultry Improvement, Mannuthy centre under Kerala Agricultural University contributed the data for this study. The data collected from 2120 progeny of IWN strain and 2112 progeny of IWP strain produced by 50 sires and 300 dams. The chicks were obtained from 5 hatches at 10 days interval. The data on average age at first egg or Age at Sexual Maturity (ASM) in days, Body weight at 16 and 40 weeks of age in kg (Bw16, Bw40), Egg weight at 28 and 40 weeks of age in gram (Ew28, Ew40) and egg production up to 40 weeks of age in numbers (En 40) were recorded on individual basis. The hatch effect was adjusted by using least square constants (Harvey, 1979) and hatch corrected data were utilized for the estimation of heritability and correlations (King and Henderson, 1954). The standard errors of heritability, genetic and phenotypic correlations were estimated as per Dickerson (1960), Robertson (1959) and Gounden (1962), respectively.

RESULTS AND DISCUSSION

The overall performance of IWN and IWP strains for economic traits are depicted in Table 1. The average age at first egg or Age at Sexual Maturity (ASM) recorded was 143.85 ± 0.04 and 137.55±0.04 for IWN and IWP strains of White Leghorn, respectively. The birds started lying two days earlier than the previous generation as reported by Anon (1999) and IWP strain started laying one week prior to IWN strain.

Table 1: Overall performance of IWN and IWP strains of White Leghorn

Traits	IWN	IWP
Number housed	2120	2112
Body Weight (Kg.)		
16 weeks Mean ± SE	1.116± 0.0006	1.131± 0.0008
40 weeks Mean ± SE	1.584±0.0007	1.651±0.001
Average age at first egg or Age at Sexual Maturity (days)	143.85±0.04	137.55±0.04
Egg weight at		
28 weeks Mean ± SE (g.)	50.63±0.01	50.42±0.01
40 weeks Mean ± SE (g.)	54.26±0.02	54.01± 0.02
Egg number upto 40 weeks		
Hen housed	115.99±0.03	121.21±0.02
Hen day : 17:40	117.35	124.03
21-40	116.63	123.72
Survivor	118.09	125.23
Egg number upto 64 weeks		
Hen housed	237.13±0.10	246.40±0.04
Hen day : 17:64	242.09	250.13
21-64	241.54	249.84
Survivor	243.72	251.95

The body weight at 16 & 40 weeks of age was 1.116 ± 0.0006 kg & 1.584 ± 0.0007 kg and 1.131 ± 0.0008kg & 1.651±0.001 kg for IWN and IWP strains, respectively. A slight improvement in body weight (20 g) was noticed as compared to the previous generation (Anon, 2000). The egg weight at 28 & 40 weeks of age recorded was 50.63 ± 0.01 g & 54.26 ± 0.02 g and 50.42±0.01 g & 54.01± 0.02 g for IWN and IWP strains, respectively. A slight improvement in egg weight at both the age groups (20 g) was noticed as compared to the previous generation (Anon, 2000).

The hen housed egg production at 40 & 64 weeks of age recorded was 115.99 ± 0.03 & 237.13±0.10 and 121.22 ± 0.02 & 246.40±0.04 for IWN and IWP strains respectively. This shows improvement of 12-14 eggs during 40 weeks and marginal improvement during 64 weeks of age over previous generation. This inputs showed an improvement in all economic traits over generation in both the strains which might be attributed to the effective selection and breeding for increased egg number and other economic traits.

Heritabilities

The estimates of heritability along with genetic and phenotypic correlations among various economic traits of IWN strain are presented in Table 2 and for IWP in Table 3. The heritability value for age at first egg derived from sire, dam and sire + dam components for IWN and IWP strains were 0.28, 0.30 and 0.29; 0.32, 0.12 and 0.22, respectively. It is in comparison with the estimates reported by Bais *et al*. (1997). The heritability estimate for both body weight traits was moderate to high.

At 16 weeks of age the body weight heritabilities estimated were 0.38, 0.50 and 0.44; 0.51, 0.39 and 0.42 from sire, dam and sire + dam components for IWN and IWP strains. At 40 weeks of age the body weight heritabilities estimated were 0.41; 0.45, 0.39 and 0.42 from sire, dam and sire + dam components for IWN and IWP strains. Moderate to high heritability was also estimated and reported by Singh *et al*. (1996) and Vasu *et al*. (2004). The estimates obtained from sire component were higher than dam component.

The heritability estimates for egg weight at 28 and 40 weeks of age in both the strains were low to moderate in magnitude. The higher heritability for egg weight at 28 weeks of age from sire component than dam component in IWN strain is in agreement with the findings of Chaubal *et al.* (1994). This may reveals the predominance of sex linked and additive gene effects. The higher heritability value for 40-week egg weight obtained from dam component is in concurrence with the findings of Brah *et al*. (1998). The heritability estimate for 40-week egg production from dam component was low (0.29 & 0.26) in magnitude. Higher estimate of sire component was in agreement with the reports of Singh *et al.* (1996). This may be due to additive genetic effect. The low heritability values for egg production might be indicated that there was little scope for improving this trait through selection.

