ESTIMATION OF HERITABILITY AND CORRELATION OF ECONOMIC
TRAITS IN IWP STRAIN OF WHITE LEGHORN CHICKEN

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ABSTRACT

The data on age at first egg (ASM), 16, 40 and 64 week body weight (Bw16, Bw40, Bw64), 28
and 40 week egg weight (Ew28, Ew40) and egg production up to 40 and 64 weeks age (En40, En64)
pertaining to 20th generation of IWP strain from 2112 progenies belonging to 50 sires and 300 dam
formed the basis of this study. The mean values for age at first egg (ASM), body weights (Bw16,
Bw40 and Bw64), egg weights (Ew28, Ew40) and egg production up to 40 and 64 weeks age (En40,
En64) recorded were 137 days, 1.131 kg, 1.651 kg, 1.712 kg, 50.42 g, 54.01g, 121.21 and 246.40
eggs respectively. The Heritabilities of ASM, egg weight and egg production was low to moderate.
Higher heritability was recorded for body weight at various intervals. Positive correlation 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 Egg production on both
genetic and phenotypic scale. Negative correlation was noticed between Egg weight and Egg
production on both genetic and phenotypic scale.

INTRODUCTION

The Layer industry in India witnessed a
phenomenal growth in last two decades due the
challenging performance of White Leghorn breed.
White Leghorn is the only breed having
contributing more than 90 per cent to the Indian
layer industry. The genetic improvement in White
Leghorn is paving the way for exploiting the
production potential of this breed. The planning
of sustainable breeding programs will be achieved
by the improvement in the economic traits. The
analysis of the genetic parameters viz., heritability
and correlation between the economic traits is
necessary for achieving 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 on IWP strain of White Leghorn
selected for high egg production at AICRP on
Poultry, Mannuthy centre.

MATERIAL AND METHODS

The IWP strain of White Leghorn maintained at AICRP on Poultry for Egg,
Mannuthy centre under Kerala Agricultural University, Mannuthy, Kerala contributed the data
for this study. The data collected from 20th
generation from progeny (n=2112) produced by
50 sires and 300 dams. The chicks were obtained
in 5 hatches at 10 days interval. The data on
age at first egg in days, Body weight at 16, 40
and 64 weeks of age in kg, egg weight at 28
and 40 weeks of age in gram and egg production up
to 40 and 64 weeks of age in numbers 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
Goulden (1962) respectively.

RESULTS AND DISCUSSION

The overall performance of IWP strain for
economic traits is depicted in Table 1: The
average age at first egg (ASM) in IWP strain of
White Leghorn was recorded as 137.55 ± 0.04.
which was seven days earlier than the previous
generation (144.53 ± 0.04) as reported by
Anonymous (2002). The body weights recorded
at 16, 40 and 64 weeks of age were 1.131 ±
0.0008 kg, 1.651 ± 0.001 kg and 1.712 ± 0.0009 respectively. The egg weight at 28 and 40 weeks of age were 50.42 ± 0.01 and 54.01 ± 0.02 which was slightly higher in both the traits as compared to previous generation (Anonymous 1999). The egg production up to 40 and 64 weeks of age recorded were 121.21 ± 0.02 and 246.40 ± 0.04 eggs indicating 20 eggs improvement over previous generation. This result implies that there may be improvement in all economic traits over generation in IWP strain which might be attributed to the rigorous selection applied for increased egg number and other economic traits.

**Heritability**: The estimates of heritability along with genetic and phenotypic correlations among various economic traits of IWP strain are depicted in Table 2. The heritability value for age at first egg derived from sire, dam and sire + dam components were 0.32, 0.12 and 0.22 respectively. The heritability estimates for body weight traits were moderate to high. At 16 weeks of age the body weight heritabilities estimated were 0.51, 0.31 and 0.41 and for 40 week body weight the estimates were 0.45, 0.39 and 0.42 from sire, dam and sire + dam components respectively. Moderate to high heritability was also reported by Singh et al. (1996) and Vasu et al. (2004). The estimates obtained from sire component were higher than dam component indicates the importance of additive gene action or sex linked gene effects in the inheritance of this trait. The heritability estimates for egg weight at 28 and 40 weeks of age in IWP strain were moderate to high. The higher heritability for egg weight at 28 and 40 weeks of age from sire component in IWP strain was in agreement with the findings of Chaubal et al. (1994). This may indicates the importance of sex linked and additive gene effects. The heritability estimate for 40-week egg production from dam component was low (0.12) in magnitude than sire component. 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 indicates that there is little scope for improving this trait through selection further.

**Correlation**: 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. These results were in agreement with the findings of Singh et al. (1986). This may indicate that the birds heavier at 16 weeks, mature earlier (Vasu et al., 2004). The phenotypic associations of ASM with body weights were negative in direction. The egg production at 40 and 64 weeks of age revealed a negative genetic and phenotypic correlation with ASM, which was in close agreement with the findings of Poggenpoel et al. (1996). The negative association between ASM and egg production indicated that improvement in egg production indicated that improvement in egg number was a limiting factor.

