GENETIC PARAMETERS FOR SOME ECONOMIC CHARACTERS IN THE EXTRA-LONG COTTON CROSS “GIZA 68 X SEA ISLAND”

El-Helw, Sayeda S. H.
Cotton Research Institute, Agricultural Research Center, Giza.

ABSTRACT

This study was conducted during the three successive growing seasons 1998, 1999 and 2000 at the Sakha experimental farm, Agricultural Research Station. The Egyptian cultivar Giza 68 and Sea Island cultivar were crossed to obtain the hybrid was used in this investigation. The genetical parameters of some economic cotton traits were determined. The estimate potence ratio were over dominance for all studied traits except for seed index and 50% staple length which showed partial dominance and 2.5% staple length which showed complete dominance. Highly significant positive heterotic effect relative mid parents was calculated for seed cotton yield, lint cotton yield and boll weight while, it was significant for 2.5% staple length. Meanwhile, the MP heterosis was highly significant and negative for number of days to first flower. The inbreeding depression effect was highly significant for seed cotton yield, lint yield and lint percent. A highly significant positive value of additive was showed for seed cotton and lint cotton yield traits. A significant negative value of the epistatic effect (additive x dominance) was showed for seed cotton yield. Meanwhile, highly significant positive values of the epistatic effect (dominance x dominance) were showed for seed cotton yield, lint yield and 2.5% staple length. High heritability estimates were calculated for boll weight, lint percent, seed index, 2.5% and 50% staple length.

The genotypic correlation coefficient was positive and highly significant between seed cotton yield with lint yield, boll weight, lint percent, node number and span length at 2.5%. Also, it was highly significant between lint yield with boll weight, lint percent, node number and span length at 50%. The relation between boll weight with seed index and 2.5% and 50% staple length, and the relation between seed index with 2.5% and 50% staple length were highly significant. Genetic correlation coefficients were highly significant and negative between seed cotton yield and number of days to first flower and between lint percent and seed index. Most of genetic correlation coefficients were higher than phenotypic correlation coefficients.

INTRODUCTION

The understanding of the fundamental nature of gene action and gene interaction involved in the inheritance of quantitative characters help plant breeders in their evaluation of various selection and breeding procedures. Moreover, the estimation of the additive and dominance components of genetic variances are very important in evaluating the potential of any heterotic response. Heterosis, inbreeding depression and type of gene action in cotton and their implications in cotton programs were studied by many investigators. Different results were obtained by Miller et al. (1958), Marani (1968), Al-Rawi and Kohel (1969), El-Gohary et al. (1981), El-Helw (1981), Sallam et al. (1985), Al-Enani and Esmail (1986), Al-Hashash (1987), Ismail et al. (1988), Abo Arab et al. (1994) and Abdel-Gelil (2001).
The present investigation was carried out to determine the types of gene action and to estimate some genetic parameters. Also, it also aimed to study the phenotypic and genotypic correlation coefficients among some economic characters in an extra-long staple cross Giza 68 x Sea Island.

**MATERIALS AND METHODS**

A cross between the two cotton varieties Giza 68 (P₁) and Sea Island (P₂) had been carried out in 1998 growing season. In 1999 growing season, the hybrid seeds were grown and the F₁ plants were back crossed to both parents to produce Bc₁a and Bc₁b. Also, the parents were recrossed to obtain more hybrid seeds and the F₁ plants were selfed to produce the seeds of F₂ generations.

In the growing season 2000, the six populations, i.e. the two parents (P₁ and P₂), F₁ hybrid, the two back crosses (Bc₁a and Bc₁b) and F₂ generations were planted in a randomized complete block design with four replications, at Sakha Experimental Station. Each replicate block included two rows for each of the two parents and F₁, four rows for Bc₁a and Bc₁b and 10 rows for the F₂. Plants were grown in rows 7.5 meter long and 60 cm. wide. Each row had ten hills 75 cm. apart. After 40 days all hills were thinned to single plant per hill. All agricultural practices were done as usual. Nine characters were studied, i.e.:

2. Lint cotton yield (L.C.Y.) per plant in grams.
3. Boll weight (B.W.) as the average weight (in grams) of five sound opened bolls, picked at random for each plant.
4. Lint percentage (L%) as the amount of lint in seed cotton, expressed in percentage.
5. Seed index (S.I.) as the weight of 100 seeds in grams.
6. Node number (N.N.) of the first fruiting branch.
7. Number of days to first flower opening (D.F.).
8. 2.5% span length in mm, measured by digital fibrograph according to ASTM (1998).
9. 50% span length in mm, measured by digital fibrograph according to ASTM (1998).