Correlations

The genetic correlation between age at first egg and 16 week-body weight was negative, where as, with 40-week body weight it was positive in both the strains. These results were in agreement with the findings of Singh *et al.* (1986). This may indicate that the heavier birds at 16 weeks mature earlier than at 40 weeks of age (Vasu *et al*., 2004). The Phenotypic association of ASM with body weights was negative in direction. The egg production at 40 weeks of age exerted a negative genetic and phenotypic correlation with ASM in both strains of White Leghorn, which is in close agreement with the findings of Poggenpoel *et al*. (1996). The negative association between ASM and egg production implies that improvement in egg production will be resulted in early sexual maturity of birds. The positive association obtained in this study, between ASM and egg weight at 28 and 40 weeks of age in both the strains were obtained from this study on genetic and phenotypic scale as

Table 2: Estimates of heritability (on diagonal) based on sire (row 1), dam (row2), and sire + dam components (row 3), genetic correlations (above diagonal) and phenotypic correlations (below diagonal) among various economic traits in IWN strain of White Leghorn

Average age at first Egg	16 week body weight	40 week body weight	40 week Egg production	28 week Egg weight	40 week Egg weight
0.28±0.08 0.30±0.07 0.29±0.05	-0.05±0.21	0.34±0.10	-0.81±0.04	0.31±0.11	0.25±0.12
-0.10±0.02	0.38±0.11 0.50±0.09 0.44±0.06	0.75±0.04	0.05±0.11	0.35±0.10	0.31±0.10
0.12±0.02	0.43±0.02	0.41±0.11 0.41±0.08 0.41±0.06	-0.12±0.11	0.25±0.11	0.27±0.11
-0.47±0.02	0.09±0.02	0.03±0.02	0.29±0.09 0.34±0.08 0.31±0.05	-0.31±0.11	-0.27±0.11
0.14±0.02	0.17±0.02	0.20±0.02	-0.14±0.02	0.38±0.11 0.36±0.08 0.37±0.06	0.96±0.01
0.12±0.02	0.17±0.02	0.22±0.02	-0.16±0.02	0.63±0.02	0.27±0.08 0.30±0.07 0.28±0.05

Table 3: Estimates of heritability (on diagonal) based on sire (row 1), dam (row2), and sire + dam components (row 3), genetic correlations (above diagonal) and phenotypic correlations (below diagonal) among various economic traits in IWP strain of White Leghorn

Average age at first Egg	16 week body weight	40 week body weight	40 week Egg production	28 week Egg weight	40 week Egg weight
0.32±0.09 0.12±0.06 0.22±0.05	-0.09±0.14	0.09±0.13	-0.44±0.13	0.17±0.14	0.10±0.13
-0.11±0.02	0.51±0.13 0.31±0.07 0.41±0.07	0.53±0.08	-0.10±0.14	0.31±0.11	0.34±0.11
0.03±0.02	0.40±0.02	0.45±0.12 0.39±0.08 0.42±0.07	-0.14±0.13	-0.03±0.12	-0.01±0.12
-0.41±0.02	0.05±0.02	0.05±0.02	0.26±0.07 0.12±0.06 0.19±0.04	-0.34±0.13	-0.24±0.13
0.05±0.02	0.15±0.02	0.09±0.02	-0.14±0.02	0.58±0.14 0.27±0.07 0.42±0.08	0.96±0.01
0.03±0.02	0.18±0.02	0.08±0.02	-0.10±0.02	0.56±0.02	0.48±0.13 0.36±0.08 0.42±0.07

reported by Verma *et al*. (1983). As well the correlation between body weight and egg weight were in positive direction and moderate in magnitude. The same finding was reported by Kumararaj *et al.* (1995). The positive genetic as well as phenotypic association between these traits revealed that heavier birds would produce large sized eggs. Among the body weight traits, positive genetic and phenotypic correlation with magnitude of moderate to high was observed in this study. It is comparable with the findings of Vasu *et al.* (2004). This may be reveled that birds heavier at early age were also heavier at later age due to the pleiotropic actions of genes controlling body weights. The genetic and phenotypic correlation between egg productions at 40 weeks with the egg weight traits was negative in direction as reported by Vasu *et al.* (2004). This may indicate that improvement in egg number will reduce the egg weight at both the age groups. The correlations among egg weights were positive and high in magnitude. It may be revealed that improvement in egg weight at early age would bring concomitant improvement in egg weight at later age.

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