### Table 1. Overall performance (Mean ± SE) of IWP strain of White Leghorn

<table>
<thead>
<tr>
<th>Traits</th>
<th>IWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number housed</td>
<td>2112</td>
</tr>
<tr>
<td>Body Weight (Kg.) at:</td>
<td></td>
</tr>
<tr>
<td>16 weeks</td>
<td>1.131 ± 0.0008</td>
</tr>
<tr>
<td>40 weeks</td>
<td>1.651 ± 0.0010</td>
</tr>
<tr>
<td>64 weeks</td>
<td>1.712 ± 0.0009</td>
</tr>
<tr>
<td>Age at sexual maturity (days)</td>
<td>137.55 ± 0.04</td>
</tr>
<tr>
<td>Egg weight at:</td>
<td></td>
</tr>
<tr>
<td>28 weeks (g.)</td>
<td>50.42 ± 0.01</td>
</tr>
<tr>
<td>40 weeks (g.)</td>
<td>54.01 ± 0.02</td>
</tr>
<tr>
<td>Egg number up to</td>
<td></td>
</tr>
<tr>
<td>40 weeks: Hen housed</td>
<td>121.21 ± 0.02</td>
</tr>
<tr>
<td>Hen day : 16-40</td>
<td>124.03</td>
</tr>
<tr>
<td>Hen day : 21-40</td>
<td>123.72</td>
</tr>
<tr>
<td>Survivor</td>
<td>125.23</td>
</tr>
<tr>
<td>Egg number up to</td>
<td></td>
</tr>
<tr>
<td>64 weeks: Hen housed</td>
<td>246.40 ± 0.04</td>
</tr>
<tr>
<td>Hen day : 17-64</td>
<td>250.13</td>
</tr>
<tr>
<td>Hen day : 21-64</td>
<td>249.84</td>
</tr>
<tr>
<td>Survivor</td>
<td>251.95</td>
</tr>
</tbody>
</table>
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 IWP strain of White Leghorns

<table>
<thead>
<tr>
<th></th>
<th>Average age at first Egg</th>
<th>16 week body weight</th>
<th>40 week body weight</th>
<th>64 week body weight</th>
<th>40 week Egg production</th>
<th>64 week Egg production</th>
<th>28 week Egg weight</th>
<th>40 week Egg weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.32±0.09</td>
<td>-0.20±0.18</td>
<td>0.10±0.19</td>
<td>0.32±0.18</td>
<td>-0.81±0.07</td>
<td>-0.34±0.19</td>
<td>0.27±0.17</td>
<td>0.11±0.19</td>
</tr>
<tr>
<td>2</td>
<td>0.12±0.06</td>
<td>0.22±0.05</td>
<td>0.51±0.13</td>
<td>0.33±0.17</td>
<td>-0.004±0.19</td>
<td>-0.13±0.20</td>
<td>0.18±0.17</td>
<td>0.30±0.17</td>
</tr>
<tr>
<td>3</td>
<td>0.03±0.02</td>
<td>0.40±0.02</td>
<td>0.45±0.12</td>
<td>0.98±0.01</td>
<td>-0.08±0.20</td>
<td>0.28±0.19</td>
<td>0.09±0.18</td>
<td>-0.14±0.19</td>
</tr>
<tr>
<td>4</td>
<td>0.03±0.02</td>
<td>0.38±0.02</td>
<td>0.94±0.01</td>
<td>0.40±0.11</td>
<td>-0.24±0.19</td>
<td>-0.08±0.22</td>
<td>-0.08±0.19</td>
<td>-0.09±0.19</td>
</tr>
<tr>
<td>5</td>
<td>-0.41±0.02</td>
<td>-0.04±0.02</td>
<td>-0.005±0.02</td>
<td>-0.04±0.02</td>
<td>0.26±0.07</td>
<td>0.71±0.11</td>
<td>-0.50±0.14</td>
<td>-0.31±0.18</td>
</tr>
<tr>
<td>6</td>
<td>-0.21±0.02</td>
<td>0.05±0.02</td>
<td>0.11±0.02</td>
<td>0.06±0.02</td>
<td>0.67±0.02</td>
<td>0.18±0.06</td>
<td>-0.28±0.19</td>
<td>-0.16±0.20</td>
</tr>
<tr>
<td>7</td>
<td>0.05±0.02</td>
<td>0.15±0.02</td>
<td>0.09±0.02</td>
<td>0.07±0.02</td>
<td>-0.14±0.02</td>
<td>0.58±0.14</td>
<td>0.94±0.02</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.03±0.02</td>
<td>0.18±0.02</td>
<td>0.08±0.02</td>
<td>0.84±0.01</td>
<td>-0.005±0.02</td>
<td>-0.03±0.02</td>
<td>0.56±0.02</td>
<td>0.42±0.07</td>
</tr>
</tbody>
</table>
production resulted in early sexual maturity of birds. The positive association between ASM and egg weight at 28 and 40 weeks of age were obtained from this study on genetic and phenotypic scale which was in consistent with the findings of Verma et al. (1983). 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 were observed in this study. It is comparable with the findings of Vasu et al. (2004). This may implies 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 production at 40 and 64 weeks of age with the egg weight traits were negative in direction as also reported by Vasu et al. (2004). This indicated that improvement in egg number will reduce the egg weight at both the age stages. The correlations among egg weights were positive and high in magnitude. It is revealed that improvement in egg weight at early age would bring concomitant improvement in egg weight at later age.

REFERENCES