**Statistical procedures:**

1. **Potence ratio (P):**

   Potence ratio (P) was calculated from the formula given by Smith (1952):

   \[
   P = \frac{\bar{F}_1 - \bar{M}_P}{\frac{1}{2} (\bar{P}_2 - \bar{P}_1)}
   \]

2. **Heterosis and inbreeding depression:**

   Heterosis was determined as percent of the deviation of \( \bar{F}_1 \) hybrid over its mid parents (\( \bar{M}_P \)) or its better parent (\( \bar{B}_P \)) values as follow:

   \[
   \% \text{ Heterosis} = \frac{\bar{F}_1 - \bar{M}_P}{\bar{M}_P} \times 100
   \]

   \[
   \% \text{ Inbreeding Depression} = \frac{\bar{B}_P - \bar{M}_P}{\bar{M}_P} \times 100
   \]
Heterosis from the mid parents = $\frac{\bar{F}_1 - \bar{MP}}{\bar{MP}} \times 100$

Heterosis from the better parent = $\frac{\bar{F}_1 - \bar{BP}}{\bar{BP}} \times 100$

Inbreeding depression was calculated from comparison held between $\bar{F}_2$ and $\bar{F}_1$ as follow:

Inbreeding depression = $\frac{\bar{F}_1 - \bar{F}_2}{\bar{F}_1} \times 100$

Standard errors of differences for heterosis and inbreeding depression were calculated and t-test were then used to determine significant differences from zero.

3. Heritability:

Heritability in broad sense = $\frac{VF_2-VE}{VF_2} \times 100$ as

$VE = \frac{VP_1 + VP_2 + VF_1}{3}$

Heritability in narrow sense = $\frac{2VF_2(VC_{1a} + VC_{1b})}{VF_2} \times 100$

Mather (1949).

4. Expected genetic advance:

The predicated genetic advance from selection was calculated according to Allard (1960) as follows:

$G_s = K \times \delta A \times h^2$

Where:

$K$ = the selection differential which equals to 2.06 upon selecting the highest 5% of the $F_2$ population.

$\delta A$ = phenotypic standard deviation of $F_2$.

$h^2$ = heritability in narrow sense.

$G_s\% = \frac{Gs value}{F_2 mean} \times 100$

5. Genetic components:

Individual joint scaling test was applied to the six population data as outlined by Mather (1949). The three tests A, B and C and their variances were calculated. Statistical significance from zero was determined.

The statistical method using generation means was applied according to Gamble (1962) as follows:

Additive effect (a) = $BC_{1a} - BC_{1b}$

Dominance effect (d) = $-\frac{1}{2} P_1 - \frac{1}{2} P_2 + F_1 + 2BC_{1a} + 2BC_{1b}$

Additive X additive type of epistasis (aa) = $-4F_2 + 2BC_{1a} + 2BC_{1b}$

Additive X dominance type of epistasis (ad) = $-\frac{1}{2} P_1 + \frac{1}{2} P_2 + BC_{1a} - BC_{1b}$

Dominance X dominance type of epistasis (dd) =
P_1 - P_2 + 2F_1 + 4F_2 - 4Bc_{1a} - 4Bc_{1b}

The significance of the previous values were calculated by t- test as:
\[ \pm t = \frac{\text{effect}}{\sqrt{\text{variance of effect}}} \]

6. Phenotypic and genotypic correlation coefficient:

The phenotypic and genotypic correlation coefficients were estimated according to Burton (1952).

RESULTS AND DISCUSSION

The results in Table 1 showed insignificant differences between the two parents in all studied traits except the S.C.Y./plant and L.C.Y./plant where the differences between the means of for two parents were highly significant. The parent Giza 68 exceeded the Sea Island parent in S.C.Y./plant, L.C.Y./plant, boll weight and number of days to first opening flower. However, Sea Island exceeded Giza 68 in lint percent and staple length at 2.5% and 50%. Moreover, F_1 hybrid, F_2 generations, Bc_{1a} and Bc_{1b} showed the highest mean performances for seed cotton yield, lint cotton yield and boll weight. These results may be attributed to Giza 68 which easily transmitted its high performance into its offspring. Hence, this variety could be utilized for improvement of these characters.

As for days to first flower trait, the offspring generations showed lowest number of days to first flower opening. These results may be attributed to the Sea Island. So this variety could be utilized for improvement of that character.

The results in Table (2) indicted that potence ratio estimates were over dominance for most studied triats. Seed index and 50% staple length showed partial dominance and 2.5% staple length showed complete dominance. These results were in agreement with those obtained by Al-Hashash (1987) who reported over dominance for seed cotton yield and boll weight and Abdel-Gelil (2001) who cleared the presence of over dominance for seed cotton yield, Allam (1992) reported over dominance for number of days to first flower and partial dominance for node number and lint percent. Different results were obtained by Sallam et al. (1985) and Ismail et al. (1988).

With regard to heterotic effects which appeared in Table 2 seed cotton yield and lint yield showed highly significant positive heterotic effect relative to the mid - parents and insignificant heterotic effect relative to the better parent. Boll weight showed highly significant heterotic effect relative to mid parents and significant heterotic effect relative to the better parent. The number of days to first opening flower showed highly significant negative heterotic effect which is preferable for this trait. Also, 2.5% staple length showed significant heterotic effect relative to mid - parents. Different results were obtained by Al-Rawi and Kohel (1969), Sallam et al. (1985), Al-Hashash (1987) and Ismail et al. (1988).

The results of inbreeding depression whih appeared in Table, 2 indicated that S.C.Y. pre-plant, L.C.Y. pre-plant and L% showed high
These results indicated the accumulation of additive gene effects which turn the increment of the mean expression. These results were in harmony with that obtained by Abdel-Gelil (2001). Meanwhile, the other traits showed no significant values of inbreeding depression effects. Al-Hashash (1987) found insignificant inbreeding depression values for boll weight and seed index. Negative inbreeding depression values were reported by Ismail et al. (1988) for lint percent and seed index while, positive inbreeding depression values were noted by El-Gohary et al. (1981) for boll weight and lint percent.

Concerning heritability values in broad and narrow senses, The results in table 2 showed relatively moderat values for S.C.Y. (27.58% and 28.73%), L.C.Y. (23.31% and 11.62%) and days for first flower (17.66% and 38.02%). High heritability estimates in broad and narrow senses were noticed for boll weight (42.71% and 78.38%), 2.5% span length (54.87 and 67.21) and 50% span length (43.04% and 48.58%). Similar results were obtained by El-Helw (1981) for all traits except lint percent which showed heritability value of 53.37% and 52.00%. Different results were obtained by Sallam et al. (1985), Al-Hashash (1987) Ismail et al. (1988) and Abdel-Gelil (2001).

The expected genetic advance from selecting five percent of the better performance of the F2 generations was tabulated in Table (2). The results showed that the predicted genetic advance was high for S.C.Y. (29.67%) and boll weight (22.71%). Narrow sense heritability was relatively moderate for seed cotton yield and high for boll weight. Meanwhile, the other traits exhibited small predicted genetic advance. Johanson et al. (1955) reported that heritability along with genetic gain were usually more useful than heritability alone in predicting the resultant effect for selecting the best individuals. On the other hand, heritability was not always related to genetic advance but to make effective selection. High heritability should be related to high genetic gain. High and low expected genetic advance values for studied traits were reported by El-Helw (1981), Ismail et al. (1988) and Abdel-Gelil (2001).

The results of the scaling tests for the nine studied traits are given in Table (3). The results indicated that testing for non-allelic interaction A, B and C were highly significant for S.C.Y., L.C.Y., lint percent, days to first flower and 2.5% S.L. These results revealed the presence of non-allelic interaction indicating the inadequacy of additive dominance model for these traits. Meanwhile, the testing for non-allelic interaction (A, B and C) were not significant for boll weight, seed index, node number and 50% S.L. These results revealed the presence of non-allelic interaction for these traits.

The types of gene action were showed in Table 3. The results showed highly significant values of additive effect (a) for seed cotton yield and lint cotton yield while it was insignificant for dominance effect (d) and additive X additive (aa) for all traits. Meanwhile, S.C.Y. showed significant negative value for the epistatic effect additive X dominance (ad) and highly significant positive values for the epistatic effect dominance X dominance (dd). Also, L.C.Y. and staple length at 2.5% showed highly significant value for (dd).
Significant additive effect (a) for lint percent and seed index was found by Al-Rawi and Kohel (1969), whereas, Al-Enani (1986) reported insignificant additive effect (a) for all traits except boll weight and S.C.Y. which showed significant positive effect. The epistatic component dominance X dominance (dd) was greater in magnitude than those additive X additive and additive X dominance for seed cotton yield.

Table 3 showed complementary epistasis for S.C.Y. and L.C.Y. and duplicate epistasis was noticed for 2.5% S.L.

Regarding phenotypic and genotypic correlation coefficients which are presented in table, 4, the results indicated that phenotypic and genotypic correlation coefficients were positive and highly significant or significant for S.C.Y. with each of L.C.Y., B.W., L%, N.N. and staple length at 2.5% and 50%. Also they were positive and significant or highly significant between L.C.Y. with each of B.W., L%, N.N. and staple length at 2.5% and 50%. The values of phenotypic and genotypic correlation coefficients were also positive and highly significant between boll weight with S.I., 2.5% , 50% S.L. and node number with days to first flower were highly significant.

On the other hand, phenotypic and genotypic correlation coefficients were negative and highly significant for days to first flower with S.C.Y. and with B.W. and between lint percent with seed index. Similar results were obtained by El-Helw (1981).

CONCLUSION

It could be recommended such hybrid should be evaluated in several environments before reliable breeding decision could be made.

REFERENCES


8016

القيم الوراثية لبعض الصفات الاقتصادية في الهجين "جِيزة 68 × سَيى أَيْلَنْد" من طبقة الأقطان فائقة الطول
CADELME: Sayeda S.H. الحوفي
معهد بحوث الفطن - مركز البحوث الزراعية - الجيزة

يهدف هذا البحث لدراسة بعض القيم الوراثية مثل السيادة وقوة الوجهين وآثار التربة الداخلية وكفاءة النمو وطبيعة الفعل الجيني وكذا الأرتباط المظهري والوراثي لبعض الصفات الاقتصادية في الهجين جيزة 68 × سيميل من طبقة الأقطان فائقة الطول.


يمكن تلخيص النتائج فيما يلي:

8017
1. أظهرت النتائج سلامة متفقة لكل الصفات المختبرة ما عدا معامل البذرة وطول النبتة عند 20%. حيث كانت السيادة جزئية بينما كانت السيادة ثابتة في صفة طول النبتة عند 20%. كان تأثير قوة الهجين على متوسط الأروقة معنويًا جدًا ووجيбаً لصفة محاول الانتباش من القطن الزهر ومحاول الانتباش من القطن الشعر ومتوسط وزن اللوزة ومعنويًا قط في صفة طول النبتة عند 20%. بينما لم تكن قوة الهجين معنوية في بقية الصفات.

2. كان تأثير قوة الهجين عن متوسط الأروقة معنويًا جدًا ووسبًا، صفتين تفتتح أول زهرة.

3. أظهرت نتائج الإخلع الناجح للجريد الأشري خذل معنويًا جدًا لصفة محاول الانتباش من القطن الزهر، معامل البذرة وطول النبتة علو 40% و50%.

4. كان الارتباط الوراثي معنويًا جدًا ووجيбаً بين متوسط محاول الانتباش من القطن الزهر وكل من متوسط تحول النبتة من القطن الشعر ومتوسط وزن اللوزة، تعافى الزيت، ارتفاع أول فرع مملي وطول النبتة عند 50%. كذلك كان الارتباط الوراثي معنويًا جدًا ووجيباً بين محاول الانتباش من القطن الشعر وكل من متوسط وزن اللوزة، تعافى الزيت، ارتفاع أول فرع مملي وطول النبتة عند 50%. أيضاً كان الارتباط بين متوسط وزن اللوزة وكل من معامل البذرة، طول النبتة عند 20% و50% والارتباط بين معامل البذرة وكل من طول النبتة عند 20% و50% معنويًا جدًا.

5. أظهرت النتائج أن الأروقة جزيئة 28، سي أبلد مقارن أثناء في مطلع الصفات تحت الدراسة فيما عدا متوسط حصول الانتباش من القطن الزهر ومتوسط حصول الانتباش من القطن الشعر.

6. من النتائج السابقة يمكن استخلاص أنه يجب أن يؤخذ في الاعتبار إعادة تقييم هذا الهجين في مناطق مختلفة قبل اتخاذ قرار بشأن إدخاله في برنامج الترتبة.
Table 1: Means of $P_1$, $P_2$, $F_1$, $F_2$, $Bc_{1a}$ and $Bc_{1b}$ of some economic traits in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

<table>
<thead>
<tr>
<th>Character</th>
<th>$P_1$ Giza 68</th>
<th>$P_2$ Sea Island</th>
<th>$F_1$</th>
<th>$F_2$</th>
<th>$Bc_{1a}$</th>
<th>$Bc_{1b}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.C.Y./plant (g)</td>
<td>167.7 ± 11.6</td>
<td>83.7 ± 9.6</td>
<td>186.2 ± 9.1</td>
<td>147.8 ± 5.8</td>
<td>142.0 ± 8.7</td>
<td>126.8 ± 7.0</td>
</tr>
<tr>
<td>L.C.Y./plant (g)</td>
<td>56.2 ± 4.0</td>
<td>28.8 ± 3.5</td>
<td>62.3 ± 3.2</td>
<td>48.7 ± 2.0</td>
<td>47.0 ± 3.2</td>
<td>40.9 ± 2.3</td>
</tr>
<tr>
<td>Boll weight (g)</td>
<td>2.46 ± 0.04</td>
<td>2.43 ± 0.05</td>
<td>2.60 ± 0.04</td>
<td>2.51 ± 0.03</td>
<td>2.54 ± 0.03</td>
<td>2.48 ± 0.03</td>
</tr>
<tr>
<td>Lint percent</td>
<td>33.3 ± 0.33</td>
<td>34.1 ± 0.55</td>
<td>33.2 ± 0.29</td>
<td>31.9 ± 0.22</td>
<td>32.5 ± 0.28</td>
<td>32.2 ± 0.27</td>
</tr>
<tr>
<td>Seed index (g)</td>
<td>9.4 ± 0.08</td>
<td>10.2 ± 0.18</td>
<td>9.9 ± 0.12</td>
<td>9.9 ± 0.09</td>
<td>9.6 ± 0.10</td>
<td>9.9 ± 0.12</td>
</tr>
<tr>
<td>Node number</td>
<td>7.39 ± 0.09</td>
<td>7.43 ± 0.08</td>
<td>7.35 ± 0.07</td>
<td>7.36 ± 0.04</td>
<td>7.40 ± 0.06</td>
<td>7.39 ± 0.06</td>
</tr>
<tr>
<td>Days to first flower</td>
<td>81.3 ± 0.34</td>
<td>80.7 ± 0.36</td>
<td>79.3 ± 0.38</td>
<td>78.7 ± 0.20</td>
<td>79.3 ± 0.22</td>
<td>78.8 ± 0.29</td>
</tr>
<tr>
<td>Staple length (2.5%) m.m.</td>
<td>31.6 ± 0.16</td>
<td>32.9 ± 0.24</td>
<td>32.9 ± 0.25</td>
<td>32.4 ± 0.13</td>
<td>31.9 ± 0.16</td>
<td>32.3 ± 0.14</td>
</tr>
<tr>
<td>Staple length (50%) m.m.</td>
<td>15.86 ± 0.13</td>
<td>16.19 ± 0.18</td>
<td>16.00 ± 0.08</td>
<td>16.04 ± 0.09</td>
<td>15.92 ± 0.10</td>
<td>15.85 ± 0.10</td>
</tr>
</tbody>
</table>

Table 2: Estimates of potence ratios, heterosis percentage, inbreeding depression, heritability and genetic advance for some economic characters in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

<table>
<thead>
<tr>
<th>Character</th>
<th>Potence ratio</th>
<th>Heterosis% M.P</th>
<th>Heterosis% B.P</th>
<th>Inbreeding depression</th>
<th>Heritability % B.S.</th>
<th>N.S.</th>
<th>Genetic advance Value</th>
<th>Genetic advance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.C.Y./plant</td>
<td>1.44</td>
<td>48.13**</td>
<td>11.03</td>
<td>20.62**</td>
<td>27.58</td>
<td>28.73</td>
<td>43.9</td>
<td>29.67</td>
</tr>
<tr>
<td>Boll weight</td>
<td>10.33</td>
<td>6.34**</td>
<td>5.69**</td>
<td>3.46</td>
<td>42.71</td>
<td>78.38</td>
<td>0.57</td>
<td>22.71</td>
</tr>
<tr>
<td>Lint percent</td>
<td>-1.25</td>
<td>-1.48</td>
<td>-2.64</td>
<td>4.08**</td>
<td>23.63</td>
<td>48.02</td>
<td>2.8</td>
<td>8.78</td>
</tr>
<tr>
<td>Seed index</td>
<td>0.25</td>
<td>1.01</td>
<td>-2.94</td>
<td>0.00</td>
<td>43.22</td>
<td>29.32</td>
<td>0.7</td>
<td>7.07</td>
</tr>
<tr>
<td>Node number</td>
<td>-3.00</td>
<td>-0.81</td>
<td>-0.54</td>
<td>-0.14</td>
<td>0.49</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Days to first flower</td>
<td>-5.70</td>
<td>-2.10**</td>
<td>-1.73**</td>
<td>0.76</td>
<td>17.66</td>
<td>38.02</td>
<td>2.0</td>
<td>2.54</td>
</tr>
<tr>
<td>Staple length (2.5%)</td>
<td>-1.00</td>
<td>2.02*</td>
<td>0.00</td>
<td>1.52</td>
<td>54.87</td>
<td>67.21</td>
<td>2.1</td>
<td>6.48</td>
</tr>
<tr>
<td>Staple length (50%)</td>
<td>-0.15</td>
<td>-0.30</td>
<td>-0.01</td>
<td>-0.25</td>
<td>43.04</td>
<td>48.58</td>
<td>0.99</td>
<td>6.17</td>
</tr>
</tbody>
</table>
Table 3: Estimates of Mather’s scales (A, B, C), gene effect and type of epistasis for some economic characters in the cross (Giza 68 X Sea Island) of extra-long staple cotton.

<table>
<thead>
<tr>
<th>Character</th>
<th>Mather’s scales</th>
<th>Gene effect</th>
<th>Type of epistasis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>S.C.Y./plant</td>
<td>-69.9 ± 22.4**</td>
<td>-16.3 ± 6.3**</td>
<td>-32.6±13.1**</td>
</tr>
<tr>
<td>L.C.Y./plant</td>
<td>-24.5 ± 8.1**</td>
<td>-9.3 ± 3.6**</td>
<td>-14.8±5.5**</td>
</tr>
<tr>
<td>Boll weight</td>
<td>0.02 ± 0.08</td>
<td>-0.07 ± 0.09</td>
<td>0.05±0.15</td>
</tr>
<tr>
<td>Lint percent</td>
<td>-1.5 ± 0.7**</td>
<td>-2.9 ± 0.8**</td>
<td>-6.2±1.2**</td>
</tr>
<tr>
<td>Seed index</td>
<td>-0.1 ± 0.25</td>
<td>0.3 ± 0.53</td>
<td>0.2±0.46</td>
</tr>
<tr>
<td>Node number</td>
<td>0.06 ± 0.17</td>
<td>0.00 ± 0.17</td>
<td>-0.08±0.25</td>
</tr>
<tr>
<td>Days to first flower</td>
<td>-2.0 ± 0.7**</td>
<td>-2.4 ± 0.8**</td>
<td>-5.8±1.2**</td>
</tr>
<tr>
<td>Staple length (2.5%)</td>
<td>-0.7 ± 0.4**</td>
<td>-1.2±0.4**</td>
<td>-0.7±0.8</td>
</tr>
<tr>
<td>Staple length (50%)</td>
<td>-0.02 ± 0.26</td>
<td>-0.49±0.28</td>
<td>0.11±0.43</td>
</tr>
</tbody>
</table>

Table 4: Phenotypic (P) and genotypic (G) correlation coefficient of various characters.

<table>
<thead>
<tr>
<th>Character</th>
<th>S.L. 50%</th>
<th>S.L. 2.5%</th>
<th>D.F.</th>
<th>N.N.</th>
<th>S.I.</th>
<th>L%</th>
<th>B.W.</th>
<th>L.C.Y.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S.C.Y.</td>
<td>P</td>
<td>0.2634**</td>
<td>0.1791*</td>
<td>-0.2953**</td>
<td>0.1637*</td>
<td>-0.1108</td>
<td>0.3323**</td>
<td>0.2310**</td>
<td>0.9879**</td>
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<tr>
<td>G</td>
<td>0.3211**</td>
<td>0.2179**</td>
<td>-0.3843**</td>
<td>0.2552**</td>
<td>-0.1201</td>
<td>0.3352**</td>
<td>0.2729**</td>
<td>0.9883**</td>
<td></td>
</tr>
<tr>
<td>L.C.Y.</td>
<td>P</td>
<td>0.2441**</td>
<td>0.1555*</td>
<td>-0.0023</td>
<td>0.1570*</td>
<td>-0.0539</td>
<td>0.5565**</td>
<td>0.2071**</td>
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<tr>
<td>G</td>
<td>0.2588**</td>
<td>0.1941*</td>
<td>0.0351</td>
<td>0.2316**</td>
<td>-0.0521</td>
<td>0.5814**</td>
<td>0.2358**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.W.</td>
<td>P</td>
<td>0.1757*</td>
<td>0.1353</td>
<td>-0.0065</td>
<td>0.0538</td>
<td>0.4412**</td>
<td>0.0490</td>
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<td></td>
</tr>
<tr>
<td>G</td>
<td>0.2461**</td>
<td>0.1946*</td>
<td>-0.1806*</td>
<td>0.0709</td>
<td>0.4781**</td>
<td>0.0386</td>
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<td></td>
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<tr>
<td>L%</td>
<td>P</td>
<td>0.0454</td>
<td>-0.0400</td>
<td>-0.0429</td>
<td>0.0858</td>
<td>-0.2815**</td>
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<tr>
<td>G</td>
<td>0.0485</td>
<td>-0.0350</td>
<td>-0.0268</td>
<td>0.1381</td>
<td>-0.3677**</td>
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<tr>
<td>S.I.</td>
<td>P</td>
<td>0.1909</td>
<td>0.2423*</td>
<td>-0.0365</td>
<td>0.0393</td>
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<tr>
<td>G</td>
<td>0.2191**</td>
<td>0.2530**</td>
<td>-0.0141</td>
<td>0.0219</td>
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<tr>
<td>N.N.</td>
<td>P</td>
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<td>0.0138</td>
<td>0.4168**</td>
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<tr>
<td>G</td>
<td>-0.0804</td>
<td>-0.0384</td>
<td>0.4409**</td>
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<tr>
<td>D.F.</td>
<td>P</td>
<td>0.0962</td>
<td>-0.0251</td>
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<tr>
<td>G</td>
<td>0.0977</td>
<td>-0.1295</td>
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<tr>
<td>S.L. 2.5%</td>
<td>P</td>
<td>0.9206**</td>
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<tr>
<td>G</td>
<td>0.9261**</td>
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</table>

*0.05 = 0.1485
**0.01 = 0.1945